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Application of the method of computer forensic simulation of crimes in the course of an armed conflict

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Abstract

The objective of the study was to determine the characteristics and perspectives of the use of computer simulation as a method for investigating crimes committed in the course of an armed conflict. In addition, the study involved a system approach, descriptive analysis, systematic sampling, doctrinal approach and prognostic methods. The author chooses the technological direction of application of the simulation (prospective or retrospective) and simulates the characteristics of the event, the identity of the offender, the victim of the crime and the sequence of the investigation process. In the course of hostilities, computer simulation can be performed by representatives of national and international law enforcement agencies, depending on the type of crime. Computer simulation in the course of armed conflict requires standardization of procedures and improvement of the substantive and instrumental components of the application of this method. It is concluded that this model has different perspectives for its development, which include: standardization of procedures with due regard to the specifics of the crime committed and the offender; details of information sources;

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technological direction of simulation; possible types of models; and, the need/appropriateness of involving international coordination assistance.

Keywords: law enforcement; armed conflict; crime investigation; criminal justice; forensic methods.

Aplicación del método de simulación informática forense de delitos en el curso de un conflicto armado

Resumen

El objetivo del estudio fue determinar las características y perspectivas del uso de la simulación por computadora como método para investigar los delitos cometidos en el curso de un conflicto armado. Además, el estudio involucró un enfoque de sistema, análisis descriptivo, muestreo sistemático, enfoque doctrinal y métodos de pronóstico. El autorizado elige la dirección tecnológica de aplicación de la simulación (prospectiva o retrospectiva) y simula las características del hecho, la identidad del delincuente, la víctima del delito y la secuencia del proceso de investigación. En el curso de las hostilidades, la simulación por computadora puede ser realizada por representantes de las fuerzas del orden nacionales e internacionales, según el tipo de delito. La simulación por computadora en el curso de un conflicto armado requiere de la estandarización de los procedimientos y la mejora de los componentes sustantivos e instrumentales de la aplicación de este método. Se concluye que este modelo tiene diferentes perspectivas para su desarrollo, que incluyen: la estandarización de los procedimientos teniendo debidamente en cuenta las especificidades del delito cometido y del delincuente; detalles de las fuentes de información; dirección tecnológica de simulación; posibles tipos de modelos; y, la necesidad/adecuación de involucrar la asistencia de coordinación internacional.

Palabras clave: aplicación de la ley; conflicto armado; investigación de delitos; justicia penal; métodos forenses.

Introduction

The fight against crime is extremely necessary for the stability and development of society. Law enforcement agencies try to exert effective influence on criminals and their groups with due regard to the specifics of criminal activity (Tyagi and Sharma, 2018). This is why innovative methods of detection and investigation of crimes reflect the use of currently available

technologies in criminal actions.

The use of the latest technologies (Caldwell *et al.*, 2020) by criminals led to the reorientation of law enforcement officers to the collection of mostly digital evidence (Freeman, 2018). In general, cybernetic methods (Pryakhin, 2022), in particular data mining, their processing with the help of artificial intelligence (Shah *et al.*, 2021), have become an important part of crime detection (McClendon and Meghanathan, 2015).

Forensic innovations have provided a better understanding of the dynamics of criminal activity, identification of criminal behaviour patterns (Tyagi and Sharma, 2018). This, in turn, provided an opportunity to simulate and predict the development of criminal situations (Blahuta and Movchan, 2020), to visualize various aspects of the committed crime through models. Virtual reality becomes a component of forensic methods that increase the quality of proceedings and trials (Ahir *et al.*, 2020). Therefore, it became possible to obtain evidence that is accepted in courts through general methods of investigation of all types of crimes by means of digital forensics (Rani, 2018).

However, armed conflicts are an obvious challenge to law enforcement and judicial systems. Armed aggression always results in massive violations of human rights. The governments of states, the territory of which is covered by hostilities, are objectively unable to effectively fulfil their obligations to protect citizens from criminal encroachments, including the payment of compensation to victims.

