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While forming the 23rd issue of collection of scientific papers *Theory and Practice of Forensic Science and Criminalistics* the Editorial Board adhered to traditional headline system. This collection provides the content regarding coverage of contemporary forensic science issues, solving common forensic theory problems, organization and regulation of forensic activities; as well as sections formed from research papers revealing theoretical and practical issues according to separate classes, kinds, species and subspecies of forensic science.

Representatives of forensic institutions participated in the preparation of the articles for the collection, higher education institutions, law enforcement agencies not only in Ukraine but also in foreign countries.

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The papers were reviewed internally and externally



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Dear colleagues!

The next issue of the Collection of Scientific Papers: *Theory and Practice of Forensic Science and Criminalistics* this year is dedicated to the Forensic Expert Day. The Collection traditionally contains materials with a detailed analysis of modern problems of criminalistics, general provisions of forensic examination and topical issues of scientific and methodological support of different classes, species, types and subtypes of forensic science.

The Editorial Board of the Collection of Scientific Papers: *Theory and Practice of Forensic Science and Criminalistics* constantly expands the geography of articles and interacts with fellow scientists in Ukraine and abroad.

National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute” actively cooperates with expert institutions of foreign states within the framework of cooperation agreements: the National Center for Forensic Expertise of the Ministry of Justice of the Republic of Moldova, State Institution “Scientific and Practical Center of The State Forensic Examination Committee of The Republic of Belarus”, State Non-Profit Organization of the National Bureau of Expertises of the National Academy of Sciences of the Republic of Armenia, etc.

The authors of the 23rd Collection: *Theory and Practice of Forensic Science and Criminalistics* — scientists and practitioners: employees of forensic institutions, universities, law enforcement agencies of Ukraine, Belarus, Moldova, Armenia and Romania.

The Collection also provides information on scientific and communicative activities that took place during the first half of 2021 in the field of forensic science, etc.

The Editorial Board of the Collection expresses its sincere gratitude to all the authors who provided content for publication, as well as to the professionals who took part in its edition, and invites all interested to prepare articles in the future issues.

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Research Article

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Innovative principles of forensic support of law enforcement activity: issues of concept formation

Theoretical and methodological principles of development and formation of concept of innovative bases of forensic support of law enforcement activity are still insufficiently studied. The main tasks, prospects of implementation and further directions of research of this concept are defined. It is substantiated that innovative bases of forensic support of law enforcement activities should be considered, on the one hand, as creating conditions for effective application of new forensic knowledge and means (technical, tactical, methodological and forensic ones), on the other hand, as a specific type of innovative forensic activity, carried out in order to optimize, improve efficiency and quality of the process of investigation of criminal offenses, hearings and law enforcement in general.

Possibilities and prospects for a significant expansion of boundaries of forensic support, outlining the innovative foundations of forensic support in various areas of law enforcement (in particular, in pre-trial investigation and hearings; in criminal and civil proceedings; administrative proceedings; in prosecutors, lawyers and notaries) are considered. It is noted that innovations in forensic support of law enforcement agencies should be identified both as a whole and by individual entities. With regard to the subjects whose activities need forensic support, certain levels and directions of such activities are identified. New scientific approaches to the solution of the researched discussion questions are substantiated and perspective directions of their research are defined.

Keywords: *innovations in criminalistics, innovative bases of forensic support, innovative directions of development of criminalistics, forensic innovation, concept of innovative forensic support of law enforcement activity.*

Formulation of Research Problem. In modern conditions, one of priority tasks and directions of criminalistics is research and development of forensic

innovations that has a lot of hidden, unused resources and promising practical opportunities that can optimize activities of law enforcement agencies. For effective solving the tasks facing, criminalistics carries out active innovative activities, successfully developing, implementing and applying the latest information technologies, various intelligent systems, nanotechnologies (in particular, creates and implements innovative forensic products which use is aimed primarily at optimizing activities). We believe that to strengthen innovative nature and development of criminalistics, practical value of scientific developments should take into account in research on this issue one of its laws, namely the law of accelerating development of criminalistics under influence of technological advances ¹.

In the current conditions of law enforcement reform in Ukraine, the need to intensify development and implementation of forensic innovations in law enforcement has become quite acute (along with organizational problems). In particular, update the system of scientific and technical means for detection, retrieval, recording and preliminary research on evidence, more vigorously apply the latest forensic means and innovative technologies, develop new tactics, operations and recommendations for certain investigative (search) actions and forensic methods of investigation ².

Currently, criminalistics and law enforcement practice has accumulated, systematized and generalized a fairly rich empirical material that is the starting point the creation of a separate theory: forensic innovation³, which relevance is beyond doubt. Provisions of forensic innovation form first of all a system of knowledge that characterizes the subject-practical and information-cognitive side of investigative, judicial, expert and other activities. Like criminalistics in general, forensic innovation has an applied nature, as it is a scientific basis for development and application of innovative forensic means of criminal proceedings, hearings, various types of proceedings and legal practice (investigative, judicial, expert, prosecutorial, legal, notarial ones, etc.) for their optimization, increase efficiency

¹ Іщенко А. В., Ієрусалимов І. О., Удовенко Ж. В. Теорія і практика криміналістичного забезпечення процесу доказування в розслідуванні злочинів : навч. посіб. Київ, 2007. Р. 133 ; Черноус Ю. М. Криміналістичне забезпечення розслідування злочинів : монографія. Вінниця, 2017. Р. 139 ; Жижина М. В. Инновационное развитие криминалистики на современном этапе. *Lex Russica (Научные труды МГЮА)*. 2012. № 1. Р. 117 ; Shevchuk V. M. Methodological Problems of the Conceptual Framework Development for Innovation Studies in Forensic Science. *Journal of the National Academy of Legal Sciences of Ukraine*. 2020. 27 (2). Р. 170—183. DOI: <https://doi.org/10.36074/30.10.2020.v2.20> (date accessed: 23.02.2021) etc.

² Шепітько В. Ю., Авдєєва Г. К. Інноваційні засади техніко-криміналістичного забезпечення діяльності органів кримінальної юстиції : монографія ; ред.: В. Ю. Шепітько, В. А. Журавель. Харків, 2017. Р. 22.

³ Shevchuk V. Criminalistic innovation: modern problems of formation and prospects for research. *Perspectives of world science and education* : abstracts of VIII International Scientific and Practical Conference (22—24.04.2020). Osaka, Japan. 2020. Pp. 158—168.

and effectiveness. In this regard, the need to develop innovative support concept for law enforcement as a promising area of research in modern forensic doctrine becomes especially relevant.

Analysis of Essential Researches and Publications. The scientific basis of the research were research papers of forensic scientists devoted to the development of problems of innovative support of law enforcement and innovative areas of forensic science and consideration of some of its debatable issues related to formation of forensic innovation: T. V. Averyanova, G. K. Avdeeva, N. I. Dolzhenko, M. V. Zhizhina, V. A. Zhuravlya, V. O. Konovalova, I. I. Kogutich, M. V. Salteviskyi, D. K. Taryanyk, N. B. Nechaeva, Yu. V. Chornous, V. Yu. Shepitko and others ¹. At the same time, in modern realities in this field of knowledge there are a number of debatable issues regarding research on innovative principles of forensic enforcement and the problems of implementing their provisions and recommendations in the practice of investigative, judicial and forensic expert activities. Methodological problems of developing and forming the concept of innovative principles of forensic support of law enforcement agencies which have not been sufficiently studied so far, require a separate in-depth study, analysis and further scientific elaboration.

The study and analysis of forensic literature indicates that in criminalistics there are currently no special researches on issues of developing and forming innovative principles of forensic support of law enforcement agencies. It should be noted that only in some works and only as a formulation of the problem, scientists note the need to explore certain issues of the activity approach to this

¹ Аверьянова Т. В. Инновации в криминалистике и судебной экспертизе. *Уголовно-процессуальные и криминалистические проблемы борьбы с преступностью* : мат-лы Всерос. науч.-практ. конф. Орёл, 2015. Р. 11—16 ; Берназ П. В. Інновації — основа криміналістичного забезпечення діяльності з розслідування злочинів. *Південноукраїнський правничий часопис*. 2015. № 4. Р. 50 ; Долженко Н. И., Таряник Д. К. Инновации в криминалистическом обеспечении раскрытия и расследования преступлений: некоторые проблемы внедрения и пути их решения. *Научный альманах*. 2017. № 5-1 (31). Р. 274 ; Жижина М. В. Инновации в криминалистике и судебной экспертизе. *Судебная экспертиза: российский и международный опыт* : сб. Междунар. науч.-практ. конф. (Волгоград, 23—24.05.2012). Волгоград, 2012. Р. 22—27 ; Нечаева Н. Б. Инновации в криминалистике. *Ленинградский юридический журнал*. 2013. № 2 (32). Р. 158 ; Сокол В. Ю. Инновационная деятельность как объект криминалистических исследований. *«Черные дыры» в Российском Законодательстве*. 2008. № 1. Р. 388—389 ; Шевчук В. М. Криміналістика: традиції, новації, перспективи : добірка наук. пр. / Віктор Шевчук ; [упоряд. Н. А. Чмутова]. Харків, 2020. Р. 859—899 ; Шепітько В. Ю., Журавель В. А., Авдєєва Г. К. Інновації в криміналістиці та їх впровадження в діяльність органів досудового слідства. *Питання боротьби зі злочинністю* : зб. наук. пр. Харків, 2011. Вип. 21. Р. 44—45 etc.

issue (P. V. Bernaz, O. H. Volynskyi, V. Yu. Sokol, and others) ¹. In addition, there are trends of significant lag of theoretical developments from the practice of forensic innovations in law enforcement activities of criminal justice. These and other circumstances determine relevance and timeliness of research on these issues and intensification of further research and development of these issues.

This **Article Purpose** is research on methodological principles of innovative principles of forensic law enforcement and the issues of implementing their provisions and recommendations in practice of investigative, judicial and forensic expert activities. The aim is to formulate the concept of innovative principles of forensic enforcement, to outline and consider the most promising areas of research on this issue.

Main Content Presentation. Recently, doctrinal approaches to defining modern understanding of forensic innovation have undergone significant changes². Proposals to apply activity approach in such researches and consider innovations in criminalistics in a broad sense as innovative activity can be considered as certain innovative approaches. Thus, in particular, as noted by V. Yu. Sokol, any new method, new technique, new tool, new methodology, etc., developed by criminalistics for the needs of practice can be considered from standpoint of innovation as a forensic innovation. From the moment of adoption to dissemination, this innovation becomes an innovation. *Innovation* is the result of innovative activity, brought to the stage of practical use of this innovation. Accordingly the development of forensic innovation without its introduction and dissemination does not have a useful effect, but creates preconditions for its further implementation in practice. Innovation is associated with a certain type of activity, innovation one³. Therefore, according to the scientist, solution of forensic issue of scientific support of implementation of recommendations developed by it provides isolation and comprehensive studying in a subject of criminalistics of rather independent, homogeneous group of the laws characterizing application of methods, receptions and means of optimization of innovation activities in practice ⁴.

¹ Вольинский А. Ф. Инновационная сущность криминалистического обеспечения расследования преступлений. *Вестник криминалистики*. Москва, 2011. № 3 (39). Р. 26—29 ; Сокол В. Ю. Научоведческие проблемы криминалистики. *Общество и право*. 2008. № 1 (19). Р. 218—220 etc.

² Shevchuk V. Modern problems of formation and prospects for researching the concept of criminalistic innovation. *Tendances scientifiques de la recherche fondamentale et appliquée* : collection de papiers scientifiques «ΛΟΓΟΣ» avec des matériaux (Vol. 2), 30 octobre, 2020. Strasbourg, République française. Pp. 67—72.

³ Сокол В. Ю. Инновационная деятельность как объект ...

⁴ Ibid.

Investigating some problems of forensic innovations in law enforcement, forensic literature focuses¹ on the innovative nature of such activities, the main directions and features of the introduction and application of innovative forensic products in practice in modern conditions. Thus, O. H. Volynskiy notes the special role of innovation in forensic investigation support of criminal offenses. In this regard, in our opinion, it is appropriate to note the scientist that in such realities criminalistics should intensify its predictive function and scientifically and methodologically provide criminal proceedings with forensic recommendations for effective use of these innovative technologies in pre-trial investigation. Only under condition of integrated approach and in such unity and interconnection of tasks it is possible to fully ensure the planning and innovation implementation that involves introduction, dissemination and application of innovations². In addition, it is important to note that without innovative technologies and tools to solve organizational, legal, scientific and technical issues, development and implementation of forensic methods, tools and recommendations to ensure the activities of law enforcement agencies will not meet *efficiency* requirements³.

As the scientist rightly points out, innovations are component of forensic support for investigation of criminal offenses and in the structure of the latter new modern forensic knowledge and skills acquire special significance. Obviously, they do not arise by themselves: such knowledge and skills are formed while certain activity. At the same time, formation and development of new forensic knowledge precedes the actual forensic support. In addition, implementation of such knowledge and skills in investigation of criminal offenses and their prevention, as well as “*determining their content (goals, objectives, forms), taking into account their daily needs*” [Here and below translated from Russian.— Author’s note] is derived from forensic support. However, the issue is much more complex in its content and structure, at least in terms of the tasks to be solved. Basically, all the tasks of criminalistics are closely related to the innovative component of forensic support, implementation of new modern advances in science and technology in practice of criminal investigation⁴.

¹ Волинский А. Ф. Инновационная деятельность в криминалистическом обеспечении расследования преступлений. *Вестник Владимирского юридического института*. Владимир, 2001. № 3 (20). Р. 77—79 ; Сокол В. Ю. *Op. cit.* ; Романюк Д. А. Электронный контроль работы следователя как инновационный подход криминалистического обеспечения расследования преступлений. *Криминалистическое обеспечение расследования преступлений: проблемы, перспективы и инновации* : мат-лы Междунар. науч.-практ. конф., посвящ. 45-лет. каф. криминалистики БГУ (Минск, 12—13.10.2017). Минск, 2017. Р. 93—96 etc.

² Волинский А. Ф. Еще раз о криминалистическом обеспечении и инновациях (письмо ответственному редактору по поводу «Заметок на полях»). *Вестник криминалистики*. Москва, 2012. Вып. 1 (41). Р. 25—27.

³ *Idem*. Инновационная сущность криминалистического обеспечения ...

⁴ *Idem*. Инновационная деятельность в криминалистическом обеспечении ...

Analyzing and deepening the researched problems, V. Yu. Shepitko notes that the need to introduce innovations in the investigator activities is due to objective reasons and a number of negative phenomena. First of all, it is a change in the structure of crime itself, as the emergence of new ways and methods of criminal activity affects the emergence of a modern type of criminal who uses latest technology, modern tools, high technology. This presupposes the need for significant changes and the need for practice in forensic support of law enforcement agencies in the fight against crime ¹. In addition, this need is also due to a number of other negative factors, among which the most significant are: solving a significant number of complex mental problems in a relatively short time (lack of time); lack of available technical and tactical means of carrying out activities; difficulties in interaction with professionals and employees of operative units; lack of information about the event under investigation; lack of reliable sources of information; opposition to investigation by interested parties. Implementation of innovations helps to optimize investigation and prevents investigative errors (reduces their number) ².

Some scientific interest in the context of the problem is scientific approaches of M. V. Zhizhina, who notes that one of the main tasks of criminalistics is creation and application of appropriate means, techniques and methods of crime detection and investigation, establishing true circumstances of the case. In order to effectively combat the threat of crime, modern criminalistics integrating and synthesizing the latest advances in science and technology, carries out the most active innovative activities: successfully develops, implements and applies the latest information and knowledge-intensive technologies, various intelligent systems, nanotechnology and etc. In research on this issue, it is necessary to take into account the innovative nature of the development of criminalistics at the present stage and one of its laws; acceleration of criminalistics pace under the influence of technological advances ³. According to the author, there are three main areas of innovative development of criminalistics: 1) use of fundamentally new content, development and implementation of new technologies and solutions (this trend is characteristic mainly for development of forensic researches); 2) introduction and use of various innovative technologies

¹ Шепитько В. Ю. Инновации в криминалистике и следственной деятельности. *Проблемы управления органами расследования преступлений в связи изменением уголовно-процессуального законодательства* : матер. межвуз. науч.-практ. конф. В 2 ч. Ч. 2. Москва, 2007. Р. 45.

² Idem. Проблемы разработки, внедрения и использования инноваций в следственной деятельности. *Использование современных информационных технологий в правоохранительной деятельности и региональные проблемы информационной безопасности* : сб. мат-лов междунар. науч.-практ. конф. Калининград, 2006. Вып. VII. Ч. 1. Р. 126.

³ Жижина М. В. Инновационное развитие криминалистики

in tactics of investigative (search) actions; 3) introduction of modern information technologies into activity of law enforcement bodies and their active application. The selected areas of innovative development do not in any way exhaust the possibilities of using innovative tools and technologies in criminalistics. Development and implementation of forensic innovative products is also carried out “*in other areas of forensic support of pre-trial investigation and judicial proceedings*”¹. As we can see, this is an innovative component of forensic support of the pre-trial investigation and court.

Thus, innovative activity in the structure of forensic support for the investigation of criminal offenses is an integral part of forensic support, which main task is to optimize activities of criminal justice in combating crime through implementation of technological advances. In this regard, the issues of *developing innovative principles of forensic support for investigation of criminal offenses are particularly relevant*.

It should be noted that issue of innovative principles of forensic support² is reflected in research papers of forensic scientists³, so we believe that such scientific developments can be taken into account in further research on this issue. Essence of innovative principles of forensic support of criminal justice in forensic literature is defined as a system of improving its quality that includes development of theoretical basis and terminology, algorithm of innovation and specific latest forensic means based on modern information technology⁴. Improving quality of technical and forensic support of criminal justice authorities is carried out by developing specific viable innovations, their testing

¹ Жижина М. В. Оp. cit.

² Шепітько В. Ю., Авдєєва Г. К. Оp. cit. ; Іщенко А. В., Ієрусалимов І. О., Удовєнко Ж. В. Оp. cit. ; Капустіна М. В. Криміналістичне забезпечення досудового розслідування: поняття та ознаки. *Теорія та практика судової експертизи і криміналістики* : зб. наук. пр. Харків, 2014. Вип. 14. Р. 71—79 ; Черноус Ю. М. Знач. твір. 492 р. ; Шевчук В. М. Методологічні проблеми формування понятійного апарату криміналістичної інноватики. *Вісник Національної академії правових наук України*. Харків, 2020. Т . 27. № 2. Р. 170—183. DOI: [https://doi.org/10.37635/jnalsu.27\(2\).2020.170-183](https://doi.org/10.37635/jnalsu.27(2).2020.170-183) (date accessed: 23.02.2021) ; Idem. Інноваційні напрямки розвитку криміналістики. *Інноваційні методи та цифрові технології в криміналістиці, судовій експертизі та юридичній практиці* : мат-ли міжнар. «круглого столу» (Харків, 12.12.2019). Харків, 2019. Р. 142—147 etc.

³ Idem. Інноваційні засади криміналістичного забезпечення діяльності органів правопорядку: постановка проблеми. *Paradigmatic view on the concept of world science* : Collection of scientific papers «ΛΟΓΟΣ» with Proceedings of the International Scientific and Practical Conference (Vol. 2), August 21, 2020. Toronto, Canada: European Scientific Platform. Р. 139—144. DOI: <https://doi.org/10.36074/21.08.2020.v2.51> (date accessed: 23.02.2021).

⁴ Шепітько В. Ю., Авдєєва Г. К. Проблеми розроблення інноваційних засад техніко-криміналістичного забезпечення діяльності органів кримінальної юстиції. *Питання боротьби зі злочинністю* : зб. наук. пр. Харків, 2014. Вип. 27. Р. 156—165.

and implementation in practice of law enforcement agencies. Ensuring quality of technical and forensic support of criminal justice is carried out through the rational organization of research with the use of information technology and the involvement of qualified specialists to develop innovations and provide scientific and practical recommendations for their use in law enforcement¹.

Examining the role and purpose of forensic innovations in combating crime, P. V. Bernaz rightly notes that innovations are the basis of forensic support for criminal investigation and in modern conditions, these issues are particularly relevant, so they can be identified as a priority area of forensic research. Therefore, in current realities, forensic science and each of its sections always face important theoretical and methodological problems aimed at studying and taking into account modern innovative achievements of science and technology, impact of technological advances on development and formation of modern forensic knowledge, their effective use in combating crime and providing innovative forensic recommendations for the urgent needs of investigative, judicial and forensic expert practice. Traditionally, in criminalistics there are three areas of detection, development and implementation of innovations: technical forensics, tactical forensics and providing methods for investigating certain types of crimes². We believe that the technical and forensic field is the most actively developing in terms of innovation, however, there are still many debatable and unresolved issues in research on this issue that need special study and resolution. At the same time, all areas of scientific development (technical, tactical, methodological and forensic one) require further fundamental and applied forensic research, that will provide innovative essence of forensics and prospects for its development.

In view of the above, we can draw the following conclusions.

Firstly, essence of innovative principles of forensic law enforcement should be considered as: 1) activities to create conditions for effective application of new forensic knowledge and means (technical, tactical, methodological and forensic ones) and constant readiness of pre-trial investigation bodies to solve forensic issues using innovative forensic products; 2) specific type of innovative forensic activity, carried out in order to optimize, improve efficiency and quality of investigation, hearings and crime prevention. We believe that such a comprehensive and systematic approach creates a methodological basis and necessitates development and formation of a *separate theory concept of innovative support of forensic activities as a priority area of research in modern forensic science*.

¹ Шепітько В. Ю., Авдєєва Г. К. Інноваційні засади техніко-криміналістичного забезпечення ... Р. 13.

² Берназ П. В. *Op. cit.* С. 50 ; Шевчук В. М. Сучасний стан та тенденції розвитку криміналістики: актуальні проблеми сьогодення. *Проблеми законності*. 2019. Вип. 146. Р. 234—246 etc.

Secondly, innovative principles of forensic support of law enforcement activities should also be considered in the form of a system for creating, implementing and using innovations in practice aimed at optimizing such practices and creating conditions for constant readiness of investigators, judges and law enforcement to apply innovative forensic means designed to solve forensic issues and the practical implementation of these conditions and means. This is a system of measures for development, implementation and use of innovative forensic means, methods, technologies which purpose is to optimize, improve quality and efficiency of detection, investigation and prevention of criminal offenses and law enforcement in general.

Thirdly, it seems that all the above points of view on innovative principles of forensic law enforcement are united by the fact that they relate to the use of innovative forensic means while detection, investigation and prevention of criminal offenses. At the same time, in our opinion, it should be noted that forensic innovations are used not only in pre-trial investigation, but in legal proceedings and other areas of activity ¹. This is due to the more active introduction of innovative forensic means (both specially designed and adapted for the needs of criminalistics) not only in investigative activities, but also in judicial, expert, law enforcement and other areas of everyday life. Examples include the use of fingerprint scanners, polygraphs during hiring, various equipment (including forensic) for business activities, etc. in modern telecommunications and security systems. However, one of the first and main directions of forensic support was and remains law enforcement activity ².

With this in mind, we can conclude that opportunities for use of innovations in forensic support in areas of law enforcement that are not exclusively related to investigation and prevention of criminal offenses. We are speaking about a significant expansion of the boundaries of innovative forensic support, so we can speak about *innovative principles of forensic support in various areas of law enforcement*. This can be confirmed by numerous researches by forensic scientists of theoretical and applied application issues of achievements of criminalistics in litigation, criminal and civil proceedings, administrative proceedings, prosecutors, lawyers and notaries ³ and others.

¹ Когутич І. І. Тенденції пристосування криміналістичних знань у здійсненні судочинства. *Вісник Львівського університету*. Серія юридична. 2013. Вип. 57. Р. 338 ; Шевчук В. М. Інновації у криміналістичній техніці: сучасні можливості й проблеми застосування. *Науковий вісник Міжнародного гуманітарного університету*. Серія «Юриспруденція». Одеса, 2020. № 43. Р. 146—151 etc.

² Перлін С. Поняття і види техніко-криміналістичного забезпечення правозастосовної діяльності. *Підприємництво, господарство і право*. 2020. № 1. Р. 221—226.

³ Ароцкер Л. Е. Криминалистические методы в судебном разбирательстве уголовных дел : автореф. дис. ... д-ра юрид. наук. Москва, 1965. 38 р. ; Козьяков І.

In view of the above, innovative principles of forensic support should be applied to certain subjects. In particular, one of law enforcement areas is the activities of criminal justice bodies. It is crucial to clarify innovation essence in criminal proceedings, not only their type, content and scope but the subject using them. Developing this idea, we note that subjective side of innovative principles of forensic support is also manifested in the subject definition whose activities are accompanied by the use of innovative forensic means. Therefore, we can speak about the innovative principles of forensic support for activities of both the police and other bodies belonging to the criminal justice system including the court.

In addition, currently the problem is posed and the need to develop innovative principles of forensic support of the newly created Bureau of Economic Security of Ukraine. As you know, in order to implement effective reform in combating criminal threats to economic security in Ukraine, optimize the criminal justice system and eliminate duplication of law enforcement functions in early 2021, Bureau of Economic Security of Ukraine: central executive body tasked with combating offenses that encroach on functioning of the state economy and implementation of law enforcement, analytical, economic, informational and other functions (Article 1 of the Law: *On the Bureau of Economic Security of Ukraine*)¹.

Successful and effective support of the Bureau of Economic Security of Ukraine involves application of a comprehensive approach to solving assigned tasks. Among them, active use of all possible types and forms of ensuring activities of the Bureau is of particular importance: organizational; social and monetary; financial and logistical; personnel; psychological; information and analytical; scientific and methodical; legal; forensic ones.

Thus, in current realities, one of the priority tasks of criminalistics is to develop innovative principles of forensic support of the Bureau of Economic Security of Ukraine which now has quite a lot of promising practical opportunities that can optimize the activities of this body. As can be seen, a comprehensive solution to this problem involves taking into account in criminalistics three areas of such activities: technical forensics, tactical forensics and ensuring

Теоретичні основи криміналістичного забезпечення процесуального керівництва прокурором досудовим розслідуванням. *Науковий часопис Національної академії прокуратури України*. 2014. № 2. Р. 60—71 ; Рубис А. С. Основы теории криминалистического обеспечения деятельности прокурора в сфере борьбы с преступностью : монография. Минск, 2006. 416 р. ; Пінчук Н. І. Теоретичні та правові питання і практика криміналістичного забезпечення діяльності нотаріату : автореф. дис. ... канд. юрид. наук. Київ, 2008. 21 р.

¹ Про Бюро економічної безпеки України : Закон України від 28.01.2021 р. № 1150-IX (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/1150-20> (date accessed: 23.02.2021).

the formation and improvement of forensic methods of investigating criminal economic crimes¹.

With this in mind, we consider it appropriate to single out innovations in forensic support of law enforcement agencies as a whole and as individuals. According to the subjects which activity requires forensic support, the following levels can be distinguished: 1) forensic support of law enforcement activity in general; 2) forensic support for activities of criminal justice bodies; 3) forensic support of activities of individual departments and bodies (bodies of the system of the Ministry of Internal Affairs of Ukraine, Security Service of Ukraine, the prosecutor's office, Bureau of Economic Security of Ukraine, etc.); 4) forensic support of activities of individual entities (investigators, detectives, analysts, employees of operational units, experts). For its part, in terms of implementation, the following levels of forensic support are subject to separation: 1) litigation by industry (criminal proceedings, administrative, civil, arbitration, commercial litigation); 2) separate stages and proceedings in criminal proceedings (pre-trial investigation and legal proceedings); 3) investigation of certain types of crimes as a component of forensic support of pre-trial investigation; 4) carrying out of separate investigative (search) actions, i.e. help of forensic experts and interaction with operative and search divisions.

This suggests that innovative principles of forensic law enforcement is a fairly broad, comprehensive concept, that contains a set of innovative forensic means and methods of their application, activities of certain entities to create appropriate conditions for effective use of these tools in law enforcement practice, on the other hand, a system of scientific provisions that study the patterns of innovative forensic activities which results are aimed at solving practical problems in the use of innovative forensic products in the activities of law enforcement agencies.

Thus, innovative principles of forensic support of law enforcement is a system of measures for the creation, implementation and use of innovative forensic products in law enforcement practice including development of theoretical basis and terminology, algorithm of innovative activities to solve practical problems and effective functioning of innovative methods of innovation and technologies aimed at optimizing, improving the quality and effectiveness of law enforcement.

Conclusions. Given the above, we can conclude that issues of developing and forming innovative principles of forensic support of law enforcement in modern conditions is one of the most important tasks of forensics. At the same

¹ Шепітько В. Ю. Завдання криміналістики в умовах глобальних загроз та еволюційних перетворень злочинності. *Криміналістика и судебная экспертиза: наука, обучение, практика* : мат-ли наук.-практ. конф. Міжнар. конгресу криміналістів (Одеса, 13—15.09.2018) : у 2 т. Т. 1. Одеса, 2018. Р. 14—26.

time, in our opinion, essence of innovative principles of forensic law enforcement should be considered, on the one hand, as activities to create conditions for effective application of new forensic knowledge and means (technical, tactical, methodological and forensic ones) and constant readiness of pre-trial bodies to solve forensic problems with the use of innovative forensic products and on the other hand, as a specific type of innovative forensic activity, carried out to optimize, improve efficiency and quality of criminal investigation, trial and enforcement in general.

Development of this issue is quite relevant in both theoretical and practical terms. In the criminological doctrine and practice of combating crime, creation issues, implementation and application of innovations in the practice of law enforcement, criminal justice, court have always been and remain the priority of criminalistics. At the same time, in modern realities in this field of knowledge there are a number of debatable issues regarding research on innovative principles of forensic support of law enforcement agencies and issues of implementing their provisions and recommendations in the practice of investigative, judicial and forensic activities. In this regard, a separate in-depth study, critical analysis and further research need theoretical and methodological issues of development and formation of concept of innovative principles of forensic support of law enforcement as one of new scientific directions in forensic science formed in modern conditions.

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**Інноваційні засади криміналістичного забезпечення
правозастосовної діяльності:
проблеми формування концепції**

Досліджено теоретико-методологічне підґрунтя концепції інноваційних засад криміналістичного забезпечення правозастосовної діяльності. Визначено основні завдання, перспективи впровадження й подальші напрями досліджень цієї концепції. Обґрунтовано, що інноваційні засади криміналістичного забезпечення діяльності органів правопорядку необхідно розглядати, з одного боку, як створення умов для ефективного застосування нових криміналістичних знань і засобів (техніко-, тактико-,

методико-криміналістичних), а з іншого — як специфічний вид інноваційної криміналістичної діяльності, здійснюваної з метою оптимізації, підвищення ефективності та якості процесу розслідування кримінальних правопорушень і судового розгляду.

Ключові слова: інновації у криміналістиці, інноваційні засади криміналістичного забезпечення, інноваційні напрями розвитку криміналістики, криміналістична інноватика, концепція інноваційного криміналістичного забезпечення правозастосовної діяльності.

В. М. Шевчук

**Инновационные основы криминалистического обеспечения
правоприменительной деятельности:
проблемы формирования концепции**

Исследованы всё ещё недостаточно изученные теоретико-методологические принципы разработки и формирования концепции инновационных основ криминалистического обеспечения правоприменительной деятельности. Определены основные задачи, перспективы внедрения и дальнейшие направления исследований этой концепции. Обосновано, что инновационные основы криминалистического обеспечения деятельности органов правопорядка необходимо рассматривать, с одной стороны, как создание условий для эффективного применения новых криминалистических знаний и средств (техничко-, тактико-, методико-криминалистических), а с другой — как специфический вид инновационной криминалистической деятельности, осуществляемой с целью оптимизации, повышения эффективности и качества процесса расследования уголовных правонарушений, судебного рассмотрения и правоприменения вообще.

Очерчены возможности и перспективы значительного расширения границ криминалистического обеспечения, позволяющие говорить об инновационных основах криминалистического обеспечения в различных сферах правоприменения (в частности, в досудебном расследовании и судебном рассмотрении; в уголовном и гражданском судопроизводстве; административном производстве; в прокурорской, адвокатской и нотариальной деятельности и пр.). Отмечено, что инновации в криминалистическом обеспечении деятельности органов правопорядка целесообразно выделять как в целом, так и по отдельным субъектам. В отношении субъектов, деятельность которых нуждается в криминалистическом обеспечении, выделены определённые уровни и направления такой деятельности. Обоснованы новые научные подходы к решению исследуемых дискуссионных вопросов и определены перспективные направления их исследования.

Ключевые слова: инновации в криминалистике, инновационные основы криминалистического обеспечения, инновационные направления развития криминалистики, криминалистическая инноватика, концепция инновационного криминалистического обеспечения правоприменительной деятельности.

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Forensic researches at the National Academy of Internal Affairs: heritage of scientific schools (Review Article)

The Article purpose is to disclose the process of the formation of forensic scientific schools in the National Academy of Internal Affairs on the basis of the study of its historical development; to emphasize the role of heads of departments and leading professors of the National Academy of Internal Affairs in formation of forensic scientific schools, identify the main research directions of forensic scientific schools of the National Academy of Internal Affairs, highlight their contribution in training of highly qualified scientific and pedagogical staff; to emphasize achievements of forensic scientific schools of the National Academy of Internal Affairs and their significance for advancement of legal science and education in Ukraine.

When covering the article content, historical, historiographic, terminological, systemic-structural, formal-logical, comparative-legal and statistical methods have been applied.

It is substantiated that the center for the development of forensic scientific schools in the National Academy of Internal Affairs is the Department of Criminalistics. Main directions of research of forensic scientific schools in the National Academy of Internal Affairs have been systematized and shown. It has been proved that forensic scientific schools of the National Academy of Internal Affairs are developing according to two scientific directions: innovative research on non-traditional traces of crime (the school of Professor M. V. Saltevs'kij); advancement of investigative activities and methods of investigating criminal offenses based on studying tactics applied by criminals, current achievements in science and technology (school of Professor V. P. Bahin). Scientific links between forensic schools of the

National Academy of Internal Affairs and other forensic schools and centers of research institutions, higher educational institutions, law enforcement agencies have been demonstrated.

Forensic scientific schools of the National Academy of Internal Affairs play a crucial role in the development of legal science and education, contribute to the formation of the high level of professionalism in law enforcement agencies and lawyers, ensure the unity of law enforcement practice and educational-scientific activity in higher education institutions.

Keywords: *forensic researchers, forensic scientific school, criminalistics department, National Academy of Internal Affairs, criminalistics, forensic science.*

Formulation of Research Problem. National Academy of Internal Affairs (hereinafter referred to as NAIA) is a leading institution of higher education in the system of the Ministry of Internal Affairs of Ukraine, which provides training for bachelor's and master's degrees in *Law, Law Enforcement and Psychology*; master's degree in *Public Administration and Management*; as well as the degree of Doctor of Philosophy and Doctor of Science in the scientific specializations: *Law, Psychology and Philosophy*. In 2021, NAIA marks 100th anniversary of its foundation.

The history of the Academy formation dates back to June 11, 1921: from the beginning of the local courses for militiamen of the Kharkiv provincial militia. A year later, on the basis of the Courses, the *School of the Senior Command of the Workers' and Peasants' Militia of the USSR* was established. At a meeting of Council of People's Commissars of the Ukrainian SSR on December 25, 1922, actions were taken to reorganize the militia school into the All-Ukrainian school and accept it for state support. Under this decision, on October 23, 1923, the school was renamed the *All-Ukrainian School of Police and Criminal Investigation*. Thus, the educational institution obtained the status of republican and started training of senior command staff for the police bodies of the whole Ukraine. In 1925, the All-Ukrainian School was relocated from Kharkiv to Kyiv (*History of the National Academy of Internal Affairs, 2021*).

In 1936, the educational institution was renamed the *School of Senior Chiefs of the Workers' and Peasants' Militia named after V. A. Balytsky*, and within a year: the *Kyiv School for the Improvement of the Chiefs of the Workers' and Peasants' Militia*. The school had this status until the summer of 1941. After, it was renamed and reorganized several times. By order of the Ministry of Internal Affairs of the USSR dated on 20 August, 1956, Kyiv Special Secondary School of Militia of the Ministry of Internal Affairs of the USSR was organized. On April 11, 1960, the Higher School of the Ministry of Internal Affairs of the USSR was established. In 1962, the name of the educational institution slightly changed, owing to the change in the name of the Ministry: the school was named the *Higher School of the Ministry of Public Order of the USSR*. Since 1968, the educational institution again changed its name: *Kyiv Higher School of the*

Ministry of Internal Affairs of the USSR (History of National Academy of Internal Affairs, 2021) ¹.

After declaration of Ukraine's independence in 1991, the educational institution became the *Kyiv Higher School of the Ministry of Internal Affairs of Ukraine*, and in 1992 the *Ukrainian Academy of Internal Affairs* was established on its basis, which by the Decree of the President of Ukraine obtained the status of *National* in 1992. Ukraine's accession to the Bologna Process in May 2005 necessitated realigning of the system of higher education institutions, including departmental ones. In this regard, the Academy, by the Resolution of the Cabinet of Ministers of Ukraine dated on September 8, 2005, was reorganized into *Kyiv National University of Internal Affairs*. By the Ordinance of the Cabinet of Ministers of Ukraine: *On reorganization of some higher educational institutions of the Ministry of Internal Affairs* dated on August 27, 2010, Kyiv National University of Internal Affairs was reorganized into the *National Academy of Internal Affairs (History of the National Academy of Internal Affairs, 2021)* ².

Analysis of Essential Researches and Publications. Forensic researches of the National Academy of Internal Affairs were covered by few researchers. Thorough researches in this direction were performed by A. V. Ishchenko, who covered certain aspects in the following research papers: *Bibliographic index of dissertations on criminalistics* (1989), *Problems of researches development in the field of forensic science* (1995), *Forensic support of crime counteraction (dissertations of criminalists defended in specialized academic councils of Ukraine)* (1997), *Scientific support of counteraction to crime* (2002)³, *Methodological issues of forensic researches* (2003), *The Chronicle of criminalistics: data, facts, names* (2016 .). S. S. Cherniavskyi and V. V. Iusupov (*The place of scientific school of the Department of Criminology and Forensic Science of the National Academy of Internal Affairs in the development of legal science in Ukraine*, 2019) delivered reports about researchers at the Department of Criminology and Forensic Science of NAIA during the conference, as well as Yu. M. Chornous (*The role of personality in the formation and development of the Department of Criminology and Forensic Medicine*, 2019); also covered V. V. Yusupov in the scientific article (*Development of criminalistics in Kyiv, Odessa, Kharkiv scientific schools: main stages and personalities*, 2011). D. A. Liashenko studied forensic scientific centers and schools in Ukraine (*Forensic scientific centers and schools in Ukraine*, 2019), having covered issues

¹ Історична довідка кафедри криміналістики та судової медицини Національної академії внутрішніх справ. URL: <https://www.naiau.kiev.ua/zagalnoakademichni-kafedri/kafedra-kriminalistiki-ta-sudovoyi-medicini/zagalni-vidomosti/istorichna-dovidka.html> (date accessed: 17.03.2021).

² Етапи розвитку Національної академії внутрішніх справ. URL: <https://www.naiau.kiev.ua/pro-akademiyu/istoriya/etapi-rozvitku-nacionalnoyi-akademiyi-vnutrishnih-sprav.html> (date accessed: 17.03.2021).

³ Іщенко А. В., Карпов Н. С., Кондратьєв Я. Ю. Наукове забезпечення протидії злочинності : посібник. Київ, 2002. 224 р.

of creation and development of the forensic scientific center on the basis of the Department of Criminalistics and Forensic Medicine of NAIA.

At the same time, a multidisciplinary analysis of modern forensic researches in various structural divisions of NAIA (departments, scientific laboratories, educational and scientific institutes) was not carried out in mentioned research papers.

The **Article Purpose** is to study the process of formation and development of forensic researches of scientific schools of the National Academy of Internal Affairs. To fulfill this goal, it is necessary: to emphasize the role of heads of departments and leading professors of the National Academy of Internal Affairs in the development of forensic researches; disclose main directions of forensic researches at scientific schools of this higher education institution; finalize developments of forensic scientific schools of higher education and its significance for the development of legal science and education in Ukraine.

Main Content Presentation. Over the time of the Academy existence, it gained the status of a leading higher departmental institution, has a respectful authority among domestic institutions of higher education of a legal profile, actively exercises educational and scientific cooperation internationally.

Today NAIA is widely known in educational circles as a basic institution of higher education in training and post-graduate training of a new generation of policemen-criminalists and forensic experts, a leader in creating practical training areas, offices and laboratories in accordance with the latest directions of cybersecurity and *digital forensics*. Creative contributions of different generations: representatives of strong forensic scientific schools are highly significant.

One of manifestations of combining scientific and practical components of the educational process is the formation of highly qualified staff. In particular, in 1983, for the first time the specialized academic council on defence of PhD dissertations in specializations 12.00.02, 12.00.08, 12.00.09 was created in the Kiev Higher School of the Ministry of Internal Affairs of the USSR. Symbolic is the fact that the first defense of a dissertation took place in the specialization 12.00.09 — criminal procedure; judiciary; procuratorial supervision; criminalistics (A. O. Yerokhin: *Investigation of theft in the logistics system (according to the USSR)*), where one of the opponents was a famous forensic scientist R. S. Bielkin (*Ishchenko, Karpov & Kondratiev, 2002, p. 14*).

Therefore, one of the priority areas of the school's development was the advancement of forensic researches.

The center of forensic researches formed at the Department of Criminalistics which was established at the Higher School of the Ministry of Public Order of the USSR in 1964 (*History of the Department of Criminalistic and Forensic Medicine, 2021*). For more than half a century of the department operation, among its heads and employees: the names of distinguished scientists, experienced domestic lawyers, honored teachers with a significant practical experience.

Without stretching the point, contribution to the formation and development of criminalistics of such world-recognized researchers as M. V. Saltevskyi, V. P. Bakhin, Ye. D. Lukianchykova, V. S. Kuzmichov, A. V. Ishchenko, V. K. Veselskyi, P. D. Bilenchuk is invaluable. These extraordinary figures managed to establish their own forensic schools or continued to develop directions of forensic researches of academic science founders.

In particular, in 1971, the Department of Criminalistics was headed by M. V. Saltevskyi, Doctor of Law, Professor, Honored Worker of Science and Technology.



Fig.1. Mykhailo Vasylovych Saltevskyi

At that time, the department consisted of eight people: experienced law enforcement practitioners. Mykhailo Vasylovych for the first time developed programmed tasks for teaching criminalistics in the system of the Ministry of Internal Affairs, which are covered in his works: *Forensic technique* (1967), *Forensic technique and tactics* (1973). M. V. Saltevskyi headed the interuniversity program for the development and use of technical means in the educational process in the system of higher education institutions of the Ministry of Internal Affairs of the USSR. The scientist published a unique at that time: *Specialized course of criminalistics* (for students of universities of the Ministry of Internal Affairs of the USSR, studying on the basis of secondary special legal education) (1987). During his work at the Kyiv Higher School of the Ministry of Internal Affairs, M. V. Saltevskyi initiated new directions in domestic criminalistics: odorology, acoustic researches; the application of traces of memory and temporal relations while crimes detection. In these scientific directions under his guidance and consulting, five PhD and two doctoral dissertations were defended (V. M. Mieshkov, M. M. Lysov), methods of acoustic research on sound traces are developed collection and use of odorous traces that gained general recognition, in particular abroad.

Another scientific direction was the inventive activity of Professor M. V. Saltevskyi in the field of forensic technique. He developed a number of methods for the study of physical evidence, a new method of measuring photography and identification of sound recording devices; designed a ship-

metric camera FSM-1. He patented new forensic tools and methods and obtained three copyright certificates for inventions: a forensic metric camera (1972), a method of identifying tape recorders (1977), a method of forensic identification of a person by physical parameters of speech signals (1989) (*Cherniavskiy & Yusupov*, 2017).

The main publications of the forensic scientific school of Professor M. V. Saltevskiy are textbooks, manuals and other publications: *Forensic technique and tactics: programmed tasks*, 1973; *Forensic photography and cinematography in the activities of law enforcement agencies*, 1974; *Forensic odorology. (Work with odor traces)*, 1976; *Collection of forensic information by technical tools while preliminary investigation*, 1980; *Methodology of speaker identification by parameters of spectral transitions of speech signals with the help of a special computing system (SCS)*, 1980 (co-authored); *Modern possibilities of performing research on a person's voice in forensic practice*, 1982 (co-authored); *Odor traces in investigative practice*, 1992 (co-authored); *Forensic photography, cinematography and video analysis in law enforcement*, 1993 (co-authored); *Sound traces are a new source of evidence*, 1995; *Criminalistics. In modern interpretation of lawyers*, 1996, 1997; *Criminalistics*, 1996; *Criminalistics: textbook*: in 2 parts, 1999, 2001; *Criminalistics (in modern interpretation)*: textbook, 2005, 2006, 2008, etc.¹

Therefore, at the militia higher education institution (Department of Criminalistics), Professor M. V. Saltevskiy established not only a scientific center but also formed a forensic school named after him. The main directions of forensic researches were: forensic odorology and forensic acoustics; use of traces and time relations in crimes detection; development of methodologies of acoustic identification of audio traces, collecting and using odor traces; fundamentals of methods of video-phonoscopic studies.



Fig. 2 Volodymyr Petrovych Bakhin

¹ Чернявський С. С., Юсупов В. В. Професор М. В. Салтевський — відомий криміналіст і талановитий педагог (до 100-річчя від дня народження). *Науковий вісник Національної академії внутрішніх справ*. 2017. Вип. 4. Р. 360—366.

Volodymyr Petrovych Bakhin created his own scientific school at the Department of Criminalistics of the Kyiv Higher School of the Ministry of Internal Affairs of the USSR, who headed the department between 1979—1985, and since 1996 until 2000 worked as a Professor of this Department.

Volodymyr Petrovych was a Doctor of Law, Professor, Academician of the International Slavic Academy of Sciences, laureate of R. S. Bielkin Medal of Honor. Principal directions of his scientific interests were the issue of studying investigative practice and improving crime tactics. This is precisely the topic of the doctoral dissertation by V. P. Bakhin: *Investigative practice: problems of research and advancement* (1991).

The Scientific School of Professor V.P. Bakhin unites 11 Doctors (V. S. Kuzmichov, A. V. Ishchenko, Ye. D. Lukianchykov, V. V. Lysenko, N. S. Karpov, P. V. Tsymbal, S. S. Cherniavskyi, L. I. Arkush, I. V. Hora, V. A. Kolesnyk, H. P. Vlasov) and more than 30 PhDs in Law. Most of these scholars worked or still work at NAIA and continue to develop forensic researches of V. P. Bakhin Scientific School, they worked as academic advisers of doctoral dissertations and academic supervisors of PhD dissertations which had been successfully defended in specialized academic councils. Thus, under the guidance of Professor V. S. Kuzmichov, Yu. M. Chornous and I. V. Pyrih, Professors of Ye. D. Lukianchykova: K. O. Chaplynskyi and O. B. Taran and others defended doctoral dissertations.

The scientific school contribution is a significant number of publications: textbooks, monographs, manuals, encyclopedias, patents for inventions, etc. In particular: *Criminalistics. Problems and Opinions* (1962-2002), 2002; *Inspection of the scene during investigation of particular types of crimes*, 2005 (co-authored); *Tactics: professionalism and communication skills*, 2006; *Criminal tactics. Tactical methods of criminals' counteracting to an investigation*, 2009; *Encyclopedia of Forensic Science*, 2013 (co-authored); *The art of solving crimes*, 2014 (co-authored), etc.

Thus, the main directions of forensic researches in Professor V. P. Bakhin scientific school include issues of general theory of criminalistics, scientific support for investigation optimization, forensic methods, study of criminal activity tactics.

The first student of Volodymyr Petrovych Bakhin, who defended his doctoral dissertation, was Volodymyr Serhiiiovych Kuzmichev. He headed the Department of Criminology of the National Academy of Sciences of Ukraine between 1996—2004, and from 2009 to 2012 he was a Professor of the department.



Fig. 3. Volodymyr Serhiiovych Kuzmichov

V. S. Kuzmichov is Doctor of Law, Professor, Honored Lawyer of Ukraine, laureate of the State Prize of Ukraine in the field of science and technology. He defended his doctoral dissertation on the topic: *Investigative activity: essence, principles, forensic techniques and means of implementation* in 1996, and continued developing the direction of Professor V. P. Bakhin scientific school.

Managing the Department of Criminology and understanding the importance of combining theoretical knowledge with practical skills in training cadets and students of the Academy, V. S. Kuzmichov made considerable efforts to create the first in Ukraine departmental museum of criminalistics officially registered in 2001. For a long time, Volodymyr Serhiiovych collected interesting exhibits related to the detection of crimes, covered scientific advances in criminalistics. The museum served as a research and educational-practical complex. Later, it became the basis for the formation of a multifunctional museum of the Ministry of Internal Affairs of Ukraine. During this period, the Department of Criminology became a scientific center of forensic science. Experienced scientists and practitioners joined the educational process. By his personal example, Volodymyr Serhiiovych demonstrated high pedagogical skills, delivered brilliant lectures, conducted seminars and practical classes, and communicated sincerely with audience.

Professor V. S. Kuzmichov is the founder of a new approach in teaching a course of criminalistics based on better foreign practices, predominately of European states, and helps to implement professional training of experts both for Ukraine and for other countries. He was one of the authors of creation of a separate area of forensic ballistics.

Professor V. S. Kuzmichov presented students' personal and scientific developments to the Coordination Office for criminalistics, forensic science and legal psychology of the National Academy of Legal Sciences of Ukraine, Council of State Security and Internal Affairs of the State Attestation

Commission of Ukraine, Secretariat of the Verkhovna Rada of Ukraine where he worked. Volodymyr Serhiiiovych headed the Kyiv Regional Department of the International Congress of Criminalists, which contributed to the dissemination of achievements of the scientific school internationally. The name and credibility of V. S. Kuzmichov is recognized outside of Ukraine, he was a member of specialized academic councils on defense of doctoral and PhD dissertations in leading higher education institutions of Ukraine and other states: of Baku State University (Azerbaijan), Chişinău State University (Moldova) .

Volodymyr Serhiiiovych's Scientific School consists of two Doctors of Sciences (Yu. M. Chornous, I. V. Pyrih) and more than 20 PhDs in Law. Published heritage includes textbooks, numerous manuals and monographs and other publications, in particular: *Forensic analysis of crime investigation*, 2000; *Criminalistics*, 2001 (co-authored); *Investigative activity: characteristic and directions of improvement*, 2005 (co-authored); *Alibi in crimes detection*, 2007 (co-authored); *Compromise while pre-trial investigation* (forensic aspect), 2007 (co-authored); *Crime investigation: international and national legislation. Theory and practice*, 2008 (co-authored), etc.

Thus, main directions of forensic researches of Professor V. S. Kuzmichov scientific school are the methodological principles of criminalistics, problems of investigative activities, development and advancement of forensic tools and methods; improvement of investigation methodologies on certain types of crimes; issues of international cooperation.



Fig. 4. Andrii Volodymyrovych Ishchenko

A follower of Professor V.P. Bakhin scientific school was Andriy Volodymyrovych Ishchenko who undergone post-graduate military course, and later worked as a teacher (1982—1985), Professor of the Department of Criminology (1996—1998, 2004—2009, 2010—2019). During 1992—1994, A. V. Ishchenko became the first head of the Department of Forensic Examinations at Investigative-Forensic Faculty of the Academy (by the way,

it was the first department of forensic examinations not only in Ukraine but also in Europe).

Andriy Volodymyrovych was a Doctor of Law, Professor, Honored Lawyer of Ukraine, Academician of the International Slavic Academy of Sciences, a member of the Kyiv regional branch of the International Public Organization: *Congress of Criminalists*.

In 1997, A. V. Ishchenko successfully defended his dissertation on the topic: *Methodological and organizational issues of forensic researches*. Apart from this direction, his scientific school studied problems of forensic and crime detection and investigation support in crime counteraction practice, formation of forensic recommendations for investigation of certain types of crimes.

Professor A. V. Ishchenko scientific school consists of five Doctors and 21 PhDs in Law. A. V. Ishchenko was an academic adviser of doctoral dissertations of L. D. Udalova: *Theoretical principles of obtaining verbal information in the criminal process of Ukraine* (2007), D. I. Nykyforchuk: *Theoretical and organizational foundations of combating drug trafficking by operational police units* (2009), V. H. Khakhanovskyi: *Theory and practice of crime informatics* (2011), O. I. Motliakh: *Instrumental diagnostics of the accuracy of verbal information and the use of its results in criminal proceedings* (2014), V. V. Iusupov: *Criminalistics in Ukraine in the XX — beginning of the XXI centuries. (historical and theoretical research)* (2019).

A special place among researches of Professor A. V. Ishchenko is taken by the development of historical problems in the development of criminalistics. A striking continuation of this direction is the second edition of the Chronicle of Criminalistics in Ukrainian, that students and successors arduously worked on after the death of the Teacher.



Fig. 5 The Chronicle of Criminalistics (Kyiv, 2021)

Professor A. V. Ishchenko was a member of specialized academic councils for defense of doctoral dissertations at NAIA and headed one of these academic councils. As a representative of a famous forensic scientific school, he was a member of specialized academic councils for dissertations defense in Dnipropetrovsk State University of Internal Affairs, Classic Private University, Ivan Franko National University of Lviv, the National Academy of Security Service of Ukraine, the National Defense University of Ukraine named after Ivan Cherniakhovskyi, Lviv State University of Internal Affairs, Kharkiv National University of Internal Affairs. A. V. Ishchenko forensic scientific school also gained recognition abroad, where he was a member of councils for dissertations defense at Baku and Tbilisi universities.

Contribution of A. V. Ishchenko scientific school are numerous forensic editions: *A bibliographic index of dissertations on criminalistics*, 1989 (co-authored); *Issues of researches development in forensics*, 1995 (co-authored); *Methodological issues of criminalistics*, 1997; *Scientific support of crime counteraction*, 2002 (co-authored); *Means and methods for detecting explosives and devices in combating terrorism*, 2005 (co-authored); *Forensic support of search for missing persons*, 2005 (co-authored); *Theory and practice of forensic support of the proof process while crimes investigation*, 2007 (co-authored); *Criminalist Calendar*, 2010 (co-authored); *Criminalistics: textbook*, 2015, 2020 (co-authored); *Criminalistics: multimedia textbook, software product*, 2016 (co-authored), *The Chronicle of Criminalistics: data, facts, names*, 2016; *The basics of criminalistics: Educational manual*, 2018 (co-authored); *The Chronicle of Criminalistics*, 2021 (co-authored), etc.

To conclude, main directions of forensic researches of Professor A. V. Ishchenko scientific school are methodological issues of criminalistics and forensic expertology; history of criminalistics; forensic support of crime counteraction practice; scientific provision of forensic researches; a methodology of investigating certain types of crimes.

Doctor of Law, Professor Yevhen Dmytrovych Lukianchykov headed the Department of Criminalistics of the Ukrainian Academy of Internal Affairs between 1985—1993.



Fig. 6. Yevhen Dmytrovych Lukianchykov

Scientific interests of Professor Y. D. Lukianchykov are diverse topical issues of criminalistics, criminal procedure, crime detection and investigation. The study of such complex problems that form information background for the disclosure of criminal offenses helped Yevhen Dmytrovych to successfully defend his doctoral dissertation on the topic: *Information support of crimes investigation (legal and tactical-forensic aspects)* in 2005. Two Doctors of Law (K. O. Chaplynskyi, O. V. Taran) and more than 25 PhDs work at his school. Some of them (V. I. Halahan, V. H. Drozd, D. B. Serhieieva) defended doctoral dissertations over time. Ye. D. Lukianchykov participated in work of specialized academic councils for defense of PhD and doctoral dissertations of the National Academy of Sciences of Ukraine, the Academy of Advocacy of Ukraine, the Classic Private University, the University of the State Fiscal Service of Ukraine. In 2010, he headed the specialized academic council at the Academy of Management of the Ministry of Internal Affairs of Ukraine. For a long time, he worked as an academic secretary of the specialized academic council at NAIA.

Contribution of Professor Y. D. Lukianchykov scientific school is more than half a thousand publications, in particular: *Tactical foundations of crimes investigation*, 1989 (co-authored); *Peculiarities of the investigation of juvenile delinquency*, 1990; *Presentation for identification*, 1998 (co-authored); *Forensic identification of objects by memory traces*, 1998; *Methodological principles of information support in crime investigation*, 2005; *Covert investigation (search) operations and their classification*, 2013 (co-authored); *Criminalistics: textbook*, 2020 (co-authored), etc.

Thus, main directions of forensic researches of Professor Y. D. Lukianchykov scientific school are issues of forensic and information support of crime investigation; tactics of conducting individual covert investigation (search) operations and problems of methodology of crimes investigation.

Viktor Kazymyrovych Veselskyi held the position of Head of the Department of Criminology and Forensic Medicine at the National Academy of Internal Affairs (2004—2015), and after retirement was a Professor of this department (2015—2016).



Fig. 7. Viktor Kazymyrovych Veselskyi

Professor V. K. Veselskyi created his own forensic school and made a significant contribution to the training of scientific and pedagogical staff. Over the time of his work at the Department of Criminology and Forensic Medicine, about 150 military postgraduate Students and recipients defended their dissertations. V. K. Veselskyi constantly contributed to it in his daily work. The main directions of his research interests were issues of forensic tactics and methodology of investigating certain types of crimes. Among issues of investigative tactics, Viktor Kazymyrovych emphasized the fundamentals of investigative tactics and current problems of interrogation, investigative examination, appointment and conduct of forensic examinations. Professor V. K. Veselskyi developed ways to improve counteraction to the most socially dangerous, complex and high-profile crimes: human trafficking, cybercrimes, drug trafficking. His scientific school consists of more than thirty students: PhDs in Law.

Viktor Kazymyrovych systematically participated in the development of proposals on improving the domestic legal system in the field of forensic science, detection, investigation and combating of crimes, reform of criminal procedure legislation.

Professor V. K. Veselskyi was a member of the Academic Council of NAIA, scientific-methodical section and scientific-methodical council of the Academy. Thanks to his academic standing, he became a member of the specialized academic council for dissertations defense at the University of the State Fiscal Service of Ukraine.

A weighty contribution of V. K. Veselskyi scientific school includes, in particular, publications and registered objects of intellectual property: *Modern problems of interrogation (procedural, organizational and tactical aspects)*, 1999; *Human trafficking in Ukraine (problems of investigation)*, 2007 (co-authored); *The methodology of disclosure and investigation of a knowingly false report about the threat to public safety, destruction or damage to property: scientific report*, 2011 (co-authored); *Multimedia textbook "Criminalistics": A software product*, 2016 (co-authored); *Investigation of certain types of crimes*, 2017 (co-authored), etc.

Therefore, the main directions of forensic researches of Professor V. K. Veselskyi scientific school are issues of tactics of investigation (search) operations, methodology of investigating certain types of crimes.

Petro Dmytrovych Bilenchuk, PnD in Law, Docent, headed the Department of Criminology of NAIA of Ukraine between 1993—1996.



Fig. 8. Petro Dmytrovych Bilenchuk

As an experienced practitioner, Petro Dmytrovych conducted classes in an engaging way, skillfully united a team of scientists. His scientific school consists of eleven PhDs in Law whom he prepared. Directions of scientific activity: criminalistics, means of knowledge in court procedure, constitutional, banking, insurance, stock, competition, tax, environmental, municipal, information-communication and criminal law, neurobionics, forensic cybernetics, computer science and systems science, electronic and information technology.

P. D. Bilenchuk is the author of new directions in legal science: means of knowledge in court procedure; forensic anthropology and computer psychophysiological diagnostics and prediction of human behavior while court procedure.

The contribution of Petr Dmytrovych scientific school are textbooks, monographs, patents, innovative proposals, bills and drafts of bylaw legal regulations, in particular: innovative proposals: *Investigative and operational odorological suitcase*, 1985, *Forensic topographic ruler*, 1987; industrial design patent: *Stencil line of the investigator: "Line-C"*, 1998; *Computer Crimes: socio-legal and criminological-forensic aspects*, 1994 (co-authored); *Forensic examinations conduct*, 1996 (co-authored); *Criminalistics*, 1997; *Procedural and forensic issues of the accused's investigation*, 1999; *Legal deontology: textbook*, 1999 (co-authored); *Ballistics: forensic firearms: textbook*, 2003 (co-authored); *Weapon studies: legal bases of firearms circulation*, 2004 (in co-authorship); *Forensic tactics and methods of investigation of certain types of crimes*, 2007 (co-authored); *Multimedia textbook "Forensics": software*, 2008 (co-authored); *Systematization of cognition means in criminal procedure: traditional and modern*, 2012; *Legal and forensic support for countering nuclear terrorism*, 2017 (co-authored); *Forensic documentation of the scene inspection: methods, tools, technologies*, 2019 (co-authored).

Thus, the main directions of forensic researches of P. D. Bilenchuk scientific school are study of current issues of forensic investigation of crimes involving data from other sciences (cybernetics, computer science, neurobionics, etc.), nuclear and digital forensics.

Development of forensic support of counteraction to cybercrime at NAIA is implemented by Professor Valerii Heorhiiiovych Khakhanovskiy scientific school, a student of Professor A. V. Ishchenko.

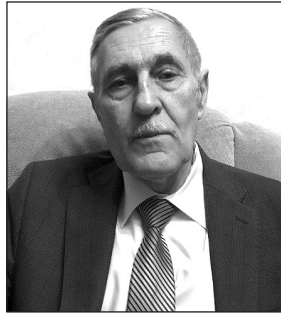


Fig. 9. Valerii Heorhiiiovych Khakhanovskiy

V. H. Khakhanovskiy is a Professor of the Department of Information Technology and Cyber Security at NAIA, Doctor of Law, Professor, laureate of Award of Prince Yaroslav the Wise. In 2012, he obtained the degree of Doctor of Law based on the results of dissertation defense on the topic: *Theory and practice of forensic computer science*. He has prepared five PhDs in Law, currently supervises four candidates for the degree of PhD, and is an academic adviser for candidates receiving the degree of Doctor of Law.

The main priority in the research of Professor V. H. Khakhanovskiy scientific school is provision of forensic knowledge that will help law enforcement to handle key provisions of electronic (digital) evidence, adequately formulate questions to forensic experts, cameramen and providers to obtain information needed while cybercrime, to maintain rules of collection and storage of digital media.

V. H. Khakhanovskiy has been working in the field of information security and counteraction to cybercrime for over 35 years, is a member of specialized academic councils for doctoral dissertations defense of NAIA and the University of State Fiscal Service of Ukraine.

The contribution of his scientific school includes numerous publications, in particular: *Issues of theory and practice of computer forensics*, 2010; *Information support of internal affairs bodies*, 2015; *Information technology in law enforcement practice*, 2015; *The system of information and analytical support of law enforcement agencies in terms of e-governance*, 2018 (co-authored); *A scientific and practical commentary of the Law of Ukraine: On basic principles of cybersecurity provision in Ukraine*, 2019 (co-authored); *The use of electronic (digital) evidence in criminal proceedings*, 2020 (co-authored); as well as registered objects of intellectual property right: software product “*Information Law Manual*”,

2008; computer program: *Expert system of search for a serial killer*, 2009; software product: *Multimedia educational complex "Forensic computer science"*, 2010, etc.

Thus, Professor V. H. Khakhanovskiy scientific school carries out the following researches: forensic computer science; information technology law; forensic examination of devices and materials of video recording; information and analytical support of law enforcement activities; information security, cybersecurity and data protection; peculiarities of cybercrime investigation.

Oleh Volodymyrovych Rybalskyi, Principal Researcher of Research Laboratory on Forensic Support and Expertise of the National Academy of Internal Affairs of Ukraine continues to develop problematic issues of forensic acoustics, which Professor M. V. Saltevskyi began to study at the Academy.

Oleh Volodymyrovych is Doctor of Technology, Professor, laureate of the State Prize, Honored Professor of NAIA.



Fig. 10. Oleh Volodymyrovych Rybalskyi

He went from a fitter to the Head of the design bureau, a chief designer of a number of special purpose equipment, including analog, modulation and digital recording devices. For the development and introduction into serial production of one of these products designated for accurate recording of analog signals in digital format was awarded the title of laureate of the State Prize of the USSR in the field of science and technology (1989).

Oleh Volodymyrovych is a famous expert in the field of forensic technology, phonoscopic examinations. In 2006, he was awarded the degree of Doctor of Technology in the specialization: *Information Security Systems*.

In his publications, O. V. Rybalskyi studied issues of developing a new methodology, methods and means of forensic examination of complex technical objects, including materials and tools of analog and digital video recording. The scientist considered these problems as an aspect of protection of law enforcement agencies from misinformation.

He is the founder of a new scientific direction of recreation of methods and means of expert researches of the equipment and materials of video and audio recording which is based on the use of properties of stray parameters of the recording equipment. On this basis, he created a theory for detecting traces of sound record digital processing, which for the first time shows sources and mechanisms of appearance and separation of identification features of digital sound recording equipment from digital sound records and features of their processing. For the first time in 2006 he proved the fractality of the structure of signals recorded in sound records, variability of this structure during digital processing, and proposed to use these properties while forensic examination of materials and equipment of digital sound recording.

Based on and in view of the development of these theoretical provisions, a number of expert methodologies and tools have been introduced, co-authored by Professor O. V. Rybalskyi: these methods are included in the Register of methods of forensic examinations of the Ministry of Justice of Ukraine.

Professor O. V. Rybalskyi has his own scientific school, which includes five PhDs, whom he prepared, and other scholars performing research in the field of forensic acoustics. O. V. Rybalskyi has been working in his specialization for over 50 years. He actively participates in training of audio experts: he is a member of expert qualification commissions for attestation of forensic experts in forensic research institutes of the Ministry of Justice and the State Research Forensic Center (Expert Service) of the Ministry of Internal Affairs of Ukraine.

Currently, he is a member of specialized academic councils for doctoral dissertations defense at NAIA in the specialization 12.00.09: *Criminal Procedure and Criminalistics; Forensic Science; Crime Detection and Investigation* and Odessa Polytechnic State University in the specialization 05.13.21: *Information Security Systems*.

The contribution of O. V. Rybalskyi scientific school is scientific and methodical research papers, textbooks, monographs, lecture courses, more than 30 USSR copyright certificates and patents of Ukraine for inventions, in particular: *Modern methods of authenticity verification of magnetic sound records in forensic acoustics*, 2003 (co-authored); *Application of wavelet analysis to detect traces of digital processing of analog and digital sound records in forensic acoustics*, 2006; *Storage, preparation and procedure for providing materials and tools of video and audio recording for forensic examination*, 2010 (co-authored); *Peculiarities of the development of traces of digital processing of analog and digital sound records and methods of their detection*, 2010, etc.

Thus, the main directions of forensic researches of Professor O. V. Rybalskyi scientific school are issues of forensic science related to creation and use of expert tools designated for conducting forensic examinations of complex

technical objects, including materials and tools of digital video and audio recording.

Currently, NAIA develops other directions of forensic researches in new scientific schools. Praxeology issues of law enforcement practice make up the basis for researches of Professor S. S. Cherniavskiy scientific school (consisting of six Doctors and 15 PhDs in Law); development of forensic support of counteraction to crime is implemented by scientists of Professor Yu. M. Chornous forensic school (as part of this scientific school: ten PhDs in Law); issues of the history of criminalistics and modern methodologies of investigating criminal offenses are studied in the scientific school of V. V. Yusupov, Doctor of Law (the school consists of five PhDs in Law).

Scientists-criminalists of NAIA have creative and friendly relations with practically all staff of the Departments of Criminology, Criminal Law, Criminal Process, Operational and Investigative Activities of leading legal universities of the state. Since the proclamation of Ukraine's independence, 28 Doctors of Sciences and more than 220 PhDs in Law have been trained in the forensic schools of NAIA.

Conclusions. To summarize the above, forensic researches of scientific schools of NAIA initiated by the heads of the Department of Criminology M. V. Salteviskiy and V. P. Bakhin are developing according to two scientific directions: innovative researches of non-traditional traces of a crime (research directions of Professor M. V. Salteviskiy) and advancement of investigative activities and methodologies of investigating criminal offenses based on studying the tactics of criminals, modern achievements of science and technology (research directions of Professor V. P. Bakhin). Relying on generalization of the results of the Academy forensic researches, a series of analytical and methodical works, commentaries and textbooks (in particular, in foreign languages) were prepared and published. The development of unique devices and technologies in the field of special and forensic techniques and tactics, forensic medicine with their corresponding recognition at the state level, certification by protection title for intellectual property objects, including dozens of patents and copyright certificates.

In research activity, forensic science schools of NAIA develop close scientific ties with leading forensic centers: Taras Shevchenko National University of Kyiv, National Academy of Security Service of Ukraine, Academy of Advocacy of Ukraine, University of the State Fiscal Service of Ukraine, Yaroslav Mudryi National Law University, National Scientific Center "Hon. Prof. M. S. Bokarius Forensic Science Institute", Kharkiv National University of Internal Affairs, National University "Odessa Law Academy", Odessa State University of Internal Affairs, Dnipropetrovsk State University of Internal Affairs, Lviv State University of Internal Affairs, National Academy of the State Border Guard Service of Ukraine named after B. Khmelnytsky and other educational institutions both of Ukraine and foreign countries.

The practical component of researches is supported by joint work of scientists-criminalists of the Academy with forensic experts, investigators and other law enforcement agencies, namely by forensic research institutes of the Ministry of Justice, units of the Expert Service of the Ministry of Internal Affairs, Main Investigation Department, Department of Explosive Service and other structural units of the National, National Anti-Corruption Bureau, State Bureau of Investigation, etc.

The forensic science center of NAIA substantially contributes to the development of legal science and education, promotes formation of a high level of professionalism in law enforcement agencies and lawyers, ensures the unity of law enforcement practice and educational-scientific activities in the higher education institution.

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С. С. Чернявський, В. В. Юсупов

**Криміналістичні наукові дослідження
Національної академії внутрішніх справ:
доробок наукових шкіл
(оглядова стаття)**

Проаналізовано розвиток криміналістичних досліджень наукових шкіл Національної академії внутрішніх справ (далі — НАВС). Показано роль керівників кафедр і провідних професорів НАВС у розвитку наукових досліджень; розкрито напрями криміналістичних досліджень наукових шкіл НАВС.

Криміналістичні дослідження НАВС розвиваються за двома векторами — інноваційні дослідження нетрадиційних слідів злочину (школа

професора М. В. Салтевського) і вдосконалення слідчої діяльності й методик розслідування злочинів (школа професора В. П. Бахіна).

Ключові слова: криміналістичні наукові дослідження, криміналістична наукова школа, кафедра криміналістики, Національна академія внутрішніх справ, криміналістика, судова експертиза.

С. С. Чернявский, В. В. Юсупов

**Криминалистические научные исследования Национальной
академии внутренних дел: наследие научных школ
(обзорная статья)**

Цель — на основании исследования исторического развития Национальной академии внутренних дел раскрыть процесс формирования в ней криминалистических научных школ; показать роль руководителей кафедр и ведущих профессоров Национальной академии внутренних дел в образовании криминалистических научных школ; раскрыть основные направления исследований криминалистических научных школ Национальной академии внутренних дел, осветить их вклад в подготовку научно-педагогических работников высшей квалификации; определить достижения криминалистических научных школ Национальной академии внутренних дел и их значение для развития юридической науки и образования в Украине.

При освещении материала статьи применяли исторический, историографический, терминологический, системно-структурный, формально-логический, сравнительно-правовой и статистический методы.

Обосновано, что центром развития криминалистических научных школ в Национальной академии внутренних дел является кафедра криминалистики. Систематизированы и показаны основные направления исследований криминалистических научных школ Национальной академии внутренних дел. Доказано, что криминалистические школы Национальной академии внутренних дел развиваются на основе двух научных векторов — инновационные исследования нетрадиционных следов преступления (школа профессора М. В. Салтевского); усовершенствование следственной деятельности и методик расследования уголовных преступлений на основании изучения тактики преступников, современных достижений науки и техники (школа профессора В. П. Бахина). Показаны научные связи криминалистических школ Национальной академии внутренних дел с другими криминалистическими школами и центрами научно-исследовательских учреждений, высших учебных заведений, правоохранительных органов.

Криминалистические научные школы Национальной академии внутренних дел играют важную роль в развитии юридической науки и образования, способствуют формированию высокого профессионализма правоохранителей и юристов, обеспечивают единство правоприменительной практики и образовательно-научной деятельности в учреждениях высшего образования.

Ключевые слова: криминалистические научные исследования, криминалистическая научная школа, кафедра криминалистики, Национальная академия внутренних дел, криминалистика, судебная экспертиза.

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Contributors

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Research Article

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Criminal records: problems of classification

Problems of criminal records classification have been studied. The article considers classification of criminal records according to the main criteria: intended purpose, degree of centralization and functional (target) purpose.

Criminal records develop and operate within various state bodies of Ukraine, therefore records can be classified by intended purpose as follows: records of the Ministry of Internal Affairs of Ukraine; State Tax Service of Ukraine; State Customs Service of Ukraine; Security Service of Ukraine; State Bureau of Investigation of National Anti-Corruption Bureau; General Prosecutor's Office, etc. All of them are aimed at facilitating investigation of criminal offenses. At the same time, criminal records of the Ministry of Internal Affairs of Ukraine, in turn include records of: the National Police of Ukraine, functioning in the department of information and analytical support; the State Border Guard Service of Ukraine; State Migration Service of Ukraine; Main service center of MIA of Ukraine; Expert Service of the Ministry of Internal Affairs of Ukraine.

It has been proved that according to the degree of centralization, records should be divided into central, regional and local, but at the same time, the virtual absence of records in the expert service at the local level is stressed, which is confirmed by results of studying case files of criminal proceedings and interviews of investigators. According to the view of authors, criminal record keeping of objects at the local level in the general classification should be left for further consideration, but responsibility for its formation and functioning should be assigned to the city departments of technical and forensic support of police.

Classification of criminal records by functional (target) purpose into search and reference ones is substantiated. At the same time, it is noted that reference and support records in the form of collections have lost their meaning today and cannot make up the system of criminal records. In view of the authors,

they can be characterized as information databases formed and operating in cyberspace and that can be both freely available and owned by enterprises, institutions, organizations and individuals. In practice, this type of record keeping practically non-existent which is evidenced by studying work results of investigative police departments and expert service.

Keywords: classification, investigation of criminal offenses, criminal records, search records, reference records, expert service.

Formulation of Research Problem. Classification in any field of knowledge is a system-forming component, the basis of science methodology. Classification is the process of dividing objects, processes and phenomena into genera, classes, groups according to common features and properties. Accordingly, a class or group make up a system with common, predetermined features. A feature of any object is an element characterizing its peculiarity, individuality. The set of features helps to distinguish one object from another. V. V. Biriukov focused on the importance of criminal records classification: “Issues related to the definition and classification of record-keeping objects ¹ are of great importance for the theory of criminalistics, as well as activities for organization and maintenance of criminal records, ensuring the process of investigation with needed information”. Systematization is the maintenance of record-keeping objects in accordance with a scientifically developed system that is based on the classification of identification features of these objects. The system contains various types of criminal records which have their own structure, purpose, formation mechanism and procedure of functioning. Each type of record-keeping is based on features and properties of objects forming its content and referring to which search and identification are implemented.

Analysis of Essential Researches and Publications. In the scientific literature, issues of information support of investigation in general and the improvement of certain types of records are paid much attention to. It is needed to mention monographs dedicated to individual issues of information support of investigation reflecting the content of corresponding defended doctoral dissertations: Ye. D. Lukianchikov: *Methodological bases of information support of crimes investigation* (2005) ², V. V. Biriukov: *Theoretical foundations of information and reference support of crimes investigation* (2009) ³, V. H. Khakhonovskiy: *Issues of theory and practice of forensic computer science* (2010) ⁴. These research papers are to a large extent a synthesis of scientific opinions of

¹ Бірюков В. В. Теоретичні основи інформаційно-довідкового забезпечення розслідування злочинів : монограф. Луганськ, 2009. Р. 382.

² Лук'янчиков Є. Д. Методологічні засади інформаційного забезпечення розслідування злочинів : монограф. Київ, 2005. 360 р.

³ Бірюков В. В. Op. cit.

⁴ Хахановський В. Г. Проблеми теорії і практики криміналістичної інформатики : монограф. Київ, 2010. 382 р.

predecessors in the researched field. The following PhD dissertations are dedicated to functioning of certain types of criminal records: S. V. Kaduk: *Forensic reference collections and their importance in the crimes investigation* (2010) ¹, A. E. Volkova: *Formation and use of information and reference collections of the expert service of the Ministry of Internal Affairs of Ukraine* (2012) ². However, in modern conditions of informatization of society and development of telecommunication networks and information technologies, provision of law enforcement agencies with relevant information is breaking new ground. Therefore, scientific developments of functioning and use of criminal records in the investigation of criminal offenses require constant improvement and updating, what conditions the relevance of this article.

The **Article Purpose** is to summarize views of scientists on classification of criminal records and develop their classification.

Main Content Presentation. Criminal records are very diverse and numerous, and although they are interrelated, it is feasible to distinguish them by individual criteria. Scientists define criteria for the classification of criminal records in different ways. Thus, L. Ya. Drapkin and V. M. Karahodin note that: “classification of records can be implemented by different features. The most important of them are: a) the main function of record-keeping; b) information contained in a record; c) methods of information processing; d) a place of record-keeping information concentration” ³. V. V. Biriukov (along with the above criteria) stresses the following: “By type of record-keeping documents that form their arrays; by record-keeping objects; by the degree of automation; by forms of record-keeping; by the way of combining information arrays; by methods and forms of displaying information in record-keeping units; by types of details and other criteria” ⁴. In our opinion, quite exhaustive classification is suggested by P. D. Bilenchuk who noted that: “criminal records can be systematized on various grounds: for specific expertise: into criminal records that require specific expertise (records of forensic units), and those that do not require specific expertise (records of information centers); according to the degree of territorial distribution distinguish: interstate, state, regional and local records; depending on the place of concentration, they can be divided into records of information analysis centers and records of forensic units; by the nature of processing of forensically significant information: into automated data banks, automated information retrieval systems and manual files; by the

¹ Кадук С. В. Криміналістично-довідкові колекції та їх значення у розслідуванні злочинів : автореф. дис. ... канд. юрид. наук. Київ, 2010. 20 р.

² Волкова А. Е. Формування і використання інформаційно-довідкових колекцій експертної служби МВС України. автореф. дис. ... канд. юрид. наук. Запоріжжя, 2012. 22 р.

³ Драпкин Л. Я., Карагодин В. Н. Криминалистика : учебник. Москва, 2007. Р. 148.

⁴ Бірюков В. В. О.р. cit.

degree of centralization into: centralized, centralized-local and local; records kept at SSRFC of the MIA are called centralized”¹. In general, concurring with the above classification, it should be stressed that criteria by the degree of prevalence and the degree of centralization are the same and need to be united into one which most scientists call “by the degree of centralization”.

Let's consider the classification of criminal records according to the criteria that, in our opinion, more fully characterize their essence and which are most significant for practice. Criminal records are formed and operate within various state bodies of Ukraine, therefore records can be classified by service belonging as follows: records of Ministry of Internal Affairs of Ukraine; records of State Tax Service of Ukraine; records of State Customs Service of Ukraine; records of Security Service of Ukraine; records of State Bureau of Investigation; records of National Anti-Corruption Bureau; records of General Prosecutor's Office.

All of them are aimed at facilitating investigation of criminal offenses. At the same time, criminal records of the Ministry of Internal Affairs of Ukraine, in turn, contain the following records: of the National Police of Ukraine, which operate within the department of information analysis support (hereinafter referred to as DIAS); State Border Guard Service of Ukraine; State Migration Service of Ukraine; the Main Service Center of the Ministry of Internal Affairs of Ukraine; Expert service of the Ministry of Internal Affairs of Ukraine.

Referring to the results of research on materials of criminal proceedings, we found out that the most vital for investigation are criminal records of the Expert Service and DIAS of the police. Records operating within these units, according to data obtained while research, were used in 92 % of criminal proceedings. Later, we will focus in more detail on types of these records.

As I. O. Vozghrin notes, the content of criminal records is limited by territorial, time and target limits. The territorial limit is understood by the author as limited gathering and use of information at a certain territory, the time limit is restriction by a specific time period; the target limit is the collection and use of only those data that meet tasks for which solution particular records are assigned². In general, we agree with the specified characteristic of records and believe that these criteria are the foundation for their classification. However, we believe that territorial limits are more likely to be considered not as processes of collecting and using information, but as their concentration or centralization. Thus, information concentrated at a region level can be obtained outside a region and sent by request upon receipt of certain information during investigation of a particular criminal proceeding. Conversely, information or objects

¹ Арешонков В. В., Біленчук П. Д., Волошин О. Г. та ін. Криміналістична техніка. Книга друга : навч. посіб. ; за ред. А. В. Кофанова. Київ, 2009. Р. 399.

² Возгрин И. А. Некоторые вопросы теории и практики криминалистического учёта. *Вопросы теории и практики борьбы с преступностью*. Ленинград, 1972. Р. 7.

found at a specific location (for example, bullets seized while scene inspection) can be identified by weapons seized elsewhere. The time period cannot serve as a basis for classification of records and rather refers to the period of presence of certain objects in a certain information array.

Thus, according to territoriality, or, as we have emphasized and believe to be more accurate, according to the level of concentration, criminal records can be divided into: central, regional and local. The belonging of information systems to a certain level is conditioned by the principles of territoriality, specifics of use and the amount of information being processed. Some scientists classify records by territoriality emphasizing that objects of record-keeping may be the same at different levels. Thus, I. V. Hora and V. A. Kolesnyk note: "Centralization and concentration of record-keeping material can be carried out at the state or regional level, within the region, city, district. By this feature criminal records are divided into centralized and local. Information about individual objects is registered at the state and local levels. Such records are mixed by the feature of materials concentration"¹. These scientists, co-authored with A. V. Ishchenko, specify their opinion by dividing records depending on the "the level of concentration of information on registered objects: centralized, regional, local and mixed"². Individual textbooks on criminalistics address the levels of criminal records but do not name criteria for specified classification³. We believe that this is due to the fact that in this classification the same objects may be concentrated at different levels, depending on the need to use them in a particular criminal proceeding.

If there is no special discussion among scholars on classification of records by levels, then the content of this classification needs, in our opinion, clarification. Dividing records into three levels, V. V. Biriukov emphasizes: "a) at the central level: the level of MIA of Ukraine; b) regional: the level of regional Directorates of the Ministry of Internal Affairs of Ukraine; c) at the local level: the level of municipal and regional departments of Directorates of the Ministry of Internal Affairs of Ukraine. What is more, some records operate at the local, the second: at the local and regional, the third: at the regional and central, the fourth: only at the central level"⁴. Characterizing criminal records of the expert service, Yu. B. Komarynska defines the three-level structure as follows: at the central level: at SSRFC of the MIA of Ukraine, where central collections are maintained; regional: in SRFC at headquarters, regional headquarters where

¹ Гора І. В., Колесник В. А. Криміналістика : навч. посіб. Ч. 1. Криміналістична техніка. Київ, 2005. Р. 300.

² Гора І. В., Іщенко А. В., Колесник В. А. Криміналістика : посіб. для підготов. до іспитів. 2-ге вид., допов. та перероб. Київ, 2004. Р. 143.

³ Андреев И. С., Грамович Г. И., Порубов Н. И. Курс криминалистики ; под ред. Н. И. Порубова. Минск, 1997. Р. 91 ; Пясковський В. В., Чорноус Ю. М., Іщенко А. В., Алексєєв О. О. та ін. Криміналістика : підручник. Київ, 2015. Р. 249.

⁴ Бірюков В. В. Опр. cit. Р. 363.

regional collections are maintained; local (local, cluster): in units of forensic support of local, district departments where local (local, cluster) collections are maintained. Local, cluster records are kept at the unit for forensic support of local, district, police bodies and formed from objects (their copies, images) and / or information about them, which come from two or more local, district police departments serving adjacent territories ¹.

Given the current situation, we cannot agree with the above views on functioning of criminal records at the local level. Undoubtedly, we agree that initial information for the formation of criminal records comes from the regional police departments. Objects seized during investigation (search) operations, information about detainees and suspects are registered in corresponding documents. But it is impossible to speak about its accumulation and systematization in full at the level of regional police departments. This is evidenced by the results of a survey performed among police officers. The lack of records at the local level (traces of shoes bottom, gloves, vehicles, burglary equipment and tools, etc.) was noted by 95 % of criminalists-inspectors interviewed by us. A survey of DIAS employees in Kyiv and Kharkiv regions shows that positions staffing of employees of their service in regional police departments is about 40 %, mostly in region centers. A similar survey in other regions showed significantly worse results.

Maintaining local records before reforming internal affairs bodies was entrusted to forensic experts of regional departments. Currently, as enshrined in law, forensic inspectors-criminalists are only required to keep individual records, so they do not analyze or summarize trace information seized during the investigation (search) operations (in particular, scene inspection). There is also no exchange of such information between police departments. For example: a group of burglars is detained, and shoes and burglary tools are not confiscated during search of their place of residence, therefore ignore their check for committing other crimes at this territory.

The Order of the Ministry of Internal Affairs of Ukraine No. 257 dated on 16.03.2020 provides for the formation and maintenance of the information subsystem: *СЛІД* of the information and telecommunication system: *Інформаційний портал Національної поліції України*, which actually obliges forensic units of the police pre-trial investigation body to keep forensic records at the local level. In particular, the purpose of the information subsystem *СЛІД* is:

“•record-keeping for information about objects seized during investigation (search) operations in a single information space using modern information technology, computer and telecommunications equipment;

¹ Пясковський В. В., Чорноус Ю. М., Іщенко А. В., Алексєєв О. О. та ін. *Op. cit.*

- *provision of information analysis support to the activities of police bodies (units) aimed at preventing and disclosing criminal offenses;*
- *establishing links between data significant for a criminal proceeding;*
- *ensure processing of information about objects that were seized while investigation (search) operations, filling and maintaining the current state of information resources in databases (databanks) included in Information Portal of National Police”¹.*

The following information is entered to the *СЛІД* information system: “about objects that were seized during investigation (search) operations by responsible persons of the police pre-trial investigation after its assessment for the presence of a set of identification features by the Head of the forensic support unit of the police pre-trial investigation body. If during the analysis of seized objects coincidences with other objects entered into the *СЛІД* information subsystem are identified, the administration of the police pre-trial investigation body shall be immediately notified”². In practice, this subsystem does not actually exist. For high-profile crimes, the information is sent to SRFC and is recorded and systematized at the level of DMIA in regions. In the district police departments, there are only “guard” cards with information on seized traces, which sometimes do not contain their images, and in the case of their presence, the images often allow to establish only the group belonging of objects. We do not speak about any identification researches. In addition, the lack of necessary technical and forensic support (this was stated by 87% of our investigators and inspectors-criminalists) and the low level of training of inspectors-criminalists (68% of surveyed investigators) in district police departments should be stressed.

In view of the above, we believe that consideration of objects record-keeping at the local level should be left, but the responsibility for its formation and operation should be assigned to local units of technical and forensic support. Our suggestion is also justified by the need to verify traces of these records not only within the district, but also throughout the city as criminals are usually not limited to one district, but operate throughout the city. This is especially true of such crimes as theft, robbery, burglary, hooliganism, causing bodily harm, etc.

From information viewpoint and in terms of importance for solution of criminal proceeding tasks, the distribution of records not by concentration but by functional purpose or tasks solved by criminal records is more important. Regarding classification of criminal records, forensic scientists did not reach consensus on this criterion. One group, represented by forensic scientists

¹ Про затвердження Інструкції з формування й ведення інформаційної підсистеми «СЛІД» інформаційно-телекомунікаційної системи «Інформаційний портал Національної поліції України»: наказ МВС України від 16.03.2020 р. № 257. URL: <https://zakon.rada.gov.ua/laws/show/z0319-20> (date accessed: 22.02.2021).

² Ibid.

of the so-called Soviet school (T. V. Averianova, R. S. Bielkin, O. F. Volynskyi, Yu. H. Korukhov, O. R. Rosynska) divides criminal records into three groups: operative-reference, forensic, reference-supplementary¹. According to O. F. Volynskyi, operative-reference records include information: “about objects (and features individualizing them) that often have a cause-effect relation with a crime event. Thus, information is externally obvious, visually acceptable. No specific expertise is required to identify it and use it to detect wanted objects among similar (being inspected) objects. Criminal records contain information about objects, acquisition and implementation of which: “involves the help of forensic experts and the use of forensic research techniques”. Reference-supplementary records contain information: “about objects, and sometimes objects themselves (their collections), which have no cause-action relation with a crime event. However, their use is important to establish crime circumstances”².

In our view, the above classification is not accurate since all of the above types of records should be called *forensic*, as they directly relate to investigation of criminal proceedings and contribute to identification of people involved in a crime and to other circumstances of the offense. V. A. Zhbankov, classifying records by functionality, divides them into “forensic operative-reference, forensic search and forensic reference-supplementary”³, confirming their generic feature as forensic.

The second group of scientists provides another classification of records. V. Yu. Shepitko divides records (depending on tasks to be solved) into operative-search and information-reference⁴, at the same time adhering to the classification specified in the Instruction on maintenance of criminal records functioning of the expert service of the Ministry of Internal Affairs of Ukraine. According to this Instruction, operative-search collections: “are formed from objects (their copies, images) and (or) information about them seized or obtained while scene inspection <...>, other investigative actions, operation-search operations, etc. as well as fingerprint cards, photo and video images, voice and speech recordings of persons, DNA profiles obtained during forensic registration”⁵. Information-reference collections: “are formed from objects of interest

¹ Аверьянова Т. В., Белкин Р. С., Корухов Ю. Г., Россинская Е. Р. Криминалистика : учеб. для вузов ; под. ред. Р. С. Белкина. Москва, 2000. Р. 369 ; Криминалистика : учеб. для студ. вузов ; под ред. А. Ф. Вольнского, В. П. Лаврова. 2-е изд., перераб. и доп. Москва, 2008. Р. 321.

² Криминалистика : учеб. для студ. вузов... .

³ Жбанков В. А. Получение образцов для сравнительного исследования. Москва, 1992. Р. 63.

⁴ Шепітько В. Ю., Журавель В. А., Коновалова В. О. та ін. Криміналістика : підручник : у 2 т. Т. 1 ; за ред. В. Ю. Шепітька. Харків, 2019. Р. 203.

⁵ Про затвердження Інструкції з організації функціонування криміналістичних обліків експертної служби МВС України : наказ МВС України від 10.09.2009 р. № 390. URL: <https://zakon.rada.gov.ua/laws/show/z0963-09> (date accessed: 22.02.2021).

for crime detection and investigation, research and methodological activities and is physical evidence in criminal cases in which the case is closed and in respect of which there is a court decision on their placement in collections, as well as objects received from institutions, organizations, enterprises regardless of the form of ownership”¹. Yu. B. Komarynska also classifies criminal records, but at the same time emphasizes that this classification belongs exclusively to criminal records of the expert service of the Ministry of Internal Affairs of Ukraine². In general, the textbook content prepared by composite authors of the National Academy of Internal Affairs demonstrates that records kept by DIAS do not belong to the category of forensic (Chapters 18 and 19, author Yu. B. Komarynska), and we certainly disagree with it. P. D. Bilenchuk also distinguishes two types of records, but views them differently: a) operative-reference records which differ in a significant amount of arrays with a fairly short (reference) description of recorded objects. Their main purpose is to check the availability of constituent data about an object and its location at the time of request. Eternally obvious, visually acceptable features of objects are the basis of it; b) operation-search records that contain more information about an object, performing (along with operation-reference) the function of comparing not only constituent data, but also similar external descriptions of persons, things, products; they are outlined directly by the investigator and operative entities. Recording objects or their features does not require forensic knowledge. According to the scientist, these records are available in divisions of DIAS. Such distribution of records is quite possible, however, in fact the difference between them is the volume of descriptive part of objects forming arrays of recorded data, which are not, in our opinion, the basis for their division. In addition, the author singles out forensic records, in which: “informational features of objects are usually identified by implementing special researches or forensic examinations, and these records are kept only in forensic departments”³.

Expanding classification of records by purpose, V. V. Biriukov divides them into three groups: operative-search, information-reference and reference-supplementary. According to the scientist, criminal records of operation and search purpose: “contain information about objects involved in unsolved crimes, as well as specific objects of operational interest, which are directly intended to facilitate their establishment by artificial or personal features”⁴. Criminal records are: “records designated to provide the investigation process with a wide range of information about objects involved in a crime which may be useful for solving problems arising in investigation process”⁵.

¹ Ibidem.

² Пясковський В. В., Черноус Ю. М., Іщенко А. В., Алексєєв О. О. та ін. *Op. cit.*

³ Арешонков В. В., Біленчук П. Д., Волошин О. Г. та ін. *Op. cit.*

⁴ Бірюков В. В. *Op. cit.* P. 375.

⁵ Ibidem.

According to most scientists-criminalists, collections that are created and operate within the divisions of the expert service make up the basis of reference-support records. Thus, according to V. V. Biriukov, “reference-supplementary criminal records include collections and catalogs of various objects being used as samples for comparison during forensic examinations and researches, as well as in search activities to solve classification tasks”¹. According to S. V. Kaduk, whose dissertation was dedicated to forensic-reference collections, they are systematized: “by one or more common features of collection of certain forensic physical objects or their copies (representations), which constitute scientific, cognitive and practical interest as a whole”². The author concludes that forensic reference collections are part of reference and supplementary records and are formed from real-world objects, as well as their models (representations, copies): photographs, videos, casts, impressions, descriptions, etc. N. I. Klymenko emphasizes: “As for collections of reference and real-world nature, they are used to ensure information support to a forensic expert. In forensic science, they fall into two types: real-world collections and descriptive forms. <...> Real-world collections can be presented in the form of direct objects or their images. Forensic units of the Ministry of Internal Affairs have such descriptive collections as a reference fund of publications on various areas of forensic activity (including management), Automated Information-search system of regulations of MIA, etc.”³. At the same time, the scientist does not mention the importance of collections directly while investigation, but singles out only their importance in forensic expert activities.

The significance of reference-supplementary records is stressed by V. V. Biriukov as follows: “Although these records do not directly help in detection of specific crimes, however, they contribute to solution of others, no less important tasks arising while investigation. For example, to categorize an object, define a group of similar objects, etc.”⁴ The Instruction on the organization of criminal records functioning of the expert service of the Ministry of Internal Affairs of Ukraine states: “Information and reference collections are intended for the use of objects contained in it during expert researches, creation of research and design-experimental developments, updating of methodological and regulatory framework of forensic examination, preparation of indicative information, summarizing information on causes and conditions of crimes and

¹ Ibidem. P. 375—377.

² Кадук С. В. *Оп. cit.* P. 9.

³ Клименко Н. І. Судова експертологія. Курс лекцій : навч. посіб. Київ, 2007. P. 98.

⁴ Бірюков В. В., Хахановський В. Г., Бондар В. С., Шалімов С. В. Інформаційно-довідкове забезпечення кримінальних проваджень : підручник ; за заг. ред. В. В. Бірюкова. Київ, 2014. P. 27.

other offenses to counteract them”¹. Analyzing the purpose of collections in this regulation, it can be observed that there is no direct indication of their use in investigation. It should also be noted that information-reference collections are developed from objects that don't relate to a criminal offense event.

As noted above, important research papers on formation and use of information-reference collections are dissertation researches by S. V. Kaduk: *Forensic-reference collections and their importance in crimes*² investigation and A. E. Volkova: *Formation and use of information and reference collections of the expert service of the Ministry of Internal Affairs of Ukraine*³. Scientists emphasize the use of collections both in forensic activities and directly in investigation (search) operations and crime detection and investigation. Let's consider more detailly main provisions of these research papers.

Thus, A. E. Volkova and E. O. Razumov in a joint monograph stress: “Information-reference records is a subsystem of criminal records that provides collection, registration, concentration, systematization of objects and other information used for information support of expert researches, procedural actions, operational measures, performing research, methodological and didactic work. For their part, reference records are divided into various types of reference collections designated to provide information support for conducting individual types of forensic examinations”⁴. However, in the dissertation, A. E. Volkov provides statistics of own research confirming use of this type of records in forensic activity but almost minimizing their significance in carrying out investigation (search) operations: “Collectible objects are used in procedural (during forensic examinations — 53%) and non-procedural (during previous researches — 33%, training of forensic experts — 9%, performing investigative actions — 3%, inspections by investigative records — 2%)” forms⁵.

Having familiarized with the content of paragraph 3.1: *The use of objects of forensic-reference collections during individual investigative actions* of the dissertation, S. V. Kaduk adheres to conclusions about the use of collections by the investigator, most often: at the preparatory stage of the investigation (search) operation to obtain additional information. But according to the results of the performed survey on investigators, none of them turned to expert collections both during preparation and execution of investigative (search) operations. At the same time, 65% do not see the need for this, 12% rely on their own expertise, 23%: on the knowledge of experts involved in investigative (search) operations.

¹ Про затвердження Інструкції з організації функціонування криміналістичних об'єктів URL: <https://zakon.rada.gov.ua/laws/show/z0963-09> (date accessed: 22.02.2021).

² Кадук С. В. Оп. cit.

³ Волкова А. Е. Оп. cit.

⁴ Волкова А. Э., Разумов Э. А. Информационно-справочные криминалистические учеты: теория, организация, использование. Сумы, 2013. 344 р.

⁵ Волкова А. Е. Оп. cit. P. 11.

S. V. Kaduk's thesis on the use of: "collections of photographs, videos regarding persons who have previously committed similar socially dangerous acts" while compiling a portrait with a suspect's appearance is considered unjustified both from a theoretical and practical viewpoint, because forensic experts use a variety of computer programs such as *Portrait* for this purpose. There are also doubts about the use of collectible specimens of "objects which sound should be diagnosed ¹ by analogy" during an investigative experiment.