The crime rate is increasing rapidly in the course of hostilities, accompanied by an increased number of the most serious crimes in its structure, the number of law enforcement officers involved in the investigation process is being significantly reduced, so it is impossible to ensure the proper safety of participants in criminal proceedings. The efforts of international justice also do not guarantee a quick and effective trial of cases on conflict-related crimes and bringing the perpetrators to justice (Farrell Rosenberg and Nassar, 2022).

The specifics of hostilities necessitate the use of the newest methods of digital forensics by law enforcement agencies, which enable generating a set of evidence acceptable to the court quickly, qualitatively, safely with the involvement of a small number of people. Computer simulation takes a prominent place among such methods. At the same time, the analysis of the significance and effectiveness of computer simulation of crimes in the course of hostilities faces a number of conceptual legal, organizational and procedural problems.

As for the legal aspect, genocide, crimes against humanity and war crimes are considered the most serious acts as the object of application of the latest forensic methods. The international community considers that

the prevention, investigation and prosecution of such crimes play a central role in the fight against impunity (Interpol, 2015). War crimes committed with the use of the latest weapons leave digital traces.

This becomes the basis for new sources and types of data, and fundamentally changes the investigation of such crimes (Freeman, 2021). However, little attention is paid to the fact that other violent and acquisitive crimes are committed in the course of military operations, which also require effective investigation.

Besides, the specifics of the justice system are important because the generated set of evidence must be accepted by the court. It can be both a national and an international court for crimes committed during the hostilities. However, international criminal justice is different from national one, as the international justice does not appeal to harsh sanctions. This is a humanitarian form of justice, where the victim occupies a central place (Lohne, 2020).

The state plays the main role in the investigation and prosecution of international crimes remains with the state. It has the duty and right to exercise criminal jurisdiction when crimes are committed on its territory or by its citizens (Mayans-Hermida and Hola, 2020). The International Criminal Court only supplements national efforts (International Criminal Court & The Office of the Prosecutor, 2014).

This is why the national law enforcement and judicial systems carry the main burden of detection, investigation and trial of criminal cases about crimes during the hostilities. However, quite often the International Criminal Court does not accept the evidence collected by "external" (national) investigators (Braga da Silva, 2020).

This results in the organizational problems of using computer simulation of crimes in the course of hostilities. Not all states that face such acts have specially trained law enforcement officers. This raises the issue of conducting training of investigators. Ideally, every investigator in the field will be able to conduct expert research by connecting a laptop to databases (Du *et al.*, 2017). However, this is possible only with proper strategic cooperation and ensuring the exchange of experience with international specialists (Interpol, 2015).

The practical skills of processing information and forming databases are an important procedural component of computer simulation of crimes. During the hostilities, a significant information array can be obtained with the help of social networks. These platforms are obviously valuable for collecting and storing the testimonies of victims and witnesses of crimes, although they are limited in showing certain events and their evaluations (Goldschmidt-Gjerløw and Remkes, 2019).

Even in a normal situation, social networks are actively analysed to detect and investigate criminal activity (Nizamani *et al.*, 2019). This becomes especially important in the military conflict zones (Freeman, 2018). Among other things, this will enable working out algorithms for cooperation with civil society in order to integrate the results of the application of the latest forensic methods into procedural activities (Zweig *et al.*, 2018). For example, the Office of the Prosecutor of the International Criminal Court recognizes the important role that civil society plays in the fight against sexual crimes and crimes against children.

The Office supports and strengthens cooperation with those civil institutions that have experience in documenting such crimes and working with victims (International Criminal Court & The Office of the Prosecutor, 2014).

Although the area of intersection of technology, human rights and criminal prosecution is relatively new, it will cover a wide range of criminal cases in the near future (Freeman, 2018). Therefore, the use of digital forensics methods in general and computer simulation of crimes in particular will be increasingly expanding, especially in the course of armed conflicts.

1. Aim

In view of the foregoing, the aim of this study is to consider the specifics of the use of computer simulation of crimes in the course of hostilities with the determination of problematic aspects to achieve the goals of justice. The aim involved the following research objectives: clarify the legal, organizational and procedural aspects of applying the method of computer simulation of crimes in the course of hostilities; determine prospects for the introduction of standards governing the use of this method in crime investigation.

2. Methodology and methods

The sources which textually and contextually cover the issue of computer simulation of crimes as a method of digital forensics were selected in order to achieve the goals and tasks set in the article. Their analysis resulted in formulation of the main legal, organizational and procedural aspects of the subject under research.

The article also involved a generalization of the practice of international judicial bodies and law enforcement agencies regarding the standards for determining the signs of international crimes committed during hostilities,

and regarding the results of the use of computer simulation of crimes in the context of requirements for the presentation of evidence in national and international courts.

This enabled determining the main prospects for improving the effectiveness of the use of computer simulation of crimes in the course of hostilities.

The aim of this study was achieved through the following methods: *the system approach* was used to study computer simulation of crimes as a logical sequence of actions of authorized persons for the generation of evidence in criminal proceedings for cases on crimes in the course of hostilities; *descriptive analysis* was used to identify and study the specifics of computer simulation as a method of digital forensics; systematic sampling and doctrinal approach enabled identifying and describing the features of crimes for which computer simulation is used in the course of hostilities; *forecasting* was used to determine the prospects for improving the effectiveness of computer simulation of crimes.

3. Results

The application of the computer simulation of crimes in the course of hostilities is a problem with many components. These reasons are the following: a) the heterogeneity of crimes that can be committed during hostilities, and the characteristics of criminals; b) characteristics of persons whose authority may include simulation; c) specifics that determine the organizational and procedural aspects of the application of this forensic method.

With regard to crimes committed during hostilities, they represent a heterogeneous set of dangerous acts. These actions are different in terms of danger and subjects. However, they can be combined into one group based on the situation — the crimes committed during the hostilities. Such crimes can include: a) international crimes with their inherent features determined by the International Criminal Court (genocide, crimes against humanity and war crimes (International Criminal Court, 2013), sexual violence occupies a special place in this list (UN; DPKO/DFS Specialised Training Materials, 2017); b) military crimes against the procedure of military service provided for by national legislation (for example, disobeying an order, desertion); c) crimes against national security (for example, treason); d) general crimes that are not directly related to the conflict, but the hostilities facilitate the commission of these crimes and hiding of criminals from law enforcement authorities (for example, murder, robbery, fraud) (see Figure 1).

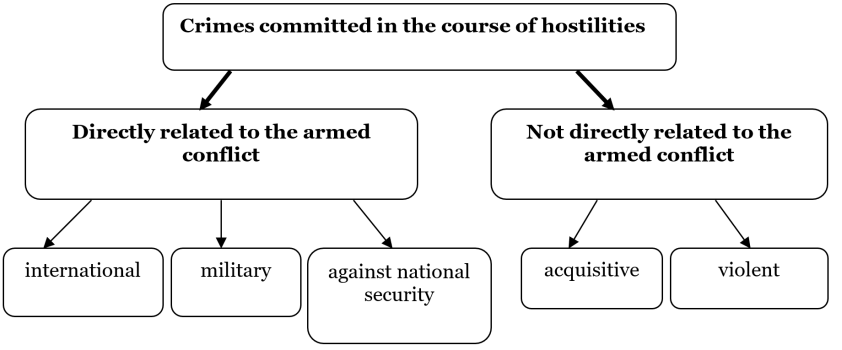

Figure 1: A set of crimes committed in the course of military operations.

The specifics of the perpetrators are an important characteristic of crimes in the course of military operations, which affects the specifics of the use of computer simulation. For example, perpetrators of international crimes include both direct perpetrators and military commanders. A military commander can be prosecuted for crimes committed by forces under his effective control and command.

Even if the commander did not give the criminal order, he will be responsible for the inability or the failure to exercise effective control (UN; DPKO/DFS Specialised Training Materials, 2017). Besides, crimes can be committed individually or in groups characterized by varying degrees of cohesion (see Figures 2a, 2b).