Summarizing the above as to functioning and use of reference-supplementary records as collections, we can conclude that this type of record-keeping is used only in forensic activities; therefore collections cannot be considered criminal records in full understanding of this term. Research on forensic practice as well as the results of the survey of experts regarding types of collections of the expert service indicate that currently only objects of forensic ballistics and cold weapon examination are presented in real-world form (firearms, ammunition, bullets, cartridge cases). Their existence in the expert units in quantitative measurement is far below any catalog of the indicated objects that are publicly available to private collectors (in particular, on the Internet). The same can be stated about collections of models of explosive devices and substances; narcotic drugs, psychotropic substances, their analogues and precursors; tools used for break-in. Currently, there are no such collections in expert units as: embossed shoe soles; objects of trace evidence analysis; seals and stamps; magnetic media; paint coatings; glass of a car headlight; tire treads; fibers and hair; fuels and lubricants; fake numbers of knots and details and vehicle aggregates .

With the development of computer technology, real-world collections are losing their significance. Digital technology helps to create and store images of any object in excellent quality in digital format, as a consequence individual records take a different form. For example, samples of strict record keeping documents, securities and money are contained in the database of the video spectral comparator: *VSC 8000* from *Foster + Freeman Ltd*, which software allows you to create your own database as well as update the existing offline. A database of vehicle tire treads can be obtained using the catalogs of leading car manufacturers.

Conclusions. Summing up the classification of criminal records by functional (target) purpose, let's emphasize that today such types of records as reference-supplementary have lost their significance for investigation in general, have acquired new forms and cannot be called *forensic*. In our opinion, they can be characterized as information databases that are created and operate in cyberspace and can be both publicly available and owned by enterprises, institutions, organizations and individuals.

Thus, from our perspective, criminal records by functional (target) purpose are divided into search and reference. We consider it superfluous to use the

¹ Кадук С. В. О. цит. Р. 13.

concept of *operative search*, since with the introduction of the concept of *public and covert investigation (search) operations* in criminal procedure legislation, objects and information for records are obtained after their conduct, and results of inspections by records are used oftentimes in investigative, not in operative and search activities. We also consider the use of the term information-reference to be superfluous as any record-keeping contains a certain amount of information, as mentioned above.

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Криміналістичні обліки: проблеми класифікації

Досліджено проблеми класифікації криміналістичних обліків. Розглянуто класифікацію криміналістичних обліків за службовою належністю, ступенем централізації та функціональним (цільовим) призначенням (як основними критеріями для класифікації). Доведено, що за ступенем централізації обліки потрібно поділяти на центральні, регіональні й місцеві, але при цьому зауважено фактичну відсутність обліків експертної служби на місцевому рівні. Обґрунтовано розподіл криміналістичних обліків за функціональним (цільовим) призначенням на розшукові та довідкові, водночас зазначено, що довідково-допоміжні обліки у вигляді колекцій станом на сьогодні втратили своє значення й не можуть складати систему криміналістичних обліків.

Ключові слова: класифікація, розслідування кримінальних правопорушень, криміналістичні обліки, розшукові обліки, довідкові обліки, експертна служба.

И. В. Пирог, В. О. Приходько

Криминалистические учёты: проблемы классификации

Исследованы проблемы классификации криминалистических учётов. Рассмотрена классификация криминалистических учётов по основным критериям: служебному назначению, степени централизации и функциональному (целевому) назначению.

Криминалистические учёты образуются и функционируют в различных государственных органах Украины, поэтому возможна классификация учётов по служебному назначению следующим образом: МВД Украины; Государственной налоговой службы Украины; Государственной таможенной службы Украины; Службы безопасности Украины; Государственного бюро расследований Национального антикоррупционного бюро; Генеральной прокуратуры и т. п. Все они направлены на содействие расследованию уголовных преступлений. При этом криминалистические учёты МВД Украины, в свою очередь, включают в себя учёты: Национальной полиции Украины, функционирующие в департаменте информационно-аналитической поддержки; Государственной пограничной службы Украины; Государственной миграционной службы Украины; Главного сервисного центра МВД Украины; Экспертной службы МВД Украины.

Доказано, что по степени централизации учёты следует разделять на центральные, региональные и местные, но при этом отмечается фактическое отсутствие учётов экспертной службы на местном уровне, что подтверждается результатами изучения материалов уголовных производств и опросов следователей. По мнению авторов, учёт объектов на местном уровне в общей классификации нужно оставить, но ответственность за его формирование и функционирование возложить на городские подразделения технико-криминалистического обеспечения полиции.

Обосновано разделение криминалистических учётов по функциональному (целевому) назначению на поисковые и справочные, при этом отмечено, что справочно-вспомогательные учёты в виде коллекций в настоящее время утратили своё значение и не могут составлять систему криминалистических учётов. По мнению авторов, их можно охарактеризовать как информационные базы данных, которые образуются и функционируют в киберпространстве и могут находиться как в свободном доступе, так и в собственности предприятий, учреждений, организаций и частных лиц. На практике этого вида учётов практически не существует, что подтверждается результатами изучения работы следственных подразделений полиции и экспертной службы.

Ключевые слова: классификация, расследование уголовных преступлений, криминалистические учёты, розыскные учёты, справочные учёты, экспертная служба.

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Contributors

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Forensic support of the activities of forensic science institutions and pre-trial investigation and inquest bodies in counteraction to crime

Pressing issues of forensic support of activities of pre-trial investigation and inquiry bodies in countering criminal offenses are outlined.

The concept and essence of crime counteraction are considered. The article analyzes the national criminal procedural legislation, departmental regulatory legal framework and their amendments concerning the direction under study, genesis of scientific findings on theoretical and applied issues of forensic support of the activities of pre-trial investigation and inquest bodies in this direction, as well as the genesis of the concept and essence of forensic science as a science. The modern state of the development of forensic science, current high-priority issues and feasibility of changing the scientific paradigm of forensic science as well as the use of innovations are studied; ways for their improvement are proposed. Theoretical and applied problematic issues of forensic science are subject to thorough study and resolution. Fundamental changes are required both in forensic science in general and in particular in its individual areas. The current legislation, law enforcement agencies, forensic science institutions, prosecutors' bodies and judicial bodies, as well as law enforcement, in which modern advances in science and technology (in particular, computer and telecommunication technologies) are being implemented should be reformed. The article highlights such problematic issues as the improvement of the forensic characteristics of certain types of crimes, forensic techniques combining forensic techniques and tactics. The issue of further implementation in law enforcement and forensic expert activities of promising molecular genetic examinations for pre-trial investigation bodies, including the method of DNA analysis is outlined separately and fully. Relying on the results of research, specific author proposals and recommendations are provided on the studied area of activity in general and in individual directions.

Keywords: forensic science, genesis, scientific viewpoint, improvement, investigator, inquiry body, prosecutor, forensic science institutions, support, crime counteraction, science, forms, methods, methodology, scientific and technical tools.

Formulation of Research Problem. As of today, crime counteraction is one of the main factors in ensuring stable political, economic and social development of Ukraine that is enshrined in certain areas of law, in legislative and law enforcement practice. Criminalistics has always performed a significant number of functions in the activities of pre-trial investigation and inquest bodies (in particular, in combating crime). The beginning of criminalistics is connected with the needs of the country and science in the development of new forms, methods and means of detecting, disclosing and investigating crimes. At the same time, the current state of society development, legislation reform, law enforcement, including investigative bodies and bodies of inquiry, forensic science institutions and courts, significant changes in the criminogenic country situation, emergence of new crimes and mechanisms of their commission using modern science and technology and telecommunication technologies and the existing problems in law enforcement require further but quite radical change and development of criminalistics and its scientific paradigm (using innovations and identifying ways to improve). In this regard, theoretical and applied issues of criminalistics are subject to careful research. Attention should be paid to presence of such issues as improving forensic characteristics of certain types of crimes, forensic techniques that combine forensic techniques and tactics, issues of further dissemination and application in law enforcement and expert activities promising for pre-trial investigation of molecular genetic examinations, including methods DNA analysis, etc.

Analysis of Essential Researches and Publications. Pressing issues of criminalistics and the raised topic were investigated by R. S. Belkin, V. P. Bakhin, V. D. Bernaz, A. I. Vinberg, I. F. Gerasimov, V. I. Goncharenko, I. Y. Gorbatenko, M. M. Didyk, V. A. Zhuravel, G. A. Matusovskyi, E. I. Mostovshchikov, N. S. Karpov, V. V. Kikinchuk, V. O. Konovalova, S. I. Perlin, R. L. Stepanyuk, M. S. Strogovich, V. D. Pcholkin, V. V. Tishchenko, V. Yu. Shepitko, O. O. Eisman, M. P. Yablokov, I. M. Yakimov and others¹. However, most of

¹ Белкин Р. С. Курс криминалистики : в 3-х т. Т. 1 : Общая теория криминалистики. Москва, 1997 ; Бахин В. П. Следственная ситуация и тактическое решение // Специализированный курс криминалистики : учебник. Киев, 1987 ; Берназ В. Д., Бірюков В. В., Волобуєв А. Ф. Криміналістика : підручник ; за заг. ред. А. Ф. Волобуєва. Харків, 2011 ; Матусовский Г. А. Криминалистика в системе научных знаний. Харьков, 1976 ; Шепітько В. Ю. Тенденції і перспективи розвитку криміналістики (концептуальність підходів і дискусійність поглядів). *Актуальні проблеми криміналістики* : мат-ли Міжнар. наук.-практ. конф. (Харків, 25—26.09.2003). Харків, 2003 ; Журавель В. А. Ситуація слідча // Велика українська юридична енциклопедія : у 20 т. Т. 20 : Криміналістика, судова експертиза, юридична психологія ; редкол. В. Ю. Шепітько (голова) та ін. Харків, 2018. С. 743—744 ; Шепітько В. Ю., Журавель В. А., Коновалова В. О. Криміналістика : підручник : у 2 т. Т. 1 ; за ред. В. Ю. Шепітька. Харків, 2019 ; Шепітько В. Ю., Журавель В. А. Типові системи тактичних прийомів: проблеми розробки та ефективного застосування. *Питання боротьби зі злочинністю* : зб. наук. пр. Харків, 2009. Вип. 17. Р. 237—251 та ін.

these scientists have studied this issue in terms of analysis of individual trends in forensic science. Their scientific works drew attention to certain trends in the development of forensic science and its tasks, the role in the system of scientific knowledge, however, mostly did not have a conceptual and systemic nature, but a complex problem of the place of criminalistics in the legal sciences and forensic support of pre-trial investigation and inquiry in the fight against crime have not been investigated. In the 1970s, G. A. Matusovskyi formulated fundamentally important provisions of forensic science at the level of his doctoral dissertation, which were generally recognized for a long time, but later, despite changes in state formation, expanding the range of scientific ideas, etc., they were not revised. Later, on the basis of the correlation of the purpose of legal sciences, E. V. Smakhtin ¹ at the monographic level explored the relationship of criminalistics with criminal law and criminal procedure, although he ignored the integration of all branches of the unified system of criminal law and the place of criminalistics among them. A rather powerful attempt to solve certain issues of criminalistics in the national system of legal sciences was M. V. Danshin's doctoral dissertation: *Place of criminalistics in legal sciences* (2014) where the author, based on the dynamic transformation of scientific knowledge, considered the issue of determination of place and links of criminalistics. Languages of criminology on the basis of radical changes in the Criminal Procedural Code of Ukraine of Ukraine, the emergence of new legal sciences, as well as various theoretical constructions ("forensic expertology", "forensic advocacy", "forensic eidology", "forensic phenomenology", etc.), which reflect certain trends in criminalistics or the ideas of scientists (both individual researchers and their groups). In his work, he rightly asked the following problematic question: *"To whom the scientific provisions of criminalistics and its recommendations are addressed and who is the user of its knowledge"* and stressed that this circumstance is determinant and causes changes in criminalistics, integrates it with other sciences and determines its development ². This was suggested by him and other scholars to choose the topic of this article.

The **Article Purpose**: analysis of national criminal procedural legislation, departmental regulations governing the forensic support of pre-trial investigation and inquestor in crime counteraction, availability of problematic theoretical and applied issues of current state of criminalistics.

The *main tasks* are to develop appropriate proposals and recommendations on how to solve the identified problems at the theoretical and legislative level and in law enforcement.

¹ Смахтин Е. В. Криминалистика: соотношение с уголовным и уголовно-процессуальным правом : монограф. ; под общ. ред. А. С. Подшибякина. Москва, 2009. 232 р.

² Данышин М. В. Місце криміналістики у системі юридичних наук : автореф. дис. ... д-ра юрид. наук. Харків, 2014. 40 р.

The Research academic novelty. Research has the following elements of novelty: for the first time it was carried out at junction of criminalistics and criminal procedure with establishment of existing issues of the state of development of criminalistics in the modern period; improved development of proposals and recommendations for solving the identified development problems through radical changes in the scientific paradigm of criminalistics with use of innovations.

Main Content Presentation. Crime counteraction gave way to a more stable notion of “fighting crime” which the Soviet government used as the ideological postulate of the ultimate goal in defeating crime. The history and law enforcement activities of the entire law enforcement system have determined the absurdity of this political platform. In our opinion, the fight against crime consists of a system and a comprehensive impact on crime and its individual factors. Other scientists agree with us. Thus, A. V. Mayorov notes that the existing ways of responding to a crime can be represented in the form of a certain system, namely the system of combating crime, which contains measures of preventive and precautionary influence on certain types of crimes and crime in general. Such a system should contain the means, methods and techniques used not only by law enforcement agencies, but also by local governments, public and other organizations, as well as the citizens themselves. At the same time, mechanism of crime prevention requires serious efforts not only by the state, but also by society and individuals. The expected result of combating crime can be achieved only through the use of a wide range of general social and specific prevention measures ¹ that we support and this confirms the relevance of the chosen topic of our research.

Research has indicated that criminalistics has performed a significant number of functions in the activities of pre-trial investigation and inquest bodies (in particular, in crime counteraction). Emergence of criminalistics is associated with the needs of the country and science in the development of new forms, methods and means of detecting, desclosing and investigating crimes. According to the definition of R. S. Belkin, formation of criminalistics as a science, scientists date to the late nineteenth century ², that we support. At the same time, historically, it was formed from the depths of criminal procedural science, in connection with it is closely connected with theory of evidence. Other scholars have noted that criminalistics is the science about forensic evidence: science of evidence law and dialectic of criminal process, it is a procedure in the dynamics, in development; it involves the use of a creative approach, situational conditionality, availability of alternatives in choosing certain paths, methods, techniques, methodologies. According to modern

¹ Майоров А. В. Виктимологическая модель противодействия преступности : монограф. Москва, 2014. Р. 57.

² Белкин Р. С. Криминалистическая энциклопедия. 2-е изд., доп. Москва, 2000. Р. 5.

researchers, criminalistics is an independent branch of scientific knowledge, which attracts attention primarily by helping to establish the truth, to penetrate the unknown. Its formation and development were accompanied by sharp discussions and debates. In the current state, there are various scientific positions on the subject of criminalistics, in particular: 1) science of crime investigation; 2) science of a set of technical means, tactics and guidelines. However, with regard to the first scientific position, it should be noted that it is outdated, as today not only crimes but also criminal offenses are investigated. At the same time, all the above scientific positions narrow the real subject of criminalistics and the laws it studies, but emphasize its security nature in combating crime. For example, R. S. Belkin noted that both procedural and non-procedural activities of law enforcement agencies solve all such problems on the basis of their theoretical foundations, using their inherent arsenal of tools and methods, and if possible using the forces and methods of related industries. In addition, it should be noted that the subject of criminalistics was particularly heated in the 1950s and 1970s. This was due to the complexity of the object of knowledge: in particular, the study of the criminal activity itself and crime prevention activities. During the discussion of 1967-1968, R. S. Belkin tried to formulate a definition of the subject of criminalistics, which at that time became widespread: in particular, that it is “science of patterns of origin, collection, research, evaluation and use of evidence and based on knowledge of these regularities, means and methods of judicial investigation and crime prevention”¹. This concept took into account the main content of the subject of criminalistics. As of today, criminalistics considers a dual object of knowledge, in particular: criminal activity (criminal behavior), activity of detection, disclosure, pre-trial investigation by investigators and coroners and the establishment of truth in criminal proceedings. In our opinion, the most appropriate definition should be considered the scientific position of V. Yu. Shepitko, who notes that criminalistics is the science of patterns of criminal activity and its reflection in sources of information that serve as a basis for developing tools, techniques and methods of collection, research, evaluation and use of evidence for the purpose of detection, investigation, trial and prevention of crimes². This definition emphasizes pragmatic nature of criminalistics, its focus on creating scientific concepts for the practice of combating crimes and criminal offenses (criminal offenses). For his part, V. I. Goncharenko noted that in the applied aspect, development of criminalistics has always been characterized by constant involvement, improvement or adaptation to their needs of achievements of natural and technical sciences³, that we support.

¹ Idem. *Общая теория советской криминалистики*. Саратов, 1986. Р. 20.

² *Криміналістика : підручник ; за ред. В. Ю. Шепітька*. 3-тє вид., перероб. і допов. Київ, 2004. Р. 7—8.

³ Гончаренко В. И. *Использование данных естественных и технических наук в уголовном производстве (Методологические вопросы)* : монограф. Киев, 1980. Р. 75—76.

Theoretical directions of criminalistics need to be reconsidered taking into account the reform of law enforcement agencies, forensic science institutions, prosecutors and courts, improving law enforcement and criminal, criminal procedural and other legislation, as well as regulations including departmental and interdepartmental ones, emergence of new participants in criminal proceeding, investigating officer, etc., development of its new concepts. Current state, development of criminalistics is characterized by formation of general and individual theories, development and implementation of modern scientific and technical developments, communications, telecommunications and information networks and technologies in the practice of combating crime and misdemeanors associated with improving development of modern methods of investigation of new types of criminal offenses. Accumulation of new scientific knowledge at certain historical stages leads to a change in scientific paradigm of criminalistics, in particular: change in the systems of dominant ideas. Forensics is a science that is improving in dynamics, changing its boundaries, spheres of influence, introducing new directions and proposing new theories. One of important areas of forensic support of pre-trial investigation and inquest bodies in combating criminal offenses is the introduction of modern innovations. Their introduction into the activities of investigators, inquestors, prosecutors, detectives, employees of the operational unit of the National Police, employees of the Security Service of Ukraine, NABU, the State Bureau of Investigation and other bodies is due to responsibilities for solving a significant number of tasks within reasonable but limited time; lack of technical means, as are currently in service with relevant law enforcement agencies; existing problems in coordination and interaction with relevant professionals, experts in various fields of knowledge and operational staff; lack of information about the event under investigation in the past; limited reliable sources of relevant information; opposition to pre-trial investigation by interested parties. The introduction of innovations helps to increase the efficiency of pre-trial investigations and inquiries and prevents errors or reduces their number in such activities. Their introduction into activities of investigators, inquestors, prosecutors is possible in the following measures: a) development and implementation in practice of the latest scientific and technical means to identify, collect, record and evaluate and preliminary examine evidence; b) elaboration of proposals on introduction of new telecommunication and other information technologies into the activity of investigator, inquestor, prosecutor; c) development of new techniques, methods, techniques for conducting individual investigative measures and pre-trial investigation and inquiry in general. Technique of criminalistics is a branch of criminalistics which arose due to implementation of advances in natural and technical sciences to identify traces of criminal offenses and obtain other forensic information.

Expanding and updating the list of scientific and technical means used to combat criminal offenses (subject to the criminal procedural mechanism) raises the question of the expediency of checking their scientific nature, prohibiting the use of anti-scientific techniques and those that do not comply with the principles of democracy and doctrine of criminal justice. In order for scientific and technical means to improve the quality and efficiency of pre-trial investigation in the detection, disclosure and investigation of criminal offenses, it is proposed to use the help of specialists more widely. It is no coincidence that the current Criminal Procedural Code of Ukrainian 2012 introduced novelties that clarified and supplemented 2020, in particular: Art. 71: *Specialist* and Art. 72 *Specialist Responsibility* ¹. In addition, in the divisions of district police departments and investigative departments of the Headquarters of the National Police of Ukraine in regions, in accordance with the order of the National Police of Ukraine: *On organizational and staffing changes* dated on 24.12.2020 positions of *forensic inspectors* (introduced in 2017) were renamed to *forensic scientists*, whose task is to provide assistance to police investigators while crime scene inspections in certain investigative measures, etc. At the same time, there is a tendency to oppose the specialist and the investigator, the Investigating officer; separation of the investigator, inquestor from use of scientific and technical means; performance of activities by specialist at his own discretion and not providing assistance to the investigator. In modern conditions, the emergence of new types of criminal offenses, greater technical and other equipment of those who commit them, investigator activities, investigating officer, prosecutor, judge requires immediate technical re-equipment. In recent years, certain measures have been taken to introduce into pre-trial activities of investigation and inquest body of combined sets of investigators, in particular: a unified set of investigators; narrow focus kits; set of search tools of the investigator (set-search); a set of scientific and technical means for inspection of the place of fire (set-fire); a set of scientific and technical means for inspection of explosive devices and the place of explosion (set-explosion); a set of scientific and technical tools for working with micro-objects (micro-set, or “Molecule”); set for work with handprints (trace evidence set); set of an investigator to review documents, etc.

Currently, one of the most important achievements of the twentieth century in this area is the development and implementation of DNA analysis methods in law enforcement agencies, forensic science institutions and courts to collect, research, evaluate and use indicative and evidentiary information in criminal proceedings. To date, national criminalistics has not paid due attention to the issues of forensic DNA research (molecular genetic research), which is a consequence of the lack of educational and methodological literature in this area. There is also no single approach to the place of molecular genetic

¹ Кримінальний процесуальний кодекс України : Закон України від 13.04.2012 р. № 4651-VI (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/4651-17> (date accessed: 18.09.2020).

analysis in forensic science; forensic and forensic aspects of this issue are developing in parallel. The first genetically identified examination in the former USSR was conducted in 1988 by expert P. Ivanov in the case of the mentally retarded vagrant Sopov, who was convicted of raping and killing two elderly women ¹. In Ukraine, molecular genetic examinations have been conducted since 1992, in particular, with the use of a radiation mark, such an examination was conducted by N. M. Dyachenko, an expert of the State Research Forensic Center of the Ministry of Internal Affairs of Ukraine in the murder case ². In the same year, such examinations began to be conducted in the Odessa Regional Bureau of Forensic Medicine ³. Investigating the state of their use today, R. L. Stepaniuk, S. I. Perlin, V. V. Kikinchuk ⁴ noted that the use of forensic DNA research technologies in the investigation of criminal offenses is a powerful tool to combat crime, and molecular genetic research from one year to year play an increasing role (in particular, in combating serious crimes, etc.). In the context of hostilities in eastern Ukraine and the increase in terrorist threats, it is important to use the capabilities of such research to establish the identity of unidentified corpses and their parts, charred corpses, and others. In addition, DNA analysis methods are effectively used in civil proceedings to resolve cases of paternity, determine the biological relationship of people, as well as in the case of homeless children and minors or persons who have lost their memory, and others. Thus, forensic molecular genetics is, in essence, an interdisciplinary field of scientific knowledge, the achievements of which are actively used in forensics and forensic medicine. Its forensic significance is especially important because the identification of a person by his genetic characteristics is one of the most accurate methods of identifying a person. For its part, genotyping as a branch of forensic science should take a worthy place in the structure of forensic science, and its relevant provisions should be part of the professional training of lawyers, including future investigators, prosecutors, lawyers and judges ⁵, supported by us.

Currently, its computerization is quite relevant in improving activities of investigator, investigating officer, prosecutor, because nowadays it is impossible to work effectively without creating integrated databases, knowledge banks,

¹ Мостовщиков Е. Профессор на тропе войны. Русский репортер. 10.04.2014. URL: https://expert.ru/russian_reporter/2014/14/professor-na-trope-vojnyi (date accessed: 20.02.2021).

² Дяченко Н. М. Основні етапи розвитку молекулярно-генетичної експертизи в Державному науково-дослідному експертно-криміналістичному центрі МВС України. *Криміналістичний вісник*. 2011. № 1 (15). Р. 166—167.

³ Дунаєв О.В. Актуальні питання судово-медичної генетики в Україні. *Український медичний альманах*. 2013. № 1. Т. 16. Р. 179—183.

⁴ Степанюк Р. Л., Перлін С. І., Кікінчук В. В. Криміналістичне дослідження ДНК: технології та можливості : навч. посіб. Харків, 2019. 144 р.

⁵ Ibid. Р. 7—8.

information systems that can greatly simplify the search, analysis, transmission and information processing. Law enforcement agencies and expert institutions use the following information systems in practice: automated, expert, consulting systems of artificial intelligence, forensic, information-analytical, statistical information processing systems, investigative measures, etc.

In recent years, there have been significant changes in the definition of the subject of forensic tactics, and its formation is characterized by uneven development, amplification of some of its parts and directions. From genesis of this issue, we found that at different times there were different tendencies: for example, to study the tactics of criminal activity, the study of the person and type of criminal, then spread the direction of investigative tactics and the development of investigative techniques. While research, it was found that forensic support of pre-trial investigation and inquiry consists of development and implementation of systems of tactics of individual investigative actions, their systems in the form of tactical combinations, typical tactical complexes and tactical operations. According to the well-known criminalists V. Yu. Shepitko, the current state of forensic theory allows us to raise the issue regarding need to develop and apply systems of tactics that are the optimal means of identifying evidence and its use in forensic practice ¹ that we support. A new problem in criminalistics is the use of covert measures while investigation which should be used as evidence in the pre-trial investigation and during the inquiry, in particular, it concerns the use of complex investigative (search) actions, operational and organizational measures for the investigation, i.e. tactical operations, the feasibility of which is confirmed in practice). Thus, on the basis of empirical research I. M. Komarov estimated that 75% of the surveyed investigators see a special need in the use of forensic operations in their practice while detection, investigation and prevention of complex crimes ². For their part, according to our survey of police officers who underwent advanced training, this trend was noted by 89.9% of pre-trial investigation officers, 79.9% of police inquestors and 93.7% of employees of the State Bureau of Investigation. Synthesizing significance and role in criminalistics is performed by forensic methodology, which combines the recommendations of forensic techniques and tactics and helps in the pre-trial investigation of certain types of criminal offenses. According to I. F. Gerasimov and L. Yak. Draping, the method of investigation of certain types of criminal offenses is a component of criminalistics, which considers the methods and tools used in the detection, detection and investigation of certain types and groups of criminal offenses on

¹ Шепітько В. Ю. Криміналістична тактика (системно-структурний аналіз) : монограф. Харків, 2007. Р. 112.

² Комаров И. М. Криминалистические операции в досудебном производстве : монограф. Барнаул, 2002. Р. 33.

the basis of forensic characteristics and typical investigative situations ¹. A more common definition of forensic methodology, formulated by the famous forensic scientist V. A. Zhuravl, who noted that forensic methodology as a system of knowledge and an independent section of forensics should be improved through generalization and theoretical explanation of accumulated empirical material and knowledge of scientific facts and prevention of criminal offenses, and that it is advisable to present guidelines in a more accessible form (in particular, in the form of certain algorithmic schemes that can be implemented on the basis of modern computer technology) ² that we support. In forensic literature there were proposals for the introduction of programming and algorithm development of investigation, creation of appropriate programs for the investigator. In this regard, back in 2007, a well-known criminalist V. O. Konovalova noted that the implementation of certain algorithmic schemes (programs) of actions of investigator in certain situations of investigation is promising ³. This demonstrates the emergence of a promising direction in the development of criminalistics. This is confirmed by the present: today the scientist or practitioner is not surprised by specific algorithms proposed in dissertations for the investigator, inquestor and prosecutor, and in practice this is not news not only for the investigator but also for other law enforcement officials (e.g. police). Regarding the prospects for further development of the type and content of forensic methods, V. A. Zhuravel quite rightly noted that the clarification of this problem depends primarily on the existence of a single generally accepted and consistent classification of methods of crime investigation, as different technological levels of methods can be offered different technological approaches regarding their formation (development). He proposed the following 4-level structure of forensic methods of investigation: 1) interspecific (group) individual; 2) individual species; 3) individual subspecies; 4) complex individual ones.

Conclusions. Forensic support of investigator and inquestor in crime counteraction can be classified in the following areas: forensic through introduction and development of new scientific and technical means, forensic techniques, telecommunications and other modern information technologies; organizational and tactical due to development of appropriate tactics of pre-

¹ Герасимов И. Ф. Общие положения методики расследования преступлений. Криминалистика : учебник ; под ред. И. Ф. Герасимова, Л. Я. Драпкина. Москва, 1994. Р. 325.

² Журавель В. А. Сучасні концепції формування окремих криміналістичних методик розслідування злочинів. Вісник Академії правових наук України. 2007. Вип. 2 (49). Р. 177—184.

³ Коновалова В. О. Алгоритмізація в теорії криміналістики. Вісник академії правових наук України. 2007. Вип. 1 (48). Р. 169—174.

trial investigation and investigative actions in the case of introduction of the latest tactical techniques and algorithms and their systems, the use of tactical operations and operational combinations; methodical: formation and introduction of separate forensic methods. Systematic forensic support of pre-trial investigation, conducted by investigator and coroner, inquestor, forensic specialist, expert in the field of knowledge, helps to improve detection, disclosure and investigation of criminal offenses, combating criminal offenses in accordance with scientific proposals and recommendations for their organization. Thus, conceptual research on further improvement of criminalistics and its place in legal science are urgent at the present stage of development of Ukraine. However, the issues raised in this article are not definitive and require additional separate research or scientific study.

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О. О. Юхно

**Криміналістичне забезпечення діяльності
установ судових експертиз та органів досудового розслідування
і дізнання у протидії злочинності**

Розглянуто проблемні питання криміналістичного забезпечення діяльності установ судових експертиз та органів досудового розслідування

і дізнання у протидії кримінальним правопорушенням. Проаналізовано національне кримінально-процесуальне законодавство, відомчу нормативно-правову базу, генезис наукових позицій щодо теоретичних і прикладних питань криміналістичного забезпечення у цьому напрямі, а також щодо поняття та сутності криміналістики як науки, досліджено питання сучасного стану її розвитку, наявні проблемні питання та визначено шляхи вдосконалення. За результатами дослідження надано конкретні пропозиції й рекомендації щодо вивченого напрямку діяльності.

Ключові слова: криміналістика, генезис, наукова позиція, удосконалення, слідчий, дізнавач, прокурор, установи судових експертиз, судовий експерт, забезпечення, протидія злочинності, наука, форми, методи, методика, науково-технічні засоби.

А. А. Юхно

Криминалистическое обеспечение деятельности учреждений судебных экспертиз и органов предварительного расследования и дознания в противодействии преступности

Рассмотрены проблемные вопросы криминалистического обеспечения деятельности органов досудебного расследования и дознания в противодействии уголовным правонарушениям.

Охарактеризованы понятие и сущность противодействия преступлению. Проанализированы национальное уголовно-процессуальное законодательство, ведомственная нормативно-правовая база и изменения к ним, касающиеся исследуемого направления, генезис научных позиций по теоретическим и прикладным вопросам криминалистического обеспечения деятельности органов досудебного расследования и дознания в указанном направлении, а также генезис понятия и сути криминалистики как науки. Исследовано современное состояние развития криминалистики, имеющиеся проблемные вопросы и целесообразность изменения научной парадигмы криминалистики, применения при этом инноваций; определены пути их совершенствования. Теоретические и прикладные проблемные вопросы криминалистики подлежат тщательному исследованию и решению. Кардинальные изменения необходимы как в целом криминалистике, так и отдельным её направлениям. в реформировании нуждаются действующее законодательство, правоохранительные органы, экспертные учреждения, органы прокуратуры и судебные инстанции, а также правоприменительная деятельность, в которую внедряются современные достижения науки и техники (в частности, компьютерные и телекоммуникационные технологии). Освещены такие проблемные вопросы, как совершенствование криминалистической характеристики отдельных видов преступлений, криминалистической методики, объединяющей криминалистическую технику и тактику. Отдельно и полно рассмотрен вопрос дальнейшего внедрения

в правоприменительную и экспертную деятельность перспективных для досудебного расследования молекулярно-генетических экспертиз, в том числе методом ДНК-анализа. По результатам исследования представлены конкретные авторские предложения и рекомендации по изученному направлению деятельности в целом и по отдельным направлениям.

Ключевые слова: криминалистика, генезис, научная позиция, усовершенствование, следователь, дознаватель, прокурор, учреждения судебных экспертиз, судебный эксперт, обеспечение, противодействие преступности, наука, формы, методы, методика, научно-технические средства.

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Issues and main optimization directions of unsolved crime investigation over past years

This article discusses one of the topical issues of forensic science, namely: investigation of unsolved crimes over past years and the state of this activity.

The factors of such a situation and the social danger of the availability of array of unsolved crimes over past years are considered.

Based on the analysis of investigative practice, opinions of scientists and practitioners, the main issues of this activity are identified and the main directions for its optimization are proposed in order to reduce the number of unsolved crimes over past years.

Positive influence of time factor on disclosure and investigation of criminal cases of this category is considered. Modern possibilities in the investigation of crimes over past years and directions of their use are demonstrated.

It is concluded that issue of disclosing and investigating unsolved crimes over past years is complex, therefore, its solution requires the same complex efforts.

Keywords: *crime detection, investigation, unsolved crimes over past years, activity optimization.*

Formulation of Research Problem. For many years, domestic scholars and practitioners have unjustifiably paid little attention to the issues of detection and investigation of unsolved crimes of previous years. There are almost no dissertations, monographs, other comprehensive research, guidelines, relevant sections in textbooks and manuals on this topic. Separate publications on this topic appearing from time to time in periodicals and conference proceedings cannot solve this issue definitively.

Analysis of Essential Researches and Publications. Despite its relevance and relative antiquity, the investigation issue of unsolved crimes of past years has lacked the attention of scientific community. Individual research papers in particular dissertations, did not solve this issue in general, but only covered some of its components. To date, only 6 dissertations have been defended on this issue, in particular, two of them were prepared by domestic researchers E. M. Voitovych¹

¹ Войтович Е. М. Теоретические и практические вопросы методики расследования убийств прошлых лет : дис. ... канд. юрид. наук. Запорожье, 2005. 249 р.

and O. V. Luskatov ¹. Other dissertations were written in Russia while 2005—2016 (V. Yu. Nizamov, I. Yu. Kuleeva, A. V. Morozov, N. M. Samilev) ².

It should be noted that all these research papers are devoted to various aspects of this issue: legal regulation of investigation, methodology of investigation of individual unsolved crimes of past years, the investigation organizational basis. O. V. Luskatov came close to considering the problems of unsolved crimes of past years investigation in his dissertation, although some important issues of the practice of investigating crimes of this category were left out of his attention.

Considering that mentioned dissertations of Ukrainian scientists were written during the Criminal Procedural Code of Ukraine of Ukraine in 1960 (Criminal Procedural Code of Ukraine from 2012 is currently in force containing new institutions (covert investigative) actions), modern conditions of law enforcement agencies and new opportunities to use innovative technical means and technologies in the investigation of unsolved crimes of past years), this issue is still relevant and requires urgent further research to address.

Research Paper Purpose is to consider the investigation state of unsolved crimes of past years, to identify a number of problems in optimizing activities of law enforcement agencies to investigate this category crimes.

Main Content Presentation. In our opinion, this state has developed, in particular, due to the lack of understanding by the leadership of law enforcement agencies (primarily pre-trial investigation bodies and operational units) of public danger of unsolved crimes of past years existence, especially their number, the array of decades.

Even non-disclosure of one crime, non-detection of at least one criminal (especially a criminal group), except for transfer of such criminal cases/proceedings in the category of “unsolved” (eloquent treatment of them and return to work on them is in the professional statements law enforcement agencies: “unsolved case”, “cold case” (hopeless case), indicates certain significant shortcomings in activities of pre-trial investigation bodies and operational units, their inability to identify the perpetrators and bring them to justice as a result, elusiveness, impunity, gives them weight in the criminal hierarchy, which helps to involve and attract new people to commit crimes, the

¹ Лускатов О. В. Розслідування нерозкритих злочинів минулих років : автореф. дис. ... канд. юрид. наук. Харків, 2006. 20 р.

² Е.г., Низамов В. Ю. Вопросы теории и практики раскрытия убийств прошлых лет : дис. ... канд. юрид. наук. Иркутск, 2005 ; Кулеева И. Ю. Правовое регулирование и криминалистическое обеспечение расследования нераскрытых преступлений прошлых лет : дис. ... канд. юрид. наук. Омск, 2010 ; Морозов А. В. Использование экспертно-криминалистических учетов в расследовании преступлений прошлых лет : автореф. дис. ... канд. юрид. наук. Москва, 2016 ; Самилев Н. М. Расследование нераскрытых преступлений прошлых лет (по материалам Республики Таджикистан и Российской Федерации) : дис. ... канд. юрид. наук. Москва, 2016. 221 р.

latter contributes to continuation of criminal activity at a higher professional level, gaining criminal experience, leading to repeated crimes and serial crimes.

In addition, it is unsolved crimes of past years that most often fall into the category of so-called high profile crimes (serial murders, robberies and robberies, fraud, etc.), when society can no longer accept that criminals remain at large, continue to die and suffer material damage and the damage has not been compensated, law enforcement agencies are not able to put an end to this, so let's not talk about protecting the rights, freedoms and legitimate interests of citizens.

While working on unsolved crimes of past year, professionals simultaneously identify and solve many criminal cases. Among such high-profile criminal cases, in particular, the case of A. Chikatilo about which high party cabinets said: "that there is no case in the country more important than Operation Forest Path", while investigation of which 1,062 crimes were solved. During 1984—1985, during the investigation of H. Mikhasevich's case, 221 crimes were solved, including 27 murders, 479 criminals were identified, and 186 people were found missing. Such results are typical of most crimes of the past years, which investigation was carried out organizationally and tactically correctly with the use of all necessary forces and means.

It seems that the above is enough to understand the danger of having a large array of unsolved crimes of past years and to conclude that it is necessary to intensify work on their detection and investigation.

However, there are other factors that motivate us to return to this topic and undertake to correct the current situation in such cases/proceedings.

In addition to de facto non-compliance/non-compliance with the law to ensure prompt, full and impartial investigation and trial so that anyone who has committed a criminal offense is prosecuted as he is guilty and no innocent person is charged or convicted (Article 2 of Criminal Procedural Code of Ukraine) array existence of unsolved crimes of past years also complicates the work on detecting and investigating current crimes that have just been committed and which with the proper attitude and professional work of investigators and operatives (hopefully!) Will not move to the category of "unsolved".

The fact is that working on unsolved crimes of past years is a good school both for training and becoming a young investigator and for improving the skills of more experienced investigators, as it requires certain knowledge and approaches to study the analysis of case papers/proceedings, their evaluation, organization and planning of investigations, tactics of re-investigation, nature and direction of operational and investigative measures, other important components of this category of criminal cases proceedings. In particular, their materials may contain information for the disclosure of later crimes, which may have involved the same persons wanted under unsolved crimes of past years, or their accomplices in previously committed crimes: data on how to commit and

conceal the crime, traces of criminals and crimes previously committed was not investigated due to lack of technical capabilities and expert methods, physical evidence, data on connections, relatives and acquaintances of criminals, testimony of witnesses, results of investigative actions, etc. All of the above with proper skill and proper use cannot only help to solve these crimes but to identify previously unknown crimes (by the commission method, characteristic traces and signs of appearance).

The time factor for an investigation can play both a negative and a positive role that should always be kept in mind. For example, victims and witnesses may change their residence, move abroad, be abducted and resold, destroyed, criminals may change their appearance, surname, residence and so on.

However, with modern communication possibilities, a person can be found through social networks, interrogated and interrogated remotely via video conferencing, correspondence and photos can be used to obtain information about his current appearance, identification and research on photos from social networks, etc. It possible to establish the circle of communication of the person, his current connections, find the stolen or find out his future fate. The digitalization of the world space is developing and expanding almost every day, providing, in particular, many opportunities to solve the problems of investigation. Consideration of all modern possibilities deserves a separate publication. Conducting covert investigative actions and investigative measures further enhances the ability to identify and collect forensically significant and evidentiary information.

The analysis of the practice of research on physical evidence according to unsolved crimes of past years indicates that positive results in this work can be achieved in the case of a combination of several factors, including: appointment of additional (repeated) examinations of objects (given the emergence of new (modern) opportunities for forensic examinations); involvement of geneticists to assess the completeness of previous research, the objectivity of their results and determine the possibility of new research; use of other possibilities of forensic examinations ¹.

Among the shortcomings of investigative unit activities that did not allow to detect crimes in a timely manner, generalization of investigative practice revealed, in particular: conducting forensic researches on not all objects removed from crime scenes; limited to that period possibility of conducting forensic examinations ².

¹ Бастрыкин А. И. Раскрытие преступлений прошлых лет как одно из приоритетных направлений деятельности Следственного комитета Российской Федерации. Раскрытие и расследование преступлений серийных и прошлых лет : мат-лы Междунар. науч.-практ. конф. (Москва, 16.03.2017). Москва, 2017. Р. 8—18.

² Багмет А. М. Раскрытие и расследование Следственным комитетом Российской Федерации преступлений прошлых лет. *Ibid.* Р. 19—23.

Despite importance of modern possibilities of forensic science the most important thing while working on unsolved crimes of past years is the mental activity of the investigator, his investigative thinking, his training, experience and ability to analyze the materials of criminal cases/proceedings. While working on such cases that investigators learn analysis methods, which results are often the starting point for the successful detection of a crime (in particular, through investigation), identify other, previously unknown criminal episodes.

This is exactly what happened with the criminal case of Yu. Ladjun that arose from the analysis of documents, when it was established that several dozen thefts and frauds remained unsolved in various republics. Despite the geography of the scene, an experienced investigator M. P. Daineko on the basis of analysis of available materials, comparing the methods of the offender to “enter into trust”, in default of a single handwriting of crimes, practically calculated the offender, determining where the latter could see acquaintances, establishing them and having obtained the identity of the offender. The criminal case, initiated on the facts of theft of personal property of 72 citizens, was opened by investigation and ended with proving an episode of premeditated murder that Lajun carefully hidden ¹.

Unfortunately, such findings of investigative skills have not been studied and generalized in detail, they do not become the subject of methodological recommendations, they are unknown to general investigative community, they are not available to students of departmental educational institutions preparing for crime detection and investigation.

At present, conditions for combating crime have changed significantly, as has the quality of crime itself. It is no longer enough to work as before, relying only on one's own experience and skills, on positive examples from investigative practice. It is necessary to actively and more widely apply the scientific knowledge provided by science opportunities, and not only in the form of examination results. It is a question of proper mastering of modern criminological knowledge and corresponding practical skills and methods of “field criminalistics”.

“Shortcomings of the investigation are explained primarily by the weak theoretical training of our investigators and, in particular, weak and sometimes complete ignorance of criminalistics... This explains the fact that manuals that generalize investigative practice are left without attention... Criminalistics requires that criminalist-practitioner, the investigator has mastered all the variety of knowledge needed to collect and study evidence... Equipped with diverse knowledge of criminology studying ways of committing crimes and summarizing the experience of investigative work, should show the investigator

¹ Лаврова О. А., Лавров А. С. Полуденный вор : криминальные повести. Москва, 1991. Р. 9—71.

*the right way to solve crimes and expose criminals”*¹. This conclusion of the outstanding criminalist V. P. Kolmakov about importance of criminology in the investigation of crimes is shared by the famous scientist S. S. Samishchenko, disappointing: *“procedural law is observed quite scrupulously, but the laws and requirements of criminology are grossly ignored”*².

Conclusions. Without proper attention to the training of investigators, identification of its weaknesses, improvement of theoretical knowledge relevant to the current crime state, without inculcation and development of practical skills required by investigation in modern conditions do not expect to improve the work on unsolved crimes of past years and results in the fight with crime in general.

However, one professional skill of investigators will be lacking to significantly improve the situation with investigation of unsolved crimes of past years; the issue that is complex and also requires the use of a set of forces and measures; the case for further thorough research, study and implementation of best practices specific recommendations for the investigation of unsolved crimes of past years for practitioners.

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¹ Колмаков В. П. Больше внимания криминалистике : сб. науч. тр. : к 100-лет. со дня рожд. учен.-криминалиста ; сост. : В. В. Тищенко, О. П. Вашук. Одесса, 2013. Р. 11, 15.

² Самищенко С. С., Самищенко А. С. Синдром игнорирования криминалистики при расследовании убийств. Актуальные проблемы расследования преступлений : мат-лы Междунар. науч.-практ. конф. (Москва, 23.05.2013) : в 2 ч. Ч. 2. Москва, 2013. Р. 311.

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О. В. Александренко

**Проблемні питання та основні напрями оптимізації діяльності
з розслідування нерозкритих злочинів минулих років**

Розглянуто одну з актуальних проблем криміналістики — розслідування нерозкритих злочинів минулих років і стан цієї діяльності. Визначено чинники такого положення та суспільну небезпеку існування масиву злочинів попередніх років. На основі аналізу слідчої практики, думок науковців і практиків виявлено проблемні питання цієї діяльності та запропоновано шляхи їх вирішення. Показано сучасні можливості в розслідуванні злочинів минулих років. Зауважено, що проблема розкриття і розслідування злочинів минулих років має комплексний характер, тому її вирішення потребує саме комплексних зусиль.

Ключові слова: розкриття злочинів, розслідування, нерозкриті злочини минулих років, оптимізація діяльності.

Е. В. Александренко

**Проблемные вопросы и основные направления оптимизации
деятельности по расследованию нераскрытых преступлений
прошлых лет**

В статье рассмотрена одна из актуальных проблем криминалистики — расследование нераскрытых преступлений прошлых лет и состояние указанной деятельности.

Отмечены факторы такого положения и общественная опасность наличия массива нераскрытых преступлений прошлых лет.

На основе анализа следственной практики, мнений учёных и практиков выявлены и определены основные проблемные вопросы этой деятельности

и предложены основные направления по её оптимизации с целью сокращения количества нераскрытых преступлений прошлых лет.

Рассмотрено позитивное влияние временного фактора на раскрытие и расследование уголовных дел указанной категории. Показаны современные возможности в расследовании преступлений прошлых лет и направления их использования.

Сделан вывод, что проблема раскрытия и расследования нераскрытых преступлений прошлых лет носит комплексный характер, поэтому её решение требует таких же комплексных усилий.

Ключевые слова: раскрытие преступлений, расследование, нераскрытые преступления прошлых лет, оптимизация деятельности.

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GENERAL PROVISIONS OF FORENSIC SCIENCE

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The study of the scientific heritage of M. S. Bokarius is the duty of employees working in a scientific institution named after him

A significant part of the scientific heritage of M. S. Bokarius, including reports, overviews, and reviews of the works of leading forensic medical examiners and lawyers from around the world has no bibliographic description and has not been put into scientific circulation. Throughout the pages of "Archives of Criminology and Forensic Medicine" and the Ukrainian-language journal: "Issues of Criminalistics and Forensic Science", the scientist reviewed more than 80 research papers. The peculiarity of the Editorial Board of Bokarius "Archives..." was that a significant number of reviews, overviews, etc., was published by the edition.

Mykola Serhiiovych is an author of more than 70 full-fledged analytical reports; and other 10 ones were published in the journal: "Issues of Criminalistics and Forensic Science". The scientist reviewed not only articles, textbooks, monographs by domestic authors, but also research papers of many foreign forensic scientists and criminalists from all over Europe, the USA, Japan, and countries of South America. Reports of scientific articles were reproduced in the journal in French, German and English, Italian and Spanish. All this became possible due to the fact that Mykola Serhiiovych himself was a gifted linguist and spoke 17 foreign languages.

¹ Grandson of Honored Professor Mykola Serhiiovych Bokarius.

The Article Purpose is a scientific search for new works by the scientist and a fundamental study of 5 issues of the "Archives of Criminology and Forensic Medicine" published in 1926—1927 and 6 issues of the "Issues of Criminalistics and Forensic Science" journal for 1931.

Keywords: *scientific periodicals, scientific heritage of M. S. Bokarius, "Archives of Criminology and Forensic Medicine", forensic examination, Kharkiv Research Institute of Forensic Examinations, National Scientific Center "Hon. Prof. M. S. Bokarius Forensic Science Institute".*

Formulation of Research Problem. If we summarize the bibliographic descriptions of scientific works by Mykola Serhiiovych Bokarius¹, they can be counted more than 50 – allegedly a little: because even modern novice scientists announce more published researches during the defense of dissertations. However, given the titanic employment of M. S. Bocarius with practical work – administrative, economic, pedagogical, publishing² and, ultimately, forensic (by the way, only in the latter field, the scientist has studied more than 5,000 pieces of evidence and made more than 3,000 autopsies)³, than this number can be considered gigantic.

Analysis of Recent Researches and Publications. The idea of writing this article was initiated after that in the first issue of the journal: *Archives of Criminology and Forensic Sciences* was published an article co-authored by Professors O. M. Kliuiev and V. O. Olkhovskyi, and Associate Professor V. V. Bondarenko *Academic integrity and creative perseverance of Honored Professor M. S. Bokarius — an urgent example for today*⁴, in the second issue of this journal A. S. Tyapkin and V. M. Fesiunin published the article on the topic: *Archives of Criminology and Forensic Sciences and scientific heritage of M. S. Bokarius*⁵, which ended with the following thesis: *The search for new, previously unknown works of the outstanding scientist M. S. Bokarius is the duty of scientists working in a scientific institution named after him.*

¹ Ключев О. М., Угровецкий О. П., Сімакова-Сфремян Е. Б., Спіцина Г. О., Філіпенко Н. Є. До 150-річчя з дня народження Заслуженого професора Миколи Сергійовича Бокаріуса : монограф. Харків, 2019. Р. 160—164.

² Наприклад, навіть наприкінці життя редагував Бюлетень Народного комісаріату юстиції та найвищого суду: опобіжники, накази, інструкції, постанови та оповістки за 1931 р. (Е.г., Питання криміналістики та науково-судової експертизи. 1931. № 1—2. Січень—Березень. Р. 95).

³ Ключев О. М., Угровецкий О. П., Сімакова-Сфремян Е. Б., Спіцина Г. О., Філіпенко Н. Є. *Op.cit.* Р. 128.

⁴ Ключев О. М., Ольховський В. О., Бондаренко В. В. Академічна доброчесність та творча наполегливість Заслуженого професора М. С. Бокаріуса — насущний приклад для сьогодення. Архів кримінології та судових наук : наук. журн. / ред. кол.: О. М. Ключев, В. С. Батиргарєєва, Г. О. Спіцина та ін. 2020. № 1. Р. 30—38. DOI: <https://doi.org/10.32353.ACFS.1.2020.01> (date accessed: 22.02.2021).

⁵ Фесюнін В. М., Тяпкін А. С. *Op.cit.* Р. 77—86. DOI: <https://doi.org/10.32353.ACFS.2.2020.07> (date accessed 22.02.2021).

It is worth remembering the reprint of some works by M. S. Bokarius during his lifetime. For instance, the work: *On the method for obtaining Teichmanna crystals* (*The Bulletin of Public Hygiene, Forensic, and Practical Medicine*. Kharkov, 1914. Book VIII) was reprinted in 1914 in Petrograd. It is referred to by S. Kaplan in the article *A new modification of obtaining iodine hematin crystals from blood stains*¹. Interestingly, in the copy that belonged to Mykola Serhiiiovych (stored in the library of NSC “Hon. Prof. M. S. Bokarius FSI”), he personally corrected the mistake in the word *iodine hematin* on p. 29.

The **Article Purpose** is the scientific search for new works of the scientist and the fundamental study of five issues of the *Archives of Criminology and Forensic Sciences*, published in 1926-1927, and six issues of the journal: *Issues of Criminalistics and Forensic Science* for 1931.

Main Content Presentation. In the preamble to the first issue *Archives...*, Mykola Serhiiiovych noted that *it would be useful to publish a number of manuals, monographs in various fields, but life goes forward, without stopping and quickly discovers so many new and interesting, especially in criminology and forensic science, criminal technology, which in this sense requires the publication of periodicals, such that would allow timely become familiar with researches not only in our republic, but also in Western European and other countries*².

The peculiarity of the editorial policy of the Bokarius *Archives...* was that the publication contained a significant number of recensions, reviews, etc. Mykola Serhiiiovych himself wrote more than 70 full-fledged analytical abstracts, reviewed not only articles, textbooks and monographs of domestic authors, but also the works of many foreign forensic scientists and criminologists — from Europe and Japan, the USA and countries of the South America³. Due to the fact that Mykola Serhiiiovych knew 17 foreign languages, abstracts of scientific articles were published in the *Archives...* in French, German and English, some ones in the native languages of their authors (in particular, Italian and Spanish).

In accordance with DSTU 3017:2015 *Issue. Main types. Terms and definitions of concepts*, DSTU 3008:2015 *Information and documentation. Reports in the field of science and technology. The structure and rules of design* and the Legal Encyclopedia edited by Yu. S. Shemshuchenko, the abstract is a full-fledged scientific work. A word: *abstract* derives from the German *Referat* — a report, from Latin *referre* — to report, give information, i.e., it is a summary of the content of a scientific work (research) or literary work in writing or in an oral report; contains information on the topic of the abstracted work, the purpose and description of methods of its achievement, the obtained results, etc.; may be published together with the abstracted work or separately from it; may contain

¹ Е.г., Питання криміналістики та науково-судової експертизи ... Р. 29—34.

² Архив криминологии и судебной медицины. 1926. Т. 1. Кн. 1. Р. XVII.

³ Фесюнін В. М., Тяпкін А. С. *Op. cit.* DOI: <https://doi.org/10.32353.ACSF.2.2020.07> (date accessed: 22.02.2021).

a bibliography of the abstracted work, and another information. There are the following abstracts: questionnaire, author's (extended abstract of dissertation), analytical, review (informative), etc.¹.

This significant part of the scientist's scientific work has not been described or put into scientific circulation to date. Let's fill this gap:

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¹ Реферат // Юридична енциклопедія : у 6 т. / ред. кол.: Ю. С. Шемшученко (відп. ред.) [та ін.]. Київ, 2003. Т. 5 : П — С.

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Conclusions. Thus, to the well-known works of Honored Professor M. S. Bokarius, which have a bibliographic description, we add a description of 84 more abstracts and reviews. Note that they have been translated from English, German, French, Spanish, Czech and other languages. Ways of further explorations lead us to the search for works by Mykola Serhiiovych in the 1920s and 1930s in foreign journals, business and scientific correspondence, and to responses to his works.

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О. М. Ключев, Л. В. Бокариус, А. С. Тяпкин

Дослідження наукової спадщини М. С. Бокариуса — обов'язок працівників наукової установи, що носить його ім'я

Значна частина наукової спадщини М. С. Бокариуса залишилася поза увагою бібліографів: зокрема, його рецензії на статті, підручники та

монографії вітчизняних авторів, а також на праці закордонних судових медиків, криміналістів і юристів (усього понад 80)¹. Особливістю редакційної політики «Архіву кримінології та судової медицини» і журналу «Питання криміналістики та науково-судової експертизи» була значна кількість рецензій, оглядів та ін. Мета статті полягає в науковому пошуку нових праць М. С. Бокаріуса та фундаментальному дослідженні 5 випусків «Архіву кримінології та судової медицини» за 1926—1927 рр. і журналу «Питання криміналістики та науково-судової експертизи» № 1—6 за 1931 р.

Ключові слова: наукова періодика, наукова спадщина М. С. Бокаріуса, «Архів кримінології та судової медицини», судова експертиза, Харківський науково-дослідний інститут судових експертиз, Національний науковий центр «Інститут судових експертиз ім. Засл. проф. М. С. Бокаріуса».

А. Н. Ключев, Л. В. Бокариус, А. С. Тяпкин

**Изучение научного наследия М. С. Бокариуса — долг работников
научного учреждения, носящего его имя**

Большая часть научного наследия Н. С. Бокариуса — в частности, рефераты, обзоры и рецензии на труды ведущих судебных медиков и юристов со всего мира — не имеет библиографического описания и не введена в научный оборот. На страницах «Архива криминалогии и судебной медицины» и украиноязычного журнала «Вопросы криминалистики и научно-судебной экспертизы» учёный прореферировал более 80 работ. Особенностью редакционной политики бокариусовского «Архива...» было то, что издание публиковало значительное количество рецензий, обзоров и пр. Николай Сергеевич — автор более 70 полноценных аналитических рефератов, ещё 10 опубликовано в журнале «Вопросы криминалистики и научно-судебной экспертизы». Учёный реферировал не только статьи, учебники, монографии отечественных авторов, но и труды многих зарубежных судебных медиков и криминалистов — со всей Европы, из США и Японии, стран Южной Америки. Рефераты научных статей воспроизводились в журнале на французском, немецком и английском, итальянском и испанском языках. Всё это стало возможным благодаря тому, что сам Николай Сергеевич был одарённым лингвистом и владел 17 иностранными языками.

Цель статьи заключается в научном поиске новых трудов учёного и фундаментальном исследовании пяти выпусков «Архива криминалогии и судебных наук», выходившего в 1926—1927 гг., и шести выпусков журнала «Вопросы криминалистики и научно-судебной экспертизы» за 1931 г.

¹ Фесюнін В. М., Тяпкін А. С. «Архів кримінології та судових наук» і наукова спадщина М. С. Бокаріуса. *Архів кримінології та судових наук* : наук. журн. / ред. кол.: О. М. Ключев, В. С. Батиргарєєва, Г. О. Спіцина та ін. 2020. № 2. Р. 79. DOI: <https://doi.org/10.32353.ACFS.2.2020.07> (date accessed: 22.02.2021).

Ключевые слова: научная периодика, научное наследие Н. С. Бокариуса, «Архив криминологии и судебной медицины», судебная экспертиза, Харьковский научно-исследовательский институт судебных экспертиз, Национальный научный центр «Институт судебных экспертиз им. Засл. проф. Н. С. Бокариуса».

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Research Article

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As for decision making rules based on research results while forensic science activities

While forensic research, obtained results should be evaluated in order to ensure adoption of correct conclusion regarding the research object. For this purpose forensic experts should use established decision rules to substantiate a statement about conformity of an object or certain requirements, or parameters, or characteristics. Currently, the need to ensure that a decision is made based on results of forensic examination using the concept of decision rules is constantly increasing. Therefore, consideration of the issue of establishing rules for making decisions while forensic science activity at international and national levels is relevant. Relevance of this issue is justified not only by the requirements of ISO/IEC 17025:2017 for testing laboratories but by the requirements for the objectivity of expert opinion. ISO/IEC 17025:2017 recognizes that there is no single rule for deciding on conformity. In other words, in a specific situation there will be its own decision making rule. This also applies to forensic science activity.

Therefore, this article purpose is necessary for forensic science activity to determine:

- *general guidelines for choosing appropriate decision making rule;*
- *directives for determining the components of decision making rules depending on the object and the task of forensic examination;*
- *rules for applying certain requirements to the research results of carried out in accordance with requirements of research methods, research object and the type of quantitative or qualitative research.*

Thus, this article defines and considers the process of establishing the rules for making decisions, criteria which the rules for making decisions are established by, options for making a decision on compliance/non-compliance with requirements.

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The authors declares no conflict of interest of relevance to this topic.

Keywords: *decision making rules, uncertainty, conformity assessment, measurements, protective strip.*

Formulation of Research Problem. Forensic science activity under the Law of Ukraine: *On Judicial Examination*¹ includes research on wide range of objects and requires specific expertise in many subject matters. While research on objects various techniques are used, from visual inspection to complex instrumental techniques. In this case, the units of forensic science institutions conduct researches through measuring and/or testing in order to determine quantitative and qualitative indicators of the objects submitted for examination. For forensic science institutions, all these actions are researches that are carried out according to the methods entered in the relevant Register of the Ministry of Justice of Ukraine. However, the results obtained while forensic examination should be evaluated in order to ensure a correct conclusion about research object. For this purpose, forensic experts should apply certain decision making rules to justify the object compliance statement with certain requirements, parameters or characteristics. Currently, there is a growing need to ensure decision making based on results of forensic examination using the concept of decision making rules. Therefore, consideration of the issue of determining the rules of decision making during forensic science activities at international and national levels is relevant. Relevance of this issue is justified not only by the *ISO/IEC 17025:2017*² General requirements for the competence of testing and calibration laboratories but by requirements for the objectivity of forensic expert conclusion.

Analysis of Essential Researches and Publications. The issue of decision making rules is covered in many publications of domestic and foreign scientists such as O. Madera, I. Blank, A. Chernikov, T. Kravchenko, D. Isayev and others³. In their research papers, this issue is largely covered, however is not considered in the field of forensic science activity.

The Article Purpose. *ISO/IEC 17025:2017*⁴ recognizes that there is no single rule for compliance. In other words each specific situation involves its own decision

¹ Про судову експертизу : Закон України від 25.02.1994 р. № 4038-XII (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/4038-12> (date accessed: 02.03.2021).

² ДСТУ EN ISO/IEC 17025:2019. Загальні вимоги до компетентності випробувальних та калібрувальних лабораторій (EN ISO/IEC 17025:2017, IDT; ISO/IEC 17025:2017, IDT) : затв. наказом ДП «УкрНДНЦ» від 23.12.2019 р. № 483. [Чинний від 23.12.2019]. URL: http://online.budstandart.com/ru/catalog/doc-page.html?id_doc=88724 (date accessed: 17.02.2021).

³ Мадера А. Г. Принятие решений в условиях неопределенности при актуализации в будущем множества возможных шансов и рисков. *Международный журнал прикладных и фундаментальных исследований*. 2014. № 4. Р. 136—140. URL: <https://applied-research.ru/ru/article/view?id=5087> (date accessed: 19.02.2021) ; Бланк И. Принятие решений в условиях неопределенности [Электронный ресурс]. URL: <https://www.kpilib.ru/article.php?page=302> (date accessed: 19.02.2021) ; Кравченко Т. К., Исаев Д. В. Принятие стратегических решений в условиях риска и неопределенности. *Финансы: теория и практика*. 2016. Т. 20. № 4. Р. 22—31. DOI: <https://doi.org/10.26794/2587-5671-2016-20-4-22-31> (date accessed: 19.02.2021).

⁴ ДСТУ EN ISO/IEC 17025:2019.

making rule. This applies to forensic science activity, so it is for forensic science activity to determine:

- general guidelines for choosing the appropriate decision making rule;
- guidelines for determining the constituent rules of decision making depending on the object and task of forensic examination;
- rules for applying certain requirements to research results of (according to the requirements of the research methods, research object of and research species: quantitative or qualitative).

Main Content Presentation. According to *ISO/IEC 17025:2017* for quantitative researches where the result of measurements/tests is the value of the measured quantity, decision making rule is a rule describing how to take into account the uncertainty of measurement while determining the object compliance of forensic examination with these requirements.

For establishing the rules for decision making on uncertainty, it is necessary to determine the methods of estimating and standardizing uncertainty of measurements while quantitative tests that requires significant financial costs for relevant research. Therefore, we propose to determine the rules of decision making according to other criteria and after their definition to list these values in measurement uncertainty.

Examples of this approach are documents of *Eurachem* and *CITAC (Cooperation on International Traceability in Analytical Chemistry)* on uncertainty application in conformity assessment. According to their proposals, characteristics of measurement results (correctness, reproducibility, limits of conformity, etc.) are evaluated and target uncertainty is determined using these characteristics.

For realizing this approach it is necessary to apply the following characteristics:

- limit of the tolerance field, limit of technical requirements: stipulated upper or lower limit value for admissible values of parameter (property). This term is associated with the *tolerance field* term as a range of valid values;
- acceptance limits: stipulated upper or lower limit value for admissible measured quantity values;
- receiving range: range of allowable measured values (receiving interval usually contains receiving limits);
- defective range : range of measured values that are considered as unacceptable ones;
- protective strip: range between the boundary of tolerance field and the corresponding receiving limit.

For establishing acceptance rule in the case of simple acceptance, acceptance range is equal to the admission field and it is possible to determine the areas of acceptance and rejection using acceptability limits of forensic research result.

In this case, the tolerance should be set on the parameter (or property) value for measured value, for example:

- It should not be more (or less) a certain value;
- It has to be in the range from... to...;
- It should be (quantitative value) and in a technique it is defined through what means of measuring equipment to carry out measurements with indication of its type or the maximum admissible error (accuracy class).

While performing measurements and notification of compliance or non-compliance of forensic examination object with specific requirements, there are 2 possible options:

- A. Making the right/wrong decision on compliance with requirements;
- B. Making the right/wrong decision on non-compliance with requirements.

In this case, each measured value has an associated measurement uncertainty. For example, if there is a minimum value, a nominal value and a maximum value of the parameter, then if measurement result plus/minus uncertainty is in the range from minimum to maximum value, the result is recognized as appropriate. If the uncertainty value is such that the result of the measurement plus/minus uncertainty goes beyond acceptance limits, it is necessary to have a decision making rule for compliance.

The use of protective strips can reduce likelihood of wrong decision making about compliance. In fact, it is a protective factor built into decision making based on measurement result that is to narrow the receiving limits below the tolerance field. Therefore, the length of protective strip is the difference between tolerance field and the receiving limit. This means that if the measurement result for the upper tolerance limit is within the receiving limit, then measurement result is considered to meet specification.

In description of protective strip often indicate the upper and lower limits of the tolerance field. A protective strip: of length zero indicates that any measurement result that is below the tolerance field is accepted. This is a simple assumption called *shared risk*, as probability of being outside the tolerance field can reach 50% if the measurement result is at the level of tolerance field (meaning a symmetrically normal distribution of results).

The binary decision rule is used when the choice for the result is limited to two options: *Pass/Fail*. The non-binary decision making rule is used when decision on the result can be expressed in several variants (satisfactory, conditionally corresponding, conditionally not corresponding, unsatisfactory).

In default of a protective strip, the binary statement of compliance with the upper value of tolerance field for the rule of simple acceptance is made by means of:

- *Pass*: measured value is below the tolerance field;
- *Fail*: measured value is above the tolerance field.

In case of establishing protective strip, the binary declaration of conformity is made by means of:

- *Pass*: result of the measured value below receiving upper limit (upper value of the tolerance field minus the protective strip value);
- *Fail*: failure is based on a protective strip if the measurement result is above receiving limit.

Examples are presented on Fig. 1–3.

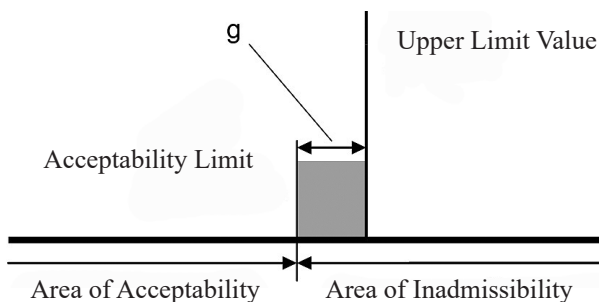


Fig. 1. Protective Range (g), limit of acceptability and areas of acceptability and inadmissibility determined in accordance with the stipulated upper limit value and decision making rules that ensure high conclusion reliability of compliance

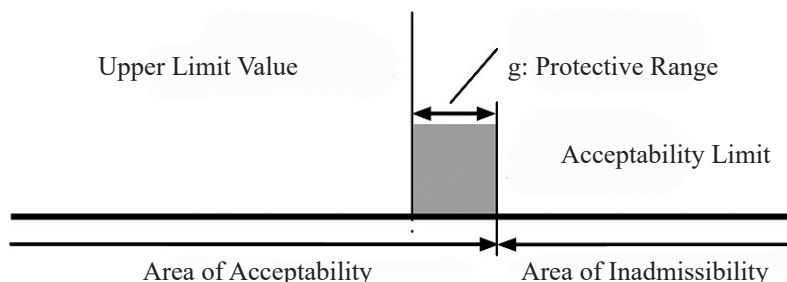


Fig. 2. Protective range (g), limit of acceptability and areas of acceptability and inadmissibility determined in accordance with the stipulated upper limit value and decision making rules that ensure high conclusion reliability of compliance

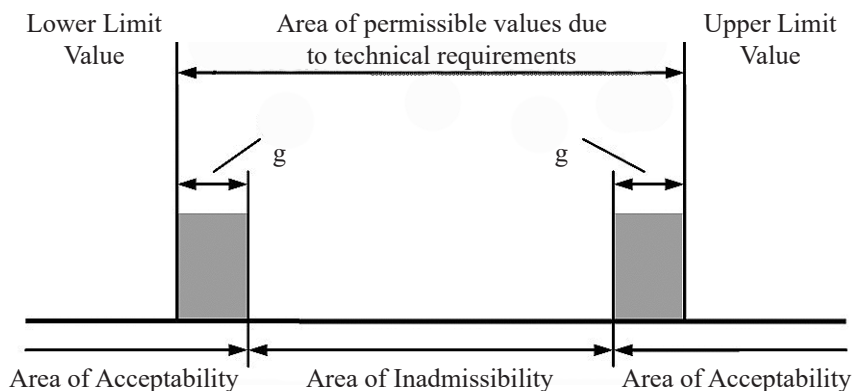


Fig. 3. Protective ranges (g), limits of acceptability and areas of acceptability and inadmissibility determined in accordance with the stipulated upper limit value and decision making rules that ensure high conclusion reliability of compliance

According to *ISO/IEC 17025:2017*¹ decision making rule is a rule describing how to take into account the measurement uncertainty while determining compliance with specified requirements.

*ISO/IEC 17025:2017*² sets out criteria related to decision rules and declarations of conformity, for example:

- in clause 7.1.3: *“when the customer requests an opinion on specification conformity or standard for testing or calibration (e.g. suitable/unsuitable, within tolerance/out of tolerance), specification or standard and decision rules should be clearly defined. If decision making rule is not specified in the specification or standard, it should be reported to the customer and agreed with”*;
- in clause/subclause: 7.8.3.1 b): *“if necessary, a statement of compliance with the requirements or specifications”* and in in clause/subclause: 7.8.3.1 (c) *“where applicable, the uncertainty of the measurements, presented in the same units as the measured quantity, or in relation to the measured quantity (for example, as a percentage), when this concerns probability or application of test results; this is required by the customer; or measurement uncertainty affects compliance with the established limits”*.

Clause/subclause: 7.8.4.1 a), 7.8.4.1 e), 7.8.6.1, 7.8.6.2 of *ISO/IEC 17025:2017*³ defines the criteria for when and by what rules compliance should be established. However, it is important to note that conformity assessment is performed on compliance with technical conditions, technical specifications or standards. In default of a decision making rule in methodology, it should be agreed with customer. Uncertainty in decision making rules is applied *“where it can be applied”* or where it *“affects compliance with established limits”*.

Defining uncertainty decision-making rules requires knowledge of a certain normative value of measurement uncertainty, such as the maximum allowable uncertainty that would be defined in the measurement/test methods. In default of such a value, the target uncertainty value can be applied. According to *VIM (ISO/IEC Guide 99:2007)*⁴, target uncertainty is measurement uncertainty set as the upper limit and selected based on the expected use of measurement results.

If uncertainty is significant, there is a limit to right decision making about compliance. The values of maximum allowable uncertainty for specific measurements in international practice are obtained by rounds of interlaboratory

¹ ДСТУ EN ISO/IEC 17025:2019.

² Ibid.

³ Ibid.

⁴ ISO/IEC Guide 99:2007 (E/R). International Vocabulary of Metrology — Basic and General Concepts and Associated Terms (VIM) (Международный словарь по метрологии. Основные и общие понятия и соответствующие термины (VIM)). 2007. 92 с. URL: https://metrology.kiev.ua/files/ISO_IEC_Guide_99_2007.pdf (date accessed: 17.02.2021).

comparisons. Indirect values of uncertainty are also established in international documents. For example, for measuring equipment as a ratio of its maximum permissible error.

*ISO/IEC 17025:2017*¹ requires laboratories to assess measurement uncertainty and to apply a documented decision making rule while applying for conformity declaration.

As mentioned above, approaches used can vary significantly depending on the situation and different protective strips can be used. The most common is the use of target uncertainty for protective strip. However, in many cases use a factor for the value of uncertainty other than 1. Table 1 *ILAC-G8:09*² demonstrates examples of different protective strips to achieve certain levels of specific risks based on the customer's application.

Table 1**Examples of protective strips**

Decision making rule	Protective strip	Specific risk
6 sigma	3	<1 ppm probability of erroneous acceptance
3 sigma	1,5 U	< 0.16 % probability of erroneous acceptance
<i>ILAC G8:2009</i> rule	1 U	< 2.5 % probability of erroneous acceptance
<i>ISO 14253-1:2017</i>	0,83 U	< 5 % probability of erroneous acceptance
Simple acceptance	0	< 50 % probability of erroneous acceptance
Uncritical	–U	Object deviates by a measured value greater than < 2.5 % probability of erroneous acceptance
Defined by the customer		Customer determines protective strip value
<i>Note.</i> In table U – the value of extended uncertainty		

The expanded target uncertainty can be clarified by some performance characteristics of methods. For example:

- as 1/8 of the width of the correspondence range;
- reproducibility of measurements (R) by 2.8 and multiply by 2;
- multiply the standard deviation determined while proficiency check by 2.

¹ ДСТУ EN ISO/IEC 17025:2019.

² ILAC-G8:09:2019. Настанова щодо правил прийняття рішення та висновків щодо відповідності (Guidelines on Decision Rules and Statements of Conformity). URL: https://naau.org.ua/wp-content/uploads/2021/03/ILAC_G8_09_2019_Nast-ano-va-shhodo-pravy-%60l-pry-%60jnyatty-a-rishen-%60.pdf (date accessed: 17.02.2021).

The provisions of some documents ¹ can also be applied while determining in laboratory the rules of decision making on measurements carried out according to specific research methods in forensic science activities. However, the use of uncertainty for decision making in conformity assessment when:

- there are no national standards for methods of calibration of measuring equipment;
- uncertainty of measurements that is estimated while calibration of measuring equipment significant compared to deviations of its readings from the reference value;
- measurement uncertainty is not required at national level, it is possible only on the basis of application of real decision making rules on conformity on the basis of theory of admissible control, defined by methods and other documents of requirements to objects of forensic researches, admissible norms to measured sizes, normalized errors of the applied measuring equipment. Application of such real rules makes it possible to list them in the value of uncertainty to ensure realization of the requirements of *ISO/IEC 17025:2017* ². However, this is only possible for quantitative methods of research of objects provided for forensic research.

Professionals have been using mathematical decision making methods for a long time to determine the rules of decision making. When using these methods, objects are divided into *simple* and *complex* ones. Exact mathematical models that are adequate to the research object can be applied to simple objects. Therefore, simple objects can usually be identified in the case of quantitative researches where the object is studied by measuring its inherent characteristics or parameters. Therefore, in this case, it is possible to apply methodology for establishing the rules of decision making proposed above.

While conducting qualitative research, the object should be considered as a complex one. The following objects are characterized by the following:

- its characteristics cannot be quantified;
- there is no formalized description of the object or it is very complex;
- much of information about this object exists only as the ideas and wishes of forensic experts based on their experience of researching on similar objects.

¹ ILAC-G8:09:2019 ; ДСТУ ISO/IEC Guide 98-4:2018. Невизначеність вимірювань. Ч. 4 : Роль невизначеності вимірювань під час оцінювання відповідності (ISO/IEC Guide 98-4:2012, IDT). URL: https://online.budstandart.com/ua/catalog/doc-page.html?id_doc=81670 (date accessed: 17.02.2021) ; ISO 14253-1:2017. Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment. Part 1 : Decision rules for verifying conformity or nonconformity with specifications (Геометричні технічні характеристики виробу (GPS). Перевірка шляхом вимірювання деталей та вимірювального обладнання. Ч. 1 : Правила прийняття рішень для перевірки відповідності чи невідповідності специфікаціям). URL: <https://www.iso.org/ru/standard/70137.html> (date accessed: 17.02.2021).

² ДСТУ EN ISO/IEC 17025:2019.

Therefore, methodology proposed above for quantitative research cannot be applied while qualitative research. For such research, a different methodology should be developed for decision making based on fuzzy logic, for example.

Conclusions. The practice of domestic and foreign forensic institutions indicates that high-quality conformity assessment is the basis for ensuring a high scientific and technical level of their researches and confidence in the results. Institutions that apply compliance decision making rules and assess compliance with regulatory requirements, measurement uncertainties and risks will have an advantage over other forensic science institutions in terms of international standards for research quality.

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Щодо правил прийняття рішень за результатами досліджень під час судово-експертної діяльності

У процесі судово-експертного дослідження здобуті результати слід оцінювати з метою забезпечити прийняття правильного висновку щодо об'єкта дослідження. Саме тому експерти мають застосовувати визначені правила прийняття рішень для обґрунтування заяви про відповідність об'єкта або певним вимогам, або параметрами, або характеристиками. Станом на сьогодні постійно зростає потреба в забезпеченні винесення рішення за результатами експертизи із застосуванням концепції правил прийняття рішень. Тому розгляд питання визначення правил прийняття рішень під час судово-експертної діяльності на міжнародному та національному рівні є актуальним. Актуальність цього питання обґрунтовано не тільки вимогами ISO/IEC 17025:2017 до випробувальних лабораторій, а й вимогами до об'єктивності експертного висновку. ISO/IEC 17025:2017 визнає, що єдиного правила прийняття рішення щодо відповідності не існує. Тобто кожна конкретна ситуація передбачає своє правило прийняття рішення. Це також стосується судово-експертної діяльності, тому саме для судово-експертної діяльності необхідно визначити:

- загальні настанови щодо вибору відповідного правила прийняття рішення;
- настанови щодо визначення складових правил прийняття рішень залежно від об'єкта й завдання експертизи;
- правила застосування певних вимог до результатів проведених досліджень (відповідно до вимог методики досліджень, об'єкта досліджень і виду дослідження — кількісного чи якісного).

Отже, у статті з'ясовано й розглянуто процес визначення правил прийняття рішень, критерії, за якими встановлено правила прийняття рішень, варіанти прийняття рішення про відповідність/невідповідність вимогам.

Ключові слова: правила прийняття рішень, невизначеність, оцінювання відповідності, вимірювання, захисна смуга.

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О правилах принятия решений по результатам исследований в процессе судебно-экспертной деятельности

В процессе судебно-экспертного исследования полученные результаты должны быть оценены с целью обеспечения принятия правильного

заклучения относительно объекта исследования. Для этого эксперты должны использовать установленные правила принятия решений для обоснования заявления о соответствии объекта или определённым требованиям, или параметрам, или характеристикам. В настоящее время постоянно увеличивается потребность в обеспечении вынесения решения по результатам экспертизы с применением концепции правил принятия решений. Поэтому рассмотрение вопроса установления правил принятия решений во время судебно-экспертной деятельности на международном и национальном уровне актуально. Актуальность этого вопроса обосновывается не только требованиями ISO/IEC 17025:2017 [2] к испытательным лабораториям, но и требованиями к объективности экспертного заключения. ISO/IEC 17025:2017 признаёт, что единого правила принятия решения о соответствии не существует. То есть в конкретной ситуации будет своё правило принятия решения. Это касается также и судебно-экспертной деятельности.

Поэтому целью статьи является определить необходимые для судебно-экспертной деятельности:

- общие указания по выбору соответствующего правила принятия решения;
- установки по определению составляющих правил принятия решений в зависимости от объекта и задачи экспертизы;
- правила применения определённых требований к результатам проведённых исследований в соответствии с требованиями методики исследований, объекта исследований и вида исследования — количественного или качественного.

Таким образом, в статье определён и рассмотрен процесс установления правил принятия решений, критерии, по которым устанавливаются правила принятия решений, варианты принятия решения о соответствии/несоответствии требованиям.

Ключевые слова: правила принятия решений, неопределённость, оценки соответствия, измерения, защитная полоса.

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Features of the psychological training of forensic experts as a component of the adaptation process to working conditions

The article purpose is to substantiate the need to include psychological training in the general system of professional training of forensic experts as a component of the adaptation process to working conditions and proper performance by forensic experts of their official duties, the development of regulatory support for this training, as well as ways of its implementation in work with the staff of state forensic expert institutions.

It has been proved that the current regulatory framework for the professional training of forensic experts in the system of the Ministry of Justice of Ukraine needs further improvement. We consider it necessary to develop a separate regulatory act on the organization of professional training of forensic experts of state forensic institutions of the Ministry of Justice of Ukraine, and we propose to add to the research work plan of the Ministry of Justice of Ukraine the development of such guidelines as a separate topic of the research work (RW).

Attention is focused on the need for psychological training as a priority area of work on the professional training of forensic experts.

Keywords: *psychological training, staff, adaptation, teamwork, training, business games, situation modeling.*

Formulation of Research Problem. In the system of forensic institutions of the Ministry of Justice of Ukraine, training and advanced training of forensic experts is regulated by the Regulations on the Central Expert Qualification Commission under the Ministry of Justice of Ukraine and attestation of forensic experts (hereinafter referred as *Regulations on the CEQ*)¹, that determines the procedure for training (internship) of persons who intend to obtain (confirm) the qualification of a forensic expert. The lack of legal regulation of psychological training complicates the process of adaptation of

¹ Положення про Центральну експертно-кваліфікаційну комісію при Міністерстві юстиції України та атестацію судових експертів : затв. наказом Мін'юсту України від 03.03.2015 р. № 301/5 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/card/z0249-15> (date accessed: 22.02.2021).

employees to new working conditions and negatively affects the ability of the forensic experts to properly perform their duties.

Psychological training as a method of staff development is used not only in other government ministries and departments, but also in leading domestic and global private companies.

The establishment of the psychological training in the system of professional training will accelerate the adaptation of new employees to the specific working conditions of forensic experts, improve the performance of forensic experts' duties, promote a positive moral and psychological climate in the team and adherence to corporate culture.

In addition, the system of professional training and advanced training of forensic experts of forensic institutions of the Ministry of Justice of Ukraine needs to be rethought: the development and adoption of a special legal act, regulating the professional training of these employees, is urgent.

Analysis of Recent Researches and Publications. The issue of training forensic experts has attracted the attention of many scientists, in particular, O. M. Kliuiev ¹, I. A. Petrova ², E. B. Simakova-Yefremian ³, N. M. Tkachenko ⁴, S. H. Hasparian ⁵, and others. It should be noted the significant contribution of these scientists in building a modern system of working with staff of state forensic institutions. At the same time, we must admit that the problem of psychological training of forensic experts has not been sufficiently studied. Analysis of works by V. H. Babenko and V. P. Ostapovych ⁶,

¹ Ключев О. М. Проблеми розвитку професійного рівня працівників судово-експертних установ Міністерства юстиції України. *Актуальні питання судової експертизи і криміналістики* : зб. мат-лів Міжнар. наук.-практ. конф., присвяч. 150-річ. з дня народж. Засл. проф. М. С. Бокаріуса (м. Харків, 18—19.04.2019). Харків, 2019. Р. 29—31.

² Петрова І. А., Снігерьев О. П. Шляхи вдосконалення системи підготовки судових експертів в Україні. *Актуальні питання судової експертизи та криміналістики* : зб. мат-лів Міжнар. наук.-практ. конф., присвяч. 95-річ. створ. ХНДІСЕ ім. Засл. проф. М. С. Бокаріуса (м. Харків, 10—11.10.2018). Харків, 2018. Р. 17—20.

³ Сімакова-Сфремян Е. Б., Дереча Л. М. Проблеми підбору наукових кадрів для здійснення судово-експертної діяльності. *Вісник ОНДІСЕ* : зб. наук. пр. Одеса, 2019. Вип. 5. Р. 174—182.

⁴ Ткаченко Н. М. Удосконалення професійної підготовки судового експерта — важливий фактор розвитку експертної дидактики. Теорія та практика судової експертизи і криміналістики : зб. наук. пр. Харків, 2018. Вип. 18. Р. 203—214. DOI: <https://doi.org/10.32353/khrife.2018.22> (date accessed: 22.02.2021).

⁵ Гаспарян С. Г. Адміністративно-правові засади кадрового забезпечення судово-експертних установ України : дис. ... канд. юрид. наук. Харків, 2019. 217 р.

⁶ Бабенко В. Г., Остапович В. П. Професійно-психологічна підготовка персоналу Національної поліції України: перспективи розвитку. *Наука і правоохорона* : наук. журн. Київ, 2016. № 4 (34). Р. 246—253.

N. I. Baraniuk¹, B. V. Durniak², N. A. Kochetkova³, M. O. Sova⁴, V. P. Chudakova⁵, and other researches related to the introduction of psychological training in the territorial divisions of other ministries and departments, as well as in enterprises of various forms of ownership, allows to summarize the existing experience and scientifically substantiate the urgent need to start working with staff of state forensic psychological training institutions as component of professional training — to facilitate the adaptation of forensic experts to working conditions and the proper performance of their duties.

The **Article Purpose** is to substantiate the need to include psychological training in the general system of professional training of forensic experts as a component of adaptation to working conditions and proper performance by forensic experts of their official duties, develop regulatory support for this training, as well as ways of its implementation in work with staff of state forensic science institutions.

Main Content Presentation. The effective performance by the forensic institution of tasks assigned to it by the state depends on the quality of the personnel potential of these institutions, which must be properly prepared for work. Not the last role in this process is played by psychological training of the personnel. Each individual forms the psychological climate of the team and vice versa – the psychological climate of the team affects the performance of each of its members. The working conditions of the forensic expert, which are often associated with the negative emotional impact of the objects of study, somehow deform his psyche. Properly organized psychological training prevents these negative findings and maintains the efficiency of the expert at the appropriate level.

¹ Баранюк Н. І. Соціально-психологічні особливості розвитку організаційної культури у правоохоронних органах в умовах кризового суспільства. *Науковий вісник Львівського державного університету внутрішніх справ*. Серія : психологічна : зб. наук. пр. Львів, 2014. Вип. 2. Р. 3—14.

² Дурняк Б. В., Сікора Л. С., Лиса Н. К., Мазур М. Н., Щерба Г. В. Моделі структуризації знань для інтелектуальної підготовки персоналу при їх роботі в надзвичайних умовах. *Моделювання та інформаційні технології* : зб. наук. пр. Київ, 2013. Вип. 69. Р. 204—210.

³ Кочеткова Н. А. Психодіагностичні технології покращення ефективності кадрового потенціалу в системі державної служби. *Державне будівництво* : електрон. наук. фах. вид. Харків, 2012. № 1. 9 р.

⁴ Сова М. О. Професійно-психологічна підготовка працівників пенітенціарної служби до саморегуляції в екстремальних ситуаціях оперативно-службової діяльності. *Науковий вісник Інституту кримінально-виконавчої служби* : наук. журн. Київ, 2014. № 2. Р. 136—148.

⁵ Чудакова В. П. Психолого-організаційна технологія формування готовності персоналу освітніх організацій до інноваційної діяльності. *Навчання і виховання обдарованої дитини: теорія та практика* : зб. наук. пр. Київ, 2015. Вип. 1. Р. 136—147.

The role of the organizer in the formation of a positive moral and psychological climate in the team and the study of psychological readiness to perform functional duties by each of its employees is assigned to the personnel department. This article discusses one of the methods of improving these components – psychological training.

The professional training of forensic experts in the system of the Ministry of Justice of Ukraine is defined by the Regulations on the CEQ. At the same time, we should note that this Regulation governs the procedure for training, internships and advanced training only for those persons who intend to obtain, confirm (continue) or improve the qualification of a forensic expert. In addition, training programs for this category of workers lack the basics of psychological training. Therefore, we are forced to state that to date psychological training of staff in forensic institutions has not been introduced, which, in our opinion, is a gap in the general system of training forensic experts.

According to N. A. Kochetkova, it is the psychological training and diagnosing of staff will improve the staffing of the civil service, and in the practical implementation of this will *be the development and implementation of special technologies for psychological training*¹.

It is worth noting the opinion of B. V. Durniak and colleagues on the tasks of psychological training of the staff, among which they highlight the need for the formation of such moral and volitional qualities as: determination, psychological resilience in stressful situations, responsibility and ability to make the right decisions². Researchers believe that due to psychological training the employee develops such qualities as: self-control, will, teamwork, psychological resilience in stressful situations, the ability to mobilize knowledge to assess the situation, analytical and creative thinking, the ability to identify cause-and-effect relationships³. These researchers also emphasize the need to draw up plans for psychological training of the staff⁴.

N. I. Baraniuk's opinion is interesting on the importance of socio-psychological aspects for the development of organizational culture of law enforcement agencies, which can be applied to state forensic institutions, namely: corporatism (sense of belonging to a particular group), high professionalism, responsibility to state, the ideology of departmental consciousness. The scientist concludes that law enforcement officers share the values of the team to which they belong, namely:

- its internal atmosphere, *which determines the general spirit, understandable to each employee, as well as the basis of his job orientation and mood;*

¹ Кочеткова Н. А. Op.cit. P. 1.

² Дурняк Б. В., Сікора Л. С., Лиса Н. К., Мазур М. Н., Щерба Г. В. Op.cit. P. 205.

³ Ibidem. P. 206 —207.

⁴ Ibidem. P. 210.

- a clear code of rules and norms of official communication and behavior, the presence of certain traditions;
- the rule of honesty, decency, honesty, mutual assistance, demanding of themselves and others¹.

According to N. I. Baraniuk, organizational culture is *a system of socially acceptable patterns of behavior, patterns of intragroup life (knowledge, skills, formal and informal rules and norms, values, moral principles, customs and traditions), which are supported by the employee of the department and determine the general boundaries of his behavior, consistent with the goals and objectives of law enforcement*².

V. H. Babenko and V. P. Ostapovych call the main causes of the crisis of professional and psychological training:

- lack of conditions for self-realization, improvement and development;
- deterioration of the image of the specialization, wrong choice of profession;
- instability of the socio-economic situation;
- professional deformation of personality;
- maladaptation to activities;
- reduction of staff positions;
- insufficient wages;
- difficult living conditions³.

The experience of the National Police of Ukraine in organizing the psychological training of personnel requires a detailed study. Thus, in accordance with the Regulations on the organization of training of employees of the National Police of Ukraine, approved by the Order of the Ministry of Internal Affairs of Ukraine No. 50 dated on 26.01.2016 (hereinafter referred as *the Regulations of MIA of Ukraine*), psychological training is a component of general training of National Police officers (paragraph 1 of Section VII)⁴.

According to this Regulations, training on life safety and psychological training must be practically oriented and make up at least 30% of the total training time for this type of training (paragraph 2, (2), Section VII)⁵.

The Regulation of the MIA of Ukraine defines the concept of *psychological training* as *training aimed at acquiring theoretical knowledge by police and mastering practical skills necessary for the formation of professional and*

¹ Баранюк Н. І. *Op.cit.* P. 8—9.

² *Ibidem.* P. 12 — 13.

³ Бабенко В. Г., Остапович В. П. *Op.cit.* P. 248.

⁴ Положення про організацію службової підготовки працівників Національної поліції України : затв. наказом МВС України від 26.01.2016 р. № 50 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z0260-16> (date accessed: 23.02.2021).

⁵ *Ibidem.*

psychological reliability, resilience, readiness for various working conditions and constructive communication with the public. (paragraph 15, (2), Section VII) ¹.

This Regulation (paragraph 16, (2), Section VII) ² requires psychological training in study groups at the place of service and at training meetings, and one of the requirements for their implementation is the use of innovative methods, technologies, interactive forms of learning (business games), simulation of situations, trainings, etc.).

The formation of *psychological reliability and resilience of police officers* should also be practiced during practical classes on other types of training (paragraph 17, (2), Section VII of the Regulations of the MIA of Ukraine ³. According to paragraph 18 (2) Section VII ⁴ of the Regulations of the MIA of Ukraine, classes on psychological training should be conducted by employees of psychological support units of police bodies (units), institutions, police agencies. Specialists of profile departments of higher education institutions, specialized enterprises, institutions and organizations (if necessary) can be involved in conducting classes.

V. P. Chudakova's opinion is correct that *the atmosphere of actualization and rethinking of life determines the need for well-developed staff*, able to meet the requirements of the time, navigate in different situations, which is characterized by such qualities as sociability, ability to self-development and innovation, resistance to negative manifestations. The researcher believes that in modern conditions the level of readiness of employees for innovation deserves special attention ⁵ and suggests for changes and development of individuals (and even whole groups of people) to conduct classes in the conditions of *appropriate special training and consultations (trainings, seminars, coaching)* ⁶.

M. O. Sova notes that the experience of acute emotional states by the employee causes stress, which, in turn, reduces productivity and worsens its results. According to the scientist's opinion, destructive mental states can lead to a violation of discipline and legality, and in the future – to professional deformation of personality ⁷. The scientist believes that the development and implementation of professional and psychological training in relevant training programs will have *practical significance for the formation of psychological preparedness for self-regulation of emotional states and behavior in extreme situations, development of emotional and volitional stability, self-control and self-confidence* ⁸.

¹ Ibidem.

² Ibidem.

³ Ibidem.

⁴ Ibidem.

⁵ Чудакова В. П. Op.cit. P. 137.

⁶ Ibidem. P. 139.

⁷ Сова М. О. Op.cit. P. 138.

⁸ Ibidem. P. 148.

According to I. I. Gazda, employees should have *professional reliability*, which he understands as *resistance to extreme factors of activity*, seeing in it *stress resistance, nervous system properties, volitional self-regulation, organizational and communication skills* ¹. Accordingly, the role of the personnel department of the institution in terms of quality selection of employees for the positions of forensic experts is very important. We are sure that a properly organized process of hiring employees, preliminary testing and questionnaires, interviews, thorough study of their personal qualities and documents (education, employment record book, characteristics and recommendations from previous jobs, etc.) will allow at the first stage of the position to staff the forensic institution with employees who by their moral and psychological qualities are able to perform the duties of a forensic expert at a high level.

I. Gazda's conclusions on the areas of psychological support are convincing:

- professional and psychological selection (conducted by the personnel department during the recruitment of positions);
- psychological support of the employee during the performance of official duties;
- professional and psychological training;
- psychological support of official activities ².

We agree with the opinion of Z. R. Kisil that today in the world the vision of the process of human development has changed: in particular, the wording *lifelong learning* has given way to a new one – *learning throughout life* ³. In modern realities, there is a need for constant professional growth of staff, in particular – through psychological training.

O. V. Lazarenko offers the following main forms of psychological training of staff:

- *psychological education (lectures, reports, conversations, speeches, memorabilia, leaflets, information sheets)*;
- *classes on development of the necessary psychological qualities and states*, focused on training staff to act in stressful situations;
- *special forms of psychological training (trainings, role-playing games, group discussions)*;

¹ Газда І. І. Аналіз психологічних складових професійної надійності працівників органів внутрішніх справ. Науковий вісник Львівського державного університету внутрішніх справ. Серія : психологічна : зб. наук. пр. Львів, 2014. № 2. Р. 16.

² Газда І. І. *Op.cit.* Р. 18.

³ Кісіль З. Р. До питання вдосконалення професіоналізації кадрів Національної поліції України. Науковий вісник Львівського державного університету внутрішніх справ. Серія : психологічна : зб. наук. пр. Львів, 2017. № 2. Р. 27. URI: <http://dspace.lvduvs.edu.ua/handle/1234567890/855> (date accessed: 21.02.2021).

- independent work of employees *on training in techniques and methods of self-regulation* (voluntary mobilization, soothing breathing, self-belief, etc ¹.

Also noteworthy are the conclusions by Ya. O. Ovsyannikova that psychological training of staff should be carried out constantly (at work, in training and in everyday life), applying a differentiated approach to each employee — depending on his category, working hours, specialization, psychological characteristics. She emphasizes the sequence and duration of the process of *professional and psychological training of a specialist, which includes a set of organizational, professional, psychological measures and is carried out in the presence of certain psychological factors and principles* ².

Sharing the positions of the mentioned scientists, taking into account the domestic and world experience of working with staff, the specifics of working conditions of forensic experts of state forensic institutions of Ukraine, we state the urgent need to introduce psychological training in their training system.

The organization and conduct of psychological training of forensic experts should be entrusted to the units of work with the staff of forensic institutions and the newly established departments of advanced training, in connection with which it is necessary to adjust the provisions on the functioning of such units. We propose to distribute these functions between these units:

- personnel department — selects job candidates, monitors the moral and psychological climate in the team, proposes measures to improve it;
- advanced training department — directly organizes psychological training.

It should be emphasized on the possibility of introducing the position of a psychologist to the staff of state forensic institutions, whose job responsibilities will include testing and questioning employees during their hiring, their subsequent psychological support, as well as participation in theoretical and practical classes on psychological training. However, these issues should be investigated in detail.

Considering the components of psychological training of forensic experts, we consider it necessary to devote 30 % of training time to the theoretical part of the training, and 70 % — practical. The theoretical part of the training should

¹ Лазоренко О. В. Обґрунтування пропозицій керівникам прикордонних підрозділів щодо організації психологічної підготовки персоналу до несення служби в прикордонних нарядах. *Науковий вісник Миколаївського національного університету імені В. О. Сухомлинського. Серія : Психологічні науки* : зб. наук. пр. Миколаїв, 2014. Вип. 2.12 (103). Р. 119.

² Овсяннікова Я. О. Ефективна психологічна підготовка до професійної діяльності як засіб профілактики «синдрому» вигорання у працівників ДСНС України. *Вісник Національного університету оборони України*. Київ, 2013. Вип. 3 (34). Р. 271—275.

include lectures, reports, conversations, speeches, and the practical – training, simulation and business games.

A necessary precondition for the successful functioning of psychological training of forensic experts should be the development of a program of psychological trainings, preferably at the level of the Ministry of Justice of Ukraine. In addition, the current training programs in expert specializations need to be revised to supplement them with elements of psychological training, taking into account the specifics of each specialization.

Classes on psychological training should be conducted at training facilities of departments of post-graduate studies of forensic institutions with the involvement of employees of psychological research units of these institutions, specialists of specialized departments of higher education institutions, specialized enterprises, institutions and organizations. To this end, it is necessary to develop visual information and apply information technology.