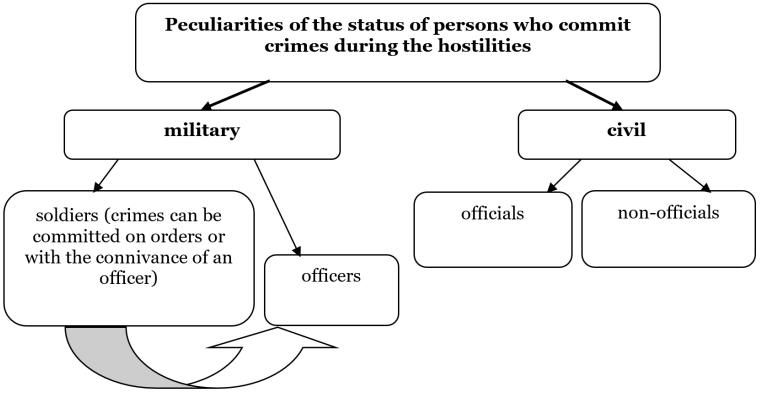

Figure 2a: The specifics of the status of persons who commit crimes during hostilities

The crimes of soldiers entail the responsibility of officers.

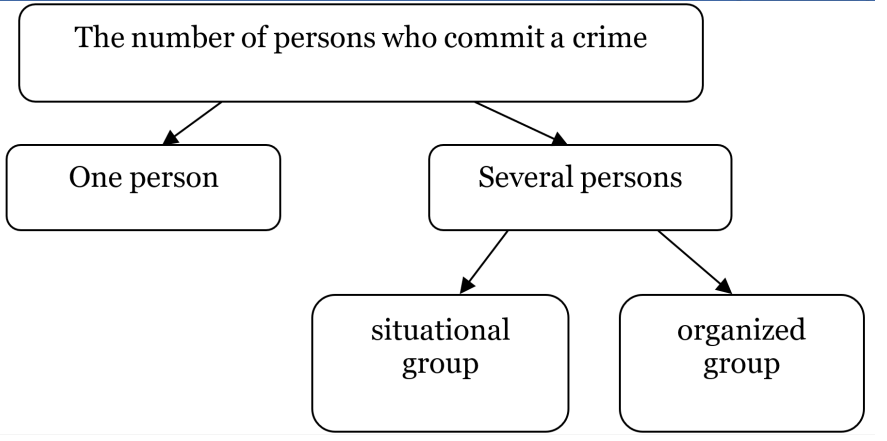

Figure 2b: Quantitative composition of perpetrators who commit crimes during the hostilities.

The data for drawing conclusions about the specifics of the crime committed during military operations are obtained from various sources. Features of the combat situation determine the main aspects that should be taken into account: a) the most effective collection of information that can be used for computer simulation in hard-to-reach areas; b) objectivity of the data obtained; c) safety of persons participating in the proceedings; d) availability of information for all persons concerned (Freeman, 2018).

Messages in mass media and social networks become very widespread sources of information during the hostilities (Sarkin, 2021). In particular, social networks are a huge archive of digitized images. Having an image of a person of interest to the officers of the criminal investigation department, it is possible to establish his/her location, connections, or at least the direction for further search (Blahuta and Movchan, 2020). The results of processing of the information obtained determine the choice of the technological direction of applying the computer simulation as a component of the investigation of the act by the authorized person - prospective or retrospective (see Figure 3).

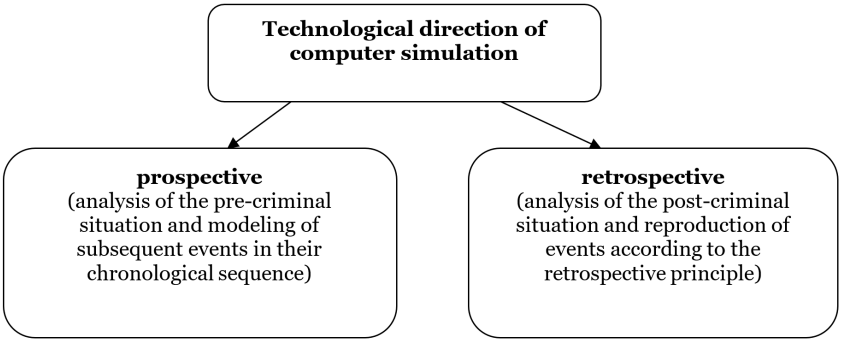

Figure 3: Technological direction of applying computer simulation (Pryakhin, 2022).

The peculiarities of the committed crime, the specifics of the available information and the choice of technological direction allow the authorized person to determine most appropriate computer models. Studying practical experience allows us to single out the four most widespread types of models that can be components of the investigation of crimes during hostilities. They help to reproduce: a) the event of the crime; b) the criminal's identity; c) the victim's identity; d) certain regularities of the investigation (see Figure 4).

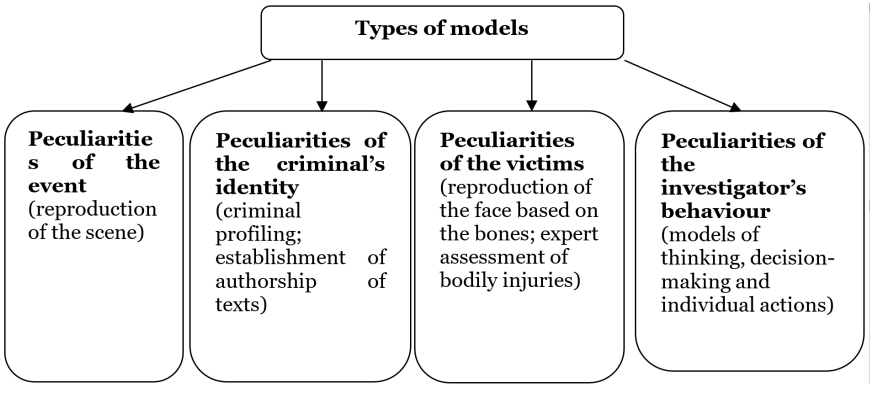

Figure 4: Types of models as a result of computer simulation of crimes in the course of hostilities (Benz et al., 2022; Blahuta and Movchan, 2020; Gupta et al., 2015; Horsman and Sunde, 2022; Jha et al., 2019; Longhi, 2021).

The specifics of the use of computer simulation of crimes in the course of hostilities determines that only authorized persons - experts in the field of criminal justice - can apply this forensic method. At the same time, the peculiarities of the crimes, in connection with which this simulation is used, determine the principle of complementarity of efforts of international and national law enforcement agencies and judicial bodies (Mayans-Hermida and Hola, 2020).

However, the main way to achieve the goals of justice for crimes committed in the course of hostilities is through national legal systems (Farrell Rosenberg and Nassar, 2022). Their activities regarding serious international crimes are coordinated and supported by Interpol (Interpol, 2015). This is why the subject competence of authorized persons can be presented as follows (see Figure 5):

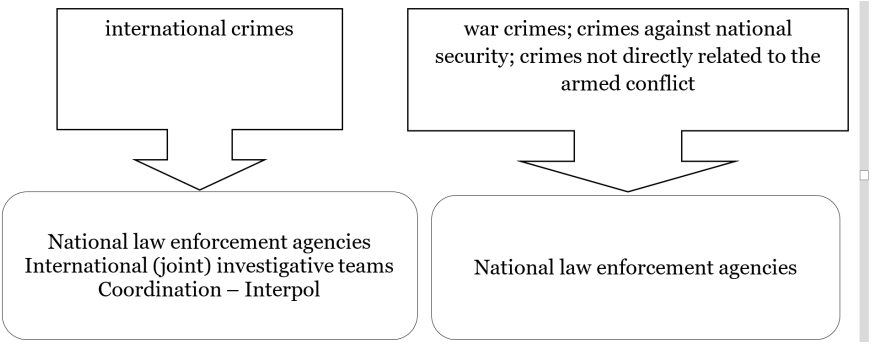

Figure 5: Subject competence of persons authorized to apply computer simulation of crimes committed in the course of hostilities