The profession of an expert belongs to the professions related to stressful situations that accompany the performance of this work. It should be noted that there are cases when the positions of experts are applied for by persons who are not psychologically prepared for activities in specific conditions, which further negatively affects their performance of official duties and leads to staff turnover, as well as unsatisfactory moral and psychological climate in team. Such annoying situations should be hindered by the use of modern scientifically based methods and techniques of psychological training of staff, which will positively affect the ability of experts to work even in stressful conditions. The mentioned methods and techniques should be practically oriented and accessible for mastering.

The main prerequisite for the successful functioning of psychological training of the forensic experts is the development of a separate legal act on the organization of professional training of forensic experts of state forensic institutions of the Ministry of Justice of Ukraine, which should provide all types of training, including psychological training as well as development of a unified methodological support of such personnel training for all Ministry of Justice institutions.

We should emphasize the expediency of developing methodological recommendations for the training of forensic institutions of the Ministry of Justice of Ukraine, adding the development of such methodological recommendations to the research plan of the Ministry of Justice of Ukraine as a separate topic of research, which will significantly improve the activities of these institutions.

Conclusions. Thus, the legal framework for the professional training of forensic experts in the system of the Ministry of Justice of Ukraine needs to be improved. The establishment of psychological training of forensic experts of state forensic institutions in the system of the Ministry of Justice of Ukraine

will accelerate the process of adaptation of new employees to the specific working conditions of forensic experts, promote proper performance of their duties, improve the moral and psychological climate in the team and create a corporate culture in the institution.

The main time of psychological training of forensic experts should be devoted to practical classes using innovative methods, technologies, interactive forms of education, including the use of business games, simulation, training, involving employees of psychological research units of forensic institutions, specialists of specialized departments of higher education, specialized enterprises, institutions and organizations.

The functions of organizing psychological training should be entrusted to the departments of post-graduate studies of state forensic institutions, extending their tasks and powers.

On the agenda was the issue of developing programs for psychological training of forensic experts, which is important in practice for the formation of their psychological readiness to work in positions.

The beginning of psychological training is associated with the entire personnel policy of forensic institutions, the creation of a team of professionals and corporate culture, where there is an atmosphere of cohesion and interest in the joint results of work.

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О. В. Курдес

Особливості психологічної підготовки

судових експертів як складової процесу адаптації до умов праці

У статті узагальнено досвід психологічної підготовки персоналу різних міністерств і відомств, підприємств і організацій та запропоновано запровадити психологічну підготовку судових експертів як складову системи професійної підготовки в установах Міністерства юстиції України — для сприяння адаптації судових експертів до умов праці й належного виконання ними своїх посадових обов'язків.

Психологічну підготовку судових експертів рекомендовано здійснювати з використанням інноваційних методів і технологій, інтерактивних форм навчання, з-поміж яких віддавати перевагу діловим іграм, моделюванню ситуацій, тренінгам та ін. До проведення таких занять доцільно залучати працівників підрозділів психологічних досліджень судово-експертних установ, фахівців відповідних профільних кафедр закладів вищої освіти, спеціалізованих підприємств, установ та організацій.

Звернено увагу на потребу в нормативно-правовому забезпеченні психологічної підготовки судових експертів державних судово-експертних установ. Наголошено на необхідності психологічної підготовки як пріоритетного напрямку роботи з професійної підготовки судово-експертних кадрів.

Ключові слова: психологічна підготовка, персонал, адаптація, робота в команді, тренінг, ділові ігри, моделювання ситуацій.

О. В. Курдес

Особенности психологической подготовки судебных экспертов как составляющей процесса адаптации к условиям труда

Целью статьи является обоснование необходимости включения в общую систему профессиональной подготовки судебных экспертов психологической подготовки как составляющей процесса адаптации к условиям труда и надлежащего выполнения судебными экспертами своих должностных обязанностей, разработки нормативно-правового обеспечения этой подготовки, а также путей её внедрения в работу с персоналом государственных судебно-экспертных учреждений.

Доказано, что действующая нормативно-правовая база профессиональной подготовки судебных экспертов системы Министерства юстиции Украины нуждается в дальнейшем совершенствовании. Считаем необходимым разработать отдельный нормативно-правовой акт об организации профессиональной подготовки судебных экспертов государственных судебно-экспертных учреждений Министерства юстиции Украины и предлагаем добавить к плану научно-исследовательских работ Министерства юстиции Украины разработку таких методических рекомендаций как отдельную тему НИР.

Акцентируется внимание на необходимости психологической подготовки как приоритетном направлении работы по профессиональной подготовке судебно-экспертных кадров.

Ключевые слова: психологическая подготовка, персонал, адаптация, работа в команде, тренинг, деловые игры, моделирование ситуаций.

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Topical aspects of round table holding at the current stage of forensic science institutions development

In modern international conditions, cooperation with representatives of other countries is becoming an objective need for pre-trial investigation bodies and forensic science institutions. And it requires not only the improvement of current forms and methods of negotiations but also the search for new forms of cooperation between countries based on mutual interests.

The Article purpose is to identify problem areas in holding scientific events in round table format as a means of finding solutions to detected issues in the field of forensic science at the regional and international levels. Recommendations for enhancing efficiency in round tables holding have been developed.

While research, the main issues leading to unsuccessful organization of round tables as a result of inconsistencies, lack of interactivity, insufficient argumentation framework, uncontrolled polyphonic discussion, inability to justify and develop their point of view have been considered.

Referring to the analysis of held round tables, a number of recommendations have been created and several methods have been developed for successful holding in the form of project with a clear division of preparation stages and allocation of specific tasks at each stage.

Validity of obtained results and conclusions is ensured thanks to general scientific and special research methods, being means for research, in particular for observation and formal logic (analysis, synthesis, deduction, induction, analogy, abstraction); the systemic and structural method was used to define peculiarities in holding of business meetings.

Implementation of these recommendations into forensic expert practice while business meetings will contribute to search for rational ways of problems solution, exchange of experience at the regional and international levels with forensic experts from leading countries of the world.

Keywords: round table, business meeting, conversation, discussion, interactivity, research, forensic science institutions.

Formulation of Research Problem. Essence of modern international relations is in development of potential and cooperation, increasing authority and activation of legal institutions. In view of this, changing world realities objectively determine partnership formation as a principle of legal interaction which achievement should now be considered as the main goal and as a technology for solving complex pressing issues in forensic science.

Forensic science institutions are part of the relevant system and their activities contribute to clarifying the objective truth in cases of violations of law ensuring the rights and freedoms of participants in criminal proceedings through objective and fair proceedings, an objective basis for assessing the results of pre-trial investigation.

In modern international conditions, cooperation with representatives of other countries for pre-trial investigation bodies and forensic science institutions is becoming objective necessity. There is a need not only to improve existing forms and methods of negotiations, but also to find new cooperation forms between countries based on mutual interests, in order to prevent corruption and crime in Ukraine.

The idea of partnership importance (as a guiding principle of a democratic society) has already gained international recognition. Thus, the Copenhagen Declaration on Social Development dated on 01.01.1995 states importance of transparency and accountability in management of public bodies and the need to develop partnerships with free and representative civil society institutions¹.

Partnership importance for effective work of forensic science institutions and government agencies, for creation of a legal welfare state has repeatedly drawn the attention of domestic and foreign scholars.

Ukrainian forensic science institutions need a long-term strategic partnership in the international legal field where tolerant relations between participants would be cultivated. Cooperation should be focused on improving the methods and techniques of forensic expert activity, systematic expansion of forensic expert competence and professional skills, increasing the degree of certainty of forensic expert conclusions, modernization of methods of forensic expert training, discussion of problematic issues.

Share point makes it possible to find certain points of contact that would serve in the future as a starting point for finding common ground, finding scientific truth or reaching a consensus on a problem.

Analysis of Essential Researches and Publications. The issue of developing effective methods of decision-making in the system of public administration has been studied by many scientists (V. D. Bakumenko, O. O. Babinova,

¹ Конвенция о договоре международной автомобильной перевозке пассажиров и багажа. Женева, 1973. (КАПП) // *Treaty Series*. Vol. 1774. N. Y., 2000. P. 109—162.

O. H. Pukhkal, etc.)¹. However, the methodology of the Round Table is not considered in research papers at appropriate level, especially its specification in the field of forensic science (although the issue of public participation in state-building processes paid attention to such researchers as: V. I. Bordenyuk, E. P. Kushnaryov, S. O. Moskalenko, O. V. Kulinich and others)². Scholars have substantiated the use of various technologies and methods to build a strong democracy in the country.

Most developed democracies have already gained considerable experience in interaction of public authorities with public. One of the main cooperation methods between the public and the authorities, scientists call open discussion (for all its democracy) characterized by certain features: both organization of such a discussion and discussion process itself.

Researches indicate that from various symposia, conferences, workshops up to 40% of efficiency of professionals receive while informal communication that is often important and has a significant impact on entire communication process. The effectiveness of this conversation can be increased by giving it organized character in form of thematic discussions, i.e. Round Table.

The *Round Table* term derives from the medieval knightly novels about King Arthur: when the knights sat at the round table so that there was no dispute between the participants for the best place. Later, stories about the Round Table spread through European folklore and literature³.

Over time, the round table became an indispensable attribute of diplomatic negotiations and international conferences. The phrase “sit at the round table” now means equality of all participants in the discussion, peace talks, friendly share point.

This **Article Purpose** is to identify problem areas in conducting scientific events in the format of a Round Table as a means of finding ways to solve identified issues in the field of forensic science at regional and international levels.

Main Content Presentation. The *Round Table* term in modern sense has been used since the XX century.

¹ Бакуменко В. Д. Державно-управлінські рішення : навч. посіб. Київ, 2012. 344 р. ; Бабінова О. О. Методи залучення громадськості до прийняття управлінських рішень: зарубіжний досвід. *Ефективність державного управління* : зб. наук. пр. ЛРІДУ НАДУ при Президентові України ; за заг. ред. А. О. Чемериса. Львів, 2004/05. Вип. 6/7. Р. 217—224.

² Борденюк В. І. Децентралізація державної влади і місцеве самоврядування: поняття, суть та форми (види). *Право України*. 2005. № 1. Р. 21—25 ; Москаленко С. О. Взаємодія держави і громадських організацій як суб'єктів соціальної політики. *Вісник НАДУ*. 2006. № 4. Р. 242—249 ; Кулініч О. В. Механізми взаємодії органів державного управління та громадських організацій в реалізації молодіжної політики в Україні : автореф. дис. ... канд. наук. Харків, 2009. 19 р.

³ Попова М. К. Легенда о короле Артуре в культуре елизаветинской Англии // *Миф в культуре Возрождения*. Москва, 2003. Р. 294—300.

This is one of the ways to organize the discussion of acute, complex and topical issues and experience exchange in professional area. Each of participants has the right to express their point of view while discussion of a controversial or debatable issue. No one is allowed to behave superficially towards other participants. Position of each participant should be respected. While Round Table criticism is inadmissible.

This model of discussion ultimately yields results that become new agreements.

Let us consider the issues that can often hinder a successful roundtable, and a number of solutions to these issues. Achieving interactivity in communication plays a significant role in discussion. The key to achieving interactivity is combination of a thorough step-by-step preparatory process with equal and tolerant discussion during the Round Table discussion.

Round Table discussion provides equal opportunities for all participants to defend their point of view. Unfortunately, it is not always possible to reach unanimity and agreement by finding common solutions to the problems.

Let us highlight weakest points in preparation and holding Round Table that lead to unsuccessful or mediocre results.

Sometimes the cause of many unsuccessful business meetings is insufficient argumentation and inability to develop and justify their point of view. Such a problem can arise due to the participant's too general understanding of his task. Accordingly, it can be solved by detailing roles of the participants. At the same time, the variety of opinions during the conversation, in contrast to the debate, greatly contributes to success of business meeting.

The greatest challenge in conducting a successful Round Table is to provide real interactivity that provides many opportunities to solve specific issues, as it is a platform for exchanging views on a particular issue and each participant has opportunity to express themselves.

Ironically, for the same reason, a business meeting can be a real problem, if you do not strike a balance between exciting and lively conversation and order: it is impossible to turn discussion into a monotonous speech of the opponent or uncontrolled polyphonic discussion.

The reason for the latter is inability of interlocutors to listen and hear each other. Excessive attention in their speech leads to the fact that instead of thoughtful listening to interlocutors and adequate response to their words (i.e. full participation in communication), opponents repeat the prepared text of their speech. Another extreme is intolerance to opposite opinion and unwillingness to listen to the interlocutor and his arguments. It should be noted that the latter occurs much less frequently than excessive passivity and apathy.

Based on the analysis of the round tables, a number of recommendations were developed. In particular, moderator is recommended to carefully prepare and consider introduction, to formulate a specific, rather narrow topic of discussion (for example, instead of too broad a topic to prefer a narrower and

more specific). The moderator should be well acquainted with the position of each participant and be able to translate questions from one position to opposite for a lively discussion. Participants should be active (not only when voicing their position, but while listening to the speeches of others), boldly express their opinion, be ready to discuss the problem to identify possible ways for its solving, have a position, theoretical knowledge and practical experience.

In addition, lack of interactivity of the participants in the business meeting is largely manifested in inability of interlocutors to make necessary arguments in time in favor of their position to respond to opponent statements.

Another difficulty in holding a Round Table while the interlocutors, for various reasons have a very vague idea is expected. Participants take turns taking part in performance, but such a business meeting causes nothing but boredom. Therefore, it is recommended to organize a round table in the form of project work, with a clear division of preparation stages and specific, equally clearly defined tasks at each stage.

Research activities can involve problems such as the unforeseen absence of participants due to health problems (especially moderators, VIP guests and speakers) and lack of financial support.

Currently, there are several approaches to Round Table that we consider appropriate to consider in this article.

The most common way to hold a business meeting is a meeting in any form that does not have a clearly defined agenda. Sometimes no one even chairs such meetings, they are held with a large number of participants in the form of a conversation (for example, a commission meeting or scientific meeting). In this case, no decisions are made. The Round Table purpose organized in this way is to exchange views¹.

Another way to organize and hold a business meeting requires specific issue discussion. The purpose of such a business meeting is to express, study and summarize a wide range of opinions and ideas on the issue: each of the participants expresses a personal opinion on discussed issue².

In this case, the round table is an opportunity to discuss controversial issues, examine the problem from different points of view, draw attention to unresolved issues and reach consensus. The task of holding business meetings in this way is to mobilize and activate the participants to solve specific pressing problems.

Conducting a business meeting involves: compliance with certain rules, willingness of interlocutors to discuss the problem and identify possible ways for its solving, as well as the participants have theoretical knowledge, certain position and practical experience. In order to create a business ambience and achieve a positive result it is necessary:

¹ Галушко В. П. Діловий протокол та ведення переговорів : навч. посіб. Вінниця, 2002. 226 р.

² Гах Й. М. Етика ділового спілкування : навч. посіб. Київ, 2005. 160 р.

- provide optimal number of participants (for an audience of 20—30 people need an assistant who provides the work of technical means for video and audio recordings; involvement of a significant number of professionals requires two moderators);
- agree on the rules of speeches (usually common rules of speeches: 2 hours, speeches of participants and experts: up to 10 minutes, participation in discussion: 3—5 minutes);
- decorate the room accordingly (it is desirable that the Round Table was really round, this will facilitate group communication and maximum participation of all present in discussion) ¹.

There are three stages in management and holding Round Table: preparatory, discussion and final one ².

Preparatory stage includes:

- problem choice (problem should be relevant, acute, have different solutions);
- moderator selection (he manages business meeting and therefore should know at a high level the method of building information, art of creating a trusting ambience, be able to support and lead discussions, be erudite and informed);
- selection of disputants (disputants are international partners, representatives of various institutions and stakeholders of other executive structures);
- scenario preparation (holding round table according to a pre-planned scenario allows to avoid spontaneity and chaos).
- equipping premises with standard equipment in order to maintain business ambience (multimedia, audio and video equipment);
- advising participants (allow to develop certain beliefs in majority of participants that these participants will further defend);
- preparation of necessary materials (in paper form or on electronic media: materials of express examinations, statistical data of conducted analysis).

Discussion stage includes moderator's speech who defines the Round Tables rules, problem, rules and informed all participants about common rules of communication.

Final stage includes:

- summarizing final results by moderator;
- making decisions or recommendations, adopting resolution;
- determining joint event results.

¹ Чмут Т. К., Чайка Г. Л. Етика ділового спілкування : навч. посіб. 2-ге вид., перероб. і доп. Київ, 2002. 224 р.

² Требін М. П. Круглий стіл // Політична енциклопедія ; редкол. : Ю. Левенець (голова), Ю. Шаповал (заст. голови) та ін. Київ, 2011. Р. 377.

It should be noted that communication is an extremely complex phenomenon when the success of negotiations in general depends on individual actions.

At the conversation beginning you should orient yourself and try to establish contact with your partner. This stage purpose is to attract attention and interest of the partner to the conversation and create a favorable atmosphere for communication. This is crucial to ensure the interlocutor's willingness and willingness to participate in the conversation.

The most rational communication beginning is a direct transition to the subject of conversation without long introduction.

While sending a message, you should express your position so that interlocutor clearly understands it. It will be easier to understand message if it is presented concisely, consistently, logically and clearly. Intonation, pace of conversation, tone of voice, facial expressions, facial expressions and gestures play an important role in conveying the message. After presenting the initial message in the conversation, the initiative must be given to the partner ¹.

While communication, you need to actively listen; this involves not only understanding content of statements, but stimulating the interlocutor statements reflecting the state of the partner, his interests, showing attention to.

There are three main forms of listening: clarification, speech support, commenting ².

Clarifying means making sure of adequate interlocutor understanding. By supporting the statement, it is necessary to provide the interlocutor with opportunity to express his position; commenting means expressing your opinion.

Arguments should be clear, convincing, simple and accurate. Argumentation phase is aimed at logical connection of ideas, clear definition of differences, influence on interlocutor position. Evidence should be presented in correct form. The persuasion method should be built taking into account characteristics of the partner temperament. The principle of clarity will also come in handy.

Summing-up stage involves formulation of mutual obligations and the definition of specific actions to implement and control fixing of agreements. Notes made in the interlocutor presence indicate a serious attitude to the decisions made.

Leaving contact involves: paying attention to the partner, outlining cooperation prospects, demonstrating their interest in compliance with the agreements, thank them for their participation. The form in when conversation ends should help to create an ambience of mutual respect. If conversation is delayed, it should be directed to current affairs: so you can without creating

¹ Кубрак О. В. Етика ділового та повсякденного спілкування : навч. посіб. 3-тє вид., стереотип. Суми ; Київ, 2005. 224 р.

² Зубенко Л. Г., Немцов В. Д. Культура ділового спілкування : навч. посіб. Київ, 2002. 200 р.

a feeling of inconvenience, to make it clear to the interlocutor that it is necessary to end the conversation ¹.

While organizing round tables, it is necessary take into account location of participants at the table: it plays a significant role in its success. Let us consider problems that can arise between participants in the discussion in the case of their location at a standard table (rectangular, round, square) and determine which of them is optimal in certain circumstances.

While researches it was found that sitting opposite each other, each participant subconsciously divides the table into two levels of territory, while each claims to its own territory and will protect it in case of encroachment. If participants do not want to communicate with each other at the table, they take an independent position. This situation is usually seen as a lack of interest and hostility from a person whose territorial boundaries have been violated. If you need an open conversation between the participants, such an arrangement should be avoided ².

It has long been believed that table should focus on one side of the world. The ancients believed that by sitting to the North, one could count on success in business. A sense of will and a propensity to take risks can be ensured by facing south. The face facing east foretells ingenuity and dynamism. The location in the western direction should provide new creative ideas.

As for square table, it contributes to creation of relations of rivalry equal in status to the participants. Such tables are effective for emphasizing subordination or for a short business conversation. At the same time, it will be possible to establish cooperation faster with person sitting at the table next to you. The person sitting to your right will understand you better than the person to your left. At the same time, one sitting right in front of you will put up the most resistance. It is generally believed that a square table is not conducive to building an atmosphere of trust.

Using rectangular table, guests who are placed at different ends of the table risk being left out of conversation taking place at the center of the table. Leading position will be occupied and exercised by those who do not sit with their backs to the door ³.

Practice has demonstrated that relaxed ambience is facilitated by an informal round table: it is the best way to hold a business meeting of people having the same social status, as everyone at the table is given the same space. At this table, none of the guests will be out of the group and none will claim the championship.

Conclusions. At the present modernization stage of forensic activity and active cooperation, Round Tables will contribute to the democratic development of legal relations in the context of globalization and the formation of consensus

¹ Кубрак О. В. *Op. cit.*

² Білик Е. Сучасна енциклопедія етикету: 1000 правил і корисних порад ; пер. з рос. О. Росінської. Донецьк, 2005. 382 р.

³ Статінова Н. П., Радченко С. Г. *Етика бізнесу : навч. посіб.* Київ, 2001. 280 р.

as an effective mechanism for cooperation in interstate relations. Discussing problems, exchanging views, establishing close contacts, finding additional opportunities and discussing special, “hot” issues gives the roundtable dynamism and eccentricity. Their holding will facilitate experience exchange and the search for the most rational ways to solve the issues caused by activities of forensic science institutions.

The results of performed research that proposed innovations do not claim to be the final solution to relevant problems while conducting Round Tables and can be the basis for choosing the most appropriate solution to these problems through a broad and correct scientific discussion.

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А. О. Томашевська, О. В. Томашевський
Актуальні аспекти проведення круглих столів
на сучасному етапі розвитку
судово-експертних установ

На основі дослідження визначено проблемні аспекти проведення наукових заходів у форматі круглого столу у сфері експертної діяльності. Розглянуто декілька способів вдалого проведення круглих столів у формі проєктної роботи з чітким поділом етапів підготовки й конкретними завданнями на кожному етапі. Розроблено рекомендації і запропоновано рішення для ефективності проведення круглих столів на регіональному й міжнародному рівнях.

Достовірність здобутих результатів і висновків забезпечено загальнонауковими та спеціальними методами дослідження, зокрема: спостереження, формальної логіки (аналіз, синтез, дедукція, індукція, аналогія, абстрагування), а також системно-структурним.

Ключові слова: круглий стіл, ділова зустріч, бесіда, дискусія, інтерактивність, дослідження, судово-експертні установи.

А. А. Томашевская, О. В. Томашевский
Актуальные аспекты проведения круглых столов
на современном этапе развития судебно-экспертных учреждений

В современных международных условиях сотрудничество с представителями других стран для органов досудебного расследования и судебно-экспертных учреждений становится объективной необходимостью. а это требует не только совершенствования уже существующих форм и методов ведения переговоров, но и поиска новых форм сотрудничества между странами на основе взаимных интересов.

Целью данной статьи является выявление проблемных зон в проведении научных мероприятий в формате круглого стола как средства нахождения путей решения обнаруженных проблем в сфере экспертной деятельности на региональном и международном уровнях. Разработаны рекомендации для эффективности проведения круглых столов.

В процессе исследования определены основные проблемы, приводящие к неудачным круглым столам из-за несогласованности, отсутствия интерактивности, недостаточной аргументационной базы, неуправляемого многоголосого обсуждения, неумения обосновать и развить свою точку зрения.

На основании анализа проведённых круглых столов разработан ряд рекомендаций и рассмотрено несколько способов удачного проведения в форме проектной работы с чётким разделением этапов подготовки и распределением конкретных задач на каждом этапе.

Достоверность полученных результатов и выводов обеспечена благодаря общенаучным и специальным методам исследования, являющимся

средствами научного поиска, в частности — наблюдению и формальной логике (анализ, синтез, дедукция, индукция, аналогия, абстрагирование); системно-структурный метод использовали для определения особенностей проведения деловых встреч.

Внедрение в экспертную практику указанных рекомендаций при проведении деловых встреч будет способствовать поиску рациональных путей решения проблем, обмену опытом на региональном и международном уровнях с экспертами ведущих стран мира.

Ключевые слова: круглый стол, деловая встреча, беседа, дискуссия, интерактивность, исследования, судебно-экспертные учреждения.

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ISSUES OF REGULATORY, LEGAL, SCIENTIFIC AND METHODOLOGICAL SUPPORT OF DIFFERENT CLASSES AND KINDS, SPECIES OF FORENSIC SCIENCE

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Topical issues of handwriting analysis of signatures performed with a significant gap in time

At the present stage, the objects of forensic handwriting analysis are signatures performed with a significant gap in time. In this case, such objects are both signatures in studied documents, made at different intervals and studied signatures performed in relation to the comparative material with a time gap.

Establishing stability of signature signs depending on performing time is possible taking into account characteristic signs of the stages of the signature handwriting formation. Since the factors causing changes in signatures are a lengthy process of forming the signature skill and the amount of signature practice (that is how often a person has to sign). While research on signatures that are at the formation stage, different signs, established together with significant coinciding signs can indicate a further improvement of movements. In persons

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of middle age (30-60 years old) who have a formed signature handwriting, significant changes do not occur over time until they stop practicing writing. While research on elderly people signatures along with the established coinciding signs, differing ones appear: signs of ataxia, decreased coordination of movements, low coherence of written signs, etc. These signs indicate degradation of movements due to physiological changes in the body in old age and a decrease in writing practice including practice of performing signature.

Considering the above, research on signatures performed with a significant time gap is a rather complicated process that often causes difficulties when forensic expert evaluates revealed signs. Within the framework of this research paper, the authors focused on some topical issues existing in modern forensic expert practice of handwriting analyses of signatures performed with a significant time gap.

The state of development of modern practical handwriting studies requires improvement of methodological approaches to this type of research. Currently, forensic experts are conducting R&D on the topic: "Improving research methods of signatures performed with a significant gap in time" which relevance is due to the need to improve forensic expert algorithm while handwriting research on signatures performed with a significant gap in time, as well as requirements of modern scientific standards.

Keywords: *identification handwriting signs; signature; signature strength; stages of signature handwriting formation ; handwriting analysis of signatures performed with significant time gap*

Formulation of Research Problem. At the present stage, the forensic handwriting analysis objects are often signatures performed with a significant gap in time. Such handwriting objects are found in various notarial and banking documents, wills, contracts, power of attorney, statements and other documents. Currently, the Register of Methods of Forensic Examinations of the Ministry of Justice of Ukraine has Methods for research on signatures performed with a significant gap in time, however, it lacks an algorithm for forensic expert sequence of actions while handwriting analysis of these objects. Taking into account urgent needs of methodological forensic science support, this Methodology needs to be updated in order to be further used in forensic expert practice.

Analysis of current practice of conducting forensic examinations indicates that judicial and investigative bodies quite often have a need to address issues related to research on signatures performed with a significant gap in time. We believe that improving research methods of such handwriting objects is one of the urgent current needs.

Lack of modern methodological approaches to identification research on signatures performed with a significant gap in time causes some difficulties for handwriting experts. This is due to peculiarities of comparative material preparation and subsequent separate and comparative research including

explanation of nature of differences and coincidences of common and individual signs in signatures performed with a significant time gap, determining detection frequency of established signs, differences explanation. The latter makes it possible to identify the most stable signs in signatures performed with a significant gap in time; characteristic signs of particular person signature.

Improving methodological approaches to the research on signatures performed with a significant gap in time, requires consideration of research on these rather complex graphic objects taking into account generalization of forensic expert practice at the present stage of handwriting analysis that will use methodological principles for identifying identification issues of such graphic objects and create an up-to-date algorithm of consecutive forensic expert actions for handwriting analysis of signatures performed with a significant gap in time and for their further application in forensic expert practice and while training of new professionals in forensic handwriting analysis.

Analysis of Essential Researches and Publications. Many scientists have paid attention to the topical issue of research on signatures performed with a significant gap in time. Here are some of the names of those who have made significant contributions to research on handwriting objects.

V. V. Tomilin, Honored Worker of Science and Technology of Ukraine, Doctor of Medicine, Professor studying anatomical and physiological foundations of writing¹ considers the issues of formation mechanisms of writing skills taking into account psychophysiological analysis of basic properties of formed writing skills, specifics of changes in writing and motor skills of different age groups (in particular, changes due to certain diseases, general intoxications and mechanical injuries)².

Among research papers in handwriting field should be noted the dissertation of I. M. Mozhar, PhD in Law, where the researcher carefully considers the peculiarities of research methods of manuscripts and signatures performed with a significant gap in time³. In other research papers, she develops methodological approaches to research on this type of objects⁴: In particular, performed with

¹ Томилин В. В. Основы судебно-медицинской экспертизы письма. Москва, 1974. Р. 67—85.

² Idem. Физиология, патология и судебно-медицинская экспертиза письма. Москва, 1963. Р. 20—52, 52—84.

³ Можар И. М. Криминалистическая экспертиза рукописей и подписей, выполненных с разрывом во времени, в уголовном и гражданском судопроизводстве: дис. ... канд. юрид. наук. Харьков, 1966.

⁴ Idem. Исследование рукописных текстов, выполненных с разрывом во времени / Судебно-почерковедческая экспертиза : пособ. для экспертов-почерковед. и судеб.-следств. работников ; отв. ред.: А. И. Манцетова, В. Ф. Орлова, Е. Е. Доброславская. Москва, 1971. Р. 97—116, 313—323.

a significant time gap by elderly ¹, theoretical issues of stability of handwriting signs depending on performing time ², etc.

V. V. Lipovskyi considered the issue of individuality of signatures ³ and important issues of forensic examination of signatures performed with a gap in time ⁴, in particular, on behalf of elderly and old age people ⁵.

In research papers, handwriting experts, such as V. G. Abrosimova, L. G. Grinenko, O. I. Suetnova, developing methodological principles for research on such objects⁶, clarified nature of stability and regularity of changes in handwriting features, considered the use of comparative material, performed with a gap in time⁷.

The **Article Purpose**: analyze theoretical aspects and literature sources on research on signatures performed with a significant gap in time; consider stability concept of signature signs depending on performing time (taking into account the formation stages of signature handwriting); reveal topical issues arising against forensic experts while research on signatures performed with a significant gap in time (by summarizing expert practice of forensic science institutions of the Ministry of Justice of Ukraine); determine modern methodological approaches to possibilities of handwriting research of signatures performed with a significant gap in time.

Main Content Presentation. Handwriting analyses of signatures performed with a significant gap in time are carried out quite often. In this case, such objects are both signatures performed at different intervals of time and signatures performed relative to comparative material with a gap in time.

¹ Idem. Криміналістическе іследованіе підписей, виконаних с большим разрывом во времени, лицами преклонного возраста. *Вопросы криминалистики и судебной экспертизы* : мат-лы науч. конф. Душанбе, 1962. Р. 172—174.

² Idem. Устойчивость признаков почерка в зависимости от времени. Рефераты докладов объединенной науч. конф. Киев, 1956. Р. 14—16.

³ Липовский В. В. О некоторых вопросах проблемы индивидуальности подписи. Рефераты докладов второй науч. конф. Ташкент. НИИСЭ, посвящ. вопросам судебн. экспертизы. Ташкент, 1961. Р. 96—99.

⁴ Idem. Некоторые вопросы устойчивости подписей во времени. *Вопросы криминалистики и судебной экспертизы* : мат-лы науч. конф. Душанбе, 1962. Р. 196—199.

⁵ Idem. Устойчивость признаков подписей, выполненных лицами пожилого и старческого возраста в необычных условиях. *Криминалистика и судебная экспертиза*. 1984. Вып. 29. Р. 76—81.

⁶ Гриненко Л. Г., Абросимова В. Г. Методические принципы исследования подписей, выполненных с разрывом во времени. Актуальные вопросы судебной экспертизы и криминалистика на современном этапе судебно-правовой реформы : сб. науч.-практ. мат-лов (к 75-лет. основан. ХНИИСЭ). Харьков, 1998. Р. 54—55.

⁷ Абросимова В. Г. До питання про ідентифікацію виконавця підпису, виконаного з великим розривом у часі відносно часу виконання порівняльних зразків. *Криміналістика та судова експертиза*. 2000. № 49. Р. 65—69.

The immediate object is handwriting information of an identification nature contained in the above mentioned signatures.

Establishing stability of the signature signs depending on performing time is possible taking into account the formation stage of signature handwriting. Let us consider the characteristics of each stage.

Despite the same psychophysiological process of handwriting and signature formation, the signature stereotype is more mobile over time than handwriting stereotype. Factors that cause changes in signatures are the long process of formation of signature skills and the amount of practice of signing (i.e. how often a person has to sign).

While research on signatures that are at the formation stage, discrepancies established together with significant similarities can indicate further improvement of movements. This is most often expressed in changes: transcription, tempo, structure of movements, arrangement and coherence of written characters, as well as the type of connection, length and placement of movements while performing letters and their elements relative to the line, shape of movements in initial and final strokes letters. These discrepancies should be carefully analyzed by expert while comparative research. Then they are considered insignificant and explained by improvement of movements while forming signature.

In such cases, in the signatures executed later it was established similarities together with those that appeared form a new set of individual signs of signature of this person while subsequent performing period.

It should be noted while research on signatures formed (in case of availability of transcription discrepancies, some general and individual signs and lack of coincidences), forensic expert cannot reach a negative conclusion about identity. This is due to the fact that person whose signature samples are being studied by professional did not have a signature at performing time. As a result of further subscription practice, signature signs can change significantly. Therefore, in such cases, it is impossible to resolve the issue of executors of signatures being formed without sample signatures performed at the same time.

Middle aged people (30-60 years old) who have formed a signature handwriting do not experience significant changes in their signatures over time until they stop writing practice, due to retirement, for example.

Only if there are some insignificant discrepancies in formed signatures performed with a significant time gap, forensic expert explains this by circumstances known to him from the case file (for example, sharp increase or decrease in practice of signature performing).

If while research on analyzed signatures insignificant discrepancies are found, it indicates a certain improvement of movements, for example, insignificant discrepancy of transcription towards reduction of number of letterless signature elements, some general (coherence and arrangement) and separate signs (connection type) of movements while performing letters and

their elements, the location of the start end points or connection of movements relative to the string line).

It should be noted that people with extensive signature practice can have several signature variants: from full, so-called official, to abbreviated, typical for use in single-character documents of a significant number. In addition, during this period of life there is usually a change of surnames (for example, in persons who marry), that leads to a change in signature transcription.

These discrepancies can be considered typical signs due to further simplification of movements in the signature due to frequent performance and therefore insignificant. Coincidence of common features (size, slope), as well as stable, significant and rare, individual features form an individual set, characteristic signature of a particular person. They can be enough for a categorical positive conclusion about identity.

Research on signatures of elderly and old age people together with the established similarities reveal differences: signs of ataxia, decreased coordination of movements, low coherence of written signs and large arrangement, type of connection, tortuosity and angularity while performing rectilinear and arc elements of letters, form of movements in initial and final strokes that are available in the later execution of signatures. These signs indicate degradation of movements due to physiological changes in the body in old age and a decrease in writing practice including practice of signing. These discrepancies should be explained by circumstances of the case known to forensic expert and recognized as insignificant¹.

However, in the signatures of the elderly with a significant gap in time remain convergent transcription and such common features as the degree of elaboration, constructive simplicity of movement, size, inclination, as well as individual (shape when performing basic elements of letters, direction of movement, length and location movements while performing letters and elements relative to each other). If these coincidences are significant and their stability is established in the signatures of elderly, in their totality they individualize the signature of a certain person and are the basis for a positive conclusion about the identity.

In some cases, due to signature characteristics in different periods of its implementation (when these signs are denominated and in availability of samples belonging to different periods of human life), we can speak about the relative age of person while performing investigated signature.

Given the above, research on signatures performed with a significant gap in time is a rather complex procedure causing difficulties in assessing identified signs by handwriting expert. In addition, in some cases it is very difficult to trace stability of the performer signature handwriting over a long period of time.

¹ Чепульченко Т. А. Дифференциация возрастных изменений почерка (пожилой и старческий возраст, молодой и средний возраст) и подражания «старческому» почерку. *Проблемы комплексного криминалистического исследования подписей* : мат-лы Всесоюз. науч.-практ. семинара. Москва, 1986. Р. 68—73.

Within the framework of this research paper, the authors considered topical issues that are available in the modern forensic expert practice of handwriting research on signatures made with a significant gap in time.

Here are some examples of forensic handwriting analyses on such issues. For conducting a forensic handwriting reanalysis of a civil case, originals of investigated documents were received: a lifetime maintenance agreement for 2007 and a bank account opening agreement for 2004 ¹. Forensic expert who conducted the initial handwriting analysis came to the probable conclusion that M. had signed on his behalf in the 2007 lifetime maintenance agreement. Research incompleteness is due to the fact that the comparative material was provided in limited quantity and performed with a significant time gap ².

The issue of the signature executor identification on behalf of M. in submitted documents was raised for the decision of forensic handwriting reanalysis.

The signature under research on behalf of M. in lifetime maintenance agreement for 2007 had a full letter transcription: “М-е-р-к-у-л-о-в”. The signature was made by movements of a simple structure, a high elaboration degree at a quick pace. Letter size and acceleration are average, right slope, average connectivity. The study signature in the bank account opening agreement for 2004 had the following transcription and coherence: conditionally read the letter “И” + letterless strokes + flourish. This signature was performed through simple structure movements of a high degree of elaboration at a rapid pace (see Figs. 1-2).

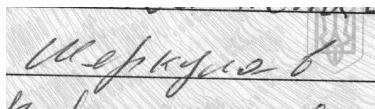


Fig. 1

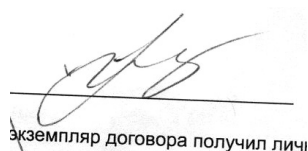


Fig. 2

Fig. 1-2. Researched signatures on behalf of M.

Samples of M.'s signature and handwriting, performed while 1972-1974 in student notes, diaries and Military ID Card when he was 15-18 years old, were provided for reanalysis.

Signature samples of specified period were performed in full letter transcription, performing pace is closer to the average, coherence is almost solid, size of the letters is from medium to large.

The second part of the samples of M.'s signature was performed while 2016-2017, at the age of about 60, some of them were in applications of the pension case. The signatures were also characterized by a high degree of elaboration but were executed at a pace from fast to slow. In addition, in the signature handwriting there were violations of coordination of movements of the 1st group

¹ Архів ННЦ «ІСЕ ім. Засл. проф. М. С. Бокаріуса» (ХНДІСЕ) за 2019 р.

² Архів ННЦ «ІСЕ ім. Засл. проф. М. С. Бокаріуса» (ХНДІСЕ) за 2018 р.

(tortuosity and angularity while performing rectilinear and arc elements of letters, availability of initial and final reflex strokes), as well as violations of coordination of movements of the 2nd group. Line and unstable placement of movements vertically and horizontally while performing letters and their elements). There was an unstable size of letters: from lowercase to uppercase, slope varied from vertical to right. Coherence of movements was almost non-existent, acceleration and arrangement while performing the written signs increased.

M. performed a small number of samples at the age of 40—44 (while about 1994 to 2000). The signatures were made in formed written movements, at a fast pace, they had both a complete letter transcription and a simplified structure: “Мрк” + letterless strokes + flourish, “М” + letterless strokes + flourish (see Fig. 3—9).

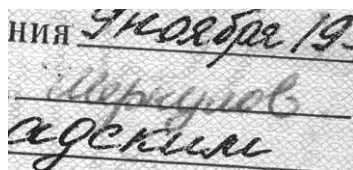
A handwritten signature on a document. The text above the signature is "ния 9 ноября 19...". The signature itself is written in cursive and appears to be "Меркулов". Below the signature, the word "адский" is partially visible.

Fig.3. Sample signature of M. at the age of 17 years

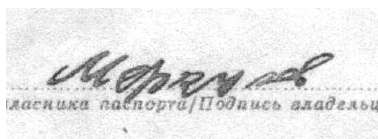
A handwritten signature "Меркулов" written over a horizontal line. Below the line, the text "паспорта/Подпись владельца" is printed.

Fig. 4

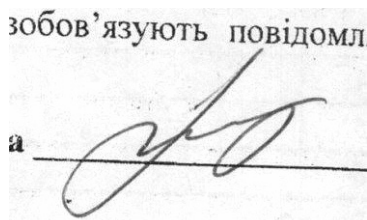
A handwritten signature written over a horizontal line. Above the line, the text "зобов'язують повідомл" is printed. To the left of the signature, the letter "а" is printed.

Fig. 5

Fig. 4-5. Samples of M.'s signature at the age of 40-44

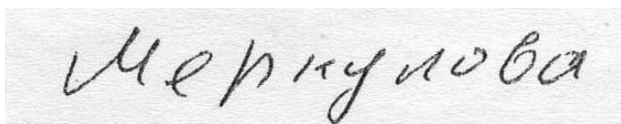
A handwritten signature "Меркулова" written in a cursive style.

Fig. 6. Sample signature of M. at the age of 60 years

Through carefully comparing studied signatures with the existing groups of samples of M.'s signature, forensic experts established coincidence of the movement degree, some general and informative signs: the shape and direction of movements, connection, length and placement of movements vertically and horizontally, placement of start and end points, the type of connection while performing letters and their elements.

Given the above, forensic experts came to categorical conclusions as for performing studied signatures by M. himself.

Analysis of the identified discrepancies and their localization indicated they were characteristic of M.'s handwriting at different times of execution, as they appeared in signature handwriting formed while writing practice: transition to fast writing, change of transcription from full letter to simplified, as well as diagnostic signs that were found in samples of a later period.

Unfortunately, forensic experts are not always able to resolve the issue of identifying executors of signatures performed with a gap in time. An example is the report on impossibility of providing the conclusion of forensic handwriting analysis which solution was the issue of performing signature on behalf of Є. in the receipt for 2016, Є. himself or another person ¹.

For a comparative research, three samples of Є.'s signature were provided in applications for 2004 and 2006 on award of a disability pension and in the application for 2007 on the award/recalculation of a pension. In response to the experts' request for additional materials, the judge noted: *"Due to Є.'s death in 2017, it is not possible to provide other signature samples"*.

The studied signature was made by movements of a simplified structure, it had a limited amount of graphic material: "E" + flourish. In addition, there were violations of movement coordination of the 1st group: blunt start of movement during the execution of the first element of the letter "E", small tortuosity and angularity, unmotivated stops of the typewriter.

Through comparing the studied signature with samples of Є.'s signature, coincidences of signature transcription, size, acceleration, inclination and individual features were established: structure of movements according to the degree of complexity while performing the "E" letter, direction of movements during execution and connection of its elements, placement vertical and horizontal movements. In addition, in the provided samples there were no coordination violations of movements and some discrepancies of separate signs were established.

Therefore, the provided comparative material, made much earlier than the studied signature could not be a basis for tracking changes in general and individual signs, in particular identifying nature and location of diagnostic signs that can appear over time in the signature Є.' handwriting, moreover, according to the case file, the document under research was drawn up shortly before Є.' death who had numerous illnesses.

Based on generalization of forensic expert practice, it is determined that resolving forensic expert tasks traditionally divided into three stages of research: preparatory, analytical, synthesizing when research objects are signatures performed with a significant gap in time ².

¹ Архів ННЦ «ІСЕ ім. Засл. проф. М. С. Бокариуса» (ХНДІСЕ) за 2019 р.

² Гриненко Л. Г., Суєтнова О. І. Щодо питання про дослідження підписів, виконаних з розривом у часі. *Експертное обеспечение правосудия на современном этапе судебно-правовой реформы* : сб. науч.-практ. мат-лов (к 10-лет. основан. Крым. отделен. НИИСЭ им. Засл. проф. Н. С. Бокариуса). Симферополь. 2000. Р. 32—38.

Given research peculiarities of signatures performed with a significant gap in time, specifics and nature of objects, attention should be paid to the preparatory stage: preparation of materials for forensic handwriting analysis.

Firstly, if expert found significant discrepancies between general and individual signs in investigated signature and in the samples, it is necessary to apply for comparative material made as soon as possible before performing investigated signature. In case of dissatisfaction with the petition taking into account discrepancies observed in the investigated signature, it is very difficult and sometimes impossible to conduct an identification research and reach a categorical conclusion.

Sufficient comparative material is also required including samples of signature of the person being inspected performed at different times. This allows forensic expert to trace individuality of the signature over time at different stages of its formation. In addition, information about the intended signatory (year of birth, profession, large or small writing practice, health status, etc.) plays an important role.

If forensic expert finds significant discrepancies between signs in the samples and in investigated signature, then a categorical conclusion can often be reached only in the case of availability of samples as close as possible to performing period of the signature being verified.

At the analytical research stage, general and individual features are thoroughly studied. The identified convergent signs are carefully analyzed, paying attention to identification significance and frequency of detection of each of them. At this stage, it is necessary to pay attention to signature practice of the person and nature of changes that could be due to the signature formation over time, given the age, profession, subscription practice, health status of probable signature executor. If discrepancies are identified, forensic expert should also carefully analyze them.

While research the most difficult is the *synthesizing stage*. Forensic expert should determine identification significance and materiality of identified signs, explain nature of their origin, evaluate them accordingly.

Conclusions. Thus, given the difficulties arising while research on signatures performed with a significant gap in time, the state of development of modern practical handwriting requires improvement of methodological approaches to this type of research (by updating them based on modern requirements), generalization of a significant volume as an experimental array and forensic expert practice.

Currently, forensic experts of NSC “Hon. Prof. M. S. Bokarius FSI” are performing R&D on the topic: *Improving research methods of signatures performed with a significant gap in time* which relevance is due to the need to improve forensic expert algorithm while handwriting research on signatures performed with a significant gap in time, as well as requirements of modern scientific standards.

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**О. С. Дробишева, Д. І. Гайдамакіна,
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**Актуальні питання почеркознавчих досліджень підписів,
виконаних зі значним розривом у часі**

На сучасному етапі об'єктами судово-почеркознавчої експертизи часто стають підписи, виконані зі значним розривом у часі. При цьому такими об'єктами є як підписи, виконані у різні проміжки часу, так і підписи, виконані відносно порівняльного матеріалу, із розривом у часі.

Установити стійкість ознак підпису залежно від часу виконання можна, зважаючи на ознаки, характерні для стадій формування підписного почерку. Оскільки факторами що викликають зміни в підписах, є тривалий процес формування підписної навички й обсяг практики виконання підпису (тобто як часто особі доводиться розписуватися).

Під час дослідження підписів, що перебувають на стадії формування, розбіжності, установлені разом із суттєвими збіжними ознаками, можуть свідчити про подальше вдосконалення рухів. В осіб середнього та зрілого віку (30—60 років), які мають сформований підписний почерк, суттєвих змін у підписі з часом не настає, доки вони не припиняють займатися письмовою практикою, наприклад, у зв'язку з виходом на пенсію. Під час досліджень підписів осіб похилого та старечого віку разом зі встановленими збіжними ознаками виявляються розбіжні: ознаки атаксії, зниження координації рухів, низька зв'язність письмових знаків і велика розстановка, вид з'єднання, звивистість і кутастість під час виконання прямолінійних і дугових елементів літер, форма рухів у початкових і заключних штрихах, наявних у пізніших за часом виконання підписах. Ці ознаки свідчать про деградацію рухів унаслідок фізіологічних змін організму в старості й зменшення письмової практики, зокрема практики виконання підпису.

З огляду на викладене, дослідження підписів, виконаних зі значним розривом у часі,— це доволі складний процес, що нерідко спричиняє труднощі в оцінюванні експертом-почеркознавцем виявлених ознак. У межах цієї наукової роботи автори розглянули актуальні питання, наявні в сучасній експертній практиці почеркознавчого дослідження підписів, виконаних зі значним розривом у часі.

Стан розвитку сучасного практичного почеркознавства потребує вдосконалення методичних підходів до такого виду досліджень. Станом на сьогодні експерти проводять науково-дослідну роботу за темою «Вдосконалення методики дослідження підписів, виконаних зі значним розривом у часі», актуальність якої зумовлена необхідністю вдосконалити алгоритм дій судового експерта під час проведення почеркознавчого дослідження підписів, виконаних зі значним розривом у часі, а також вимогами сучасних наукових стандартів.

Ключові слова: ідентифікаційні почеркові ознаки; підпис; стійкість підпису; стадії формування підписного почерку; почеркознавче дослідження підписів, виконаних зі значним розривом у часі.

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Актуальные вопросы почерковедческих исследований подписей, выполненных со значительным разрывом во времени

На современном этапе объектами судебно-почерковедческой экспертизы часто становятся подписи, выполненные со значительным разрывом во времени. При этом такими объектами являются как подписи в исследуемых документах, выполненные в разные промежутки времени, так и исследуемые подписи, выполненные по отношению к сравнительному материалу с разрывом во времени.

Установление устойчивости признаков подписи в зависимости от времени выполнения возможно с учётом признаков, характерных для стадий формирования подписного почерка. Поскольку факторами, вызывающими изменения в подписях, является длительный процесс формирования подписного навыка и объём практики выполнения подписи (то есть как часто лицу приходится расписываться). Во время исследования подписей, находящихся на стадии формирования, различающиеся признаки, установленные вместе с существенными совпадающими признаками, могут свидетельствовать о дальнейшем совершенствовании движений. У лиц среднего и зрелого возраста (30—60 лет), имеющих сформированный подписной почерк, существенных изменений со временем не наступает, пока они не перестают заниматься письменной практикой. Во время исследований подписей лиц пожилого и старческого возраста вместе с установленными совпадающими признаками появляются различающиеся: признаки атаксии, снижение координации движений, низкая связность письменных знаков и др. Эти признаки свидетельствуют о деградации движений вследствие физиологических изменений организма в старости и уменьшения письменной практики, в том числе практики выполнения подписи.

Учитывая изложенное, исследования подписей, выполненных со значительным разрывом во времени,— довольно сложный процесс, который нередко вызывает трудности при оценивании экспертом выявленных признаков. В рамках данной научной работы авторы акцентировали внимание на некоторых актуальных вопросах, существующих в современной экспертной практике почерковедческого исследования подписей, выполненных со значительным разрывом во времени.

Состояние развития современного практического почерковедения свидетельствует о необходимости совершенствования методических подходов к такому виду исследований. В настоящее время эксперты проводят научно-исследовательскую работу по теме «Усовершенствование методики исследования подписей, выполненных со значительным разрывом во

времени», актуальность которой обусловлена необходимостью усовершенствования алгоритма действий судебного эксперта при проведении почерковедческого исследования подписей, выполненных со значительным разрывом во времени, а также требованиями современных научных стандартов.

Ключевые слова: идентификационные почерковые признаки; подпись; стойкость подписи; стадии формирования подписного почерка; почерковедческое исследование подписей, выполненных со значительным разрывом во времени.

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Increasing reliability of forensic analysis while research on destroyed relief marking with magneto-optical devices

While research on destroyed relief marking of metal objects using the magneto-optical method, visualization of (invisible) fields of internal stress in the VIN plate area is performed and then a forensic analysis of obtained instrumental data is carried out (indirect organoleptic observation of the visualization results); thus, forensic analysis reliability of results directly depends on sensitivity of instruments and informativeness of instrumental data.

The main quantitative characteristic in this case is probability of correct signal recognition (contours of marking signs) against the background of noise (structural noise of investigated surface and the noise of the visualization method itself) determined by the signal-to-noise ratio.

This article presents results of a comparative experimental assessment of signal-to-noise ratio and probability of correct signal recognition while restoring the destroyed relief markings for two complexes of magneto-optical imaging – models of 2006 and 2018.

This article purpose is a quantitative and qualitative comparative assessment of results of visualization of internal stresses in areas of completely removed relief marking of metal objects. The results of successful practical research obtained by forensic experts from different countries make it possible to assess effectiveness and prospects of using the magneto-optical imaging method.

In a new modification of the magneto-optical complex:

- *signal level is 4.35 dB higher (contrast of reconstructed marking signs);*
- *2.71 dB lower noise level (surface relief/texture and magnetic copying noise);*
- *probability of correct character recognition is $P > 0.995$ (increased by 14.9%).*

Technical improvements in implementation of magneto-optical visualization method made it possible to expand the range of materials for research objects (magnetic and electrically conductive materials were investigated).

The high efficiency of method for restoring marking is illustrated by results of forensic examinations for materials with a low level of residual stresses (aluminum alloy, low-carbon steel) which chemical etching method did not give results for.

The use of new modification allows examining the rust layer, up to cases of corrosion to the entire depth of marks.

Considering non-destructive nature of magneto-optical researches, possibility of their repeated repetition without losing object properties, this method (in accordance with the order of application of types of studies) deserves more attention for application.

Keywords: relief marking, magneto-optical visualization, data recovery of remote marking, non-destructive methods.

Formulation of Research Problem. While research on destroyed relief marking, firstly, visualization of (invisible) fields of internal stress in the VIN plate area is performed and then a forensic analysis of obtained instrumental data is carried out (indirect organoleptic observation of visualization results); thus, forensic analysis reliability of results directly depends on sensitivity of instruments and informativeness of instrumental data.

It is known from the signal theory that the probability of correct signal recognition (marking contours) against the background of noise (structural noise of investigated surface and the noise of the visualization method itself) is determined by the signal-to-noise ratio.

The task of this research paper is a comparative experimental assessment of signal-to-noise ratio and probability of correct signal recognition while restoring the destroyed relief markings for two complexes of magneto-optical imaging: models of 2006 and 2018.

Analysis of Essential Researches and Publications. Forensic expert practice of using magneto-optical (hereinafter referred to as MO) devices for the study of relief marking has been initiated recently: the first complexes were introduced in 2000¹. Main provisions of application of such techniques in forensic examinations are outlined in the corresponding methodology², further integration of theoretical foundations of this method is carried out in the research paper³.

¹ Спосіб магнітооптичного контролю виробу : пат. 42880 Україна. № 99074257 ; заявл. 22.07.1999 р.; опубл. 15.11.2001 р., Бюл. № 10.

² Агалиди Ю. С., Левый С. В., Прохоров-Лукин Г. В. Реализация комплексной методики криминалистических исследований идентификационных номеров авто-транспортных средств на программно-аппаратном уровне. *Криминалистика и судебная экспертиза*. 2003. Вып. 51. Р. 24—29.

³ Агаліді Ю. С. Магнітооптична візуалізація магнітограм рельєфних зображень і структурних неоднорідностей поверхневого шару феромагнітних виробів : дис. ... канд. техн. наук. Київ, 2006. 193 р.

Over time, authors of the methodology thoroughly studied technical parameters and tested devices, as well as performed a metrological assessment of their main characteristics¹. The next stage in the application of the new instrumental method was the study of its potential within the framework of expert researches. Results of the comparison of the experimental assessment of sensitivity for MO, magnetic-powder and electrochemical methods of research on removed relief marking are considered in a number of research papers².

The result of these research papers³ was a conclusion on certain fundamental advantages of the MO method, among which the main ones are high sensitivity and non-destructive nature of researches helping to effectively investigate even such a complex substance as a layer of rust from the surface of the VIN plate area.

The result of successful approbation of MO devices and a corresponding methodology was the introduction of this method in the forensic expert practice of research on vehicle⁴ marking.

The next major step in the development of MO equipment for expert researches is the development of eddy current magnetic imaging registered as a national patent of Ukraine and international patents. This technology has significantly increased sensitivity and informativeness of magneto-optical visualization as well as expanded the scope of application of the MO method, having added to the list of studied objects not only magnetic but also electrically conductive materials.

¹ Агалиди Ю. С., Левый С. В., Мачнев А. М. Экспериментальная оценка чувствительности и достоверности магнитооптической визуализации рельефных трасс. *Вісник НТУУ «КПІ». Серія приладобудування*. 2006. Вип. 32. Р. 39—46 ; Ibidem. Методика исследований сигналов и шумов при магнитооптической дефектоскопии. *Учёные записки Таврического национального университета им. В. И. Вернадского. Серия: физика*. 2006. Вып. 19 (58). № 1. Р. 23—29.

² Ibid. Сравнительный анализ магнитопорошкового и магнитооптического методов визуализации пространственного распределения магнитного поля при исследовании остаточных напряжений. *Вісник НТУУ «КПІ». Серія приладобудування*. 2006. Вип. 31. Р. 18—24 ; Про затвердження Інструкції про порядок проведення криміналістичних досліджень транспортних засобів і реєстраційних документів, що їх супроводжують, працівниками Експертної служби МВС України : наказ МВС України від 31.05.2013 р. № 537. URL: <https://zakon.rada.gov.ua/laws/show/z1309-13> (date accessed: 22.02.2021) ; Агалиди Ю. С., Левый С. В., Мачнев А. М., Прохоров-Лукин Г. В. Сравнительная оценка чувствительности магнитооптического, магнитопорошкового и электрохимического методов при исследовании удалённой рельефной маркировки. Ч. 1—3. *Криминалістика і судовба експертиза*. 2008. Вип. 54. Р. 80—119.

³ Агалиди Ю. С., Левый С. В., Мачнев А. М. Сравнительный анализ ... ; Агалиди Ю. С., Левый С. В., Мачнев А. М., Прохоров-Лукин Г. В. Сравнительная оценка чувствительности ...

⁴ Про затвердження Інструкції про порядок проведення криміналістичних досліджень транспортних засобів ... URL: <https://zakon.rada.gov.ua/laws/show/z1309-13> (date accessed: 22.02.2021).

The development of the theory of the magneto-optical visualization method has contributed to the advancement of technical tools implemented in forensic laboratories in more than 40 countries.

The **Article Purpose**. Research papers about technical visualization tools used for expert researches, published predominantly in foreign publications and are little known among Ukrainian experts.

This paper outlines results of the experimental assessment of the signal-to-noise ratio and probability of correct signal recognition while restoring the destroyed relief markings for two complexes of magneto-optical imaging being checked.

New possibilities of MO technology for restoring the destroyed relief marking of metal magnetic and electrically conductive objects are considered.

Results of expert research on restoration of destroyed relief markings on real objects for which obtaining data on primary marking by other methods was inefficient or impossible are presented.

Main Content Presentation. Equipment. Both comparable complexes are guided by similar physical principles: it can be stressed that they demonstrate the evolution of technical improvement of this type of devices.

The principle of operation of such MO devices is outlined in detail in publications¹, it consists of subsequent performance of a number of operations. Firstly, the magnetic tape (intermediate storage medium) is demagnetized. Then the magnetic tape is placed on the studied surface and with the help of a magnetic scanner, magnetic imaging (magnetography) is performed: record to a magnetic tape the response of the magnetic field from the surface layers of the VIN plate area of a metal research object. The response of the magnetic field reflects the relief and structural inhomogeneities (in particular, the internal tension). Then the obtained magnetogram (magnetic tape with a copy of magnetic properties) is placed in the MO imaging device where it is gradually read out and converted into a visible image using a converter based on the MO Faraday effect.

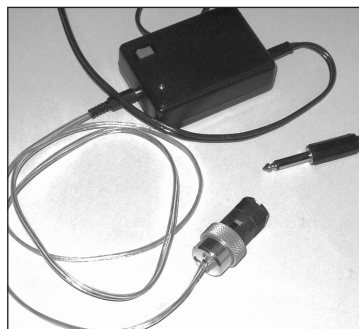
The compared complexes of the MO equipment differ in structural and design solutions, hardware components, technological sophistication of production, software and algorithm support, what, undoubtedly, impacts main functional characteristics.

Thus, the set of the MO equipment for research on relief marking of the 2006 model (Fig. 1) consisted of *Біт-5А* MO imaging device, high-frequency bias device and a metal magnetic tape for digital recording from ЕІІ-298 alloy (as a magnetic carrier).

¹ Пат. 42880 Україна ; Агаліді Ю. С. Магнітооптична візуалізація магнітограм ... ; Agalidi Yu., Kozhukhar P., Levyi S., Rogozhinsky Yu., Shumsky I. Eddy current fields/magnetic recording/magneto-optic imaging NDI method. *Nondestructive Testing and Evaluation*. 2012. Vol. 27. Is. 2. P. 109—119. DOI: <https://doi.org/10.1080/10589759.2011.610453> (date accessed: 22.02.2021).



a) *Biü-5A* MO imaging device



b) High-frequency bias device

Fig. 1. Set of MO equipment for research on relief marking (model of 2006)

Biü-5A MO imaging device (Fig. 1) helps to copy the visualized area with dimensions of 150×22 mm, the image has a physical size of image point: 37 m. The high-frequency bias device uses a harmonic signal with a frequency of 400 Hz and an amplitude of about 40 kA / m, which allows to increase the sensitivity of magnetography to weak signals of internal stress fields. The type of magnetic carrier used is a metal magnetic tape for EII-298 TY14-1-375-94 (bandwidth: 25.4 mm) digital recording. This type of magnetic carrier has a high amplitude of the recorded signal, however, also has a high level of structural noise. The set of MO equipment for research on relief marking of the 2018 model (Fig. 2) contains *Регула 7505М* MO visualization device, *Регула 7515М* high-frequency bias device, magnetic carrier: *BASF Sm900* plastic magnetic tape for analogue recording.



a) *Регула 7505М* MO visualization device



b) *Регула 7515М* high-frequency bias device

Fig. 2. Set of MO equipment for research on relief marking (model dated 2018)

Резула 7505М MO visualization device (Fig. 2) ensures copying of the visualized area with dimensions of 450×18 mm, and the physical size of the image point: 14 m, which is much higher than similar indicators of the previous model.

Резула 7515М high-frequency bias device uses an impulse signal of instantaneous frequency up to 1 MHz with adjustable amplitude, which allows not only to increase the sensitivity of magnetography to weak signals of internal stress fields but also to create eddy currents in the surface layer (skin effect), having added to the magnetic component of the analyzed data also the electric alone. Additionally, the use of high frequency biasing enables to study not only magnetic materials, but also electrically conductive ones (in particular, aluminum alloys) ¹.

The type of the used magnetic media carrier is *BASF Sm900* (magnetic tape for polymer-based analog recording, magnetic carrier width: 25.4 mm). This type of magnetic carrier has not only a high amplitude of a recorded signal but also a low level of structural noise, which significantly improves the signal-to-noise ratio for recorded magnetograms.

Experimental researches. The purpose of experimental research was to obtain visualization of latent images of a test object (hereinafter referred to as TO); research was conducted on two sets of MO equipment which were compared. TO is a plate of sheet metal (Steel 45 with the thickness of 1,5 mm) with the primary relief marking: 865 performed by the method of mechanical stress treatment (cold stamping). The size of a mark : font № 6 (characters height is 6 mm), the depth of characters relief is 0.3—0.4 mm. Conditions for changing the VIN number (removal of markings): grinding with the removal of a metal layer of 0.5 mm deep (it is impossible to visually determine contours of initial characters).

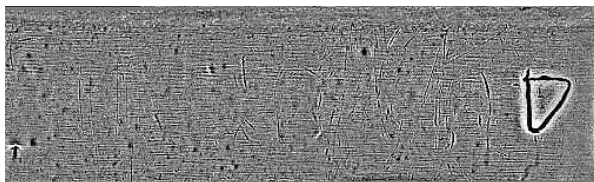
The appearance of the TO surface is shown in Fig. 3a, the relief mark in the form of a triangle on the right serves to mark the stressed side of the sample (side with removed signs).

¹ Ibid; Пат. 42880 Україна ; Patent Certificate for Invention (China) № ZL2009801595628, announcement date 30.07.2014 announcement number CN102449470. Inductor of eddy currents for magnetic tape scanning and scanner based thereon. Inventor: Levyi S., Agalidi Yu., Shumsky I. Forwarding letter for the Patent Certificate Y/R: I000364MZ-CN, O/R: PIUA1111850(YFK), filling date 01.07.2009. Patentee: Levyi S., Agalidi Yu., Shumsky I. ; Patent Certificate for Invention (EP) № EP2435822 A1, announcement date 04.04.2018 announcement number 09845325, 09845325.1, 2009845325, EP 2435822 A1, EP 2435822A1, EP-A1-2435822, EP09845325, EP20090845325, EP2435822 A1, EP2435822A1. Inductor of eddy currents for magnetic tape scanning and scanner based thereon. Inventor: Levyi S., Agalidi Yu., Shumsky I. Forwarding letter for the Patent Certificate EP20090845325 filling date 01.07.2009. Patentee: Levyi S., Agalidi Yu., Shumsky I.

Qualitative assessment of the obtained experimental data (Fig. 3) indicates that there are significant differences in the results of the MO visualization of internal stress conditioned by properties of the compared models of complexes.

Thus, the complex of the magneto-optical model of 2006 (Fig. 3b) makes it possible to visualize the internal stress in the area of removed 865 signs at the level enabling to determine their original value (the image was obtained from the results of an eddy-current scanner). At the same time, the MO image has noticeable magnetic copying noises: black lines from the plane-parallel movement of a scanner mark the boundaries of the width of the magnetic imaging area. Also structural noises of the EPI-298 metal magnetic tape could be observed: horizontal lines corresponding to the orientation of the domain structure and formed while magnetic tape manufacture (strip roll). Besides, a characteristic feature of high-frequency magnetic imaging is the high sensitivity to surface defects of types of scratches: location of scratches in the optical image (Fig. 3a) and MO image (Fig. 3b) is almost the same. However, in this type of research (restoration of signs of primary marking) such kinds of surface defects are uninformative: in fact, they are noises that prevent the reading of the signal of the internal stress field. In addition, the amplitude of the signal in gradation of brightness (Fig. 3c) looks a bit asymmetrical: the peak brightness of *white* reaches 209, that is +81 for the average level (*gray*: level 128), the peak of *black* is only 87 (or -41 from *gray*).

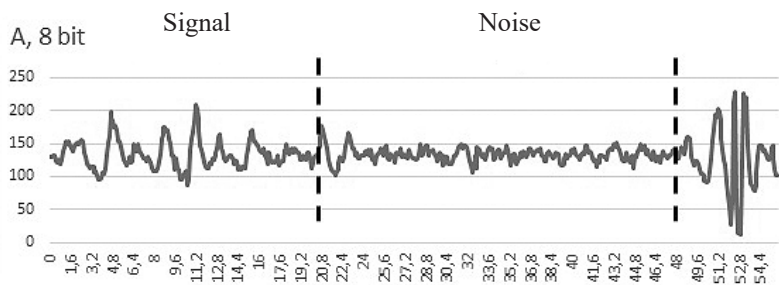
The set of MO model dated 2018 (Fig. 3d) also directly visualizes the internal stress in the area of the removed 865 signs, at the same time the image has a higher quality. The MO image of this complex has no noticeable noises: no traces of the scanner's trajectory are visible during magnetic imaging. The structural noises of the BASF Sm900 polymer magnetic tape are practically invisible, what corresponds to fine graininess size (approximately 0.5 m) and high homogenization of the magnetic substance. What is more, a characteristic feature of eddy current magnetic imaging is low sensitivity to surface defects such as scratches: location of big scratches in the optical image (Fig. 3a) and MO image (Fig. 3d) is identical, but small scratches in MO image are absent: they are filtered thanks to excitation of eddy currents in a deeper subsurface skin layer.



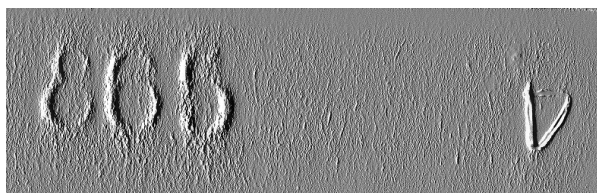
a)



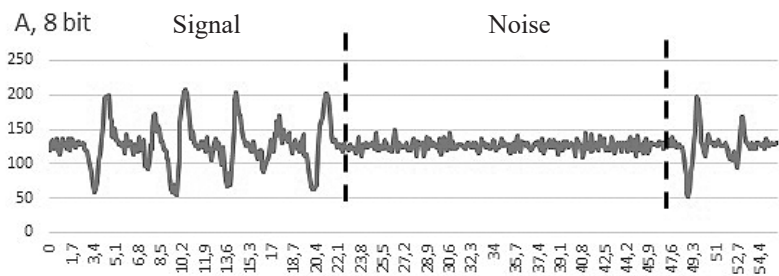
b)



c)



d)



e)

Fig. 3. TO with the internal stress of the metal in the area of destroyed relief marking: a) photo of the surface; b) MO imaging and signal amplitude for the device of 2006 model; c) brightness in the horizontal section for MO image b); d) MO visualization for the device model dated 2018; e) the brightness in the horizontal section for the MO image d)

The above-mentioned skin effect enabled to improve the detailing of MO image of the samples contours due to the superposition of dispersion fields from magnetic and electrical inhomogeneities in the areas of internal stress of the surface layer of a TO. The amplitude of the signal in the gradations of brightness (Fig. 3d) looks symmetrical: the brightness peak of *white* reaches 208, or +80 as to the average level (*gray*: level 128), while the peak of *black* is 55 (or -73).

Thus, the quantitative assessment of graphs and visual assessment of images of Fig. 3 show that the set of MO equipment of the model dated 2018 ensures a higher level of internal stress signal (in the area of destroyed marking) and a lower level of structural noise of a TO (in the area without marking).

Analysis of experimental data. To assess the signal-to-noise ratio and probability of correct signal recognition, a technique¹ based on the study of experimental data for signal and noise distributions was implemented: signal and noise areas are separated by vertical dotted lines (Figs. 3c, 3e).

According to the brightness of these sections, the values of mathematical expectation and standard deviation (for signal and noise respectively) were calculated, and the amplitude values of local brightness extrema calculated as moduli of deviation from the *gray* level were used to assess a signal and a noise.

The boundary value (decision threshold) of the correct recognition of the internal stress signal against the background of noise was taken to be the value at which the probability of erroneous signal detection is equal to the probability of signal omission. The value of the quantile corresponding to the tabular values² for the normal distribution with parameters (0, 1) was calculated as follows:

$$u_p = \frac{|M_c - M_u|}{\delta_c + \delta_u}$$

where: M , δ — mathematical expectation and standard deviation of a signal (c) and a noise (u).

The Table 1 shows the values of mathematical expectation and standard deviations for a signal and a noise as well as results of the probability of correct recognition of the contours of primary (Fig. 3) markings.

Table 1

№ s/n	Set of MO equipment	M_u	δ_u	M_c	δ_c	u_p	P
1	Model dated 2006	8,1	5,6	36,5	21,7	1,04	> 0,851
2	Model dated 2018	5,2	4,1	60,2	17,0	2,60	> 0,995

Analysis of data from Table 1 demonstrates the following: the MO equipment set of the 2018 model has significant advantages, as evidenced by a higher level

¹ Агалиди Ю. С., Левый С. В., Мачнев А. М. Методика исследований сигналов и шумов ...

² Ивченко Г. И., Медведев Ю. И. Математическая статистика. Москва, 1984. 248 p.

of visualization quality indicators: the signal level increased by $20 \lg (60.2 / 36.5) = 4.35$ dB, while the noise level decreased by $20 \lg (5.6 / 4.1) = 2.71$ dB.

The criterion of exceeding the boundary level by the instantaneous value of the signal amplitude provides detection / recognition of symbols of removed relief marking with a probability not worse than:

- 0,995 for the set of MO equipment of the 2018 model;
- 0,851 for the set of MO equipment of the 2006 model.

At the same time, while forensic examinations, a forensic expert assesses results of experimental researches by a number of factors (font style and size, nature of structural surface noise, etc.) that are poorly formalized, i.e. recognition of primary marking by restored markings also depends on individual visual properties, features of psychophysiological processing of visual information and experience of forensic expert practice, etc.

The results of practical research using MO devices: “Резула 7505м” and “Резула 7515м”. The unique characteristics of modern magneto-optical devices enabled to implement a number of new types of research previously unavailable or limitedly available for tools of forensic technique.

Thus, Fig. 4 demonstrates the result of a practical research on removed relief markings on the motorcycle frame (steel structure). Marking is removed completely, the layer of metal with relief markings is removed to a depth exceeding the depth of relief markings; it is impossible to identify contours of markings visually.

Peculiarities of this research are a shape and condition of the VIN plate area (Fig. 4b): VIN plate that is placed on a cylindrical surface (which is not convenient for most methods of trace evidence analysis); in addition, the surface is rough, with craters from ulcerative corrosion due to previous chemical etching (which was not effective).

Obtained results of MO visualization of internal stress fields in the area of removed marking helped to determine absolutely all signs of primary marking.

In addition, the detailing of the MO image made it possible to specify the method of carrying out primary marking (laser engraving) and the method of its removal: grinding with the use of a hand tool with a small diameter work tool (type: dremel; Fig. 4c).



a) Appearance of an object



b) Enlarged image of the VIN plate area



c) MO visualization of internal stress

Fig. 4. The result of a practical research on removed relief marking on the frame of the motorcycle (ferromagnetic material: steel)

In the following example of a practical research study of remote marking, the research object is also the motorcycle frame (Fig. 5), but the construction material is non-magnetic (aluminum alloy).

The VIN plate area (fig. 5b) is placed on a flat surface and is not considerably rough. Markings are also completely removed, contours of the markings cannot be visually established.



a) Object appearance



b) Enlarged image of the VIN plate area



c) MO visualization of internal stress

Fig. 5. The result of a practical research
on removed relief marking on the frame of the motorcycle
(aluminum alloy: non-magnetic, electrically conductive)

As was mentioned above, research by the magneto-optical method of internal stresses in non-ferromagnetic electrically conductive materials became possible only in models after 2018 (with the advent of eddy current technology of magnetic copying). The amplitude and depth of internal stress fields for aluminum alloys (due to significant ductility) is smaller than for steel.

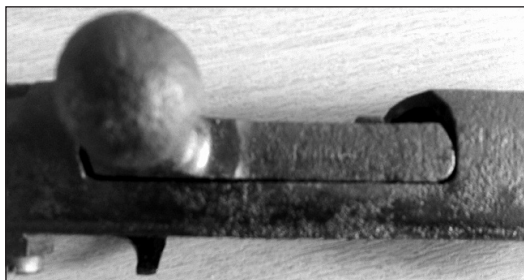
However, even in this case, the result of MO visualization of internal stress fields in the area of removed marking (Fig. 5c) allows to actually restore primary markings. Also, the high detailing of the MO image helps to draw a conclusion regarding the fact that laser engraving is the method of manufacturing primary marking.

Researches which results are provided in Fig. 4 and 5, were held in one of forensic centers of the United States with participation of a specialist from the *Регула* company.

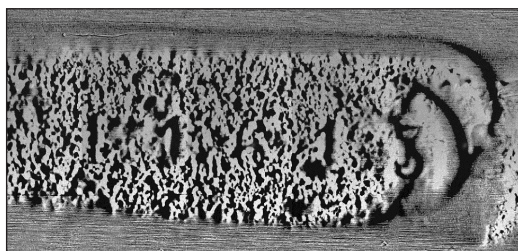
Subsequent researches were performed in the forensic center of Latvia; it is interesting because the marking is damaged as a result of surface corrosion process (Fig. 6).



a) Object appearance



b) Enlarged image of the VIN plate area



c) MO visualization of internal stresses

Fig. 6. The result of a practical research on removed relief marking on bolt-action of the rifle

The VIN area plate is placed on the shutter of the Mosin rifle, which has strong corrosion due to long stay under the ground (Fig. 6a, 6b), markings in the relief surface of the corrosion layer cannot be identified.

The corrosion layer has a heterogeneous structure due uneven corrosion process, in particular due to the dependence of the relief of the corrosion layer on the initial surface relief and on the internal stresses of the surface layer.

As stated above, the corrosion layer is a specific data carrier, and its studies (especially in a non-destructive manner) are now¹ available, as far as we know, only by the MO method.

From forensic expert practice it is known that for cases where corrosion penetrates to a depth greater than the depth of marking, the corrosion layer may be the last available source of information.

According to results of researches, obtained images of the MO visualization of internal stress fields enabled to establish all signs of primary marking (Fig. 6c). Detailing of the MO image is sufficient to determine the method of marking (plastic deformation, branding). There are no signs of primary marking removal.

After, results of a practical study of the removed relief marking on a container made of a thick layer of steel (Fig. 7a) are outlined.

Marking is removed in particular areas of the VIP plate area in order to get rid of important identification information applied by the manufacturer, as well as in the process of maintenance and filling cycles. Markings were completely removed, visible elements of primary marking are absent.

The surface of the container is curved, spherical, as a consequence implementation of marking renewal methods that use liquids is hard to put into practice.

Sizes of the VIP plate area compared to ordinary research objects (transport, weapons) are insignificant, and the number of characters in the VIP plate area reaches several dozen. An example of the VIP plate area is provided in Fig. 7b.

¹ Агалиди Ю. С., Левый С. В., Троицкий В. А., Посыпайко Ю. Н. Магнитооптическая дефектоскопия приповерхностных слоёв ферромагнитных изделий. *Техническая диагностика и неразрушающий контроль*. 2007. Вып. 4. Р. 16—20.

It should be emphasized that the material on which the marking is applied (branding by impacts manually) is low-carbon non-alloy steel with high ductility and low hardness, resulting in low residual internal stresses (this conclusion was drawn by forensic experts based on numerous expert researches on relief marking by impacts in different types of steel: from average carbon to complex alloyed).

The task of restoring marking on the indicated containers is complicated for all methods of marking restoring, as physical fundamentals of processes used in various methods of trace evidence analysis on marking restoring are structural heterogeneities (and, accordingly, residual stresses).

An attempt to use the method of chemical etching turned out to be ineffective for the above reasons: surface curvilinearity, size of the VIN plate area, residual stresses.

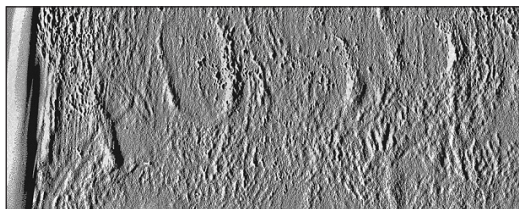
As a result of applying magneto-optical method for visualization of the fields of internal residual stresses, data which have identification meaning were restored in areas with destroyed primary relief marking. Examples of restored data are shown in Fig. 7c and 7d.



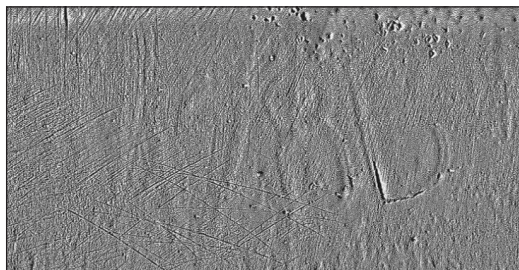
a) Appearance of object



b) Enlarged image of the VIN plate area



c) MO visualization 1



d) MO visualization 2

Fig. 7. The result of research on removed relief marking on a thick-walled object (material: low-carbon non-alloyed steel)

It should be emphasized that the method of magneto-optical imaging is non-destructive: in all studies, geometry of the objects surface remained unchanged, without changing the residual stress fields. Thus, MO technology helps to repeatedly study the same areas using this method, for example, to clarify the elements of primary markings, ways to remove primary markings.

Researches carried out in indicated research papers¹ on the boundary sensitivity of the magneto-optical method for ferromagnetic alloys show that thanks to application of this method it is possible to restore markings after removing the metal surface layer to a depth of 1.5 mm.

Conclusions. Comparative experimental researches are conducted on the assessment of basic parameters of magneto-optical visualization of internal stresses of destroyed relief marking for two sets of MO complexes: models dated 2006 and 2018.

Quantitative assessment of obtained experimental data allows to provide a numerical assessment of main indicators of image quality for comparable sets of MO complexes. The best indicators of the 2018 model are noted in comparison with similar characteristics of the 2006 model:

¹ Agalidi Yu., Kozhukhar P., Levyi S., Turbin D. Enhanced magneto-optical imaging of internal stresses in the removed surface layer. *Nondestructive Testing and Evaluation*. 2015. Vol. 30. Is. 4. P. 347—355 ; Agalidi Yu., Kozhukhar P., Levyi S., Rogozhinsky Yu., Shumsky I. Eddy current fields/magnetic ... DOI: <https://doi.org/10.1080/10589759.2011.610453> (date accessed: 22.02.2021).

- signal level is 4.35 dB higher (contrast of reconstructed marking signs);
- 2.71 dB lower noise level (surface relief/texture and magnetic copying noise);
- probability of correct character recognition is $P > 0.995$ increased by 14.9% (for the 2006 model, the indicator is $P > 0.851$).

Qualitative assessment of collected experimental data demonstrates that the complex of 2018 has significant advantages over the model of 2006, which is evidenced by a higher quality of visualization:

- improved detailing of the display of outlines of restored markings as a result of the superposition of the scattering fields of magnetic and electrical inhomogeneities in the area of internal stress (due to the eddy current nature of object magnetization);
- improved distinction / contrast of restored markings against the background of smoothed relief noise of the surface of the VIN plate area, which is one of results of the eddy current nature of magnetization in the subsurface skin layer;
- magnetic copying noise is significantly reduced due to the adaptive design of the flexible emitter of the eddy current scanner and fineness of the working layer of the polymer magnetic tape.

Results of practical researches obtained with the use of modern models of MO equipment by forensic experts from different countries sufficiently prove the effectiveness of MO technology for a wide range of objects with removed marking, in particular, traditionally complex for instrumental researches on plastic aluminum alloys and low-carbon non-alloy steel (with low internal stresses), a thick layer of corrosion on the surface of steel objects (in case of destruction of the initial relief and, most frequently, the subsurface layer of residual stresses).

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**Підвищення достовірності експертної оцінки під час дослідження
знищеного рельєфного маркування
магнітооптичними приладами**

Можливість відновлення даних видаленого рельєфного маркування залежить від чутливості інструментальних засобів дослідження та визначається співвідношенням сигнал/шум.

Останнім часом в експертній практиці для дослідження маркувальних даних металевих об'єктів використовують магнітооптичний метод,

реалізацію якого в цій статті представлено на прикладі двох поколінь комплексів, для яких досі не було проведено комплексного порівняльного аналізу.

Метою статті є кількісна та якісна оцінка результатів візуалізації залишкових полів внутрішніх напружень для комплексів магнітооптичного обладнання моделей 2006 р. і 2018 р., а також презентація практичних результатів досліджень, у яких традиційні методи не мали успіху.

Ключові слова: рельєфне маркування, магнітооптична візуалізація, відновлення даних видаленого маркування, неруйнівні методи.

Ю. С. Агалиди, А. Ю. Кошель

**Повышение достоверности экспертной оценки
при исследовании уничтоженной рельефной маркировки
магнитооптическими приборами**

При исследовании уничтоженной рельефной маркировки металлических объектов с помощью магнитооптического метода выполняют визуализацию (невидимых) полей внутреннего напряжения в зоне номерной площадки, а затем проводят экспертную оценку полученных инструментальных данных (непрямое органолептическое наблюдение за результатами визуализации); таким образом, достоверность экспертной оценки результатов непосредственно зависит от чувствительности приборов и информативности инструментальных данных.

Основной количественной характеристикой в данном случае выступает вероятность правильного распознавания сигнала (контуров знаков маркировки) на фоне шума (структурного шума исследуемой поверхности и шумов самого метода визуализации), определяемая соотношением сигнал/шум.

В данной статье представлены результаты сравнительной экспериментальной оценки отношения сигнал/шум и вероятности правильного распознавания сигнала при восстановлении уничтоженной рельефной маркировки для двух комплексов магнитооптической визуализации — моделей 2006 г. и 2018 г.

Целью статьи является количественная и качественная сравнительная оценка результатов визуализации внутренних напряжений на участках полностью удалённой рельефной маркировки металлических объектов. Результаты успешных практических исследований, полученных экспертами разных стран, дают возможность оценить эффективность и перспективность применения метода магнитооптической визуализации.

В новой модификации магнитооптического комплекса:

- на 4,35 дБ выше уровень сигнала (контраст восстановленных знаков маркировки);
- на 2,71 дБ ниже уровень шума (рельеф/фактура поверхности и шумы магнитного копирования);
- вероятность правильного распознавания символов составляет $P > 0,995$ (возросла на 14,9 %).

Технические усовершенствования реализации метода магнитооптической визуализации позволили расширить диапазон материалов объектов исследования (исследованы магнитные и электропроводные материалы).

Высокую эффективность метода по восстановлению маркировки проиллюстрировано результатами экспертиз для материалов с низким уровнем остаточных напряжений (алюминиевого сплава, низкоуглеродистой стали), для которых метод химического травления не дал результатов.

Использование новой модификации позволяет исследовать слой ржавчины, вплоть до случаев коррозии на всю глубину знаков.

Учитывая неразрушающий характер магнитооптических исследований, возможность их многократного повторения без потери свойств объекта, этот метод (в соответствии с порядком применения видов исследований) заслуживает большего внимания для применения.

Ключевые слова: рельефная маркировка, магнитооптическая визуализация, восстановление данных удалённой маркировки, неразрушающие методы.

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Contributors

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Certain issues on methodical support of forensic examinations of images on the dorsum of the hands

With the proliferation of video surveillance systems and an increase in their quality, it is becoming increasingly important to identify suspects using these video recordings. Given the importance of wearing masks, due to quarantine requirements, identification by facial images is not always possible. The next element of an appearance, which is usually not covered by clothing, are the hands, namely their dorsum. At the same time, there are certain gaps in the methodological support of forensic examination of hand images. The article deals with certain problematic issues of scientific and methodological support as to forensic examination of images on the dorsum of the hands. Modern scientific developments in this area are indicated, namely guidelines: "Personal identification by photographic images of hands", subsection 2.1.3: "Examination of traces of the dorsum of the hand" taken from the textbook: "Forensic examinations in the procedural law of Ukraine" and a methodological manual which is now being developed at the Ukrainian Research Institute of Special Equipment and Forensic Science of the Security Service of Ukraine. The Expert specializations were analyzed for their compliance with the type of research under consideration. Based on the results of the analysis, it is concluded that the research of images on the dorsum of the hands now corresponds to several expert specializations at the same time. An opinion is also expressed about the imperfection of the modern system of expert specializations in Ukraine.

Keywords: *criminalistics, forensic examination, examination of hand images, expert specialization, methodical support.*

Formulation of Research Problem. In recent years, various video surveillance systems have become increasingly common. Although the quality of video recording of such systems is gradually improving, it is not always sufficient to identify individuals. However, even with sufficient quality, situations may arise where the video does not capture the suspect's face (for instance, due to quarantine requirements, the face may be covered by a mask) and shows only other features of his appearance (other body parts, dynamic features, etc.). Among images of body parts, a special place is occupied by images of the dorsum of the hand. This

is because the dorsum of the hands is usually bare (even in winter people do not always wear gloves), and dorsum of the palm is clearly visible. Thus, the study of images of dorsum of the hands is becoming increasingly important.

Analysis of Essential Researches and Publications. Certain aspects of the study of handprints in their works were considered by such outstanding forensic scientists as R. S. Belkin, N. I. Klymenko, V. K. Lysychenko, M. V. Saltevskyi, M. Ya. Sehai, A. V. Ishchenko, etc. For example, V. V. Yusupov clearly covers the history of detection, fixation and study of fingerprints¹. Problems of using dactuloscopic information in the investigation of crimes are considered by A. O. Logvinenko². A similar issue, namely the problems and prospects of forensic examination of traces of dactyloscopic origin are studied by T. I. Savchuk, T. S. Kostiukova and I. A. Hretskykh in their publication³.

At the same time, despite the significant number of scientific developments and publications on the study of human handprints, scientific and methodological support for the study of the images of dorsum of the hands still remains underdeveloped.

The **Article Purpose** is to study the latest scientific and methodological developments in the field of forensic examination of images of hands, identify and highlight existing issues.

Main Content Presentation. In 2006 specialists of the State Research Forensic Center (Expert Service) of the Ministry of Internal Affairs of Ukraine developed guidelines: *Identification of a person by photographic images of*⁴ (although insignificant in volume — only 27 pages) — the first in Ukraine methodical material on this topic. These methodical recommendations consisted of four sections (one of which had three subsections), introduction, conclusion and a list of used and recommended literature:

Introduction

1. Anatomical features of the structure of hand.
2. Photographing the hand
3. Procedure of the study
 - 3.1. Preliminary study of the provided and comparative images

¹ Юсупов В. В. Сліди пальців рук: історія виявлення, фіксації, дослідження. *Криміналістичний вісник*. 2015. № 2. Р. 190—201. URL: https://nbuv.gov.ua/UJRN/krvs_2015_2_28 (date accessed: 25.02.2021).

² Логвиненко А. О. Проблеми використання дактилоскопічної інформації в розслідуванні злочинів. *Юридичний вісник. Повітряне і космічне право*. 2017. № 1. Р. 174—178. URL: https://nbuv.gov.ua/UJRN/Npnau_2017_1_29 (date accessed: 25.02.2021).

³ Савчук Т. І., Костюкова Т. С., Грецьких І. А. Проблеми та перспективи криміналістичного дослідження слідів дактилоскопічного походження. *Право і безпека*. 2020. № 3 (78). Р. 109—113. DOI: <https://doi.org/10.32631/pb.2020.3.14> (date accessed: 25.02.2021).

⁴ Ковальов К. М., Нізовцев Ю. Ю. Ідентифікація особи за фотографічними зображеннями кистей рук : метод. рек. Київ, 2006. 27 р.

- 3.2. Comparison of hands according to general signs
- 3.3. Comparison of hands by separate signs
4. Evaluation of results of comparison and formulation of the conclusion

Conclusion

List of the used and recommended literature.

These method recommendations are studied the anatomical structure of the hand and its anomalies; recommendations for photographing the hand for a comparative study are given separately; special attention is paid to the procedure of the study. In the framework of the previous study, the general characteristics of images, conditions of photography, quality of photographic images were compared. It is suggested to compare the hands according to the following general features: color, length, width and general features; shape, relief, contour, length, width, color, size of the free edge and features of nails. There is a wider range of individual features: dimensional characteristics; features of the skin pattern; visible location of veins; individually acquired features (tattoos, scars, amputations, tanning, etc.). The description of the features is given accompanied by visual illustrative material and explanations, in particular, regarding their stability and identification value.

First of all, these methodical recommendations were intended to identify the images of dorsum of the hands from the surveillance cameras of ATMs. The author does not know cases of their use for this purpose, instead, these methodical recommendations were applied in practice in 2012 during a series of portrait examinations of videos from the Internet. Then specialists identified several people based on images of their faces, partially recorded, and images of their hands. Scientific and methodological support of forensic examination of dorsum of the hand was continued in 2019 in the textbook: *Forensic examinations in procedural law of Ukraine*, which addresses this issue in subsection 2.1.3 *Examination of traces of the dorsum of the hand* ¹ (which does not contain illustrations and much smaller in volume than the methodical recommendations *Identification of a person by photographic images of the hands*; instead, it more clearly spells out certain methodological provisions). In general, the mentioned subsection contains: data on expert tasks and objects of examination (main objects, materials of pre-trial investigation, samples of the dorsum of the hands); typical questions that specialists solve during the examination of the dorsum of the hand; features of examination appointment.

As of today, the Ukrainian Research Institute of Special Equipment and Forensic Science of the Security Service of Ukraine is developing a manual on forensic examination of images of the dorsum of the hands. This manual plans not only to combine the best features of the works described above, but also to update the illustrative material.

¹ Судові експертизи в процесуальному праві України : навч. посіб. ; за заг. ред. О. Г. Рувіна. Київ, 2019. Р. 150—152.

Despite the gradual progress in the development of scientific and methodological support for forensic examination of images of the dorsum of the hand, some problematic issues remain to this day. One of them is to determine the affiliation of this type of research to a particular expert specialization.

Currently, there are several points of view on determining whether the study of the images of the dorsum of the hand belongs to a certain expert specialization: it is trace evidence analysis, forensic phototechnical and portrait examination; and there are arguments in favor of each of these specializations.

Thus, in accordance with paragraph 5.1 Section I of Scientific and methodological recommendations on the preparation and appointment of forensic examinations and expert studies (hereinafter referred as the *Recommendations*), the main tasks of trace evidence analysis are *identification or determination of the generic (group) affiliation of individually identified objects on materially fixed traces — reflections of their trace-forming surfaces; diagnostics (establishment of properties, states) of objects; situational tasks (establishment of the mechanism of trace formation, etc.)*¹.

In paragraph 5.4 of the same section was defined that *the following main subtypes of trace evidence analysis are distinguished: examination of human handprints, examination of human footprints, shoes, socks, stockings; examination of traces of gloves, human clothing, traces of damage to objects, traces of layers on objects; examination of footprints (paws) of the animal; examination of tools, cold steel and traces left by them, identification of the whole in parts, examination of traces of tools and instruments; examination of traces of vehicle; examination of locking and control means; examination of traces of division of the whole into parts; examination of relief traces on metal, plastic and other materials; examination of knots and loops.*

The possibility of conducting trace evidence analysis based on traces of other trace-forming objects, in particular teeth (other parts of the human or animal body), various objects of mass production, etc., is not excluded. <...>.

For example, a trace of the dorsum of the hand on a certain surface, detected with fingerprint powder and removed on fingerprint film, is the subject of trace evidence analysis. There is no doubt about it. However, the reflection of the dorsum of the hand in photographs or videos is, in fact, a kind of handprints, where the carrier of the traces is not a fingerprint film, but such photo or video images. That is, the difference is only in the carrier.

Thus, the arguments in favor of determining the affiliation of the study of the images of the dorsum of the hand to the trace evidence analysis, namely to

¹ Науково-методичні рекомендації з питань підготовки та призначення судових експертиз та експертних досліджень : затв. наказом Мін'юсту України від 08.10.1998 р. № 53/5 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z0705-98#Text> (date accessed: 25.02.2021).

the expert specialization 4.1 *Study of human and animal footprints*¹, are quite strong. That is why the subsection 2.1.3 *Examination of traces of the dorsum of the hand* in the textbook *Forensic examinations in procedural law of Ukraine* is given in the section of trace evidence analysis.

At the same time, a careful study of the provisions of paragraph 6 *Examination of handprints (dactyloscopic examination)* Section I of the above-mentioned Recommendations show that the main task of dactyloscopic examination is to identify a person by traces of his hands left at the scene. Examination of handprints solves a number of non-identification problems related to the definition of the trace formation mechanism, the peculiarities of the structure of the hand that left a trace, some other characteristics of the trace-forming object.

An indicative list of issues to be addressed by dactyloscopic examination is as follows:

- *Are there handprints on the object?*
- *Are the given traces suitable for identification?*
- *Are handprints left by a specific (one) person?*
- *Are handprints left by one person removed in different places?*
- *Are there handprints on the given item and, if so, are they suitable for identification?*
- *With which hand and which fingers are traces left?*
- *What are the features of the hands of a person who has left traces (no fingers, presence of scars, etc.)?*
- *What areas of the palm surface left traces?*
- *As a result of what action is left a trace (capture, touch, etc.)?*
- *Were there traces of a specific object on the surface before removal?*
- *Are there signs of transferring the removed traces from one surface to another?*².

As you can see, the provisions of the Recommendations are formulated so that the study of the dorsum of the hand can be considered as a part of the dactyloscopic examination (namely the expert specialization 4.6 *Dactyloscopic examination*).

In favor of phototechnical examination is evidenced by the provisions of paragraph 17.1.4 Section I of the Recommendations, according to which one of the main tasks of photographic examination is the identification of objects, premises and areas reflected in the photos (negatives) and videos. Accordingly, one of the typical issues to be addressed by the photographic examination is:

¹ Додаток 5 до Положення про Центральну експертно-кваліфікаційну комісію при Міністерстві юстиції України та атестацію судових експертів : затв. наказом Мін'юсту України від 03.03.2015 р. № 301/5 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z0249-15#Text> (date accessed: 25.02.2021).

² Науково-методичні рекомендації ... URL: <https://zakon.rada.gov.ua/laws/show/z0705-98#Text> (date accessed: 25.02.2021).

The same or another object (room, area, etc.) is recorded on these photographs (movies, videos) provided for the examination?

So, if while trace evidence analysis there is a reference to the object (handprints), then in this case we have a reference to the carrier (photo and video image). In accordance with paragraph 18.1 of the Recommendations, the main task of the portrait examination is the identification of the person (corpse) by a photograph (photographic negative) and video.

Paragraph 18.3 and 18.4 of the recommendation stipulates that *the comparative materials for the identification of a person by a photograph may be authentic photographs and video recordings of this person (amateur, professional, as well as experimental). It is advisable that among the comparative samples were images close to the time studied and the angle of the image, and identification of the corpse is carried out by comparing a photograph of the corpse with in-vivo images. Photographs of the corpse itself should be taken not only in the face, profile, but also in several other angles, because among the life photos may not be samples in which the person is depicted in the face or profile.*

As we can see, the face is mentioned only in the regulation of photographing the corpse, and the profile and several other angles are mentioned separately. Thus, it is quite possible to assume that in this case the identification of a person occurs not only by the image of the face. This is also confirmed by the name of the expert specialization 6.2: *Identification of a person by appearance on the basis of material images*: i.e., it is a question of identification of the person on features of appearance, thus the circle of these features is not limited to the person: it can be, in particular, the dorsum of a hand.

Conclusions. Thus, the study of images of the dorsum of the hand formally corresponds to several expert specializations. At the same time, there are strong arguments in favor of each expert specialization. On the one hand, according to the author, this allows experts of different specialties to study the image of the dorsum of the hand and provide a reasonable and objective conclusion. On the other hand, such a number of expert specializations in this type of study to some extent indicates the imperfection of the current system of expert specializations in Ukraine.

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Ю. Ю. Нізовцев

**Окремі проблемні питання методичного
забезпечення судово-експертних досліджень
зображень тильної сторони кистей рук**

Із розповсюдженням систем відеонагляду дедалі більшого значення набуває ідентифікація підозрюваних осіб за такими відеозаписами. Зважаючи на носіння масок, не завжди можна ідентифікувати особу за зображенням обличчя. Іще одним елементом зовнішності, який зазвичай не прикрито одягом, є тильна сторона кистей рук. Водночас методичне забезпечення експертного дослідження зображень кистей рук має певні прогалини. Метою статті є виявити та висвітлити наявні проблемні питання методичного забезпечення судово-експертного дослідження зображень тильної сторони кистей рук. Зазначено сучасні наукові напрацювання у цій галузі. Проведено аналіз експертних спеціальностей на предмет їх відповідності розглянутому виду досліджень. За результатом аналізу зроблено висновок, що дослідження зображень тильної сторони кистей рук наразі відповідає водночас декільком експертним спеціальностям. Також висловлено думку про недосконалість сучасної системи експертних спеціальностей в Україні.