The development of methods and tools of digital criminology enables determining the main prospects for improving computer simulation of crimes in the course of hostilities: a) meaningful innovations that are related to the formulation of new tasks (Pavliuk, 2019; Wang *et al*., 2019); b) instrumental innovations in terms of technical and technological support for computer simulation of crimes (D'alessandra and Sutherland, 2021; Gunha *et al*., 2022; Shah *et al*., 2021) (see Figure 6).

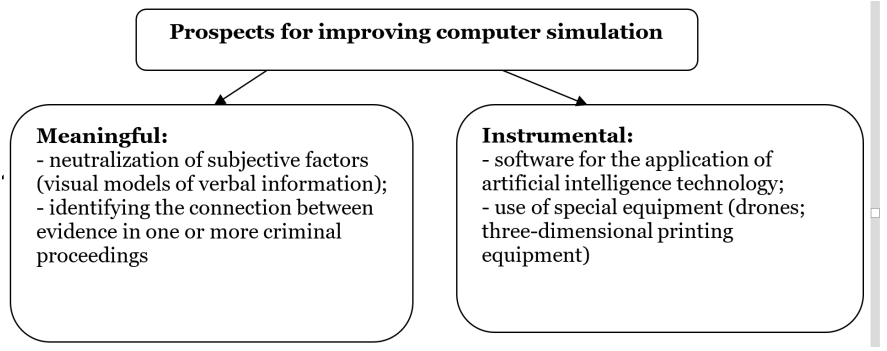

Figure 6: Prospects for improving computer simulation of crimes in the course of hostilities.

In view of the foregoing, it is considered appropriate to talk about the reasonability of developing standard computer simulation procedures that can be applied in most investigations of crimes committed in the course of hostilities. These procedures should be based on the following aspects: peculiarities of the committed crime and the criminal (criminals); the specifics of data obtained from available sources of information; technological direction of simulation; the types of models to be applied; the necessity/appropriateness of involving international coordination assistance. This will enable standardizing the results of computer simulations for the needs of national and international justice.

4. Discussion

Research on the application of computer simulation of crimes in the course of hostilities is still lacking. In general, this problem is a component of the theoretical applied discourse regarding the latest technologies in detecting and investigating crimes. The digital forensics is currently not only about the process of investigating computer crimes.

It provides methods of identification, storage, collection, verification, analysis, documentation and provision of digital evidence in all categories of criminal proceedings (Rani, 2018). As experts rightly note, this raises the practical importance of technologies that: a) speed up data collection; b) reduce storage volumes; c) provide timely review and analysis of information; d) management of knowledge and archives (Du *et al*., 2017).

In general, it is emphasized that computer simulation of crimes is quite widely used in countries with developed law enforcement systems.

Ukraine is no exception (Avdieieva and Bululukov, 2019; Bilous, 2021). The following models are mainly paid attention: a) crime scene reproduction with the help of 3D visualization among other techniques (Wang *et al.*, 2019); b) forensic medical examination of victims based on 3D models (Benz *et al.*, 2022); c) facial reconstruction (forensic facial approximation) (Gupta *et al.*, 2015); d) criminal profiling (Jha *et al.*, 2019).

One should support the position of the appropriateness of using simulation with regard to crimes committed in the course of hostilities, because the creation of models is used mainly in those cases when the study of the object, phenomenon or process in the original is impossible for one reason or another. The authors correctly point out that the specifics of modern warfare led to the growth of the intellectual component in armament. In case of crimes related to armed conflict, this allows the use of new types of data that can be interpreted in criminal proceedings as evidence (Freeman, 2021).