Ключові слова: криміналістика, судова експертиза, дослідження зображень рук, експертна спеціальність, методичне забезпечення.

Ю. Ю. Низовцев

**Отдельные проблемные вопросы методического обеспечения
судебно-экспертных исследований
изображений тыльной стороны кистей рук**

С распространением систем видеонаблюдения и повышением их качества всё большее значение приобретает идентификация подозреваемых по таким видеозаписям. Учитывая необходимость ношения защитных масок, обусловленную требованиями карантина, не всегда можно провести идентификацию по изображениям лиц. Другим элементом внешности, обычно

не прикрытым одеждой, являются кисти рук, а именно их тыльная сторона. Вместе с тем в методическом обеспечении экспертного исследования изображений кистей рук имеются некоторые пробелы. в статье рассмотрены отдельные проблемные вопросы научно-методического обеспечения судебно-экспертного исследования изображений тыльной стороны кистей рук. Упоминаются современные научные наработки в указанной области, а именно методические рекомендации «Идентификация личности по фотографическим изображениям кистей рук», подраздел 2.1.3 «Экспертиза следов тыльной стороны кисти руки» из учебного пособия «Судебные экспертизы в процессуальном праве Украины», а также методическое пособие, которое в настоящее время разрабатывает Украинский научно-исследовательский институт специальной техники и судебных экспертиз Службы безопасности Украины. Проведён анализ экспертных специальностей на предмет соответствия их рассматриваемому виду исследований. По результатам анализа сделан вывод, что исследование изображений тыльной стороны кистей рук в настоящее время одновременно соответствует нескольким экспертным специальностям. Также высказано мнение о несовершенстве современной системы экспертных специальностей в Украине.

Ключевые слова: криминалистика, судебная экспертиза, исследование изображений рук, экспертная специальность, методическое обеспечение.

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Specifics of fire damage to cotton clothing while shooting point-blank at a human torso simulator from a Fort-12RM pistol

This Article Purpose is to determine specifics of damage to cotton jersey, arising from a point-blank shot from a nickel-plated "Fort-12RM" pistol, equipped with .45 Rubber cartridges into dressed simulator of a human torso made of ballistic gel. For achieving this goal, 12 human torso simulators were made, dressed in cotton T-shirts, with the subsequent firing of shots using a nickel-plated "Fort-12RM" pistol equipped with .45 Rubber cartridges. The shots were fired from a distance, closely followed by examination of damage to clothing using photographic and microscopic research methods. Obtained data and

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The authors declares no conflict of interest of relevance to this topic.

their comparison with the previously obtained research results when the shots were fired at the clothing samples, fixed in the frame made it possible to identify important differences and for the first time describe the phenomenon of internal muzzle imprint mark and volumetric muzzle imprint mark; while describing the internal muzzle imprint mark, specific deposition of additional factors of the shot (namely, soot), reminiscent of a candle flame was found. In addition, a double marker phenomenon was observed around the input gunshot injury on the investigated human torso simulator. Most of additional factors of the shot (in form of soot and dust particles of unburned gunpowder) were determined in wound channel. While carrying out the contact-diffusion method of research, small particles of nickel were determined around input fire damage to the simulator. The revealed differences require revision of the classical method of experimental shooting, while test samples of clothing are fixed in a frame or fixed in a similar way. An important stage in research formulation is to recreate the conditions as close as possible to real ones. The search for the most appropriate, efficient and simple method for carrying out such experiments is promising for ballistics.

Keywords: “Fort-12RM”, ballistic gel, gunshot damage, point-blank shot, non-lethal weapon, muzzle imprint mark.

Formulation of Research Problem. Non-lethal weapons are becoming more common both in military formations and among the civilian population, as this type of weapon is not designed to destroy the enemy, but only to neutralize it with minimal damage to health. However, this does not prevent criminals from using this type of weapon to commit criminal acts. This is especially true of non-lethal weapons (mostly traumatic pistols) ¹.

According to the US Department of Justice in 2016 ², among those serving sentences for crimes committed in federal prisons, 8,300 people committed criminal offenses using firearms (700 murders, 600 rapes, 1,600 robberies, 700 armed attacks), out of these 43.2% received weapons illegally and only 10.1% bought it in gun shops. There has been a significant increase (from 33 to 112%) in the use of semi-automatic weapons in offenses ³.

¹ E.g., Alper M., Glaze L. Source and Use of Firearms Involved in Crimes: Survey of Prison Inmates, 2016. U. S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics. 2019. January ; Hiquet J., Gromb-Monnoyeur S. Severe craniocerebral trauma with sequelae caused by Flash-Ball® shot, a less-lethal weapon: Report of one case and review of the literature. *SAGE Journals*. 2015. June, 30 ; Koper C. S., Johnson W. D., Nichols J. L., Ayers A., Mullins N. Criminal Use of Assault Weapons and High-Capacity Semiautomatic Firearms: an Updated Examination of Local and National Sources. *Journal of Urban Health*. 2017. October, 02 ; Ribeiro A. P., Souza E. R. de, Sousa C. A. M. de. Injuries caused by firearms treated at Brazilian urgent and emergency healthcare services. *Ciênc. saúde coletiva*. Rio de Janeiro, 2017. Set. Vol. 22. No. 9.

² Alper M., Glaze L. Ibid.

³ Koper C. S., Johnson W. D., Nichols J. L., Ayers A., Mullins N. Ibid. Pp. 313—321.

During the 90 days in 2016, Indian law enforcement agencies in the Kashmir region, armed with traumatic pistols, inflicted nearly 10,000 injuries and killed 80 people. The same source said that the use of traumatic firearms by paramilitary groups in 2010 killed 120 people ¹.

B. Dumenčić and co-authors ² estimate that between 1998 and 2018, the use of gas weapons led to 69 deaths in Croatia.

In Brazil in 2014, the use of firearms caused 45,068 deaths. And 71.6% of all murders in the country: it is with the use of firearms ³.

As for Ukraine, after the beginning of the Russian aggression in 2014 the criminogenic situation worsened that is connected, in particular, with illegal input of firearms from the ATO zone ⁴. Prior to that, without significant practical experience, forensic medicine in Ukraine for the first time encountered the widespread use of various types of firearms (both non-lethal and lethal), which caused fatalities in the final stages of the Revolution of Dignity ⁵.

Because of all these factors, there is an urgent need for research to determine the specifics of the damage caused by firearms, including non-lethal action, which will help in identifying the weapon, determining the distance of the shot, and so on. Of particular interest are the damage from firearms in the case of shooting point-blank ⁶. Currently, most wound ballistics research is performed using ballistic gel cubes ⁷, and clothing damage research is performed by fixing

¹ David S. Use of pellet guns for crowd control in Kashmir: How lethal is “non-lethal”? *Indian journal of medical ethics*. 2016. December, 20.

² Dumenčić B., Rajc J., Pavoković D., Damjanović T. Fatal injury by air gun: a case report. *Egyptian Journal of Forensic Sciences*. 2020. July, 21.

³ Ribeiro A. P., Souza E. R. de, Sousa C. A. M. de. Ibid. Pp. 2851—2860.

⁴ Лень В. В., Олійников Г. В. Незаконний обіг вогнепальної зброї, бойових припасів, вибухових речовин та пристроїв, пов'язаний із проведенням антитерористичної операції: окремі питання запобігання. *Право і суспільство*. 2016. № 1. P. 204—208.

⁵ Mishalov V. D., Petroshak O. Y., Hoholyeva T. V., Gurina O. O., Gunas V. I. Forensic assessment of gunshot injuries in Maidan Nezalezhnosti protesters. *World of medicine and biology*. 2019. Vol. 3 (69). Pp. 118—122.

⁶ Pircher R., Bielefeld L., Geisenberger D., Perdekamp M. G., Pollak S., Thierauf-Emberger A. Muzzle imprint mark: a patterned injury which may be constituted of intradermal blood extravasations. *Forensic science international*. 2014. Vol. 244. Pp. 166—169.

⁷ Perdekamp M. G., Glardon M., Kneubuehl B. P., Bielefeld L., Nadjem H., Pollak S., Pircher R. Fatal contact shot to the chest caused by the gas jet from a muzzle-loading pistol discharging only black powder and no bullet: Case study and experimental simulation of the wounding effect. *International Journal of Legal Medicine*. 2015. Vol. 129 (1). Pp. 125—131.

the material in a frame ¹. However, it should be noted that the results of such experiments may be inaccurate, because they do not take into account the physiological shape of the human body and the presence of clothing, which is not only a common obstacle, but also a factor that (along with the human torso simulator) damage.

All this requires research using modern models of domestic firearms of non-lethal action on the human torso simulators and clothing together as one complex.

Analysis of Essential Researches and Publications. Once this issue was studied by P. Yu. Bobkov, M. F. Lebed, A. M. Perebetiuk, V. I. Hunas, O. M. Hurov, S. V. Kutsenko, V. V. Shcherbak, D. B. Hladkykh, V. V. Sapielkin and other scientists ².

The **Article Purpose** is to determine specifics of damage to cotton jersey, arising from a point-blank shot from a nickel-plated *Fort-12RM* pistol, equipped with .45 Rubber cartridges into dressed simulator of a human torso made of ballistic gel.

Main Content Presentation. For achieving this goal, 12 human torso simulators were made according to the generally accepted method of making gelatin blocks ³ with adaptation of the authors (10 % edible gelatin 270 Bloom, obtained from Scientific Research Center National Pirogov Memorial Medical University), dressed simulators in white, cotton T-shirts of the appropriate size and fired at them from *Fort-12RM* pistol equipped with .45 Rubber cartridges.

The shots were fired point-blank (hermetically), at right angles, with a preliminary fixation of the weapon in the vise in the shooting range of the Vinnytsia Scientific Research Forensic Center (within the framework of the cooperation agreement between National Pirogov Memorial Medical University and the Vinnytsia Scientific Research Forensic Center). Performed 4 shots at each

¹ Бобков П. Ю., Лебедь М. Ф., Перебетюк А. М., Гунас В. І. Судово-медична характеристика вогнепальних пошкоджень шкірозамінника при пострілах із пістолета «Форт-17Р» (Актуальні питання судово-медичної експертизи). *Буковинський медичний вісник*. 2019. Т. 23. № 2 (90). Р. 51—56 ; Bobkov P., Perebetiuk A., Gunas V. Peculiarities of gunshot injuries caused by shots Fort-12RM pistol using cartridges of calibre. 45 Rubber. *Folia Societatis Medicinae Legalis Slovacae*. 2019. Vol. 9. Nr. 1. Pp. 44—48 ; Щербак В. В. Морфологічні особливості вогнепальних пошкоджень при пострілах впритул із пістолета «Форт-12» в залежності від матеріалу одягу. Судово-медична експертиза : наук.-практ. журн. 2014. № 1. Р. 41—45.

² Бобков П. Ю., Лебедь М. Ф., Перебетюк А. М., Гунас В. І. Op.cit. Bobkov P., Perebetiuk A., Gunas V. Ibid ; Гуров О. М., Куценко С. В., Щербак В. В., Гладких Д. Б., Сапелкін В. В. Механізм утворення подвійної штанцмарки при пострілах із пістолетів модельного ряду Форт. *Судово-медична експертиза* : наук.-практ. журн. 2019. № 1. Р. 60—65.

³ Stevenson T., Carr D. J., Stapley S. A. The effect of military clothing on gunshot wounding patterns in gelatine. *International Journal of Legal Medicine*. 2019. Vol. 133. Pp. 1121—1131.

simulator on its anterior surface in the left and right thoracic areas, epigastrium and umbilical area. Subsequently, damage to clothing and the surface of the ballistic gel was examined under normal lighting using photographic and microscopic examination methods. In order to detect unburned gunpowder particles, Aidlin's, Vladymyrskiy's reactions and the microscopic method of examination were used. Microscopic examination was performed using the MBS — 10 microscope under a magnification of 4.8x to 56x. The metallization of the lesions was studied using the contact-diffusion method of the study.

As a result of a series of shots (4 shots in each simulator) there were 48 gunshot wounds, of which: 11 formed a defect of clothing round shape (average diameter of the defect — 1.35 cm), 37 — oval shape (average size 1.67×1), 38 cm, Fig. 1).

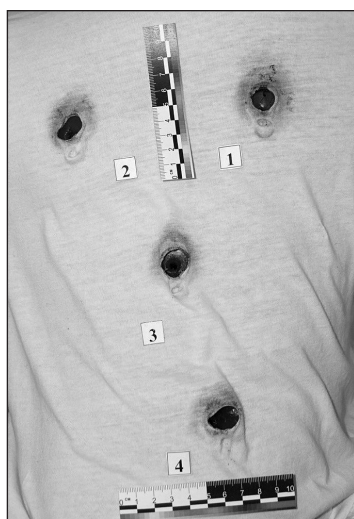


Fig. 1. General view of the mannequin after a series of shots

The edges of the damage are uneven, pointed, turned inward by about 0.10—0.15 cm in the direction of flight of the bullet, disheveled, thinned, slightly scorched, dark gray and black-gray. Externally around the damage, soot deposits of indefinite shape of light gray, gray and black-gray colors were found. The width in the upper part of the damage is approximately 2.31 cm, on the sides — 1.10 cm and down — 1.62 cm below the lower edge of the imprint of the return spring tip and the external dimensions of approximately 5.51×3.72 cm. The damage is located on the background of the inwardly imprinted muzzle end of the weapon (punch) with contour soot deposits of a more intense dark gray color. In the lower part, the existing soot deposition was observed in the form of a crescent-shaped strip about 0.01—0.15 cm wide, and a radius of about 0.61 cm, about 1.21 cm long. Soot deposition was clearer on the upper and lateral

edges, and less intense on the lower edges. The edges of all the damage formed a volcanic rise (three-dimensional stamp) above the level of undamaged material by 0.60—1.30 cm. The edges that protrude outwards are also pointed, with the formation of free single threads, sometimes burnt. In the area of the imprint of the front edge of the return spring, deformation of the material is noted: in the center — a recess, and behind the periphery — a roller-like increase (Fig. 2).



Fig. 2. Appearance of clothing damage from the outside

On the inside of clothing, soot deposition is more intense, especially in the upper and side areas in the form of a drop or flame of a candle measuring approximately 1.51—2.79 cm from the upper edge of the material defect and in side areas wide approximately 1.10—1.52 cm from the edge of the material defect. In all cases, the narrow part of the edge of the sediment is directed upwards and gradually disappears (Fig. 3).



Fig. 3. Appearance of clothing damage from the inside

A superficial examination of the damage to the human torso simulator shows that most of the additional factors of the shot in the form of soot and unburned gunpowder are deposited in the wound canal. During the contact-diffusion method of research (the method of color prints) around the input fire damage of the simulator, small nickel particles were detected. In most cases (31 out of 48 injuries), specific soot deposition in the form of a double stamp was observed around the input gunshot wound of the human body simulator.

Comparison of these data with our previous study, in which we used similar weapons, ammunition and targets (but the target was fixed in a frame), revealed significant differences. First of all, the square shape of the defect attracts attention, while in the study with the torso simulator we observed a defect of oval, sometimes round shape. However, this difference, in our opinion, is due to the fact that in this experiment we used cotton knitwear, while in the previous one we used cotton fabric (calico). The size of the defect was approximately 1.0×1.0 cm, while using a torso simulator — 1.67×1.38 cm and a diameter of 1.35 cm (if the shape of the defect is oval and rounded, respectively). In addition, there were no deposition of additional factors of the shot on the inner surface and changes in the relief of the target (three-dimensional stamp). A slightly different configuration of the deposition of additional firing factors around the incoming gunshot damage was also noted ¹. All these data indicate that there are differences in the results obtained, so the question arises: which of the designs of the experimental study is more reliable and adequate?

V. V. Shcherbak ² also studied the features of damage to cotton fabric fixed in the frame in the case of point-blank shots, but using *Fort-12*. He described a star-shaped damage with a defect size of 1.5×1.4 – 1.9×1.8 cm. In this study, in particular, multilayer targets were used, however, in none of the cases the author did not describe such phenomena as *internal stamping* or *three-dimensional stamping*.

According to the authors, the detected deposition of additional factors of the shot on the inner surface of the garment (internal stamping) is probably an analogue of the same phenomenon as the Vynohradov phenomenon. However, the search for a reliable explanation of the phenomenon of internal stamping described by us, we believe, it should be the goal of further research. Regarding the shape of the deposition of additional shot factors in the form of a candle flame, this is probably due to the action of the return spring tip, which blocks the lower part of the fabric during the shot (as if creating an obstacle) and thus causes more additional factors to go up.

Regarding the discovered phenomenon of double stamping, this phenomenon has already been studied for pistols of the *Fort* model series by a group of Ukrainian scientists headed by O. M. Hurov ³, and R. Pircher with

¹ Бобков П. Ю., Лебедь М. Ф., Перебетюк А. М., Гунас В. І. *Op.cit.*

² Щербак В. В. *Op.cit.*

³ Гуров О. М., Куценко С. В., Щербак В. В., Гладких Д. Б., Сапелкін В. В. *Op.cit.*

co-authors ¹, in cases from practice, have described the effect of cartridges on stamp deformation.

For forensic medicine and criminalistics, the study of clothing is critical. Thus, according to 202 cases of gunshot wounds that occurred in Tehran from 2014 to 2017, in 70 % of cases, the study of clothing allowed to determine the distance and type of firearms ($P = 0.0001$) ².

D. J. Carr and co-authors ³ have identified features of clothing damage previously contaminated with blood, which can be used to develop realistic scenarios for working out in combat zones.

A significant category of work is the study, in which scientists study microscopic features (e.g., the condition of the threads in the area of damage, the application of trace elements, etc.), to determine the distance of the shot and the type of firearm ⁴.

Studies of clothing damage from firearms are quite small both in Ukraine and abroad, and studies of the impact of clothing on injuries to the human body or its simulator are generally rare in the scientific literature.

¹ Pircher R., Glardon M., Perdekamp M. G., Pollak S., Geisenberger D. Rearward movement of the slide in semi-automatic pistols: a factor potentially influencing the configuration of muzzle imprint marks in contact shots. *International Journal of Legal Medicine*. 2019. № 133 (1). Pp. 169—176. DOI: 10.1007/s00414-018-1978-2 (date accessed: 05.02.2021).

² Najari F., Jafari H., Alimohammadi A. M., Najari D. The importance of victim's clothes in gunshot wounds. *Journal of Emergency Practice and Trauma*. 2020. № 6 (2). Pp. 73—76. DOI: 10.34172/jept.2020.13 (date accessed: 05.02.2021).

³ Carr D. J., Featherstone M., Malbon C., Miller D., Teagle, M. Preliminary development of a bleeding layer to assess the effect of a ballistic impact on textile damage. *Forensic science international*. 2018. № 288. Pp. 169—172. DOI: 10.1016/j.forsciint.2018.04.031 (date accessed: 05.02.2021).

⁴ Carr D., Kieser J., Mabbott A., Mott C., Champion S., Girvan E. Damage to apparel layers and underlying tissue due to hand-gun bullets. *International Journal of Legal Medicine*. 2014. № 128 (1). Pp. 83—93. DOI: 10.1007/s00414-013-0856-1 (date accessed: 05.02.2021) ; Giraudo C., Fais P., Pelletti G., Viero A., Miotto D., Boscolo-Berto R., Viel G., Montisci M., Cecchetto G., Ferrara S. D. Micro-CT features of intermediate gunshot wounds covered by textiles. *Ibid*. 2016. № 130 (5). Pp. 1257—1264. DOI: 10.1007/s00414-016-1403-7 (date accessed: 05.02.2021) ; Hinrichs R., Frank P. R. O., Vasconcellos M. A. Z. Short range shooting distance estimation using variable pressure SEM images of the surroundings of bullet holes in textiles. *Forensic science international*. 2017. № 272. Pp. 28—36. DOI: 10.1016/j.forsciint.2016.12.033 (date accessed: 05.02.2021) ; Roberts K. A., Fischer G., Davis A. R. Identification of polygonal barrel rifling characteristics in bullet wipe residue deposited on textiles. *International Journal of Legal Medicine*. 2020. № 134 (2). Pp. 533—542. DOI: 10.1007/s00414-019-02009-0 (date accessed: 05.02.2021) ; Sahu K. I., Kennao P., Gupta A. K., Saran V., Waghmare N. P. Study of 9mm Improvised Pistol Pattern & Gunshot Residue with respect to Different Range. *Int. J. Comput. Sci. Eng.*, 6. 2018. Pp. 155—160.

In particular, T. Stevenson with co-authors ¹ did an experiment with the use of combat firearms on gelatin blocks to identify the effect of military clothing on the features of firearms damage. At the same time, we have not found research in modern literature that would study the features of gunshot damage to clothing on the human body simulator.

Conclusions and prospects for further studies. The study provided completely new data on damage to clothing in the case of non-lethal firearms, namely the *Fort-12RM* pistol. Phenomena such as three-dimensional stamping and internal stamping were described for the first time, and during the description of the latter, a specific deposition of soot in the form of a candle flame was revealed. The phenomenon of double stamping was observed around the entrance gunshot wound on the studied human torso simulator. Most of the additional shot factors in the form of soot and unburned gunpowder were noted in the wound canal. During the contact-diffusion method of the study, small nickel particles were observed around the input fire damage of the simulator.

Given the data obtained and the experience of previous studies using the same pistol, ammunition and clothing material, there is a need to revise the classical method of experimental shooting, when the studied clothing samples are fixed in the frame.

In the future, we plan to conduct similar studies using simulators of other parts of the human body (head, upper and lower extremities), other types of weapons and clothing.

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¹ Stevenson T., Carr D. J., Stapley S. A. Ibid.

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**В. І. Гунас, П. Ю. Бобков, І. М. Плахотнюк,
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**Особливості вогнепальних пошкоджень
бавовняного одягу в разі пострілу впритул
в імітатор людського торса з пістолета «Форт-12РМ»**

Зброя нелетальної дії набуває дедалі більшого поширення як у військових формуваннях, так і поміж цивільного населення, адже такий вид зброї створено не для знищення супротивника, а лише для його нейтралізації з мінімальною шкодою для здоров'я. Проте, це не заважає злочинцям застосовувати цей вид зброї для вчинення кримінальних дій. Особливо це стосується вогнепальної зброї нелетальної дії (здебільшого травматичних пістолетів).

Мета роботи — визначити особливості пошкоджень бавовняного трикотажу, які виникають у разі пострілу впритул з нікельованого пістолета «Форт-12РМ», спорядженого патронами .45 Rubber, в одягнутий імітатор людського торса, виготовлений із балістичного гелю.

Для досягнення поставленої мети 12 імітаторів людського торса вдягли в бавовняні футболки, по ним виконували постріли впритул з нікельованого пістолета «Форт-12РМ», спорядженого патронами .45 Rubber, із подальшим дослідженням пошкоджень одягу фотографічним і мікроскопічним методами. Порівняння здобутих результатів з більш ранніми, коли постріли виконували у зразки одягу, закріплені в рамці, дали змогу вперше описати феномен внутрішньої یشانцмарки й об'ємної یشانцмарки: під час опису внутрішньої یشانцмарки виявлено специфічне відкладання додаткових факторів пострілу (а саме — кіптяви), що нагадує полум'я свічки. Окрім того, спостерігали феномен подвійної یشانцмарки навколо

вхідного вогнепального пошкодження на досліджуваному імітаторі людського торса. Більшість додаткових факторів пострілу (у вигляді кінтяви та порошинок незгорілого пороха) виявлено в рановому каналі. Під час проведення контактнo-дифузійного методу дослідження навколо вхідного вогнепального пошкодження імітатора спостерігали дрібні частинки нікелю.

Виявлені відмінності вимагають перегляду класичної методики проведення експериментальних відстрілів, коли досліджувані зразки одягу закріплюють у рамі або фіксують у схожий спосіб. Важливим етапом постановки дослідження є відтворення умов, максимально наближених до реальних. Пошук найбільш доречного, ефективного та простого методу для здійснення таких експериментів є перспективним для балістики.

Ключові слова: «Форт-12РМ», балістичний гель, вогнепальні пошкодження, постріл упритул, зброя нелетальної дії, штанцмарка.

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**Особенности огнестрельных повреждений хлопковой одежды
при выстреле в упор в имитатор человеческого торса
из пистолета «Форт-12РМ»**

Цель работы — определить особенности повреждений хлопкового трикотажа, возникающих при выстреле в упор из никелированного пистолета «Форт-12РМ», снаряжённого патронами .45 Rubber, в одетый имитатор человеческого торса, выполненный из баллистического геля. Для достижения поставленной цели были изготовлены 12 имитаторов человеческого торса, одетых в хлопчатобумажные футболки, с последующей постановкой выстрелов с использованием никелированного пистолета «Форт-12РМ», снаряжённого патронами .45 Rubber. Выстрелы выполняли с дистанции вплотную с последующим исследованием повреждений одежды, используя фотографический и микроскопический методы исследования. Полученные данные и сравнение их с ранее полученными результатами исследований, когда выстрелы выполняли в образцы одежды, закреплённые в рамке, позволили выявить важные различия и впервые описать феномен внутренней штанцмарки и объёмной штанцмарки; при описании внутренней штанцмарки обнаружено специфическое отложение дополнительных факторов выстрела (а именно копоти), напоминающих пламя свечи. Кроме того, наблюдался феномен двойной штанцмарки вокруг входного огнестрельного повреждения на исследуемом имитаторе человеческого торса. Большинство дополнительных факторов выстрела (в виде копоти и пылинок несгоревшего пороха) определяли в раневом канале. При проведении контактнo-диффузионного метода исследования вокруг входного огнестрельного повреждения имитатора определяли мелкие частицы никеля. Выявленные различия нуждаются в пересмотре классической методики проведения экспериментальных отстрелов, когда исследуемые

образцы одежды закрепляют в раме или фиксируют похожим образом. Важным этапом постановки исследования является воссоздание условий, максимально приближённых к реальным. Поиск наиболее уместного, эффективного и простого метода для осуществления таких экспериментов является перспективным для баллистики.

Ключевые слова: «Форт-12РМ», баллистический гель, огнестрельные повреждения, выстрел в упор, оружие нелетального действия, итанджмарка.

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Research on a voice changed by distortion

The concept and essence of distortion are considered from a technical standpoint and criminal law perspective. The most common ways of distorting a voice and a speech are provided, as well as certain methods of detecting an intentional change in a voice and human speech by computer tools and linguistic analysis.

Some software and hardware tools changing a speech signal both in real time and in a pre-prepared recording are analyzed.

To solve diagnostic and identification tasks, a pressing issue in forensic video and audio analysis is studied which is addressed to forensic experts in this field more often.

Keywords: *simulation; distortion; forensic video and audio analysis; editing; person identification by voice and speech; instrumental analysis; linguistic analysis.*

Formulation of Research Problem. In recent years, the number of various anonymous messages (in particular, fraudulent ones, threats, as well as reports on mining administrative buildings, shopping centers, etc.) has grown. With necessary skills, you can simulate the speech of an opposite sex, another age and/or ethnic or territorial affiliation, the speech of a person in an excited state, in a state of alcohol or narcotic intoxication and other speech characteristics of a person.

Research on methods of concealing a crime is a multidimensional and complex problem that possesses not only forensic but also criminological, criminal-law and procedural significance. Some of the mentioned aspects of the problem have already been considered by forensic experts in scientific papers,

and ways to hide traces of a crime and concealing can be interpreted differently from the standpoint of various legal sciences. Thus, from the point of view of the criminal law, crime concealing is a way to avoid criminal liability, from the standpoint of criminology: an element of the method of committing a crime; and for forensic psychology, the way to conceal a crime is the embodiment of peculiarities of behavior and traits of a criminal personality and crime victim.

Specific nature of the forensic aspect of the issue of concealing is to study the laws of crime concealment, gain and handle information to investigate and prevent crimes.

Objections arise as to accepted in criminalistics identification in the structure of the method of committing crimes of the following components: preparation for crime commission → direct commission of a crime → concealing traces of a crime. Concealing (hiding, way of avoiding responsibility) may take place both at the stage of preparation for the commission of a crime and while its commission, as well as after its implementation. In individual cases concealing may not be present. Sometimes concealing can be absent while crime commission (for example, when it is committed as a result of negligence) or after its commission (for example, if a criminal voluntarily and honestly declares what he has done). Consequently, concealing is always associated with the way of committing a crime.

Concealing should be interpreted as actions or inactivity of criminals or other persons aimed at full or partial destruction, change, hiding of traces of a crime which is being committed or has already been committed, misleading of both persons carrying out investigations and victims, witnesses on individual accomplices, a method of committing a crime, location of a corpse, objects obtained by criminal means, crime weapons and the rest of traces. Concealing is always a structural element of a crime commission. Study of concealing in the system of forensic science should be inextricably linked to the teaching on the way of committing crimes.

Knowledge of laws as to formation of certain concealing methods of criminal activity will allow not only to identify the method of concealing but also criminals by studying certain signs of these methods.

Concealing actions in criminal activity are conditioned by:

- a sense of fear, fear of exposure;
- impossibility of criminal intent realization without relevant concealing;
- imitation of certain patterns of criminal behavior taken from stories of other criminals, literature, movies, etc.;
- the desire to determine *originality*, impress a victim, witnesses, accomplices and other persons.

Analysis of Essential Researches and Publications. There are a great number of ways to create a human voice sample. Usually these are different combinations of frequency and statistical characteristics of a voice, such as intonation or tone height. Let's consider some modern technologies created on the basis of artificial intelligence, namely neural networks.

The *Google DeepMind* British company presented a new algorithm for the synthesis of human voice called *Wavenet*. It is based on the use of neural networks helping to reach a realistic voice simulation. The program distinguishes sounds and assembles them on the basis of entered data that allows you to get a rather natural sound: for example, in this case *SIRI* or *Google Assistant* ¹ may serve this purpose.

Also, there is an alternative method: parametric synthesis which uses a fully computer-generated voice and does not necessitate to use the collection of "live" speech. Its work is grounded on already set parameters corresponding to the rules of grammar and principles of sounds pronunciation.

In the field of creating tools for voice changing, there is a huge number of commands aimed at software products commercialization, for example *Resemble.AI* (provides demo version of a program), *iSpeech* (there is a demo version for 27 languages), *Lyrebird AI* (you can download demo version for 3 hours of speech), as well as *Vera Voice* created by *ScreenLife Technologies* company of Timur Bekmambetov and developers of "*Robot Vera*" *Stafory*² HR service. The technology of voice synthesis introduced by *Facebook*: authors of this project taught the neural network to speak the voice of Bill Gates. *Amazon* reported about a similar development. A voice assistant of the *Alexa* company can talk to its owners with the voice of the actor Samuel Leroy Jackson, and it will be able to master voices and speech of other celebrities over time.

Researchers presented a program based on artificial intelligence called *Vocodes*. This tool may simulate voices of more than 100 celebrities (politicians, scientists and artists: Donald Trump, Barack Obama, Bryan Cranston, Danny DeVito, Elon Musk, etc.). To simulate a voice, the user has to enter a text and select a voice. The *ThenExtWeb* edition notes that there are several such applications, but *Vocodes* impresses with a huge number of voices available for reproduction. However, it has its own disadvantages: every time the application faces a word that cannot read, it simply misses it. Among these words: *Tesla* and *Elon Mask* ³.

That is, the neural network has learned to simulate the tone, intonation and other nuances of a voice and speech. At the same time, creators of projects assure that technically it is impossible to identify whether the recording is synthesized or original, but how they do not specify. It is known that the system possesses the ability to detect synthesized human speech and distinguish it from natural.

¹ Siri або Google Assistant: хто кращий, розумніший і крутіше [Електронний ресурс]. URL: <https://razborka-pc.com.ua/siri-abo-google-assistant-khto-krashchyj-rozumnishyj-i-kruti.html> (date accessed: 13.03.2021).

² Проект Vera Voice научил нейросеть говорить голосом знаменитостей [Електронний ресурс]. URL: <https://screenlifer.com/projects/screenlife-technologies-i-robot-vera-nauchili-nejroset-govorit-golosom-znamenitostej> (date accessed: 14.03.2021).

³ Нейросеть научилась реалистично имитировать речь человека [Електронний ресурс]. URL: <https://nplus1.ru/news/2016/09/14/google-ai-voice> (date accessed: 14.03.2021).

The **Article Purpose** is to analyze certain methods of detecting intentional voice change by computer tools and linguistic analysis.

Main Content Presentation. The main task of forensic video and audio analysis is to identify a person by a voice and speech. The speaker recognition while forensic video and audio analysis is a process of determining the belonging of a particular statement to an individual based on the characteristics of speech signals. As it is known, voices of different people usually are not similar to each other, besides (excluding the linguistic component) a human voice conveys information on a geographical and social status of the speaker, on his physiological features and psychological traits, emotional state, etc.

Referring to forensic video and audio analysis, new available methods for concealing and distorting a speech signal appear, which complicate the identification of certain characteristics.

According to the distortion nature, they can be *intentional* (artificial) and *random* (natural). *Natural distortions* have a “situationally, technically, technologically conditioned nature”.

The *intentionality* of voice and speech *distortion* can be traced through peculiarities of a provided voice message, inconsistency of identified signs of a voice and speech in a studied sound record and in specimens of oral speech, which can be detected at the level of auditory perception. If a forensic expert identifies signs of any distortion in a phonogram, then he has to establish a “*mechanism, methods and reasons for introduction of changes into a sound record, their artificial or natural character*”.

The concepts of *distortion* and *simulation*, at first glance, are extremely similar and aimed at: “*in any way to hide the real voice of the speaker within the framework of forensic audio and video analysis, however, simulation and distortion are implemented in various ways and have a different degree of performance complexity*”.

Simulation is primarily imitation of a voice and speech of another person by analyzing peculiarities of the voice of a speaker (tempo, articulation, intonation, etc.). Possessing needed skills, you can simulate the speech of an opposite sex, another age and/or ethnic or territorial affiliation, the speech of a person in an excited state, in a state of alcohol or narcotic intoxication and other speech characteristics of a person.

Distortion of a voice is associated with changing linguistic and acoustic characteristics in a person's voice and speech to intentionally hide their own personality or personality of another person. When simulating the voice of a person, simulators try (intentionally or not) to reach those values of formant frequencies which correspond to a voice of a person that should be copied by reproducing certain characteristics of a voice and speech. However, as research demonstrates, it is almost impossible for simulators to reach values of formant parameters. At the same time, by means of comparative research using microanalysis of sounds and analysis of ratio between formant frequencies, it is

possible to determine with a certain degree of probability whose voice is recorded in a studied sound record.

To some extent, simulation of a voice and speech is an integral part of the concept of *distortion* which is more comprehensive in content, that is distortion can be implemented both by simulating a person's voice and speech.

According to authors, *the most common methods of distorting voice and speech are:*

- *linguistic*: a change in linguistic parameters of oral speech;
- *acoustic*: a change in acoustic parameters of a speech signal;
- *mixed*: a change of both certain linguistic features, and acoustic characteristics of oral speech.

Linguistic distortion manifests itself in distortion of certain linguistic features of a voice and speech which leads to a change in some personality traits. For example, deliberate use of profanity (if it was not characteristic of a speaker), increase in the number of violations in grammatical rules (government, agreement, etc.), improper stress, a great number of jargons lowering the level of a speaker's speech culture. However, this type of distortion can be detected by both acoustic and linguistic analysis; while comparative research, concurrence of signs that have not been distorted could be traced, and appropriate evaluation of identified inconsistencies in features will enable to establish facts as to linguistic distortion of personality traits.

Mixed distortion is associated with distortion of certain linguistic features of a voice and speech, acoustic parameters, but without using computer tools. In this case, many features belonging to a linguistic group can be intentionally altered (for example, timbre, articulation, prosodic, lexical features and signs of speech culture, etc.), acoustic parameters are also changing (for example, the frequency of the main tone). Thanks to using mixed distortion, you can change the gender, age and dialect of a person. It can be connected with the need to simulate the voice of another person, and to hide their identity. Thus, a voice and speech are distorted, for example, with the help of clamping nostrils, jaw clenching, retracting cheeks, lips protrusion, etc.¹.

A criminal may resort to acoustic distortion in situations when there is an intention to remain unrecognizable, that is when his main goal is to ensure the impossibility of his further identification.

The majority of computer tools for altering voice focus on changing primarily features indicating the gender and age of a speaker. It should be noted that when changing the voice in real time, there is no change in a sound record. Changes are introduced at the stage of developing a speech signal entering the recording channel, as a result (by means of digital-to-analog transformation) a new, modified speech signal is formed, but without any signs of processing.

¹ Лебедева А. К. Судебно-экспертное исследование обликовых характеристик личности по фонограммам речи: правовые и методические аспекты : дис. ... канд. юрид. наук. Москва, 2017. 231 p.

To understand how a voice is changed and which changes it undergoes, first, it is needed to study existing techniques and methods of intentional voice change using computer tools. There is a variety of programs for changing a speaker's voice, such as *AV Voice Changer Diamond*, *Voxal Voice Changer*, *MorphVOX JR*, *MorphVOX Pro*, *Scramby*, *Fake Voice*, *Funny Voice*, *Clownfish Voice Changer*, *VoiceMod*, etc.¹.

The above-mentioned programs are created particularly for a PC, however, there are also applications for altering voice which are made for modern phones and smart phones. It is possible to download them on the Internet. These programs enable to change the sex and age of a speaker and to help a criminal hide his personality this way.

Software and hardware tools for changing a voice can be classified into two groups:

- modifying a speech signal directly before it was sent to a recording channel, that is in real time;
- changing a speech signal already recorded in a sound record using post processing.

Diagnostic research on determining voice and speech characteristics is performed with the use of a set of methods:

- audio-linguistic analysis is intended to study a voice message, verbal behavior by analyzing and evaluating features of a speaker's speech and voice: features of the speech flow, phrases, words, sounds.
- acoustic comprising of phased calculation and evaluation of acoustic diagnostic features and comparison of these features vectors reflecting physical parameters of a speech signal.

Difficulty while research on sound records having undergone changes in real time is that none of the features of audio editing are formed: a completely new continuous sound record with a speech signal recorded in it, changed directly while its recording is created. In case of sound record change by means of post processing, a forensic expert should pay attention (excluding search for signs of change in the acoustic characteristics of the speech signal) to the presence of audio editing signs. The voice in a sound record changed both in the first and second way can be studied by analyzing file service-based data, within the framework of which the binary structure of a file, its metadata and other service characteristics are studied. A similar analysis is carried out by implementing such programs as *X-Ways Forensics*, *DUMP*, *Exiftool*, *WinHEX*, etc.

The majority of computer tools for changing a speaker's voice or his age work according to a similar algorithm: they automatically, according to a pre-laid program, change those voice parameters that make up a functional-dynamic complex of human acoustic skills, especially the frequency of the main voice

¹ 19 лучших программ для изменения голоса онлайн и офлайн [Электронный ресурс]. URL: <https://lifehacker.ru/programmy-dlya-izmeneniya-golosa> (date accessed: 16.03.2021).

tone. The above-mentioned programs can change both the previously recorded sound record as well as modify the speech signal in real time (for example, when communicating by IP telephony, such as *Skype*, *WhatsApp*, *Viber*, *Telegram*, etc.). This method is used when it is necessary to hide your personality, but there is no chance to avoid a conversation in real time. The scheme for this algorithm is as follows: at the beginning, the speech signal is converted to a digital code with the help of analog-to-digital converter, and then processor converts this code according to the algorithm recorded in the processor. As a result, the digital code is converted to an electrical signal by means of analog-to-digital converter that the addressee receives at the other end of the telephone line.

In case of using the mentioned programs, delays appear while transmission of already altered speech signal. Before voice recording or telephone conversation, the user independently chooses how he wants to change his voice, how to lower or raise the frequency of the main tone, and only after begins to record a conversation accordingly.

So, let's consider programs processing a speech signal, that is when a sound record itself undergoes changes by means of any device. When changing the gender and age of a speaker this way, a situation is possible when a sound record with a recorded voice of one person is divided into several parts and each part is processed individually in a different way by software tools. As a result of changes, you can get several sound records with perfect voices from one sound record with a recording of the voice of one person. In such cases, the forensic expert should draw attention (except for the search for signs of change in acoustic characteristics of a speech signal) to the possibility of the presence of audio editing signs. Both types of the above programs changing sex characteristics of the speaker are based on the algorithm according to which the main tone changes by lengthening or shortening short speech segments. To preserve a natural speech tempo in case of a tone lowering (lengthening segments), some segments are deleted; in case of tone raise (shortening segments), certain segments are duplicated. In a foreign literature, the process associated with modification of frequency of the main tone without changing its speed is called *Pitch-Shifter* (word per word translation: *the main tone change*) is a sound effect or a corresponding device that adds to a signal its copy falling behind the main tone at any interval within two octaves up or down¹. Pitch-shifter is a way to alter the basic tone of the speech signal without changing its length. As it is known, the voice coloration depends on the values of formants frequency: if we change the frequency of the main tone of the speech signal with the help of specialized tools, then in this way, we will also change the value of formants, resulting in change in the voice nature, specifically in its timbre.

In the United States of America, over 10 companies produce telephone devices and add-on devices which have a voice change feature (*voice changer*)

¹ Питч-шифтер [Электронный ресурс]. URL: <https://ru.wikipedia.org/wiki/Питч-шифтер> (date accessed: 16.03.2021).

and are implemented by using the latest specialized chip. Add-on and telephone devices provide the user with an opportunity to speak one of 16 versions of voices: from a low bass to a high soprano, at the same time maintaining the speech tempo and sound naturalness. It enables to talk and not be recognized even by your closest people. Such products are of demand mostly for parents, minors who often stay home alone¹.

The Americans conducted research on the effect occurring as a result of increasing the frequency of the main tone called *Mickey Mouse effect*. It was called that way since due to increase in the frequency of the main tone the voice pitch also raises, and the listener hears a little “squeaky” timbre: similar to characters of cartoons about *Mikki Mouse*. To avoid this effect and to make a voice sound more natural, a formant correction algorithm is implemented thanks to which the position of formant frequencies updates after or at the time of pitch shifting, in other words the main tone formant frequencies do not change with a change in a frequency.

Marketers have long realized that the use of media characters in projects always draws audience attention to a product and, as a result, increases profits. The Americans and Europeans get used to listening to rules of passengers' behavior on board the aircraft voiced by celebrities.

However, expenditures for a project from attracting different celebrities are also growing: you have to pay a honorarium, to adapt to a celebrity's schedule, in addition, some of them can refuse to participate in it. As we noted above, creators of the *Vera Voice* project, made by using a neural network, succeeded in doing so because they decided not to invite celebrities at all: why they should pay them if you can simulate a speech acoustic signal with the help of the program.

Changing the sex of the speaker voice is possible by deleting frequency bands from 100 Hz to 500 Hz from the spectrum of a male voice; as a result of such changes, listeners identified a male voice in a suggested sound record as female².

Research on a voice altered by computer tools is a complex and controversial task for forensic video and audio analysis. Due to the fact that instrumental study of a changed voice recorded in a sound record still has certain difficulties, forensic experts use linguistic methods for identifying changes made to a sound record in practice. As it is known, the content and semantic parts of the speech material characterize a number of personality traits, and in the case of intentional

¹ Кринов С. Н. Современные методы изменения голоса и идентификация говорящего. *Информатизация правоохранительных систем* : мат-лы VIII Междунар. конф. Москва, 1999. Р. 328—330.

² Потапова Р. К. Сексолект как комплексное гендерное понятие (об усложненном характере задачи определения сексолекта в судебной фонетике). *Информатизация правоохранительных систем* : мат-лы X Междунар. конф. Москва, 2001. Р. 314—320.

change in a voice using computer tools, there is no change in the content of statements: only acoustic characteristics change.

For example, when oral speech in a sound record at the auditory level is perceived as a female voice of an elderly person, and the conversation is characterized by a low level of stylistic and speech competence (for example, with the use of curse words, low degree of development of speech and stylistic skills) and there are no signs of conscious distortion in oral speech, it can become the basis for drawing a possible conclusion on the fact that a speaker is a person with elementary / incomplete secondary education who has a low level of speech culture in communication.

It should be stressed that men and women speak with different intonations, use various means of non-verbal communication, pronounce words in a different way; also, their so-called vocabulary varies. In speech, women more often use interjections (“Ouch!”, “Oh”, “Hey”, “My God”, etc.) helping to express emotions, diminutive words, phrases that convey feelings and emotions (“my sweetheart”, “scary”, “cool”, “it is such a pleasure”, etc.).

Conducting of forensic video and audio analysis comprises of a complex of various methods of not only linguistic analysis but also instrumental. Certain linguistic voice characteristics may not change in case of using computer and technical tools for distortion of the speaker’s sex and age: the forensic expert must know how to establish the fact of changing a person’s voice by means of instrumental analysis methods.

As far as it is known, methods of research on an altered voice were not developed until today. Thus, we will analyze which of the existing methods of forensic video and audio analysis can be applied to study a voice changed with the help of computer tools.

When conducting experimental researches on a voice and speech of males and females (20—35 years old), their characteristics were changed using *Adobe Audition* and *AV Voice Changer Diamond*. It should be noted that these programs are publicly exposed: they can be downloaded from the Internet.

As it is known, the sound pitch depends on the frequency of the main tone. The higher frequency, the higher a sound. To change the voice of a woman-speaker, we used *lower pitch* function, to change the voice of a man-speaker: *raise pitch* function. Using a certain algorithm laid down in the program, the voice pitch in the first case automatically lowers as a result of frequency decrease of the main voice tone, the female voice turns into a male, in the second case: on the contrary, raises due to increase in the main tone frequency.

It is possible to change the voice pitch in *Adobe Audition* program manually by changing certain settings. For example, on the *Effects* tab in the *Time and Pitch* section, select *Stretch and Pitch*, in the dialogue box: *Pitch Shift* parameter, reducing its value by 5 halftones: as a result, the voice tone pitch immediately lowers (for example, a female voice turns into a male). It should be noted that the main advantage of the *Stretch and pitch* effect is that it is possible to change

the tone of the sound signal without changing the tempo of the voice recording. In *Adobe Audition* program, you can also select the *Advanced Settings* panel (*Advanced* tab). By selecting the *Izotope Radius* algorithm, the user gets advanced features, for example, setting *Preserve Speech Characteristics* check box maintains the realism of speech in case of changing in the frequency of the main voice tone.

The *Formant Shift* function automatically determines how formants adapt in the event of a tonality shift. By default, the zero value adjusts formants along with a tonality shift, at the same time maintaining timbre and realism. Setting values above zero raises the timbre enabling you to convert a male voice to a female one, below zero: creates the opposite effect: converts a female voice to a male one.

We deem it important to stress that due to the fact that low frequencies possess more energy than high ones, and some sounds are clearly recognized by one first formant (for example, sounds [a], [o], [y]), if you cut the spectrum auxiliary formants of the speech signal with the help of low-pass filter, the individual coloration of uttered sounds for each person will disappear, but the very semantic information embedded in the speech message will not be altered and remain clear.

Let's consider, for example, the *AV Voice Changer Diamond* program, which belongs to methods of changing a speech signal in real time, that is in the process of its formation during entry into the recording channel. This program has a *Voice morpher* function, which is responsible for changing a voice. The algorithm for changing a voice is the same as in the previous program: we can raise or decrease the frequency of the main voice tone while recording. To start recording a voice, click on the *Recorder* icon and turn on the recording (*rec*). Now, when you speak into the microphone, the speech signal will change according to the parameters of the *Voice morpher* field. These settings for changing a voice can be changed while recording: for example, we can record one half of a speech at a low frequency and the other half: at a high frequency. Pressing the *stop* button stops recording and automatically saves it in *MPEG-1 Layer 3 (*.mp3)* format.

The program also includes certain algorithms, enabling which, we can choose, for example, the change of a female voice to male, the voice of a child, an elderly person, etc. You can select a specific algorithm in the *Nickvoices* tab, individual algorithms are introduced for female and male voices.

This program allows you to change a voice when communicating through various programs such as *Skype*, *WhatsApp*, *Telegram* via voice chats and voice messages, and can also change a voice from the streaming audio that will be played on the computer when using the program.

However, we cannot exclude the fact that voice change systems are implemented by criminals to commit criminal offenses. As practice demonstrates, even an experienced forensic expert may not identify changes in a voice, which led to the following conclusion: perhaps in some unsolved criminal cases involving anonymous phone calls, criminals used technical means of voice

change; however, due to the reasons mentioned above the fact of change could remain unnoticed by forensic experts.

To solve this task, it is needed to consider the properties of possible algorithms for changing a voice. The above-mentioned *pitch shift* and *voice changer* algorithms alter the main tone by lengthening or shortening short sections of speech. To maintain the natural tempo of speech in case of lowering a tone (lengthening of sections), some sections are deleted, in case of raising a tone (shortening of sections), some sections are repeated twice. For this purpose, there is no need to perform any analysis of the input signal: the algorithm operates formally and equally at pauses, vowels and consonants.

In case of a tone raise, there should be repetitive sections of speech in the signal. The duration of such a section is a parameter by which you can determine the degree of shift and restore the original speech.

In case of a tone lowering certain sections are distinguished in a signal. Since the algorithm functions formally, without being connected to specific sounds, it may result in loss of some consonant and transition sections. Such deformations can be detected by ears at raised and even normal tempo of an original speech. To avoid it, a speaker delivering a speech should speak more slowly, maintaining prolong pauses in a speech, comparing to the norm. At the same time, a listener can perceive disappearance of some short consonant and transition sections as slip of a tongue. Identification of signs of tone lowering algorithm application in such conditions becomes a complex task which can be solved in availability of sufficient duration of recorded message in a studied sound record, when the quantity of detected slips of tongue (in case of listening sections) is statistically significant. In this case, the evaluation of probability as to disappearance of short speech segments in a studied sound record must coincide with a calculated probability under a certain parameter of the tone shift down the frequency¹.

Functionalities of modern software include the task of destroying signs of changes in a sound record. For example, in the *Sound Forge* program you can create a desired sound wave shape, adjust a tempo and change spectral characteristics, timbre and sound quality of an original sound record, remove signs of crossfade, which considerably complicates the process of forensic video and audio analysis. By using *hex*-editors, you can remove signs of post-processing even in the binary structure of a file. In such cases, the only way to identify the set of basic personality traits on the basis of the analysis of a person's voice and speech is to conduct a linguistic analysis allowing to identify signs of editing even in well-edited records, which will help a forensic expert to make a well-grounded and informed decision.

¹ Лебедева А. К. Особенности судебно-экспертного исследования голоса, изменённого при помощи компьютерно-технических средств. *Известия Тульского государственного университета. Экономические и юридические науки*. Тула, 2016. № 3—2. Р. 323—329.

For example, if a voice in a sound record is perceived by a listener as the voice of a child, it is possible to determine, for example, discrepancy between the level of speech culture and the level of education of a person and so on. In case a forensic expert has samples of a person's voice and speech whose voice is presumably recorded in a sound record, it is possible to conduct a comparative study and determine the presence of coincidences / differences by certain features of the linguistic group. In the course of instrumental analysis, statistical, dynamic, spectral speech characteristics are studied. Main provisions of the instrumental analysis of a voice are based on the individuality of the spectral content of a voice for each person, despite general mechanisms of specific sounds formation.

Conclusions. Summarizing the above, let's highlight key moments that a forensic expert should pay attention to in the presence of signs characteristic for the use of computer software to change a voice.

1. To determine the presence/absence of signs of changes in a sound record and their cause which may be the result of the use of computer tools to change a voice, editing of a sound record or peculiarities of devices operation, etc. During the instrumental analysis, to identify, if possible, the software implemented to record a studied sound record by analyzing the file structure, spectral representation of a signal, etc.
2. The use of computer tools to change a voice can be evidenced by: the presence in the file metadata of information on the use of specific software (being used to alter a voice), inconsistency between linguistic and acoustic features and characteristics of the speaker's speech. For example, a voice that a listener perceives as male at the auditory level in a studied sound record corresponds to characteristics of a woman's speech or a person in an excited state (alcohol or drug intoxication, etc.).

Thus, despite the lack of developed methodological approaches to the study of a voice altered by computer tools, it is crucial to establish the fact of the use of software tools, and (in some cases) to detect altered voice and speech characteristics that individualize a person, and later, at the next stage: to identify a speaker.

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Х. В. Луценко, А. І. Роман, С. С. Григорян, В. В. Кочарян

Дослідження голосу, зміненого маскуванням

Розглянуто поняття й сутність маскування з технічного погляду та з погляду кримінального права. Наведено найпоширеніші способи маскування голосу й мовлення, деякі методи виявлення навмисного змінення голосу та мовлення людини за допомогою комп'ютерно-технічних засобів і лінгвістичного аналізу.

Проаналізовано останні публікації, а також дослідження в галузі імітування голосу й мовлення людини за допомогою новітніх комп'ютерно-технічних засобів — деяких сучасних технологій, створених на базі штучного інтелекту, а саме — нейронних мереж. Розглянуто найпоширеніші способи маскування голосу й мовлення диктора. Наведено деякі методи виявлення навмисного змінення голосу за допомогою комп'ютерно-технічних засобів і лінгвістичного аналізу.

Проаналізовано деякі наявні програмно-технічні засоби, що змінюють мовленнєвий сигнал як у реальному часі (а саме — у процесі його формування під час надходження у канал запису), так і на заздалегідь підготовленому записі (за допомогою засобів оброблення мовленнєвого сигналу після запису на будь-якому пристрої). Констатовано (зважаючи на експертну практику), що в тих випадках, коли виявити ознаки маскування голосу/мовлення не виявляється можливим інструментальним способом (що, зі свого боку, суттєво ускладнює процес виконання судової експертизи відео-, звукозапису), то єдиною можливістю встановити індивідуальні характеристики голосу й мовлення залишається лінгвістичний аналіз.

Зроблено висновок: незважаючи на відсутність розроблених методичних підходів щодо дослідження голосу, зміненого за допомогою комп'ютерно-технічних засобів, є змога як визначити факт використання програмних засобів, так і (у деяких випадках) діагностувати змінені характеристики голосу й мовлення, що індивідуалізують особу, а згодом, на наступному етапі,— провести ідентифікацію диктора.

Із метою вирішити діагностичні й ідентифікаційні завдання досліджено проблемне питання в експертизі відео-, звукозапису, яке все частіше постає перед експертами у цій галузі.

Ключові слова: імітація; маскування; експертиза відео-, звукозапису; монтаж; ідентифікація особи за голосом і мовленням; інструментальний аналіз; лінгвістичний аналіз.

К. В. Луценко, А. И. Роман, С. С. Григорян, В. В. Кочарян
Исследование голоса, изменённого маскировкой

Рассмотрены понятие и сущность маскировки с технической точки зрения и с точки зрения уголовного права. Приведены наиболее распространённые способы маскировки голоса и речи.

Проанализированы последние публикации, а также исследования в области имитации голоса и речи человека с помощью современных компьютерно-технических средств, а именно обученного искусственного интеллекта на основе нейронных сетей. Рассмотрены наиболее распространённые способы маскировки голоса и речи диктора. Приведены некоторые методы выявления умышленного изменения голоса и речи человека с помощью компьютерно-технических средств и лингвистического анализа.

Проанализированы некоторые существующие программно-технические средства, изменяющие речевой сигнал как в реальном времени (а именно — в процессе его формирования при поступлении в канал записи), так и на заранее подготовленной записи (с помощью средств обработки речевого сигнала после записи на любом устройстве). Констатируется (исходя из экспертной практики), что в тех случаях, когда выявить признаки маскировки голоса/речи не представляется возможным инструментальным способом (что, в свою очередь, существенно затрудняет процесс производства судебной экспертизы видео-, звукозаписи), то единственной возможностью установить индивидуальные характеристики голоса и речи является проведение лингвистического анализа. Несмотря на отсутствие в настоящее время разработанных методических подходов к исследованию голоса, изменённого с помощью современных технологий, установить факт использования вышеуказанных средств возможно.

С целью решить диагностические и идентификационные задачи исследован проблемный вопрос в экспертизе видео-, звукозаписи, который всё чаще встаёт перед экспертами в этой области.

Ключевые слова: имитация; маскировка; экспертиза видео-, звукозаписи; монтаж; идентификация личности по голосу и речи; инструментальный анализ; лингвистический анализ.

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Modern possibilities of diagnostic research in the field of forensic video and audio analysis

Issues that are increasingly arising in criminal proceedings are highlighted, namely: use of data obtained as a result of diagnostic researches on video, sound recordings that allows to ensure a higher level of completeness, objectivity and comprehensiveness of research. The purpose of the article is to analyze the possibilities of forensic diagnostic researches on video and sound recordings of both oral speech and the sound environment of an offense event. Various modern possibilities of researches on video and sound recordings are considered. Attention is paid both to the specifics of diagnostic speech researches in order to obtain information about personality of the unknown speaker and to information that can be obtained through research and diagnosis of non-speech information. Analyzed the possibilities (within the framework of the examination of video, sound recording) diagnostic researches on directly speech information, including the definition of: oral speech form, nature of relations between the interlocutors, conversation meaning (definition of the meaningful situation: consent vs disagreement; permission vs prohibition; understanding vs misunderstanding; request; advice; promise; assurance; gratitude; threat; clarification; order; question; message, etc.), rate of speech and the emotional state of the interlocutors, as well as expert diagnostics of biological parameters of the speakers. Possibilities of diagnostic studies of technical studies of recording media and recording equipment, that can contain information about the technology of obtaining/fixing/saving video, sound recordings, properties, and features of the media itself are considered. Non-speech sounds are classified according to their belonging to certain sources. The article highlights effectiveness of using the forensic information obtained through forensic examination in practice of investigating crimes.

Keywords: forensic video and audio analysis; sound environment; diagnostic researches; non-speech signals; research; speech.

Formulation of Research Problem. A special role in criminal proceedings (in particular, in criminal procedural proof) is drawn to factual data obtained from video and audio recordings. This is due to the fact that factual data contained on storage media, given the possibility of their perception and verification after a certain time, are characterized by a certain degree of

reliability; they can often be used in proof without disclosing sources and methods of obtaining them.

Results of forensic video and audio recordings can be used while investigation only if they are duly processed in procedural-forensic way. The procedural aspect is governed by the criminal procedure law, and rules of technical format have been developed in practice.

Reproduction of video and audio recordings (both while preliminary investigation and trial) facilitates the perception of a corresponding information, creates a *being there* effect and generally enables to ensure a higher level of completeness, objectivity and thoroughness of investigation. The relevance of research is also confirmed by the fact that a full and objective establishment of circumstances of events to identify the mechanism of crime and guilt of participants while investigation can be ensured not only through identification research on video, sound recording, but also through diagnostic one.

Analysis of Essential Researches and Publications. Possibilities of diagnostics: information that can be obtained from video, sound recordings have been considered by such scientists, as V. L. Sharshunskiy, O. O. Lozhkevych, V. O. Snietkov, V. O. Chyvanov, Yu. V. Iashchurnyskiy, V. X. Manerov, S. M. Vul, L. M. Cherniak, A. T. Hulak, V. I. Zakaretskiy, O. K. Dambrauskaite, O. K. Yermolaiev, V. M. Sorokin, S. L. Koval and others ¹. Their research is a significant contribution to the development of theoretical principles for the use of specific expertise in criminal proceedings. At the same time, the analysis of possibilities of forensic diagnostic research on video and sound recordings is an issue that currently should be thoroughly researched on.

The **Article Purpose** is to outline possibilities of diagnostic research on video and sound recordings through coverage of their classification, when conditionally by a research object, three directions of diagnostic research can be identified and described in the course of forensic audio and video analysis:

¹ Е.г., Ложкевич А. А., Снетков В. А., Чиванов В. А., Шаршунский В. Л. Криминалистическое исследование звуковой среды, записанной на фонограмме : метод. пособ. Москва, 1981. 48 р. ; Ящурицкий Ю. В. Криминалистическая диагностика звуковой среды : дис. ... канд. юрид. наук. Киев, 1990. 327 р. ; Манёров В. Х. Успешность восприятия говорящего в зависимости от индивидуальных особенностей слушателей. *Вопросы психологии*. 1990. № 1. Р. 147—153 ; Вул С. М. Судебно-автороведческая идентификационная экспертиза : метод. пособ. Харьков, 2007. 64 р. ; Дамбраускайте О. К. Использование особенностей профессиональной лексики при исследовании анонимных документов. *Вопросы судебной экспертизы и криминологии*. 1982. Вып. 16. Р. 41—49 ; Сорокин В. Н., Макаров И. С. Определение пола диктора по голосу. Обработка акустических сигналов, компьютерное моделирование. *Акустический журнал*. 2008. Т. 54. № 4. Р. 659—668 ; Коваль С. Л., Панова Е. А. Экспертный метод диагностики биологических параметров диктора по голосу. *Труды Международной конференции «Диалог 2007»*. Наро-Фоминск, 2007. Р. 263—268.

- study of direct speech information which may contain information about the identity of a person in question;
- technical studies containing information about the technology of obtaining / recording / storing video, sound recordings, properties and features of data carrier itself;
- research on non-speech information (namely, the sound environment which combines information about sound sources by acoustic phenomena accompanying the process of video, sound recording, or directly associated with a situation of an offense event).

Main Content Presentation. An offense event should always be determined as an event taking place in a particular environment conditioned by spacetime properties. The task of the forensic research on sound environment, as well as forensic cognition of an offense event in general, are due to the tasks of procedural proof, that is while criminal proceedings, an offense event, time, place, a way of committing a crime, a guilty person, etc. should be proven.

The audio environment of an offense event is a single system of sound traces of natural and artificial sources of origin, subjective-communicative activity of an offender, tools, instruments and technical tools for committing crimes used by the offender and united with a common goal. Fulfillment of the above goal is due to the nature and durability of effects on the object of an offense event, as well as unity of a place (space) and manner of its achievement¹. Legally speaking, the peculiarity of the analysis of the sound environment while investigating an offense event lies in the fact that such research enables to prove many facts of criminal activity taking place face-to-face, without witnesses. During offense commission, its participants facilitate interaction between means of criminal activity (explosive devices, weapons, tools) and physical environment, and thus a set of sounds that forms the sound environment of a crime emerges.

Oftentimes, law enforcement agencies are addressed with anonymous reports on certain events; for example, facts of sabotage, threats, offenses, bullying presented as reports on bombing of certain facilities, etc. For some reason, “authors” of such reports are reluctant to reveal their personality, thus further complicating investigation of such offenses. In such circumstances, there is an urgent need to study video and audio recording to find all possible data about the unknown speaker. Obtained information about the identity of the unknown speaker provides an opportunity to more effectively identify and search for a particular person, reduce the number of persons who are the subject to inspection, thereby reduce the time of offense investigation. In addition, recorded non-verbal sounds from various sources (street noise; sounds of working mechanisms; different signaling devices) accompanying oral speech (the so-called sound environment) can be used to prove various facts and circumstances associated with an offense event. Separately, let’s note that the range of circumstances that can be determined by expert researches keep constantly expanding.

¹ Ящуринский Ю. В. *Op. cit.*

Regarding diagnostic research directly on speech information. The audio content of recordings containing speech information and information about the sound environment is analyzed by ear. The hearing range and experience of acoustic diagnostics under certain skills enable to distinguish necessary elements from the sound environment, evaluate and determine their belonging to a specific group of sound phenomena ¹. At the same time, let's emphasize that no matter which accurate measuring instruments and sound visualization methods are used by forensic experts, the conclusion of video and sound recording examination begins to be formed and finalized only considering auditory perception of sound information recorded in a sound record (verbal and nonverbal nature of origin).

Diagnosis of directly verbal information includes the definition of: forms of oral speech, nature of relations between interlocutors, meaning of conversation content, speech tempo and emotional state of interlocutors. First of all, forensic experts determine the number of speakers, i.e. whether the speech is the statements of only one person or the conversation of two, three or more people. One person's statement can be a story about what they saw, a report, lecture, speech at a meeting, etc. During a conversation of two or more people, statements may influence each other, be combined, interact, complement each other, several topics of conversation may develop simultaneously, etc.

The nature of the relationship between participants of a conversation is determined, considering circumstances of a case (proceeding), analysis of the content and manner of statements. Generally, there are three types of relationships: formal, neutral and close.

By a voice tone, intonation and content of conversations you can also establish an emotional state of a person at the time of conversation: calm, even, irritable, depressed, joyful. Fundamental emotions, according to K. Izard ², can be called:

- 1) interest — anxiety;
- 2) joy;
- 3) surprise;
- 4) grief — suffering;
- 5) anger;
- 6) disgust;
- 7) contempt;
- 8) fear;
- 9) shame;
- 10) guilt.

All other emotions are their derivatives and combinations. Usually, an emotional state of a speaker is indicated in an expert conclusion as a commentary.

¹ Ложкевич А. А., Снетков В. А., Чиванов В. А., Шаршунский В. Л. *Op. cit.*

² Изард К. *Эмоции человека : монография ; пер. с англ. под ред. Л. Я. Гозмана, М. С. Егоровой.* Москва, 1980. 439 p.

Human oral speech is characterized by acoustic and linguistic features, which, while being individual and constant, help us not only to recreate an approximate appearance of a person who is speaking but also to identify it. By a person's oral speech we can establish the place of stay, education, intellectual level, communication skills, temperament, emotional state at the time of conversation, psychological traits of a speaker, his socio-professional belonging, the circle of his communication, age, gender, certain anthropological data, nationality, speech defects (burring, snuffling, lisping), etc. Practice has demonstrated that particular biological parameters of the speaker (sex, age, height, weight) can be determined fairly accurately by his speech. However, expert diagnosis of biological parameters of those speakers who have non-standard temperament parameters is more complex and requires special training of forensic experts. An issue on the officially certified characteristics of the speaker: biological (sex, age, height, weight) and social (native language, place of language skills formation, education, profession and social environment or social belonging) indicate only corresponding (potential) social and biological characteristics of a person being inspected, that are characteristic of a relevant category of people.

Diagnostic research on the establishment of conversation meaning includes detection of a content situation: agreement — disagreement; permission — prohibition; understanding — misunderstanding; request; advice; promise; assurance; gratitude; threat; clarification; order; question; report; etc.

Regarding diagnostic technical researches on recording media and equipment, which may contain information on the technology of receiving/recording/storing video, sound recordings, properties and features of a data carrier itself. The essence of this type of forensic examination of video and sound recording is to carry out researches on technical means of receiving/transmitting/recording/storing visual and additive information and its carriers. The following studies are performed to establish: technical specifications and technologies for video and audio recording (in particular, recording system (mechanical, optical, magnetic), method (analog or digital)); the fact of copying, re-recording or duplication; signs and methods of editing; technical specifications of recording, the existence of defects, damage, etc. as well as (for the purpose of diagnosing recording devices, means of their manufacture) to determine the technical condition of video, audio and their components, nature of faults, probable causes, etc. Thus, for example, in the practice of criminal offense investigations while forensic video, audio analyses and devices for their creation, professionalism of a person who conducted a sound recording is determined, age of records, initial condition of a studied sound record is restored.

At the same time, ***issues of forensic diagnosis of the sound environment*** should be viewed separately. Auditory perception is most often associated with visual perceptions of what is happening. The sound environment of a studied sound record allegedly transports the listener to the environment characteristic of this sound background: a stadium, room with open windows, long corridor,

underground station, countryside, etc. The sound environment (noise level, existence of certain sound sources, frequency of sound vibrations) inherent in each real situation along with the language situation help us to draw conclusions about the environment by its sound manifestations based on our own experience and auditory memory.

In general, non-verbal sounds according to their belonging to certain sources can be classified as follows:

- sounds typical of natural sources of a sound:
 - a) nature sounds (voices of birds, animals, noise of wings, noise of animals movement, etc.), in particular, sounds inherent in the human person (noise of steps, hands clapping, non-verbal sounds of movement, etc.);
 - b) sounds of inanimate nature (wind, thunder, surf noise, leaves rustle, etc.);
- sounds produced by machines, apparatus, devices:
 - a) sounds of musical instruments;
 - b) sounds of TV, radio broadcasting, reproduction;
 - c) siren sounds, alarm systems, alerting systems, etc.;
 - d) sounds of communication devices (phone calls, messengers), clockwork, etc.;
- sound vibrations, functionally characteristic of mechanisms, machines, appliances:
 - a) sounds of industrial mechanisms (machine tools, cranes, presses);
 - b) sounds of vehicles;
 - c) sounds of household appliances (vacuum cleaner, refrigerator, electric razor);
 - d) sounds of electric and hand tools (electric drill, hacksaw, lawn mower, etc.);
 - e) sounds of office equipment (office equipment, printer, scanner, keyboard, cooler);
- sounds characteristic of objects for non-intended purpose:
 - f) falling objects, car body hits, etc.;
 - g) use of household items (dishes shattering; fallen coins jangling; the sound of the door opening/closing; a bridge creaking, etc.).

The answers to the questions of forensic diagnosis of the sound environment are primarily based on an integrated analysis of the characteristics of those sound sources (mostly of technical origin) that make up the sound environment of an offense event.

Conclusions. Summarizing the above, in forensic diagnosis can be used both information that can be obtained about a person's personality by sound records with a speech, and information about the acoustic environment (chronology of events that take place), about non-verbal sources of sound signals (a phone being dialed, sources of noise or musical obstacles, etc.), determination of acoustic conditions and circumstances of sound record production.

The conducted research allows to distinguish and classify data of results of diagnostic researches on video and sound recording which:

- can be used to obtain information about traits and condition of a speaker by his oral speech;
- may contain information about a technology of receiving / recording/ storing video and sound recordings, properties and features of the data carrier itself;
- can store information about the sound environment: sound sources by their acoustic characteristics that are directly associated with a situation of an investigated offense event.

The conducted research does not exclude all possibilities of forensic diagnostic research on video and sound recordings, and only confirms the necessity of performing further detailed and thorough researches in this direction.

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О. І. Брендель

Сучасні можливості діагностичних досліджень у криміналістичній експертизі відео-, звукозапису

Висвітлено одне з важливих питань кримінального судочинства — використання даних, здобутих у результаті діагностичних досліджень відео-, звукозаписів, що дає змогу забезпечити більш високий рівень повноти,

об'єктивності й усебічності розслідування. Метою статті є аналіз можливостей діагностичних досліджень записів як усного мовлення, так і звукового середовища події правопорушення. Розглянуто різноманітні можливості таких досліджень. Звернено увагу як на особливості діагностичних досліджень мовлення з метою отримання інформації про особистість невідомого, так і на відомості, які можна здобути діагностуванням немовленнєвої інформації.

Ключові слова: судова експертиза відео-, звукозапису; звукове середовище; діагностичні дослідження; немовленнєві сигнали; дослідження; мовлення.

О. И. Брендель

**Современные возможности диагностических исследований
в криминалистической экспертизе видео-, звукозаписи**

Освещены вопросы, всё чаще возникающие в уголовном судопроизводстве, а именно: использование данных, полученных в результате диагностических исследований видео-, звукозаписей, что в целом позволяет обеспечить более высокий уровень полноты, объективности и всесторонности расследования. Целью статьи является анализ возможностей криминалистических диагностических исследований видео-, звукозаписей как устной речи, так и звуковой среды события правонарушения. Рассмотрены современные разнообразные возможности диагностических исследований видео-, звукозаписей. Обращено внимание как на особенности диагностических исследований речи с целью получения информации о личности неизвестного, так и на сведения, которые можно получить благодаря исследованию и диагностике неречевой информации. Проанализированы возможности (в рамках проведения экспертизы видео-, звукозаписи) диагностических исследований непосредственно речевой информации, которая включает определение: формы устной речи, характера отношений между собеседниками, смысла беседы (определение содержательной ситуации: согласие — несогласие; разрешение — запрет; понимание — непонимание; просьба; совет; обещание; заверение; благодарность; угроза; разъяснение; распоряжение; вопрос; сообщение и т. п.), темпа речи и эмоционального состояния собеседников, а также экспертную диагностику биологических параметров дикторов. Рассмотрены возможности диагностических исследований технических исследований носителей записи и аппаратуры записи, которые могут содержать сведения о технологии получения/фиксирования/сохранения видео-, звукозаписей, свойств и особенностей непосредственно самого носителя. Классифицированы неречевые звуки по их принадлежности к определённым источникам. Освещены эффективность использования полученной экспертизой криминалистической информации в практике расследования преступлений.

Ключевые слова: судебная экспертиза видео-, звукозаписи; звуковая среда; диагностические исследования; неречевые сигналы; исследования; речь.

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Forensic comparative analysis of soils by the method of spore-pollen analysis using projection to latent structures discriminant analysis

For more than 50 years, spore-pollen analysis data have been used around the world to investigate crimes. Pollen and spores are most often studied while complex forensic examination of soils.

Extensive use of spore-pollen analysis is largely conditioned by such specific features of pollen and spores as their very-large-scale production in plants, the ability to preserve in soils, presence of characteristic morphological features enabling to distinguish and identify individual taxa, etc.

In Belarus, the method of spore-pollen analysis has also been implemented while forensic soil examination: it is increasingly applied to solve identification tasks in comparative analysis to establish the belonging of soil layers on physical evidence to the searched area. Its main advantage is that it is a multicomponent analysis allowing to evaluate both the composition of palynoflora and the percentage of several dozen components of spore-pollen spectra contained in soil samples. Therefore, to determine the belonging of soil layers on physical evidence to the searched area, most informative are data obtained while spore-pollen analysis, helping forensic experts on the basis of a specific taxonomic composition of pollen and spores and percentage of spectra components to draw the most valid conclusions.

Detection of pollen and spores in studied samples in a quantity sufficient for comparative analysis enables to statistically process data of samples microscopic examination. Statistical processing of results is one of the characteristic features of spore-pollen analysis as a method that distinguishes it from other methods implemented in multidisciplinary forensic examination of soil.

Keywords: forensic palynology, soil, microscopy, taxonomic composition, percentage, projection to latent structures discriminant analysis.

Forensic comparative analysis of soils by the method of spore-pollen analysis using projection to latent structures-discriminant analysis

Formulation of Research Problem. Enhancement of possibilities of forensic science depends mainly on the introduction of new research methods into forensic practice. The discovery of a huge number of features characterizing properties of studied objects is essential while group identification, because a more full study of compared objects enables to narrow the group of objects to which they belong, therefore to bring group identification to individual.

When conducting examinations of various physical evidence, experts usually extensively use research methods applied in biology, chemistry and physics. One of the methods which application can be important for forensic examination in the field of soil research is spore-pollen analysis (hereinafter referred to as SPA) aimed at identifying plants based on the study of their spores or pollen.

Analysis of Essential Researches and Publications. Specialists have been using spore-pollen analysis to study all types of soils for decades ¹. Foreign authors describe various methods and examples of using palynology to solve forensic tasks ². Research objects are pollen of gymnosperms and angiosperms and spores of cryptogam plants.

The main tasks of soil forensics are individual identification of a local area by layers on soil-contaminated objects or establishing the source of soil layers, that is determining the territorial belonging of soil layers if the event site is not established. Solution of the first issue is possible in the case of determining a unique set of identification features. At the same time, the more features are studied, the more successful solution for this task will be.

The need to solve tasks on establishing territorial belonging of soil layers on clothing and footwear, vehicles or other objects arises when the location of

¹ Horrocks M., Coulson S. A., Walsh K. A. J. Forensic palynology: variation in the pollen content of soil surface samples. *Journal of Forensic Science*. 1998. Vol. 43. Is. 2. P. 320—323. DOI: <https://doi.org/10.1520/JFS16139J> (date accessed: 20.02.2021) ; Marumo Y. Forensic examination of soil evidence. *Japanese Journal of science and technology for identification*. 2003. No 7. Is. 2. P. 95—111. DOI: <https://doi.org/10.3408/jasti.7.95> (date accessed: 20.02.2021).

² Walter O. J., Adekanmbi O. H., Olowokudejo J. D. Palynological and Lithological Investigation of Forensic Materials at the University of Lagos, Nigeria: First Experimental Palynological Approach in Nigeria. *Journal of Forensic Science & Criminology*. 2019. Vol. 7. Is. 1. P. 104 ; Pereira J. S. R., Ribeiro H., Abreu I. Spatial and temporal environmental pollen analysis of footwear worn in the area of Barcelos, North-West Portugal, in a forensic context. *Aerobiologia*. 2019. Vol. 36. No 3. P. 1—6. DOI: <https://doi.org/10.1007/s10453-019-09598-8> (date accessed: 20.02.2021) ; Reis C. I., Coimbra-Dores M. J., Rebelo M. T., Faria, M. S. Palynological analysis of soil in Portugal: potential for forensic science. *Palynology*. 2019. Vol. 43. Is. 4. P. 585—595. DOI: <https://doi.org/10.1080/01916122.2018.1503199> (date accessed: 20.02.2021).

corpse or object does not correspond to a crime scene, which is the searched area; if it is necessary to establish the vehicle path, the place of material assets theft, etc.¹

The advantage of SPA, compared to other methods applied in multidisciplinary soil forensics, is that it is a multicomponent analysis² enabling to assess both the composition of palynoflora and the percentage of several dozen components of spore-pollen spectra contained in soil samples. Therefore, when solving tasks of soil forensics, oftentimes it is data of spore-pollen analysis that allow forensic experts to draw the most valid conclusions based on a certain taxonomic composition of pollen and spores and the percentage of spectral components.

It should be stressed that in recent years, to assess results of a research on identified spore-pollen complexes, experts started to apply the methods of multivariate statistical analysis³.

The **Article Purpose** is to consider practical approaches to determining the belonging of soil layers (from contaminated objects) to a specific local area with the help of SPA implementing elements of mathematical statistics.

Main Content Presentation. Apart from other issues, soil forensics should address the following issue: “Do soil layers obtained from 2 round-pointed shovels presented for research and a polymer bag with soil samples taken for a comparative study at 2 forest areas where the theft of the upper fertile soil layer was detected have a common genera (group) affiliation?” Along with other research methods, comparative research on the composition of spore-pollen complexes was performed.

To extract pollen and spores from the soil, the separation techniques developed by V. P. Hrychuk⁴ were used. Zinc chloride dissolved in 2% hydrochloric acid with the specific weight of 1.9 was used as a heavy liquid.

¹ Wiltshire P. E. J. Protocols for forensic palynology. *Palynology*. 2016. Vol. 40, Is. 1. P.4—24. DOI: <https://doi.org/10.1080/01916122.2015.1091138> (date accessed: 20.02.2021).

² Хох А. Н., Рылова Т. Б. Доказательственное значение спорово-пыльцевого анализа при исследовании вещественных доказательств. *Вопросы криминологии, криминалистики и судебной экспертизы*. 2018. № 1 (43). P. 148—155.

³ Ochando J. et al. Forensic palynology revisited: Case studies from semi-arid Spain. *Review of palaeobotany and palynology*. 2018. Vol. 259. P. 29—38. DOI: <https://doi.org/10.1016/j.revpalbo.2018.09.015> (date accessed: 20.02.2021) ; Kumari M., Sankhla M. S., Nandan M., Sharma K., Kumar R. Role of forensic palynology in crime investigation. *Journals: International Journal of Social Relevance & Concern*. 2017. Vol. 5. Is. 3. P. 1—13 ; Abdulrahman A. A., Al Sahli A. A., Okoli J. U. The use of soil palynomorphs in forensics. *Journal of Applied Sciences and Environmental Management*. 2018. Vol. 22. No. 1. P. 85—89. DOI: <https://doi.org/10.4314/jasem.v22i1.15> (date accessed: 20.02.2021) ; Riding J. B. A guide to preparation protocols in palynology. *Palynology*. 2021. Vol. 45. Is. 1. P. 1—110. DOI: <https://doi.org/10.1080/01916122.2021.1878305> (date accessed: 20.02.2021).

⁴ Ларина Т. В. Использование метода спорово-пыльцевого анализа при криминалистическом исследовании почв для локализации участков местности. *Проблемы экспертизы растительных объектов*. Москва, 1972. P. 104—106.

Pollen and spores identification was performed in a movable specimen using МИКМЕД 6 (JIOMO) light microscope equipped with a digital camera while magnifying with a 50x to 1000x (with immersion). This was done so that each pollen grain or spore could be turned to both polar and equatorial positions, it is expedient to consider morphological features of the surface structure. In each specimen all pollen grains and spores were counted, encountered during sequential viewing of a specimen in parallel rows, starting from the upper left corner of the cover glass and ending with the lower right corner.

All samples contained a large quantity of pollen and spores (from 246 to 383). It helped to calculate the reliable percentage of spectral components. The composition of certain taxa, the number of pollen grains of each taxon and their percentage in each studied sample are presented in Table 1.

Table 1

**Taxonomic composition, quantity and percentage
of pollen and spores**

Taxonomic composition of pollen and spores	Polymer bag		Shovel № 1		Shovel № 2		Forest area № 1		Forest area № 2	
	No.	%	No.	%	No.	%	No.	%	No.	%
Pollen of tree and shrub species	42,0	17,0	297,0	77,5	281,0	87,0	265,0	87,0	44,0	16,9
Pollen of herbaceous plants and prostrate shrubs	203,0	82,5	15,0	4,0	23,0	7,0	24,0	8,0	216,0	82,8
Spores	1,0	0,5	71,0	18,5	18,0	6,0	15,0	5,0	1,0	0,4
<i>Picea abies</i> (L.) H. Karst. (European spruce)	—	—	1,0	0,3	7,0	2,2	8,0	2,6	—	—
<i>Pinus sylvestris</i> L. (Scots pine)	40	16,3	164,0	42,8	243,0	75,5	218,0	71,5	42,0	16,1
<i>Betula</i> sp. (birch)	—	—	41,0	10,7	4,0	1,2	6,0	1,9	—	—
<i>Alnus</i> sp. (alder)	1,0	0,4	57,0	14,9	17,0	5,3	23,0	7,5	1,0	0,4

Taxonomic composition of pollen and spores	Polymer bag		Shovel № 1		Shovel № 2		Forest area № 1		Forest area № 2	
	No.	%	No.	%	No.	%	No.	%	No.	%
<i>Quercus robur</i> L. (common oak)	—	—	9,0	2,3	4,0	1,2	3,0	1,0	—	—
<i>Ulmus</i> sp. (elm)	—	—	1,0	0,3	—	—	—	—	—	—
<i>Carpinus betulus</i> L. (common hornbeam)	1,0	0,4	9,0	2,3	—	—	—	—	1,0	0,4
<i>Corylus avellana</i> L. (common hazel)	—	—	12,0	3,1	1,0	0,3	1,0	0,3	—	—
<i>Salix</i> sp. (willow)	—	—	3,0	0,8	5,0	1,6	7,0	2,3	—	—
<i>Amaranthaceae</i> subgen. <i>Chenopodioideae</i> (goosefoot family)	43,0	17,5	—	—	6,0	1,9	7,0	2,3	45,0	17,2
<i>Polygonaceae</i> (buckwheat family)	2,0	0,8	—	—	—	—	—	—	2,0	0,8
<i>Apiaceae</i> (celery)	—	—	1,0	0,3	2,0	0,6	1,0	0,3	—	—
<i>Artemisia</i> sp. (sagebrush)	2,0	0,8	2,0	0,5	1,0	0,3	—	—	2,0	0,8
<i>Asteraceae</i> (composites)	3,0	1,2	—	—	1,0	0,3	1,0	0,3	3,0	1,1
<i>Asteraceae</i> subgen. <i>Cichorioideae</i> (common chicory)	3,0	1,2	1,0	0,3	—	—	—	—	4,0	1,5
<i>Poaceae</i> (grasses))	15,0	61,0	11,0	2,9	6,0	1,9	6,0	2,0	16,0	61,3
<i>Cyperaceae</i> (sedges)	—	—	—	—	1,0	0,3	1,0	0,3	—	—

Taxonomic composition of pollen and spores	Polymer bag		Shovel № 1		Shovel № 2		Forest area № 1		Forest area № 2	
	No.	%	No.	%	No.	%	No.	%	No.	%
<i>Typha angustifolia</i> L. (lesser bulrush)	—	—	—	—	5,0	1,6	6,0	2,0	—	—
<i>Myriophyllum spicatum</i> L. (Eurasian watermilfoil)	—	—	—	—	1,0	0,3	2,0	0,7	—	—
<i>Bryales</i> (green mosses)	—	—	4,0	1,0	4,0	1,2	5,0	1,6	—	—
<i>Sphagnum</i> sp. (peat moss)	—	—	67,0	17,5	10	3,1	7,0	2,3	—	—
<i>Lycopodium clavatum</i> L. (club moss)	—	—	—	—	1,0	0,3	—	—	—	—
<i>Polypodiaceae</i> (polypody family)	1,0	0,4	—	—	3,0	0,9	2,0	0,7	1,0	0,4
<i>Salvinia natans</i> (L.) All. (floating fern)	—	—	—	—	—	—	1,0	0,3	—	—

In the overall composition of spectra of samples from round-pointed shovel No. 2 (3 samples) and taken from forest area No. 1 (10 samples), where theft of the upper fertile soil layer was detected, pollen of tree species constitutes 86—91 %, herbaceous plants and prostrate shrubs: 6—8 %, spores: 3—7 %.

Scots pine (*Pinus sylvestris* L.) prevails in the pollen of tree species: 71—76 %. Pollen of alder (*Alnus* sp.): 5—8 %, European spruce (*Picea abies* (L.) H. Karst.): 2—3 %, birch (*Betula* sp.): 0,3—1,6 %. There is also pollen of common oak (*Quercus robur* L.): 1—1,5 %, common hazel (*Corylus avellana* L.): 0,3—0,35 % and willow (*Salix* sp.): 1,1—2,5 %.

Among the pollen of herbaceous plants, pollen grains of goosefoots were mainly identified in specimens (*Amaranthaceae* subgen. *Chenopodioideae*):

1,8—2,6 % and grasses (*Poaceae*): 1,4—2,3%. Constant presence in each sample of pollen of aquatic and semi-aquatic species is typical: lesser bulrush (*Typha angustifolia* L.): 1,5—2,2 %, Eurasian watermilfoil (*Meniantus spicatum* L.): 0,3—0,7 %, sedges (*Cyperaceae*): 0,3—0,35 %.

Cryptogam plants are represented by a small number of spores of sphagnum mosses (*Sphagnum* sp.): 2—3,3 %, green mosses (*Bryales*): 0,9—2 %, polypodies (*Polypodiaceae*): 0.4—1.1 %; there are single microsporangia of a floating fern (*Salvinia natans* (L.) All.) and club moss (*Lycopodium clavatum* L.): 0—0.3%.

The composition of the pollen of tree species for samples from a polymer bag (3 samples) and taken at forest area No. 2 (10 samples) contains Scots pine: 16—16,5 %, as well as single pollen grains of alder: 0.4% and common hornbeam (*Carpinus betulus* L.): 0,4—0,6 %.

In the composition of the pollen of herbaceous plants, in turn, representatives of the grasses were identified: 60,7—61,8 % and the goosefoots: 17,0—17,8 %. Pollen grains of sagebrush (*Artemisia* sp.), buckwheat (*Polygonaceae*), composites (*Asteraceae*), common chicory (*Asteraceae* subgen. *Cichorioideae*) are found occasionally.

Cryptogam plants are represented by single spores of polypodies: 0—0,4 %. In samples from round-pointed shovel No. 1 (3 samples) in the total composition of the spectra, the pollen of tree species is 77.5 %, herbaceous plants 4 %, spores 18.5 %. Scots pine pollen prevails among tree species pollen 53 %. Alder pollen 15 %, birch 11.5 %, common oak 3 %, common hornbeam 3 %, common hazel 4 %, willow 1 %, elm (*Ulmus* sp.) 0.3 %. An insignificant amount of pollen of herbaceous plants was found in: grasses 3.5 %, single-celery (*Apiaceae*), sagebrush, common chicory.

Cryptogam plants are represented mainly by sphagnum moss spores: 18 %, occasionally spores of green mosses (*Bryales*) are found: 1.5 %.

Later, obtained palynological data were analyzed using the principal component analysis (hereinafter referred to as PCA) ¹. For this purpose, *The Unscrambler X v.10.4.1* (CAMO, USA) specialized program was used.

Based on the performed analysis, all studied samples were combined into 3 classes:

- 1) samples from a round-pointed shovel No. 1;
- 2) samples from a round-pointed shovel No. 2 and taken at forest area No. 1;
- 3) samples from a polymer bag and taken at forest area No. 2.

Fig. 1 shows that points reflecting the studied samples and corresponding to one class do not overlap and are located in different areas of the model regarding the 1st and 2nd principal components, indicating significant differences between them.

¹ Kherif F., Latypova A. Principal component analysis. *Machine Learning*. 2020. P. 209—225.

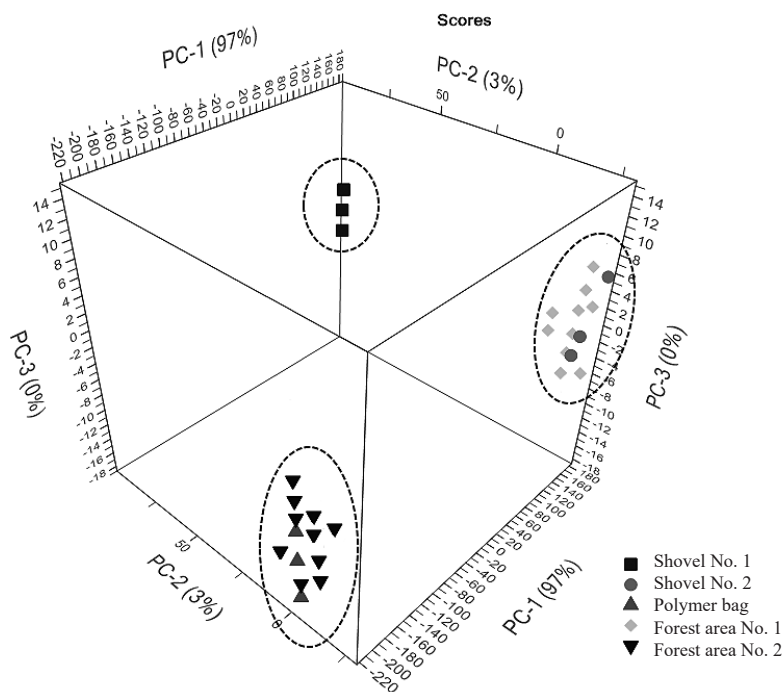


Fig. 1. Graph of PCA-calculations for 29 studied samples

After, projection to latent structures-discriminant analysis (hereinafter referred to as PLS-DA) ¹ was conducted. We used the same data as for PCA, but at the same time samples from round-pointed shovels and a polymer package were assigned to the test dataset (test), and samples from two forest areas where theft of the upper fertile soil layer was detected were assigned to the training data set (training) and preliminary divided into 2 classes: site No. 1 Class I; site No. 2 Class I.

The accuracy of the designed PLS-DA-model assessed by the cross-validation method was 99.8%.

Table 2 shows the significance coefficient of identified samples from round-pointed shovels and polymer bags. The mentioned coefficients have both positive and negative values depending on their contribution to the positive or negative areas of the model, their significance in this case does not depend on a sign and is determined only by deviation from zero.

¹ Sampaio P. S. et al. Identification of rice flour types with near-infrared spectroscopy associated with PLS-DA and SVM methods. *European Food Research and Technology*. 2020. Vol. 246. Is. 3. P. 527—537. DOI: <https://doi.org/10.1007/s00217-019-03419-5> (date accessed: 20.02.2021) ; Ruiz-Perez D. et al. So you think you can PLS-DA? *BMC bioinformatics*. 2020. Vol. 21. Is. 1. P. 1—10. DOI: <https://doi.org/10.1186/s12859-019-3310-7> (date accessed: 20.02.2021).

Table 2

Calculated significance coefficients

Sample No.	Significance coefficient	Deviation
Polymer bag No. 1	-0,9494005	0,085706
Polymer bag No. 2	-0,9619232	0,264547
Polymer bag No. 3	-0,9708145	0,049738
Shovel No. 1_1	3,621863	8,977525
Shovel No. 1_2	3,662567	9,069019
Shovel No. 1_3	3,703678	9,161437
Shovel No. 2_1	0,9100758	0,603048
Shovel No. 2_2	0,9250175	0,297527
Shovel No. 2_2	0,9394305	0,148326

According to the results of the performed research, studied samples from a polymer bag were assigned to Class -1 of the corresponding forest area No. 2 (the average significance coefficient was -0.96), and the samples from the round-pointed shovel No. 2: to Class 1, corresponding to the forest area No. 1 (the average significance coefficient was 0.92). In turn, the samples from the round-pointed shovel No. 2 were not assigned to any of the 2 classes, that is areas where the upper fertile soil layer was stolen (the average coefficient of significance was 3.7; Fig. 2).

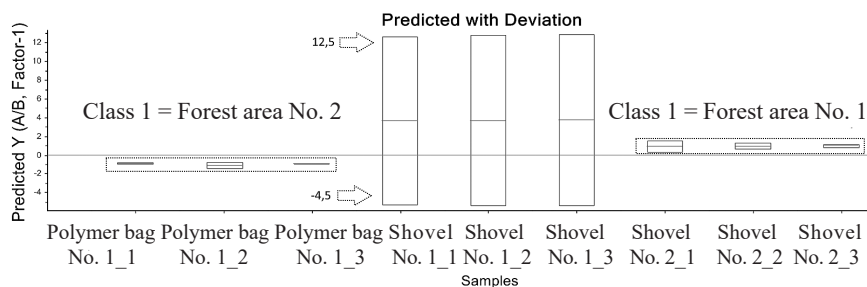


Fig. 2. Division of samples from test dataset

To assess the degree of variability influence of the taxonomic composition of pollen and spores on the distribution of objects from the test dataset (test) in principal component space and to determine the most informative parameters, an analysis of loads on the first and second principal components was performed. The results are presented in Fig. 3.

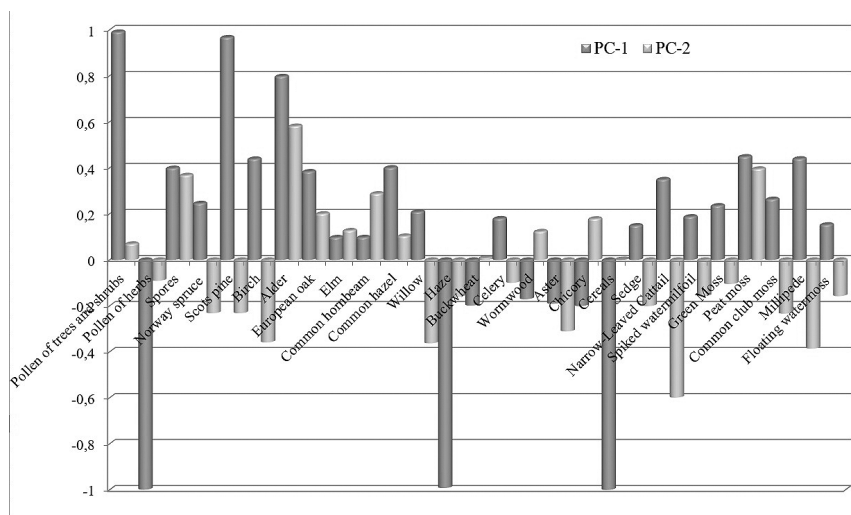


Fig. 3. Graphs of loads on the first and second principal components

As can be noted, the most informative (variable) parameters of the obtained spore-pollen spectra are the overall composition of the spore-pollen spectrum (the quantitative ratio of pollen of three main groups of plants (tree species, herbaceous plants and prostrate shrubs, as well as spores), along with the quantitative and percentage concentration of the following taxa: Scots pine, birch, alder, goosefoots and grasses; that is, it is these indicators that are increasingly responsible for dividing the studied samples into 3 different groups.

Conclusions. In the case considered in this research paper, the abundance of pollen and spores in the samples under study and the possibility of determining these plant remains helped to statistically process the data of samples microscopic examination. Comparison of spore-pollen spectra for samples from round-pointed shovel No. 1 with the rest of the studied samples showed the existing sharp differences, as confirmed by the results of projection to latent structures-discriminant analysis. At the same time, the spore-pollen spectra (1) for samples from the round-pointed shovel No. 2 and taken at forest area No. 1, and also (2) for samples from a polymer bag and taken at forest area No. 2 had a similar percentage of pollen and spores in the main groups of plants in the overall composition of the spectra, in addition, they are characterized by coincidence of the composition of taxa of tree species (regional components), herbaceous and spore plants (local components) and their quantitative content. According to the results of the classification by the PLS-DA method, it was concluded that the samples from the round-pointed shovel No. 2 and taken from forest area No. 1 have a common group affiliation; samples from a polymer bag and forest area No. 2 also had a common group affiliation. At the same time, it should be

emphasized that (1) and (2) have a different generic affiliation. The classification accuracy turned out to be high and amounted to 99.8%. Consequently, pollen and plant spores are an integral part of any type of soil, and therefore (along with a complex of soil morphological characteristics) they can be efficiently used in solving tasks of soil forensics.

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**Судебно-экспертные сравнительные исследования почв
методом спорово-пыльцевого анализа
с использованием дискриминантного анализа
проекций на латентные структуры**

В статье рассмотрены практические подходы к использованию спорово-пыльцевого анализа в установлении принадлежности почвенных наслоений на загрязнённых предметах конкретному локальному участку местности. Показана возможность интерпретации палинологических данных с применением дискриминантного анализа проекций на латентные структуры. По результатам проведённого исследования сделан вывод, что пыльца и споры растений наряду с комплексом морфологических признаков почвы можно использовать как информативный показатель при решении задач судебной почвоведческой экспертизы.

Ключевые слова: судебная палинология, почва, микроскопия, таксономический состав, процентное содержание, дискриминантный анализ проекций на латентные структуры.

Г. М. Хох, В. Л. Шалабода

**Судово-експертні порівняльні дослідження ґрунтів методом
спорово-пилкового аналізу з використанням
дискримінантного аналізу проєкцій на латентні структури**

Уже понад 50 років у всьому світі під час розслідування злочинів використовують дані спорово-пилкового аналізу. Найчастіше пилок і спори досліджують під час виконання комплексної криміналістичної експертизи ґрунтів.

Широке застосування спорово-пилкового аналізу зумовлено значною мірою такими специфічними особливостями пилку та спор, як величезна кількість їх продукування рослинами, здатність зберігатися в ґрунтах, наявність характерних морфологічних особливостей, що дають змогу розрізняти й визначати окремі таксони і т. ін.

У Білорусі метод спорово-пилкового аналізу також знайшов застосування під час виконання судової ґрунтознавчої експертизи: його частіше

застосовують для вирішення ідентифікаційних завдань під час порівняльних досліджень для встановлення належності ґрунтових нашарувань на речових доказах ділянці місцевості. Його головна перевага полягає в тому, що це багатокомпонентний аналіз, який дає змогу оцінювати як склад палінофлори, так і відсотковий вміст одразу декількох десятків компонентів спорово-пилкових спектрів, що містяться в ґрунтових зразках. Тому для визначення належності ґрунтових нашарувань певній локальній ділянці місцевості найбільш інформативними є саме дані спорово-пилкового аналізу, що дають змогу експертам на підставі певного таксономічного складу пилку і спор та процентного вмісту компонентів спектрів дійти найбільш обґрунтованих висновків.

Виявлення пилку і спор у досліджуваних пробах у кількості, достатній для порівняльного дослідження, дає змогу статистично обробити дані мікроскопічного вивчення зразків. Статистичне оброблення результатів — одна з характерних ознак спорово-пилкового аналізу як методу, що відрізняє його від решти методів, які застосовують у комплексній експертизі ґрунтів.

Ключові слова: судова палінологія, ґрунт, мікроскопія, таксономічний склад, відсотковий вміст, дискримінантний аналіз проєкцій на латентні структури.

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Identification as a means of detecting counterfeiting of sausages

Currently, the key issues in domestic economy are issues of competitiveness and quality of goods produced in Ukraine. Ukrainian market of meat products conquers consumers with a wide assortment but one should not rejoice at such a rich list of names. Many enterprises focused on the production of meat products use technical requirements as regulatory documentation. Technical requirements make it possible to significantly reduce the quality of manufactured goods and prevent healthy competition. Food products manufactured according to technical requirements have a reduced cost that is beneficial to many enterprises in Ukraine. Responsibility for the quality of finished product lies not on manufacturer but with the buyers and forensic merchandising experts themselves.

Topic relevance is due to the need to inform consumers about quality and consumer properties of cooked sausages of various manufacturers sold in the retail chain.

Therefore, planning as a function of assortment management for the merchant is to determine the way of future actions, content and sequence of steps leading to the intended goal. Assortment planning methods should allow evaluating the product in three areas: profitability, competitiveness, compliance with quality and safety requirements.

Theoretical research basis were research papers in the field of merchandising, in particular: I. I. Shtyk, L. V. Peshuk and N. V. Budnik, who patented the histological method for studying multicomponent meat systems.

Investigating the Ukrainian market of cooked sausages, the methods of commodity assessment of the safety, quality of meat products and their identification were applied.

The Article Purpose is to investigate methods for identifying the quality of sausages to identify counterfeit products, analyze the procedure for conducting merchandising assessment.

Keywords: *identification, product, falsification, raw materials, sausages, dyes.*

Formulation of Research Problem. Sales of sausages in Ukraine have increased significantly in recent years. The various sausage range has a constant

demand from buyers. Today the consumer faces a difficult task — to choose a tasty and high-quality sausage product. Many Ukrainian sausage companies, in the pursuit of profit to increase sales of their products and reduce their cost, use in production such schemes as dilution of raw materials for sausage with blood or water, use of soy textures, non-traditional components. All these factors negatively affect the quality of cooked sausage product (taste and nutritional properties, aroma and even safety).

In particular, counterfeiters (sausages from different manufacturers), which contained too much water are studied. It should be noted that most sausages are used without heat treatment, so the quality of goods is very important: it directly affects the health of consumers. Ukrainian companies should use ingredients such as meat, lard, seasonings and some other components for cooking sausages.

The **Article Purpose** is to investigate methods for identifying the quality of sausages to identify counterfeit products, analyze the procedure for conducting merchandising assessment.

Analysis of Essential Researches and Publications. The beginning of the solution of this problem was laid by such scientists as T. M. Artiukh, N. V. Budnik, S. Vilkova, L. Halun, I. V. Hryhorenko, A. A. Dubinina, A. P. Zakusilov, D. P. Lysovska, Z. V. Lovkis, V. D. Malyhina, N. I. Osypenko, V. A. Pavlova, S. O. Petrov, I. A. Petrova, L. V. Peshuk, I. S. Polikarpov, L. Sarafanova, L. D. Tytarenko, I. I. Shtyk and others ¹, comprehensively exploring various aspects of methods in the field of falsification of sausages. The author of this article relies on their scientific works, as well as on the practice of their application.

¹ Артюх Т. М., Григоренко І. В. Теоретичні основи товарознавства [електронний ресурс] : навч. посіб. Київ, 2014. 263 р. ; Будник Н. В., Пешук Л. В., Штик І. І. Використання гістологічних методів для оцінки якості та ідентифікації складу ковбасних виробів. *Технічні науки: стан, досягнення і перспективи розвитку м'ясної, олієжирової та молочної галузей* : мат-ли 2-ї Міжнар. наук.-тех. конф. (Київ, 25—26.03.2014). Київ, 2014. Р. 61—62 ; Вилкова С. А. Экспертиза потребительских товаров : учебник. Москва, 2007. 252 р. ; Галун Л. А., Лисовская Д. П., Ловкис З. В. Теоретические основы товароведения и экспертиза товаров : учеб. пособ. Минск, 2007. 352 р. ; Дубініна А. А., Овчиннікова І. Ф., Дубініна С. О., Летута Т. М., Науменко М. О. Методи визначення фальсифікації товарів : підручник. Київ, 2010. 272 р. ; Полікарпов І. С., Закусілов А. П. Ідентифікація товарів : підручник. Київ, 2005. 344 р. ; Осипенко Н. І. Інформаційна фальсифікація товарів і комплексне інформаційне забезпечення як захист від неї. *Вісник Львівської комерційної академії. Серія товарознавча*. 2011. Вип. 12. Р. 26—29. URL: https://nbuv.gov.ua/UJRN/Vlca_2011_12_7 (date accessed: 20.03.2021) ; Титаренко Л. Д., Павлова В. А., Малигіна В. Д. Ідентифікація та фальсифікація продовольчих товарів : навч. посіб. Київ, 2006. 192 р. ; Петрова І. А., Петров С. О., Кричковська Л. В., Дубоносов В. Л. Загальні методи визначення якості та безпеки споживчих товарів : навч.-практ. посіб. Харків, 2017. 234 р. ; Сарафанова Л. А. Применение пищевых добавок в переработке мяса и рыбы : учебник. 2-е изд., перераб. Санкт-Петербург, 2015. 240 р.

Main Content Presentation. The fourth position in the list of the most popular food products is occupied by sausages. Only dairy products, vegetables, fruits and bread were ahead of them. Many people consider that the indicator of the nation's well-being is the level of sausage consumption. Sausages are nutritious foods that are in constant demand from consumers who do not want to spend time cooking and consume domestic sausages raw. The market of sausages is growing every year (new types and varieties of sausages are appeared). The number of producers in this field is also increasing, however, the variety of new sausage products complicates the process of assessing the quality of cooked food products (compliance of sausages to technical requirements and DSTU)¹.

The lion's share in the meat products segment belongs to domestic producers. As a result, it is critical to monitor the quality and degree of conformity with the standards of sausage products that delivered to store shelves from Ukrainian companies.

Sausages contain (except minced meat) offal, salt, fat and spicy spices. This meat mixture is formed into a product using a mesh or sausage casing, and then heated. Finally, the consumer receives a ready-to-eat sausage product².

Boiled sausage is a ready-to eat food made from minced meat, wrapped in a natural or artificial shell (thick or thin). Bringing cooked sausages to readiness involves several steps: adding of nitrite, frying, cooking. Ready-made cooked sausages have characteristic features – pink (dark or light) color. The moisture content in the cooked product reaches 72%.

No less popular cooked product is meat bread, made from ripe minced sausage. This product has no shell: it is cooked by baking in metal molds pre-cooked meat mixture.

Identification is the establishment of conformity of an object according to the set criteria. The process of product identification is quite simple that involves identification of matches of the name of the product with the specified information (on the label or in the documentation accompanying the product). Today there are 3 types of good identification (depending on their purpose): species (assortment) analysis, qualitative and shipment identification³.

Labeling and quality indicators are checked on each product to which the identification method is applied. The following information is obligatory in the labeling: manufacturer's brand and location (the company name, legal and physical address, including the country of origin of the goods); trademark

¹ ДСТУ 4436:2005. Ковбаси варені, сосиски, сардельки, хліби м'ясні (33977) : затв. наказом Держспоживстандарту України від 15.07.2005 р. № 175 [Чинний від 01.01.2007 р.]. URL: https://dnaop.com/html/33977/doc-%D0%94%D0%A1%D0%A2%D0%A3_4436_2005 (date accessed: 10.04.2021).

² Пищевые добавки, используемые для приготовления колбасных изделий // Портал о вкусном и здоровом питании. URL: https://e-pitanie.ru/dobavki_v_produk-tah/kolbasnie_izdeliya (date accessed: 10.09.2020).

³ Сарафанова Л. А. Оп.cit.

(optional); type of product; name and variety; composition, presence of food impurities; nutritional value of the product; date of manufacture; expiration date; storage conditions; weight (if the goods are packed up); designation of the standard; information confirming compliance with the standards applied during production; the inscription *Vacuum-packed* (if the product is placed in a vacuum container or package) ¹.

If the sausage product is in an artificial shell, it is permissible to indicate simplified information: product name, address of production, type, variety, quality standard. Identification of meat products on the basis of assortment involves comparison by organoleptic indicators: shape, color, taste, aroma, consistency and internal structure. The integrity of the shell is a mandatory criterion in cooked sausages: it must be dry and clean. The color of minced meat in the section of boiled sausage is pink, and the color of lard is white. The boiled sausage should not have any cavities. The aroma of cooked sausages is pleasant.

The regulations for sausages specify such a complex indicator as the *type of minced meat in the cut* (this is the internal structure of the product). It is important to analyze its structure when evaluating this factor of cooked sausage (the presence of lard in some varieties of cooked and smoked sausages). There are also unstructured boiled sausages (varieties *Molochna*, *Doktorska*, *Diabetychna*, etc.). Lard is added to the crushed meat mass in their composition. These sausages are more difficult to identify. Some brands of cooked sausages are tied by producers with twine (according to DSTU 4436: 2005). This feature is common in cooked and meat bread: all these products have a large number of loaves. However, there are many varieties of sausages on the market that are not tied with twine. If sausages are produced in accordance with the technical requirements, this rule is not followed. As a result, the binding of loaves is an indication of a higher-quality sausage brand ².

There is often a falsification in the sausage market (from the Latin *falsifico*). Falsification is defined as an act performed for selfish purpose – deception of the consumer (buyer) by forging the object of purchase or sale. A broad understanding of the concept *falsification* – actions aimed at deteriorating the consumer properties of goods or reducing its weight (quantity). For non-food products, the counterfeit is made by giving the counterfeit certain typical features: color, appearance, consistency. At the same time, counterfeit sausages are characterized by deterioration or complete loss of certain properties of food (violation of the appropriate amount of proteins, fats, vitamins, trace elements, etc.) and their safety.

¹ Про основні принципи та вимоги до безпечності та якості харчових продуктів : Закон України від 23.12.1997 р. № 771/97-ВР (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/771/97-вр> (date accessed: 10.04.2021).

² ДСТУ 4436:2005.

Counterfeit sausages are products of dubious quality. For its production the composition of the cooked raw sausage can be changed as follows: increase the water content; use red dyes of natural (beet juice) or synthetic nature to improve the color; do not follow the recipe during production; violate the manufacturing technology and storage regime; add stale main ingredient (completely or partially replace it with fresh natural meat), non-traditional components, antibiotics and/or conservants, foreign impurities.

For a long time, domestic scientists and researchers have used the method of identification to detect the falsification of sausages and meat products. Biochemical, structural-mechanical, and physicochemical analyses have traditionally been used to determine the component composition of meat-containing products (sausages). However, currently these methods of research and detection of product quality are not enough. Non-traditional methods should also be used for a more effective and in-depth analysis of counterfeit sausage product detection.

Today, there are numerous developments in which identification is considered as a means of detecting counterfeiting in sausages. Unfortunately, given the scientific level of such developments, this problem has been insufficiently studied (particularly the issue of standardization of histological methods), impacting the effectiveness of commodity examinations to assess the quality of sausages in the Ukrainian market.

The acceptable proportion of water in a quality cooked sausage is 70%. Counterfeit products may contain more moisture. To do this, unscrupulous manufacturers are willing to add to their products moisture-binding components (dextrins, gums, starch, inulin, other polysaccharide complexes). Scientists-technologists have proved that sausage with the addition of starch (3—5%) can contain 25% more water than a high-quality analogue without impurities¹.

There are several concepts in production: traditional raw materials and non-traditional raw materials. The traditional raw materials, used to make sausages, include meat (beef and pork), lard, spices (kitchen herbs, salt and sugar), nitrate salt. Non-traditional raw materials are considered milk and soy proteins, emulsion made from pig skin, soy insulators, starch, offal, crystalline cellulose, carrageenan, products of hydrolysis of down, feathers, bones, wool, leather and other impurities.

In order to check the presence of starch in the sausage, it is not necessary to examine the sausage products in the laboratory. This can be done at home by dripping a solution of iodine on a piece of sausage (its cut). If a blue color (blue dots or stain) appears in the place of the drop, then the sausage contains starch, which is unacceptable according to the classic recipe.

Today, there are many ways to counterfeit sausages. Most often by coloring products (adding the most common dyes — beet juice, magenta and

¹ Сарафанова Л. А. *Op.cit.* P. 33.

other synthetic components). Not only Ukrainian companies, but also foreign enterprises use various dyes in the production of sausage products. In order to check the sausage for falsification at home, you can boil a piece of the product in a small amount of water, paying attention to whether the water has changed color to pink or red. If the water is colored, then the sausage is counterfeit. Examining the sausage for falsification in the laboratory, the dyes in its composition are detected using alcohol (solvent — amyl alcohol). In this experiment, solvents are added to samples of sausage in vitro. If the liquid changes color, then there are dyes in the composition. Another way to detect the dye is to dye the lard. If the sausage contains aniline dyes, then (due to their ability to dissolve quickly in fat) lard will also acquire a different color ¹.

In order to prolong the shelf life of sausages, the production technology is violated and various antibiotics are added. Some producers even use spoiled dangerous products to make sausages: instead of high-quality fresh meat, low-grade raw materials or spoiled ones in general, which have characteristic features (may contain life-threatening parasites — echinococcus, finns) ².

In Ukraine, a wide variety of counterfeit sausages: re-sorting or replacement by external features of a quality product can be found on store shelves. In the case of re-sorting, the manufacturer intentionally replaces products of the highest or first grade with analogues of lower quality (goods of the first or even second sort). The lower sort, the more in the composition of low-quality main product — meat. In counterfeit or low-quality sausage, coarse meat is used, which contains a significant amount of cartilage and tendons. Most often, falsification is made on the well-known classic sorts of sausages. As a result, these products are low-grade, they have a non-traditional recipe (low-quality raw materials with dyes, conservants, antibiotics, foreign impurities). Manufacturers also violate storage conditions and do not follow the rules of the technological process ³.

Re-sorting of high-quality expensive sausages is done by intentionally replacing high-quality and first-sort sausages with low-quality products in which the meat is replaced by ordinary lard or raw materials of dubious quality which contains tendons. In addition to the manufacturing falsification of sausages, there is information, which consists in the distortion of product information (when the accompanying documents provide distorted information, available advertising and false labeling). Most often, the following inaccuracies are characteristic of information falsification of sausages of different sorts: incorrect name of the product, its quantity, incorrect indication of the manufacturer, lack of information about available food impurities, which should not be part of the sausage produced according to the recipe.

¹ Стріха Л. О., Назаренко І. В. Технологічне обладнання та технологія переробки м'яса : курс лекцій для студ. спец. 7.09010201 і 8.09010201 «Технологія виробництва і переробки продукції тваринництва». Миколаїв, 2015. Р. 26.

² Титаренко Л. Д., Павлова В. А., Малигіна В. Д. *Op.cit.* Р. 33.

³ Стріха Л. О., Назаренко І. В. *Op.cit.* Р. 28.

Information falsification of sausage products is deliberate deception by producers of consumers with inaccurate or distorted information about the product. This deception is indicated on the label. Some companies honestly print on the label information about the addition of flavorings (to enhance the taste of meat products), dyes, but often this information is ignored by manufacturers (do not specify). This is consumer fraud.

Forgery of sausage quality certificates, as well as customs documentation, dates of manufacture of products, indication of incorrect bar code and other data are also considered information falsification.

Consumers should pay attention to details when identifying cooked sausages, as methods of counterfeiting quality goods are becoming more professional and sophisticated. Before purchasing a sausage, you should perform a preliminary inspection. If the product was stored in improper conditions, defects may appear on the cooked or other sort of sausage: white plaque, worminess, mold, spots of putrefaction. The taste of spoiled sausage can be bitter.

To protect consumers, new DSTU has been introduced for meat products, which is able to limit the recipe of sausages, clearly regulate the production process. These standards provide for the inspection of the quality of manufactured goods by regulatory authorities. The DSTU compliance documentation has been developed so that Ukrainian sausage manufacturers can compete with foreign sausage brands. These standards are in line with the requirements of the countries of the European Union and are designed to prevent falsification of sausages of different sorts ¹.

However, there is still a problem with the lack of promising research methods for meat products, standardized by the relevant new documents. It is worth noting that currently there is no complete quality control of sausages and the ability to accurately identify the composition of raw materials used by producers. As a result of noncompliance with the standards, producers may commit violations such as using low-grade raw meat, vegetable impurities, and offal in sausages. Consequently, sausages produced in this way are *high quality* only on paper (in such indicators as microbiological, chemical and organoleptic). These accompanying documents do not correspond to the composition and name of the specified sort of sausage.

Thanks to N. V. Budnik, I. Shtyk and L. V. Peshuk, who developed and patented a histological method for the study of multicomponent meat systems, today we can check the quality and compliance of the composition, labeling of sausages. Their method is based on the already existing microstructural study of individual tissues of the sample (study of bone, connective and muscle tissues).

Histological examination of samples of sausages lasts 24 hours in the following conditions: 2.5% glutaraldehyde, phosphate buffer pH — 7.4, temperature +4 °C. After that, the samples are washed in phosphate buffer with

¹ ДСТУ 4436:2005.

pH of — 7.3. *G. M. Millonig* is used for additional fixation in an immersed osmium fixative, in which pieces of meat products are kept for 2 hours. Following that, the samples should be washed from the fixative in 0.1 gram-molecular of phosphate buffer (pH — 7.3), after which the material is subjected to dehydration with alcohol solutions of different strength (10 minutes each): first 50% — and gradually adjusted to 90%. The next step is dehydration in absolute alcohol, followed by a mixture of shirgacegon ¹.

The washed samples are treated according to the Laft method (filling medium — Epon-812). Sections are obtained on an ultramicrotome UMTF-7, using the method of targeted microtoming. The dye used in the experiment is a freshly made 0.1 % solution of toluidine blue (43595). An optical microscope with a photodetector will be required for morphometric analysis ².

The use of this research method to identify non-compliance with sausage recipe allows you to conduct a comparative analysis of product composition with these indicators in DSTU ³.

Conclusions. Technological influence on raw meat for sausages causes changes in the morphological properties of the cooked product (changes in the internal system of the studied composition). Particularly noticeable modification of the structure of the elements of raw meat under the technological influence, if different components (vegetable, animal or even chemical) are used. That is why it is important to use morphological methods to identify the composition of the cooked sausage product, which allows to determine the composition and research the quality of the product as accurately as possible.

Almost every Ukrainian family consumes sausages. Due to the ease of cooking a full meal or a light snack with sausage, people eat it quite often. That is why it is so important to choose high-quality, safe, tasty sausage products that do not contain various impurities. In order to protect yourself from falsification (counterfeit products), it is important to choose a decent manufacturer. To do this, it will be useful to know the methods used by sausage companies to counterfeit products, as well as knowledge of methods to detect such counterfeiting.

Currently, the most popular way to identify the composition of meat products is histological method of examination of samples. It allows you to most accurately determine the composition of the studied products (which meat is used in the composition, whether there are muscle tissue and impurities in the raw material in the form of offal and other impurities). Histological methods of research of sausages need to be standardized for their further use in production laboratories of the enterprises ⁴.

¹ Будник Н. В., Пешук Л. В., Штик І. І. *Op.cit.*

² *Ibidem.*

³ ДСТУ 4436:2005.

⁴ Житенко П. В. Ветеринарно-санитарная экспертиза продуктов животного происхождения : учебник. Москва, 2011, 250 р.

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**Ідентифікація як засіб виявлення
фальсифікації ковбасних виробів**

Станом на сьогодні ключовими у сфері вітчизняної економіки є проблеми конкурентоспроможності та якості товарів, які виробляють в Україні. Багато підприємств, орієнтованих на виробництво м'ясної продукції, послуговуються технічними умовами (далі — ТУ) як нормативною документацією. Виготовлені за ТУ продукти харчування мають занижену собівартість, що вигідно багатьом підприємствам України. У статті досліджено методи ідентифікації якості ковбасних виробів з метою виявити фальсифіковану продукцію, проаналізувати порядок проведення товарознавчого оцінювання.

Ключові слова: ідентифікація, продукт, фальсифікація, сировина, ковбасні вироби, барвники.

М. Л. Бондаренко

**Идентификация как средство выявления
фальсификации колбасных изделий**

В настоящее время ключевыми в сфере отечественной экономики являются проблемы конкурентоспособности и качества товаров, производимых в Украине. Украинский рынок мясной продукции покоряет потребителей широким ассортиментом, но не стоит радоваться такому насыщенному перечню наименований. Многие предприятия, ориентированные на производство мясной продукции, пользуются техническими условиями (далее — ТУ) в качестве нормативной документации. Технические условия позволяют существенно снижать качество производимых товаров, не допускают здоровой конкуренции. Изготовленные по ТУ продукты питания имеют заниженную себестоимость, что выгодно многим предприятиям Украины. Ответственность именно за качество готового продукта ложится не на производителя, а на самих покупателей и товароведов.

Актуальность темы обусловлена необходимостью информировать потребителей о качестве и потребительских свойствах варёных колбас различных производителей, реализуемых в розничной торговой сети.

Поэтому планирование как функция управления ассортиментом для товароведа заключается в определении способа будущих действий, содержания и последовательности шагов, ведущих к намеченной цели. Методика планирования ассортимента должна позволять оценивать товар по трём направлениям: доходность, конкурентоспособность, соответствие требованиям качества и безопасности.

Теоретической основой исследования послужили труды учёных и практиков в области товароведения, в частности — И. И. Штык, Л. В. Пешук и Н. В. Будник, запатентовавших гистологический метод исследования многокомпонентных мясных систем.

Исследуя украинский рынок варёных колбас, были применены методы товароведческого оценивания безопасности, качества продуктов из мяса и их идентификации.

Цель статьи — исследовать методы идентификации качества колбасных изделий для выявления фальсифицированной продукции, проанализировать порядок проведения товароведческого оценивания.

Ключевые слова: *идентификация, продукт, фальсификация, сырьё, колбасные изделия, красители.*

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Quality consideration of building and renovation works while forensic structural inspections to determine the volume and cost of construction

Currently, forensic methods and regulations in the field of construction do not explain how quality of work affects the procedure of forensic examinations and research related to determining the work scope.

While carrying out building and renovation services, it is possible to control provided construction and renovation services, establish their physical volume and quality. While research, forensic expert can identify violations of building codes, as well as determine the cost of refurbishment or elimination of defects made providing services.

The scoop of performed works is determined by geometric parameters of construction elements, established during field surveys using design and as-built documentation.

While carrying out field surveys, it is necessary (along with the determination of service scope) to pay attention to the compliance of the work performed with the requirements of building codes.

The article outlines problematic issues and provides a list of basic indicators determining the scoop and quality of the construction works carried out, indicated in the reporting documentation drawn up by contractors based on results of activities in the field of construction. Actual issue arising in the establishment of the scoop and cost of construction work is considered that quality does not meet the requirements of regulatory documents in the field of construction.

It is explained how the quality of the work performed affects the results of research related to the determination of the actually completed volumes of repair, building and renovation and construction work.

Keywords: work quality, actually completed construction work, defects, working scope, engineering and technical staff.

Formulation of Research Problem. While forensic structural inspections, forensic experts often have to address issues related to determining quality of renovation works and further consideration (not taking into account) of these

service scoop and their cost while determining performed building services as of forensic research.

Quite often, forensic science institutions receive court applications and rulings when construction customers are faced with the problem of poor quality renovation (construction services), namely ordered services do not correspond to those actually performed or performed with defects. Usually builders do not admit their guilt, refuse to eliminate deficiencies or compensate for losses, citing the fact that service was provided in the amounts specified in the design and reporting documentation.

Analysis of Essential Researches and Publications. Well-known research papers: *Methods for establishing the actual volume and cost of provided building works on reporting documentation* (registration code 10.6.17) and *Methods for determining quality of building and installation works* (registration code 10.6.01) do not fully disclose the correlation between construction quality and renovation services and the scoop of services taken into account (in accordance with the relevant budget standards) in reporting documentation.

Currently, there are no explanations in forensic methods and normative documents in the field of construction as to how quality of services affects the procedure of forensic examinations and researches related to the scope determining of such works.

Article Purpose. Substantiation and systematization of theoretical knowledge on conducting forensic examinations related to determining actual scope of building and renovation works through analyzing regulations in the field of construction that regulating requirements for service quality.

The main purpose of this type of forensic structural inspections is to protect the property and non-property rights of the construction customer. While providing construction services of any scoop and scale, there is a risk that contractor services for certain reasons does not meet the requirements of construction standards, as well as technical contract conditions.

Main Content Presentation. Forensic structural engineering or forensic research on building and renovation works is carried out to resolve disputes that arise between customer and contractor or the service provider on the site.

If construction facility forensic structural inspection was not carried out immediately before commissioning construction facility it can cause some risks for the customer in the future (for example, a contractor can refuse to recognize violation of the order and quality of building works in case of problems with the construction facility arose during its direct operation by the customer). Therefore, the causes of these problems are treated in terms of violation of operating conditions. In this case, dispute between the customer and the contractor is already considered in court and this can require forensic structural inspections:

- pre-trial forensic structural inspections conducted by one of the parties to the dispute while preparation of arguments in their favor on the eve of hearing;

- forensic structural inspection carried out according to court decision.

Forensic examination allows you to control the repair services, determine the scope and quality of performed works. While research, forensic expert can identify violations of building codes, as well as determine the cost of repairs or elimination of defects committed while service providing.

Checking the scope helps to identify the following violations:

- overstated reports on service scope;
- registration of fictitious works;
- replacement of materials with cheaper ones;
- reducing service quality (for example, applying one coat of paint instead of two provided by the documents);
- overestimation of the number of materials, components (doors, sinks, electrical or piping fittings, etc.);
- incompleteness of construction facilities, separate stages of works.

The main purpose of construction scope inspection is to check the scope and cost of paid or presented for works on fully completed and commissioned facilities.

In addition, control over:

- compliance of the object with its characteristics and purpose, provided by the approved design and estimate documentation;
- completeness of provided services adopted under acceptance certificate;
- operational readiness of commissioned facility.

The purpose of measuring works is to clarify actual geometric parameters of building structures and their elements, determine their compliance with the project or deviations from. Instrumental measurements specify the spans of structures, their location and step in the project, size of the cross sections, height of the premises, marks of the characteristic nodes, distance between the nodes, etc. According to the results of measurements, projects are made with the actual location of structures, sections of buildings, drawings of working sections of load-bearing structures and joints of structures and their elements.

Calculation of service scoop is carried out on the basis of completed structural elements and work types. The sequence of calculations should be such their preliminary results can be used for further calculations. It is recommended to calculate the service scoop in the following sequence: holes in the outer walls (windows, doors, gates); internal openings (doors, gates, transoms); foundations; earthworks; frame; walls; partitions; floors; overlapping; coating; roofing; stairs; porch; external equipment; interior decoration; other works.

For substantiating the scope and composition of performed work, acceptance certificates and concealed works acceptance certificate are used. In default of such acts, service scoop can be calculated from the working drawings. If it is impossible to determine the work scope during control measurement, these works are not taken into account. If necessary, forensic expert has the right to request disclosure of such works.

If there are no acceptance certificates, forensic expert carries out control measurements of performed works in kind, compares obtained results with the approved design documentation.

Calculation of performed work is carried out on the actual plane (volume, length) of the element under research.

Many technical indicators of the quality of repair work are included in state construction standards, technical conditions, etc.

The repair quality depends not only on performance indicators but on appearance of the completed facility object or its element (part).

Construction quality is a set of product properties that meet certain requirements in accordance with its purpose. Construction quality is determined by assessing overall architectural and artistic solutions, the technical level of design solutions, design and technological parameters, as well as quality of construction products, semi-finished products and materials.

Product quality indicator is a quantitative characteristic of one or more product properties considered in accordance with certain conditions of its manufacture and operation or use.

The reasons for quality inconsistency of provided services with requirements of building codes and standards is great number, namely: contractor's desire to speed up work by simplifying some construction procedures, contractor's ignorance, use of unskilled builders or poor quality building materials, theft of building materials. One point is clear, regardless of the reason for the contractor's negligent attitude to his work, only customer suffers.

Execution quality depends on established technology and quality control. Quality control is carried out by engineering and technical outsourcing staff (internal control) and the customer, author's supervision and bodies of the State Construction Inspectorate (external control). Engineering and technical outsourcing staff is obliged to systematically monitor compliance with project requirements, building code while construction and installation work. Components of such control are input operating and receiving. The results of all these types of control should be recorded in the registers that daily record the basic data on performed work, materials used and other important points which service quality depends on.

While determining quality level, relative characteristics of the quality of works or products are compared with corresponding basic indicators. Indicators reducing quality of construction products include:

- appearance deterioration of products leading to the need to perform additional work to improve their quality;
- reducing strength and stability of individual structures, products and buildings in general;
- reduction of operational qualities of buildings.

Quality management is systematic control and influence on conditions that should ensure quality. Quality management includes: accounting for possible sources

of defects; identifying ways to prevent them and the factors that affect quality. Impact of quality management can be organizational, sociological, technological, aimed at improving or maintaining a certain high level of product quality. Influence of management can extend to increasing the number of products which will already be managing not only quality but quantity of manufactured products.

Estimates, terms of reference, and other supporting documentation related to construction work often include the terms: *improved* or *high-quality* finishing.

According to building code it is established to distinguish three species (classes) of furnishing: simple, improved and high-quality. Each type of decoration implies compliance regulations determining maximum possible deviations from the design values or conditions adopted for relations between the parties by default.

According to building code, works are classified in accordance with certain types of works, include: plaster, painting with the use of oil, casein, glue and emulsion mixtures.

For example, a simple plaster is applied in one layer with or without grinding. Grinding is performed without applying an additional layer of fresh solution with polyurethane or foam graters without any spraying and lids. The cover layer is necessary for grinding, therefore for it use fine-grained or sifted mix. Apply the cover after leveling the soil and grind fresh or after drying (10—60 minutes). Layer thickness: up to 3 mm ¹.

Improved plaster is applied in three layers: spraying, priming, cover. The improved plastering is put manually or in the mechanized way, and level as a rule horizontally and vertically. Maximum clearance while checking accuracy of the 2-meter rule is 2.5 mm, for the entire height of the wall is 5 mm.

The main difference between high-quality plaster and improved one is work accuracy. The number and thickness of the layers are the same, except that total thickness of the tent is allowed to increase by 5 mm. Permissible deviation of 2 mm per 2 m of height/wall length or 3 mm for the entire height. These are limit values, in modern construction deviations are within 1 mm.

While painting of plastered walls with water mixes (performance of painting works) corresponding class of furnishing provides surface preparation, simple painting, namely: surface cleaning, its priming, filling of cracks and sinks, dedusting and directly painting; improved painting in addition to the provided service for simple painting, partial lubrication of irregularities twice, grinding of such places by the number of layers, priming of each lubrication layer, the second priming of all surface; high-quality painting, in addition to provided services for improved painting, continuous filling in twice with grinding of each layer and additional (third) continuous priming.

¹ ДСТУ-Н Б А.3.1-23:2013. Настанова щодо проведення робіт з улаштування ізоляційних, оздоблювальних, захисних покриттів стін, підлог і покрівель будівель і споруд (СНИП 3.04.01-87, MOD) : затв. наказом Мінрегіонбуду України від 18.07.2012 р. № 326. [Чинний від 01.01.2014]. Вид. офіц. Київ, 2013. 39 р.

In other words, while conducting field surveys of performed works, related to determining the actual service scoop, it is necessary to pay attention to how the work is done: whether it can be considered a certain species (class) of work (*simple, improved, high quality*) works on plastering or painting of surfaces, arrangement of coverings of floors, roofs, etc.

Availability of deviations of the plane from the horizontal and vertical, the number and size of irregularities on the surfaces while plastering, plastering work affect the affiliation of the work to one of three types (classes) of finishing: *simple, improved, high quality*.

State construction standards provide for relevant requirements for other works.

Thus, high requirements concerning durability, aesthetics and observance of sanitary and hygienic norms and quality are put forward to works on floor arrangement. Clearances between the control two-meter rail and the floor surface to be inspected shall not exceed 4 mm.

In case of performance of facing works by ceramic, glass-ceramic and other similar tiles, the surface should have a deviation from a vertical no more than 2 mm on 1 m. The deviation of an arrangement of seams from a vertical and horizontal (on 1 m of length) in facing 2 mm is provided.

Deviation of the plane of all field of a surface of false ceilings on a diagonal, vertical and horizontal (from design) is allowed 1,5 mm on 1 m.

Roof coverings should meet the following requirements: have sufficient water resistance; provide uniform normalized temperature and humidity of air in rooms; prevent condensation formation on the ceilings and in the thickness of the structure; to accept without destruction the normalized load; meet requirements of building codes for quality.

Arranging a roll roof, the panels should be glued in the direction of:

- from the lowered sites to the raised with an arrangement of cloths on length perpendicularly to a water drain at slopes of roofs to 15 %;
- Runoff for roof slopes over 15 %.

The panels should be laid overlapping by 100 mm (70 mm across the width of the panels of the lower layers of the roof with a slope of more than 1.5%).

While inspecting the filling of window and door openings of external walls, it is necessary to pay attention to quality of nodes adjacent to the walls.

While design and implementation of adjacent nodes should comply with requirements of regulations approved in the prescribed manner.

The design of connection units and technology of installation of window or door blocks must meet the requirements of the project and ДСТУ-Н Б В.2.6-146:2010¹.

¹ ДСТУ-Н Б В.2.6-146:2010. Конструкції будинків і споруд. Настанова щодо проектування і улаштування вікон та дверей : затв. наказом Мінрегіонбуду України від 15.11.2010 № 444. [Чинний від 15.11.2010]. Вид. офіц. Київ, 2010. 68 р.

While arranging adjacent nodes, it is necessary to comply with the following conditions:

- closing of assembly cracks between products and jambs of apertures of wall designs should be dense, tight, calculated on endurance of climatic loadings outside and conditions of operation indoors;
- construction of adjacent units (including the location of the window unit by the slot depth) shall prevent occurrence of cold bridges, that cause condensate formation on the inner surfaces of window openings;
- operational characteristics of structures of junctions and applied materials (heat and sound insulation, vapor and air permeability) should meet requirements stipulated by current regulations;
- sealing of seams from premises should be more dense than from outside;
- while choosing the filling of mounting slots, it is necessary to take into account the operational temperature changes of the overall dimensions of the products;
- polymer composites used for installation work should obtain a hygienic conclusion of the health authorities about possibility of their use in construction.

Building elements where it is necessary to carry out quality control:

- alignment of ceilings and walls;
- installation of different sizes and contents of window and door structures;
- arrangement of a floor covering;
- installation of such communications as: ventilation, electricity, heating, water supply, etc.

Forensic expert controls whether all communications have been concluded in accordance with the project documentation and whether actually performed works correspond to the design and estimate and reporting documentation.

While inspection of the water supply system, forensic expert pays attention to reliability of the used fasteners, as well as to tightness of the connecting system. Existence of even the slightest leak can later lead to the breakdown of the tap and flooding of the entire room.

While leveling walls or ceilings, it is necessary to use specific tools that will help to identify any existing shortcomings. Upon completion, forensic expert checks the smoothness of the walls and ceilings.

All violations are detected during the works, controlling compliance of construction services with regulations and instructions.

It is possible to control quality of planes by means of spirit level, a plummet and goniometer.

Deviation from the above requirements while operation of building (premises) can cause a decrease in thermophysical and insulating properties of enclosing structures.

Therefore, before calculating the scope of work, it is necessary to understand in detail the drawings, clarify correlation between individual parts of working

drawings, clearly present those works that are not depicted in the drawings (exterior and interior, partition material, floors, etc.), study textual material of the project, get acquainted with drawings of standard knots and details with catalogs of the products which have found application in this project, requirements of the state building code and standards regulating quality of works.

Thus, for example, in case of availability of estimated norms in acceptance certificates from high-quality plastering by a solution of walls, the result should to meet requirements stipulated by building standards for these works.

In other words, service quality should meet the parameters specified in the building codes and the estimated standards stated in reporting documentation.

Therefore, while forensic examinations and researches to determine compliance of actually performed works with reporting documentation, works that have deviations from the state building codes and standards cannot be accepted as performed one and need to be finalized (according to requirements of the mentioned standards) as for quality of provided service within the measures to eliminate recorded defects.

Conclusions. The given theoretical and practical aspects of forensic examinations, related to the determination of actual scoop and quality of building and renovation works can be used in forensic practice to optimize forensic research.

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Т. Г. Дудник, Л. Г. Кинтя

Урахування якості ремонтно-будівельних робіт під час проведення судових будівельно-технічних експертиз із визначення обсягів і вартості будівництва

Станом на сьогодні в експертних методиках і нормативних документах у галузі будівництва відсутні роз'яснення щодо того, як саме якість робіт впливає на порядок проведення експертиз та експертних досліджень, пов'язаних із визначенням обсягів таких робіт.

Будівельно-технічна експертиза дає змогу проконтролювати проведені ремонтні роботи, визначити обсяги та якість виконаних робіт. У процесі дослідження експерт може виявити порушення будівельних норм, а також визначити вартість відновлювального ремонту або усунення дефектів, яких будівельники чи ремонтники припустилися під час виконання робіт.

Обсяги виконаних робіт обраховують за геометричними параметрами елементів будівництва, які визначають за допомогою натурних обстежень із використанням проєктної та виконавчої документації.

Під час проведення натурних обстежень необхідно (паралельно з визначенням обсягів робіт) звертати увагу на відповідність виконаних робіт вимогам будівельних норм за якістю.

Окреслено проблемні питання та наведено перелік базових показників, за якими потрібно визначати обсяги та якість проведених будівельних робіт у звітній документації, складеній підрядниками за результатами діяльності в галузі будівництва. Також розглянуто актуальну проблему, яка виникає під час визначення обсягів і вартості будівельних робіт, що за якістю не відповідають вимогам нормативних документів у галузі будівництва.

Роз'яснено, як впливає якість проведених робіт на результати досліджень, пов'язаних із визначенням фактично виконаних обсягів ремонтно-будівельних і будівельних робіт.

Наведені авторами теоретичні та практичні аспекти проведення судових експертиз, пов'язані з визначенням фактично виконаних обсягів та якості ремонтно-будівельних і будівельних робіт, можна застосувати в експертній практиці для оптимізації експертного дослідження.

Ключові слова: якість робіт, фактично виконані будівельні роботи, дефект, обсяг робіт, інженерно-технічний персонал.

Т. Г. Дудник, Л. Г. Кинтя

**Учёт качества ремонтно-строительных работ
при проведении судебных строительно-технических экспертиз
по установлению объёмов и стоимости строительства**

В настоящее время в экспертных методиках и нормативных документах в сфере строительства отсутствуют разъяснения относительно того, каким образом качество проведённых работ влияет на порядок проведения экспертиз и экспертных исследований, связанных с определением объёмов работ.

При проведении строительно-технической экспертизы имеется возможность проконтролировать выполненные ремонтные и строительные работы, установить их физические объёмы и качество. В процессе исследования эксперт может выявить нарушения строительных норм, а также определить стоимость восстановительного ремонта или устранения дефектов, допущенных при проведении работ.

Объёмы выполненных работ определяют по геометрическим параметрам элементов строительства, устанавливаемым при осуществлении натурных обследований с использованием проектной и исполнительной документации.

При проведении натурных обследований, необходимо (наряду с определением объёмов работ) обращать внимание на соответствие выполненных работ требованиям строительных норм по качеству.

В статье изложены проблемные вопросы и приведён перечень базовых показателей, по которым определяют объёмы и качество проведённых строительных работ, указываемые в отчётной документации, составленной подрядчиками по результатам деятельности в области строительства. Также рассмотрена актуальная проблема, возникающая при установлении объёмов и стоимости строительных работ, по качеству не соответствующих требованиям нормативных документов в сфере строительства.

Разъяснено, как влияет качество проведённых работ на результаты исследований, связанных с определением фактически выполненных объёмов ремонтно-строительных и строительных работ.

Ключевые слова: *качество работ, фактически выполненные строительные работы, дефекты, объёмы работ, инженерно-технический персонал.*

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Problematic issues in forensic structural engineering analysis of attributing work at construction sites to ongoing and heavy maintenance

The article is dedicated to solving issues posed to forensic experts while forensic structural engineering analysis (research), to determine the belonging of repair and construction work performed at construction facility (conducted or planned) to heavy or ongoing maintenance.

Solution of issues encountered by forensic experts while conducting forensic structural engineering analyses as to attributing to a particular type of work (ongoing, heavy maintenance) is relevant for the theory and practice of forensic examinations and expert researches.

Legislative acts, regulatory documents and other sources of information used when carrying out this type of research and being the basis for formation of final conclusions on performed researches have been analyzed.

Discrepancies, uncertainty and complexity of data contained in these regulatory and information sources, their controversial nature, which complicates the choice of reference for these data and their use in solving expert tasks; and in particular cases it makes it impossible for forensic experts to formulate conclusions while forensic structural engineering analysis of these issues.

Relying on the analysis of legislative acts, requirements for regulatory documents, as well as forensic expert practice, it has been concluded that it is needed to systematize and develop uniform methodological approaches to solve current tasks in forensic structural engineering to attribute types of repair and construction work to a specific classification.

Keywords: *real estate, construction sites, ongoing maintenance, heavy maintenance, remodeling, rebuilding, sizes, area, building structures, intervention, works, forensic examination, analyses, window fillings, door fillings, engineering systems.*

Formulation of Research Problem. Forensic experts-builders are increasingly faced with the task: to conduct forensic structural engineering analysis on which work has been carried out on heavy or ongoing maintenance.

Attention is drawn to the difficulties that arise during the implementation of forensic structural engineering analysis to address issues related to the assignment of work on real estate to a particular type. These difficulties are due to the lack of unique algorithms for solving such issues – given the ambiguity of the data set out in current regulations and explanations, as well as in the letters of the Ministry of Regional Development, Construction and Housing of Ukraine (hereinafter referred as *the Ministry of Regional Development, Construction and Housing of Ukraine*). Thus, the relevance of the article is due to the lack and uncertainty of the data of regulatory and information sources, on the basis of which forensic experts form conclusions on the definition of a particular type of work on construction sites. At the same time, attention is focused on the need to develop general approaches to determining the types of work in each case on the object to be studied.

Analysis of Essential Researches and Publications. In regulations and information sources, the features of a certain type of repair and construction work are either not specified at all, or are ambiguous, or are not fully reflected. In addition, there are no publications devoted to the classification of works on construction sites to a certain type (in accordance with the classification of works on heavy or ongoing maintenance. These circumstances prompted the analysis of laws and regulations and conduct of forensic expert research to determine the types of ongoing and heavy maintenance and the results of this analysis – to state the need to improve methodological approaches to addressing these issues.

The Article Purpose: Relying on the analysis of laws and regulations and forensic expert practice to find out whether there are uniform approaches to definition (classification) of types of works on construction objects which are the subject of forensic structural engineering analysis and to offer the solution of this problem.

Main Content Presentation. Objects of construction production (except for standards ones), which are examined by the forensic construction expert, differ greatly in technical characteristics and functional purpose.

According to Articles 1, 9, and 10 of the Law of Ukraine *On Architectural Activity*¹:

"Article 1. Terms and definitions

¹ Про архітектурну діяльність : Закон України від 20.05.1999 р. № 687-XIV (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/687-14> (date accessed: 18.03.2021).

<...>

Architectural activity – activity on creation of objects of architecture involving creative process of searching architectural decision and its evocation, coordination of actions of the participants of elaboration of all components of the projects on planning, development and improvement of the territory, building (new building, reconstruction, restoration, capital repair) of the buildings and constructions, provision of architectural and building control and designer's field supervision, as well as scientific and research activity and teaching in this field;

objects of architectural activity (objects of architecture) – houses and constructions of civil housing, municipal, industrial and other intended purpose, complexes of them, objects of redevelopment, gardening and landscape architecture, monumental art, territories (areas of territory) of administrative territorial entities and settlements;

<...>.

Article 9. Building of the object of architecture

Building (new building, reconstruction, restoration, capital repair) of the object of architecture shall be performed according to the approved design project documentation, state standards, norms and rules, local rules of settlements development due to the procedure, envisaged by the Law of Ukraine On Regulation of Urban Development.

<...>

Article 10. State architectural and building control and supervision

State architectural and building control and supervision shall be performed according to the legislation with the view of guaranteeing during the development of the territories, allocation and building of the objects of architecture the adherence by the actors of architectural activity of the enforced city development and other design project documentation, local rules of settlements development, input data requirements, and with the view of state protection of the rights of consumers of building materials.

State architectural and building control shall be performed by the executive body on the issues of building, city development and architecture <...>¹.

Among the topical issues that arise in any modern litigation and require the application of special knowledge in the field of construction, there is the question of classifying repair and construction work to a certain type. To resolve such issues, forensic structural engineering analysis or expert studies are appointed.

Determining the affiliation of repair and construction works carried out on construction sites (those that are carried out or those that are planned to be carried out) to the heavy or ongoing type of maintenance or reconstruction is a classification task of forensic structural engineering analysis (expert research).

¹ Ibidem.

An important basis for the classification of works – the need for their registration in the manner prescribed by law.

In accordance with Articles 34 and 36 of the Law of Ukraine: *On Regulation of Urban Planning Activities* ¹:

"Article 34. Right to perform construction work

1. The customer has the right to perform construction work after:

1) submission of the notice of commencement of construction works by the customer to the relevant body of the state architectural and construction control – concerning construction objects which by a class of consequences (responsibility) belong to objects with insignificant consequences (CC1), and concerning objects which construction is carried out on the basis of a construction passport and which do not require a construction permit in accordance with the list of construction sites approved by the Cabinet of Ministers of Ukraine. The form of notification on the commencement of construction works and the procedure for its submission shall be determined by the Cabinet of Ministers of Ukraine; ²

*3) issuance of a permit for construction works to the customer by the state architectural and construction control body – in respect of objects that by class of consequences (responsibility) belong to objects with medium (CC2) and significant (CC3) consequences or are subject to environmental impact assessment according to Law of Ukraine: *On Environmental Impact Assessment*.*

2. These <...> documents, that give the right to perform construction work, are valid until the completion of construction.

<...>

5. Control over the implementation of preparatory and construction works shall be exercised by the bodies of state architectural and construction control.

7. Execution of construction works without the corresponding documents <...> is considered as spontaneous construction and entails responsibility according to the law.

<...>

Article 36. Notice to proceed construction works

<...>

2. It is forbidden to perform construction works without submitting a notice to proceed construction works ³.

¹ Про регулювання містобудівної діяльності : Закон України від 17.02.2011 р. № 3038-VI (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/3038-17> (date accessed: 18.03.2021).

² Пункт 2 ч. 1 ст. 34 Закону України від 17.02.2011 р. № 3038-VI «Про регулювання містобудівної діяльності» виключено на підставі Закону від 17.01.2017 р. № 1817-VIII.

³ Про регулювання містобудівної діяльності : ... URL: <https://zakon.rada.gov.ua/laws/show/3038-17> (date accessed: 18.03.2021).

In Section 3.7 of BC A.2.2-3-2014 *On Structure and Content of Project Documentation for Construction* (hereinafter referred as BC A.2.2-3-2014) ¹ the concept of heavy maintenance is defined:

Set of works on the construction site, put into operation in the prescribed manner, without changing its geometric dimensions and functional purpose, involving intervention in the load-bearing and enclosing systems [Emphasis added – Author's notes], when replacing or restoring structures or engineering systems and equipment in connection with their physical deterioration and destruction, improving its performance, as well as landscaping.

Heavy maintenance involves the suspension for the duration of the operation of the facility as a whole or its parts (subject to their autonomy) ².

At the same time, the letter of the State Committee of Ukraine for Construction and Architecture No. 7/7-401 dated on 30.04.2003 *Regarding the attribution of repair and construction works to heavy and ongoing maintenance* ³ clarifies the following:

Heavy maintenance of a building is a complex of repair and construction works, which involves the replacement, restoration and modernization of structures and equipment of buildings due to their physical deterioration and destruction, improving performance, as well as improving building planning and landscaping without changing construction dimensions of the object.

Heavy maintenance involves the suspension for the duration of the operation of the facility as a whole or its parts (subject to their autonomy).

Ongoing maintenance is a complex of repair and construction works, which provides for systematic and timely maintenance of operational qualities and prevention of premature wear of structures and engineering equipment. If the building as a whole is not subject to heavy maintenance, the set of ongoing maintenance may include individual works that are classified as related to heavy maintenance (except for works that involve the replacement and modernization of structural elements of the building). Ongoing maintenance should be carried out at intervals that ensure efficient operation of the building or facility from the moment of completion of its construction (heavy maintenance) to the moment of installation for the next heavy maintenance (reconstruction) ⁴.

The letters of the Ministry of Regional Development, Construction and Housing of Ukraine № 9/9-26 dated on 13.01.2009 (hereinafter referred as

¹ ДБН А.2.2-3-2014. Склад та зміст проектної документації на будівництво : затв. наказом Мінрегіонбуду України від 04.06.2014 р. № 163 [Чинний від 01.10.2014 р.]. URL: https://dbn.co.ua/load/normativy/dbn/dbn_a_2_2_3_2014/1-1-0-1168 (date accessed: 18.03.2021).

² Ibidem.

³ Щодо віднесення ремонтно-будівельних робіт до капітального та поточного ремонтів : лист Держкомбудархітектури України від 30.04.2003 р. № 7/7-401. URL: <https://zakon.rada.gov.ua/rada/show/v-401509-03> (date accessed: 18.03.2021).

⁴ Щодо віднесення ремонтно-будівельних робіт ... URL: <https://zakon.rada.gov.ua/rada/show/v-401509-03> (date accessed: 18.03.2021).

Ministry of Housing and Communal Services of Ukraine) informed in a letter No. 8/7-2425 ¹ dated 11.03.2009 on the following:

"A suggested list of services for the maintenance of buildings and structures and adjacent territories and services for the repair of premises, approved by the Order of the State Housing and Communal Services No. 150 dated on 10.08.2004 (as amended) was developed to implement the Law of Ukraine On Housing and Communal Services".

Given the above, the Ministry of Housing and Communal Services believes that mentioned above Suggested List No. 150 can be used to determine the ongoing or heavy maintenance of hospitals, educational institutions, office buildings by the decision of their owners ².

The letter of the Ministry of Regional Development, Construction and Housing of Ukraine No 9/9-1056 ³ dated on 15.07.2009 states:

The Ministry of Regional Development, Construction and Housing of Ukraine has considered the letter from Heads of Control and Audit Department (CAD) regarding the assignment of repair and construction works to heavy or ongoing maintenance and on matters of authority reports:

The State Construction Committee of Ukraine by the letter No. 7/7-401 dated on 30.04.2003 addressed to the central and local executive bodies explained that the heavy maintenance is a complex of repair and construction works that involves replacement, restoration and modernization of structures and equipment in connection of their physical deterioration and destruction, improvement of operational indicators, as well as improving the planning of the building and landscaping without changing the construction dimensions of the object. Heavy maintenance involves the suspension of the operation of the building as a whole or its parts (subject to their autonomy). Ongoing maintenance is a complex of repair and construction works, which provides for systematic and timely maintenance of operational qualities and prevention of premature wear of structures and engineering equipment. If the building as a whole is not subject to the heavy maintenance, the set of ongoing maintenance may include individual works that are classified as related to the heavy maintenance (except for works that involve the replacement and modernization of structural elements of the building).

The ongoing maintenance should be carried out at intervals that ensure efficient operation of the building or facility from the moment of completion of its construction (heavy maintenance) to the moment of installation for the next heavy maintenance (reconstruction).

¹ Лист Мінжитлокомунгосп України від 11.03.2009 р. № 8/7-2425. URL: <https://zakon.rada.gov.ua/rada/show/v2425662-09> (date accessed: 18.03.2021).

² Ibidem.

³ Лист Мінрегіонбуду України від 15.07.2009 р. № 9/9-1056. URL: <https://zakon.rada.gov.ua/rada/show/v1056661-09> (date accessed: 18.03.2021).

Issues related to the operation of residential buildings, the timing of their repairs and the distribution of repair and construction works according to the classification belong to the powers of the Ministry of Housing and Communal Services of Ukraine.

According to the explanations provided by the letter No. 8/7-2425 dated on 11.03.2009 from the Ministry of Housing and Communal Services of Ukraine, the Suggested List of services for maintenance of buildings and structures and adjacent territories and services for repair of premises, buildings, structures, developed to implement the law of Ukraine: On Housing and Communal Services (approved by the Order of the State Housing and Communal Services of Ukraine No. 150 dated on 10.08.2004 as amended by the Order No. 198 dated on 12.11.2004), can be used to determine the work of ongoing or heavy maintenance of hospitals, educational institutions, administrative buildings by the relevant decision of the main fund manager.

In accordance with laws and regulations on construction, the issues of development of construction projects and their approval, implementation of financing and calculations for the volume of work performed are within the powers of the customer (fund manager) ¹.

Thus, the above quotations indicate that the definition of the concept of the *heavy maintenance* is given Section 3.7 of BC A.2.2-3-2014 and in the explanations of the Ministry of Regional Development, Construction and Housing of Ukraine (with reference to the Suggested List of services for the maintenance of buildings, structures, and adjacent territories and services for the repair of premises, buildings, structures, approved by the Order of the State Housing and Communal Services of Ukraine No. 150 dated on 10.08.2004 ²), differ, namely in the definition of the Ministry of Regional Development, Construction and Housing of Ukraine in the concept of the *heavy maintenance* there is a lack of an important feature characteristic of the classification of works – the prohibition to interfere in the load-bearing and facing systems.

Therefore (in accordance with Section 3.7 of BC A.2.2-3-2014), the important features of the heavy maintenance are:

- performance of works providing intervention in load-bearing and facing systems in case of replacement or restoration of designs or engineering systems and the equipment because of their physical deterioration and destruction, improvement of operational indicators;
- suspension for the duration of the operation of the building as a whole or its parts (subject to their autonomy).

¹ Лист Мінрегіонбуду України від 15.07.2009 р. № 9/9-1056. URL: <https://zakon.rada.gov.ua/rada/show/v1056661-09> (date accessed: 18.03.2021).

² Примірний перелік послуг з утримання будинків і споруд та прибудинкових територій та послуг з ремонту приміщень, будинків, споруд : затв. наказом Держжитлокомунгоспу України від 10.08.2004 р. № 150 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z1046-04> (date accessed: 18.03.2021).

It is also necessary to pay attention to Article 34 paragraph 2 (2) of the Law of Ukraine *On Regulation of Urban Planning Activities*, according to which *"the list of construction works that do not require documents allowing their performance, and after which the object is not subject to operation, approved by the Cabinet of Ministers of Ukraine"*¹.

As of today, the List of construction works that do not require documents that give the right to perform them, and after which the object is not subject to operation, approved by the Cabinet of Ministers of Ukraine from No. 406 dated on 07.06.2017 (hereinafter referred as the *List No. 406*)². This paper draws attention to such works as:

1. *Works on re-equipment and re-planning of a residential building and residential premises, as well as non-residential buildings, buildings, structures, premises within them, the implementation of which does not involve interference in facing and load-bearing structures and / or engineering systems of public use — class of consequences (responsibilities) belong to objects with insignificant (CC1), with average (CC2) and significant (CC3) consequences.*

<...>

3. *Reconstruction, heavy maintenance, technical re-equipment of internal systems:*

- *heating, including installation or replacement of equipment of individual heating stations, replacement of pipelines of heating systems <...> change of type of heating systems from one-pipe to two-pipe and / or from vertical to horizontal, installation and / or replacement of heating appliances, equipment of heating devices with automatic temperature regulators in premises, installation and replacement of devices-distributors and other equipment of regulation and accounting of thermal energy;*

- *ventilation;*
- *water supply and drainage, including pipelines;*
- *power and low-current systems that ensure the functioning of buildings and structures.*

4. *Replacement of existing fillings of window, balcony and doorways*³.

So, the question arises: to what kind of work do these works belong, which do not require the issuance of permits for their conduct and operation after their implementation?

¹ Про регулювання містобудівної діяльності URL: <https://zakon.rada.gov.ua/laws/show/3038-17> (date accessed: 18.03.2021).

² Перелік будівельних робіт, які не потребують документів, що дають право на їх виконання, та після закінчення яких об'єкт не підлягає прийняттю в експлуатацію : затв. Постановою КМУ від 07.06.2017 р. № 406 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/406-2017-п> (date accessed: 18.03.2021).

³ Перелік будівельних робіт, які не потребують документів URL: <https://zakon.rada.gov.ua/laws/show/406-2017-п> (date accessed: 18.03.2021).

Let's consider in more detail in what way it is possible to perform separate works:

- re-planning of rooms of building objects without interference in *facing and load-bearing* constructions (for example, on condition of demolition of the existing partitions not carrying loadings from other constructions of the object) and installation of new constructions of partitions which increase or, conversely, reduce the size and area of certain premises without increasing (decreasing) the construction object as a whole).

These works are connected with the replacement of old constructions of partitions by new;

- replacement of heating system (radiators, pipelines), water supply (pipelines and relevant devices), ventilation and power and low-current systems in buildings with autonomous utilities. These works are related to the replacement of old engineering systems with new ones;
- replacement of fillings of window, balcony and doorways. These works are related to the replacement of old window and door fillings with new ones.

From the aforementioned it can be seen that the implementation of these works involves the replacement of old building structures with new ones.

If we refer to the norm of Section 3.7 of BC A.2.2-3-2014, the work on the replacement or restoration of structures or engineering systems and equipment due to their physical deterioration and destruction are the heavy maintenance, but subject to intervention in the load-bearing and facing systems.

According to the aforementioned explanations of the Ministry of Regional Development, Construction and Housing of Ukraine, these works can also be classified as works belonging to the type of the heavy maintenance works, but not observed: with or without intervention in the load-bearing and facing systems. Simultaneously, these explanations introduce the concept of *ongoing maintenance* and state that *a set of ongoing maintenance may include individual works that are classified as related to heavy maintenance (except for works that involve replacement and modernization of structural elements of the building)*¹.

Consequently, if the object of the forensic structural engineering analysis is a building in which work with the following features is carried out: the geometric dimensions have not been increased, the functional purpose of the object has not been changed, structures that do not bear a certain load and autonomous engineering systems have been replaced (without interfering with load-bearing and facing structures), and operation of the building as a whole or its parts (subject to their autonomy) did not stop — then they can be classified as work related to the ongoing maintenance.

¹ Лист Мінрегіонбуду України від 15.07.2009 р. № 9/9-1056. URL: <https://zakon.rada.gov.ua/rada/show/v1056661-09> (date accessed: 18.03.2021).

Based on the above, it is deemed that the regulatory requirements for determining the type of construction (repair) work are not fully correlated with the explanations of the Ministry of Regional Development, Construction and Housing of Ukraine.

In addition, in accordance with the requirements of the Law of Ukraine *On Architectural Activity*, restoration, heavy maintenance, reconstruction of existing buildings and structures, as well as the construction of new architectural objects is carried out in accordance with the approved design documentation, current building codes and regulations, provided by the Law of Ukraine: *On Regulation of Urban Planning Activities*.

In this regard, there are at least two questions: 1) whether it is possible to consider the works that contain the List No. 406 and which are provided for in Article 34 of the Law *On Regulation of Urban Planning Activities*, simple, if they do not require permits, and after their completion, construction products are not subject to operation? 2) whether these works can be considered as those that do not require the preparation of design documentation or state architectural and construction control for compliance with legislation in the field of urban planning, building codes and regulations, state standards during construction (repair, reconstruction).

Conclusions. Thus, the ambiguity of interpretation in legislative, regulatory and information sources of classification features of types of work on construction sites complicates, and sometimes makes it impossible to form the conclusions of experts in forensic structural engineering analysis. Therefore, it is necessary to develop common approaches to solving such classification problems of forensic structural engineering analyses (research) in each case at studied facilities.

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І. Л. Пугачова, К. О. Осипенко, С. А. Кириленко

Проблемні питання будівельно-технічних досліджень із віднесення робіт на будівельних об'єктах до поточного та капітального ремонтів

Розглянуто актуальні проблемні питання будівельно-технічних досліджень щодо визначення певного виду робіт (поточний, капітальний ремонт).

Проаналізовано нормативні документи й інші джерела інформації, які фахівці застосовують під час проведення цього виду досліджень і для формування остаточних висновків експертних досліджень.

Акцентовано увагу на неоднозначному й дискусійному характері даних цих нормативів та інформаційних джерел, що ускладнює вибір посилання на такі дані й використання їх для розв'язання експертних завдань.

За результатами аналізу законодавчих і нормативних документів та експертної практики зроблено висновок про потребу у створенні класифікації різновидів будівельних робіт.

Ключові слова: *нерухомість, будівельні об'єкти, поточний ремонт, капітальний ремонт, переplanування, перебудова, розміри, площа, будівельні конструкції, утручання, роботи, експертиза, дослідження, віконні заповнення, дверні заповнення, інженерні системи.*

И. Л. Пугачёва, Е. А. Осипенко, С. А. Кириленко

Проблемные вопросы строительно-технических исследований по отнесению работ на строительных объектах к текущему и капитальному ремонтам

Статья посвящена решению вопросов, которые ставят перед экспертами при выполнении строительно-технических экспертиз (исследований), по определению принадлежности проведённых на строительных объектах ремонтно-строительных работ (проводимых или запланированных) к капитальному или текущему ремонту.

Решение проблем, с которыми приходится сталкиваться экспертам при проведении строительно-технических исследований по отнесению

к определённому виду работ (текущему, капитальному ремонту), актуально для теории и практики судебных экспертиз и экспертных исследований.

Проанализированы законодательные акты, нормативные документы и другие источники информации, используемые при проведении такого вида исследований и являющиеся основанием для формирования окончательных выводов выполняемых исследований.

Отмечены разночтения, неопределённость и неоднозначность данных, содержащихся в этих нормативных и информационных источниках, их дискуссионный характер, что затрудняет выбор ссылки на эти данные и их использование при решении экспертных задач, а в отдельных случаях делает невозможным формирование выводов экспертов строительно-технических исследований по этим вопросам.

На основании анализа законодательных актов, требований нормативных документов, а также экспертной практики сделан вывод о необходимости систематизировать и выработать единые методические подходы к решению актуальных задач судебной строительно-технической экспертизы по отнесению видов ремонтно-строительных работ к определённой классификации.

Ключевые слова: недвижимость, строительные объекты, текущий ремонт, капитальный ремонт, перепланировка, перестройка, размеры, площадь, строительные конструкции, вмешательство, работы, экспертиза, исследования, оконные заполнения, дверные заполнения, инженерные системы.

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Basic calculation methods of investigation of circumstances and mechanism of man-made explosions

The article purpose is to analyze the danger of man-made explosions and provide calculation methods for determining the mechanism of the occurrence of an explosion during forensic examinations of the study of the circumstances and mechanism of man-made explosions.

The relevance of the article is caused by the fact that present-day production and everyday life cannot dispense with the usage of combustible and explosive substances. The particular attention to be paid to emergency prevention related to explosives, as well as the research to determine the mechanism of man-made explosions. The research on the mechanism of man-made explosions will make it possible to determine the technical cause of their occurrence, to analyze for what reason and for whose fault the event occurred, and also what measures should be taken to minimize the likelihood of such situations occurrence.

It is noted that in order to obtain reliable conclusions about the mechanism of man-made explosions, it is necessary to use scientifically based methods and methodologies allowing us to assess the extent of destruction. The degree of destruction of surrounding building structures and harm to people depends on overpressure caused as the result of a significant expansion of the explosion products and their spread to all directions from the center of explosion. The most frequent causes of explosions in the explosive object are: destruction and damage to production tanks, equipment and pipelines; deviation from production regulations (excess pressure and temperature of equipment operating mode), low-quality control of equipment and work while conducting require work, and untimely or poor-quality maintenance of technological equipment.

The main calculation methods for the research of the man-made explosions in open areas, indoors, and limited space are given, which will allow to systematize the research process and analyze the flow of explosions in specific situations, and to establish a mechanism for their occurrence when conducting forensic examinations of the circumstances and mechanism of man-made explosions.

Keywords: *explosive, gas-vapor mixture, concentration limits for flame propagation, emergency situation, overpressure, man-made explosion.*

Formulation of Research Problem. Emergency situations (hereinafter referred to as *ES*) of a man-made nature related to man-made explosions are highly dangerous. An explosion combines a set of dangerous factors that can result in injury and death of people, as well as significant material losses and environmental pollution.

Since modern production and everyday life are impossible without the use of flammable substances and explosives, particular attention should be drawn to prevention of the occurrence of emergencies associated with explosions, as well as research on determining the mechanism of the occurrence of man-made explosions to further minimize their occurrence. Therefore, this topic is relevant and necessitates detailed consideration.

Analysis of Essential Researches and Publications. Forecasting the effects of man-made explosions occurring while deflagration of explosive-fire-hazardous mixtures at facilities of economic activity has been studied in detail by L. P. Piliuhin ¹. The scientist described destruction of buildings and structures due to the influence of excess pressure. Dynamics of scenarios of fire and explosions is provided in a research paper by N. N. Brushlynskyi and A. Ia. Korolchenko ². Consequences of fires and man-made explosions depending on conditions of a dangerous scenario are outlined by S. I. Taubkin ³. His son, I. S. Taubkin, developed foundations for performing forensic examinations of circumstances and mechanism of man-made explosions ⁴.

The mechanism of man-made explosions occurrence as well as the algorithm for conducting a research have been outlined by O. V. Tarakhno, V. M. Syrykh and R. V. Tarakhno in the following research papers: *Pressing*

¹ Пилиugin Л. П. Прогнозирование последствий внутренних аварийных взрывов. Москва, 2010. 380 р.

² Брушлинский Н. Н., Корольченко А. Я. Моделирование пожаров и взрывов. Москва, 2000. 482 р.

³ Таубкин С. И. Пожар и взрыв, особенности их экспертизы. Москва, 1999. 600 р.

⁴ Таубкин И. С. Судебная экспертиза техногенных взрывов. Организационные, методические и правовые основы. Москва, 2009. 592 р.

*issues of a research on explosions of gas-air mixtures during fire investigation*¹
*and Expert research on the version of gas-air mixture explosion indoors*².

The **Article Purpose** analysis of the danger of man-made explosions and provision of calculation research methods to determine the mechanism of their occurrence during forensic examinations of the circumstances and mechanism of man-made explosions.

Main Content Presentation. Research on man-made explosions in an open area aims to determine conditions for formation of explosive concentrations of combustible substances, possibilities for ignition and consequences of the development of explosive events. The potential danger is enterprises using large volumes of combustible gases and flammable liquids (gas stations, warehouses of liquefied gases and petroleum products, gas pipelines and oil pipelines). First of all, this is due to the threat of releasing significant volumes of combustible substances into the atmosphere to further explode.

Accordingly, simulation of emergencies associated with emergency leakage of gas or flammable liquids from technological equipment and formation of explosive areas is a pressing issue.

To obtain valid conclusions on the possibility of occurrence of fire and explosions, scientifically substantiated techniques should be implemented. In existing scientific and regulatory-procedural guidelines on forecasting consequences of emergency release of combustible substances into the environment, a sequence of calculation of such parameters as excess pressure, radius and time of “life” of the object engulfed in flames, etc. are provided. An important issue of research on man-made explosions in open area is to determine the possibility of destruction of buildings, constructions and death of people from the effects of explosion. The degree of destruction of surrounding building structures and damage to people depends on excess pressure which develops as a result of sharp thermal expansion of combustion products and spreads in all directions from the center of explosion. Excess pressure is determined as follows:

$$\Delta P = P_0 \left(0,8 \frac{m_{\text{TNT}}^{0,33}}{r} + 3 \frac{m_{\text{TNT}}^{0,66}}{r^2} + 5 \frac{m_{\text{TNT}}}{r^3} \right), \quad \text{кПа}, \quad (1)$$

where: P_0 — atmospheric pressure, кПа;

m_{TNT} — TNT equivalent, kg;

r — distance from the geometric median of steam-gas mixture, m³.

Determination of the explosion power is determined by the formula:

¹ Таран О. В., Сирих В. М., Тарахно Р. В. Проблемні питання дослідження вибухів газоповітряних сумішей при проведенні пожежно-технічних експертиз. *Проблеми пожежної безпеки* : сб. науч. тр. Харьков, 2009. Вып. 25. Р. 175—180.

² Ibid. Експертне дослідження версії виникнення вибуху газоповітряної суміші у приміщенні. Ibidem. Харьков, 2010. Вып. 27. Р. 198—205.

³ Таубкин С. И. Op. cit.

$$m_{\text{THT}} = \frac{Q_r \cdot m_{\text{rB}}}{4520}, \text{ кг}, \quad (2)$$

where: Q_r — combustion heat of combustible substance, kJ/kg;

m_{rB} — mass of explosive combustible substance, kg;

4520 — explosion heat of trinitrotoluene, kJ/kg.

However, unlike an explosion of condensed explosives, combustion of a gas-vapor mixture (hereinafter referred to as *GVM*) in the explosion regime occurs only on the outer part of the cloud and at a different speed in which concentration of combustible substance is in the range from lower to upper flammability limit.

Therefore, while evaluating parameters of the explosion of the gas-vapor cloud in open area, it is considered that the explosive (kinetic) combustion involves from 2% to 10% (max) of a combustible substance¹.

What is more, explosion of condensed explosives occurs in the detonation mode, at the same time transition of deflagration combustion of GVM in detonation is possible only for a small range of combustible gases: for example, hydrogen, acetylene. Given the above, the maximum possible efficiency of the GVM explosion due to deflagration is not more than 30%. Some part of energy converts into heated combustion products. After, the TNT equivalent of the explosion is determined as follows:

$$m_{\text{THT}} = \frac{0,3zQ_r m_{\text{rB}}}{0,9 \cdot 4520}, \text{ кг}, \quad (3)$$

where: 0,3 і 0,9 accordingly some part of energy spent on formation of explosion of gas-vapor cloud and trinitrotoluene;

m_{rB} — mass of combustible substance that entered the environment as a result of an emergency and formed GVM, kg;

z — coefficient of involvement of energy of steam and gases in explosion.

The area with calculated center of explosion and limits determined by the $r_{\text{пор}}$ blast radius is considered to be the area where destruction and injury to people takes place. And the probable destructive effect while explosion can be calculated from the generalized data by the approximation formula:

$$r_{\text{пор}} = \frac{k_i \sqrt[3]{m_{\text{B3}}}}{\left[1 + \left(\frac{3180}{m_{\text{B3}}} \right)^2 \right]^{\frac{1}{6}}}, \text{ м}, \quad (4)$$

where: k_i — dimensionless coefficient of the impact level of explosion which is determined depending on the excess pressure;

m_{B3} — mass of combustible substance involved in an explosion and equal to $m_{\text{rB}} \cdot z$, kg.

¹ Таран О. В., Сирих В. М., Тарахно Р. В. Проблемні питання дослідження вибухів ...

It is known, an emergency with the risk of explosion and subsequent fire at an industrial building or premises may occur as a result of accidental depressurization of an outdoor installation. The probability of explosion in the event of a combustible gas leakage into the room is created when the gas concentration reaches the lower flammability limit. Thus, to establish the possibility of combustion, it is necessary to compare the actual average concentration of combustible gas with the lower flammability limit of this gas.

The average actual concentration of gas formed in the room due to emergency leakage can be calculated by the formula:

$$\varphi'_{\text{сеп}} = \frac{m_{\Gamma}}{V_{\text{прим}}(1-\eta)} = \frac{m_{\Gamma}}{V_{\text{вільн}}}, \quad \text{or} \quad \varphi_{\text{сеп}} = \frac{100m}{\rho_{\Gamma} V_{\text{вільн}}}, \% \quad (5)$$

КТМ^{-3}

where: $\varphi'_{\text{сеп}}$, $\varphi_{\text{сеп}}$ — accordingly mass and volume average actual concentration of gas in a free volume of a room;

m_{Γ} — mass of gas entered the room while emergency, kg;

$V_{\text{прим}}$ — total room volume, m^3 ;

η — some part of room volume occupied by equipment or furniture;

$V_{\text{вільн}}$ — free volume of a room, m^3 .

To identify the average concentration of combustible gas, it is needed to know the mass of gas that entered into the room while the emergency leakage, with a certain mass flow rate of $g_{\Gamma}^{\text{налх}}$ for a certain time of the emergency situation.

As it is known¹, the mass flow rate at which gas flows through the opening and enters the room can be calculated by the formulas:

- if the leakage mode is subcritical ($\frac{P_{\text{сис}}}{P_{\text{атм}}} < 2$) —

$$g_{\Gamma}^{\text{налх}} = K_{\text{отв}} S_{\text{отв}} P_{\text{сис}} \sqrt{\frac{1}{R_{\text{шт}} T} \cdot \frac{2k}{k-1} \left[\left(\frac{P_{\text{атм}}}{P_{\text{сис}}} \right)^{\frac{2}{k}} - \left(\frac{P_{\text{атм}}}{P_{\text{сис}}} \right)^{\frac{k+1}{k}} \right]}, \quad \text{КТ} \cdot \text{с}^{-1}; \quad (6)$$

- if the leakage mode is critical ($\frac{P_{\text{сис}}}{P_{\text{атм}}} > 2$) —

$$g_{\Gamma}^{\text{налх}} = K_{\text{отв}} S_{\text{отв}} P_{\text{сис}} \sqrt{\frac{1}{R_{\text{шт}} T} \cdot \frac{2k}{k+1} \left(\frac{2}{k+1} \right)^{\frac{2}{k-1}}}}, \quad \text{КТ} \cdot \text{с}^{-1}, \quad (7)$$

where: $K_{\text{отв}}$ — gas flow rate through an opening (usually $K_{\text{отв}} = 0,64$)

k — adiabatic index of combustible gas;

$P_{\text{сис}}$ — the pressure in the gas supply system which is greater than the pressure of the environment where leakage occurs, Pa;

$P_{\text{атм}}$ — pressure in the environment in which gas leaks, Pa;

¹ Рябова І. Б., Сайчук І. В., Шаршанов А. Я. Термодинаміка і теплопередача у пожежній справі : навч. посіб. Харків, 2002. 356 р.

$S_{\text{отв}}$ — the area of opening through which gas leaks, m^2 ;

T — gas temperature, K ;

$R_{\text{пит}}$ — relative gas constant, $\text{J} \cdot \text{kg}^{-1} \cdot \text{K}^{-1}$.

Therefore, the time for which the average actual concentration of gas formed in a room as a result of accidental leakage and lack of gas exchange with the environment and will reach the value of the lower flammability limit can be estimated by the formula:

$$\tau_{\text{нкмпл}} = \frac{m_{\text{г}}}{g_{\text{г}}^{\text{налх}}} = \frac{V_{\text{вильн}} \phi'_{\text{н}}}{g_{\text{г}}^{\text{налх}}}, \text{ c}, \quad (8)$$

where: $\phi'_{\text{н}}$ — mass lower concentration limit of combustible gas flammability, kg m^{-3} . The equation of the material balance of combustible gas entered into the environment can be expressed by the differential equation:

$$\frac{dm_{\text{г}}}{dt} = V_{\text{вильн}} \frac{d\phi'_{\text{г}}}{dt} = g_{\text{г}}^{\text{налх}} - g_{\text{гс}}^{\text{внт}} \frac{\phi'_{\text{г}}}{\rho_{\text{гс}}}, \quad (9)$$

where: $\phi'_{\text{г}}$ — the average mass concentration of gas in the room at the τ time, kg m^{-3} ;

$g_{\text{гс}}^{\text{внт}}$ — mass flow rate at which the mixture of air and combustible gas leaks out of the room through openings (calculated depending on the gas exchange scheme), kg s^{-1} ;

$\rho_{\text{гс}}$ — density of the gas-air mixture under such conditions, kg m^{-3} .

The mass flow rate at which the gas mixture leaks through openings of a room can be calculated by the formula:

- if openings are at the same level —

$$g_{\text{гс}}^{\text{внт}} = \frac{2}{3} K_{\text{отв}} S_{\text{отв}} \sqrt{\frac{2gh_{\text{отв}} \rho_{\text{пов}} \rho_{\text{пт}} (\rho_{\text{пов}} - \rho_{\text{пт}})}{(\rho_{\text{пов}}^{0,33} + \rho_{\text{пт}}^{0,33})^3}}, \text{ кг} \cdot \text{с}^{-1}, \quad (10)$$

- if openings are at different levels —

$$g_{\text{гс}}^{\text{внт}} = K_{\text{отв}} S_{\text{прип}} S_{\text{внт}} \sqrt{\frac{2gHg_{\text{пов}} \rho_{\text{пт}} (\rho_{\text{пов}} - \rho_{\text{пт}})}{\rho_{\text{пов}}^2 S_{\text{прип}}^2 + \rho_{\text{пт}}^2 S_{\text{внт}}^2}}, \text{ кг} \cdot \text{с}^{-1}, \quad (11)$$

where: $K_{\text{отв}}$ — gas flow rate through an opening, which takes into account the loss of kinetic energy of the gas flow during its passage through openings as a result of friction, vorticity, etc. and depends on the shape of opening and wall thickness (for window and door openings are taken equal as $0.6 \div 0.65$);

$S_{\text{прип}}$ — the area of opening working to an air inflow;

$S_{\text{внт}}$ — the area of exhaust opening;

g — acceleration of gravity,

H — distance between centers of fresh air outlet and exhaust opening;

$\rho_{\text{пов}}$ — density of air outdoors;

$\rho_{\text{пт}}$ — density of gas environment in premises.

Solving the equation of material balance enables to determine the gas mass that accumulates in a premises during a certain time of the development of emergency, taking into account gas exchange with the environment:

$$m_r = \frac{g_r^{надх} \rho_r V_{вильн}}{g_r^{внт}} \left(1 - e^{-\frac{g_r^{внт} \tau}{\rho_r V_{вильн}}} \right), \text{ кг.} \quad (12)$$

Solving the equation within $\tau = 0$, $\phi_r = 0$ та $\tau = \tau_{нкмпп}$, $\phi_r = \phi_n$ helps to calculate the time in which the average concentration of combustible gas in a free volume of a room will reach the value of the lower flammability limit, given partial leakage of combustible gas through openings of a room in the course of its emergency entry:

$$\tau_{нкмпп} = \frac{V_{вильн} \rho_r}{g_r^{внт}} \ln \frac{g_r^{надх}}{g_r^{надх} - \frac{g_r^{внт} \phi'_n}{\rho_r}}, \text{ с.} \quad (13)$$

Over a certain time of flammable gas leakage, the lower flammability limit can be reached only in some part of a room. The so-called zone of explosive gas contamination is created. The radius of the zone of explosive gas contamination is estimated as follows:

$$R_{заг} = 1,1314 L \sqrt{\ln \left(\frac{1,38 \phi_o}{\phi_n} \right)}, \text{ м,} \quad (14)$$

where: L — the length of premises, м;

ϕ_n — volumetric lower combustible gas flammability limit, %;

ϕ_o — pre-exponential factor which is determined by empirical formulas:

• in the immovable environment —

$$\phi_o = 3,77 \cdot 10^3 \frac{m_r}{\rho_r V_{вильн}}, \text{ \%}, \quad (15)$$

• in movable environment ($v_{пов} > 0,1 \text{ м} \cdot \text{с}^{-1}$) —

$$\phi_o = 300 \frac{m_r}{\rho_r V_{вильн} v_{пов}}, \text{ \%}, \quad (16)$$

where: $v_{пов}$ — the speed of air in a room, $\text{м} \cdot \text{с}^{-1}$.

The time it takes for an explosive mixture to reach a potential ignition source (e.g. electric switch, open flame installations, etc.) can be estimated by the formulas (in the absence of airflows):

• in the immovable environment —

$$\tau = 1,92 \cdot 10^{-4} \frac{\rho_r V_{вильн} \phi_n}{g_r^{надх}} e^{\left(\frac{R}{1,1314 L} \right)^2}, \text{ с,} \quad (17)$$

- in the movable environment —

$$\tau = 2,4 \cdot 10^{-3} \frac{\rho_{\Gamma} V_{\text{вильн}} V_{\text{поврн}} \rho_{\text{н}}}{g_{\Gamma}^{\text{надх}}} e^{\left(\frac{R}{1,1314}\right)^2}, \text{ c}, \quad (18)$$

where: R — distance from the source of gas leakage to the probable ignition source, m.

Investigation of accidents at work due to explosions in pressure equipment (to establish the probable cause of their occurrence) is one of the main tasks assigned to the study of man-made explosions (this conditioned by occurrence possibility of such a physical phenomenon as gas-dynamic discontinuity). Due to release of energy that accumulates while gases compression, the vessel is torn into individual fragments. As it is known, during the arbitrary decay of a gas-dynamic discontinuity, three situations are possible which are outlined in detail below.

The first situation. The gas-dynamic discontinuity splits into two waves that spread in different directions from the initial discontinuity and to a contact discontinuity. This situation can occur during collision of two masses of gas moving towards each other at a significant speed, if the following condition is fulfilled ¹:

$$u_1 - u_2 > (P_2 - P_1) \sqrt{\frac{2/\rho_1}{P_1(\gamma_1 - 1) + P_2(\gamma_1 + 1)}}, \quad (19)$$

where: P_1, P_2 — pressure of gas environments (pressure of the first P_1 pressure environment is lower that the pressure of the second P_2 gas environment);

u_1, u_2 — speed of gas movement in the first and second environment;

ρ_1 — density of gas in the first environment;

γ_1 — adiabatic index of the first gas environment;

In practice, such events may occur at industrial machinery and equipment as a result of violations of conditions of technological processes. Thus, one of the stages in establishing the cause of explosion under the mentioned circumstances is the research on technological automation.

The second situation is when the gap splits into two separate rarefaction waves moving in opposite directions and into a contact discontinuity. Thus, in practice, the above-mentioned situation is realized while destruction of the vessel shell with subsequent collision of gases. It should be stressed that this is the most typical scenario for the development of an emergency explosion of pressure vessels with both combustible and non-combustible substances which is implemented in the following conditions ²:

$$\frac{2c_{s2}}{\gamma_2 - 1} \left(1 - \frac{P_1}{P_2}\right)^{\frac{\gamma_2 - 1}{2\gamma_2}} < u_1 - u_2 < (P_2 - P_1) \sqrt{\frac{2/\rho_1}{P_1(\gamma_1 - 1) + P_2(\gamma_1 + 1)}}, \quad (20)$$

¹ Таубкин С. И. Оп. cit.

² Таубкин С. И. Оп. cit.

where: γ_2 — the adiabatic index of the second gas environment;
 c_{s2} — speed of sound propagation in gas environment.

Thus, the destruction of vessels, being under the pressure, which contain liquefied gas or low-boiling liquid, is also accompanied by the appearance of an outside air wave and entering of the rarefaction wave into a vessel. This phenomenon provokes boiling of the liquid phase in a vessel and intense vaporization. During the described process, i.e. release of energy of the phase transition and the energy accumulated due to compression of the substance, the walls of the vessel shell are destroyed with possible spread of fragments over long distances.

The third situation is when the gas-dynamic discontinuity splits into two separate waves of rarefaction (their spread occurs in opposite directions). As a result, dispersion of gases takes place. At a fairly high speed of dispersion, the pressure in rarefaction waves drops to 0, and at the place of arbitrary discontinuity the area without gas appears which is being expanded: a vacuum. Thus, the explosion of the vessel with compressed gases and low-boiling liquids in the focal area of fire is called *BLEVE* (*Boiling Liquid Expanding Vapor Explosion*, that is explosion of vapors expanding while liquid boiling).

Studying the version of the occurrence of a physical or combined explosion conditioned by *BLEVE*, the potential possibility of such a phenomenon for a particular substance that was in the vessel is usually established. For this purpose, calculate the proportion of substance that immediately evaporates at a defined temperature according to the formula:

$$\xi_T = \frac{H_T - H_{T_{\text{кип}}}}{\Delta H_{\text{вип}}} = \frac{c_p (T - T_{\text{кип}})}{\Delta H_{\text{вип}}} \quad (21)$$

where: ξ_T — the proportion of liquid that immediately evaporates at T temperature;

H_T — relative enthalpy of liquid at T temperature;

$H_{T_{\text{кип}}}$ — relative enthalpy of liquid at $T_{\text{кип}}$ temperature according to atmospheric pressure;

$\Delta H_{\text{вип}}$ — relative heat of evaporation at the boiling point according to atmospheric pressure;

c_p — relative heat capacity of the liquid phase;

$T_{\text{кип}}$ — temperature of liquid boiling according to atmospheric pressure;

T — temperature of the liquid phase (in the availability in the vessel of the relief device, the T value is estimated by the formula:

$$T = \frac{B}{A - \lg P_K} - C_A + 273 \quad , K, \quad (22)$$

where: P_K — discharge pressure of the relief device;

A, B, C_A — Antoine constants (determined according to the reference literature).

If $\xi < 0,35$, then *BLEVE* does not occur. At $\xi > 0,35$ probability of the occurrence of this phenomenon is significant.

The explosive power of a vessel with superheated flammable and combustible liquids or liquefied hydrocarbon gases is determined by the TNT equivalent, and the degree of destruction of the facility structure is due to ΔR excess pressure and i momentum of an explosion, which can be estimated by the formulas:

$$\Delta P = P_0 \left(0,8 \frac{m_{np}^{0,33}}{r} + 3 \frac{m_{np}^{0,66}}{r^2} + 5 \frac{m_{np}}{r^3} \right), \quad \text{кПа}, \quad (23)$$

$$i = 123 \frac{m_{np}^{0,66}}{r}, \quad (24)$$

where: P_0 — atmospheric pressure, кПа;

r — distance from the center of vessel, m;

m_{np} — provided mass or the TNT equivalent of the explosion (mass of trinitrotoluene provoking a similar degree of destruction), kg;

$Q_{\text{THT}} = 4,52 \cdot 10^6 \text{ J} \cdot \text{kg}^{-1}$ — explosion heat of trinitrotoluene;

E_{eff} — the effective energy of the explosion during the expansion of vessel environment which is calculated by the formula:

$$E_{\text{eff}} = V \frac{P_p - P_0}{\gamma - 1}, \quad (25)$$

where: γ — the adiabatic index of the expanding gas atmosphere;

V — the volume of the tank being demolished;

P_p — the pressure at which the tank demolishes¹.

To sum up, the above calculations enable to analyze how explosions occur in particular situations, and to determine the mechanism of their occurrence while forensic examination of the circumstances and mechanism of man-made explosions.

Conclusions. The scientific paper presents main methods of studying man-made explosions in the open area, indoors and in limited amounts. It should be emphasized that in forensic expert practice of research on man-made explosions, experts often encounter ambiguous situations related to the mechanism of occurrence and development of such explosions. A full and multidisciplinary analysis of probable circumstances of the development of an emergency with application of calculation methods is provided allowing to resolve this issue and to perform corresponding researches in short terms.

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¹ Таубкин С. И. Оп. cit.

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Р. Н. Гусейнов, Ю. В. Панчук

Основні розрахункові методи дослідження обставин і механізму техногенних вибухів

Проаналізовано небезпеку техногенних вибухів, комплекс небезпечних чинників яких може спричинити тяжкі наслідки.

Метою статті є проведення аналізу небезпеки техногенних вибухів і наведення розрахункових методів дослідження для визначення механізму їх виникнення.

У статті викладено основні розрахункові методи дослідження техногенних вибухів на відкритій місцевості, у приміщеннях і в обмеженому об'ємі, що дасть змогу систематизувати процес дослідження та проаналізувати, як відбуваються вибухи в конкретних ситуаціях, і визначити механізм їх виникнення під час виконання судових експертиз дослідження обставин і механізму техногенних вибухів.

Ключові слова: вибухова речовина, газопароповітряна суміш, концентраційні межі поширення полум'я, надзвичайна ситуація, надлишковий тиск, техногенний вибух.

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Основные расчётные методы исследования обстоятельств и механизма техногенных взрывов

Цель данной статьи — проанализировать опасность техногенных взрывов и привести расчётные методы исследования для установления механизма их возникновения при проведении судебных экспертиз исследования обстоятельств и механизма техногенных взрывов.

Актуальность данной работы обусловлена тем, что современное производство и быт не могут обходиться без использования горючих и взрывоопасных веществ. При этом особое внимание следует уделять предупреждению чрезвычайных ситуаций, связанных со взрывами, а также проведению исследований по определению механизма возникновения тех-

ногенных взрывов. Исследования механизма возникновения техногенных взрывов позволят установить техническую причину их возникновения, проанализировать, по какой причине и по чьей вине наступило данное событие, а также какие меры следует предпринимать для минимизации вероятности возникновения подобных ситуаций.

Отмечено, что для получения достоверных выводов о механизме возникновения техногенных взрывов необходимо использовать научно обоснованные методы и методики, позволяющие оценить масштабы разрушения. Степень разрушения окружающих строительных конструкций и поражения людей зависит от избыточного давления, создаваемого в результате значительного расширения продуктов взрыва и распространения во все стороны от эпицентра. На взрывоопасных объектах причинами взрывов чаще всего являются: разрушение и повреждение производственных резервуаров, оборудования и трубопроводов; отклонение от технологического регламента (превышение давления и температурного режима работы оборудования), некачественный контроль за оборудованием и работой при проведении необходимых работ, а также несвоевременное или некачественное технологическое обслуживание оборудования.

Приведены основные расчётные методы исследования техногенных взрывов на открытой местности, в помещениях и ограниченном объёме, что позволит систематизировать процесс исследования и проанализировать протекание взрывов в конкретных ситуациях, а также установить механизм их возникновения при проведении судебных экспертиз исследования обстоятельств и механизма техногенных взрывов.

Ключевые слова: взрывчатое вещество, газопаровоздушная смесь, концентрационные пределы распространения пламени, чрезвычайная ситуация, избыточное давление, техногенный взрыв.

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Features of performing expert researches on electricity meters that have been exposed to radiofrequency electromagnetic radiation

The normative requirements for the stability of electricity meters to the influence of radiofrequency electromagnetic radiation on them were systematized. The mechanism of influence of radiofrequency electromagnetic radiation was outlined and the constructive elements of metering devices, sensitive to the action of such radiation, were determined. The division of constructive execution of electricity meters into groups according to the signs of protection against the specified influence is executed. Based on the division of the electricity meters into groups, the list of initial data required for such researches, was determined; recommendations for the researches of the effect of radiofrequency electromagnetic radiation on the studied meter are developed.

Keywords: *electricity meter, interference in the operation of the metering device, electromagnetic radiation, radiation frequency, electric field, electric field strength, level of electromagnetic radiation, Poynting vector, radiation power, electromagnetic field.*

Formulation of Research Problem. Researches on facts and circumstances of uncouncted electricity consumption in the practice of conducting forensic electrical examinations is one of the most common. Currently, in forensic practice, there are certain developments in the implementation of electrical researches on electricity meters. The researches on the influence of electromagnetic radiation on the operation of electronic (static) watt hour meters are one of the areas of the electrical researches on electricity meters,

but scientific and practical consideration of this area of forensic examinations does not meet modern needs. The research on operation of electronic electricity meters under the influence of external radiofrequency electromagnetic radiation with the determination of the researched radiation to random or artificially generated, i.e., a factor, formed intentionally for the purpose of unaccounted electricity consumption, is relevant.

Analysis of Essential Researches and Publications. Tasks, which are solved by forensic electrical examination of metering devices, which are to establish the facts of unaccounted electricity consumption with violation by consumers of the Rules of the retail market of electricity ¹ (hereinafter referred to as RRME), Code of commercial electricity accounting ² (hereinafter referred to as CCEA) and requirements for the operation of meters established by the manufacturer. Researches in forensic examinations with establishment of violations of the RRME and the CCEA today are conducted in accordance with the provisions of the Methodology of research on means electricity accounting and schemes of their connection in order to solve diagnostic tasks ³. This Methodology determines the general algorithm for researching the signs of interference in metering devices (the presence of mechanical and other damages to the device's body, protective elements, fishing line and sealing devices, revealing indicators, magnetic and electromagnetic effects, etc.) and provides instrumental confirmation, among other things, of impact technical feasibility on the researched metering device for the purpose of distortion of accounting with the use provided by the body or a person who initiated the research, of additional devices, apparatus, mechanisms (radiofrequency radiations, electromagnetic field sources, permanent magnetic field sources, etc.). General provisions of this Methodology make it impossible to specify the researches on circumstances of electromagnetic influence on the electricity meter, which complicates the determination of the existence of the influence of radiofrequency radiation on the electricity meter in the expert conclusion. Therefore, while forensic examination, the conclusion on the possibility of exposure to the radiofrequency electromagnetic radiation on the researched metering device is additionally based on other scientific and reference sources of information, where the electromagnetic compatibility of individual

¹ Правила роздрібного ринку електричної енергії : затв. постановою НКРЕКП від 14.03.2018 р. № 312 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/v0312874-18> (date accessed: 21.01.2021).

² Кодекс комерційного обліку електричної енергії : затв. постановою НКРЕКП від 14.03.2018 р. № 311 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/v0311874-18> (date accessed: 21.01.2021).

³ Методика дослідження засобів обліку електричної енергії та схем їх підключення з метою вирішення діагностичних завдань ; укладачі: В. В. Сабадаш, В. О. Дмитрієв, Д. І. Фокін, О. М. Меленцов, В. О. Рябухіна, Ю. О. Носатенко, В. І. Дубинка, В. В. Хоша, О. Б. Шмерего, О. С. Філіпчук, О. В. Лисенко. Харків, 2015. 20 с. URL: <https://rmpse.minjust.gov.ua/page/1> (date accessed: 21.01.2021).

components, namely integrated micro schemes ¹, as well as the issue of electromagnetic shielding ² has engineering processing ³ taking into account the characteristic parameters of radiation sources that form the electromagnetic field of influence. These sources of scientific and technical information were given as an illustrative example among the available ones and are not limited to them.

The **Article Purpose.** Review of the structure of electronic (static) electricity meters and determination of their components that are vulnerable to electromagnetic radiation with power field characteristics exceeding the normative value. Review of the constructive operating of means of protection of individual vulnerable components, or metering devices in general from the impact of electromagnetic radiation with power field characteristics, exceeding the normative value. Determining the list of initial data, required for research on electricity meters that have been exposed to radio frequency of the electromagnetic radiation for the purpose of unaccounted electricity consumption. Development of recommendations for research of influence of radiofrequency electromagnetic radiation on the researched metering device and delineation of conditions, under which the conclusion on interference in operation of the metering device for the purpose of unaccounted consumption of electricity due to existence of influence of radiofrequency electromagnetic radiation on the researched metering device can have categorical character. Development of recommendations for solving diagnostic tasks to determine the probable source of radiofrequency radiation in cases where the source is not provided for instrumental researches in expert proceedings to study the interference in the operation of the metering device for unaccounted electricity consumption.

Main Content Presentation. ГОСТ 30206-94 ⁴, ГОСТ 30207-94 ⁵ provide for the use of electronic (static) watt-hour meters with different design of the counting mechanism, both electronic and electromechanical. Measurement of electricity consumption by electronic measuring devices requires the

¹ Ключник А. В., Пирогов Ю. А., Солодов А. В. Исследование стойкости интегральных микросхем в электромагнитных полях импульсного радиоизлучения. Радиотехника и электроника. 2011. Т. 56. № 3. Р. 370—374.

² Максимов М. В., Бобнев М. П., Кривицкий Б. Х. и др. Защита от радиопомех ; под ред. М. В. Максимова. Москва, 1976. 496 р.

³ Князев А. Д., Кечиев Л. Н., Петров Б. В. Конструирование радиоэлектронной и электронной вычислительной аппаратуры с учетом электромагнитной совместимости. Москва, 1989. 224 р.

⁴ ГОСТ 30206-94 Статические счетчики ватт-часов активной энергии переменного тока (классы точности 0,2 S и 0,5 S) (МЭК 687-92). [Чинний від 01.07.2001]. URL: https://online.budstandart.com/ru/catalog/doc-page.html?id_doc=55951 (date accessed: 21.01.2021).