In order to eliminate impunity, it is extremely important that states strive to effectively investigate and prosecute serious international crimes (International Criminal Court & The Office of the Prosecutor, 2014). However, it seems controversial to reduce crimes committed in the course of hostilities mainly to international acts (for example, genocide, war crimes, sexual violence and torture (UN; DPKO/DFS Specialised Training Materials, 2017), against children (International Criminal Court & The Office of the Prosecutor, 2014). "Ordinary" crimes that are not related to the conflict, but are committed in the course of hostilities (robbery, murder, etc.) also pose a significant danger to victims and society. Their investigation also faces the challenges of a combat environment and requires the use of the latest forensic technologies.

The availability of simulations based on such technologies as social networks, cloud computing, mobile technologies, information resizing, encryption, and varieties of virus programmes for law enforcement officers is ambiguously evaluated, because they make the investigation quite complicated and burdensome (Thakar *et al.*, 2021; Rudyk *et al.*, 2022).

In this regard, one should agree that constant technological innovations guide the efforts of investigators, prosecutors, lawyers and judges to adapt procedures for operations with digital evidence (Freeman, 2018).

In particular, the experience of the Joint Investigative Group investigating the MH-17 crash can be considered a positive example. In its conclusions, the Joint Investigative Group refers to a significant amount and different types of digital evidence, including data from open sources. This made it possible to create models of significant aspects of the event (Freeman, 2018).

The procedural dimension of the use of computer simulation of crimes committed in the course of hostilities is also considered problematic. The relevance of the issue of compliance with the fair trial standards is rightly emphasized. This primarily concerns international courts (Zarmsky, 2021). It is suggested that the prosecution should provide the defence with maximum access to the evidence base at the early stages of the proceedings in order to ensure the fairness of the trial (Freeman, 2018). However, this is not always possible because of the specifics of crimes related to the armed conflict.

The results of this study indicate that the statement on the need for common standards of proof and algorithms for collecting and securing digital evidence should be shared. Proposals for improving data analysis algorithms through visualization of information content (Thakar *et al*., 2021) (for example, using a computer model to visualize the testimony of the interrogated) seem promising (Pavliuk, 2019; Rudyk *et al*., 2022).

However, the position that all lawyers should become experts in how to collect, store and use digital evidence may be a bit of an exaggeration. This primarily concerns the use of data from social networks and other digital communications in conflict zones (Freeman, 2018). As concerns international crimes, a point of view should be shared regarding the appropriateness of uniting the efforts of national law enforcement agencies (Interpol, 2015) and creating a legal framework for optimizing the use of national investigations at the International Criminal Court (Braga da Silva, 2020). In general, these considerations can form the basis of the legal, organizational and procedural aspects of the use of computer simulation of crimes committed in the course of hostilities.

Conclusions

The conducted research provides the ground for drawing a number of conclusions regarding the legal significance, organizational and procedural features of computer simulation of crimes committed in the course of hostilities as a forensic method.

It was established that the mentioned crimes represent a set of various actions united by the situation — they were committed in the course of hostilities. Computer simulation of these crimes is used depending on the specifics of the act, status and number of persons who commit it. It is shown that the authorized person chooses the technological direction of applying the computer simulation method — prospective or retrospective — as a component of the investigation of the act based on the results of information processing.

This makes it possible to determine the most appropriate type(s) of models in a particular criminal proceeding. It was established that representatives of national and international law enforcement agencies are among the persons authorized to use computer simulation depending on the specifics of the crime. The further use of computer simulation of crimes committed in the course of hostilities involves meaningful and instrumental development of this activity.

It is proposed to develop standard simulation procedures to standardize the results of computer simulation and their use as evidence in national and international courts. They are determined by the following aspects: specifics of the committed crime and the criminal(s); the specifics of data obtained from available sources of information; technological direction of simulation; the types of models to be applied; the necessity/appropriateness of involving international coordination assistance.

This study opens up the prospects of working out the standards of forensic support for the detection and investigation of crimes committed in the course of hostilities with the further use of the evidence base in national and international courts. A separate promising direction is the organization of training practicing lawyers for the implementation and use of the latest technologies in criminal proceedings and court proceedings.

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