⁵ ГОСТ 30207-94 (МЭК 1036-90) Статические счетчики ватт-часов активной энергии переменного тока (классы точности 1 и 2). [Чинний від 01.07.2001] URL: http://online.budstandart.com/ua/catalog/doc-page.html?id_doc=56701 (date accessed: 21.01.2021).

conversion of an analog electrical signal, proportional to the amount of electricity consumption, into a digital signal. It is known from circuit design that: *"conversion of an analog signal into a digital form consists in measuring the instantaneous values of its amplitude at regular intervals and presenting the obtained values, called samples, in the form of a sequence of numbers. This procedure is called Analog-to-Digital conversion, and the device for its implementation is called analog-to-digital converter (ADC)"*¹. This principle of measurement with the corresponding conversion of the measured electrical signal is implemented in all modern static (electronic) electricity meters. For example, we give the principle of operation of the electricity meter type NIC 2303L... E from its operating instructions: *"1.4.1 Measurement of active and reactive electricity is performed by analog-to-digital conversion of electrical signals from the primary converters of current and voltage to the input of the built-in analog-to-digital converter (ADC) of the microcontroller, which converts signals into digital code. The microcontroller calculates the RMS value of current, voltage, power, the current value of the power factor for each phase, as well as the value of active and reactive energy in total and for each tariff"*². It is known that the effect of radiofrequency electromagnetic radiation on semiconductor devices and, above all, on integrated circuits (hereinafter referred to as ICs) leads to their inadequate operation in the electronic circuit. In the study of the resistance of ICs to electromagnetic radiation in the radio frequency range, in general, the following IC disturbances were distinguished that have been affected: *"Depending on the level of power absorbed by the elements of the SHF micro scheme, it is possible to distinguish such observed violations of the ICs performance that will determine its stability"*:

- interference and reverse failures with the restoration of normal characteristics and parameters after the cessation of exposure to radio radiation;
- degradation changes in parameters and characteristics with a slow deterioration of the technical characteristics of the products during operation and the output of the operating parameters of the product outside the specified tolerances;
- rapid *catastrophic* failures with irreversible disability³.

¹ Безвесільна О. М., Коротченко Н. П. Перетворювач аналогового сигналу у цифровий оптико-електронного акселерометра. *Вісник інженерної академії України*. 2013. № 3—4. Р. 36—38.

² ААШХ.411152.012 НЕ Лічильники електричної енергії НІК 2303L...Е. Настанова з експлуатації лічильники електричної енергії. Website підприємства-виробника ТОВ «Nik». URL: https://www.nik.net.ua/uploads/RE_2303LE.pdf (date accessed: 21.01.2021).

³ Ключник А. В., Пирогов Ю. А., Солодов А. В. Методические аспекты исследования стойкости интегральных микросхем в электромагнитных полях импульсного радиоизлучения. *Журнал радиоэлектроники*. 2010. № 8. URL: <http://jre.cplire.ru/jre/aug10/index.html> (date accessed: 21.01.2021).

Forensic practice of research on metering devices (hereinafter referred to as MDs) that have been affected by radiofrequency electromagnetic radiation, faces the task of establishing the fact of unaccounted electricity consumption, in the case when improper operation of the ICs is a consequence of blocking the transmission characteristics of the ICs (microcontroller MDs) from exposure to electromagnetic radiation in the radiofrequency range, which did not lead to a degrading change or to a "catastrophic" failure in the operating of MDs, i.e. forensic researches usually investigate cases of MDS, when the cessation of radiation restores the proper operation of the microcontroller and the entire electronic circuit of the MDs. It should be noted that under the influence of radiofrequency radiation on measuring equipment, which includes ICs, the processes, occurring in semiconductor and dielectric film microstructures, are determined by the applied voltages and induced currents, the magnitude of which depends on the geometric dimensions of these microstructural elements and their orientation direction of the electromagnetic field, the so-called polarization factor and so-called antenna mechanism of influence. The external elements that ensure the operation of this ICs are also essential for determining the degree of influence on the operation of the entire circuit. That is, so to speak, "vulnerability" or the degree of impact on the MDs of a particular design using ICs together with the radio elements of the external circuit, which includes ICs, must be researched in each case due to uncertainty, which exists not only due to certain design (in particular, mounting), but also due to the uncertainty of the characteristics of the electromagnetic field of influence, formed by a particular source with parameters that determine its power, or the ability to create a field strength greater than the allowable (regulatory); due to the uncertainty of the direction of radiation, which is due to the radiation pattern of the antenna device; degree of polarization, etc. That is why, there are certain requirements for manufacturers of electricity meters, that should be implemented in a specific design to avoid the impact of external factors. The requirements for electromagnetic compatibility, defined for meters, assume the absence of exposure to electromagnetic interference among others, and from the radiofrequency radiation of the electromagnetic field. In particular, the industry standard COY-H МПЕ 40 1 35 110-2005 ¹ puts forward the following requirements: *Electronic meters must be resistant to radio interference from spark discharges up to 15 kV through the air gap created, for example, during the operation of electrical appliances. After their termination on the working counter:*

- meter registrations must not have additional changes greater than 0.1 kWh caused by this effect, and no more than the corresponding number of pulses should not be generated at the test output values;

¹ COY-H МПЕ 40 1 35 110-2005 Додаткові вимоги до засобів обліку електроенергії, спрямовані на запобігання несанкціонованому втручання в їх роботу. [Чинний від 12.09.2005]. URL: https://online.budstandart.com/ru/catalog/doc-page.html?id_doc=28386 (date accessed: 21.01.2021).

- *the meter must not be damaged, and the main error must remain within normalized values*¹.

The limit value of the electromagnetic field strength that varies in the radiofrequency range for a long time, according to the requirements of DSTU EN 50470-3:2010, according to which the manufacturer of the metering device must comply with electricity metering with a certain error (for the appropriate accuracy class) should not exceed $10 \text{ V} / \text{m}^2$. It should be noted that the manufacturers of meters set their own indicators of adverse effects to electromagnetic fields in the radiofrequency range. Thus, for example, in the operating instructions of the meter NIK 2104... P2 in section 1.2.20 it is stated that: "*meters are not sensitive to high-frequency electromagnetic fields*"³. According to the definitions of DSTU 3254-95⁴, high frequencies are radiofrequencies limited by the range from 3 to 30 MHz. That is, in the case under study, the favorable MDs should be regarded as affecting the accounting of electricity in the frequency range exceeding high frequencies from 3 to 30 MHz. It follows from the aforementioned that, taking into account the requirements of the manufacturer of the MDs under research to the favor of radiofrequency radiation, taking into account the forensic practice of research into interference in the work of MDs, the research of the MDs' favor to radiofrequency radiation should be performed in the following frequency ranges according to the definitions of DSTU 3254-95:

- very high frequencies (VHF) - radiofrequency 30-300 MHz;
- ultrahigh frequencies (UHF) - radiofrequency 300-3000 MHz;
- super-high frequencies (SHF) - 3-30 GHz radiofrequency.

It is known from forensic practice that interference in the operation of metering devices by generating radiofrequency radiation with a frequency corresponding to the range of SHF radiofrequencies is not common, and in the frequency range exceeding SHF radiation is not recorded at all for statistical processing of forensic examinations for this direction of research at Hon. Prof. M. S. Bokarius Kharkiv Research Institute of Forensic Examinations (currently, *National Scientific Center "Hon. Prof. M. S. Bokarius Forensic Science Institute"*). The generalization of the results of research on MDs electric power,

¹ СОУ-Н МПЕ 40 1 35 110-2005.

² ДСТУ EN 50470-3:2010 Засоби вимірювання електричної енергії змінного струму. Частина 3. Спеціальні вимоги. Лічильники активної енергії статичні (класів точності А, В і С) (EN 50470-3:2006, IDT). [Чинний від 01.07.2012]. URL: https://online.budstandart.com/ru/catalog/doc-page.html?id_doc=54740 (date accessed: 21.01.2021).

³ ААШХ.411152.014 Лічильники електричної енергії NIK 2104...P2. Настанова з експлуатації. Website підприємства-виробника ТОВ «Nik». URL: <https://www.nik.net.ua/files/all/2104-electronic/Operating-Instructions-2104-non-tariff-Ru.pdf> (date accessed: 21.01.2021).

⁴ ДСТУ 3254-95 Радиосвязь. Термины и определения. [Чинний від 01.07.1996]. URL: https://online.budstandart.com/ru/catalog/doc-page.html?id_doc=72635 (date accessed: 21.01.2021).

which were exposed to radiofrequency electromagnetic radiation (in a certain frequency range), allows to systematize the design of electricity meters and to divide into three groups by structure on the basis of protection against radiofrequency electromagnetic radiation.

The first group of susceptibility to radiofrequency radiation includes MDs that does not contain structural elements of protection of vulnerable components of MDs (ICs), sensitive to radiofrequency radiation in the VHF — UHF — SHF range. The first group of MDs is characterized by a high level of susceptibility to this radiofrequency radiation. The influence of this radiation on the reliable metering of electricity within the normatively established error determined by the manufacturer, extends to MDs with different structure of the counting mechanism — both electronic and electromechanical. Such MDs, for example, can include MDs of the trademark: *Energomera*, type CE6803V and CE 301 R33, or meter type: *Mercury 230 AR-03R*. MDs, which are referred to the first group, are the most vulnerable to the action of radiofrequency radiation in the VHF — UHF — SHF range. In the first group we can distinguish a separate subgroup of MDs, the structure of which has certain features, namely, consists of individual radio elements and is characterized by the absence of ICs, or which have a low level of ICs application, combining a significant number of radio elements. With such a structure, the researched MDs belonging to this subgroup of the first group have a slightly greater resistance to radiofrequency radiation in some parts of a certain range of radiation. Such MDs, for example, includes MDs type ST-EA05, which has a fairly large size, and in its structure used output, through-type installation of individual radio elements of general design in the holes on the PCB without the use of integrated assemblies, and the circuit application of ICs is insignificant.

The second group of susceptibility to radiofrequency radiation includes MDs in the design of which electromagnetic screens are used. According to the design, the software belonging to the second group differ in size and structure of the screens. There are designs of the researched MDs with a solid electromagnetic screen, made in the form of a straight prism, consisting of two parts and having a connector on one of the faces. Such MDs, for example, include MDs type ET 3A5E7KLRT enterprise-manufacturer CV PLC: *ELVIN*. MDs with partial electromagnetic shielding are also common. In such designs, prismatic screens are most often used, in which one face is missing. MDs with partial electromagnetic shielding also include MDs with a solid screen, which primarily protects the individual sensitive elements of the ICs. Such MDs, for example, include MDs type SL 7000 on the manufacturer: *Itron (Actaris) Ukraine*. MDs classified as the second group of susceptibility to radiofrequency radiation have a high resistance to radiofrequency radiation in the VHF — UHF — SHF range compared to the first group of this division.

The third group of susceptibility to radiofrequency radiation includes MDs, which design as an option (indicating the appropriate marking on the nameplate —

the MDs panel) provides for the existence of a built-in sensor of electromagnetic field. The built-in sensor of influence of an electromagnetic field is an integrated component, a constructive part of the device of the account of electric energy. That is, the equipment of the metering device with an additional structural device (namely the built-in sensor of the electromagnetic field) does not change the protection of the metering device from radiofrequency radiation in the VHF — UHF — SHF range, but detects the presence of radiation in the presence of exposure to certain characteristic parameters. Such MDs include, for example, MDs type NIK 2303L AP1 MS E enterprise-manufacturer CV NIK. The presence of the letter S in the MDs marking indicates the presence of a built-in electromagnetic field sensor. It should be noted that the MDs classified in the third group of susceptibility to radiofrequency radiation, the structure of protection does not differ from the first group, but (as noted above) MDs of the third group have an integrated device for detecting the existence of radiofrequency in VHF — UHF — SHF range, which distinguishes them by constructive structure and separates them from the first and second groups of this distribution. It is the third group of MDs that most satisfies the need of a forensic expert in the process of research in the actual establishment of the existence of a source of radiofrequency radiation of the electromagnetic field for the purpose of unaccounted consumption of electricity. *"When exposed to an electromagnetic field meter with a voltage of more than 10 V/m in the frequency range from 80 to 500 MHz for more than 3 seconds:*

- *the message "Error radio" appears on the display;*
- *a record of the influence of the electromagnetic field is formed in the event log of the meter"*¹.

As noted above, the existence of uncertainties in the research on the effect of radiofrequency electromagnetic radiation on the studied meter comes primarily from the structure of the MDs, provided for the research and the characteristics of the electromagnetic field, generated by a particular radiation source. In the presence of radiofrequency radiation of the electromagnetic field, these factors are a condition of improper operation of the electrical circuit of the researched MDs with violation of the relevant electricity meter, but because the achievement of electric potential in microstructures (films, layers) of ICs (in the presence of such uncertainties) is unknown by default, so the expert conclusion under these conditions can only be probable. This means that the study of the possibility of the source to the formation of radiofrequency radiation with a field strength of more than 10 V/m in the area of structural placement of the ICs of the researched MDs should be carried out taking into account the circumstances that determine the so-called material situation, namely: the place of installation of the researched MDs, the method of their installation (assembly) in the executive electrical circuit of electricity metering, as well as the presence (if provided) of radiofrequency radiation and data on other electromagnetic devices in the space

¹ ААШХ.411152.012 НЕ Лічильники електричної енергії НІК 2303L ... URL: https://www.nik.net.ua/uploads/RE_2303LE.pdf (date accessed: 21.01.2021).

close to the studied MDs, approximation distance, the existence of data on the passage of emergency modes in the electrical installation of the consumer, etc. Establishing in the research of these circumstances and providing for the study of the device that is the source of radiofrequency radiation of the electromagnetic field for the expert experiment in laboratory studies of objects allows the expert to reach a categorical conclusion about the impact of radiofrequency electromagnetic radiation on the corresponding account of the consumed electricity by the researched MDs. The study of these circumstances involves determining the level of radiofrequency radiation of the electromagnetic field at the place of installation of the researched MDs. Table 1 of ДСТУ IEC 61000-4-3:2007¹ shows the test levels of radio frequency radiation of the electromagnetic field for general purpose devices (in particular, for electronic MDs, to which they belong) to test their immunity to radiofrequency electromagnetic fields of radiation. The following classes of electromagnetic environment correspond to the third level with a field strength of 10 V/m and more than 10 V/m:

class 2 — situation with an average level of electromagnetic radiation. Low-power transceivers (usually less than 1 W) are used, but there are restrictions on their use near equipment. This is a typical commercial environment;

class 3 — a situation with a high level of electromagnetic radiation. Portable transceivers (with a power of 2 W and more) are used quite close to the equipment, but not less than 1 m. These are powerful radio transmitters located close to the equipment, as well as close to high-frequency industrial, scientific and medical equipment. That is a typical industrial environment.

The first and second levels with field strengths of 1 and 3 V/m, respectively, belong to class 1 of the electromagnetic environment:

class 1 — an environment with a low level of electromagnetic radiation. Radiation levels are typical for radio and television stations located at a distance of more than 1 km, and in the presence of low-power transmitters/receivers.

It should be noted that the situation with a low level of electromagnetic radiation (class 1) is typical for household consumers of electricity and does not interfere with radiofrequency radiation with a field strength of more than 10 V/m, so does not affect the relevant electricity metering by the researched MDs. Detection of cases of blocking of MDs work by devices of radiofrequency radiation of an electromagnetic field at the household consumer of electric energy in the conditions of a situation with low level of radiation (class 1) taking into account regulatory requirements concerning the device of electric metering units radiofrequency range, should be qualified as a deliberate interference in the work of the researched MDs for the purpose of unaccounted consumption

¹ ДСТУ IEC 61000-4-3:2007 Електромагнітна сумісність. Частина 4-3. Методики випробування та вимірювання. Випробування на несприйнятливості до радіочастотних електромагнітних полів випромінювання (IEC 61000-4-3:2006, IDT). [Чинний від 01.10.2007]. URL: https://online.budstandart.com/ru/catalog/doc-page.html?id_doc=52800 (date accessed: 21.01.2021).

of electricity by the household consumer. A forensic expert can reach such a conclusion only in case of exclusion of the facts of existence of emergency modes in the electrical installation of the household consumer, connected with the occurrence of the approximate arc discharge or lightning discharge, as well as according to the data, excluding welding works close to the researched MDs. That is, the existence of arc welding.

Cases of operation of the studied MDs in an environment with medium and high levels of electromagnetic radiation for commercial and industrial environments requires the establishment of the fact that the electricity consumer has certain commercial or technological equipment, so the forensic expert in the relevant request of expert proceedings should require such equipment. Failure to provide this device for laboratory or field researches gives grounds for a forensic expert to perform the following estimation of the distance from the researched MDs to the radiofrequency source for radiation power of 1 W and 2 W, which are decisive for class 2 and class 3 of electromagnetic radiation accordingly.

From the sources of scientific and technical information it is known that the power of electromagnetic radiation is defined as the flux of the electromagnetic energy density vector (Pointing vector) through an arbitrary surface S per unit of time, i.e.:

$$W = \int_S \vec{\Pi} dS, \quad (1)^1$$

where $\vec{\Pi}$ — Pointing vector $\vec{\Pi} = [\vec{E}, \vec{H}]$ is the result of a vector product;
 dS — is an element of an arbitrary surface S .

It is known that E and H — voltage of electric and magnetic fields in free space.

E and H are related by the following equation:

$$E = \rho_{cb} H, \quad (2)$$

where $\rho_{cb} = 377 \text{ Ом}$ — impedance of free space.

From this we have:

$$\Pi = 377 H^2 \quad (3)$$

or

$$\Pi = 2,65 \cdot 10^{-3} E^2 \quad (4)^2$$

For a surface of 1 m^2 with a minimum allowable value of electric field voltage of 10 V/m , when the effect of electromagnetic radiation in the researched MDs (for the case of the study of the meter type NIK 2303L AP1 MS E) take

¹ Никольский В. В., Никольская Т. И. Электродинамика и распространение радиоволн. Москва, 1989. Р. 52.

² Никольский Б. А. Бортвые радиоэлектронные системы : электрон. учеб. Самара, 2013. URL: <https://repo.ssau.ru/bitstream/Uchebnye-posobiya/Bortovye-radioelektronnye-sistemy-Elektronnyi-resurs-elektron-ucheb-54583/1/Никольский%20Б.А.%20Бортвые.pdf> С. 89 (date accessed: 21.01.2021).

place, the value of the electromagnetic energy flux density (Pointing vector module) is 0.265 W/m². The calculated value can be accepted for further study under the following assumptions:

- pointing vector intersects the surface of the meter (meter sensor) evenly and perpendicularly at any point on this surface, and the size of the sensor is equal to the size of the surface of the meter;
- further calculations are performed under the condition that the radiation is carried out when using a non-directional vibrator of a half-wave dipole antenna that emits electromagnetic waves evenly in all directions in free space.

Under the following assumptions, you can perform an estimation of the radiation power according to the formula:

$$P = 4 \cdot \pi \cdot R^2 \cdot \Pi, \quad (5)^1$$

where R — radius of the sphere (distance), m.

Taking into account the value of radiation power of 1 W and 2 W, previously determined for class 2 and class 3 of the electromagnetic radiation environment, it is possible to calculate the distance (radius of the radiation sphere) from the studied MDs to the radiofrequency source for two power values:

$$R_1 = \sqrt{\frac{\Pi}{4 \cdot \pi \cdot P}} = \sqrt{\frac{0.265}{4 \cdot \pi \cdot 1,0}} = 0,145 \text{ м} \quad (6)$$

$$R_2 = \sqrt{\frac{\Pi}{4 \cdot \pi \cdot P}} = \sqrt{\frac{0.265}{4 \cdot \pi \cdot 2,0}} = 0,103 \text{ м} \quad (7)$$

According to the results of the evaluation calculation, it is possible to make a generalization about the limit value of the approach distance in the space of the source of radiofrequency radiation of electromagnetic field with voltage over 10 V/m to the MDs, which in the studied case captures (due to the equipment of the MDs sensor of electromagnetic radiation in the studied example) the effect of electromagnetic radiation, which is able to block the accounting of electrical energy. The distance of the location of the blocking source of electromagnetic radiation to the MDs in the studied example is in the range of 100—150 mm. Comparison of the calculation result with the overall dimensions of typical electrical cabinets (input, distribution), which are installed separately, and typical electrical cells in the distribution devices, allows us to conclude that the distance, calculated in the study of the source of influence or its radiating (antenna) device to the studied MDs is relatively small and such that it is mostly within the electrical cabinet. Since the arrangement of electricity metering points is regulated by the Rules of Arrangement of Electrical Installations and

¹ Никольский Б. А. *Op. cit.*

the Code of Commercial Electricity Metering, it can be argued that the actual location (presence) within the electrical cabinet with calculation MDs or in close proximity to the source of radiofrequency radiation (or its antennas) with the given parameters of influence are executed by the consumer intentionally for the purpose of unaccounted consumption of electricity.

For cases of approximate but external (relative to the electrical cabinet with the studied MDs) location of the radiation source, to provide a categorical conclusion about the blocking of electricity metering is essential to study the method of installation of electricity metering unit. Establishing in the research the fact of grounding a solid metal electrical cabinet eliminates the possibility of blocking the accounting of electricity in the studied MDs due to the runoff of the electric field charge. However, the presence of such shielding of the studied MDs in the case of design of an electrical cabinet with an aperture and provided the use of a radiofrequency radiation device with a directional antenna (with a narrow pattern) is not effective, and blocking the electricity metering of the studied MDs groups of classification division, can occur.

It should be noted that in forensic practice (due to the coincidence of the frequency of radiation of mobile devices with the frequency range of influence of VHF — UHF — SHF on sensitive elements of MDs) the study of the possibility of mobile devices on electricity metering is common in formulations of expert task, and at the same time associated with certain difficulties in determining the power of electromagnetic radiation generated by the mobile communication terminal, because the value of the radiation power depends on the distance of the phone to the base station. Appendix E *Guidance for Product Level Committees for Test Level Selection* ДСТУ IEC 61000-4-3: 2007 states that *most GSM terminals on the market today belong to Class 4 (maximum ERP [equivalent radiated power. — Authors' note.] is 2 W)*¹. From the general principles of cellular mobile architecture, it is known that the average power is 8 times less than the maximum for the GSM 900 standard and 16 times for the GSM 1800 standard and 5 times due to the sparse transmission intervals associated with frequency principle of channel separation (FDMA/TDMA) over time. That is, in practice (taking into account the distance to the base station) the radiation power is much lower and can be from 0.01 W to the maximum manufacturer's stated value of 2.0 W for 2nd generation systems (GSM) and 3rd and 4th systems generation (UMTS and LTE respectively)². The data of Table E.1 of the reference Annex E ДСТУ IEC 61000-4-3:2007 show that the *safe* distance (distance of protection of the researched equipment) for the radiation power of 2.0 W is 5.5 and 1.8 m for the 1st and 2nd level of field strength, respectively (1 V/m and 3 V/m). For the 3rd level of field strength (10 V/m) the distance of protection is not set, because (as indicated in the notes to Table E.1)

¹ ДСТУ IEC 61000-4-3:2007 ... URL: https://online.budstandart.com/ru/catalog/doc-page.html?id_doc=52800 (date accessed: 21.01.2021).

² Лохвицкий М. С., Сорокин А. С., Шорин О. А. Мобильная связь: стандарты, структуры, алгоритмы, планирование. Москва, 2018. Р. 214.

"the consequences of failure are significant". That is, taking into account the value of the maximum radiation power given in the reference data of Annex E ДСТУ IEC 61000-4-3:2007 (based on the provisions of ДСТУ IEC 61000-4-3:2007), we can conclude that there is an influence of radiofrequency radiation of the electromagnetic field, formed by the cellular mobile communication terminal, to general purpose electronic devices, however, it is practically impossible to qualify this influence as causing blocking of the account of consumed electricity by the studied meters for the following reasons:

- the value of the actual radiation power of the cellular mobile communication terminal is always much less than the value of the maximum effective radiated power due to the sparseness of the signal transmission intervals due to the frequency division multiplexing (FDMA/TDMA) principle;
- the value of the actual radiation power of the cellular mobile communication terminal is always much less than the value of the maximum effective radiated power due to the existence of cellular base stations with a guaranteed margin of coverage that does not meet the condition of maximum distance of base stations for operation in the area of the researched MDs;
- due to short-term exposure to radiation, which is associated with the alternate operation of communication channels, as well as the time limit set by the user of mobile services.

The aforementioned proves that the effect of electromagnetic radiation, generated by the mobile communication terminal, cannot be qualified as one that causes the blocking of electricity metering by the researched MDs.

Based on the results of the research, this article develops a list of initial data for forensic examinations to determine the existence of the influence of radio frequency electromagnetic radiation on the studied meter and the tasks of identifying radiofrequency devices as sources of influence. The amount of necessary initial data is divided and provided separately according to the stages of the research, which are recommended for use in forensic practice together with previous generalizations.

The list of initial data for forensic examinations on the effects of radiofrequency electromagnetic radiation on the studied MDs is recommended for use in forensic practice in the stages of the research

1. The forensic expert performs the establishment of the class of electromagnetic radiation on the basis of the following data:

1.1 establishment of an exhaustive list of devices that are sources of electromagnetic radiation that surround the studied MDs within the premises where it is installed for commercial metering of consumed electricity.

Clarification of the functional purpose of these devices (commercial, industrial, technological, scientific, which is associated with certain activities is set for consumers of electricity that are not household). Finding out the need to

place these devices (process equipment) in the room where the studied MDs is installed;

1.2 determining the value of the maximum power of each of the available devices that are sources of electromagnetic radiation;

1.3 setting the range of radiofrequency radiation for each of all available devices that are sources of electromagnetic radiation;

1.4 setting the mode of operation of each of all available devices that are sources of electromagnetic radiation: long-term, short-term, re-short-term, etc. Setting the radiation mode: continuous or discrete. For the last mode of operation, the duration of the radiation period is additionally set.

Note. The data according to sections 1.2, 1.3 and 1.4 are determined according to the passport data of devices that are sources of electromagnetic radiofrequency radiation, or on the basis of measurement protocols performed by employees of the National Commission for State Regulation of Communications and Informatization for control over Ukrainian radio-frequency resources, which must be provided at the request of a forensic expert.

2. Investigation of the circumstances of installation of the studied MDs.

2.1 installation with field inspection, or according to the data provided at the request of the forensic expert, determining the distance from each of all available devices that are sources of electromagnetic radiation, and from their antenna devices to the studied MD;

2.2 making a sketch of the spatial location of the studied MDs in relation to each of all available devices that are sources of electromagnetic radiation;

2.3 establishing all the facts of installation of the studied MDs in the electrical cabinet, the design of the electrical cabinet (solid or with a viewing window), the material of the electrical cabinet (polymer or metal), geometric dimensions of a cabinet, the existence of metal cabinet grounding, etc.;

2.4 establishment of a group of constructive execution of the researched MDs according to the division given above in this article.

3. Establishment of the existence facts of sources of radiofrequency radiation, which are not devices, but could exist (arise) under certain conditions in the studied period of time due to physical processes in the electrical installation, as well as due to actions of electricity consumers or outsiders and are not aimed at unaccounted for electricity consumption.

3.1 establishment of the facts of existence of the arc category which has arisen as a result of an emergency mode in a place of electric installation which is close to an arrangement of the studied MDs in a place of its installation at the consumer;

3.2 establishing the facts of the existence of a lightning discharge that occurred in the place of electrical installation, which is close to the location of the studied MDs in the place of its installation by the consumer;

3.3 establishment of the facts of performance of electric welding works in the place which is close to the location of the studied MDs in the place of its installation at the consumer.

Note. Establishing the existence of sources of radiofrequency radiation, which are not devices for use by electricity consumers or third parties, for the purpose of unaccounted consumption of electricity under SECTIONS 3.1, 3.2 and 3.3 is performed to obtain linear dimensions of distances from such sources to the studied MDs for comparison study of this distance with a standard distance of 100-150 mm (half the diameter of the test loop), for which the meters are tested according to the requirements of COY-H MPE 40 1 35 110-2005 (loop diameter 200—300 mm).

4. Organization and implementation of the expert experiment to obtain data on the existence of the influence of radiofrequency radiation on the normal operation of the studied MDs. Research and obtaining data for this stage of the study is performed only in the case of providing the forensic expert with a remote device for laboratory research on the existence of such an effect.
5. Execution of the calculated part of the study is carried out by the forensic expert on the basis of initial data obtained from the previous stages of the study, and only if the source of radiofrequency radiation is uncertain or not provided for laboratory tests at the request of forensic proceedings to establish the existence of the influence of radiation on the studied MDs during the accounting of the consumed electricity.
6. Analysis of the data obtained as a result of the above stages of the study, using the recommendations of this article and on the basis of regulatory requirements for the investigated issues, the forensic expert provides an opinion on the expert task to determine the existence of radio frequency radiation on the studied MDs for the purpose of unaccounted electricity consumption, determination of the probable source of radio frequency radiation in case the radiation source is not provided for instrumental research or conclusion on the belonging of the studied radiation to accidental or artificially generated, i.e. such factor created intentionally for unaccounted electricity consumption.
7. Verification of a conclusion based on the results of the study is carried out by the forensic expert on the basis of data on electricity consumption from the event log of the studied MDs for calculation periods belonging to the studied period and in similar periods when electricity consumption is considered appropriate. Relevant data from the event log should be requested by the forensic expert in the request for additional materials.

Conclusions. The normative requirements established for the stability of electricity meters from the influence of radiofrequency electromagnetic radiation on them are systematized.

The mechanism of influence of radiofrequency electromagnetic radiation and constructive elements of metering devices, sensitive to the action of such radiation are determined. The division of types of constructive execution of electricity meters into groups on the basis of protection against the influence of radiofrequency electromagnetic radiation is performed.

Conditions are outlined under which the conclusion about interference in the operation of the metering device for the purpose of unaccounted electricity consumption may be categorical. Recommendations have been developed to determine the source of radiofrequency radiation as probable in cases where the source is not provided for instrumental research in expert proceedings to study the interference in the operation of the meter for the purpose of unaccounted electricity consumption.

Based on the results of the research, this article develops a list of initial data for forensic examinations to determine the existence of the influence of radiofrequency electromagnetic radiation on the studied meter and tasks of identification of radiofrequency devices as sources of influence. The amount of necessary initial data is divided and given separately by stages of research, which are recommended for use in the forensic practice.

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**Особливості виконання експертних досліджень приладів обліку
електричної енергії, які зазнали впливу
радіочастотного електромагнітного випромінювання**

Дослідження впливу електромагнітного випромінювання на роботу електронних приладів обліку електричної енергії — одне із затребуваних напрямів судової електротехнічної експертизи. Однак, науково-практичне опрацювання цього напрямку судово-експертних досліджень не відповідає сучасним вимогам. Дослідження впливу електромагнітного випромінювання

радіочастотного діапазону на роботу електронних приладів обліку електричної енергії, а також ідентифікація такого випромінювання як випадкового або створеного штучно з метою безоблікового споживання електричної енергії, є актуальними.

Мета статті — систематизувати нормативні вимоги до стійкості роботи електронних приладів обліку електричної енергії в разі впливу на них електромагнітного випромінювання, виконати огляд конструктивної побудови електронних приладів обліку електричної енергії з визначенням вразливих компонентів, класифікувати конструктивні виконання приладів обліку за стійкістю до такого виду впливу, розробити перелік вихідних даних, необхідних для проведення досліджень приладів обліку електричної енергії, які зазнали впливу радіочастотного електромагнітного випромінювання з метою необлікованого споживання електричної енергії, а також розробити методичні рекомендації для проведення досліджень впливу радіочастотного електромагнітного випромінювання на прилад обліку в судово-експертному виробництві.

У статті систематизовано вимоги, передбачені нормативними документами до стійкості роботи приладів обліку електричної енергії в разі впливу на них радіочастотного електромагнітного випромінювання. Визначено механізм впливу радіочастотного електромагнітного випромінювання на прилади обліку електричної енергії та конструктивні елементи приладів обліку, чутливі до дії такого випромінювання. Оглянуто сучасні типові конструктивні виконання приладів обліку електричної енергії й виконано їх класифікаційний поділ на групи за ступенем захищеності в разі впливу на прилади обліку радіочастотного електромагнітного випромінювання.

Зазначено умови, за яких висновок про втручання в роботу приладу обліку з метою неврахованого споживання електричної енергії матиме категоричний характер. Розроблено рекомендації із визначення джерела радіочастотного випромінювання як імовірного, у разі коли джерело не надано для проведення інструментальних досліджень в експертних виробництвах із дослідження втручання в роботу приладу обліку.

Розроблено перелік необхідних вихідних даних для проведення судових експертиз з питань визначення існування впливу радіочастотного електромагнітного випромінювання на досліджуваний прилад обліку та завдань ідентифікації приладів радіочастотного випромінювання як джерел впливу. Розроблений перелік необхідних вихідних даних розподілено та представлено окремо за рекомендованими до застосування етапами виконання досліджень у судово-експертній практиці.

Ключові слова: прилад обліку електричної енергії, втручання в роботу приладу обліку, електромагнітне випромінювання, частота випромінювання, електричне поле, напруженість електричного поля,

рівень електромагнітного випромінювання, вектор Умова-Пойнтінга, потужність випромінювання, електромагнітне екранування.

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Особенности выполнения экспертных исследований приборов учёта электрической энергии, подвергшихся воздействию радиочастотного электромагнитного излучения

Исследование влияния электромагнитного излучения на работу электронных приборов учёта электрической энергии — одно из востребованных направлений судебной электротехнической экспертизы. Однако научно-практическая проработка этого направления судебно-экспертных исследований не соответствует современным требованиям. Исследование влияния электромагнитного излучения радиочастотного диапазона на работу электронных приборов учёта электрической энергии, а также идентификация такого излучения как случайного или созданного искусственно с целью безучётного потребления электрической энергии являются актуальными.

Цель статьи — систематизировать нормативные требования к устойчивости работы электронных приборов учёта электрической энергии при воздействии на них электромагнитного излучения, выполнить обзор конструктивного построения электронных приборов учёта электрической энергии с определением уязвимых компонентов, классифицировать конструктивные исполнения приборов учёта по устойчивости к такому виду воздействия, разработать перечень исходных данных, необходимых для проведения исследований приборов учёта электрической энергии, подвергшихся воздействию радиочастотного электромагнитного излучения с целью неучтённого потребления электрической энергии, а также разработать методические рекомендации для проведения исследований влияния радиочастотного электромагнитного излучения на прибор учёта в судебно-экспертном производстве.

В статье систематизированы требования, установленные нормативными документами к устойчивости работы приборов учёта электрической энергии при воздействии на них радиочастотного электромагнитного излучения. Определён механизм влияния радиочастотного электромагнитного излучения на приборы учёта электрической энергии и определены конструктивные элементы приборов учёта, чувствительные к воздействию такого излучения. Выполнены обзор современных типовых конструктивных исполнений приборов учёта электрической энергии и классификационное разделение этих конструктивных исполнений на группы по степени защищённости при воздействии на приборы учёта радиочастотного электромагнитного излучения.

Обозначены условия, при которых вывод о вмешательстве в работу прибора учёта с целью неучтённого потребления электрической энергии

может иметь категорический характер. Разработаны рекомендации по определению источника радиочастотного излучения как вероятного в случаях, когда источник не предоставлен для проведения инструментальных исследований в экспертных производствах по исследованию вмешательства в работу прибора учёта.

Разработан перечень необходимых исходных данных для проведения судебных экспертиз по вопросам определения существования воздействия радиочастотного электромагнитного излучения на исследуемый прибор учёта и задач идентификации приборов радиочастотного излучения как источников воздействия. Разработанный перечень необходимых исходных данных разделён и представлен отдельно по рекомендованным к применению этапам выполнения исследований в судебно-экспертной практике.

Ключевые слова: прибор учёта электрической энергии, вмешательство в работу прибора учёта, электромагнитное излучение, частота излучения, электрическое поле, напряжение электрического поля, уровень электромагнитного излучения, вектор Умова-Пойнтинга, мощность излучения, электромагнитное экранирование.

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Regarding the improvement of the scientific and methodological framework of forensic economic analysis of budget funds (Review article)

The relevance of issues associated with spending budget funds in forensic expert practice has been substantiated. According to the authors, certain peculiarities of conducting researches on budget transactions lead de facto to the formation of a particular subtype of forensic economic analysis. It is mentioned that consideration of issues related to misuse of budget funds by forensic experts is only allowed in the presence of tax inspection report of the Units of Ukraine State Audit Service. It is proved that budget funds which their holder transfers to accounts of work executors, lose the status of budget. The emphasis is on the need to update the algorithm for conducting forensic economic analyses in the use of budget funds.

Keywords: *budget funds, forensic economic analysis, methodical framework.*

Formulation of Research Problem. The main component of improving the quality of forensic expert support of justice is advancement of scientific and methodological framework of forensic activity, in particular, forensic economic analysis.

As forensic expert practice demonstrates, in recent years, the most complicated researches have been performed while conducting forensic examination of spending budget funds, development of cost estimates, implementation stages and budget process participants.

Analysis of Essential Researches and Publications. The issue of scientific and methodological support as one of directions of ensuring activities of forensic institutions in Ukraine is not devoid of scientific interest and receives extensive coverage in writings of leading Ukrainian and foreign scientists: experts in the field of forensic science, such as T. V. Averianova, L. Yu. Arotsker, V. D. Arsenieva, V. D. Basai, V. V. Biriukov, A. I. Vinberh, O. O. Eisman, O. M. Zinin, A. V. Ishchenko, N. I. Klymenko, M. V. Kostytskyi, V. K. Lysychenko, O. M. Lytvynov, H. M. Nadhornyi, I. V. Pyroh, M. Ia. Sehai, E. B. Simakova-Yefremian, I. Ya. Fridman, M. H. Shcherbakovskyi and others.

At present, the basic expert methodology on research on forensic economic analyses of the issue of budget funds (under registration number: 11.0.12) ¹ misuse is in force, however, it was created in 2003, therefore its content does not correspond to current budget legislation. What is more, the Register of certified expert methodologies includes the Methodology of expert research on the use of inter-budgetary transfers, but it concerns a rather narrow issue that excludes its use as the basic.

The **Article Purpose** is to study the need to develop scientific guidelines of research on spending budget funds.

Main Content Presentation. Optimization of income generation and budget expenditures at all levels is one of the main directions of structural reforms implementation in the economic sector required by international financial institutions. An important instrument in solving these tasks is control and audit in the budget process.

According to Article 26 of the Budget Code of Ukraine², control over compliance with budget legislation aims to support efficient and effective management of budget funds and, in particular, ensures:

- evaluation of budget funds management by conducting a state financial audit;
- verification of the correctness of budget funds accounting and reliability of financial and budget reporting;
- increasing the economy of budgetary savings, their targeted use, efficiency and effectiveness in the activities of budget holders by adopting substantiated management decisions;
- conducting analysis and evaluation of the state of financial and economic performance of budget holders;
- prevention of budget legislation violation;
- substantiation of planning of incomes and expenditures from the budget.

¹ Реєстр методик проведення судових експертиз. URL: <https://rmpse.minjust.gov.ua/page/11> (date accessed: 21.02.2021).

² Бюджетний кодекс України : Закон України від 08.07.2010 р. № 2456-VI (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/2456-17> (date accessed: 21.02.2021).

Control over the use of budget funds is performed by the Accounting Chamber, State Audit Service, bodies of the State Treasury Service of Ukraine. Activity of central executive authorities ensuring provision of state policy in the field of control over budget legislation directs, coordinates and controls the Cabinet of Ministers of Ukraine.

Holders of budget funds in persons of their heads organize internal control and internal audit and support their implementation in their institutions and corresponding budget institutions.

Criminal liability for misuse of budget funds, implementation of budget expenditures without certain budget assignments or with their increase is stipulated in Article 210 of the Criminal Code of Ukraine¹.

According to the 1 Note to this article, budget funds include funds belonging to the state budget and local budgets regardless of the source of their formation.

A huge amount of budget funds, in accordance with paragraph 2 of this note, is considered to be the amount that exceeds the non-taxable minimum income of citizens in thousands and more times. A particularly large amount is thought to be the sum exceeding non-taxable minimum of citizens income in three thousand and more times (paragraph 3 notes).

In conformity with Article 119 of the Budget Code of Ukraine², misuse of budget funds is spending them for the purposes not corresponding to:

- budget assignment required by the law on the State Budget of Ukraine (decision on local budget);
- directions for the use of budget funds stipulated in the budget program passport or in the procedure for budget funds use;
- budget allocations (budgeting, estimate cost, budget funds use plan).

In the process of investigating criminal proceedings on budget offenses, investigative bodies (in accordance with Article 242 paragraph 2 of the Criminal Procedural Code of Ukraine³) appoint forensic economic analyses to confirm conclusions drawn while state regulatory authorities inspection.

For qualitative performance of such forensic examinations which are quite complicated and have a certain specificity, the presence of a modern expert methodology of researches on budget funds is highly important.

Currently, such forensic examinations are carried out within the framework of the specialization 11.2: *Research on documents on economic activity of enterprises and organizations*, but accounting and reporting regarding the use

¹ Кримінальний кодекс України : Закон України від 05.04.2001 р. № 2341-III (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/2341-14> (date accessed: 21.02.2021).

² Бюджетний кодекс України ... URL: <https://zakon.rada.gov.ua/laws/show/2456-17> (date accessed: 21.02.2021).

³ Кримінальний процесуальний кодекс України: Закон України від 13.04.2012 р. № 4651-VI (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/4651-17> (date accessed: 21.02.2021).

of budget funds significantly differ from the accounting of the rest of business transactions.

According to the authors, certain peculiarities of conducting researches on budget transactions lead de facto to the formation of a particular subtype of forensic economic analysis.

While application of construction budget programs, after conducting procedures stipulated by the Law of Ukraine: *On Public Procurement*, budget funds are directed to construction organizations as payment (prior payment) for goods, work (services). Before 01.01.2020, Procedure for implementation of such payments was governed by the Resolution of the Cabinet of Ministers of Ukraine No. 117: *On ensuring prepayment for goods, work and services purchased for budget funds*¹ dated on 23.04.2014 .2019; after 01.01.2020, by the Resolution of the Cabinet of Ministers of Ukraine No. 1070: *Certain issues of budget funds provision by holders (recipients) for prepayment of goods, works and services* dated on 04.12.2019.

After crediting funds to accounts of executors of a corresponding construction work, enterprises use them to fulfill their obligations, as well as can carry out transactions with such expenses not related to the implementation of relevant construction contracts (for example, to allocate them on deposit accounts). In the course of performing expert tasks, a need to define these funds as budget and confirmation of their misuse according to Article 119 of the Budget Code of Ukraine² may arise.

First and foremost, it should be stressed that (in conformity with provisions of Art. 1 and 8 of the Law of Ukraine: *On State Control Auditing Service in Ukraine*³), the implementation of state financial control and control over targeted and effective use of State and local budgets lie within the competence of state financial control body: State Audit Service of Ukraine. Results of the working meeting with participation of Directorate for Justice and criminal justice, the Department of Expert Support of Justice and the National Anti-Corruption Bureau of Ukraine, which was held on 24.12.2020 in the Ministry of Justice of Ukraine demonstrate the relevance of a significant improvement in the scientific and methodological framework of carrying out forensic examinations on the use of budget funds based on inspections performed by state financial control bodies. As stated in the information letter of the Ministry of Justice of Ukraine No. 185/09-16/a2/21 dated on 02.02.2021, based on the results of the meeting,

¹ Про здійснення попередньої оплати товарів, робіт і послуг, що закуповуються за бюджетні кошти : Постанова КМУ від 23.04.2014 р. № 117 (expired). URL: <https://zakon.rada.gov.ua/laws/show/117-2014-%D0%BF> (date accessed: 21.02.2021).

² Бюджетний кодекс України ... URL: <https://zakon.rada.gov.ua/laws/show/2456-17> (date accessed: 21.02.2021).

³ Про основні засади здійснення державного фінансового контролю в Україні : Закон України від 26.01.1993 р. № 2939-XII (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/main/2939-12> (date accessed: 21.02.2021).

agreements were reached on revision of paragraph 3 of Scientific and methodical recommendations concerning preparation and appointment of forensic examinations and expert researches approved by the Order of the Ministry of Justice of Ukraine No. 53/5¹ dated on October 8, 1998 (hereinafter referred to as *scientific guidelines*), and introduction of provisions into them concerning the fact that forensic experts cannot solve issues belonging to exclusive competence of state financial control bodies. It is mentioned that consideration of issues related to misuse of budget funds by forensic experts is only allowed in the presence of tax inspection report of the Units of Ukraine State Audit Service.

According to authors, when considering provisions of paragraph 3 of Guidelines, it is expedient to specify tasks of forensic economic analysis of budget funds use and to provide issues being resolved while its implementation.

After reviewing guidelines as a basic guideline, a modern algorithm for conducting forensic economic analysis of budget funds use should be developed where attention has to be drawn to certain problematic issues that may occur while research process.

First of all, a forensic expert must address the issues of whether a concerned organization is a participant in the budget process and whether transactions are carried out on the use of obtained budget funds by an organization within the budget process.

According to Article 19 of the Budget Code of Ukraine ²:

“Stages and participants of the budget process

1. The following stages of the budget process are recognized:

- 1) compilation and consideration of the Budget declaration (the local budget estimate) and making a decision on it;
- 2) compilation of budget projects;
- 3) consideration of a project and adoption of the Law: *On the State Budget of Ukraine* (decision on local budget);
- 4) budget execution including amending the Law: *On the State Budget of Ukraine* (decision on local budget);
- 5) preparation and consideration of a report on budget execution and making a decision on it.

<...>

3. Participants in the budget process are bodies, institutions and officials, endowed with budget powers (rights and responsibilities for budget funds management)”.

At the second stage, it is important to track the flow of funds after crediting funds to budget holder accounts and to determine directions for their use. At the

¹ Науково-методичні рекомендації з питань підготовки та призначення судових експертиз та експертних досліджень : затв. наказом Мін'юсту України від 08.10.1998 р. № 5 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z0705-98> (date accessed: 21.02.2021).

² Бюджетний кодекс України ... URL: <https://zakon.rada.gov.ua/laws/show/2456-17> (date accessed: 21.02.2021).

same time, it should be borne in mind that current regulations governing banking in Ukraine does not provide for analytical accounting of budget surplus sources that are on the bank account. Thus, in the availability of funds other than paid in advance to fulfill the budget program, it will be impossible to find out which funds were used for certain goals: advance funding or own funds.

In the text of the methodology, separately attention should be drawn to the fact that misuse can be considered as spending precisely budget funds.

According to the requirements of the Regulation of the Cabinet of Ministers of Ukraine No. 117: *On provision of prepayment for goods, works and services purchased for budget funds* dated 23.04.2014 ¹, which has lost validity:

«2¹. A budget funds holder (recipient) carries out prepayment according to capital expenditure plans and government contracts by directing budget funds to executors of work, providers of goods and services (except non-residents) to *non-budget accounts* [here and hereinafter in quotations emphasis added: *Author's note*] opened in their names in Treasury authorities <...>».

According to the Procedure of opening and closing accounts in national currency in the State Treasury Service of Ukraine approved by the Ministry of Finance of Ukraine No. 758 ² dated on 22.06.2012 :

«1.2. In that Procedure, below-mentioned terms are used in the following meaning:

<...>

non-budget accounts are accounts opened by Treasury authorities for budget holders and budget funds holders, separate structural units of budget funds, enterprises, institutions, organizations and natural persons-entrepreneurs according to transactions that *do not belong to budgets execution transactions* <...> in cases stipulated by legislative and other legal regulations.

According to Article 11 paragraph 2 of the Budget Code of Ukraine ³:

“budget funds (funds of budget) are incomes and expenditures of the budget compliant with legislation”.

Consequently, budget funds being transferred by a budget holder to non-budgetary account of work executors, lose the status of budget and are transferred to financial assets of recipients.

Therefore, although budget funds that a holder transfers to non-budget accounts of work executors, after their transfer to a non-budget account do not possess the status of budget, budget funds are the source of their origin.

¹ Про здійснення попередньої оплати ... URL: <https://zakon.rada.gov.ua/laws/show/117-2014-%D0%BF> (date accessed: 21.02.2021).

² Порядок відкриття та закриття рахунків у національній валюті в органах Державної казначейської служби України : затв. наказом Мінфіну України від 22.06.2012 р. № 758 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z1206-12> (date accessed: 21.02.2021).

³ Бюджетний кодекс України ... URL: <https://zakon.rada.gov.ua/laws/show/2456-17> (date accessed: 21.02.2021).

As we have already stressed, in accordance with requirements of the Resolution of the Cabinet of Ministers of Ukraine No. 117: *On provision of prepayment for goods, works and services purchased for budget funds* dated on 23.04.2014:

«2¹. Prepayment of budget funds under capital expenditure plans and government contracts by holders (recipients) is carried out by directing budget funds to work executors, providers of goods and services (except non-residents) to non-budget accounts opened in their names in Treasury authorities based on the established by law procedure, with *further use* of the mentioned funds by work executors, providers of goods and services exclusively from such accounts *for the purposes defined in the contracts on procurement of goods, works and services*.

At the same time, the term: *use* in such agreements is not interpreted in detail. Interpretation of the terms of agreements concluded between budget holders and work executors does not belong to the competence of a forensic economist. Consequently, in case of conclusions wording on non-compliance with the terms of agreement by forensic experts, it is recommended to indicate that (for example) placement of funds credited to deposit accounts is their use according to a corresponding agreement.

When solving similar issues, additional information contained in acts of audits (inspections) of state financial control bodies should also be used.

Conclusions. The development of an updated algorithm for conducting forensic economic analysis on the use of budget funds is relevant and will enable to further identify integrated approaches to solving pressing issues of this type of researches.

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К. В. Капустник, О. В. Хомутенко, П. І. Сажин
Щодо вдосконалення науково-методичної бази
судово-економічної експертизи бюджетних коштів
(оглядова стаття)

Основною складовою підвищення якості експертного забезпечення правосуддя є вдосконалення науково-методичної бази експертної діяльності, зокрема — судової економічної експертизи. Станом на сьогодні існує базова експертна Методика дослідження судово-економічної експертизою питань нецільового використання бюджетних коштів (реєстраційний номер 11.0.12), створена ще 2003 р., через що її зміст багато в чому не відповідає чинному бюджетному законодавству. Як свідчить експертна практика, останнім часом найскладнішими є дослідження під час проведення експертиз з питань витрачання бюджетних коштів. Виконуючи бюджетні програми з будівництва, після проведення процедур, передбачених Законом України «Про державні закупівлі», бюджетні кошти спрямовують будівельним організаціям як оплату (передоплату) товарів, робіт (послуг). Після їх зарахування на рахунки виконавців відповідних будівельних робіт, підприємства використовують ці кошти на виконання взятих на себе зобов'язань, а також можуть здійснювати операції, не пов'язані з виконанням відповідних договорів на будівництво (наприклад, розміщувати їх на депозитних рахунках). У процесі виконання експертних завдань може виникнути потреба вирішити питання належності зазначених коштів до бюджетних і можливості підтвердження їх нецільового використання в розумінні ст. 119 Бюджетного кодексу України. Розгляд експертами питань щодо нецільового використання бюджетних коштів допускається винятково за наявності акта перевірки підрозділів Державної аудиторської служби України. Бюджетні кошти, перераховані розпорядником бюджетних коштів на небюджетний

рахунок виконавців робіт, утрачають статус бюджетних і зараховуються до активів одержувачів коштів.

Необхідно оновити алгоритм проведення судово-економічних експертиз із використання бюджетних коштів, що дасть змогу надалі виробити єдиний підхід до вирішення проблемних аспектів цього різновиду досліджень.

Ключові слова: бюджетні кошти, економічна експертиза, методична база.

К. В. Капустник, А. В. Хомутенко, П. И. Сажин

**Относительно усовершенствования научно-методической базы
судебно-экономической экспертизы бюджетных средств
(обзорная статья)**

Основной составляющей повышения качества экспертного обеспечения правосудия является усовершенствование научно-методической базы экспертной деятельности, в частности — судебной экономической экспертизы. В настоящее время существует базовая экспертная Методика исследования судебно-экономической экспертизой вопросов нецелевого использования бюджетных средств (регистрационный номер 11.0.12), созданная ещё в 2003 году, в силу чего её содержание во многом не соответствует действующему бюджетному законодательству. Как свидетельствует экспертная практика, в последнее время наиболее сложными являются исследования при проведении экспертиз по вопросам расходования бюджетных средств. При выполнении бюджетных программ по строительству, после проведения процедур, предусмотренных Законом Украины «О публичных закупках», бюджетные средства направляются строительным организациям в качестве оплаты (предоплаты) за товары, работы (услуги). После их зачисления на счета исполнителей соответствующих строительных работ, предприятия используют их на выполнение взятых на себя обязательств, а также могут осуществлять операции, не связанные с выполнением соответствующих договоров на строительство (например, размещать их на депозитных счетах). В ходе выполнения экспертных заданий может возникнуть потребность в решении вопросов отнесения указанных средств к бюджетным и возможности подтверждения их нецелевого использования в понимании ст. 119 Бюджетного кодекса Украины. Рассмотрение экспертами вопросов относительно нецелевого использования бюджетных средств допускается исключительно при наличии акта проверки подразделений Государственной аудиторской службы Украины. Бюджетные средства, перечисленные распорядителем бюджетных средств на небюджетный счёт исполнителей работ, утрачивают статус бюджетных и зачисляются в активы получателей средств.

Необходимо обновить алгоритм проведения судебно-экономических экспертиз по использованию бюджетных средств, что позволит в дальнейшем выработать единый подход к решению проблемных аспектов этой разновидности исследований.

Ключевые слова: бюджетные средства, экономическая экспертиза, методическая база.

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Theoretical and methodological foundations of forensic economics

In modern conditions, the need to increase efficiency of forensic expert activity in economic field depends on development of theoretical and methodological base of forensic economics, interpretation of this economic and legal category in legislative field and determination of the system-forming factor of totality of forensic examinations.

While systematizing scientific content, the main key issues related to theoretical development foundations of this type of forensic science are considered. The key informative informational blocks of forensic economics are highlighted: the first block is procedural nature of forensic examination assignment and conducting; second block is the use of specific expertise in the field of economics; third block is the topic of forensic economic examination; fourth block is the purpose of the results of economic research. An attempt has been made to improve interpretation of forensic economics as an economic and legal category, as well as to substantiate its classification on the basis of dividing social production into material and non-material fields that are studied by corresponding economic sciences.

Thanks to the use of dialectical method, it is substantiated that solution to this methodological issue lies in the field of material production. Consideration of the relations between the economy and other fields of social activity demonstrated that economy is primary that allowed, as a result of the division of social production into the field of material production (material goods and material services; object of economic relations has a materialized form) and intangible production (intangible goods and intangible services; object economic relations has a non-material form) to determine the system-forming factor of various types of forensic economic examinations.

Keywords: *forensic economics, methodology, economic relations, public production, material production, intangible production, classification criterion.*

Formulation of Research Problem. The development of economic phenomena and processes shows that contradictions within the economic system influence the efficiency of its functioning serving as foundation for taking economic relations to a whole new level of development. Market economy provides greater opportunities for execution of different economic projects for

both legitimate profit-making and spread of economic offenses to make an illegal financial benefit. Unfortunately, domestic economy is characterized by such features.

The effectiveness of investigation carried out by law enforcement agencies of economic offenses involves collecting sufficient and uncontested evidence depending on many factors. Among them, a significant place is taken by forensic economics as one of efficient methods of judiciary which is appointed during investigation of such offenses, as well as during consideration of economic disputes in court. It helps to study in detail circumstances of economic offense, using special knowledge in the field of economics. The complexity and contradictory of legal and regulatory legislation, existence of various types of production and financial activities and complexity of the analysis of their numerous processes for judicial inquiry bodies necessitate the use of special knowledge of this segment of economic sciences.

At the same time, the level of these knowledge use depends on the development of theoretical and methodological principles of forensic economics (conceptual apparatus, classification, purpose, objectives, object, subject, research methods) as an organic unity of economic sciences and legal provisions. Transformation of economic conditions under the influence of endogenous and exogenous factors resulting in a corresponding amendment of legal and regulatory legislation in the field of economics, as well as its inconsistency should adapt forensic economics to these conditions. The relevance of our research topic is due to the above.

Analysis of Essential Researches and Publications. At different times, theoretical and methodological foundations of forensic economics were studied by domestic and foreign scientists, among whom: M. F. Bazas, I. A. Volkova, L. V. Hutsalenko, L. V. Dikan, S. V. Yevdokimenko, N. I. Klymenko, T. O. Krivtsova, V. D. Ponikarov, O. R. Rossynska, V. V. Fedchyshyna and others¹. Not diminishing the contribution of these researchers in the development

¹ Е. г., Базась М. Ф. Теоретико-методологічні засади судово-бухгалтерської експертизи : навч. посіб. для студ. вищ. навч. закл. Київ, 2007. Р. 246—256 ; Волкова І. А. Судово-бухгалтерська експертиза : навч. посіб. Київ, 2009. Р. 17—23 ; Гуцаленко Л. В., Михальчишина Л. Г., Сидорук В. М. та ін. Судово-бухгалтерська експертиза : навч. посіб. Київ, 2011. Р. 49—56 ; Дікань Л. В., Понікаров В. Д., Кожушко О. В. Судово-економічна експертиза : навч. посіб. Харків, 2014. Р. 242—265 ; Євдокіменко С. В. Перспективи розвитку судово-економічних експертиз. *Наше право*. 2016. № 2. Р. 42—46 ; Клименко Н. І., Федчишина В. В. Судово-економічна експертиза : сучасний стан і актуальні питання. *Криміналістичний вісник*. 2016. № 1 (25). Р. 56—61 ; Кривцова Т. О. Удосконалення правового забезпечення судово-економічної експертизи як форми економічного контролю. *Бізнес Інформ*. 2015. № 2. Р. 49 ; Поникаров В. Д. Теоретические основы становления и развития судебно-экономической экспертизы в Украине. *Бізнес Інформ*. 2011. № 2 (2). Р. 158—160 ; Россинская Е. Р. Судебная экспертиза в гражданском, арбитражном, административном и уголовном процессе : науч.-практ. пособ. 3-е изд., доп. Москва, 2011. Р. 143—144.

of forensic economics and without claiming to exhaustion and thoroughness of research, we believe that topical issues of theoretical and methodological principles of forensic economics under variability of economic and legal management conditions require further scientific exploration.

The **Article Purpose** is to research on fundamental theoretical and methodological principles of forensic economics; firstly, it is an attempt to scientifically substantiate its essence and systematize its types under a single criterion for classification.

Main Content Presentation. Forensic economics (as an essential functional element of the judicial and legal system) provides significant information evidence to law enforcement agencies and thus indirectly ensures economic security of the state and its citizens: return of funds to the State budget, increase in the efficiency of economic offenses investigation, etc. For this purpose, forensic economics should be ensured with a scientifically substantiated theoretical and methodological base, which is an embodiment of organically interrelated, interdependent and interconnected processes taking place at the intersection of two epistemological areas: economic and legal.

To fulfill the set goal, let's determine the essence of forensic economics, which is a point of departure for our research. There is no interpretation for this term in the domestic regulatory legal framework: this issue has been considered by individual scientists ¹. This applies to the definition of classification, subject, object and tasks of this type of forensic examination indicating the incompleteness of its theoretical principles (received its name recently, in 2001) formation under new socio-economic conditions. In such circumstances there is an objective need to develop regulatory legal support of experts specialized in economics: standardized both for state and non-state forensic institutions.

In modern scientific literature, various interpretations of *forensic economics* concept can be found. Here are just a few examples:

- procedural research carried out by application of special knowledge, skills and abilities of a forensic expert and allows to solve tasks addressed to him by inquiry bodies, pre-trial investigation or court to resolve criminal, civil, administrative cases or commercial disputes ²;
- procedural form of research is based on special knowledge in various areas of economics, economic analysis, audit and control of journal vouchers, account and tax ledgers and financial statements of entities of various forms of ownership to address a wide range of issues arising while investigation of economic offenses and litigation of economic disputes ³;

¹ Е.г., Кривцова Т. О. Оп. cit. ; Романів С. Р., Будник Л. А., Саченко С. І. Судово-економічна експертиза в Україні: її економічна суть та кадрове забезпечення. *Інфраструктура ринку*. 2018. № 23. Р. 344.

² Кривцова Т. О. Оп. cit. Р. 49.

³ Дікань Л. В., Понікаров В. Д., Кожушко О. В. Оп. cit. Р. 250.

- procedural study of economic entities, phenomena and processes which contain information about the facts and circumstances of a particular case pending in court, by applying specific expertise and skills of a forensic economist ¹.

The definition of this term specifies main substantive blocks reflecting the essence of forensic economics: the first block: the procedural nature of appointment and conduct; the second block: the use of special knowledge in the field of economics; the third block: the subject of forensic economics; the fourth block: the purpose of economic research results.

Describing these main meaningful information blocks, let's emphasize that study of production and financial activities of economic entities involves the study of research objects. These include all case files (accounting records, especially: journal vouchers, registers of synthetic and analytical accounting; tax, financial, reports; organizational and administrative documents; various types of contracts; tax audit reports; inventory files; conclusions drawn by forensic experts of other specializations, etc.), which are provided in paper or electronic form for forensic examination by forensic examination initiators.

A forensic examination is performed by a qualified person who applies special knowledge in the field of economics while research, the latter corresponds to regulatory requirements of procedural law (criminal, commercial, administrative, civil, etc.), which is a completely objective phenomenon.

Continuing research, let's stress that economy (translated from Greek: *economic management*) is the most important area of public life, in which (based on the use of various resources) production, exchange, distribution and consumption of human activity products are implemented, the system of productive forces and economic relations governed by different types of economic laws² is forming and developing. That is, economy is a comprehensive, multifaceted representation of the sum of various economic relations (organizational, economic, socio-economic), which its entities enter for production, sale and consumption of tangible and intangible goods and services to meet their needs.

Given the above, the following definition of forensic economics may be suggested. **Forensic economics** is a study of the economic activity of economic entities based on application of special economic knowledge to provide an expert conclusion on issues raised by initiators of court proceedings.

An important issue, starting point that allows you to define tasks, develop methods and expert research methods and thus form fundamental theoretical and methodological basis, is a scientifically sound classification of forensic economics. As can be seen, formation of the methodological basis as the system of integrity requires adherence to a certain logical sequence. This issue is the subject

¹ Романів С. Р., Будник Л. А., Саченко С. І. Оп. cit. P. 345.

² Економічна енциклопедія : у 3 т. Т. 1 : А (Абандон) — К (Концентрація виробництва) / ред.: Б. Д. Гаврилишин, С. В. Мочерний. Київ, 2000. P. 380.

of a rather long study of scientific expert opinion, however, there is still no classification by a single criterion.

First attempts to systematize forensic examinations (in particular, forensic economics) were made in 1970 by O. R. Shliakhov who proposed to single out classes, types, species and subspecies of forensic examinations by a common feature, and by a classification feature it's suggested to distinguish the three-component one: the subject, object and research method ¹.

At the same time, according to H. A. Matusovskyi, such classification feature includes the subject and content of forensic examination, as well as peculiarities of economy and the type of economic activity in which area offenses were made. He believes that the effectiveness of data of forensic economics, which are used as evidence in criminal cases, help to go beyond the system of genera (species) of forensic economics ².

In view of P. P. Cheberiak, in connection with the study of the range of forensic economic analyses of a common object — accounting and economic operations — they can be classified as follows: a forensic examination of the accounting process which study patterns of information presentation of economic activity in the system of accounting of economic activity facts at economic entities; forensic examination of economic operations performing research on patterns of information presentation of economic activity in the system of economic indicators and other accounting and economic information revealing the content of economic operations ³.

O. P. Rossynska suggests to use the nature of research objects with a set of solved tasks ⁴ as the basis for the division of forensic examinations into species and subspecies.

However, H. I. Klymenko believes that concepts of classification systems disregard all specifics of forensic examinations referred to, therefore, provoke certain problems that need to be addressed ⁵.

Also, the following statements of individual authors are not unreasonable: since the integration and interconnection of knowledge naturally leads to blurring of lines between forensic and non-forensic examinations, integration of various types of species and types of forensic science, then it is fully justified to make a conclusion as to a uniform nature of forensic examinations ⁶; The lack

¹ Е.г., Клименко Н. І., Федчишина В. В. *Op. cit.* P. 57 ; Юнацький О. В. Конспект лекцій з дисципліни «Експертологія». Дніпро, 2016. Р. 50.

² Матусовский Г. А. *Экономические преступления: криминалистический анализ.* Харьков, 1999. Р. 464—470.

³ Чеберяк П. П. Завдання судових експертиз при розкритті й розслідуванні злочинів, вчинених в економічній сфері України. *Наукові записки Львівського університету бізнесу та права.* 2013. Вип. 10. Р. 85.

⁴ Россинская Е. Р. *Op. cit.* P. 143.

⁵ Клименко Н. І., Федчишина В. В. *Op. cit.* P. 59.

⁶ Россинская Е. Р. *Op. cit.* P. 143.

of unity in the characteristic of forensic science is due to the absence of a single scientifically substantiated approach to the classification of forensic examinations, differences in the formulation of the subject and object of forensic economics¹; The synthetic nature of the general theory of forensic science allows viewing any kind of forensic examination simply as a forensic examination².

As shown, current development of forensic economics is marked by unresolved methodological problems: the absence of interpretation of the essence of forensic economics in the regulatory and legal framework, a universal criterion for well ordering of the range of forensic sciences. In this regard, researches by T. A. Svetlichna, A. A. Stankevych and H. O. Shumak deserve special attention, who divided all economic sciences according to research subject into two groups (the first: general theoretical, basic sciences (political economy, economic theory, etc.), the second: specific economic, applied), next specific economic, applied sciences by the criteria of the main function of management (main or specific) were divided into managerial, functional (planning, accounting, statistics, economic analysis and others) and non-functional (special sciences: labor economics, finance, credit, pricing, etc. territorial sciences; sectoral sciences and allied sciences with economy).

In the field of economic activity management, a general object of studying all specific economic, applied sciences (production relations and workforce) is a system that includes two subsystems: a subsystem undergoing management (it is studied by non-functional sciences) and subsystem that exercise control (it is studied by managerial functional sciences)³.

Later, scientists note that since the subject of economic sciences study is two sides of social production: material (productive forces) and public (economic, production relations, in which people enter at all stages of social production), then specific economic non-functional sciences study: the material aspect: labor economics, pricing, etc. the public aspect: finance, money in circulation, credit, etc. As a result, given the common object of studying all economic sciences, the classification of the latter under the research subject of their common object, forensic science may be divided into two species⁴:

- forensic production and economic (commercial and economic forensics) examination which includes such types of forensics as

¹ Вітер Д. В. Судово-економічна експертиза у доведенні обставин, що підлягають обов'язковому доказуванню при розслідуванні злочинів у сфері фінансування соціальних цільових програм. *Теорія та практика судової експертизи і криміналістики*. 2019. № 20. Р. 407.

² Аверьянова Т. В. Судебная экспертиза. Курс общей теории. Москва, 2009. Р. 318.

³ Светличная Т. А., Станкевич А. А., Шумак Г. А. Методологические основы судебных экономических экспертиз. *Право и демократия* : сб. науч. тр. 2012. Вып. 23. Р. 2—3. URL: <https://elib.bsu.by/handle/123456789/28756> (date accessed: 20.03.2021).

⁴ Ibidem. Р. 4—5.

forensic examination of terms of pay, forensic examination of prices and pricing, etc., and each of them: such subspecies as planning, accounting, analysis of or control over production or economic activities accordingly;

- forensic production and economic (commercial and economic forensics) examination which include such types of forensics as forensic examination of terms of pay, forensic examination of prices and pricing, etc., and each of them: such subspecies as planning, accounting, analysis of or control over production or economic activities accordingly;

For example, we adhere to the classification of forensic economics proposed by T. A. Svetlichna, A. A. Stankevych and H. O. Shumak, under current conditions of the development of economic relations and productive forces. At the same time, let's somewhat expand researches of these authors in the economic area.

The starting point in solving this methodological problem (by dialectical method of knowledge) is to determine a cause-effect relation between the development of material production and the rest of social activity areas. From these perspectives, economy is primary, and other areas of human activity are subordinate which are derivatives of it (public administration, finance, science, education, health care, etc.). In view of the above, the primary is the economy as a set of fields that differ in the nature of production, the secondary: economic sciences which aim to substantiate economic relations for a particular type of economic system in their inextricable connection with the development of productive forces (means of production: means of labor, subject of labor, workforce) and peculiarities of their implementation in different areas of economy (for production, distribution, exchange and consumption of material and non-material goods and services).

By its nature, social production is represented by two areas:

- 1) area of material production (industry; agriculture; construction; freight transport; services of production; public catering; logistical support, etc.)¹. It is characterized by production and implementation of material goods and services. It is a production cycle, which is constantly reproduced, and the object of economic relations is tangible;
- 2) field of non-material production (insurance; lending; taxation; social security; housing and community services; passenger transport and communication; education; health care and others)². It is characterized by production of intangible goods and intangible services. Economic relations

¹ Мацелюх Н. П., Максименко І. А. Історія економіки та економічної думки. Політична економія. Мікроекономіка. Макроекономіка : навч. посіб. 2-ге вид., перероб. та доп. Київ, 2014. Р. 72.

² Ibidem.

arise in relation to redistribution of national income by directing financial resources for the maintenance of non-productive field (education, health care, science, etc.), as well as in favor of financial and credit institutions in the form of return and payment of interest by economic entities in accordance with prior loans and other financial payments. The object of economic relations is presented as cash (non-cash), monetary assets, securities and other monetary equivalents.

Public production taking place in the field of material and non-material production, in the process of its implementation involves planning, accounting, control and analysis of productive and non-productive activities respectively, which is obligatory for adoption of rational managerial decisions.

Considering the above, classification of forensic economics according to the suggested approach is considered scientifically grounded, which, undoubtedly, does not exclude its critical analysis for its further improvement.

Conclusions. Efficiency of forensic activity in the economic field, effectiveness of interaction with judicial inquiry bodies (which is its functional purpose), depend, in particular, from the development of the theoretical and methodological base of forensic economics. Firstly, it concerns research on its essence, what is impossible without study of production processes of social production, as well as systematization of the whole range of forensic economics based on a uniform criterion, which, for its part, is impossible without the use of a scientifically substantiated approach, since this forensic examination as well as the rest of forensic examinations, is implemented by special knowledge regarding the economic area of human activity.

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О. А. Горлачук

**Теоретико-методологічні засади
судової економічної експертизи**

У сучасних умовах необхідність підвищення ефективності судово-експертної діяльності в економічній сфері залежить від розвитку теоретико-методологічної бази судової економічної експертизи, що й зумовило актуальність теми дослідження.

У процесі систематизації наукового матеріалу розглянуто основні питання, що стосуються теоретичних основ розвитку цього виду судової експертизи. Здійснено спробу вдосконалення інтерпретації судової економічної експертизи як економіко-правової категорії, а також обґрунтування її класифікації на основі поділу суспільного виробництва на матеріальну та нематеріальну сфери, котрі вивчаються відповідними економічними науками.

Ключові слова: *судова економічна експертиза, методологія, економічні відносини, суспільне виробництво, матеріальне виробництво, нематеріальне виробництво, критерій класифікації.*

А. А. Горлачук

Теоретико-методологические основы судебной экономической экспертизы

В современных условиях необходимость повышения эффективности судебно-экспертной деятельности в экономической сфере зависит от развития теоретико-методологической базы судебной экономической экспертизы, прежде всего интерпретации этой экономико-правовой категории в законодательном поле и определения системообразующего фактора совокупности экспертиз.

В процессе систематизации научного материала рассмотрены основные ключевые вопросы, касающиеся теоретических основ развития этого вида судебной экспертизы. Выделены узловые содержательные информационные блоки судебной экономической экспертизы: первый блок — процессуальный характер назначения и проведения; второй блок — использование специальных знаний в сфере экономики; третий блок — предмет исследования судебной экономической экспертизы; четвёртый блок — назначение результатов экономического исследования. Предпринята попытка усовершенствования интерпретации судебной экономической экспертизы как экономико-правовой категории, а также обоснования ее классификации на основе деления общественного производства на материальную и нематериальную сферы, которые изучаются соответственными экономическими науками.

Благодаря применению диалектического метода обосновано, что решение этой методологической проблемы находится в сфере материального производства. Рассмотрение взаимосвязи экономики и других сфер общественной деятельности показало, что экономика первична, что позволило в результате разделения общественного производства на сферу материального производства (материальные блага и материальные услуги; объект экономических отношений имеет овеществлённую форму) и нематериального производства (нематериальные блага и нематериальные услуги; объект экономических отношений имеет неовеществлённую

форму) определить системообразующий фактор различных видов судебных экономических экспертиз.

Ключевые слова: судебная экономическая экспертиза, методология, экономические отношения, общественное производство, материальное производство, нематериальное производство, критерий классификации.

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Place of forensic commodity expertise in the prevention of offenses in the retail electricity market

The article emphasizes that the threatening dynamics of the annual increase in the facts of damage and theft of energy equipment, theft of electrical energy, spontaneous connection to electrical grids can lead to imbalance and destruction of the electrical industry not only in a separate region, but also in the country as a whole. Attention is drawn to the fact that regulatory legal acts are aimed at curbing this dangerous dynamic, that carry out state regulation in the energy sector which, unfortunately, do not ensure stable security in this area. It is stated that specialists from different suppliers of electric energy prepare all the necessary materials to open criminal proceedings under Article 1881 of the Criminal Code of Ukraine, submit petitions to the investigating authorities about the need to carry out certain investigative actions, however, violators are not prosecuted. It was found that the main obstacle in bringing the perpetrators of these violations to criminal responsibility is the lack of methodological materials and skills in the police units in the investigation of criminal proceedings on the facts of theft of electrical energy and the practice of their consideration by courts.

It has been proved that the lack of methodological materials with a complete list of initial data that are necessary to determine the market price of products of the energy complex leads to discrepancies in conclusions of

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experts. New methods for determining the market price of energy products during forensic commodity examinations will help to resolve the issue of assessing the products of the energy complex in expert practice. It is proposed to determine the subject, tasks, object of research of this forensic examination; outline possible approaches and methods for assessing their value; establish the assortment of goods that has formed in this market in the world and in Ukraine; clearly identify the boundaries of competence of commodity experts. It is emphasized that the determination of the market price for electricity and the cost of services for its provision goes beyond the competence of commodity experts, since the mechanism for setting prices (tariffs) for this type of product is controlled by the state and approved by the Regulator – National Energy and Utilities Regulatory Commission.

Keywords: electric energy, offenses, state regulation, responsibility, cost, forensic commodity examination.

Formulation of Research Problem. Absence of light or frequent interruptions in the supply of electricity to customers are often caused by attackers who encroach on power equipment. The robbers do not even think about the consequences of their criminal acts: from the loss of their own lives to encroachments on the public security of the region. Most energy facilities are energized and therefore a source of increased danger, leading to the death of the robbers themselves. In addition, the border status of some regions forces us to consider such actions as terrorist, as the stability of the functioning of the entire energy system of the region is under threat.

Over time, electricity becomes a more expensive and attractive commodity, and consequently, illegal actions aimed at using it for free also become profitable. In addition, the threatening dynamics of the annual growth of damage and theft of energy equipment, electricity theft, unauthorized connections to the electricity grids and other illegal actions can quickly lead to imbalance and destruction of the electricity industry not only in the particular region but also in the country as a whole. Only in the Kherson region in 2014, UAH 3 million in fines were charged for the discovery of uncounted and gratuitous electricity consumption. In 2020, twice as many such offenses were documented, and fines amounted to almost UAH 108 million ¹. That is why the issue of counteracting such offenses with the involvement of forensic commodity expertise is relevant.

Analysis of Essential Researches and Publications. The following domestic scientists such as A. F. Volobuiev, N. I. Klymenko, O. M. Moisieiev, I. A. Petrova, I. V. Pyrih, E. B. Simakova-Yefremian, R. I. Stepaniuk,

¹ Про звернення депутатів Херсонської обласної ради VIII скликання до Кабінету Міністрів України щодо запобігання викраденню електричної або теплової енергії шляхом її самовільного використання : рішення IV сесії обласної ради VIII скликання від 05.02.2021 р. № 103. URL: <http://khor.gov.ua/iv-sesiia-khersonskoi-oblasnoi-rady-viii-sklykannia> (date accessed: 28.03.2021).

V. Yu. Shepitko, M. H. Shcherbakovskyi and others ¹ have devoted their scientific works to the study of issues on of the functioning of the institute of forensic examinations in criminal proceedings and the prevention of offenses in various spheres of human activity. However, the coverage of the place of forensic commodity expertise in the prevention of offenses in the retail electricity market was left out of their attention.

The **Article Purpose** is to outline the place of forensic commodity expertise in the prevention of offenses in the retail electricity market.

Main Content Presentation. Recently, in almost all regions of Ukraine, the number of offenses related to the destruction of energy facilities, theft of equipment and electricity, as well as violations of the Rules of the retail electricity market are being significantly increased ².

In the last three years, at energy facilities in the Kherson region, 105 thefts and 370 cases of equipment damage totaling over UAH 3 million were committed, (7 transformers, 1,795 kg of oil, 4 tons of metal corners from main crash barriers, more than 8 km of wires were stolen etc.)³.

In addition, in the last six months in the Sumy region more than 30 thefts of power equipment (dismantled 3 transformers, stolen 14 electricity meters, almost 3 km of wires) and other thefts of electrical property, which led to power outages in customers. By their actions, plunderers caused losses of almost UAH 200,000. Within 6 months, 30 power towers were damaged. Almost UAH 170,000 was spent on the restoration of power grid pylons ⁴.

¹ Е.г., Волобуєв А. Ф. Проблеми методики розслідування розкрадань майна в сфері підприємництва : монограф. Харків, 2000. 336 р. ; Клименко Н. І. Судова експертологія. Курс лекцій : навч. посіб. Київ, 2007. 521 р. ; Моїсєєв О. М. Експертні технології: теорія формування та практика застосування : монограф. Харків, 2011. 424 р. ; Петрова І. А. Правові та процесуальні засади судово-товарознавчих експертиз споживчих товарів : монограф. Харків, 2011. 275 р. ; Пиріг І. В. Теоретико-прикладні проблеми експертного забезпечення досудового розслідування : монограф. Дніпропетровськ, 2015. 432 р. ; Сімакова-Єфремян Е. Б. Комплексні судово-експертні дослідження: теорія та практика : монограф. Харків, 2016. 456 р. ; Степанюк Р. Л. Криміналістичне забезпечення розслідування злочинів, вчинених у бюджетній сфері України ; за заг. ред. д-ра юрид. наук, проф. А. Ф. Волобуєва. Харків, 2012. 382 р. ; Шепітько В. Ю. Криміналістична тактика (системно-структурний аналіз) : монограф. Харків, 2007. 432 р. ; Щербаковський М. Г. Проведення та використання судових експертиз у кримінальному провадженні : монограф. Харків, 2015. 560 р.

² Правила роздрібного ринку електричної енергії : затв. постановою НКРЕКП України від 14.03.2018 р. № 312 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/v0312874-18> (date accessed: 28.03.2021).

³ Про звернення депутатів Херсонської обласної ради ... URL: <http://khor.gov.ua/iv-sesiia-khersonskoi-oblasnoi-rady-viii-sklykannia> (date accessed: 28.03.2021).

⁴ Тимошук О. Енергокрадії загрожують здоров'ю та життю громадян. 09.08.2019. URL: <https://khoda.gov.ua/energograd%D1%96%D1%97-zagrozhujut-zdorov%E2%80%99ju-ta-zhittju-gromadjan> (date accessed: 29.03.2021).

It should be noted that in every region of Ukraine every year there is a destruction of hundreds of electric poles not only due to natural disasters, but also due to traffic accidents. Restoration of destroyed electrical poles requires significant human and material resources, disconnection from electricity supply to consumers at the time of elimination of accidents.

The norms of the Criminal Code of Ukraine ¹, as well as regulations, approved primarily by resolutions of the National Energy and Utilities Regulatory Commission of Ukraine (*hereinafter referred as NEURC*), are aimed at curbing this dangerous dynamics, including:

- Rules of the retail electricity market (No. 312, dated on 14.03.2018) ²;
- Code of Commercial Electricity Accounting (No. 311, dated on 14.03.2018) ³;
- Code of Distribution Systems (No. 310, dated on 14.03.2018) ⁴.

However, in our opinion, aforementioned regulations do not ensure proper regulation and level of security of the energy sector. Modern criminals steal electricity in a skilled, almost talented way: for example, by illegally installing electronic, pulse and similar devices in electricity meters (generators, transformers, etc.). The amount of losses due to such offenses in just one year and in one region can reach tens of millions of hryvnias. The large number of special devices used to steal electricity, the complexity of their manufacture, the features of concealed installation and the huge number of offers for their sale via the Internet, identified by experts, indicate a high level of qualification of thieves and the development of this illegal activity in the state at the level of trading.

This is confirmed by the notification of the NEURC on the beginning of the investigation of violations of the legislation on the functioning of the electricity market. *"The decision was made on the basis of monitoring the behavior of market participants, for the day ahead, and the intraday market and the notification of SE Market Operator,"* said in an official announcement. According to the NEURC, signs of violations are contained in the actions of large electricity producers (*Centerenergo, D.TEK Dniproenergo, DTEK Zakhidenergo, DTEK Skhidenergo, Ukrhydroenergo*), as well as traders (*United Energy, Utility Trading, NEW*

¹ Кримінальний кодекс України : Закон України від 05.04.2001 р. № 2341-III (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/2341-14> (date accessed: 29.03.2021).

² Правила роздрібного ринку електричної енергії URL: <https://zakon.rada.gov.ua/laws/show/v0312874-18> (date accessed: 28.03.2021).

³ Кодекс комерційного обліку електричної енергії: затв. постановою НКРЕКП від 14.03.2018 р. № 311 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/v0311874-18> (date accessed: 29.03.2021).

⁴ Кодекс систем розподілу : затв. постановою НКРЕКП від 14.03.2018 р. № 310 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/v0310874-18> (date accessed: 29.03.2021).

ENERGY COMPANY, SE GUARANTEED BUYER). The NEURC acknowledged that the excess electricity in the market could lead to *manipulation of the sale of amount of electricity by some market participants, in particular, TPS / CHP*. In order to limit such manipulations, on June 3, 2020, the NEURC adopted a resolution according to which electricity can be sold only if it is confirmed that it is physically possible to produce it¹.

In addition, since 2018, specialists of JSC “Khersonoblenergo”, using special technical means, surveyed 2,070 consumer facilities and on 254 of them recorded radiation sources of high-frequency generators. However, only 48 cases (18%) were able to remove these devices (due to the procedure stipulated by law)². The cynicism and thirst for profit of electricity thieves, who neglect the health and lives not only of themselves but also of others, are striking. The lion's share of those who like free electricity are dealers who use high-frequency generators. These devices are well known for their harmful effects on the human body: their work can cause a number of diseases – from diseases of the blood and cardiovascular system to oncology³.

Theft of hot or potable water, electricity or heat by unauthorized use without meters, the results of which are used for commercial calculations (if the use of meters is mandatory), or due to intentional damage to meters or in any other way (Article 188¹ of the Criminal Code of Ukraine)⁴. Theft of electricity, if such actions cause significant damage, entails criminal liability: a fine of 100 to 200 tax-free minimum incomes of citizens or community service for up to 2 years, or restriction of liberty for up to 3 years. The same acts, committed repeatedly or by prior conspiracy by a group of persons, or if they caused damage on a large scale, are punishable by imprisonment for up to 3 years⁵.

The basis for detecting theft of electricity is also poфider analysis, when, for certain areas of the networks, experts analyze in detail the dynamics of consumption in terms of each consumer using consumption data from previous years, identifying suspicious facts of instability (significant declines or increases), not related to seasonal consumption fluctuations or other objective factors. Directly the facts of theft of the electricity during planned and unscheduled checks are found out by employees of oblenergo, inspecting means of the account of

¹ НКРЕКП почала офіційне розслідування порушень на ринку електроенергії, про які йшлося у розслідуванні «Схем» // Офіційний сайт «Радіо Свобода». 11.03.2021. URL: <https://www.radiosvoboda.org/a/news-skhemy-nkrekp-rozsliduvannya-elektroenerhiya/31145061.html> (date accessed: 29.03.2021).

² Про звернення депутатів Херсонської обласної ради ... URL: <http://khor.gov.ua/iv-sesiia-khersonskoi-oblasnoi-rady-viii-sklykannia> (date accessed: 28.03.2021).

³ Тимошук О. Зазнач. твір. URL: <https://khoda.gov.ua/energokrad%D1%96%D1%97-zagrozhujut-zdorov%E2%80%99ju-ta-zhittju-gromadjan> (date accessed: 29.03.2021).

⁴ Кримінальний кодекс України ... URL: <https://zakon.rada.gov.ua/laws/show/2341-14> (date accessed: 29.03.2021).

⁵ Idem.

consumers according to the current legislation of Ukraine. During the raid work, a set of equipment is used, which consists of sample meters, current measuring devices, residual magnetization measuring devices, analyzers of electromagnetic radiation spectrum, etc. In order to create a sufficient evidence base, which is necessary during the consideration of the executed acts, all violations are recorded with photo and video equipment. Citizens often turn to oblenergos to report suspicions of possible illegal actions by their undisciplined neighbors.

In case of theft of electricity by unaccounted use, unauthorized connection to networks, damage to meters, failure (damage) of seals and other consumer actions that lead to a decrease in the performance of the meter or networks, employees of the distribution company draw up an act of violation of Retail Electricity Market Rules and, depending on the offense, cut off electricity. Based on the act, the company's employees calculate the amount of damages in accordance with the methodology approved by the relevant resolution of the NEURC. However, it should be emphasized that the facts, where the amount of damages for theft of electricity is 113,500 UAH or more (Article 188¹ of the Criminal Code of Ukraine provides for criminal liability), it is difficult to find a person to serve a sentence for such an offense.

In addition, specialists of various electricity suppliers for the opening of criminal proceedings, under this article prepare all the necessary materials, submit requests to the investigating authorities on the need to conduct certain investigative actions to document such offenses and other measures to ensure criminal proceedings, however, do not prosecute robbers. Last year, in all regions of our State, in accordance with the Article 188¹ of the Criminal Code of Ukraine, the court did not pass a single conviction.

Victims of criminal proceedings on theft of electricity, its suppliers, distribution system operators and consumers are not guaranteed the right to a prompt, complete, and impartial investigation and trial for compensation for damage caused by a criminal offense. Additionally, the single provision of the Criminal Code of Ukraine (Article 188¹), which defines a limited list of illegal actions to steal electricity, does not address the aggravating circumstances of such an offense by an official using his official position, for the manufacture, sale or use of devices in order to steal electricity, they block the operation of meters, etc. Thus, even if the theft of electricity causes damage on a large or particularly large scale or in other aggravating circumstances, it will not affect the qualification of the offense, and the most severe punishment for such actions is borne as a minor offense in the form of restraint of liberty for up to three years. However, under similar conditions, theft of any other property (Article 184 paragraph 4 of the Criminal Code of Ukraine) is defined in the legislation as a serious offense punishable by 5 to 8 years in the prison ¹.

¹ Кримінальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/2341-14> (date accessed: 29.03.2021).

It should be emphasized that according to the provisions of the Commercial Electricity Accounting Code, the party responsible for the commercial metering point and/or the party controlling the facility where the electricity metering units are installed are obliged to provide unimpeded access to it by authorized representatives controlling bodies and interested parties during working hours for technical inspection of the equipment of the metering unit or reading indicators from electricity meters¹.

However, the lack of the mechanism to ensure such a right to the supplier or operator of the distribution system in practice leads to the fact that (in order to hide the theft of electricity and avoid liability) the consumer who uses the device to reduce electricity meters, does not allow representatives to the facility to check meters, and after drawing up the relevant act on non-admission and leaving the inspection body of the object of inspection, the consumer dismantles and hides such a device (high-frequency generator, magnet, etc.), and then allows you to inspect the meter. The law does not provide for any liability of the consumer-theft for such illegal actions or the possibility of their prevention.

In our opinion, the main obstacle to bringing those guilty in these offenses to criminal liability should be the lack of methodological materials and skills in the police departments to investigate criminal proceedings on theft of electricity and the practice of their consideration by courts; imperfection and inconsistency of legal norms, the lack of their official interpretation. Thus, to prosecute those guilty of stealing electricity, in accordance with Article 242 of the Criminal Procedure Code of Ukraine², an investigator or prosecutor are to ensure the examination to evaluate the amount of loss of property caused by such an offense.

In addition, oblenargo experts emphasize that experts of state specialized forensic institutions of the Ministry of Internal Affairs of Ukraine and the Ministry of Justice of Ukraine do not conduct examinations to determine the amount of damage caused by theft of electricity. Experts motivate this by the fact that the cost of such goods as electricity is not the subject of expert research, as the state sets fixed prices for it, and departmental instructions (for experts) on this issue are absent.

It should be agreed that in today's conditions, expert practice does not fully meet the needs of judicial investigative bodies, legal entities and ordinary citizens in solving the urgent issue of assessing the quality and value of energy products. At the present stage of development of the national economy, the value of certain types of energy products (natural gas, products of its processing, etc.) is assessed according to the general scheme of valuation of movable property (according to the Law of Ukraine: *On Property Valuation, Property Rights and*

¹ Кодекс комерційного обліку URL: <https://zakon.rada.gov.ua/laws/show/v0311874-18> (date accessed: 29.03.2021).

² Кримінальний процесуальний кодекс України : Закон України від 13.04.2012 р. № 4651-VI (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/4651-17> (date accessed: 29.03.2021).

Professional Valuation in Ukraine) ¹. General requirements, procedure, principles, methodological approaches and methods of valuation, valuation base and types of value must comply with the regulations of the National Standard No. 1 General principles of property valuation and property rights, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 10.09.2003 No. 1440 ².

It should be noted that the lack of methodological materials with a complete list of source data needed to determine the market value of energy products, causes differences in the conclusions of experts. In addition, since the subject and tasks of forensic commodity expertise of energy products are still not clearly defined, the questions posed to experts-commodity expertise in case of appointment of such expertise may be beyond their competence, and the conclusions should be as follows: *It is not possible* ³. The solution of this problem requires a scientific substantiation of certain definitions and their definition; improvement of modern legislation on the regulation of this market (electricity, natural gas, etc.); introduction of the principles of independent market evaluation of this product and services for its provision.

The current stage of development of society is characterized by a strategic course to create a legal, democratic state. Ukraine is implementing radical socio-economic reforms, the process of democratization of all aspects of public life, which is impossible without strengthening law and order, ensuring reliable protection of constitutional rights and freedoms of citizens. However, since 01.07.2019 a new electricity market has been launched in Ukraine, based on the European model, which works effectively in Hungary, Slovakia, the Czech Republic, Germany, France, the Baltic States and Scandinavia. The introduction of innovations is a rather complex process, so some issues and controversies regarding this market of services remain unresolved to this day. However, the fact is indisputable: the new model of the electricity market is designed to create a healthy competitive environment in Ukraine for all participants in the energy process.

It should be noted that until 01.07.2019, in Ukraine there was a model of the electricity market *Energy Pool*: all generating companies sold electricity to

¹ Про оцінку майна, майнових прав та професійну оціночну діяльність в Україні : Закон України від 12.07.2001р. № 2568-III (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/4651-17> (date accessed: 29.03.2021).

² Національний стандарт № 1 «Загальні засади оцінки майна і майнових прав» : затв. Постановою КМУ від 10.09.2003 р. № 1440 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/1440-2003-%D0%BF> (date accessed: 29.03.2021).

³ Інструкція про призначення та проведення судових експертиз та експертних досліджень та Науково-методичні рекомендації з питань підготовки та призначення судових експертиз та експертних досліджень : затв. наказом Мін'юсту України від 08.10.1998 р. № 53/5 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z0705-98> (date accessed: 05.03.2021).

the only State Enterprise *Energorynok* at the tariffs set by the state according to the well-known “cost +” algorithm. Under such conditions, suppliers (usually oblenergos) could buy electricity only from the same SE *Energorynok* at the same prices for all consumers, calculated according to certain methods.

This system had many shortcomings due to the fact that the price was determined not by the market (i.e. the balance between supply and demand), but by the state (artificially, through a single regulator — the NEURC). In this aspect, these goods could not be the objects of forensic commodity science. However, the new market model of the energy sector has created a basis for a different attitude of citizens to this type of goods and services for their provision. Recently, the National Scientific Centre “Hon. Prof. M. S. Bokarius Forensic Science Institute” of the Ministry of Justice of Ukraine and other expert institutions of the Ministry of Justice of Ukraine are actively receiving requests from legal entities and ordinary citizens to conduct research to determine the market value of electricity, specified in the annexes to the appeal.

As of today (with the functioning of the new model) consumers — individuals of the market are protected by the State. The NEURC together with the government have defined a mechanism due to which suppliers, separated from oblenergos, should supply electricity to the population at tariffs that previously operated in Ukraine (despite the fact that such tariffs are lower than their cost). At the same time, individuals can independently choose a supplier, however, at much higher market tariff.

For legal entities there are market mechanisms, and the price of electricity depends on several factors: consumption; payment schedules and payment discipline; schedule of consumption during the day, etc. In addition, the supplier may offer each consumer individual conditions for cooperation, taking into account the specifics of such a customer. Today, in the conditions of the newly reformed electricity market, suppliers usually do not offer fixed prices for electricity, but enter into contracts, given the wholesale prices for electricity on electricity exchanges.

Separately, we emphasize that the modern retail market can be divided into two parts: *generic* and *free* market. The peculiarities of these markets are that: the *generic* market is limited by the administrative boundaries of regional regions (regardless of the ownership of electricity networks); The *free* market is limited to the territory of Ukraine. Generic service is *energy with delivery*, so the price of generic service is formed taking into account the cost of energy delivery to the consumer. In addition, in the free market the energy is sold without delivery, so the price usually does not take into account the cost of transmission and distribution (although options are allowed to take into account the cost of delivery by the consumer’s choice).

Legal, economic and organizational principles of the electricity market are determined by the Law of Ukraine No. 2019-VIII dated on 13.04.2017 *On*

Electricity Market (hereinafter referred as *the Law No. 2019-VIII*)¹. This Law regulates relations related to the production, transmission, distribution, buying and selling, supply of electricity to ensure reliable and safe supply of electricity to consumers, taking into account the interests of consumers, development of market relations, minimization of electricity supply costs and minimization of negative impact on the environment. Ancillary services market is a system of relations arising in connection with the buying of ancillary services from suppliers by the transmission system operator. The Law № 2019-VIII clearly stipulates that in order to ensure the supply of electricity to consumers, the generic service provider buys and sells electricity on the electricity market at free prices.

The methodology (procedure) for calculating the price of electricity offered by the generic service provider during the formation of prices for generic services is approved by the regulator — the NEURC².

The legal basis for the functioning of the electricity market consists of: the Constitution of Ukraine, Law No. 2019-VIII and other Laws of Ukraine: *On Combined Heat and Power Production (Cogeneration) and Waste Energy Potential*³, *The National Commission for State Regulation of Energy and Public Utilities*⁴, *On Natural Monopolies*⁵, *On Protection of Economic Competition*⁶, *On Environmental Protection*⁷, as well as international treaties of Ukraine, consent to be binding, provided by the Verkhovna Rada of Ukraine, and other regulations of Ukraine.

¹ Про ринок електричної енергії : Закон України від 13.04.2017 р. № 2019-VIII (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/2019-19> (date accessed: 29.03.2021).

² Про Національну комісію, що здійснює державне регулювання у сферах енергетики та комунальних послуг : Закон України від 22.09.2016 р. № 1540-VIII (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/1540-19> (date accessed: 29.03.2021).

³ Про комбіноване виробництво теплової та електричної енергії (когенерацію) та використання скидного енергопотенціалу : Закон України від 05.04.2005 р. № 2509-IV (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/2509-15> (date accessed: 29.03.2021).

⁴ Про Національну комісію, що здійснює державне регулювання URL: <https://zakon.rada.gov.ua/laws/show/1540-19> (date accessed: 29.03.2021).

⁵ Про природні монополії : Закон України від 20.04.2000 р. № 1682-III (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/1682-14> (date accessed: 29.03.2021).

⁶ Про захист економічної конкуренції : Закон України від 11.01.2001 р. № 2210-III (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/2210-14> (date accessed: 29.03.2021).

⁷ Про охорону навколишнього природного середовища : Закон України від 25.06.1991 р. № 1264-XII (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/1264-12> (date accessed: 29.03.2021).

The aforementioned indicates that the determination of the market cost of electricity and its services is beyond the competence of commodity experts, as the mechanism of pricing (tariffs) for this type of product is controlled by the state and approved by the NEURC. Methodological recommendations and methods for determining the market cost of energy products during forensic commodity expertises will help to eliminate gaps in the evaluation of energy products in expert forensic commodity practice, in which it is necessary to: determine the subject, tasks, objects of research of this forensic expertise; develop approaches and methods for estimating their value; to determine the range of goods formed on the world market and on the market of Ukraine; clearly define the limits of competence of commodity experts.

Conclusions. It should be noted that even when the theft of electricity caused damage in large or particularly large amounts or in other aggravating circumstances, the qualification of the offense will not be affected, and the most severe punishment for such actions will be punished as a minor offense in the form of restraint of liberty up to 3 years.

We note that the lack of methodological materials with a complete list of source data needed to determine the market cost of energy products, causes differences in the conclusions of experts. The solution of this problem requires a scientific substantiation of certain definitions and their definition; improvement of modern legislation on the regulation of this market (electricity, natural gas, etc.); introduction of the principles of independent evaluation of the market of this product and services for its provision.

It is proved that methodical materials for determining the market cost of energy products for forensic commodity expertises will help to eliminate the problematic issue of evaluation of energy complex products in expert forensic commodity practice, develop approaches and methods for estimating their cost; to determine the range of goods formed on the world market and on the market of Ukraine; clearly define the limits of competence of commodity experts.

Given the above, we can conclude that determining the market cost of electricity and services is beyond the competence of commodity experts, as the mechanism of pricing (tariffs) for this type of product is controlled by the state and approved by the regulator — the NEURC.

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I. А. Петрова, В. М. Фесюнін, О. С. Донцова
Місце судової товарознавчої експертизи
у запобіганні правопорушенням
на роздрібному ринку електричної енергії

Зауважено, що притягненню до кримінальної відповідальності винних у пошкодженні й викраденні енергообладнання, розкраданні електроенергії заважає відсутність у підрозділів поліції методичних матеріалів і навичок розслідування таких правопорушень і практики їх розгляду судами.

Акцентовано, що визначення ринкової вартості електроенергії та послуг з її надання перебуває за межами компетенції експертів-товарознавців, оскільки механізм формування цін (тарифів) на цей вид продукції затверджує Національна комісія, що здійснює державне регулювання у сферах енергетики та комунальних послуг, а контролює держава. Мета статті — окреслити місце судової товарознавчої експертизи у запобіганні правопорушенням на роздрібному ринку електроенергії.

Ключові слова: електрична енергія, правопорушення, державне регулювання, відповідальність, вартість, судово-товарознавча експертиза.

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Место судебной товароведческой экспертизы в предупреждении правонарушений на розничном рынке электроэнергии

Подчёркнуто, что угрожающая динамика ежегодного увеличения количества фактов порчи и воровства энергооборудования, кражи электрической энергии, самопроизвольного подключения к электросетям может привести к разбалансированию и разрушению электрической отрасли не только отдельной области, но и страны в целом. Обращено внимание на то, что на сдерживание этой опасной динамики направлены нормативно-правовые акты, осуществляющие государственное регулирование в сфере энергетики, которые, к сожалению, не обеспечивают стабильной безопасности в этой сфере. Констатируется, что для открытия уголовного производства по статье 188¹ Уголовного кодекса Украины специалисты различных поставщиков электрической энергии подготавливают все необходимые материалы, подают ходатайства следственным органам о необходимости проведения тех или иных следственных действий, однако, в итоге нарушителей к уголовной ответственности так и не привлекают. Установлено, что главным препятствием в привлечении виновных в этих нарушениях к уголовной ответственности следует признать отсутствие в подразделениях полиции методических материалов и навыков в расследовании уголовных производств по фактам хищения электрической энергии и практики их рассмотрения судами.

Доказано, что отсутствие методических материалов с полным перечнем исходных данных, необходимых для определения рыночной цены продуктов энергетического комплекса, приводит к расхождениям в заключениях экспертов. Решить проблемный вопрос оценивания продуктов энергетического комплекса в экспертной практике помогут новые методики определения рыночной цены продуктов энергетики при проведении судебных товароведческих экспертиз. Предложено определить предмет, задачи, объекты исследования этой судебной экспертизы; выработать подходы и методы к оцениванию их стоимости; оговорить ассортимент товара, сформировавшийся на этом рынке в мире и в Украине; чётко обозначить границы компетенции экспертов-товароведов. Акцентируется,

что определение рыночной цены электрической энергии и стоимости услуг по её предоставлению выходит за пределы компетенции экспертов-товароведов, поскольку механизм формирования цен (тарифов) на этот вид продукции контролирует государство и утверждает регулятор — Национальная комиссия, осуществляющая государственное регулирование в сферах энергетики и коммунальных услуг.

Ключевые слова: электрическая энергия, правонарушения, государственное регулирование, ответственность, стоимость, судебно-товароведческая экспертиза.

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Features of intellectual property analysis in Ukraine and abroad

Issues on the implementation of intellectual property analysis in Ukraine, as well as a forensic expert participation in court hearing abroad were considered. Intellectual property objects belong to a variety of types of art, science, technology and crafts, effective consideration of cases related to protection of intellectual property rights, for a complete and comprehensive study of the subject of examination and providing an expert's conclusion becomes possible only in case of attracting specialists, who have special knowledge in a particular field.

The article purpose is to define features of intellectual property analysis in Ukraine and formal requirements for a forensic expert in Ukraine and foreign states.

One of the priority directions of state policy is the protection of intellectual property rights, as the development of this area stimulates innovation in all fields by increasing the country's economy to a new level, and providing it a rightful place at the international level. Also, an increase of scientific potential not only promotes Ukraine's modernization in various fields of science and technology but also increases its defense capability and national security.

Today there is a negative state of compliance with the legislation regulating intellectual property issues, the number of violations of relevant rights is increasing. The reason for such a state is the imperfection of the mechanism of legal protection and protection of intellectual property rights in the field of scientific activity, failure to resolve the issue regarding legal protection of scientific advances, etc. In January 2020, the European Commission made a publication of a report on protection and ensuring intellectual property rights in third countries, according to which (despite all preventive measures) our country was already on the list of countries, where there are serious systematic

problems in the field of defense and protection of intellectual rights, causing significant damage to the economic interests of the EU.

Forensic science plays a priority role in introducing advanced achievements of science and technology and promotes the reliability of the proof system in the case. In some cases, the appointment and conduct of a forensic examination are not only necessary but also the only possible means of establishing the truth and solving a litigation.

Keywords: *forensic science, intellectual property, literary works, trademark, forensic expert, court.*

Formulation of Research Problem. One of the priorities of state policy is the protection of intellectual property rights, as the development of this area intensifies innovation in all areas, raises the country's economy to a new level, providing it with a worthy place at the international level. The growth of scientific potential not only contributes to the modernization of Ukraine in various fields of science and technology, but also strengthens its defense capabilities and national security.

Today, there is a negative state of compliance with legislation governing issues of intellectual property, increasing the number of violations of these rights. The reason for this situation is the imperfection of the mechanism of legal protection and protection of intellectual property rights in the sphere of scientific activity, unresolved issue of legal protection of scientific discoveries, etc. In January 2020, the European Commission published a report on the protection and enforcement of intellectual property rights in third countries, according to which despite all preventive measures, our country is once again among the countries with serious systematic problems in the sphere of protection and enforcement of intellectual property rights and cause significant damage to economic interests of the EU.

Forensic examination plays a priority role in the implementation of advanced achievements in science and technology and contributes to the reliability of the evidence system in the case. In some cases, the appointment and conduct of a forensic examination is not only necessary, but the only possible means of finding out the truth and resolving the dispute.

Analysis of Recent Researches and Publications. Problematic issues of forensic examination were studied by such scientists as P. P. Krainev, O. M. Kliuiev, E. B. Simakova-Yefremian, V. L. Fedorenko, N. V. Kisil, O. F. Doroshenko, O. P. Orliuk and others ¹.

¹ Е.г., Крайнев П. П., Ковальова Н. М., Мельников М. В. Судові експертизи у сфері інтелектуальної власності. За ред. П. П. Крайнева. Вінниця. 2008. 376 р. ; Столітній шлях судової експертизи в Україні, 1918—2018 рр.: монограф. ; авт.-уклад. : О. М. Клюєв, О. П. Угровецький, Е. Б. Сімакова-Єфремян ; за ред. О. М. Клюєва. Харків, 2018. 335 р. ; Основи судової експертизи: навчальний посібник для фахівців, які мають намір отримати або підтвердити кваліфікацію судового експерта ; авт.-уклад. : Л. М. Головченко, А. І. Лозовий, Е. Б. Сімакова-Єфремян

The **Article Purpose** is to clarify the features of conduct of forensic examination of intellectual property objects in Ukraine and the formal requirements for a forensic expert in Ukraine and foreign countries.

Main Content Presentation. Peculiarities of the content of rights to intellectual property objects determine a certain specificity of the dispute resolution procedure that arises in the process of creation and use of these objects. An important component of such disputes is that they concern specialized knowledge that requires special competence in various fields of science and technology, arts and crafts. That is, such disputes are generally not resolved without an application of specialized knowledge in the particular area and, accordingly, require the involvement of forensic experts and conduct of forensic examination and expert researches.

Legal, organizational, and financial bases of forensic activity are determined by the Law of Ukraine: *On Forensic Examination* ¹.

Forensic examination of intellectual property is rather new type of a forensic examination, which was established in Ukraine in 2001—2002 and is developing to this day ².

Prior to that, there was a certain practice of conducting examinations in this area. According to P. P. Krainev, a well-known scientist in the field of forensic examination of intellectual property, during the 1980's and 1990's district people's courts and investigative bodies appointed (as indicated in the relevant procedural documents) economic, patent-economic, and technical examination. The task of the examination was often to establish the fact of use of the plaintiffs' inventions, to determine the amount of royalties for the use of inventions on the copyright certificate, to calculate the economic effect of the use of inventions or the introduction of innovation proposals ³.

та ін. Харків, 2016. 928 р. ; Федоренко В. Л., Тимошик Л. П. Судова експертиза з питань інтелектуальної власності: генезис, поняття, класифікація та система [Електронний ресурс]. *Експерт: парадигми юридичних наук і державного управління*. 2019. № 1(3). Р. 11—52. DOI: <https://doi.org/10.32689/2617-9660-2019-3-1-11-52> (date accessed: 12.03.2021) ; Кісіль Н. В. Сутність і зміст судово-експертної діяльності у сфері інтелектуальної власності. *Теорія та практика судової експертизи і криміналістики* : зб. наук. пр. Харків, 2015. № 15. Р. 346—354 ; Дорошенко О. Ф. Процесуальні права та обов'язки судового експерта. *Питання інтелектуальної власності* : зб. наук. пр. НДІВ АПРН України за 2007 рік. Київ, 2007. № 5. Р. 4—25 ; Орлюк О. П., Дорошенко О. Ф. Проблемні питання проведення судової експертизи об'єктів інтелектуальної власності. *Юридичний радник*. 2006. № 3. Р. 88—89.

¹ Про судову експертизу : Закон України від 25.02.1994 р. № 4038-XII. URL: <https://zakon.rada.gov.ua/laws/show/4038-12> (date accessed: 19.03.2021).

² Федоренко В. Л., Тимошик Л. П. Судова експертиза з питань інтелектуальної власності: генезис, поняття, класифікація та система. 2019. (date accessed: 12.03.2021).

³ Крайнев П. П., Ковальова Н. М., Мельников М. В. Судові експертизи у сфері інтелектуальної власності. 2008.

In Ukraine, for the implementation of such forensic examination within the structure of the Ministry of Justice there is a specialized Scientific-Research Institute of Intellectual Property, as well as forensic experts of state specialized institutions and forensic experts who are not employees of these institutions, who carry out an expert activity on works of literature, arts, sciences, technology, crafts.

The Ministry of Justice organizes expert ensuring of justice and researches in the field of forensic science, in particular, in the field of intellectual property, maintains the Register of methods of conduct of forensic examinations and the State Register of certified forensic experts, promotes the Central Expert Qualification Commission under the Ministry of Justice, the main functions of which are the certification of specialists in order to assign (confirm) the qualification of a forensic expert, in particular, in the field of intellectual property, and consideration of disciplinary liability of forensic experts.

The purpose of specialized forensic institutions is to meet the needs of pre-trial investigation bodies, court, other government agencies and provide public services to legal entities and individuals to provide them with independent, qualified and objective analysis, in particular on intellectual property issues.

The subject of forensic examination in the field of intellectual property N. V. Kisil points the facts and circumstances of the case on the properties, characteristics, patterns of creation and use of intellectual property, their value, damages and economic transactions in respect of these objects, which are important for pre-trial investigation or court proceedings and which are determined by applying special knowledge in the manner prescribed by law ¹.

L. Gula confirms that persons, that persons engaged in pre-trial investigation or endowed with exclusive powers to administer justice, do not have special knowledge in the field of intellectual property, and therefore can not and should not objectively assess the evidence in terms of special knowledge. In this case, there is a need to involve people with special knowledge and relevant qualifications in this field ².

Appointment and conduct examinations in the field of intellectual property is carried out according to the rules, provided for any type of examinations. However, depending on the content of the expert task, there may be some differences in the content and structure of the expert conclusion. Today, the examination in the field of intellectual property is included in the class of forensic examinations, within which the following expert specializations are distinguished:

13.1.1 Researches related to literary, artistic, and other works;

13.1.2 Researches related to computer programs and data compilations (databases);

¹ Кісіль Н. В. Сутність і зміст судово-експертної діяльності у сфері інтелектуальної власності. 2015. Р. 346.

² Гула Л. Судова експертиза об'єктів інтелектуальної власності як одне із джерел доказів у кримінальному провадженні. 2017. Р. 255—260.

13.2 Researches related to performances, phonograms, videograms, programs (broadcasts) of broadcasting organizations;

13.3 Researches related to inventions and utility models;

13.4 Researches related to industrial designs;

13.5.1 Researches related to plant varieties;

13.6 Researches related to commercial (brand) names, trademarks (signs for goods and services), geographical indications;

13.8 Researches related to trade secret (know-how) and innovation proposals;

13.9 Economic researches in the field of intellectual property ¹.

During forensic examination in the field of intellectual property, the circumstances to be proved are clarified, namely, the type and amount of damages caused to the right holder of the intellectual property object, the volume of reproduction of intellectual property objects, the method of their use, etc. An important remark is that in the criminal process, determining the amount of material damage and non-pecuniary damage caused by a criminal offense is the basis for the mandatory involvement of an expert ².

Thus, forensic examinations, related to copyright and related rights, are appointed in the following cases: court decision on the violation of the rights of the copyright owner; recognition of the use of work, etc. Forensic examination solves the following tasks: determines the signs of originality and creative nature, originality of the title of work, the fact of use of the work and the method of its use.

Forensic examinations of means of individualization are appointed when the court decides on the violation of the rights of the owner of a trademark, commercial designation, brand name or person, an association of persons who manufacture goods under a registered geographical indication. The main tasks of forensic examination are to determine: the identity of different means of individualization or similarity so that they can be confused; the possibility of misleading the consumer about the product, service or person.

The protection of objects of intellectual property rights is carried out by conducting forensic examinations and expert researches by certified forensic experts. A forensic expert is the only subject of forensic examination. There are formal requirements for the forensic expert in Ukraine, and they are extremely strict. Given that intellectual property objects belong to various fields of art, science, technology and crafts, effective consideration of cases related to the protection of intellectual property rights for a full and comprehensive study of

¹ Про затвердження Положення про Центральну експертно-кваліфікаційну комісію при Міністерстві юстиції України та атестацію судових експертів : наказ Мін'юсту України від 03.03.2015 р. № 301/5. URL: <https://zakon.rada.gov.ua/laws/show/z0249-15> (date accessed: 20.03.2021).

² Гула Л. Судова експертиза об'єктів інтелектуальної власності як одне із джерел доказів у кримінальному провадженні. 2017. Р. 255.

the subject of examination and providing an expert conclusion is possible only in the case of involving specialists who have special knowledge in a particular field.

According to O. F. Doroshenko, after the appointment of the examination and its acceptance for conduct, a person with special knowledge acquires the procedural status of a forensic expert, with all the rights, duties and responsibilities arising from it. It should be understood that the main function of the forensic expert is to provide a written conclusion on the basis of a study conducted with the use of special knowledge of the objects submitted for examination ¹.

The expert conclusion in the field of intellectual property is an independent source of evidence in various types of litigation. Forensic examinations in the field of intellectual property are mainly appointed, resolving issues in such categories of disputes as recognition of the right to intellectual property and infringement of intellectual property rights.

The forensic expert is an independent subject of the process that has its own scope of procedural rights and duties that distinguish him from other participants in the process. The basic rights, duties, and requirements for a forensic expert are enshrined in Section II of the Law *On Forensic Examination*. In addition, Section VI Regulations on the Central Expert Qualification Commission under the Ministry of Justice of Ukraine and certification of forensic experts provide grounds for bringing a forensic expert to disciplinary responsibility.

Article 10 of the Law *On Forensic Examination* stipulates that *forensic experts of state specialized institutions may be specialists who have the appropriate higher education, educational and qualification level not lower than a specialist, have been trained and qualified as a forensic expert in a particular specialization* ².

Employees of specialized state expert institutions are required to carry out only a few types of examinations, which belong to forensic and forensic psychiatric. Such requirements do not apply to examination in the field of intellectual property. As mentioned above, in order to engage in expert activities, the expert must pass the appropriate certification procedure and pass a qualifying exam. In addition, according to the legislation of Ukraine, the main principles on which forensic activity is based are the independence of the forensic expert from the court and pre-trial investigation bodies, the competence of the forensic expert, the validity, objectivity and completeness of the expert study, the ability to verify the results of research and appoint a re-examination, compliance with the safety and rights of the expert during the study.

If we analyze the foreign experience of forensic activity, then in not all countries the law clearly defines the criteria for the competence of the forensic expert, which sometimes complicates the process of such activities. For example,

¹ Дорошенко О. Ф. Процесуальні права та обов'язки судового експерта. 2007. Р. 8.

² Про судову експертизу. URL: <https://zakon.rada.gov.ua/laws/show/4038-12> (date accessed: 19.03.2021).

in the United States, the lack of formal requirements for an expert leads to the representatives of the parties during the interrogation specifically asking questions that confirm the competence of the expert or, conversely, raise doubts about both the expert's experience and the reliability of his research methods. According to I. V. Reshetnikov, when a party is going to bring an expert to a court hearing, he must provide the opposite party with an expert conclusion and add to it all calculations, plans, etc.¹.

In England, there is a specialized Intellectual Property Enterprise Court. The Patent Act 1977 and the European Patent Convention define an intellectual property expert as an art professional, in other words, as a qualified person. Most of the evidence in patent disputes contains the conclusions of experts. In some cases, the expert lacks his own experience, so he must refer to authoritative sources, summarize the experience of others².

French civil procedure law provides that an expert examination may be appointed in any situation where the judge does not have sufficient components to rule on the case. That is why the examination is understood as the provision of evidence and as assistance in making a decision, as an investigative action carried out by a technical specialist, the need for which arose before or during the trial, using techniques to assist the judge, but not eliminating it from solving the problem³. Interestingly, the French experts are effective people involved in the reconciliation of the parties, i.e., the expert is the mediator of the parties with whom he meets, interrogates, listens and acquaints with the recordings; he has a winning position to simplify the procedure for concluding an amicable agreement.

Conclusions. In the light of judicial reform in Ukraine and the prospects of establishing a High Court of Intellectual Property, forensic examination in this area remains a necessary and often the only source of evidence in cases of infringement of property and personal non-property rights of authors, industrial property rights, since a forensic expert provides an objective and well-founded conclusion an effective and well-founded conclusion that is or will be the subject of legal proceedings. It is a certified forensic expert who is responsible for the quality and objectivity of forensic examination in the field of intellectual property in Ukraine. Certified forensic experts on intellectual property are rare abroad. Relevant researches for courts are conducted by experts, nominated by the court.

¹ Решетникова И. В. Доказательственное право Англии и США. Екатеринбург. 1997. Р. 34—41.

² England Paul. The role of experts in life sciences patent litigation [Electronic resource]. URL: https://www.taylorwessing.com/synapse/ip_patentlitigation.html (date accessed: 21.03.2021).

³ Євдокіменко С. В., Петрова І. А. Особливості використання судової експертизи за законодавствами України та Франції. 2016. № 2 (73). Р. 54—62.

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С. М. Науменко, Л. В. Золота
Особливості судової експертизи
об'єктів інтелектуальної власності
в Україні та за кордоном

Розглянуто здійснення експертизи об'єктів інтелектуальної власності в Україні, а також участь експерта в судовому засіданні за кордоном. Об'єкти інтелектуальної власності належать до різноманітних галузей мистецтва, науки, техніки й ремесла, тому ефективність розгляду справ, пов'язаних із захистом прав інтелектуальної власності, залежить від залучення фахівців, які мають спеціальні знання в певній галузі,— для повного та всебічного дослідження предмета експертизи й надання висновку експерта. З'ясовано особливості проведення судової експертизи об'єктів інтелектуальної власності в Україні та визначено формальні вимоги до судового експерта в Україні й іноземних державах.

Ключові слова: *судова експертиза, інтелектуальна власність, літературні твори, торговельна марка, судовий експерт, суд.*

С. М. Науменко, Л. В. Золотая
Особенности судебной экспертизы объектов
интеллектуальной собственности в Украине и за рубежом

Рассмотрены вопросы осуществления экспертизы объектов интеллектуальной собственности в Украине, а также участие эксперта в судебном заседании за рубежом. Объекты интеллектуальной собственности относятся к различным областям искусства, науки, техники и ремесла, эффективное рассмотрение дел, связанных с защитой прав интеллектуальной собственности, для полного и всестороннего исследования предмета экспертизы и дачи заключения эксперта возможно только в случае привлечения специалистов, обладающих специальными знаниями в определённой области.

Цель статьи — выяснить особенности осуществления судебной экспертизы объектов интеллектуальной собственности в Украине и формальные требования к судебному эксперту в Украине и иностранных государствах.

Одно из приоритетных направлений государственной политики — охрана прав интеллектуальной собственности, поскольку развитие этой сферы активизирует инновации во всех отраслях, поднимая на новый уровень экономику страны и обеспечивая ей достойное место на международном уровне. В свою очередь повышение научного потенциала не только способствует модернизации Украины в различных сферах науки и техники, но и укрепляет её обороноспособность и национальную безопасность.

Сегодня наблюдается негативное состояние соблюдения законодательства, регулирующего вопросы интеллектуальной собственности, увеличивается количество нарушений соответствующих прав. Причиной такого состояния является несовершенство механизма правовой охраны и защиты прав интеллектуальной собственности в сфере научной деятельности, неурегулированность вопроса о правовой охране научных открытий и т. п. В январе 2020 г. Европейская комиссия опубликовала отчёт о защите и обеспечении прав интеллектуальной собственности в третьих странах, согласно которому (несмотря на все превентивные меры) Украина в очередной раз оказалась среди стран с серьёзными системными проблемами в области охраны и защиты прав интеллектуальной собственности, наносящими существенный ущерб экономическим интересам ЕС.

Судебная экспертиза играет приоритетную роль во внедрении передовых достижений науки и техники и способствует надёжности системы доказывания по делу. В некоторых случаях назначение и проведение судебной экспертизы не только необходимо, но и единственно возможно для установления истины и решения судебного спора.

Ключевые слова: судебная экспертиза, интеллектуальная собственность, литературные произведения, торговая марка, судебный эксперт, суд.

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Features of forensic commodity examination of upholstered and cabinet furniture

The main task solved by forensic experts while studying furniture is to define its quality conditioned by a complex of consumer properties formed in the process of manufacturing and maintenance of such furniture.

The purpose of this article is to study main signs allowing to identify falsification or counterfeiting of furniture, and requirements for labeling.

The upholstered furniture of the provided manufacturer is characterized by the following features: a frame is made of natural wood, dried automatically in compliance with all norms and standards; particular attention is drawn to the quality of components; high-quality foam rubber is used to fill the mattress blocks which are tested for elasticity, wear resistance, certification, etc. Cabinet furniture of the provided manufacturer has the following characteristics: high quality workpieces, smooth, without knots along the entire length of a saw cut; wood edges are straightened at all areas of parts; when drilling attachment holes, the vertical and horizontal drilling accuracy is strictly controlled; furniture fittings correspond to a general artistic decision of furniture, have a long service life.

When conducting a forensic commodity examination of furniture, it is proposed to carry out its research in the following sequence: identify product characteristics, dimensional characteristics, shortcomings, causes of defects and their nature by the method of organoleptic examination and linear measurements; the method of comparative research establishes compliance or non-compliance of a studied product with regulatory requirements set for products of this commodity group, presence of defects in semi-finished products, quality of wood drying process, execution of the wood sawing process

and manufacture of parts, quality of the process of manufacturing a frame, upholstery and finishing.

When evaluating the quality of furniture, it is needed to take into account their compliance with requirements, governed regulations for design, standards and other documents.

Keywords: cabinet furniture, upholstered furniture, defects, boxes, decorative fittings, fastening materials.

Formulation of Research Problem. In the modern world, furniture is not only a vital necessity, but also a luxury item, an exclusive part of the interior. Despite the economic and political troubles, in our country there is an increase in furniture production, improving the quality of their range.

As of today, domestic products cannot fully compete with foreign ones. However, recently the furniture market of Ukraine is increasingly filled with furniture products of domestic manufacturers who are trying to meet the needs of modern consumers, however, there is still something to learn from foreign competitors. Ukraine imports furniture mostly from Poland, Italy and Germany, and the number of imports is at a high level.

The peculiarity of the study of furniture is due to the variety of materials from which the product is made. The main task solved by forensic experts while studying furniture is to define its quality conditioned by a complex of consumer properties formed in the process of manufacturing and maintenance of such furniture.

Analysis of Essential Researches and Publications. Some provisions of furniture examinations were studied in the works by O. O. Zhelavska ¹, I. M. Baidakova, L. M. Huba, H. M. Kozhushko, O. I. Peredrii, S. V. Yaheliuk ² and others, however, they did not consider the full range of forensic commodity examination of furniture, and the lack of a single set of rules for forensic commodity examination of furniture makes it difficult to conduct such researches.

The **Article Purpose** is to study main signs allowing to identify falsification or counterfeiting of furniture, determine the main characteristics of the goods of this group and the requirements for their labeling, as well as the algorithm of actions during the research of upholstered and cabinet furniture.

Main Content Presentation. The choice of the nomenclature of indicators on which to conduct research on the quality of furniture products, experts carry out in accordance with DSTU 16371-93 *Furniture. General technical conditions*, GOST 20400-80 *Products of furniture production. Terms and definitions*.

Furniture is classified by various features. Here are the main ones:

¹ Желавська О. О. Розрахунок втрати якості непродовольчих товарів у зв'язку з їх зносом та наявністю дефектів : метод. рек. Київ, 2011. 34 р.

² Байдакова І. М., Губа Л. М., Кожушко Г. М., Передрій О. І., Ягелюк С. В. Товарознавство непродовольчих товарів : підруч. для студ. вищ. навч. закл. : у 2-х ч. Ч. І. Луцьк, 2014. 355 р.

- by operational properties (household, office, for public catering establishments, rest homes, sanatoriums, country houses);
- by design (cabinet, prefabricated, demountable, non-demountable, mounted, sectional, hinged, bent, wicker);
- by type of manufacturing material (wooden, polymer, metal, combined);
- by type of product (cabinets, chests of drawers, sideboards, tables, beds, sofas, stools, chairs, armchair, dressing table, trellises, benches);
- on functional features (for sitting, lying down, work; storage of clothes, utensils, books);
- by completeness (single, complete);
- by nature of production (experimental, serial, mass);
- by the method of production (carpentry, bending, wicker, extruded, molded, stamped, cast);
- by the magnitude of the deformation of the soft element (hard, soft) ¹.

Let's dwell in more detail on the features of commodity examination of upholstered and cabinet furniture.

Examination of the production and determining the quality of upholstered and cabinet furniture is a complex process that requires special knowledge. During the forensic examination of furniture, it is proposed to conduct their examination in the following sequence:

1. The method of organoleptic inspection and linear measurements establishes the commercial characteristics of the product (variety, model, design, materials used), dimensional features, downsides (defects, their location, degree of detection), the cause of defects and their nature (raw materials, production, operation).
2. The method of comparative research determines the compliance or non-compliance of the examined product with the regulatory requirements for products of this product group, the presence of defects in the semi-finished product, the quality of the wood drying process, the quality of the sawing process and manufacturing of parts, the quality of the process of manufacturing the frame, the quality of the upholstery process furniture and decoration of cabinet furniture.

Examination of a particular product begins with its thorough inspection by a commodity expert. As a result of the inspection, the specialist establishes the product characteristics (color, model, wood processing, brand of components, product grade), method of cutting upholstery fabric for upholstered furniture, dimensional data that allow to classify the object.

The next step is to inspect the product for defects. To determine the degree of their expression, it is necessary to determine the location. Establish the nature of defects of materials from which the furniture is made, or which were formed

¹ Алексеев Н. С. Товароведение хозяйственных товаров : учеб. для вузов : в 2 т. 3-е изд., испр. и доп. Москва, 1989.

during storage, transportation and operation, and their impact on product quality (hidden defect, significant, insignificant, remedial, irreversible, critical). In practice, the percentage of wear can be calculated based on the service life or specific defects: abrasions and scratches, chips on the edges of parts, violations of adhesive joints, the presence of cracks and gaps, deformation of soft elements, breaks in upholstery at seams, through cracks and swelling material, etc.

During the forensic commodity examination, an expert should take into account that the destruction of furniture can occur due to improper care for them, errors during cleaning and operation (Fig. 1).

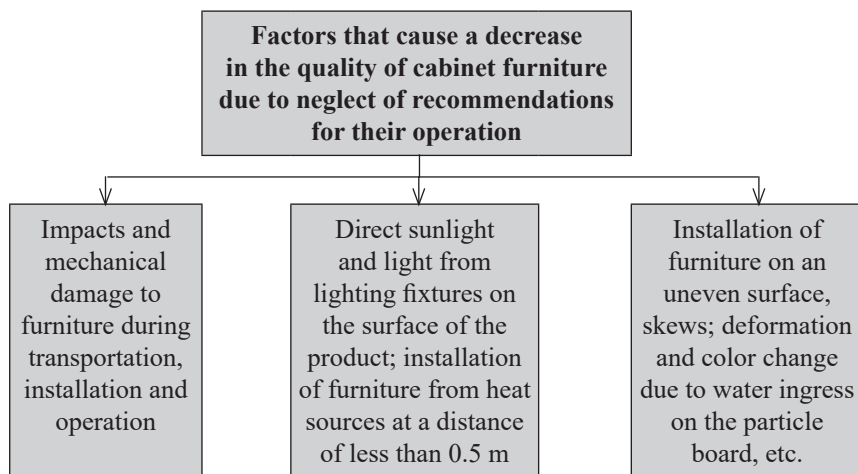


Fig. 1. List of factors that reduce the quality of furniture during operation

Features of the examination of upholstered furniture

The most important classificational features of upholstered furniture are the functional purpose and the presence of a soft element (from I to IV category of softness). Upholstered furniture has a number of requirements, compliance with which meets the specific needs of the consumer in accordance with their purpose. These requirements concern the observance of quality indicators regulated by regulatory documentation and the assessment of product quality by objective technical, economic and organoleptic properties, which are grouped into the following groups: architectural and artistic (aesthetic); efficiency (product price, consumption price); comfort and ergonomics (functional solution of the product); modern design; compliance with the requirements of DSTU; safety (environmental friendliness and hygiene); reliability, durability and maintainability ¹.

¹ Дослідження показників якості при виробництві меблів. 2014. URL: <https://student.zoomru.ru/tovar/dosldzhennya-pokaznikov-yakost-pri-virobnictv/280516.3319781.s1.html> (date accessed: 25.02.2021).

Production of upholstered furniture is carried out in stages. The first stage is the manufacture of the frame. The second stage is the upholstery of the product. Since the factory process is an organized cycle of work, the stages of production have a clear sequence.

For production of the skeleton framework a wooden bar (natural wood), particle board, fiberboard are used. Natural wood attracts special attention of the commodity expert (first of all technology of a bar drying). Such attention is quite justified, because this process is directly related to the quality of the final product. Examining the technological process of drying, the expert commodity dwells on its features. If the drying process is automated, it guarantees the stability of the parameters (temperature, humidity, etc.), because a special recorder records data on the humidity of the wooden beam, as soon as a certain mark is reached, the drying process automatically stops. The beam, dried in compliance with all technological requirements, is considered environmentally friendly, the material does not mold, does not suffer from fungus, it is not sharpened by beetles, as the latter are absent in the wood prepared in this way. Under such conditions, the strength and durability of wooden beams are provided for many years of operation. After drying, the wooden beam is transported to the carpentry shop, where it is used to make frame elements. The main stages in the carpentry shop are also automated. This ensures reliable fixing when sawing the beam, accurate calibration of workpiece widths and heights, etc. The commodity expert should take into account that particle board and fiberboard are used when the use of natural wood is technologically impossible.

At the key stages furniture production there is a technical control department (hereinafter referred as *TCD*). If *TCD* employees find violations of the quality standards of the frame or the finished product, such frame or finished product is returned for revision. The fact that the product is accepted is evidenced by a glued paper label containing the following information: a trademark, the name of the manufacturer and his address; a product name; the order name; product release date; designation of the standard; *TCD* stamp. In addition, the product is equipped with a warranty card, according to which the customer can read the recommendations for the care of upholstered furniture, the rules of their operation, the conditions of warranty and post-warranty service ¹.

One of the decisive criteria for choosing a sofa by the consumer is the appearance, which is determined by the shape, dimensions and, of course, the upholstery material. The cover itself gives the sofa an attractive, stylish look and allows you to significantly improve its consumer properties. As of today, three basic types of upholstery are used in the production of upholstered furniture:

- textiles;
- artificial leather;
- genuine leather.

¹ Петрова І. А. Експертне дослідження меблів при проведенні судово-товарознавчих експертиз. *Право і суспільство*. 2011. № 6. Р. 191—196.

The most expensive is genuine leather. It is characterized by softness and strength, elasticity and resistance to deformation. The skin is pleasant to the touch, breathable, stays cool in the heat and warm in the cold. It is not prone to stains, it is easy to clean and polish. Modern reagents used in its manufacture make it environmentally friendly and hypoallergenic. Dyeing technologies allow you to give the skin any desired shade, as well as apply a textured pattern or relief¹.

Artificial or so-called eco-leather can be a budget alternative to genuine leather. In its properties it is similar to natural, and in some respects even surpasses it. For instance, sofas made of imitation leather are much more resistant to light and less demanding in care. Today, manufacturers have learned to very accurately copy the natural pattern of the skin, its softness and plasticity. It is difficult for a layman to determine that in front of him is a man-made fabric. Therefore, furniture, upholstered in artificial leather, in general, looks no less advantageous. At the same time, the price for them, of course, is much lower.

Most often, among the upholstery materials used textiles. Fabrics are created from natural and synthetic fibers in different proportions. The most common: flock, chenille, velour, jacquard, mat (Fig. 2).

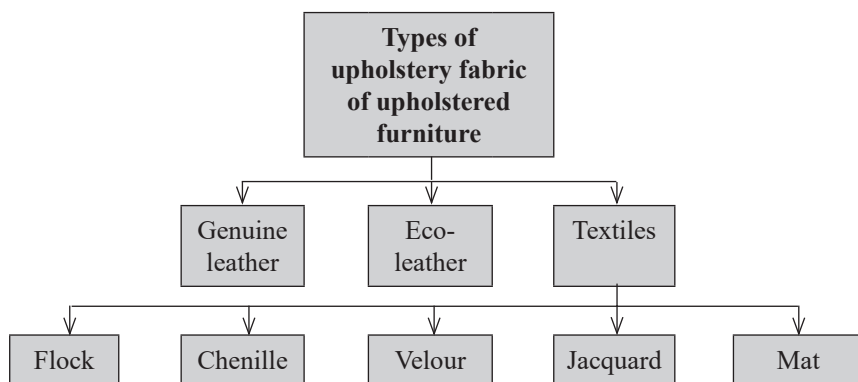


Fig. 2. The most common types of exterior upholstery fabric for sofas

Features of the study of cabinet furniture

Cabinet furniture – a piece of furniture that has a *drawer* design and is designed to be located along the walls. This category includes: tables, shelves, wardrobes, cabinets, walls and other types of furniture made of individual hard parts.

¹ Як вибрати диван: особливості матеріалів оббивки. URL: http://promebli.org.ua/yak-vybraty-dyvan-osoblyvosti-materialiv-obbyvky.html#mor_e-762 (date accessed: 20.02.2018).

First of all, these are the upper, lower, and side panels, which are the main elements of the cabinet furniture. Stiffness of connection is provided by couplers, confirmats, pins, and other accessories providing real estate by connection of elements of furniture. Cabinet panels are made of particle board, rear walls — fiberboard.

Shelves (depending on the method of fastening) are divided into stationary (non-removable) and removable. Stationary shelves are designed for books, clothes, utensils. Non-removable shelves are rigidly fixed between the frame panels, which protects the furniture from diagonal distortions. Stationary shelves, as well as cabinet elements, are made of particle board. Removable shelves can be made of particle board or glass.

The door is the front part of the furniture, the facade. In their manufacture there is a variety of materials: particle board, MDF, glass (in particular, frosted and sprayed). For door decoration use various overhead elements, decorative accessories. Doors not only protect things from the environment, but also provide access to them. Depending on the movable method of connecting the door to the furniture body, they can be plowed (hinges are used for connection) or sliding (roller mechanism and metal guides are used).

Drawers — an indispensable attribute of any of the models of cabinet furniture. Drawers are decorated similarly to doors. They are put forward thanks to directing rollers.

Main signs allowing to identify falsification or counterfeiting of furniture

Upholstered furniture from real manufacturer is characterized by the following features:

1. The frame of the products is made of natural wood. In the process of preparation, the wooden beam is dried automatically in compliance with all norms and standards. The result is an environmentally friendly material that has high strength and durability.
2. To give the product the desired shape, the curved details of upholstered furniture are upholstered with fiberboard.
3. When choosing components for products at a furniture factory, special attention is paid to their quality. This takes into account the technology of production of components, in particular, the brand of metal, the presence of galvanization, method of painting, etc., as well as compliance of components with generally accepted norms and standards, terms and conditions of guarantees provided by the manufacturing factory, the authority of the brand.
4. To fill mattress blocks ST 2542 foam rubber is used. At the manufacturing factory, each batch of foam rubber, which is delivered to the furniture factory, passes special tests for elasticity, wear resistance, recovery activity and certification. The same applies to spring blocks and beaded slats.

Upholstered furniture of artisanal and low-quality factory production, the copied products can be defined on such signs:

1. The frame is made of undried, i.e. wet beams. The design is short-lived, so it has a limited-service life. Due to the violation of the technology of drying the beam there is a high probability of fungus, mold, insects. Due to the violation of the technology of drying the beam there is a high probability of fungus, mold, insects.
2. Cardboard is used for upholstery of curved upholstered furniture details. This material is short-lived, so the product usually quickly loses its shape.
3. The components are made in violation of the production technology: low grade of metal, no galvanization, low-quality painting, bolts for cleaning the elements of the frame are not cleaned from oil, which leads to contamination of the cover, and so on. The brand of the component manufacturer is not marked.
4. Soft element of low density. This means that in a year or two it will start to sag, crumble, wrinkles and cracks will appear on the surface of the upholstery. Cheap springs will make themselves felt even earlier. In addition, they will begin to creak.
5. Cheap upholstered furniture has an unattractive appearance, because the upholstery is of low quality, poorly draped. During operation, the consumer may find the following shortcomings in the furniture: the material quickly fades and wears out, it is poorly cleaned, the seams spread. In addition, the upholstery material may contain a significant amount of synthetics, and dyes — harmful components to human health.

Cabinet furniture of the real manufacturer has the following characteristics:

1. Due to use of the modern equipment and automation of production processes, in particular a stage of sawing of a particle board, preparations have high quality: smooth, without knots on all length of cutting.
2. The edges are lined on all parts, in particular on the *invisible* (for example, the lower sides of the lower doors, the upper sides of the upper doors, etc.).
3. Drilling of connecting holes is strictly controlled by vertical and horizontal accuracy of drills. Observance of these parameters provides easy and operative assembly of cabinet furniture at home.
4. The furniture correspond to the general artistic decision of furniture, has long service life, is beautiful, convenient in use and demands a minimum of care.

Cabinet furniture of artisanal, low-quality factory production, copied products can be identified by the following characteristics:

1. Due to the use of old or cheap equipment, blanks have knots, there is a violation of the texture of the material. All this has a negative effect on the appearance of the product and its performance characteristics.
2. The facing edge is not present on all sites of detail.
3. When assembling cabinet furniture, the consumer finds a violation of the vertical and horizontal accuracy of the drills.
4. The furniture looks simple. Details of one category can differ in the sizes, color of material.

5. Deformation of the guide parts of the product (it is difficult to fully extend the drawer, slide the sliding door in the closet), etc.

Requirements for furniture labeling

Each piece of furniture must have a marking which is applied for identification on a paper label firmly glued to the product in a typographical way. It is allowed to apply indelible paint marking by stamping, pyrography, firing, punching.

The labeling must be clear and contain the following information:

- the name of the manufacturer, its location (city or conditional address) and the trademark;
- name of the product;
- date of production;
- warranty period, expiration date;
- designation of the standard;
- material of manufacture;
- type of upholstery;
- image of the quality mark (Fig. 3).



Fig. 3. General view of the label of drawers with the appropriate markings

Markings shall be applied to the upper left corner of the rear wall on products intended to be placed against the wall, on the reverse side of the table cover, on a surface invisible during operation in products without a rear wall or cover. Marking on the surface of drawers, adjustable shelves, parts and components that can be replaced is not allowed. All furniture that is part of the set, headset, next to the label must be marked with a symbol or number indicating that the product belongs to the set or garniture ¹.

The dimensions of the labels on which the furniture is marked must be at least A7 (74 × 105 mm). The design of labels may be done in accordance with the procedure for marking household furniture.

¹ Формування споживних властивостей меблів та митне оформлення при перетині митного кордону. 2017. URL: <https://www.docsity.com/ru/formuvann-ya-spozhyvniyh-vlastivostey-mebliv-ta-mitne-oformlennya-pri-peretini-mitnogo-kordo-nu/1428028> (date accessed: 20.02.2018).

Conclusions. Therefore, during the manufacture of furniture, their consumer properties may deteriorate due to violations of production technology, the use of poorly adjusted and worn equipment, slovenliness or insufficient qualifications of performers. The price of furniture depends on the type of product, its design, size, quality of basic and facing materials, decoration, softness category of furniture elements.

When assessing the quality of furniture products, it is necessary to take into account their compliance with all the above requirements, regulated by design standards, state standards and other documents. The article identifies the features and presents the sequence of forensic commodity examination of upholstered and cabinet furniture which will provide better conclusions and increase their evidence base.

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В. В. Серединський, І. М. Новицька **Особливості товарознавчого дослідження** **м'яких та корпусних меблів**

Основним завданням, яке вирішують експерти під час дослідження меблів, є визначення їхньої якості, зумовлене комплексом споживчих властивостей, що формуються у процесі їх виготовлення й експлуатації.

Метою цієї статті є вивчення основних ознак, які дають змогу виявити фальсифікацію або підробку меблів, і вимог до маркування.

Під час виконання судово-товарознавчої експертизи меблів слід проводити їх дослідження, використовуючи метод органолептичного огляду та лінійних вимірювань і метод порівняльного дослідження для встановлення відповідності виробу нормативним вимогам, що висувають до виробів цієї товарної групи.

Ключові слова: корпусні меблі, м'які меблі, дефекти, шухляди, декоративна фурнітура, кріпильні матеріали.

В. В. Серединский, И. М. Новицкая

Особенности товароведческого исследования мягкой и корпусной мебели

Основной задачей, решаемой экспертами в ходе исследования мебели, является определение её качества, обусловленного комплексом потребительских свойств, которые формируются в процессе изготовления и эксплуатации такой мебели.

Целью данной статьи является изучение основных признаков, позволяющих выявить фальсификацию или подделку мебели, и требований к маркировке.

Мягкая мебель настоящего производителя характеризуется следующими признаками: каркас выполнен из натурального дерева, высушивается в автоматическом режиме с соблюдением всех норм и стандартов; особое внимание уделяют качеству комплектующих; для наполнения матрасных блоков применяют качественный поролон, который проходит специальные тесты на эластичность, износостойкость, сертификацию и др. Корпусная мебель настоящего производителя имеет следующие характеристики: заготовки высокого качества, гладкие, без сучков по всей длине пропила; кромки облицованы на всех участках деталей; при сверлении соединительных отверстий строго контролируется вертикальная и горизонтальная точность сверлений; фурнитура соответствует общему художественному решению мебели, имеет длительный срок эксплуатации.

При выполнении судебно-товароведческой экспертизы мебели предлагается проводить её исследования в следующей последовательности: методом органолептического осмотра и линейных измерений устанавливают товарные характеристики изделия, размерные признаки, недостатки, причины возникновения дефектов и их характер; методом сравнительного исследования устанавливают соответствие или несоответствие исследуемого изделия нормативным требованиям, предъявляемым к изделиям этой товарной группы, наличия дефектов полуфабриката, качества выполнения процесса сушки древесины, выполнения процесса распила древесины

и изготовления деталей, качества выполнения процесса изготовления каркаса, обивки и отделки.

При проведении оценки качества мебельных товаров необходимо учитывать их соответствие требованиям, регламентированным нормами проектирования, стандартами и другими документами.

Ключевые слова: корпусная мебель, мягкая мебель, дефекты, ящики, декоративная фурнитура, крепёжные материалы.

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Peculiarities of the determination of value of goods as at the date in the past within the framework of a commodity expertise

When investigating and hearing criminal proceedings, civil and administrative cases in courts, there is a need for special information in the field of commodity science. Such information is obtained during commodity expertises. Analysis of the stages of forensic commodity expertise in the current legislation shows the presence of a significant number of problems at certain stages of study, which requires effective resolution in accordance with current regulatory and technical parameters and prospects for further development in Ukraine. As practice shows, forensic commodity expertises are often appointed, the subject of which is to determine the market value of objects on the date in the past. If the necessary documents are available, the difficulty of providing conclusions about the value of the objects of study is due to the lack of initial data on the market of such property. This is due to the fact that there are very few publicly available sources where you can find archival information on the price of a product at the date in the past, especially if it concerns specialized property, or property whose sale and purchase market is limited. That is why the article purpose is to highlight peculiarities of the determination of value of goods at the date of past within the framework of the commodity expertise.

At the present stage in Ukraine there are no meaningful studies and regulations on conducting the commodity expertise to determine the value of goods in the past, so this issue needs further study to create a unified and comprehensive approach while conducting the commodity expertises on the value of goods at the date of the past and development of a methodology that will be used in forensic expert practice during the conduct of commodity expertises, to ensure the systematization and methodological uniformity of the expert practice, reducing the complexity and time spent during expertises.

Thus, the formation and development of property valuation are possible only in market conditions with a clear definition of the role and place of the state in matters of pricing and legal regulation of entrepreneurial activity. In addition, it is necessary to develop ways to improve the effectiveness of research that could provide the necessary conditions to protect professional competence of a forensic expert for appealing expertise results in court.

Keywords: commodity expertise, estimation, market value, market, date of value determination, date in the past, information.

Formulation of Research Problem. The growing significance of the use of specific expertise in administrative, commercial, criminal and civil proceedings contributes to the expansion of provisions of the Commercial and Procedural Code of Ukraine, the Code of Administrative Proceedings of Ukraine, the Criminal Procedural Code of Ukraine and the Civil Procedural Code of Ukraine which govern them, in particular those that determine the procedure for appointment (involvement of a forensic expert) and conduct of forensic examinations. In Ukraine, the procedural legal foundation for forensic activity is the Commercial and Procedural Code of Ukraine, the Criminal Procedural Code of Ukraine the Civil Procedural Code of Ukraine and the Code of Administrative Proceedings of Ukraine. In accordance with the requirements of these codes, a forensic expert while court proceedings may be a person who possesses specific expertise. During investigation and court proceedings of criminal, civil and administrative cases, oftentimes there is a need to apply special knowledge in commodity science ¹.

Referring to the analysis of investigative practice, it is possible to draw a conclusion that most often forensic commodity expertises are appointed under Art. 185, 186, 187, 189, 190, 201 of the Criminal Code of Ukraine ² in the following cases:

- investigation of criminal proceedings on theft of state or personal property;
- theft;
- bribes;
- falsification of goods;
- separation of property;
- compensation for losses from property damage;
- goods damage;
- sale of defective goods.

¹ Шевченко О. В. Використання спеціальних товарознавчих знань під час досудового розслідування : дис. ... канд. юрид. наук. Київ, 2017. 317 р.

² Кримінальний кодекс України : Закон України від 05.04.2001 р. № 2341-III (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/2341-14> (date accessed: 24.03.2021).

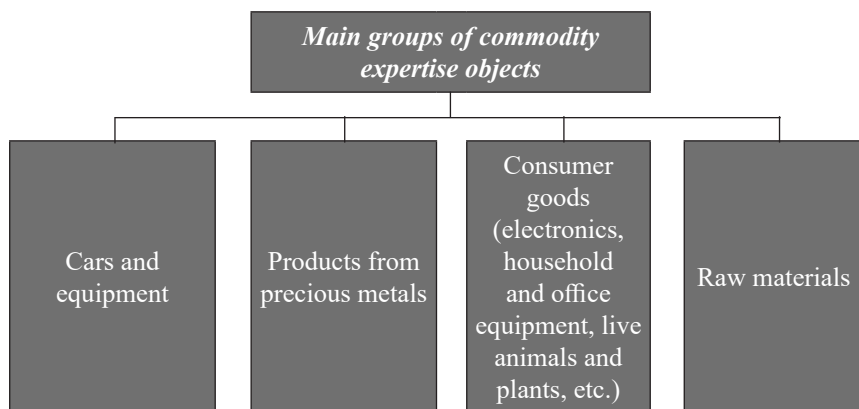


Fig. 1

Analysis of the stages of forensic commodity expertise in the current legislation demonstrates the existence of a significant number of issues at certain stages of a research, which necessitates efficient resolution in accordance with current regulatory and technical parameters and prospects for further development of forensic activity in Ukraine. The term: *estimation at the date in the past* is not specified in national standards. However, this does not prevent the use of this term in estimation practice. It is known from numerous training manuals that the date of conducting commodity expertise and the date of estimation may not coincide. Accordingly, estimation of property may be current or at a date in the past. Current legislation does not prohibit the determination of the value of the object of study at any of dates. As experience shows, today forensic commodity expertises are often appointed, which subject is to determine the market value of objects at a date far remote from the date of expertise, i.e. at a date in the past. It is difficult to analyze the past relying only on assumptions. The complexity level of the task for determining market value at a date in the past depends on many factors, including the type of assessed object; the period of time between the date of estimation and the date of expertise; the significance of changes that have taken place in the market during this period. It is quite challenging to carry out full market monitoring at a date in the past in the same amount of researches that are usually performed for current estimation. Regulations governing the process of property valuation do not contain requirements and recommendations for determining the value of object as of a date that differs significantly from the date of expertise. There are very few sources where you can find archival information on the value of a particular product at a date in the past, especially when it comes to specialized property or property which sale and purchase market is limited.

Conducting commodity expertises for research on consumer goods to determine their value at the past date is complicated by the lack of a single

methodological approach. At present in Ukraine there are no meaningful researches and legal regulations on performing commodity expertise to determine the value of goods to a date in the past, so this issue needs to be studied to create a unified and comprehensive approach to conducting commodity expertises to assess the value of goods at a date in the past.

Analysis of Essential Researches and Publications. Famous Ukrainian and foreign scientists: T. M. Artiukh, I. V. Hryhorenko ¹, V. V. Arkhypov ² and L. D. Revutskyi ³ dedicated their research papers to the study of peculiarities of goods estimation and determination of their value in market conditions. However, these researches do not fully disclose the issue of determining the value of goods at a date in the past.

The **Article Purpose** is to emphasize peculiarities of determining the value of goods at a date in the past while forensic commodity expertise.

Main Content Presentation. Estimation as a type of research in commodity expertise not only includes methods of various sciences, but also adds its own specific nature. This due to the fact that the nature of value requires corresponding ways of determination.

The National Standard № 1: *General Principles of Estimation of Property and Property Rights* (hereinafter referred to as *NS № 1*) defines fundamental principles of estimation reflecting socio-economic factors and basic patterns of property value formation. According to paragraph 4 of NS № 1, estimation is carried out in conformity with the basic principles of utility, supply and demand, substitution, expectation, marginal productivity, contribution, most efficient use⁴. These basic principles of estimation are formulated on the grounds of real practice and many years of professional experience of appraisals. Fundamental principles can be classified according to peculiarities of their logical link with certain market conditions and objectively available in the public consciousness stable ideas and stereotypes of thinking.

All basic principles are significant for estimation at a date in the past within a forensic commodity expertise: but this significance is not the same. Some of the principles are a priority. In particular, this is the principle of utility that most

¹ Артюх Т. М., Григоренко І. В. Теоретичні основи товарознавства [Електронний ресурс] : навч. посіб. Київ, 2014. 263 р.

² Архипов В. В. Экспертная оценка товаров (движимого имущества) : учеб. пособие. 2-е изд. Киев, 2016. 280 р.

³ Ревуцкий Л. Д. Виды товаров и особенности методов определения их стоимости и цен. *Бухгалтерский учет. Налоги. Аудит*. 29.06.2015. [Электронный ресурс]. URL: <https://www.audit-it.ru/articles/appraisal/a108/832140.html> (date accessed: 24.03.2021).

⁴ Про затвердження Національного стандарту № 1 «Загальні засади оцінки майна і майнових прав» : Постанова КМУ від 10.09.2003 р. № 1440 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/1440-2003-%D0%BF> (date accessed: 24.03.2021).

fully reflects the essence of methodological estimation approaches being most often used in estimation at a date in the past.

In economic value theory, the value of a property is always assessed based on needs and purpose of interested people involved in market operations or using the property. Therefore, only those things that can be used have value. The process of evaluating a thing invariably involves determining the level of its usefulness, efficiency, appropriateness of use.

Performing a commodity expertise to determine the market value of a commodity consists of five stages: initial, separate study, evaluation of conducted research results, formulation of conclusions, documentation of results of conducted research.

At the initial stage of a previous research a forensic expert clarifies the purpose of research and estimates provided materials (regarding sufficiency to address set tasks, formulation of a general idea about objects of study, their features, development of hypotheses and planning of expert researches).

During a previous research, a forensic expert:

- gets acquainted with provided materials (order, judgement, petition, appeal, materials of criminal proceedings, civil, administrative, commercial case, etc.), establishes integrity of packaging, establishes the presence of objects of study according to the list in accompanying documents;
- illustrates packaging, objects of study;
- studies condition of research objects (their integrity, lack of changes, etc.);
- establishes sufficiency and quality of received materials, objects of study;
- studies the need to initiate petitions regarding provision of additional materials and other actions related to a forensic examination;
- determines the required set of research methods and the sequence of their application.

At the stage of separate study, a forensic expert conducts an integrated and complete study of properties and features of research objects, forms interim conclusion on suitability of objects for identification and establishment of group belonging.

In the course of a separate study, a forensic expert:

- studies features and properties of each of research objects;
- determines identified general (shape, size, kind, type, etc.) and individual (special) features (specific details of external structure, characteristic properties, etc.) of each of research objects;
- formulates an interim conclusion (on suitability for identification, establishment of group belonging, etc.) based on results of performed study.

At the stage of evaluating results of conducted research and formulating conclusions, the forensic expert:

- comprehensively evaluates results of expert research;
- scientifically substantiates the origin of identified features;
- draws conclusions.

At the stage of documentation of conducted expert research results, a forensic expert:

- makes up a conclusion of expert or expert research in compliance with the established sample;
- creates illustrative or supplementary material which adds to a compiled conclusion (attachments to a conclusion) ¹.

Let's stress that an important stage of forensic examination is conducting marketing research on the domestic market, which consists of the following consistent actions:

- the choice of information sources;
- determination of the existence of state regulated prices for this type of commodity;
- search for information on offer prices and sales prices of identical goods (and in their absence: of the same type);
- establishment of economic (commercial) terms of agreements at a particular market segment;
- determining the impact of economic, political, social and other factors at a particular market segment.

Economic entities use free and government regulated prices in their activities². Depending on the fact of setting government regulated prices, forensic experts choose an approach to carry out procedure of goods estimation. If government regulated prices are set, then estimation of goods is conducted in conformity with established prices. If government regulated prices are not set, the following conditions must be taken into account: whether there are contracts or offers regarding identical (homogeneous) goods at a corresponding market; whether it is possible to obtain needed price information by special requests.

The provisions of NS № 1 stipulate the concept of **market value** is *“the value at which it is possible to alienate the estimated object in the market of similar property at a date of estimation under the agreement concluded between*

¹ Про затвердження Інструкції з організації проведення та оформлення експертних проваджень у підрозділах Експертної служби Міністерства внутрішніх справ України : наказ МВС України від 17.07.2017 р. № 591. URL: <https://zakon.rada.gov.ua/laws/show/z1024-17> (date accessed: 24.03.2021).

² Про ціни і ціноутворення : Закон України від 21.06.2012 р. № 5007-VI (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/5007-17#Text> (date accessed: 24.03.2021).

a buyer and a seller, after appropriate marketing provided that each party acted knowingly, judiciously and without coercion”¹.

If the date of research differs from the date of value determination, there are restrictions:

- marketing is limited to publicly exposed information that was relevant at a date of estimation. It is obvious that the amount of information available for analysis is significantly less than the amount of information available to market participants at the date of agreement conclusion;
- lack of objective ability to verify information about compared objects;
- implement a complete monitoring of market at the past date, i.e. call or use the Internet to obtain full information is impossible and ineffective.

The mentioned restrictions at a date of value determination lead to the objective impossibility to fully comply with criteria underlying the *market value* concept. Therefore, it is advisable for forensic experts to define the concept of *value* in accordance with paragraph 2 of NS № 1, where: “*value is the value equivalent of the estimated object expressed in a likely sum of money*”².

The fundamental array of price information required for estimation of value of goods and property can be found on the Internet. A great amount of this information is regularly updated without saving (archiving) previous data. Thus, when determining the value of goods at a date in the past, a commodity expert may not find necessary data. Also, publicly exposed price information may not be provided for certain categories of goods. For example, information about sites of a manufacturer and sellers is available, but it doesn't include a published price list. Any other price information is also not available. Usually such sites explicitly state that the price is “contract” and “contact this phone”.

If after conducting a marketing research of the property market by a forensic expert it was established that archival data on the sale price of the offer similar to the object of property research are missing, then, to conduct an objective estimation it is advisable to send information requests to enterprises (institutions and organizations that produce or are official dealers of selling objects, which according to their characteristics can be considered identical to objects of estimation or similar to them).

Based on ensuring the principle of adversarial nature of the process, inviolability of human rights and freedoms, respect for honor and dignity, presumption of innocence, the right to professional legal assistance and protection at any stage of court proceedings, procedural rules governing the use of specific expertise in criminal proceedings: forensic examination, in particular forensic commodity expertise have been formulated. In accordance with Part 1 of Art. 20 of the Law of Ukraine: *On Judicial Examination* dated on 25.02.1994

¹ Про затвердження Національного стандарту № 1 ... URL: <https://zakon.rada.gov.ua/laws/show/1440-2003-%D0%BF> (date accessed: 24.03.2021).

² Про затвердження Національного стандарту № 1 ... URL: <https://zakon.rada.gov.ua/laws/show/1440-2003-%D0%BF> (date accessed: 24.03.2021).

№ 4038a-XII: “Enterprises, institutions, organizations regardless of ownership are obliged to provide free information required for conducting forensic examinations to state specialized institutions” <...>¹. However, despite that fact, difficulties often arise at this stage of a forensic examination. In practice, not all addressees provide necessary price information: due to its absence or other reasons. The parameter of *probability* in calculations of the value of property is determined by sample of prices of offers for sale involved in the analysis (calculation). The larger the sample size, the more reliable and accurate calculation of market value will be. The amount of information significantly affects the final result of such forensic examination.

In the presence of technically necessary documents, the difficulty of providing conclusions about the value of research objects is due to the lack or insufficiency of initial data on the market of such property.

Failure to provide a forensic expert with sufficient initial data has two consequences:

- the possibility of providing a conclusion and its categoricalness;
- a significant increase in study duration.

In addition, according to NS № 1: “*Determination of the market value of the estimated object using a comparative approach is based on information about the sale (offer) of a similar property, which reliability does not make the appraiser doubt*”². Information used by a commodity expert must be impartial and exhaustive. It is the expert’s responsibility to verify information from publicly available sources. The degree of information verification depends on the volume and depth of research conditioned by forensic examination tasks.

It should be emphasized that the estimated value of market value of a particular product calculated by a forensic expert is an objective estimation of established property rights at a particular date. Market value is estimation based on market data. Probability, accuracy of calculation of goods value is determined by the sample size of offer prices for sale accepted for analysis (calculation).

In the absence or insufficiency of information on the sale price (offer) of a similar property, in a conclusion, a forensic expert shall indicate to what extent this affected reliability of a conclusion on the market value of the estimated object. This is required by NS № 1³.

In conclusion, let’s note that the analysis of data to a date in the past should be carefully approached since it depends on the final result of forensic examination/expert research. To estimate properly, it is crucial to use a significant amount of information and be able to optimize data. Obtained results directly depend

¹ Про судову експертизу : Закон України від 25.02.1994 р. № 4038-XII (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/4038-12#Text> (date accessed: 24.03.2021).

² Про затвердження Національного стандарту № 1 ... URL: <https://zakon.rada.gov.ua/laws/show/1440-2003-%D0%BF> (date accessed: 24.03.2021).

³ Ibidem.

on the activity and stability of the market. In case when it is impossible to find sufficiently exhaustive information, and only a limited amount of information is available, the expert conclusion should include own estimation of the degree of the exhaustiveness of used interim and supplementary information.

Conclusions. The problem of determining the market value of goods at a date in the past requires further research. Currently, the urgent issue is to create a unified and comprehensive approach to conducting commodity expertise to estimate the value of goods as of the past date. It is important to develop a methodology for use in expert practice during commodity expertises. This methodology will ensure systematization and methodological regulation of forensic expert practice. And this, in turn, should help reduce labor intensity and time expenditure during forensic examinations. When developing such a methodology, particular attention should be paid to ways that improve the efficiency of researches which could ensure necessary conditions to protect the professional competence of a forensic expert while appealing results of a forensic examination in court.

The priority direction of commodity expertise development today is substantiation and advancement of practical methods of goods estimation. Thus, formation and development of property estimation is possible only in market conditions by clearly defining the role and place of the state in issues of pricing and legal regulation of entrepreneurial activity.

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В. С. Косован

**Особливості визначення вартості товарів
на дату в минулому в межах
судової товарознавчої експертизи**

Доволі часто призначають судові товарознавчі експертизи, предметом яких є визначення ринкової вартості об'єктів станом на дату в минулому. Складність проведення таких експертиз пов'язана з відсутністю вихідних даних про ринок подібного майна. Саме тому метою цієї статті є висвітлення особливостей визначення вартості товарів на дату в минулому в межах судової товарознавчої експертизи.

На сучасному етапі в Україні відсутні змістовні дослідження та нормативно-правові акти щодо проведення товарознавчої експертизи з питань визначення вартості товарів у минулому часі, тому це питання потребує подальшого вивчення.

Отже, пріоритетним напрямом розвитку товарознавчої експертизи сьогодні є обґрунтування й удосконалення практичних методів оцінювання товарів.

Ключові слова: товарознавча експертиза, оцінка, ринкова вартість, ринок, дата визначення вартості, дата в минулому, інформація.

В. С. Косован

**Особенности определения стоимости товаров на дату в прошлом
в рамках судебной товароведческой экспертизы**

При расследовании и рассмотрении в судах уголовных производств, гражданских и административных дел возникает необходимость в специальной информации из области товароведения. Такую информацию получают при проведении судебных товароведческих экспертиз. Анализ этапов проведения судебной товароведческой экспертизы в условиях действующего законодательства говорит о наличии значительного количества проблем на определённых этапах исследования, что требует эффективного решения в соответствии с действующими нормативно-техническими параметрами и перспективами дальнейшего развития в Украине. Как показывает практика, довольно часто назначают судебные товароведческие экспертизы, предметом которых является определение рыночной стоимости объектов на дату, значительно отдалённую от даты проведения экспертизы, то есть на дату в прошлом. При наличии необходимых документов сложность предоставления выводов относительно стоимости объектов исследования связана с отсутствием исходных данных о рынке подобного имущества. Это объясняется тем, что крайне мало источников,

находящихся в открытом доступе, где можно найти архивную информацию о цене того или иного товара на дату в прошлом, особенно если это касается специализированного имущества или имущества, рынок купли-продажи которого ограничен. Именно поэтому целью данной статьи является освещение особенностей определения стоимости товаров на дату в прошлом при проведении судебной товароведческой экспертизы.

На современном этапе в Украине отсутствуют содержательные исследования и нормативно-правовые акты о проведении товароведческой экспертизы относительно определения стоимости товаров в прошедшем времени, поэтому данный вопрос требует дальнейшего изучения в направлении создания единого и всестороннего подхода при проведении товароведческой экспертизы по оценке стоимости товаров на дату в прошлом и разработки методики для применения в экспертной практике при проведении товароведческих экспертиз, для обеспечения систематизации и методического единообразия экспертной практики, сокращения трудоёмкости и затрат времени при проведении экспертиз.

Таким образом, становление и развитие оценки имущества возможно только в условиях рыночных отношений при чётком определении роли и места государства в вопросах ценообразования и правового регулирования предпринимательской деятельности. Кроме того, необходимо разработать способы повышения результативности исследований, которые могли бы обеспечить необходимые условия для защиты профессиональной компетентности эксперта по обжалованию результатов экспертизы в суде.

Ключевые слова: товароведческая экспертиза, оценка, рыночная стоимость, рынок, дата определения стоимости, дата в прошлом, информация.

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Research Article

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Problematic issues on the evaluation of domestic animals during forensic commodity expertises

The article purpose is to address problematic issues during forensic commodity expertises on the evaluation of pets, in particular, to determine the material damage caused to an animal owner, in case of animal abuse and injuries, mutilation or death of an animal. The animal in this case is the object of civil relations.

Carrying out forensic commodity expertises on evaluation of pets, in particular, to determine the material damage caused to an animal owner in case of animal abuse, requires an individual approach in each case, taking into account individual characteristics and obtaining complete initial data to identify objects of study.

Keywords: *forensic commodity expertise, evaluation, market price, domestic animals, financial loss, cruelty to animal.*

Formulation of Research Problem. The development of society is characterized by a strategic course to create the rule of law, public consciousness and tolerance. Decent treatment of animals is an important component of modern society.

Recently, shocking photos and videos about cruelty to animals have become more common on the Internet. At the legislative level, it is very difficult to prove the guilt of a person in the case of cruelty to animals and to bring him to justice with compensation for financial loss caused to the animal owner.

At NSC “Hon. Prof. M. S. Bokarius FSI” the number of expertises related to evaluation of pets has been significantly increased.

Since the problem of evaluating a farm animal in commodity science has been fully disclosed, this article discusses the problem of evaluating another category of pets, namely companion animals and ornamental pets (in order to determine the market price of animals and financial loss to animal owners in case of cruelty to animals with bodily injuries, mutilation or death of an animal).

Analysis of Essential Researches and Publications. Peculiarities of this problem have been studied by such scientists as D. O. Kalmykov, A. O. Danylevskiy, I. V. Yatsenko, L. M. Derecha, O. I. Parylovskiy, D. O. Antoniuk, V. O. Turska, A. A. Marchuk, O. V. Shevchenko, I. A. Holovko, S. I. Zapara, A. V. Zakhariev, M. V. Skrypka, Ya. K. Serdiukov and others.¹

The **Article Purpose** is to address problematic issues during forensic commodity expertises on the evaluation of domestic animals (in particular, to determine the financial loss caused to an animal owner, in case of cruelty to animals and causing injuries, mutilation or death of an animal).

Main Content Presentation. In discipline: *Commodity Science* there are no sections of product groups, which would indicate such goods as companion

¹ Е.г., Яценко І. В., Дереча Л. М., Парилівський О. І. Особливості структури висновку судово-ветеринарного експерта за результатами дослідження трупа тварини з ознаками насильницької смерті. *Теорія та практика судової експертизи і криміналістики* : зб. наук. пр. Харків, 2020. Вип. 21. Р. 615—639. DOI: <https://doi.org/10.32353/khnrf.1.2020.44> (date accessed: 18.03.2021); Турська В. О. Адміністративно-правове регулювання захисту тварин від жорстокого поводження : дис. ... канд. юрид. наук. Одеса, 2016. 232 р. ; Калмиков Д. О., Данилевський А. О. Кримінальна та адміністративна відповідальність за жорстоке поводження з тваринами : монографія. Луганськ, 2013. 615 р. ; Антонюк Д. О. Жорстоке поводження з тваринами: поняття та ознаки складу злочину. *Четверті харківські кримінально-правові читання* : тези доп. та наук. повідомл. учасн. Міжнар. наук. конф. студ. та аспірантів (Харків, 16—17.05.2014). Харків, 2014. Р. 373—376 ; Марчук А. А. Особливості експертної оцінки вартості домашніх тварин. *Науково-технічний бюлетень Інституту тваринництва НААН*. 2020. № 123. Р. 104—117. URL: <https://animal.kharkov.ua/archiv/ntb/STB123/15.pdf> (date accessed: 12.03.2021) ; Шевченко О. В. Використання спеціальних товарознавчих знань під час досудового розслідування : дис. ... канд. юрид. наук. Київ, 2017. 317 р. ; Головка І. А. Кримінальна відповідальність за жорстоке поводження з тваринами : автореф. дис. ... канд. юрид. наук. Київ, 2010. 23 р. ; Яценко І. В., Запара С. І., Захар'єв А. В., Кириченко В. М., Скрипка М. В., Сердюков Я. К. Судово-експертні випадки дослідження трупів тварин з ознаками насильницької смерті від жорстокого поводження. *Проблеми зооінженерії та ветеринарної медицини* : зб. наук. пр. ХДЗВА. Харків, 2018. Вип. 35. Ч. 2. Т. 3. Р. 130—138.

animals and ornamental pets, but with the development of the market and market relations, these goods are gaining momentum in the Ukrainian market and become objects of forensic commodity expertises and expert researches. Increasingly, forensic investigative bodies, other organizations and citizens turn to expert institutions with questions regarding the valuation of companion animals, ornamental animals, which are sold on the market of Ukraine at market prices and are subject to commodity evaluation. Taking into account the aforementioned and the practical experience of commodity experts of forensic expert institutions of the Ministry of Justice of Ukraine, which conducted examinations on evaluation of domestic animals, in particular, to determine the financial loss caused to the animal owner, developed an algorithm to address this problematic issue.

After the adoption of the Law of Ukraine: *On Protection of Animals from Cruelty* in 2006, a system of legal norms appeared in the field of regulation of keeping animals in Ukraine, protection of them from cruel treatment. Prior to the adoption of this Law, these issues were not regulated at the legislative level, except for the rules on criminal and administrative liability for cruelty to animals. However, despite the huge number of cases of cruelty to animals in Ukraine, which caused both by individuals and local governments, most offenses remain unpunished.

In Article 1 of the Law of Ukraine: *On Protection of Animals from Cruelty* ¹ the following terms and concepts used in this research paper are provided:

- *animals* — biological objects related to fauna: domestic, pets, wild, including poultry and wild birds, fur, laboratory, zoo, circus;

<...>

- *domestic animals* — dogs, cats and other animals traditionally kept and bred by man for a long historical period, as well as animals of species or breeds artificially bred by man to meet aesthetic and communication needs, which generally do not have viable wild populations from individuals with similar morphological features and exist for a long time in their natural range;

<...>

- *cruelty to animals* — abuse of animals, including stray ones, which caused torture, physical suffering, bodily injuries, mutilation or death, inciting animals against each other and other animals committed for hooligan or selfish motives, leaving domestic and farm animals to the mercy of fate, including violation of the rules of keeping animals ².

In Ukraine, the legislation provides both administrative and criminal responsibility for cruel treatment of animals. These types of responsibility differ in the severity of consequences, they are considered in different court proceedings.

¹ Про захист тварин від жорстокого поводження : Закон України від 21.02.2006 р. № 3447-IV (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/3447-15> (date accessed: 15.03.2021).

² Ibidem.

Article 299 part 1 of the Criminal Code of Ukraine ¹ states:

Cruel treatment of vertebrate animals, including stray animals, which is committed intentionally and resulted in mutilation or death of an animal, as well as inciting animals against each other or other animals, committed for hooligan or selfish motives, public appeals to commit acts that show signs of cruelty to animals, as well as the dissemination of materials calling for such actions are punishable by a fine of one thousand to three thousand non-taxable minimum incomes or arrest for a term up to six months or restriction of liberty for a term up to three years ².

Article 89 part 1 of the *Code on Administrative Offense* ³ states:

Cruelty to vertebrate animals: abuse of animals, beatings or other acts of violence that caused the animal physical pain, suffering and did not cause bodily harm, mutilation or death, abandonment of animals, including violations of the rules of keeping animals, entail imposition of a fine of two hundred to three hundred non-taxable minimum incomes of citizens with confiscation of an animal, if the stay of the animal with the owner poses a threat to its life or health ⁴.

In accordance with the Article 180 parts 1 and 2 of the Civil Code of Ukraine (hereinafter referred as CCU) ⁵:

1. *Animals are a special object of civil rights. They are subject to the legal regime of the thing, except in cases established by law.*
2. *Rules for the treatment of animals shall be established by law* ⁶.

The norm of this Article does not limit the range of animals that may be objects of civil law. Such objects can be farm, domestic and other animals, which are used for economic, scientific, educational, cultural and educational, aesthetic and other needs. The Civil Code of Ukraine expands the legal regulation of relations, the object of which are animals. This need is due to the increase in related offenses and the need to protect them from cruel treatment. This Article contains two norms aimed at achieving the mentioned goal. The *first norm* applies to animals general rules of ownership unless otherwise provided by law or other legal acts. The *second one* defines the limits of the exercise of rights to which they are subject: the prohibition of cruel treatment.

¹ Кримінальний кодекс України : Закон України від 05.04.2001 р. № 2341-III (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/2341-14> (date accessed: 18.03.2021).

² Ibidem.

³ Кодекс України про адміністративні правопорушення : Закон України від 07.12.1984 р. № 8073-X (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/80731-10> (date accessed: 18.03.2021).

⁴ Ibidem.

⁵ Цивільний кодекс України : Закон України від 16.01.2003 р. № 435-IV (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/435-15> (date accessed: 18.03.2021).

⁶ Ibidem.

Thus, according to Article 180 part 2 of the CCU ¹, non-compliance with this prohibition should be considered an abuse of rights. In cases of cruelty to animals, the termination of ownership is carried out in court. Damages caused to animal owners are subject to compensation in the manner prescribed by law. Belonging of live animals to the category of *object of civil rights* is due to the fact that the latter are the objects of evaluation in material form: movable property, consumer goods. Thus, the assessment turns the animal into a special object of civil rights, which is covered by the legal regime of the thing.

Assessment of losses incurred by an animal owner and their compensation is regulated by Art. 22 of the Civil Code of Ukraine *Compensation for Damages and Other Methods of Compensation for Property Damage* ².

If an animal is injured or killed through the fault of an individual (including traffic accidents) or an organization (for example, a public service dealing with animals killing), the animal owner may order a commodity expertise to evaluate the damage.

Financial loss — property loss: reduction of the value of the damaged thing, reduction or loss of income, the need for new expenses, etc. It can be reimbursed in kind or in cash. In the cases considered in this article, monetary compensation of the caused damage, i.e. compensation of losses is more often used.

Compensation for damages is a measure of civil liability determined by law. The losses in civil law are understood as the monetary valuation of property losses (damages). They contain:

- *firstly*, the costs incurred or to be incurred by the victim to remedy the consequences of the offense;
- *secondly*, the value of the lost or damaged property of the victim;
- *thirdly*, the income not received by the victim, which he could receive in the absence of the offense (Article 15 part 2 of the CCU) ³.

The costs of the victim and damage to his property are covered by the concept of *real damage*, i.e. *money damage*.

The victim must convincingly prove in court the fact of financial loss, as well as his unconditional rightness in calculating the amount of damage.

Confirmation of the amount of real losses are: a documentary proof of the price of damaged or lost property, the documentary proof of the price of an analogue of tangible properties, a conclusion of the expertise on the price of the subject of the dispute, etc.

All calculations are made in advance and added in the form of separate documents to the statement of claim.

¹ Цивільний кодекс України ... URL: <https://zakon.rada.gov.ua/laws/show/435-15> (date accessed: 18.03.2021).

² Ibidem.

³ Ibidem.

To compensate for losses associated with the death or harm to the animal, people order a commodity expertise. Most often, the assessment is performed if the animal was injured (or died) due to:

- illegal, hooligan actions (for example, abuse of an animal, intentional infliction of bodily harm, poisoning, that caused mutilation or death of the animal);
- careless actions of third parties, traffic accidents (for example, a pet jumped on the road and fell under the wheels of a car);
- actions of a specialized service engaged in catching stray animals;
- violations of transportation rules (for example, when transporting animals from one farm to another, the weather conditions were not taken into account, due to which the animals became frostbitten and became ill);
- the insured event (for example, a snake bite, falling from a height, as well as some similar situations due to the relevant contract);
- an emergency or natural disaster (for example, fire, flood, hurricane, storm, blizzard, hail, etc.);
- forced slaughter due to the threat of infection (for example, slaughter of birds during an epidemic of the *bird flu*).

Depending on the specific evaluating situation, the performing of the commodity expertise makes it possible to obtain compensation from a perpetrator, from the state or local authorities, from the insurance company. An expert conclusion, based on the results of forensic commodity expertise, is one of the evidences, provided by the Procedural Codes of Ukraine, the Law of Ukraine: *On Judicial Examination* and the Instruction on the appointment and conduct of forensic examinations and expert researches ¹.

The problem is that during this type of research it is required a complete list of initial data about the object of research, a set of morphological, physiological (external, internal) indicators, economic characteristics, and properties that form and characterize the animal as a whole. Each indicator and feature affect this value.

In everyday life, a person keeping a domestic animal does not pay attention to certain details that are extremely important during evaluation, and sometimes the lack of information from the owner of the object of research leads to the impossibility of resolving the issue by the forensic expert ².

¹ Про судову експертизу : Закон України від 25.02.1994 р. № 4038-XII (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/4038-12> (date accessed: 18.03.2021) ; Інструкція про призначення та проведення судових експертиз та експертних досліджень : затв. наказом Мін'юсту України від 08.10.1998 р. № 53/5 (as amended and supplemented.) URL: <https://zakon.rada.gov.ua/laws/show/z0705-98> (date accessed: 18.03.2021).

² Марчук А. А. Оп. cit. URL: <https://animal.kharkov.ua/archiv/ntb/STB123/15.pdf> (date accessed: 12.03.2021).

To address the issue of determining the value of financial loss caused to the owner of the animal, the research must provide the following documents:

- information about the customer (passport data or company details: for the execution of contract);
- documents confirming property rights in relation to animals;
- evidences of harm or death of the animal (photos and videos, expert conclusions, acts signed by the police, vet, traffic police officers, representatives of the insurance company, meteorological center certificates, etc.);
- veterinary documents (official consent documents, which include: international veterinary certificate, veterinary card, license and certificate, as well as veterinary passport for the animal issued by state veterinary inspectors or authorized or licensed veterinarians, who confirm the animal's veterinary status);
- pedigree and information about previous generations;
- work certificates, diplomas, documents on titles obtained at exhibitions, etc., received by the pet;
- for legal entities: accounting documents, initial and residual book value, profit and loss report.
- documents confirming the costs of maintenance, training, treatment of the pet (checks from the veterinary clinic, pet store, contract with the club, recorded evidence of the breeder, etc.).

Having considered the set of indicators that form and characterize the animal as a whole when determining its value in the case of commodity research, let us turn to the analysis of the specificity of practical experience in determining the value of domestic animals (domestic animals are cats, dogs and other animals that have long been bred and held by people; this also includes animals of species or breeds, artificially bred by humans to meet aesthetic needs, which usually do not have viable wild populations), for example, determining the value of dogs during the commodity expertise ¹.

Companion animals, as well as pets, is a term used to denote domestic animals that a person keeps in their home to communicate and receive positive emotions. These domestic animals are opposed to farm ones, which are kept as working cattle, as well as for meat and dairy products, wool, etc. the most common and traditional companion animals are dogs and cats.

The evaluation of domestic animals, in particular, in order to determine the financial loss caused to the animal owner is determined, taking into account the basic principles set out in the National Standard № 1: *General Principles of Property Valuation and Property Rights* ²:

¹ Марчук А. А. Оп. cit. URL: <https://animal.kharkov.ua/archiv/ntb/STB123/15.pdf> (date accessed: 12.03.2021).

² Про затвердження Національного стандарту № 1 «Загальні засади оцінки майна і майнових прав»: Постанова КМУ від 10.09.2003 р. № 1440 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/1440-2003-п> (date accessed: 12.03.2021).

6. *The principle of supply and demand reflects the correlation between demand and supply for such property. In accordance with this principle, while evaluating the market fluctuations in prices for similar property and other factors are taken into account that may lead to changes in the correlation between demand and supply for such property.*
7. *The principle of substitution provides <...>, that an amount greater than the minimum price of property of the same utility sold at the market is not paid property acquisition*¹.

Let us consider the determination of the value of pets, in particular, in order to determine the financial loss caused to the animal owner, using an example of evaluating dogs during the commodity expertise.

For the research, it is necessary to get complete information about the object of research, provide all initial data, breed standard (within the breed: traits), age, sex, health status, body composition, height, weight, ability to reproduce, pedigree, movements, wool, behavior, defects (any deviation from the above categories should be considered as a defect depending on the severity), the dog's achievement of certain physiological parameters (weight, height), mastery of certain skills and suitability to perform work. It is also needed to obtain the appropriate form of breeding documentation: a certificate, information about the origin of the animal, passport or registration certificate (puppy metrics), a copy of the passport indicating vaccinations (veterinary card), information (confirmed by relevant documents) on all costs of the object (dog)²:

- purchase of a puppy (purchase/sale agreement);
- transportation costs;
- other costs directly related to the acquisition and maintenance of the animal for the intended purpose;
- costs of its mandatory registration;
- the cost of training the dog;
- feeding costs;
- costs of treatment and veterinary care (in particular, costs of treatment in case of cruel treatment of an animal with bodily injuries, mutilations);
- costs associated with cremation, disposal of the dead animal (in case of cruelty to animal).

Only in the presence of the above-mentioned initial data a commodity expert can begin the evaluation process.

The stage of pet evaluation involves the division of the process into several stages:

- defining the purpose of the research and a question posed;

¹ Про затвердження Національного стандарту № 1 ... URL: <https://zakon.rada.gov.ua/laws/show/1440-2003-п> (date accessed: 12.03.2021)..

² Марчук А. А. Оп. cit. URL: <https://animal.kharkov.ua/archiv/ntb/STB123/15.pdf> (date accessed: 12.03.2021).

- analysis of documents and information provided for research (case materials);
- substantiation and choice of methodical approaches to evaluation;
- on the basis of the specified initial data and provided information (breeding and veterinary documents, purchase/sale agreement of an animal) concerning commodity objects, carrying out researches and the corresponding calculations;
- coordination of the obtained results and final conclusions about the market price of the animal for the considered period of time.

To determine the market price using the comparative approach, a forensic expert must identify available information on the selling prices (offer) of an object similar to the object of property valuation (dog) with appropriate adjustment of differences between the object of comparison and the object of evaluation.

The income methodological approach can be used in determining the market price of the object of research, if the forensic expert has information (data) on the actual and / or expected income of the owner of the object of research (from the most efficient use of the object of evaluation, including income from its possible resale), as well as the costs incurred by the owner¹.

In disputes over the establishment of damages in the case of torture of animals, disagreements often arise as to their value. For dispute parties, the reliability, transparency and objectivity of the information contained in the conclusion which indicates the cost of losses are important. This task is under the power of specialists who are highly qualified, responsible and with extensive experience in evaluation of loss suffered by the animal owner.

Commodity experts of NSC “Hon. Prof. M. S. Bokarius FSI” have extensive experience in estimating the value of pets, so they are able to transparently and objectively calculate the damage caused to animal owners due to death or damage to animals, and justify the results in accordance with current literature and legal requirements.

Conclusions. Animal research is a fairly new area of activity for commodity experts, so many indicators need to be considered when evaluating animals (specially to determine the financial loss caused to the animal owner).

It should be noted that, as of today in Ukraine, the issue of forensic determination of financial loss caused to the animal owner to compensate for damages related to the death or damage to the animal remains open: in the professional and scientific space lacks the necessary material, which causes difficulties in work of experts.

We hope that this set of indicators that can be used to evaluate such value that will be useful for forensic experts, because during the research you need to use special knowledge and well-verified terminology which contributes to the adoption of legal and reasonable court decisions.

¹ Про затвердження Національного стандарту № 1 ... URL: <https://zakon.rada.gov.ua/laws/show/1440-2003-п> (date accessed: 12.03.2021).

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О. В. Мануленко, Т. А. Заніна, А. П. Копитько, Т. М. Чекін
Проблемні питання з оцінювання домашніх тварин
під час проведення судових товарознавчих експертиз

У статті розглянуто проблемні питання, що виникають під час визначення вартості тварини. Особливо це стосується випадків, коли необхідно обрахувати матеріальну шкоду, завдану власникові тварини в разі встановлення факту жорстокого поводження з твариною з нанесенням тілесних ушкоджень, спричиненням її каліцтва чи загибелі. Тварина у цьому разі стає об'єктом цивільних правовідносин. Обґрунтування належності живих тварин до категорії «об'єкт цивільних прав» пов'язане з тим, що останні є об'єктами оцінки в матеріальній формі — рухомим майном, споживчим товаром. Отже, оцінка перетворює тварину на особливий об'єкт цивільних прав, на який поширюється правовий режим речі.

Під час проведення судових товарознавчих експертиз останнім часом усе більш актуальним стає питання визначення вартості домашніх тварин (зокрема, обрахування матеріального збитку, заподіяного власникові тварини в разі жорстокого поводження із завданням тілесних ушкоджень, спричиненням її каліцтва чи загибелі).

Проблема полягає в тому, що під час проведення такого роду досліджень необхідний повний перелік вихідних даних про об'єкт дослідження, сукупність морфологічних, фізіологічних (зовнішніх, внутрішніх) показників, господарських ознак і властивостей, що формують і характеризують тварину як одне ціле. Кожен показник та особливість впливає на таку вартість.

Проведення судових товарознавчих експертиз з оцінки домашніх тварин, зокрема, з метою визначення матеріальної шкоди, завданої власникові тварини у разі жорстокого поводження з нею, потребує індивідуального підходу в кожному окремому випадку з урахуванням індивідуальних особливостей та за умови отримання повних вихідних даних для ідентифікації об'єктів дослідження.

У суперечках щодо встановлення розміру матеріального збитку в разі катування тварин часто виникають розбіжності, що стосуються вартості цих тварин. Для обох сторін суперечки важливі достовірність, прозорість і об'єктивність інформації, зазначеної в експертизі, яка визначає розмір збитку. Упоратися з таким завданням здатні фахівці з високою відповідальністю та значним досвідом роботи у сфері оцінки збитку, якого зазнав власник тварини.

Розглядувана сукупність показників, за якими можна визначити таку вартість, стане в пригоді експертам, адже під час проведення дослідження потрібно послуговуватися чіткою термінологією та спеціальними знаннями, що сприятиме ухваленню законних і обґрунтованих судових рішень.

Ключові слова: *судова товарознавча експертиза, оцінка, ринкова вартість, домашні тварини, матеріальна шкода, жорстке поводження з тваринами.*

А. В. Мануленко, Т. А. Занина, А. П. Копытько, Т. М. Чекин

Проблемные вопросы по оценке домашних животных при проведении судебных товароведческих экспертиз

В статье рассмотрены проблемные вопросы, возникающие при определении стоимости животного. Особенно это касается случаев, когда необходимо определить материальный ущерб, нанесённый владельцу животного при установлении факта жестокого обращения с животным с нанесением телесных повреждений, увечья или гибели. Животное в данном случае выступает объектом гражданских правоотношений. Обоснование отнесения живых животных к категории «объект гражданских прав» связано с тем, что последние выступают объектами оценки в материальной форме — движимым имуществом, товаром. Следовательно, оценка превращает животное в особый объект гражданских прав, на который распространяется правовой режим вещи.

При проведении судебных товароведческих экспертиз в последнее время всё более актуальным становится вопрос определения стоимости домашних животных, в том числе определение материального ущерба, причинённого владельцу животного в случае жестокого обращения с нанесением телесных повреждений, увечья или гибели.

Проблема в том, что при проведении такого рода исследования необходим полный перечень исходных данных об объекте исследования, совокупность показателей, морфологических, физиологических (внешние, внутренние), хозяйственных признаков и свойств, которые формируют и характеризуют животное как одно целое. Каждый показатель и особенность влияет на стоимость животного.

При назначении и проведении такого рода экспертиз требуется индивидуальный подход в каждом отдельном случае с учётом особенностей и при условии получения полных исходных данных для идентификации объектов исследования.

В спорах по установлению материального ущерба в случаях истязания животных часто возникают разногласия, касающиеся его стоимости. Для обеих сторон спора важны достоверность, прозрачность и объективность информации, указанной в экспертизе, определяющей размер ущерба. Справиться с такой задачей под силу специалистам с высокой ответственностью и с большим опытом работы в сфере оценки ущерба, понесённого собственником животного.

Рассматриваемая совокупность показателей, по которым можно определить такую стоимость, пригодится экспертам, ведь при проведении исследования нужно применять чётко выверенную терминологию и специальные знания, которые способствуют принятию законных и обоснованных судебных решений.

Ключевые слова: *судебная товароведческая экспертиза, оценка, рыночная стоимость, домашние животные, материальный ущерб, жестокое обращение с животными.*

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Forensic psychological analysis in cases of invalidating a transaction concluded by a legal person

Theoretical, methodological and practical aspects in cases of invalidating a transaction concluded by a legal person are outlined.

Peculiarities of forensic psychological analysis in cases of invalidating a transaction concluded by a legal entity are studied. Referring to forensic expert practice, the object, subject, tasks of this subject type of forensic psychological analysis are determined. Issues which are solved by forensic psychological analysis in cases on invaliding transaction are indicated. Boundaries of a forensic psychologist competence are outlined. Recommendations are provided as to the reference list of source data required for conducting forensic psychological analysis. Based on forensic expert practice, an algorithm for analyzing source data when conducting a forensic psychological analysis in cases of invalidating a transaction concluded by a legal entity is outlined. The main components that should be identified when conducting a forensic examination of this subject type of forensic psychological analysis are indicated.

The experience of scientists and practitioners demonstrates that a problem of will is inseparable from problems of personality, consciousness, self-awareness, motives, needs, emotions, cognitive activity of a person. Considering that intellectual, volitional and emotional processes, states and personality traits act in interconnection, this type of research (as one of the complex subject types of forensic psychological analysis) requires further theoretical analysis of the objective and subjective factors of a person wrong actions (entity of civil law relations) in legally significant circumstances to solve methodological and practical tasks of expertology.

Keywords: *examiner; will, case of invalidating transaction, psychological research, forensic psychological analysis.*

Formulation of Research Problem. The analysis of forensic expert practice demonstrates that one of the most difficult subject types of forensic psychological analysis is psychological analysis in cases of invalidating agreements concluded by a legally capable person. Such examination is performed in accordance with Articles 225, 229, 230, 231, 233 of the Civil Code of Ukraine¹. However, as of today, there is no scientifically sound and proven methodology for conducting such subject type of forensic psychological analysis, as well as there is no unified methodological approach to solve expert tasks in this area in the Register of methods of forensic examinations², the procedure for maintenance of which was approved by the order of the Ministry of Justice of Ukraine No. 1666/5 (as amended and supplemented)³ dated on 02.10.2008. The relevance of this research is due to insufficient development of criteria for conducting forensic psychological research in civil cases on invalidation of agreements concluded by a legally capable person.

Analysis of Essential Researches and Publications. Attempts to study the content of intellectual and volitional components of the legal criterion of inability have been made by such authors as N. V. Alikin, O. V. Hutnykov, S. M. Kornieiev, D. O. Malkin, O. N. Sadykov, T. V. Sakhnova, F. S. Safuanov, T. M. Sekerazh⁴.

¹ Цивільний кодекс України : Закон України від 16.01.2003 р. № 435-IV (as amended and supplemented.). URL: <https://zakon.rada.gov.ua/laws/show/435-15> (date accessed: 13.03.2021).

² Реєстр методик проведення судових експертиз // Офіційний сайт Міністерства юстиції України. URL: <https://rmpse.minjust.gov.ua> (date accessed: 13.03.2021).

³ Порядок ведення Реєстру методик проведення судових експертиз : затв. наказом Мін'юсту України від 02.10.2008 р. № 1666/5 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z0924-08> (date accessed: 13.03.2021).

⁴ Е. г., Алікіна Н. В. Аналіз помилкових дій особистості у судово-психологічній експертизі (консультативний приклад). *Криміналістика і судова експертиза* : міжвідом. наук.-метод. зб. Київ, 2013. Вип. 58 (1). Р. 415—424 ; Гутников О. В. Недействительные сделки в гражданском праве. *Теория и практика оспаривания*. Москва, 2003. 576 р. ; Белов В. А., Белевич А. В., Витрянский В. В., Дюжева О. А., Ем В. С., Зенин И. А., Козлова Н. В., Копылов А. В. и др. Практикум по гражданскому праву : учеб. пособ. Ч. 2 ; отв. ред. С. М. Корнеев. Москва, 2002. 432 р. ; Малкин Д. А. Экспертная оценка психического состояния лиц, совершивших сделки (в рамках комплексной судебной психолого-психиатрической экспертизы) : автореф. дис. ... канд. мед. наук. Москва, 2004. 28 р. ; Садиков О. Н. Недействительные и несостоявшиеся сделки. *Юридический мир*. 2000. № 6. Р. 8 ; Сахнова Т. В. Основы судебно-психологической экспертизы по гражданским делам : учеб. пособ. Москва, 1997. 136 р. ; Сафуанов Ф. С., Переправина Ю. О., Черненко А. Д. Нейропсихологическое исследование при судебно-психологической экспертной оценке делоспособности. *Психология и право*. 2018. Т. 8. № 4. Р. 115—127. DOI: 10.17759/psylaw.2018080411 (date accessed: 13.03.2021) ; Секераж Т. Н. Теоретические и методические основы диагностики «порока воли» в судебной психологической экспертизе : дис. ... канд. юрид. наук. Москва, 2004. 205 р.

Issues concerning certain aspects of personality volition have been studied by philosophers (Aristotle, H. Bergson, O. Henisaretskyi, R. Descartes, F. M. Dostoevsky, Platon, I. Kant, N.O. Lossky, F. Nietzsche, J. Ortega y Gasset, J. Fichte, F. Schelling, A. Schopenhauer and others ¹), psychologists (N. K. Arch, L.S. Vygotzky, L.I. Bozhovych, V.A. Ivannykov, Ye. P. Ilin, V. K. Kalin, V. I. Selivanov, B. M. Smynov, S.L. Rubinstein, M. H. Yaroshevskyi ²), psychiatrists (V. M. Bekhteriev, E. V. Korolova A. R. Mokhonko, L. O. Muhandseva, N. K. Kharytonova and others ³), lawyers (M. I. Brahinskyi, O. M. Erdelevskyi, I. V. Matvieiev, I. B. Novytskii, N. V. Rabynovych, H. I. Strelnykova, N. D. Shestakova and others). However, the *volition* concept in philosophy, psychology, law, medicine coincide only partially.

The **Article purpose** is to summarize theoretical, methodological and practical aspects associated with the performance of forensic psychological analysis in cases of invalidation of agreements concluded by a legally capable person.

¹ Е.г., Новая философская энциклопедия : в 4 т. ; науч.-ред. совет : В. С. Стёпин, А. А. Гусейнов, Г. Ю. Семигин, А. П. Огурцов. Москва, 2000. URL: <https://iphlib.ru/library/collection/newphilenc/document/HASH2828150c93bb42edd37028#> (date accessed: 13.03.2021); Достоевский Ф. М. Собрание сочинений : в 15 т. ; редкол. : М. Г. Фридлендер и др. Ленинград, 1990 ; Лосский Н. О. Основные учения психологии с точки зрения волюнтаризма. *Вопросы философии и психологии*. Москва, 1991. Кн. 64 (IV). Р. 779—823 ; Кн. 65 (V). Р. 905—950 ; Ортега-и-Гассет Х. Избранные труды ; сост., ред. А. М. Руткевич. Москва, 1997. 704 p.

² Е.г., Ach N. Analyse des Willens ; E. Abderhalder (ed.). *Handbuch der biologischen Arbeitsmethoden*. Berlin, 1935. Teil E. Abt. VI ; Выготский Л. С. Мышление и речь : собр. соч. в 6 т. Москва, 1982 ; Божович Л. И., Славина Л. С., Ендовицкая Т. В. Опыт экспериментального изучения произвольного поведения. *Вопросы психологии*. 1976. № 4. Р. 55—68 ; Иванников В. А. К сущности волевого поведения. *Психологический журнал*. 1985. Т. 6. № 3. Р. 47—55 ; Ильин Е. П. Психология воли. 2-е изд., перераб. и доп. Санкт-Петербург, 2009. 368 p. ; Калинин В. К. Волевая регуляция деятельности : автореф. дис. ... д-ра психол. наук. Тбилиси, 1989. 36 p. ; Селиванов В. И. Волевая регуляция активности личности. *Психологический журнал*. 1982. Т. 3. № 4. Р. 14—25 ; Смирнов Б. Н. О разных подходах к проблеме воли в психологии. *Вопросы психологии*. 2004. № 3. Р. 64—70 ; Рубинштейн С. Л. Основы общей психологии. Санкт-Петербург, 2002. 2-е изд. 720 p. ; Ярошевский Г. М. История психологии от античности до середины XX в. : учеб. пособ. Москва, 1996. 416 p.

³ Е.г., Бехтерев В. М. Объективная психология : в 3 т. Санкт-Петербург, 1907—1910 ; Королёва Е. В. Судебно-психиатрическая оценка психических расстройств у лиц, совершивших сделки : автореф. дис. ... д-ра мед. наук. Москва, 2010. 42 p. ; Мохонько А. Р., Муганцева Л. А. Судебно-психиатрическая экспертиза в гражданском процессе : тез. науч.-практ. конф. Санкт-Петербург, 2013. Р. 13 ; Харитонов Н. К., Сафуанов Ф. С., Малкин Д. А. Экспертная оценка делкоспособности по гражданским делам в рамках комплексной судебной психолого-психиатрической экспертизы : пособ. для врачей. Москва, 2005. Р. 5.

Main Content Presentation. Based on the definition of agreement as a legal fact of voluntary and legitimate action of a natural or legal person aimed at emergence, change or termination of civil rights or obligations ¹, psychological research on invalidation of agreements concluded by a legally capable person is intended for determining peculiarities of a person's psychology (subject of civil law relations) in a juridically relevant situation. Volitional processes, states and personality traits are subject to psychological analysis. Volition is one of the most difficult concepts in psychology. Volition is viewed as an independent mental process, as an aspect of other vital mental phenomena, as a unique ability of a person to consciously regulate their activities and behavior.

In Max Vasmer's Etymological dictionary it is mentioned that in different languages the volition word derives from such words as *command* (Russian), *prevail* (Russian), *want* (Russian), as well as with the meaning: *desire, choice* (Rus.), *will, selection* (Rus.), *better* (Rus.), *power, authority* (Rus.) ². The theoretical concept of volition is rooted in philosophy, where volition (Lat. *voluntas*) is interpreted as the ability of mind to self-determination, in particular moral, as well as creation of a specific causality. Volition issues began to develop within the problem of free will and initially had no clear ontological connotations, limited to the areas of ethics, epistemology and psychology³. Platon firstly viewed *will* as a special subject of reflection and understood it as a synthesis of rational evaluation and desire (and the latter is distinguished as the ability of soul). Aristotle considered volition as a specific causality, different from the "pure" intellectual sphere and from "pure" affects, and also provided terms for classical traditional concepts (will, choice, decision, arbitrary, goal, etc.). In Descartes' system, the concept of volition is somewhat broader than the concept of intelligence, but, in fact, volition is a modus of thinking. According to Kant, volition is the ability to determine the action based on the idea of laws. According to the philosophy of J.G. Fichte, will is an ability equal to intelligence, at the same time the act of will has a logical priority in the process of self-determination of the rational *I*. In view of V. A. Schopenhauer, the volition acquires an ontocosmic status and acts as an irrational force: volition to live, which is devoid of a subjective source and is objectification of the world will (universal metaphysical model). According to F. Nietzsche, Schopenhauer's "will to live" turns to an ontological "will to power" ⁴. Thus, in the metaphor of will, philosophers singled out primarily the

¹ Велика Українська енциклопедія. Тематичний реєстр гасел з напряму «Юридичні науки»; укладачі: В. Л. Бабка, М. М. Шумило; за ред. д. і. н., проф. А. М. Киридон. Київ, 2017. 152 р.

² Фасмер М. Этимологический словарь русского языка : в 4 т. : пер. с нем. 2-е изд., стереотип. Москва, 1986. Т. 1. С. 347—348.

³ Новая философская энциклопедия ... URL: <https://iphlib.ru/library/collection/newphilenc/document/HASH2828150c93bb42edd37028#> (date accessed: 13.03.2021).

⁴ Ibidem.

intellectual-imperative aspect, a component of firm rational intention, action of thought, aiming to fulfill a goal.

Having moved from philosophy to psychology, the definition of will has lost its moral aspect and is viewed as a conscious self-regulation of human activities and behavior, which ensures overcoming of internal and external obstacles while purposeful actions and deeds¹.

As S. L. Rubinstein emphasizes, due to the presence of will, a person overcomes the limits of impulsive, instinctive actions and finds freedom in relation to them, gaining the opportunity to change it. In contrast to the impulsive action, which seems to tear through a person and break out of him, the act of will comes from a person and is directed by him². Thus, the will helps a person to break free from external circumstances and, contrary to impulsive impulses and emotions, to control his behavior, to direct it to achieve a consciously set goal.

V. M. Bekhteriev considered consciousness in unity with the will. The founder of reflexology noted that awareness is directly linked to the will, that awareness is realized "in and through" the act of will³.

In research papers by L. I. Kazmirenko, O. I. Kudermina, O. Ye. Moisieieva, it is stressed that volitional activity necessarily unfolds as a series of acts and actions that provide for realization by a person of one's efforts and the nature of mental processes: evaluation of a situation; choice of direction for future actions; selection of means needed for goal fulfillment, decision-making, etc. Will (as a mental process) is inextricably linked to cognitive and emotional activities of a man. It is known, volitional regulation of behavior always starts with an intellectual act: awareness of a challenging situation. Analysis of a challenging situation requires intensification of volitional processes. Without thinking participation, the volitional process would not be conscious and would lose the actual volitional nature. Nevertheless, will and thinking are not identical concepts, as will is not just the outer shell of thinking. In contrast to thinking, the will does not make up a stand-alone product, it only helps to perform an action and implement a chosen strategy of behavior. Thus, in the concept of *will*, the holistic nature of an individual psyche can be observed: the problem of will relates to and is inseparable from personality problems, consciousness, self-awareness, needs, motivational and emotional spheres, cognitive activity of a person⁴.

Ye. P. Ilin singles out four functions of the will: control over states and the organization of mental processes, regulation of various parameters of actions,

¹ Краткий психологический словарь ; сост. : Л. А. Карпенко ; под общ. ред. А. В. Петровского, М. Г. Ярошевского. Москва, 1985. Р. 48.

² Рубинштейн С. Л. *Op. cit.*

³ Бехтерев В. М. *Объективная психология*. Москва, 1991. 476 р.

⁴ Казміренко Л. І., Кудерміна О. І., Мойсєєва О. Є. *Психологія : підручник ; за заг. ред. Л. І. Казміренко*. Київ, 2015. 213 р.

initiation and implementation of volitional actions, the choice of action due to conflict of motives and goals ¹.

N. K. Arch, L. S. Vyhotskyi, L. I. Bozhovych, V. I. Selivanov, researchers of the problem of will, emphasize that one of its functions is to consciously overcome obstacles. V. I. Selivanov notes, the criterion of conscious overcoming of difficulties is basic for all volitional acts of a man, in general he distinguishes volitional regulation from other properties of psyche and forms of control ².

According to V. A. Ivannykov, the real mechanism for changing or initiating volitional efforts is to change the meaning of action. The possibility of participation of personality semantic formations in control over activity has been also noted by L. S. Vyhotskyi, who observed a change in the behavior of children in the event of a change in the meaning of a situation itself. At the same time, the meaning of a situation conditioned for the child all the power of effective motivation associated with a situation: regardless of the fact that a situation was progressively losing attractive features that things and direct activities with them contained. D. M. Uznadze ³ expressed a similar point of view on the role of meaning in behavior. Having initiated the concept of physical and psychological behavior, this scientist considered psychological only such physical activity of a person which he experiences as a carrier of a certain meaning, significance, value. The motive of volitional behavior, according to D. M. Uznadze, consists in change of behavior value. It is the awareness of the superiority of a particular value, characteristic of a particular behavior, and altering of one of them is the motive for a personal decision ⁴. In research papers by L. I. Bozhovych, instructions that the volitional act involves an individual as a whole and the result depends on what meaning a conflict situation possesses for a person, what position an individual takes in relation to this situation. I. M. Siechenov believed that the meaning of actions is determined by higher human needs, being decisive for the choice of volitional action ⁵.

After analyzing the psychological literature, we can single out two main functions of the will: motivational and regulatory. The motivational function ensures human activity and is manifested in the system of a person's goals and behavior specific motives to achieve these goals. In contrast to reactive response, when an action is directly conditioned by a situation, the activity generates an action as a result of the specifics of a subject's internal states, which manifests itself at the time of an action. Activity is characterized by arbitrariness, that is determined by a consciously defined goal. If a person does not need to perform a certain action, but he is obliged to perform it, the volitional process forms ancillary motivation, changing the meaning of an action and increasing its

¹ Ильин Е. П. *Op. cit.*

² Селиванов В. И. *Op. cit.*

³ Узнатдзе Д. Н. *Психология установки*. Санкт-Петербург, 2001. Р. 414.

⁴ Иванников В. А. *Op. cit.*

⁵ Сеченов И. М. *Избранные произведения*. Москва, 1953. 336 р.

significance for a person (through self-reassessment of the motive significance, by changing a role, position of a person, anticipation and overcoming of the consequences of actions) . Development of motivations for the act of will is also achieved through creation of an additional meaning for an action (by means of setting of a more specific goal, when one action is a part of another). At the same time, a new auxiliary motive starts influencing a person owing to not motivating, but meaning-making function. Encouraging a person to act creates a certain structured system in the form of motives hierarchy: from satisfaction of basic physiological needs to higher impulses associated with the experience of spiritual, moral, aesthetic and intellectual feelings. Analyzing the concept of will as a moral self-regulation of behavior, it can be emphasized that its main characteristic is subordination of personal motives to socially significant. The regulatory function of the will ensures a purposeful orientation of activity in a certain direction to achieve the greatest effect of activity and is able to inhibit performance of actions and behavior contradicting the worldview, ideals and beliefs of an individual¹. An integrator of will for a particular person is volitional orientation based on the system of views on the world around, understanding of the purpose and significance of his activities. I. B. Novytskii, a civil attorney, emphasizes that will which is not expressed externally, does not matter in terms of law, since law does not pay attention to one psychological process of will² formation. Therefore, as a matter of law, an objectified result of this psychological process is of great importance, when the will is manifested externally. In the legal literature there is the concept of *defect of will*. There is no such concept in psychology, thus, when establishing a certain conditional nature of this term, it should be stressed that lawyers use the *defect of will* phrase to denote certain emotional and volitional personality disorders, behavioral disorders, specific intellectual and volitional inferiority of regulation by the subject of civil law relations of significant actions from the point of view of own interests which do not reflect his genuine will. Such a low level of will control over one's actions by a person is not outside a mental norm. Within the limits of sanity, it is manifested in the reduced ability of the subject to fully assess a particular situation which is meaningful for him and adequately make decisions, comprehensively manage his actions aimed at fulfilling certain goals³:

T.V. Sakhnova, analyzing the legal literature on the topic of *defects of will*, notes that externally the defect of will can be interpreted as follows:

- non-conformity of will with will expression (a decision was made consciously and freely, but actions are not harmonized with it, not aimed at achieving a goal set by the agreement subject);

¹ Казміренко Л. І., Кудерміна О. І., Мойсєєва О. Є. *Op. cit.*

² Новицкий И. Б. *Op. cit.* P. 245.

³ Романов В. В. *Юридическая психология : учеб. пособ. для СПО. 3-е изд., перераб. и доп.* Москва, 2019. 170 p. [Электронный ресурс]. URL: <https://urait.ru/bcode/433474> (date accessed: 13.03.2021).

- inadequate development of the will itself under its formal expression (direction of action corresponds to a chosen goal, but a decision itself is approved neither independently nor freely) ¹.

V. F. Yenhalichev, S. S. Shypshyn believe that (psychologically) in the case of non-conformity of will with the will expression, the insufficiency of volitional component of an agreement (the intellectual side is full) is distinguished as the main, and in the case of inadequate development of the will: the lack of intellectual component (while the volitional side is full). Above all, V. F. Yenhalichev, S. S. Shypshyn also emphasize that the integrity of psyche should always be taken into account, namely intellectual, volitional and emotional processes, states and traits of a person in conjunction. To prove the existence of a defect of will as a legally significant circumstance, it is crucial to identify such peculiarities of mental processes and states of a subject which would allow to reach a right conclusion about the ability to understand the actual meaning of performed actions and willpower to control them ².

As T. M. Sekerazh notes, in law, *defect of will* is considered as a summarizing category regarding conditions of invalidity of legal acts. A summarizing psychological criterion of *defect of will* is the inability of a legally capable person to understand the meaning of his actions or to manage them as a result of a specific emotional state, mistaken belief on the activity purpose or under the influence of external influence (violence, threat, coincidence of severe circumstances) ³.

N. V. Alikina stresses that in case of reasonable doubts about the ability of a person to rightly perceive any significant elements while agreement conclusion, it is advisable to assess psychological factors (memory, attention, thinking, emotional state) affecting the nature of a person's (more often of old age, as forensic expert practice shows) perception of peculiarities and a real maintenance of a situation being considered in a case. In such cases, it is possible to conduct a forensic psychological analysis. Such research involves performing psychological analysis of initial data on external circumstances (event situation of agreement conclusion and events preceding this situation), determining a person internal state, that is establishing the presence (absence) of individual psychological traits and state of a person, specific conditions of his microsocial position and conditions of concluding an agreement (coincidence of circumstances of special unfavorability, dependence, threats, increased obedience, depression, helplessness, confusion, etc.) on the ability to understand the actual meaning of his own actions, consciously manage them and predict their consequences ⁴.

¹ Сахнова Т. В. *Op. cit.*

² Енгальчев В. Ф., Шипшин С. С. Практикум по судебной-психологической экспертизе : учеб.-метод. пособ. 2-е изд., перераб. и доп. Калуга, 2013. 286 p.

³ Секераж Т. Н. *Op. cit.*

⁴ Пашковська Т. Визнання угод недійсними: психолог розбереться? // Офіційний сайт «Юридичної газети». 24.02.2017. URL: <https://jur-gazeta.com/publications/events/viznannya-ugod-nediysnimi-psiolog-rozberetsya.html> (date accessed: 19.03.2021).

According to paragraph 6.4 of Scientific and methodical recommendations concerning preparation and appointment of forensic examinations and expert researches (hereinafter referred to as *Recommendations*), main tasks of forensic psychological analysis are identification in the examinee of:

- *individual psychological traits, character traits, leading personality traits; motivating factors of mental life and behavior;*
- *emotional reactions and states;*
- *patterns of mental processes, the level of their development and individual properties*¹.

According to the above-mentioned Recommendations, the object of psychological analysis is mentally healthy people².

According to the definition provided by T. M. Yehorova and V. V. Yehorov, the object of forensic psychological analysis is a person as a personality (examinee) and a set of information sources reflecting information about mental activity of the examinee in legally significant circumstances³.

T. M. Yehorova, N. V. Alikina, T. V. Savkina emphasize that research subject of forensic psychological analysis in cases of invalidation of agreements concluded by a person is a set of psychological facts revealing individual psychological traits of the individual, specifics of his cognitive and volitional spheres in circumstances of conclusion of the agreement being considered in a case⁴.

According to paragraph 6.7 of the Recommendations, tasks of a forensic psychologist while conducting this type of forensic psychological analysis include: establishing the degree of understanding by the examinee of an actual content of his actions and their consequences, his ability to make a conscious decision and implement it by his actions; identification of non-pathological mental anomalies in a legally capable person which impede adequate reflection of reality, as well as coverage of the issue on personal significance of circumstances under which an agreement was concluded for a person.

¹ Науково-методичні рекомендації з питань підготовки та призначення судових експертиз та експертних досліджень : затв. наказом Мін'юсту України від 08.10.1998 р. № 53/5 (as amended and supplemented). URL: <https://zakon.rada.gov.ua/laws/show/z0705-98> (date accessed: 19.03.2021).

² Ibidem.

³ Єгорова Т. М., Єгоров В. В. Дискусійні питання щодо об'єкта та предмета судової психологічної експертизи. *Актуальні питання судової експертизи і криміналістики* : зб. мат-лів Міжнар. наук.-практ. конф., присвяч. 150-річ. з дня народж. заслуж. проф. М. С. Бокаріуса (Харків, 18—19.04.2019). Харків, 2019. Р. 428—430.

⁴ Єгорова Т. М., Алікіна Н. В., Савкіна Т. В. Диференціальний підхід до проведення судової психологічної експертизи як підстава визначення її предметних видів. *Ароцкерівські читання* : зб. мат-лів Міжнар. наук.-практ. конф., присвяч. 90-річ. від дня народж. видат. вченого-криміналіста, д-ра юрид. наук, проф. Л. Ю. Ароцкера (Полтава, 25.05.2017). Харків, 2017. Р. 155—157.

Given the purpose of forensic psychological analysis on cases of invalidation of agreements, a forensic psychologist is addressed with the task of establishing: individual psychological traits of a person; personal significance of circumstances in which an agreement was concluded for a person; emotional state of a person during agreement conclusion by him ¹.

In accordance with the above questions, a forensic psychologist can answer main questions posed for psychological research, namely: *“Was a person able, taking into account particular circumstances, completely freely and consciously make decisions and implement them in his actions?”*, *“Or was a person able, taking into account established circumstances, to realize — and to what extent — an actual content of their own actions and their consequences?”*, *“Was a person able to fully and consciously make a decision being adequate for a situation, and fully consciously implement it?”* ².

Considering issues posed to a forensic expert, to conduct a psychological analysis, actual data must be provided to a forensic expert allowing to perform a complete analysis of psychological circumstances under which an agreement is concluded, as well as information on individual psychological traits of a person (subject of civil law relations) during lifetime and directly during agreement conclusion. Apart from the above initial data, answering questions of this subject type of forensic psychological analysis is quite challenging.

It is known from the scientific literature that competence of forensic psychological analysis includes the establishment of the degree of understanding by the examinee of his own actions and the ability to manage them; ability to make meaningful (considering all essential conditions) decisions; identification of psychological anomalies in a legally capable person that impede adequate reflection of reality; determining the ability of a witness to correctly perceive circumstances corresponding to a case and to provide relevant evidence ³ based on them.

M. M. Kochenov adds to this list the ability of a forensic psychologist when diagnosing a person's individual psychological traits to identify a tendency to increased suggestion, impulsivity, annoyance, rigidity, etc. which could significantly affect the subject behavior, as well as establish possibilities of a certain mental state (confusion, loss of landmarks, etc.) in a person and expertly assess their impact on the quality of individual actions performance ⁴ in specific conditions.

¹ Науково-методичні рекомендації ... URL: <https://zakon.rada.gov.ua/laws/show/z0705-98> (date accessed: 19.03.2021).

² Ibidem.

³ Кобера А. В. Судово-психологічна експертиза як форма використання психологічних знань в юриспруденції. *Наукові записки Національного університету «Острозька академія». Серія : Психологія.* 2008. Вип. 11. Р. 93—99. URL: https://nbuv.gov.ua/UJRN/Nznuoapp_2008_11_13 (date accessed: 19.03.2021).

⁴ Ibidem.

In view of T. V. Sakhnova, when performing a research, a forensic psychologist establishes the fact of incorrect, erroneous reflection by a person of agreement conclusion peculiarities, highlights reasons of psychological nature of such errors (external and internal). Whithin the content of error as a defect of will, the main is that the will of a non-compliant party is formed not on the basis of a balanced and free decision, but under the influence of misconceptions about essential elements of an agreement (or due to their ignorance). Thereby, the fact of making a mistake is established by court¹.

V. A. Polianska, considering the issue of carrying out multidisciplinary forensic psychological and psychiatric analyses under this category of civil cases, emphasizes that a forensic psychologist's competence includes identification of such legally significant personality traits as increased suggestibility, increased obedience, exposure to others' influence, the impact of somatic diseases on the psychological state, emotional state in a psycho-traumatic situation. At the same time, a forensic expert in no case solves tasks as to capacity or incapacity of a person, validity or invalidity of an agreement².

Conclusions. Thus, summarizing achievements of scientists and practitioners, peculiarities of conducting forensic psychological analyses in cases of invalidation of agreements concluded by a legally capable person are determined. The concept of *will* and its synthesized criteria in law, philosophy and psychology are outlined. Based on forensic expert practice, the object, subject, tasks of this subject type of forensic psychological examination, as well as the limits of competence of a forensic psychologist are determined. Recommendations are provided regarding the approximate list of initial data necessary for conducting psychological research on cases of invalidation of agreements concluded by a legally capable person. Experience of scientists and practitioners indicates that the problem of will cannot be separated from problems of personality, consciousness, self-awareness, motives, needs, emotions, cognitive activity. Given that intellectual, volitional and emotional processes, states and personality traits operate in interrelation, this type of research (as one of the most complex subject types of forensic psychological analyses) requires further theoretical analysis of objective and subjective factors of a person's (subject of civil law relations) mistaken actions in legally significant circumstances to solve methodological and practical problems of expertology.

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¹ Сахнова Т. В. Оп. cit.

² Полянская В. А. Компетенция психолога в комплексной судебной психолого-психиатрической экспертизе сделоксособности. *Сибирский юридический вестник*. 2006. № 4 (35). P. 97—101.

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Т. Г. Харіна, О. А. Герасименко
Судово-психологічна експертиза
за справами про визнання недійсними угод,
укладених дієздатною особою

Узагальнено теоретичні, методичні та практичні аспекти, що стосуються проведення судово-психологічних експертиз за справами про визнання недійсними угод, укладених дієздатною особою. Зважаючи на експертну практику, визначено об'єкт, предмет, завдання цього предметного виду судово-психологічної експертизи й межі компетенції судового експерта-психолога. Надано рекомендації щодо орієнтовного переліку вихідних даних, необхідних для проведення психологічного дослідження за такими справами. Досвід науковців і практиків свідчить, що проблема волі невіддільна від проблем особистості, свідомості, самосвідомості, мотивів, потреб, емоцій, пізнавальної діяльності людини.

Ключові слова: підекспертна особа, воля, справа про визнання угоди недійсною, психологічне дослідження, судово-психологічна експертиза.

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Судебно-психологическая экспертиза в делах о признании
недействительной сделки, заключённой дееспособным лицом

Обобщены теоретические, методические и практические аспекты по делам о признании недействительной сделки, заключённой дееспособным лицом.

Изучены особенности проведения психологического исследования по делам о признании недействительной сделки, заключённой дееспособным лицом. Исходя из экспертной практики, названы объект, предмет, задачи этого предметного вида судебно-психологической экспертизы. Указаны вопросы, которые ставят на решение психологической экспертизы по делам о признании сделки недействительной. Очерчены границы компетенции судебного эксперта-психолога. Даны рекомендации относительно ориентировочного перечня исходных данных, необходимых для проведения психологического исследования. С опорой на экспертную практику указан алгоритм анализа исходных данных при проведении психологического исследования по делам о признании недействительной сделки, заключённой дееспособным лицом. Указаны основные составляющие, которые

необходимо выявить при проведении экспертного исследования по этому предметному виду психологической экспертизы.

Опыт учёных и практиков свидетельствует о том, что проблема воли неотделима от проблем личности, сознания, самосознания, мотивов, потребностей, эмоций, познавательной деятельности человека. Учитывая, что интеллектуальные, волевые и эмоциональные процессы, состояния и свойства личности действуют во взаимосвязи, указанный вид исследования (как один из сложных предметных видов судебно-психологической экспертизы) нуждается в дальнейшем теоретическом анализе объективных и субъективных факторов ошибочности действий лица (субъекта гражданско-правовых отношений) в юридически значимых обстоятельствах для решения методологических и практических задач экспертологии.

Ключевые слова: подэкспертное лицо, воля, дело о признании сделки недействительной, психологическое исследование, судебно-психологическая экспертиза.

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Contributors

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Methodological analysis of military forensic science

Emergence of new independent units of forensic science is a logical result of the development of scientific knowledge and forensic expert activity, if such a process takes place on the basis of the developed methodological foundations of forensic science, which ensures the scientific nature of new types of forensic science, organizational and legal procedure for their conduct and the admissibility of their results to ensure justice. Ignoring scientific approaches in implementation of forensic activities in Ukraine and attempts to adapt it to the needs of investigative and judicial practice cannot but cause concern, especially when it comes to an attempt to substitute forensic science for the proof process.

Article purpose is to conduct a methodological analysis of the topic, objects and tasks of forensic military science and its place in the modern general classification system of forensic science on the basis of the general theory of forensic expertology.

Research methodology was made up of the provisions of materialist dialectics as a universal method of cognition, as well as a set of methods of formal logic for solving individual research tasks: analysis, synthesis, analogy, comparison, comparison, deduction.

While research, in order to establish formation consistency of military science as an independent stratification unit, its structural components were analyzed: topic, objects, tasks and specific expertise necessary for their solution.

While conducted methodological analysis, it was found that formation of military science as an independent stratification unit of forensic examinations occurred in violation of the methodological foundations developed by forensic science and the evolutionary paths of the genesis of new species of forensic science. As a result of performed research, it was concluded that it is necessary to revise the place and essence of military science in the existing classification system of forensic science in Ukraine which will ensure the unity of the methodological approach to formation of new units of forensic science and guarantee declared principles of forensic science.

Keywords: *forensic expertology, forensic science, specific expertise, military forensic science, topic of military forensic science, objects of military forensic science, tasks of military forensic science, system of forensic examinations.*

Formulation of Research Problem. Intensification of the development process of independent stratification units of forensic science in Ukraine, which has been observed recently, cannot be ignored by scientists, especially given the significance of regulation scope in forensic activity and declared principles (*Pro sudovu ekspertyzu, 1994, p. 3*). Thus, in 2015, military forensics appeared (*Pro vnesennia zmin do nakazu Ministrystva Yustytzii Ukrainy vid 08 zhovtnya 1998 roku № 53/5, 2015*), and in 2019 veterinary forensics and forensic gemmology were formed (*Pro vnesennia zmin do nakazu Ministrystva Yustytzii Ukrainy vid 08 zhovtnya 1998 roku № 53/5, 2019*). Given the developed in Ukraine trend to break the link while the development of empirical and scientific knowledge, we deem it necessary to conduct a methodological analysis of the efficiency of individual “new” types(subtypes) of forensic science, defined as independent stratification units (in particular, military forensics).

Analysis of Essential Researches and Publications. Among few scientific publications dedicated to military forensics, the ones covering general issues of military forensics (*Chuprun, 2015; Antoniuk, 2017*), and considering expert approaches to solving its separate tasks (*Bogdanyuk, 2017; Poluianov, 2020; Ruvin & Serednii, 2020; Savechko & Chernysh, 2020; Savechko & Kozlov, 2020; Vlasuk, 2020*) may be singled out.

The **Article purpose** is to perform a methodological analysis of the subject, objects and tasks of military forensics referring to the general theory of forensic expertology. Analyze the place of military forensics in the modern general classification system of forensic examinations. Stress the inviolability of the methodological approach during formation of new independent units of forensic science. To suggest an algorithm for developing separate mechanisms of forensic activity in case of emergence of new types (subtypes) of forensic examinations.

Main Content Presentation. Currently, the issue as to formation and development of forensic expertology as an independent branch of scientific knowledge with its own methodology which is the basis for the classification of forensic examinations, defining of the competence of forensic experts, development of modern expert technologies is no longer debatable. The subject of forensic expertology at the present stage of its development includes:

- theoretical, legal and organizational patterns of forensic activity in general;
- patterns of origin, formation and development of classes, species and types of forensic examinations and their individual theories based on a common methodology, unified conceptual apparatus and considering a constant updating and change in forensic knowledge;
- based on knowledge of these laws, common for all types of litigation legal and organizational support of forensic activity, common unified expert technologies, standards for a forensic expert’s competence and certified expert laboratories (*Rossinskaya, 2016*).

In our opinion, the only methodological approach to the emergence, formation and development of classes, species and types of forensic examinations can ensure compliance with the guaranteed principles of forensic science and justify the established in Ukraine organizational and legal procedure for its implementation. Such a common approach should be based solely on the developed methodology of forensic expertology which will ensure the scientific nature of forensic science as a field of human activity, as well as the objectivity of conclusions drawn by forensic experts (given their procedural significance for all types of proceedings in Ukraine). Adherence to the scientific approach while formation of new types (species) of forensic examinations is a guarantee of ensuring consistency of its genesis and appropriate place in the general classification system of existing classes, species and types of forensic examinations.

The performed analysis of the efficiency of military forensics as an independent stratification unit demonstrates non-conformity with the developed methodological framework of forensic expertology, which in general may call into question not only the place of military forensics in the general system of forensic science developed in Ukraine but also its scientific nature.

Researches in the field of forensic science show that modern classifications of forensic examinations are based on the research object in combination with tasks they solve. At the same time, there are two main directions which condition the genesis of forensic examinations (*Rossinskaya, 2016*):

- 1) the consolidation process (from the type (subtype): into the species, from the species: into the class): the emergence of a new type of forensic examination within the existing species by updating or modifying objects that were not studied sufficiently previously, formation of qualitatively new expert technologies, increase in forensic examination capabilities;
- 2) the division process: from the class: into species and types.

In addition, the need to solve a set of qualitatively new common expert tasks leads to the emergence of new objects under study, which may be a prerequisite for the formation of a new class or species of forensic examination, rather than their singling out of existing ones (as observed in military forensics, where we do not explore the emergence of new research objects: the ones we will study later).

For a better understanding and analysis of the essence of military forensics, let's consider the content of at least its three main methodological components that are essential not only for the theory of forensic science, but also for forensic activity and organizational and legal order of its provision:

- subject of forensic examination;
- objects of forensic examination;
- basic tasks and specific expertise for its solution.

The subject of forensic examination as a type of practical activity is understood as information about an event (offense) obtained by a forensic expert as a result of research referring to special knowledge of certain properties of objects submitted for forensic examination (*Shcherbakovskiy, 2016*).

This understanding clearly demonstrates the logical connection between the subject of forensic examination and its objects: carriers of information about certain circumstances associated with a criminal offense. Although the Law of Ukraine: *On Judicial Examination* defines forensic examination as: “research based on specific expertise in the field of science, technology, art, craft, etc. on objects, phenomena and processes” (*Pro sudovu ekspertyzu, 1994, st. 1*), however, being guided by the general cognition method, it could be concluded that phenomena and processes are studied through their materialized causes and consequences: objects of the material world containing information about certain events, in the form of their individual features and properties caused by the event being established (studied). That is, forensic examination objects are always certain objects of the material world. At the same time, information that is reflected in the physical objects of the environment as a result of certain actions can be divided into three types (*Burnashev et al., 1998, p. 22*): 1) personal (about the subject who left particular traces) ; 2) subject (on used (applied) items, tools, etc.); 3) timely (on actions taken).

Regarding tasks of forensic examination, forensic expertology is viewed as a set of patterns to which the cognitive activity of the forensic expert is directed. It is common to divide expert tasks into identification and non-identification (diagnostic, classification, situational, restoration, etc.) (*Klimenko, 2007, pp. 15-16*). According to objects and tasks, the range of specific expertise (a set of certain branch knowledge) is determined, based on which regularities of the research object peculiarities are studied.

Regarding military expertise, the founder has identified only its main tasks (*Naukovo-metodychni rekomendatsii z pytan pidgotovky ta pryznachennia sudovyh ekspertyz ta ekspertnyh doslidzhen, 2021, p. 9.1, rozd. IX*):

- establishing the application circumstances and actions of military units;
- identifying circumstances that led to severe consequences, deaths (servicemen, employees of the Security Service of Ukraine, Armed Forces of Ukraine, Ministry of Internal Affairs of Ukraine, National Guard of Ukraine and other representatives of ministries and departments, civilian population), loss of weapons, military equipment, entities of state authority and infrastructure, personal property of citizens during military units operation;
- establishing compliance of actions (inaction) of officials with the requirements of guiding documents (entrusted responsibilities).

The mentioned tasks can generally be considered as those that (according to a wording) correspond to the generally accepted classification: the first two tasks are diagnostic in nature, the latter: identification. However, the mentioned tasks are inherently vague, generalized and those that do not reflect either the range of patterns toward which the cognitive activity of the forensic expert is directed, or the set of professional specific knowledge on the basis of which research on their solution is performed. Thus, if we consider the military field as a branch of human activity, then the stated tasks are similar to a sociological analysis of one of the areas of human activity: management in the military field, and not a direction of applying specific expertise to study regularities of research objects.

In addition, solution of indicated expert tasks by subjects of forensic activity, in our opinion, replaces the process of proof: collection, verification and evaluation of evidence to clarify specific circumstances that are relevant for a proceeding (case). Based on the proposed logic, we can argue about feasibility of developing independent units of forensic science, given the area of human activity, for example educational, economic, social, political, etc.

The founder also suggests an indicative list of issues addressed to military forensics, which together should provide an idea of its subject as a set of factual data that can be established by a forensic expert on the basis of his specific expertise, having examined provided objects (*Naukovo-metodychni rekomendatsii z pytan pidgotovky ta pryznachennia sudovyh ekspertyz ta ekspertnyh doslidzhen*, 2021, p. 9.2 rozd. IX).

However, the analysis of the proposed indicative issues helps us formulate the following statements:

- some questions are beyond main tasks of forensic examination set by a forensic expert. For example, the question: “Is there a cause-effect relation between detected offenses and serious consequences having led to the death of servicemen (employees) and others, loss of armament and military equipment?” belongs to situational expert tasks;
- answers to certain questions do not require specific expertise, in particular in the military field, and stipulate only an analysis of a corresponding organizational and managerial documentation, for example: “Who of the officials (commanders, heads) is obliged to prepare units involved in fulfilling combat duties, and ensure control over their readiness; compliance in keeping with those regulatory documents?” or “Which measures have been implemented to prevent encirclement and taking out of the encirclement of military units and bases who were involved in fulfilling combat tasks and got trapped?”;
- answering separate questions requires the involvement of knowledge not only from one field (including military art) but also from

- economics, politics, law, etc., i.e. stipulates a comprehensive nature of specific expertise, for example: “Did negative consequences on the state defense capability and combat capability of the Armed Forces of Ukraine have (could have) a decision to liquidate (disband, reduce) certain types of troops, formations, military units and subdivisions?”;
- providing answers for the majority of questions replaces the process of proof in its cognitive essence and shifts the obligation of proof from the subject of investigation to a forensic expert, for example: “Whether the stipulated by regulations procedure for processing, adjusting and performing combat duties have been fulfilled?” or “Did actual actions of relevant officials correspond to the operative environment at the time of the combat mission?”, or “Which officials actions (inaction) who planned and conducted operations to dismantle illegal military formations (enemy) are in causal-effect relationship with severe consequences having led to the death of servicemen (employees) and other persons, loss of armament and military equipment?”, or “What regulations (regulatory documents) were used while planning and organization of hostilities?”, “How was interaction in the area of hostilities between units of the Security Service of Ukraine, the Armed Forces of Ukraine, the Ministry of Internal Affairs of Ukraine, the National Guard of Ukraine and other military units and state authorities organized?”, “How was the units withdrawal from the encirclement organized, and who withdrew the mentioned units and subdivisions?”;
 - certain questions are purely legal in nature, to provide answers to which according to Article 242 of the Criminal Procedural Code of Ukraine (*Kryminalnyi protsesualnyi kodeks Ukrainy*, 2012, st. 242), it is not allowed to perform a forensic examination, for example: “Whether combat documents by types of supporting units and subdivisions involved in military operations corresponded to regulations (regulatory documents) as well as environment?” or “Whether applied graphic images in a commander’s working map of all levels correspond to set tasks on performing military operations (fulfilling military operations)?”

At the same time, (unlike other types of forensic examinations) objects of military forensics are not defined, which results in certain uncertainties and interpretations. Thus, it is widely believed that objects of forensic military examination can be text and graphic documents (standard on paper and electronic), video and audio recordings, photographs and other media of different nature (*Chuprun*, 2015, p. 216). Without denying such a possibility, we are obliged to note that objects of military forensics are not specific and unique in nature and features and properties reflected in them.

The performed methodological analysis of the main components of military forensics as an independent stratification unit shows the lack of well-defined objects of military forensics and specific tasks that would reflect the cognitive research activities of a forensic expert as well as the field and direction of specific expertise implementation. The absence of indicated components does not allow to form an objective idea of the subject of military forensics as certain information (regularities) about an event (actual data) that can be obtained by a forensic expert as a result of research, based on specific expertise, individual properties of objects provided for forensic examination, which would, in fact, separate military forensics from other types (species) of forensic examinations.

In view of the above, we believe that formation of military forensics as an independent stratification unit (according to the existing classification: class) of forensic examinations occurred in violation of methodological principles developed by forensic expertology and evolutionary ways of genesis of new types of forensic examinations. This could be justified by the specificity of research objects, however, the conducted analysis demonstrated the lack of such uniqueness not only for research objects but also for expert tasks.

At the same time, undoubtedly, we cannot prohibit the right to develop military forensics, but its formation should take place on the basis of and within the methodological principles of forensic expertology. In this aspect, the emergence of corresponding researches within the type or kind of forensic examinations (for example, military medical analysis), or by expanding objects and tasks of existing classes of forensic examinations (*Naukovo-metodychni rekomendatsii z pytan pidgotovky ta pryznachennia sudovyh ekspertyz ta ekspertnyh doslidzhe*, 2021) is deemed to be logical: ..

- environmental (p. 8.2 rozd. VIII), which tasks include, in particular, establishing the environmental consequences caused to the environment as a result of hostilities and / or the application of military equipment and weapons; determining the amount of damage from environmental pollution, damage or destruction of fauna and flora which took place due to hostilities and / or the use of military equipment and weapons;
- commodity (p. 3 rozd. IV), one of the species of which is: *Forensic commodity examination of military property, equipment and weapons*;
- forensic examination of weapons and traces and circumstances of their use (gl. 4 rozd. I).

Apart from the above, there are questions about the scientific and methodological and information support of military forensics (*Bogdanyuk*, 2017, p. 381). Since the appearance of military forensics, only 4 methods of military forensics have passed state certification: 1) Multidisciplinary research on missile and artillery armaments ¹; 2) Methods of conducting forensic

¹ Дата держреєстрації 18.01.2019 р., розробник — Київський НДІСЕ Мін'юсту України.

military examinations as to assessment of officials (heads, commanders, chiefs) actions: subjects of terrorism counteraction while anti-terrorist operation; 3) Methods of conducting forensic military examinations related to the level of the state defense capability; 4) Methods of forensic examination associated with work of commanders (headquarters) and military units while preparation and performance of military (service-combat) operations ¹ (*Reestr metodyk provedennia sudovyh ekspertyz*, 2021). Obviously, these methods do not cover the full range of indicated tasks. Under such circumstances, there may be motivated doubts regarding scientific validity of forensic examination results and possibility of their use in court proceedings as a source of evidence. And the attempts of forensic experts to “fit” forensic science theory into practice seem illogical and only increase doubts as to scientific nature of this type of expert researches (*Savechko, Kozlov*, 2020).

As for qualified specialists: forensic experts (though it remains unclear what knowledge is required to perform forensic examinations), as of March 2021, in Ukraine, 10 forensic experts are certified in the expert specialization: 16.1 *Military Forensics* (*Reestr atestovanyh sudovyh expertiv*, 2021). All forensic experts are employees of state specialized institutions: 4 people of: National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute”; 6 people of: Kyiv Scientific Research Institute of Forensic Expertise. On the other hand, there are no forensic experts specialized in this field in the Expert Service of the Ministry of Defence of Ukraine.

The conducted methodological analysis of military forensics demonstrates a dangerous tendency to ignore laws of scientific knowledge development (in particular, forensic expertology) and create conditions for principles contravention of not only forensic activity but also of justice in general.

Current theory of forensic expertology for new species and types of forensic examinations suggests the following “evolutionary” order (*Rossinskaya*, 2016, p. 28):

- determining the subject of forensic examination;
- specification and standardization of expert tasks;
- development of the list of questions based on standard expert tasks addressed for forensic examination solution;
- personification and classification of expert research objects;
- selection of methods in the relevant field science and determination of their specifics;
- development of expert technologies in accordance with expert research stages;
- formation of the terminological apparatus of the corresponding forensic examination classification group;

¹ Дата держреєстрації 14.02.2020 р., розробник — Київський НДІСЕ Мін'юсту України.

- the development of a technology for preparation of a forensic expert conclusion.

In our view, only such an order of development of any kind of forensic examination (in particular, military) can become a key for drawing a qualitative expert conclusion for its further corresponding assessment by the subject of investigation and court.

Conclusions. The methodological analysis of military forensics helps to note that creation and further development of forensic military examination as an independent stratification unit occurs in violation of methodological principles of forensic expertology, which forms dangerous tendencies for assessing expert opinions as a source of evidence. Therefore, there is an urgent need to reconsider the place and essence of military forensics in the existing classification system of forensic examinations in Ukraine, which will ensure introduction of a unified methodological approach to the formation of new forensic science units and guarantee the declared principles of forensic science in particular and justice in general.

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П. Є. Антонюк

Методологічний аналіз військової експертизи

Поява самостійних одиниць судової експертизи є результатом розвитку наукових знань, ігнорування яких під час здійснення судово-експертної діяльності призводить до підміни судовою експертизою процесу доказування.

Мета статті — провести методологічний аналіз предмета, об'єктів і завдань судової військової експертизи та її місця в сучасній класифікаційній системі судових експертиз.

Проаналізовано структурні складові військової експертизи — предмет, об'єкти, завдання та спеціальні знання. У результаті з'ясовано, що формування військової експертизи як самостійної стратифікаційної одиниці відбулося з порушенням методологічних засад, розроблених судовою експертологією. Зроблено висновок про необхідність перегляду місця й сутності військової експертизи в наявній класифікаційній системі судових експертиз в Україні.

Ключові слова: *судова експертологія, судова експертиза, спеціальні знання, військова експертиза, предмет військової експертизи, об'єкти військової експертизи, завдання військової експертизи, система судових експертиз.*

П. Е. Антонюк

Методологический анализ военной экспертизы

Появление новых самостоятельных единиц судебной экспертизы — логичный результат развития научных знаний и судебно-экспертной деятельности, если такой процесс происходит на основании разработанных методологических основ судебной экспертологии, что обеспечивает научность новых видов судебной экспертизы, организационно-правовой порядок их проведения и допустимость их результатов для обеспечения правосудия. Игнорирование научных подходов при осуществлении судебно-экспертной деятельности в Украине и попытки приспособить её под нужды следственной и судебной практики не могут не вызывать беспокойства, особенно когда речь идёт о попытке подмены судебной экспертизой процесса доказывания.

Цель статьи — на основании общей теории судебной экспертологии провести методологический анализ предмета, объектов и заданий судебной военной экспертизы и её места в современной общей классификационной системе судебных экспертиз.

Методологию проведённого исследования составили положения материалистической диалектики как всеобщего метода познания, а также совокупность методов формальной логики для решения отдельных заданий исследования — анализ, синтез, аналогия, сопоставление, сравнение, дедукция.

В ходе исследования с целью установления состоятельности образования военной экспертизы как самостоятельной стратификационной единицы были проанализированы её структурные составляющие — предмет, объекты, задания и специальные знания, необходимые для их решения.

В ходе проведённого методологического анализа было выяснено, что формирование военной экспертизы как самостоятельной стратификационной единицы судебных экспертиз произошло с нарушением методологических основ, разработанных судебной экспертологией, и эволюционных путей генезиса новых видов судебных экспертиз. В результате проведённого исследования сделан вывод о необходимости пересмотра места и сути военной экспертизы в существующей классификационной системе судебных экспертиз в Украине, что обеспечит единство методологического подхода к образованию новых единиц судебной экспертизы и гарантирует задекларированные принципы судебно-экспертной деятельности.

Ключевые слова: *судебная экспертология, судебная экспертиза, специальные знания, военная экспертиза, предмет военной экспертизы, объекты военной экспертизы, задания военной экспертизы, система судебных экспертиз.*

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Features of establishing the presence of blood in old stains by the method of thin-layer vertical chromatography

Due to the fact that the bloodstain pattern analysis takes the first place in the structure of the study of biological objects, the question of the study of blood patterns is relevant today. The main task (that will allow to solve the following, which puts the investigation before the experts) is to prove that these patterns, which are examined, contain blood, (regardless of their remoteness, attempts to destroy patterns of blood), define its types or refute the presence of blood in blood. If the expert fails to prove the presence of blood, he must refuse to address the following issues. Otherwise, the expert may obtain results that will ultimately lead him to an erroneous conclusion.

The article considers options for extraction of old blood stains in order to establish the presence of blood by the method of thin-layer vertical chromatography. This question is still relevant, as biological material can change under the influence of environmental factors and time and this can be an obstacle to establishing the fact of its presence on physical evidence, and also it can do harm the quality of the study and the correctness of conclusions, made as a result of the study. In order to select substances that could provide rapid extraction of old blood stains, a study was performed using weak solutions of alkalis and acids and subsequent determination of the presence of blood by thin layer vertical chromatography. In immunological studies, there have been cases where blood crusts on non-hygroscopic surfaces under the influence of natural factors (such as high temperatures and direct sun rays) have not been extracted in saline and distilled water for several days. In addition, when using known blood samples in the reactions, the dependence of the saturation of the extracts on the age of the samples and the time of their extraction. These observations prompted researches in the sector of biological research and accounting of the Cherkasy NDEKs of the Ministry of Internal Affairs on methods for extracting

old blood stains, which would allow to detect blood in the shortest possible time by the method of thin-layer vertical chromatography.

Keywords: *old blood stains, thin-layer vertical chromatography, forensic expertise, haemoglobin, extracting.*

Formulation of Research Problem. Every year the number of crimes against a person increases significantly. Accordingly, there is a need for rapid and high-quality investigation of physical evidence and objects based on the combined use of data from science, criminalistics and other areas of expert research.

Traces of biological origin are strong material evidence not only in criminal proceedings for murder, grievous bodily harm, robbery, rape, robbery, but also in other crimes committed with human participation ¹. Due to the fact that the bloodstain pattern analysis takes the first place in the structure of the study of biological objects, the question of the study of blood patterns is relevant today ².

The main task (that will allow to solve the following, which puts the investigation before the experts), is to prove that these patterns, which are examined, contain blood, (regardless of their remoteness, attempts to destroy patterns of blood), find out its types or refute traces of blood. If the blood belongs to a person, then establish the possibility of its origin from a particular person, which is primarily determined by identifying the group affiliation by the system AB0 ³.

If the expert fails to prove the presence of blood, he must refuse to solve the following issues. Otherwise, the expert may obtain results that will eventually lead him to an erroneous conclusion ⁴.

Therefore, the expert must clearly, and most importantly — reasonably, using modern methods, to decide on the presence or absence of blood at the facilities provided for examination ⁵.

Any biological material seized at the scene or crime scene (including blood) may be altered or even destroyed in the event of improper removal or non-compliance with the packaging conditions. It is important to store seized biological traces, for which measures are taken to create artificial conditions that

¹ Фурман Я. В., Юсупов В. В., Котляренко Л. Т., Дмитрук Р. С. Особливості збирання у досудовому провадженні біологічних слідів людини : метод. рек. Київ, 2016. 44 р.

² Кривда Р. Г., Юшук К. М., Стоєва М. І. Дослідження можливості використання імунохроматографічного тесту «Cito Test Fecal Occult Blood» для встановлення наявності та видової приналежності слідів крові на речових доказах при проведенні комплексної судово-медичної експертизи. *Молодий вчений*. 2017. № 4. Р. 44.

³ Бурчинський В. Г., Дем'янчук А. П., Хохолєва Т. В. Дослідження рідкої крові та її слідів на речових доказах : метод. рек. Київ, 2010. 32 р.

⁴ Туманов А. К. Судебно-медицинское исследование вещественных доказательств. Москва, 1961. 580 р.

⁵ Дяченко Н. М., Єрмолаєва А. О., Чепіга С. М. Судово-медичні імунологічні дослідження слідів крові та виділень : зб. метод. рек. Київ, 2005. 70 р.

prevent the action of natural factors that can destroy the structure of biological objects ¹.

Analysis of Essential Researches and Publications. Determination of the presence of blood by thin-layer vertical chromatography is one of the most common and convenient methods. There is no information in the literature on the peculiarities of extraction and further study of old blood stains, which for various reasons are difficult to extract.

The **Article Purpose** is to identify substances that could provide rapid extraction of old blood stains for further use of extracts to determine the presence of blood by thin-layer vertical chromatography.

Main Content Presentation. During immunological studies there were cases when blood crusts on non-hygroscopic surfaces have not been extracted in saline and distilled water for several days under the influence of natural factors (such as high temperatures and direct sunlight).

In addition, when using known in the laboratory blood samples in the reactions revealed the dependence of the saturation of the extracts on the age of the samples and the time of their extraction. These observations prompted the staff of the sector of biological research and accounting at Cherkasy RECC of the MIA of Ukraine to investigate the methods for extracting old blood stains, which would allow to detect blood in the shortest possible time by the method of thin-layer vertical chromatography.

The thin-layer chromatography is an evidence-based method for detecting haemoglobin or its derivatives. This method has a number of advantages, as it helps to maximize the preservation of information about the detected blood for further study (determination of blood protein, detection of group antigens, DNA analysis, etc.) and the rational use of this material ².

Haemoglobin is a mandatory component of erythrocyte stroma. It belongs to the protein compounds, contains the protein globin and a colored prosthetic group — heme ³.

Determination of the presence of blood is based on the peroxidase properties of haemoglobin, which (similar to peroxidase enzymes) has the ability to catalyze redox reactions. Haemoglobin decomposes hydrogen peroxide with the release of atomic oxygen, which, in turn, oxidizes benzidine, accompanied by discoloration of the developers. The positive result of the reaction is evidenced by the appearance of blue zones on the plate with $R_f = 0.82-0.9$.

¹ Фурман Я. В., Юсупов В. В., Котляренко Л. Т., Дмитрук Р. С. Особливості збирання у досудовому провадженні біологічних слідів людини : метод. рек. Київ, 2016. 44 р.

² Бурчинський В. Г., Дем'янчук А. П., Хохолєва Т. В. Дослідження рідкої крові та її слідів на речових доказах : метод. рек. Київ, 2010. 32 р.

³ Кривда Г. Ф., Дем'янчук А. П., Котельникова В. О., Старовойтова Р. О., Кривда Р. Г. Судово-медичне дослідження речових доказів : навч.-метод. посіб. Херсон, 2014. 460 р.

In the guidelines, it is recommended to extract the objects with distilled water or saline solution of sodium chloride at a temperature of +4 to +8 °C. The extraction time depends on the solubility of the stain substance and can last from 1 hour to 2-3 days (the optimal extraction time is 18-20 hours).

If bloodstains on physical evidence have a significant history of formation (3-6 months or more) or were subject to the fixing action of sunlight, chemicals, alcohols, etc., the extraction can take place at room temperature, but not higher than 22 °C¹.

During the study of old blood samples, it was found that with the help of the above-mentioned recommendations to achieve saturation of the extract and obtain on the chromatographic plate spherical blue stains with $R_f = 0.82-0.9$, which corresponds to R_f blood, failed. Given the protein nature of haemoglobin, the possibility of influencing its structure with solutions of weak acids (acetic acid) and weak alkalis (10% ammonia solution) was considered.

Materials and methods of research. The research was conducted in 2020-2021 on the basis of the laboratory of the sector of biological research and accounting at Cherkasy RECC of the MIA of Ukraine. To achieve this goal, the blood samples, taken in 2011 from living people, without the addition of anticoagulants, clot activators, etc., poured on sterile gauze wipes and dried in sterile laboratory conditions with temperature and humidity, which meets the requirements of the biological laboratory, without direct sunlight, were used. Subsequently, blood samples dried on sterile gauze wipes were placed in paper rolls packed in paper envelopes. The prepared samples were stored in cabinets in the laboratory.

The method of detecting traces of blood contains the following stages:

- preparation of clippings from old blood samples;
- preparation of clippings from controls of objects-carriers and gauze;
- preparation of clippings from fresh blood samples;
- preparation of 0.01% solution of erythrocytes - *witness*;
- preparation of 10% ammonia solution;
- preparation of 10% acetic acid solution;
- extraction of clippings;
- research by thin-layer vertical chromatography.

Results of the research

Extraction method

For extraction, four clippings were prepared from obsolete traces of blood, from fresh blood samples and controls of carriers to them, which were placed in test tubes and separately filled (with a slight excess) with distilled water, saline, 10% ammonia solution and 10% acetic acid solution. The tubes were closed and extracted for 18 hours in a household refrigerator at a temperature of +6 °C.

¹ Кривда Г. Ф., Дем'янчук А. П., Котельникова В. О., Старовойтова Р. О., Кривда Р. Г. Ор. cit.

Research by thin-layer vertical chromatography method

The obtained extracts were centrifuged for 5 min at 1500 rpm and examined by thin-layer vertical chromatography method. The distribution was performed on a plate *Sorbfil PTSH-P-A-UV* length of 100 mm in a system of solvents n-butanol — glacial acetic acid — distilled water (4: 1: 2) using as a *witness* 0.01 % solution of pre-known blood.

One drop of each extract was applied in layers to the plate. Additionally, 10% ammonia solution, 10% acetic acid solution and physiological saline were applied to the plate for control. The plates were then heated for 15 min at 100 °C and placed in a solvent chamber. The plate was removed when the solvent level did not reach 10 mm to its upper edge, dried at room temperature to eliminate the smell of acetic acid, and then treated successively with 1% alcohol solution of benzidine and 3% hydrogen peroxide solution and determined *Rf witness* and extracts.

As a result of the action of developers, blue stains of spherical shape with $Rf = 0.89$, which corresponded to *Rf witness*, observed:

- with extracts from a fresh blood sample extracted in distilled water, saline, 10% ammonia solution and 10% acetic acid solution;
- with extracts from old blood samples extracted in 10 % ammonia solution and 10% acetic acid solution.

Controls of object-carriers extracted in distilled water, saline, 10% ammonia solution and 10% acetic acid solution gave a negative reaction result. Also, a negative reaction result was obtained with old blood samples, which were extracted in distilled water and in saline.

The extraction of the test samples was extended for another 24 hours, after which the extracts were centrifuged again and the research was performed by thin-layer vertical chromatography method under the above conditions. The obtained results corresponded to the previous ones, the indicators of extracts of old blood samples in distilled water and in physiological solution did not change, i.e., no blue spherical stains with *Rf* corresponding to *Rf witness* were observed on the chromatographic plate.

The extraction was extended to 20 days, until the old blood samples appeared on the chromatographic plate as blue spherical stains with *Rf*, which corresponds to *Rf witness*. The stains were not expressed: the detection of stains is almost on the verge of detection.

The results of the study are given in table. 1.

Table 1

SN (№)	Studied extract	Day									
		1st	2nd	3rd	6th	9th	10th	14th	16th	18th	20th
1	Witness 0,01 %-and Rf = 0,89	+	+	+	+	+	+	+	+	+	+
2	Old blood sample with saline	-	-	-	-	-	-	-	-	-	-/+
3	Old blood sample with distilled water	-	-	-	-	-	-	-	-	-	-/+
4	Old blood sample with 10% ammonia solution	+	+	+	+	+	+	+	+	+	+
5	Old blood sample with 10% acetic acid solution	+	+	+	+	+	+	+	+	+	+
6	Fresh blood sample with saline	+	+	+	+	+	+	+	+	+	+
7	Fresh blood sample with distilled water	+	+	+	+	+	+	+	+	+	+
8	Fresh blood sample with 10% ammonia solution	+	+	+	+	+	+	+	+	+	+
9	Fresh blood sample with 10% acetic acid solution	+	+	+	+	+	+	+	+	+	+
10	Control of the object- carrier with saline	-	-	-	-	-	-	-	-	-	-
11	Control of the object- carrier with distilled water	-	-	-	-	-	-	-	-	-	-
12	Control of the object- carrier with 10% ammonia solution	-	-	-	-	-	-	-	-	-	-
13	Control of the object- carrier with 10% acetic acid solution	-	-	-	-	-	-	-	-	-	-

SN (№)	Studied extract	Day									
		1st	2nd	3rd	6th	9th	10th	14th	16th	18th	20th
14	Control of 10% ammonia solution	—	—	—	—	—	—	—	—	—	—
15	Control of 10% acetic acid solution	—	—	—	—	—	—	—	—	—	—
16	Saline control	—	—	—	—	—	—	—	—	—	—
17	Gauze control	—	—	—	—	—	—	—	—	—	—

Explanation of Symbols:

«—» — stain is not detected;

«+» — stain is detected;

«-/+» — stain is detected on the verge of detection.

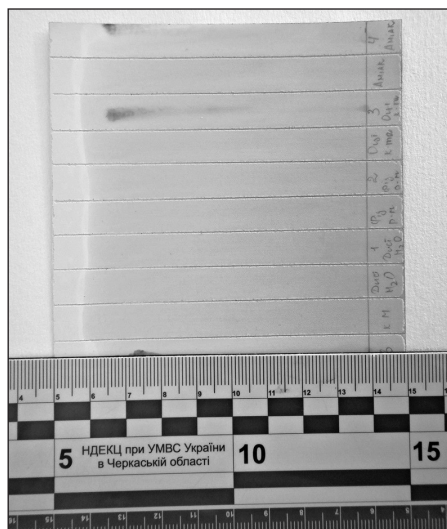


Fig. 1. Figure of the chromatographic plate with the studied objects after the first day of extraction

As a result of the study, it was found that in the case of extraction of:

- old blood samples (dried 9 years ago) with distilled water and saline to form blue spherical stains on a chromatographic plate with $R_f = 0.89$, which corresponds to R_f witness, only on the 20th day of extraction;

- old blood samples (dried 9 years ago) with 10% ammonia solution and 10% acetic acid solution formation of spherical blue stains on the chromatographic plate with $R_f = 0.89$, which corresponds to R_f witness, obtained after the first day of extraction;
- fresh blood samples with distilled water and saline to form blue spherical stains on a chromatographic plate with $R_f = 0.89$, which corresponds to R_f witness, obtained after the first day of extraction;
- controls of object-carriers with distilled water, saline, 10% ammonia solution and 10% acetic acid solution obtained a negative reaction result, i.e. blue stains of spherical shape were not formed.

Conclusions

It was found that the determination of the presence of blood by thin-layer vertical chromatography after conventional extraction of objects with saline or distilled water in old blood samples is complicated by long-term extraction.

If weak solutions of alkalis and acids (such as 10% ammonia solution and 10% acetic acid solution) are used, positive results are obtained after the first day of extraction.

The obtained extracts with 10% ammonia solution and 10% acetic acid solution require further research – to establish their suitability during other immunological tests, in addition to determining the presence of blood.

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К. В. Мосіюк, О. А. Карасьова

Особливості визначення наявності крові

в застарілих плямах методом

тонкошарової вертикальної хроматографії

Розглянуто варіанти екстрагування застарілих плям крові з метою визначити наявність крові методом тонкошарової вертикальної

хроматографії. Це питання є актуальним, оскільки біологічний матеріал має здатність змінюватися під впливом чинників зовнішнього середовища й часу, що може стати на заваді виявленню його наявності на речовому доказі, а також якості проведеного дослідження та правильності зроблених у результаті дослідження висновків. Із метою добору речовин, які б могли забезпечити швидке екстрагування застарілих слідів крові, проведено дослідження з використанням слабких розчинів лугів і кислот та подальшим визначенням наявності крові методом тонкошарової вертикальної хроматографії.

Ключові слова: застарілі сліди крові, тонкошарова вертикальна хроматографія, судова експертиза, гемоглобін, екстрагування.

Е. В. Мосиук, О. А. Карасёва

Особенности установления наличия крови в застарелых пятнах методом тонкослойной вертикальной хроматографии

Поскольку экспертиза следов крови занимает первое место в структуре исследования биологических объектов, в настоящее время актуален вопрос исследования следов крови. Основная задача (позволяющая решить вопросы, которые следствие ставит перед экспертами) — это доказать, что в представленных на экспертизу следах имеется кровь (независимо от их давности и/или попытки их уничтожить) и выявить её видовую принадлежность или опровергнуть наличие крови в следах. Если эксперту не удастся доказать наличие крови, то он должен отказаться от решения следующих вопросов. В противном случае эксперт может получить результаты, которые в конечном итоге приведут его к ошибочному выводу.

В статье рассмотрены варианты экстрагирования застарелых пятен крови для установления наличия крови методом тонкослойной вертикальной хроматографии. Этот вопрос весьма актуален, поскольку биологический материал может изменяться под воздействием факторов внешней среды и времени, что может помешать установить факт его наличия на вещественном доказательстве, а также навредить качеству проведённого исследования и правильности сделанных в результате исследования выводов. Для подбора веществ, которые могли бы обеспечить быстрое экстрагирование застарелых следов крови, провели исследование с использованием слабых растворов щелочей и кислот и последующим установлением наличия крови методом тонкослойной вертикальной хроматографии. В ходе иммунологических исследований случалось, что корочки крови на негигроскопичных поверхностях под воздействием природных факторов (таких, как высокие температуры и прямые солнечные лучи) не подвергались экстрагированию в физиологическом растворе и дистиллированной воде в течение нескольких суток. Кроме того, при использовании известных образцов крови в реакциях выявили зависимость насыщенности экстрактов от давности образцов и от времени их

экстрагирования. Эти наблюдения сподвигли сотрудников сектора биологических исследований и учёта Черкасского НИЭКЦ МВД Украины исследовать способы экстрагирования застарелых пятен крови, которые позволяли бы выявить кровь в кратчайшие сроки методом тонкослойной вертикальной хроматографии.

Ключевые слова: застарелые следы крови, тонкослойная вертикальная хроматография, судебная экспертиза, гемоглобин, экстрагирование.

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Mosiiuk E., Karasova O. (2021). Features of establishing the presence of blood in old stains by the method of thin-layer vertical chromatography. *Theory and Practice of Forensic Science and Criminalistics*. 23rd Issue, p. 400—409. DOI: 10.32353/khrife.1.2021.31.

Contributors

The authors contributed solely to the intellectual discussion underlying this paper, case-law exploration, writing and editing, and accept responsibility for the content and interpretation.

National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute” won the competition for the implementation of the Ukrainian-Latvian research project “Open Educational Resource: Forensic Science” in 2021—2022

Young and talented scientists of the National Scientific Centre “Hon. Prof. M. S. Bokarius Forensic Science Institute” has won the joint Ukrainian-Latvian science competition of research projects announced by the Ministry of Education and Science of Ukraine and the State Education Development Agency of the Republic of Latvia.

The research proposal: *Open Educational Resource: Forensic Science*, aims to create an educational “open access” web resource to scientific papers, manuals, and video presentations of the forensic expert work during forensic examinations, was highly appreciated at the third meeting of leading experts of the Ukrainian-Latvian Joint Commission on Scientific and Technological Cooperation.

The Ukrainian Head of the research project is **Olena Agapova**, Head of the Department of International Cooperation and Work with Foreigners of National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute”, PhD in Law; the Latvian one is **Karina Palkova**, researcher and lecturer at the Riga Stradins University, PhD in Law.



The responsible researchers are young research and forensic experts: **Vadym Khosha, Mykhailo Mozhaiev, Serafyma Hasparian, Aelita Zile** and **Yanis Gracis**.

*Information prepared by **Olena Agapova**,
Head of the Department of International Cooperation and Work
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PhD in Law*

International Investment Forum “Open Region” dedicated to the 30th anniversary of the Institution of Higher Education *International University of Business and Law* (Kherson)

On January 29, 2021, the delegation of National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute”, headed by **Oleksandr Kliuiev**, Director of Center, Doctor of Law, Professor, Honored Lawyer of Ukraine, took part in the International Investment Forum: *Open Region* held on the basis of IHE International University of Business and Law (Kherson).

The event was held to discuss the development of the region, creation of effective mechanisms for investment practice, monitoring, cyclical diagnostics and control of investment activities in the region.

Oleksandr Kliuiev addressed the audience and congratulated the employees of the Institution on the 30th anniversary of its foundation.



The event was also attended by representatives of Kherson Regional State Administration and Kherson City Council, business, banking and innovative entrepreneurship in Ukraine, Germany, Israel, USA, Belarus, Turkmenistan, the Council of Entrepreneurs and Industrialists of Germany and others.



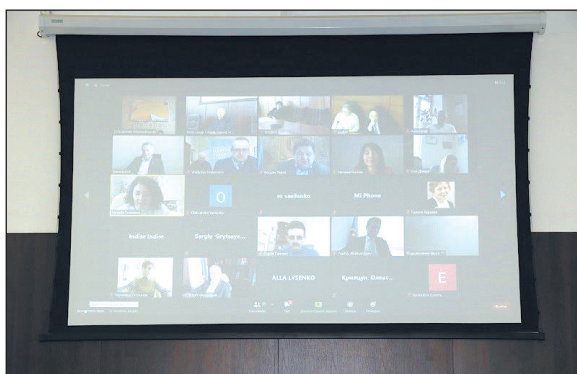
The friendly and festive atmosphere of the International Investment Forum “Open Region” contributed to a constructive discussion of all pressing issues.

*Information prepared by **Serafyma Hasparian**,
Assistant Director of National Scientific Center*

“Hon. Prof. M. S. Bokarius Forensic Science Institute”, PhD in Law

International Scientific-Practical Conference on the topic: *Forensic Examination of Intellectual Property: realias and prospects*

On February 19, 2021, an International Scientific-Practical Conference on the topic: *Forensic Examination of Intellectual Property: realias and prospects* was held online on the basis of Lviv Research Institute of Forensic Science Ministry of Justice of Ukraine.

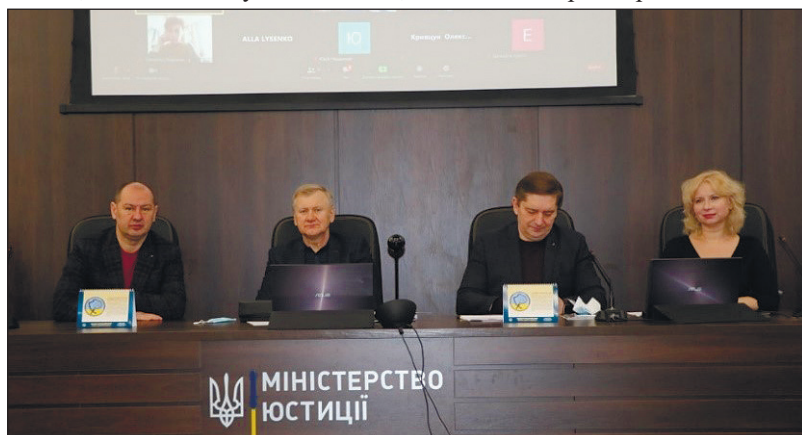


The event was invented by **Oksana Kumanska-Nor**, Director of Lviv RIFS.

The conference participants were greeted by: **Andrii Haichenko**, Deputy Minister of Justice of Ukraine; **Natalia Tkachenko**, Director of the Department

of Expert Support of Justice of the Ministry of Justice of Ukraine; **Bohdan Lyov**, Deputy Head of the Supreme Court, Head of the Commercial Court of Cassation; **Ihor Benedysiuk**, Judge of Economic Court of Cassation of the Supreme Court; directors of forensic research institutions of the Ministry of Justice of Ukraine, and others.

On behalf of National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute”, **Oleksandr Kliuiev**, Director of Center, Doctor of Law, Professor, Honored Lawyer of Ukraine, addressed the participants of the event.



At the conference participants heard reports on thematic areas: *Role and importance of forensic examination of intellectual property*, and *Industrial property and the role of forensic science: particular aspects*, as well as an interactive panel: *Artificial Intelligence: whether it takes the work away from experts or, conversely, adds?*

A report on *Peculiarities of the study of pharmaceutical labels registered as trademarks* was made by **Alla Kopytko**, a senior researcher at NSC “Hon. Prof. M. S. Bokarius FSI”.



Reports for the conference within Section I: *The role and importance of forensic examination of intellectual property* were prepared by: **Pavlo Lutsyuk**, member of the Scientific Advisory Board at the Supreme Court, Professor of Civil Law at the National Academy of Internal Affairs, Honored Lawyer of Ukraine, Doctor of Law, on the topic: *Peculiarities of the appointment of forensic examinations of intellectual property and its assessment by the court*; **Oleksandr Zherebko**, Head of the Department of Regulatory and Methodological Activities and Standardization of Kyiv Research Institute of Forensic Expertise of the Ministry of Justice of Ukraine on the topic: *Forensic Examination of intellectual property: general concepts*; **Natalia Kisil**, PhD in Agriculture Sciences, Senior Researcher, Head of *Expert&Technology* Bureau, Senior Lecturer of the Department of Intellectual Property and Law of Kyiv Institute of Intellectual Property and Law of National university “Odesa Law Academy” on the topic: *Topical issues of forensic examination of intellectual property made available on the Internet*.

Within Section II *Industrial property and the role of forensic science: particular aspects*, by **David Masker**, Professor of the Center for Commercial Law Studies of the Queen Mary University of London (UK), Certified Patent Attorney, European Attorney for Patents, Trademarks and Industrial Designs, on the topic: *Experience of British judges in considering cases on industrial samples*; by **Roman Kirin**, Doctor of Law, Docent, Senior Researcher, Forensic expert at Dnipropetrovsk RECC of MIA of Ukraine, on the topic: *Plagiarism forensic examination of scientific papers: problematic issues*; by **Galyna Avdeeva**, PhD in Law, Senior Researcher, Principal Researcher of Academician Stashis Scientific Research Institute for the Study of Crime Problems NALS of Ukraine, and by **Hryhorii Prohorov-Lukin**, PhD in Law, Certified Patent Attorney of Ukraine, Forensic Expert, Lecturer at Higher School of Advocacy of the Ukrainian National Bar Association, on the topic: *Review of a forensic expert conclusion as a means of assessing its reliability*.

Within Section III, the interactive panel *Artificial Intelligence: whether it take the work away from experts or, conversely, add?*, by **Dmytro Mishkin**, Computer Vision Researcher at the Center for Machine Perception, Czech Technical University in Prague on the topic: *How is everything arranged?*; by **Taras Slipets**, Senior Software Engineer at FlixBus, Machine Learning Engineer, Munich, Germany on the topic: *Demonstration of the neural network in real time*; by **Karina Liutenko**, Munich Intellectual Property Law Center, LL.M., Germany on the topic: *Challenges that neural networks can pose to forensic experts*; by **Mykhailo Kalinichenko**, PhD in Philology Sciences, Docent, Leading Researcher of Lviv RIFS.

The participants of the conference *Forensic Examination of Intellectual Property: realias and prospects* considered many important issues in the field of intellectual property.

*Information prepared by **Kateryna Sylenok**,
Researcher at NSC "Hon. Prof. M. S. Bokarius FSI"*

Colloquium with a representative of the Israeli police on the practice of forensic examinations

On March 12, 2021, on the basis of NSC "Hon. Prof. M. S. Bokarius Forensic Science Institute", **Borys Geller**, a retired Israeli police major and a leading specialist in the forensic laboratory with 20 years of experience presented a lecture for researchers and forensic experts.



He spoke about modern and effective methods of detecting handprints both in the laboratory and at the crime scene; the system of subjects of forensic activity of Israel; complex methods of detecting traces of blood; features of cross-examination of a forensic expert; nuances of training specialists in the field of office work, work with personnel, as well as persons with administrative and economic responsibilities.

Listeners highly appreciated the lecture on poorly researched and exclusively applied topics in the field of forensic trace evidence researches.

*Information prepared by **Olena Agapova**,
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PhD in Law*

Events on the occasion of the 150th anniversary of the birth of Mykola Valyashko, the founder of the National University of Pharmacy

On March 18, 2021, representatives of National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute”, headed by ***Ella Simakova–Yefremian***, Deputy Director for Academic Affairs of the Center, Doctor of Law, Senior Researcher, Honored Worker of Science and Technology of Ukraine, attended the National University of Pharmacy where the celebrations on the occasion of the 150th anniversary of the birth of Mykola Valyashko, the founder of the establishment took place.

The event was attended by honorary guests, namely ***Ihor Terekhov***, Kharkiv City Council Secretary, ***Mykhailo Cherniak***, Deputy Head of Kharkiv Regional State Administration, ***Volodymyr Semynozhenko***, Director General of SSI “Institute for Single Crystals” of the National Academy of Sciences of Ukraine, local government representatives, heads of higher educational establishment, and others.



It is worth noting that Mykola Valyashko jointly with Mykola Bokarius, the founder of NSC “Hon. Prof. M. S. Bokarius FSI”, practically started two interconnected branches: Ukrainian pharmaceuticals and forensic examination. The joint contribution of these outstanding scientists to the development of science will be remembered in the future.

The XXVII International Scientific and Practical Conference of Young Scientists and Students on the topic: *Topical issues of new medicines development* took place within the framework of the festivities. The work of the conference continued, in particular, in the following sections:

1. Synthesis of physiologically active substances.
2. Research of medicinal plants and creation of phytopreparations.
3. Standardization of drugs and pharmaceutical analysis.
4. Technology of pharmaceuticals and perfumes and cosmetics.
5. Biopharmaceutical aspects of extemporaneous drugs.

7. Modern biotechnology.
8. Pharmacology, pharmacotherapy and physical rehabilitation.
9. Modern aspects of laboratory, microbiological and immunological tests in medicine and pharmacy.
10. Veterinary medicine and pharmacy.
11. Clinical pharmacy.
12. Socio-economic research in pharmacy.
13. Pharmaceutical marketing and management, pharmacoeconomics and commodity analysis in pharmacy.
14. Management, economics and quality assurance in pharmacy.
15. Social sciences.
16. Philology.
17. Educational and information technologies in pharmacy.

The guests were given a tour of the institution, acquainted with the equipment and technical support of the university. The celebration left a pleasant impression on guests and participants.

*Information prepared by **Kateryna Sylenok**,
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International Research and Practice Conference- Polylogue: Topical Issues of Forensic Science and Criminalistics

On April 15—16, 2021, on the base of the National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute” the International Research and Practice Conference-Polylogue on Topical Issues of Forensic Science and Criminalistics was held in online mode.

The conference was opened with an introductory speech by the Chairman of the Organizing Committee of the event: **Oleksandr Kliuiev**, Doctor of Law, Professor, Honored Lawyer of Ukraine, Director of NSC “Hon. Prof. M. S. Bokarius FSI”.



Congratulations were made by representatives of public authorities, forensic institutions, higher education institutions of Ukraine and foreign countries: **Andrii Haichenko**, Deputy Minister of Justice of Ukraine; **Volodymyr Zhuravel**, 1st Vice President of the National Academy of Legal Sciences of Ukraine; **Natalia Tkachenko**, Director of the Department of Expert Support of Justice of the Ministry of Justice of Ukraine; **Olesia Vashchuk**, Chairman of the Council of Young Scientists of the Ministry of Justice of Ukraine; heads of specialized expert institutions and higher educational institutions of Ukraine abroad and other participants.

Scientists and forensic experts not only from Ukraine but also from Great Britain, Greece, Latvia, Lithuania, Poland, Moldova, Montenegro, Macedonia, Israel, Azerbaijan, Belarus, Armenia, Georgia, Kazakhstan, Uzbekistan and other countries took part in the conference during two days.

Within the framework of the first panel discussion: *Problems of criminalistics and normative and legal regulations in the field of expert ensuring of Justice*, on April 15, the reports prepared by: **Valerii Shepitko**, Head of the Department of Criminalistics at Yaroslav Mudryi National Law University, Academician of ANALS of Ukraine; **Vidmantas Kurapka**, Professor at Mykolas Romeris University; **Hendryk Malevski**, Professor at Mykolas Romeris University; **Snieguolė Matulienė**, Professor of at Mykolas Romeris university; **Serhii Cherniavskiy**, Vice-Rector of National Academy of Internal Affairs (hereinafter referred as NAIA); **Yuliia Chornous**, Professor at NAIA; **Aleksandar Ivanović**, Director of the Forensic Center of Montenegro; **Dariusz Zuba**, Director of Poland Instytut Ekspertyz Sadowych im. Prof. Dr. Jana Sehná; **Olga Cataraga**, Director al Centrului Național de Expertize Judiciare (Republic of Moldova); **Patvakan Voskanian**, Deputy Director of National Bureau of Expertises of the National Academy of Sciences of the Republic of Armenia; **Raimonds Apinis**, Deputy Director of the State Forensic Science Bureau of the Republic of Latvia, and other scientists were discussed.



The third panel discussion included: **Olena Agapova**, the Ukrainian Head of the Ukrainian-Latvian research project: *Open Educational Resource: Forensic Science*, Head of the Department of International Cooperation and Work with Foreigners of NSC “Hon. Prof. M. S. Bokarius FSI”; **Aelita Zile**, Lecturer at Rīga Stradiņš University.

Within the framework of the second panel discussion on April 16, the reports prepared by: **Valentyna Korzh**, Professor at Kharkiv National University of Internal Affairs; **Volodymyr Yusupov**, Leading Researcher at the National Academy of Internal Affairs; **Pavlos Kipouras**, Professor at The Democritus University of Thrace (Greece); **Marharyta Zhuravlova**, Head of the Department of Odessa RIFS; **Borys Geller**, Ex-employee of the forensic police examination department of Israeli police; **Pavel Giverts**, Employee of the Israeli Police Ballistic Laboratory; **Andrii Poltavskiy**, Assistant Director of Kyiv RIFE, **Yu. A. Yarotska**, Head of the Laboratory of Psychological and Linguistic Research of the SI: *Scientific and Practical Center of the State Forensic Examinations Committee of the Republic of Belarus*; **Alexander Sainchin**, Head of the Department of Branch Law of Kherson State University, and other scientists were discussed.

During the conference the collection of materials of the conference: *Topical Issues of Forensic Science and Criminalistics* was presented, where the abstracts of reports of more than 250 conference participants were published.



The event was marked by scale, friendly atmosphere and variety of discussed topics. Despite the quarantine restrictions, the event was successful: a large number of scientists and practitioners from different countries were involved, who were able to communicate, exchange and enrich their experience. Such conferences are important for the development of science and practice of forensic science and criminalistics, the creation of new developments, the improvement of scientific theories and methods of expert research, strengthening friendly relations between scientists and practitioners of different countries.

*Information prepared by **Ella Simakova-Yefremian**,
Deputy Director for Academic Affairs,
Doctor of Law, Senior Researcher
at NSC “Hon. Prof. M. S. Bokarius FSI”,
Honored Worker of Science and Technology of Ukraine*

International scientific-practical conference: *Current issues of the legal system* (Riga Stradins University)

On April 21, 2021, the staff of the National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute” took part online in the International scientific-practical conference: *Current issues of the legal system*, which was held in a video conference mode at Riga Stradins University.



The conference is organized by the Center's partners: Riga Stradins University (Latvia), Mykolas Romeris University (Lithuania), Yaroslav Mudryi National Law University (Ukraine).

The conference brought together representatives of the Supreme Court of the Republic of Latvia, the Ministry of the Interior of the Republic of Latvia, higher education institutions and research institutions of different countries, etc. The work continued in five thematic sections: civil law, criminal law, state and international law, police law, operational work.

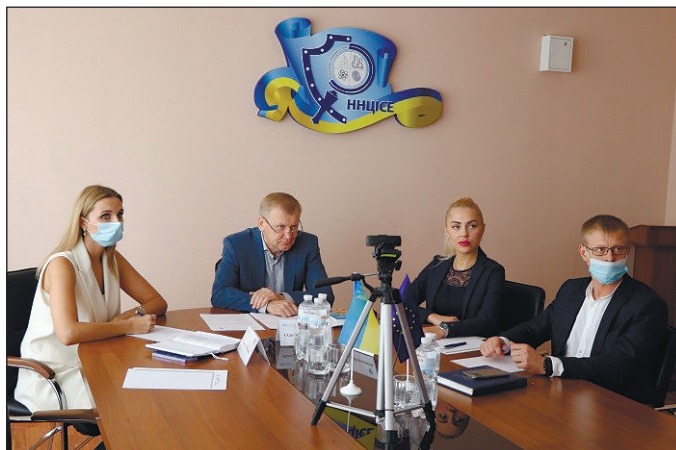
Reports were made by **Agrita Kiopa**, Vice-Rector for Science of Riga Stradiņš University; **Aivars Borovkovs**, President of the Latvian Bar Association; **Sanita Osipova**, President of the Constitutional Court; **Sandis Ģirģens**, Minister of the Interior of the Republic of Latvia; **Amit Cabravala**, a representative of the USA Embassy; **Victoria Justikis**, a representative of Mykolas Romeris University; **Davit Jandieri**, representative of Georgian Institute of Public Affairs and others.

The leadership of the Center is grateful to the organizers for the invitation, the staff of NSC “Hon. Prof. M. S. Bokarius FSI” with gratitude will continue to take part in similar events to share experiences.

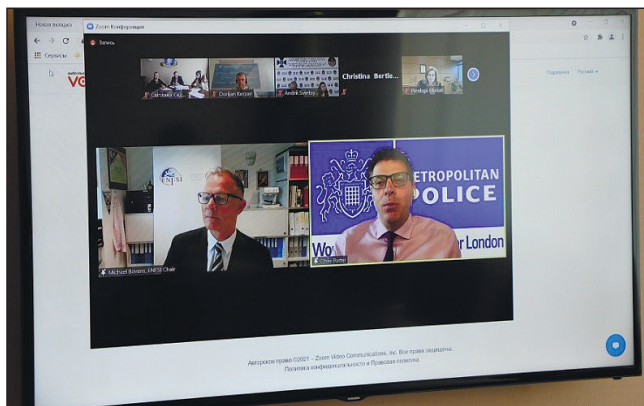
*Information prepared by **Kateryna Sylenok**,
Researcher at NSC “Hon. Prof. M. S. Bokarius FSI”*

Annual Meeting of the European Network of Forensic Science Institutes (ENFSI)

On May 27, 2021, **Oleksandr Kliuiev**, Director of NSC “Hon. Prof. M. S. Bokarius FSI”, Doctor of Law, Professor, Honored Lawyer of Ukraine, took part online in the ENFSI meeting as a permanent representative of the National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute” who has been a member of *ENFSI* since 2018.



The meeting was opened by **Pinelopi Miniati**, Director of the *ESD* Institute in Athens, and **Michael Bovens**, Chairperson of the *ENFSI*. At the beginning of the event, new permanent representatives were admitted to *ENFSI*. Another domestic institution became a member of the network: the Ukrainian Research Institute of Special Equipment and Forensic Science of SSU. Congratulations to our partners!



The agenda included consideration of the network's activities: **Dorijan Kerzan** reported on the current financial situation of *ENFSI*; **Michael Bovens** presented the *ENFSI* Board Report for 2020/21; **Pinelopi Miniati** presented the *ENFSI* Action Plan for 2021/22; **Dorijan Kerzan** provided an overview of current and planned activities of the project group of the Subcommittee on Education and Training; **Bart Nice** presented a report on the current state of the *ENFSI* White Papers, and the results obtained from them; **Stefan Becker** reported on the latest developments and activities initiated by *ENFSI*; **Richard Gill** presented an overview of the *STefa* (EU-Direct Grant 2016) and *AFORE* (EU-Direct Grant 2018) projects, information on the current state of preparation of the project proposal for the EU 2020 grant.

At the end of the meeting, **Christina Bertler** from *NFC Linköping* announced a report on the annual meeting for 2022 in Stockholm (Sweden).

The partnership with *ENFSI* provides an opportunity to share experiences in the field of forensic science and research at the international level, and the annual meeting ensures the transparency of the network.

*Information was prepared by Anton Polianskyi,
Head of R&D and Publishing Laboratory at NSC
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I International Scientific and Practical Conference: The Role and Prospects for the Development of Commodity and Economic Expertise in the Public and Private Sectors

On May 28, 2021, I International Scientific and Practical Conference: *The Role and Prospects for the Development of Commodity and Economic Expertise in the Public and Private Sectors* took place online at Odessa Research Institute of Forensic Science.

The conference addressed topical issues of economic and commodity forensic expertises. At present, almost every criminal proceeding and consideration of cases in other types of proceedings requires the appointment and conduct of forensic economic and commodity expertises and expert researches.



The conference participants were greeted by: **Yurii Cherdyntsev**, Director of Odessa Research Institute of Forensic Science; **Andrii Haichenko**, Deputy Minister of Justice of Ukraine; **Natalia Tkachenko**, Director of the Department of Expert Support of Justice of the Ministry of Justice of Ukraine; **Oleksandr Oliynyk**, Director of the Directorate of Justice and Criminal Justice of the Ministry of Justice of Ukraine; **Olesia Vashchuk**, Chairman of the Council of Young Scientists of the Ministry of Justice of Ukraine, directors of specialized expert institutions of the Ministry of Justice of Ukraine and foreign countries, leadership of higher education institutions, etc.



With a welcoming speech from National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute”, **Oleksandr Kliuiev**, Director of Center, Doctor of Law, Professor, Honored Lawyer of Ukraine, addressed the participants.

Staff of the Center: **Valentyn Fesiunin**, PhD in Law, Docent, Head of Laboratory, and **Oleksandra Manulenko** and **Tetiana Zanina**, senior researchers, prepared a report for the conference on the topic: *Tasks to be solved by commodity experts during forensic examinations.*

The rest of the conference was devoted to the following topics: *The state of economic expertise in the Republic of Moldova in the public and private sectors:* **Olga Cataraga**, Director al Centrului Național de Expertize Judiciare (Republic of Moldova); **Cara Ecaterina**, Forensic Expert of the Private Bureau of Forensic Examinations, **Cara Veaceslav**, Forensic expert of the Private Bureau of Forensic Examinations; *Service as an object of forensic commodity expertise:* **Viktor Arkhipov**, PhD in Technology, Forensic Expert of Research Center of Forensic Expertise on Intellectual Property of the Ministry of Justice of Ukraine; **Tetiana Artiukh**, Doctor of Technical Sciences, Professor of Taras Shevchenko National University of Kyiv; *Optimization of the algorithm of expert researches of audio engineering:* **Valentyna Zakharchuk**, PhD in Technology, Associate Professor of the Department of Expertise of Goods and Services of Odessa

National University of Economics; *Complexity of quality control: modern realities*: **Valentyna Pavlova**, Doctor of Economics, Professor, Professor of International Trade and Entrepreneurship, Alfred Nobel University; *Methodical aspects of the limits of competence of a forensic economist*: **Kateryna Dziubak**, PhD in Economics, Principal Forensic Expert of the Laboratory of Economic Researches of Odessa Research Institute of Forensic Science of the Ministry of Justice of Ukraine; *Conclusion of a forensic commodity expert as one of the types of evidence in criminal proceedings*: **Olha Kholodova**, PhD in Technology, Docent, Senior Researcher of Dnipropetrovsk Scientific Research Institute of Forensic Expertise of the Ministry of Justice of Ukraine.



The high scientific level of the conference allowed each scientist and forensic expert to master a lot of relevant information that will be useful to them in future work. As a result of the conference, a collection of abstracts was formed, which will be useful for scientists, practitioners and law enforcement officers.

Information was prepared by **Valentyn Fesiunin**,
Head of Laboratory of NSC
“Hon. Prof. M. S. Bokarius FSI”, PhD in Law

Digital International Criminalists Congress

On May 28, 2021, on the basis of Yaroslav Mudryi National Law University the Digital International Criminalists Congress, organized by the International Public Organization *Criminilists Congress* and the Association of Criminalists of Lithuania was held.



The theme of the Congress: *Conditions for teaching criminalistics and forensics at universities*. The Congress brought together representatives of Ukraine and foreign countries: Lithuania, Austria, Switzerland, Poland, Germany, Slovenia, Slovakia, the Czech Republic, Canada, Israel, Azerbaijan, Latvia and others.

The event began with a welcoming speech by **Yurii Bytyak**, the Vice-Rector of Yaroslav Mudryi National Law University, Academician of National Academy of Legal Sciences of Ukraine



Scientists of National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute”: **Ella Simakova-Yefremian**, Deputy Director for Academic Affairs, Doctor of Law; **Svitlana Yevdokimenko**, Principal Researcher of Post-Graduate Department, Doctor of Law, Docent; **Liudmyla Svyrydova**, Head of the Laboratory of Handwriting Analysis, Forensic Linguistics and Art Forensics, PhD in Law, Senior Researcher; **Iryna Shepitko**, Leading Researcher of Post-Graduate Department, PhD in Law.



The speakers presented their own vision of the state for teaching criminalistics and forensics. In particular, the report: *Teaching Criminalistics and Forensic Sciences in Ukraine: Historical and Contemporary Perspectives* was prepared by **Valerii Shepitko**, the President of the International Public Organization *Criminalists Congress*, Academician of National Academy of Legal Sciences of Ukraine, Doctor of law, Honored Worker of Science and Technology of Ukraine, Head of the Department of Criminalistics, Professor at Yaroslav Mudryi National Law University, and **Mykhailo Shepitko**, Doctor of Law, Senior Researcher, Professor of the Department of Criminal Law of Yaroslav Mudryi National Law University.



At the end of the meeting, the participants unanimously adopted a resolution: to continue the integration of criminalists and forensic experts

with the help of the European Federation of National Forensic Associations, initiated by the International Congress of Forensic Scientists (Ukraine), Lithuanian Forensic Association and Polish Association of Forensic Experts (Memorandum, September 16, 2017, Palanga, Lithuania); recommend combining criminalistics with the infrastructure of practical institutes that conduct forensic examinations.

*Information was prepared by **Svitlana Yevdokimenko**,
Principal Researcher of Post-Graduate Department, Doctor of Law*

OUR HEROES OF ANNIVERSARY



Ella Borysivna Simakova-Yefremian

Deputy Director for Academic Affairs,

Doctor of Law,

Senior Researcher,

*Honored Worker of Science and Technology of
Ukraine*

Ella Borysivna was born on February 12, 1961, Kazanka railway station, Kazanka Raion, Mykolaiv Oblast. She has been working at National Scientific Center "Hon. Prof. M. S. Bokarius Forensic Science Institute" since 1979. She graduated from the Kharkiv Law Institute of Feliks Dzerzhinsky (currently, *Yaroslav Mudryi National Law University*) while undergoing on-the-job training (1986). She has worked as a junior, senior researcher of the institute. During 1989 – 1993, while taking on the-job training at correspondence graduate school at the All-Union RIFE, after graduation she defended her dissertation in 1993 for the degree of PhD in Law on the topic: *Theoretical foundations and general provisions of the methodology of complex criminalistics soil-study-trace evidence analysis* (1994). The defense of the dissertation was held at the National Law Academy of Ukraine (currently, *Yaroslav Mudryi National Law University*). Having obtained the degree of PhD in Law, she was elected to the position of a Leading Researcher on a competitive basis. During the period of 1997—1998, she headed the laboratory. In 1998, she was appointed the Deputy Director for Academic Affairs of the institute. She headed the laboratory. In 1998, she was appointed Deputy Director for Academic Affairs up to now.

In 2001, she was awarded the title of Senior Researcher majoring in *Criminal Proceedings and Criminalistics; Forensic Science*.

In 2017, E. B. Simakova-Yefremian defended her dissertation seeking the degree of Doctor of Law on the topic: *Theoretical, Legal and Methodological foundations of complex forensic examinations* and obtained the degree of Doctor of Law.

Since 1986, she has been engaged in scientific work in the field of criminalistics and forensic science. During this period, she was an academic adviser and responsible executor of more than 20 scientific topics. More than 180 scientific works by E. B. Simakova-Yefremian on the problems of forensic examination have been published in professional scientific publications on legal sciences, materials of scientific-practical conferences on problems of forensic examination and criminalistics, etc., the main of which are: *On the expert*

investigation of the mechanism of soil layers formation on objects-carriers (1992), On the classification of tasks of complex criminalistics soil-study-trace evidence analysis (1993), Problems of methodological ensuring of complex expert examinations, Problematic issues of application of the new Criminal Procedure Code of Ukraine during the appointment and conduct of forensic examination (2013), Integration processes in forensic science: the essence and problematic issues of complex research (2016), etc.

Ella Borysivna participated in the preparation of articles for the legal encyclopedia, the author of monographs and training manuals for experts: *Theory and methodology of comprehensive examination of objects' contact-trace interaction (2004), Integration processes in forensic science: the essence and problematic issues of complex research, Foundations of forensic science: a training manual for professionals who intend to obtain or confirm the qualification of a forensic expert, Multidisciplinary forensic examinations: theory and practice (2016), etc.*

During the period of employment at the Center, Ella Borysivna has mastered the methods of forensic examinations and has the right to conduct examinations in five expert specializations. She personally performed almost 2,000 expert studies.

E. B. Simakova-Yefremian is a Chairman of the Contest and Certifying Commissions of the National Scientific Center "Hon. Prof. M. S. Bokarius Forensic Science Institute", an executive secretary of the collection of scientific papers: *Theory and Practice of Forensic Science and Criminalistics*, a member of the Editorial Board of the journal: *Archives of Criminology and Forensic Sciences*. Ella Borysivna is a member of the section and presidium of the SAMC on the problems of forensic examination under the Ministry of Justice of Ukraine, where she actively participates in the development and improvement of regulatory-legal and scientific-methodological provisions of forensic science.

The Editorial Board of the Collection of scientific papers: *Theory and Practice of Forensic Science and Criminalistics* congratulates Ella Borysivna Simakova-Yefremian on the anniversary and wishes good health, creative inspiration and new achievements!



Volodymyr Tymofiiiovych Chuprun

Department Head of the Laboratory of Forensic Engineering and Military Examinations

Volodymyr Tymofiiiovych was born on June 7, 1956, in Ananiv, Odessa Oblast. After graduation the Kyiv Suvorov Military School, he entered the Kharkov Guards Higher Tank Command School, from which he graduated with honors in 1977.

From September 1977 to August, 1988, he served in the Armed Forces in Germany and the

Far East in various command and staff positions. During his service, he has gained practical experience in managing units and organizing combat training. In 1988 entered the command faculty of the Malinovsky Military Armored Forces Academy of Armored Forces. During his studies, he participated in studies related to the improvement of the combat training system of tank officers. After graduating from the Academy (1991) with honor Volodymyr Tymofiiiovych was transferred to the Kharkov Guards Higher Tank Command School, where he (as an Associate Professor of the Department of Tactics) worked on the formation of tactical thinking of tank officers. Since March 1997, he was enlisted in the Military Institute of the National Guard of Ukraine, where he held the positions of a Senior Lecturer, Associate Professor, Deputy Head, Head of the Department of Tactics. Volodymyr Tymofiiiovych is an author of manuals on the use of artillery units in combat and the basics of the use of the Internal Troops of the MIA of Ukraine in special operations.

After the transfer to the reserve (2004), V. T. Chuprun worked in the system of labor protection and road safety at enterprises and institutions of Kharkiv.

At the National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute” V. T. Chuprun has been working since November 2010, on the position of a safety engineer; he has been a senior researcher since June 2016. In April 2017 V. T. Chuprun was appointed Department Head of Labor Protection Researches, Military and Electrical Researches.

V. T. Chuprun has mastered the following forensic expert specializations: 10.5 *Investigation of causes and consequences of violations of life safety and labor protection*, 16.1 *Military researches*, 10.18 *Researches on technical operation of electrical equipment*, 5.2 *Research on explosive devices, traces and circumstances of explosion*, and 3.2 *Ballistic research traces on weapons, traces of a shot and the situational circumstances of a shot*.

V. T. Chuprun is an author of more than 20 scientific publications. He takes an active part in the work of SAMC Sections.

Due to the obtained practical experience in the field of labor protection and life safety V. T. Chuprun conducts forensic expert researches, of which over 80% belong to a complex category, at a high professional level with a deep scientific basis and elaboration of the research task.

V. T. Chuprun is the developer of the methodology of forensic research of the work of commanders (staffs) and military formations during the preparation and execution of combat (service-combat) tasks and the methodology of forensic research of the use of artillery units. Currently, V. T. Chuprun develops a method of comprehensive forensic research on the use of automotive and armored vehicles of military formations.

These days, V. T. Chuprun is working on the methodology of forensic research of the work of commanders (staffs) and military formations during

the preparation and execution of combat (service-combat) tasks. He is an author of several scientific publications on modeling information warfare and forensic research in the military field.

The Editorial Board of the Collection of scientific papers: *Theory and Practice of Forensic Science and Criminalistics* congratulates Volodymyr Tymofiiiovych Chuprun on his 65th anniversary and wishes health, happiness, and family comfort!



Viktor Veniaminovich Somov
*Senior Researcher of Criminalistics Research
Laboratory*

Viktor Veniaminovich Somov was born in 1956. He has finished Kyiv Military Aviation Engineering Academy (1973—1978). He served in various positions related to the operation of aircraft weapons. He graduated from Zhukovsky Air Force Engineering Academy (1985). V. V. Somov realized the need to share the obtained experience as a senior lecturer at Kharkiv Higher Military Aviation Engineering School, where he worked until 1996.

Since March 1996, after completing his military service, he has been working at National Scientific Center “Hon. Prof. M. S. Bokarius Forensic Science Institute” (firstly as a junior researcher, in two years as a senior researcher).

V. V. Somov has mastered the following forensic expert specializations: 2.1 *Research on details of documents*, 2.3 *Research on printing forms and other means of documents production*, 3.1 *Ballistic research on firearms and ammunition to it*, 3.2 *Ballistic research on weapon traces, traces of a shot and situational circumstances of a shot*, 3.3 *Research on cold weapon*, 4.2 *Research on tools, units, tools and traces left by them, identification of the whole in parts*, 5.2 *Research on explosive devices, traces and circumstances of the explosion*, etc.

The researches conducted by V. V. Somov are marked by the depth of elaboration, the sequence of presentation and the validity of conclusions. During his work at the Center, he has performed more than 2,600 expert researches, and there are no have any repeated unconfirmed expert conclusions to his credit. In his work he widely uses the experience of expert practice, new methods and scientific developments, constantly improves his professional level, enriches special knowledge, takes an active part in methodical and research work. Actively engaged in scientific activities.

He is one of the developers of the *Dictionary of terms of forensic explosive examination*, *Methods of comprehensive research on explosive devices, explosives and traces of explosions*, a manual for forensic experts: *Ammunition for firearms*, etc. He takes an active part in the work of the SAMC Section.

The editorial board of the Collection of scientific papers: *Theory and Practice of Forensic Science and Criminalistics* congratulates Viktor Veniaminovich Somov on his anniversary and wishes him health and happiness, creative inspiration and further success!

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Blog Post

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Films (DVDs, video files)

Producer, A. A. (Producer) Director, B. B. (Director). (Year). Film title [File format]. Production Country: Studio.

Video, online (video streaming)

Publication Name. [File format]. (Publish Date). URL: http://

Video, Internet (YouTube)

Author, A. A. [Alias] (Publish Date) Publication Name [File format]. URL: http://

Music

Composer A. A. (Copyright year). Composition title [Recorded by B. B. Performer, if he/she is different from Composer]. According to Album Title [Record: CD, cassette, etc.]. Release city: Studio. (Record date if it is different from song authorship date).

TV serial, episode

Director B. W. (Scriptwriter), & Director, D. D. (Director). (Release Date). Episode Title [TV serial episode]. Producer. Episode Title. Production city, Production country: Studio or Distributor.

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