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# Examination methods at the intersection of forensic anthropologist and forensic mark expert competencies in Hungarian practice [1]

## Introduction

At the Hungarian Institute for Forensic Sciences (HIFS), forensic experts primarily carry out their activities in criminal cases. It is common in these cases that not just one, but two or more expert fields are appointed simultaneously or consecutively. Different disciplines may examine alterations found at the same crime scene and on the same evidence, leading to overlaps in their respective boundaries, emphasizing the importance of cooperation. The institutionalized legal possibility of combined expertise allows experts to effectively address complex questions involving multiple disciplines. The examination and application of multidisciplinary and interdisciplinary methods in forensic evidence examination are becoming increasingly significant both domestically and, in foreign forensic institutions[2] as evidenced by the collaborative practice and numerous working groups established by the European Network of Forensic Science Institutes (ENFSI) to examine and understand this topic more comprehensively[3]. At this year's

[1] This study is the English version of the presentation delivered at the conference 'The Science and Practice of Law Enforcement' held in Pécs 27.06.2024.

[2] Act XXIX. of 2016 on the Forensic Experts, 2. § (2);
Lontai, Márton – Kosztya, József Sándor: Az intézményi szakértés kihívásai a technológiai fejlődés tükrében [The challenges of institutional expertise in the light of technological development]. Ügyészek lapja 2023. 30(5-6) 75–90;
Fülöp, Péter – Ujvári, Zsolt – Petrétei, Dávid – Kiss, István - Dudás-Boda, Eszter – Metzger, Máté – Fullár, Alexandra: Az igazságügyi szakértői szemléltetés modern eszközei és lehetőségei [Modern tools and possibilities of forensic expert illustration]. Ügyészek lapja 2023. 30(5-6) 91–102

[3] Zampa, F. – Bandey, H. – Bécue, A. – Bouzaid, E. – Branco, M.J. – Buegler, J. – Kambosos, M. – Kneppers, S. – Kriiska-Maiväli, K. – Mattei, A. – Zatkalikova, L. (2024):

Saint László Day conference, in the *"Science and Expertise in Criminalistics"* section, our colleague István Kiss shared his insights on this topic. Building on this foundation, we examine the limits of the competence boundaries of forensic anthropology and forensic mark examination, presenting the possibilities and results of close cooperation between the two fields through exciting practical examples.

## Competence Areas of Anthropology and Mark Examination

The competencies of forensic expert fields are regulated by the 31/2008 (XII. 31) IRM decree, which is further expanded on concerning the expert fields operating within the HIFS by the 26/2017 (VI. 30) directive of the HIFS director-general [4]. Forensic anthropologists apply identification examination methods for bone remains and living individuals, and they attempt age estimation for both children and adults. The majority of criminal case appointments for forensic mark experts involve the examination of tool marks, footprints, and locks, but the director-general's directive also extends competence to the comparative examination and identification of various objects and photographs. The competence areas of the two fields converge in the identification examinations, providing an opportunity for close cooperation.

A foundation for joint work is the similar structure of identification systems in both fields. Both fields evaluate their examination results on a five-level identification scale, where the names and conceptual definitions of the levels show similarities. In forensic mark examination, the levels are exclusion, not excluded, probability – group identity, high probability, and individual identity, while in forensic anthropology, the levels are exclusion,

ENFSI 2022 multidisciplinary collaborative exercise: organisation and outcomes. Forensic Science International: Synergy, 8 100465

[4] IRM Decree 31/2008 (XII. 31.) on the operation of forensic experts, 30-31. §;
26/2017. (VI.30.) Action by the Director General of HIFS on the temporary Organizational and Operational Regulations of the Hungarian Institute for Forensic Sciences (with amendments in an unified structure)

not excluded, possible, supported, and highly supported. Therefore, the joint work of the two fields can be considered a textbook example of an interdisciplinary methodological approach.

## Forensic Examination of Bone Remains

When applying the anthropological identification examination method on bone remains, the forensic anthropologist attempts to establish a biological profile based on general and individual characteristics. The examination of general characteristics involves determining whether the bone remains are of human origin or not, how many individuals they originate from, estimating the burial time, and estimating the age, sex, and height of the deceased, as well as the ancestry (formerly "race") of the bone remains based on morphological properties. For individual characteristics, the forensic anthropologist examines dental status, alterations indicating various diseases and degenerative processes, injuries incurred before death (antemortem), around the time of death (perimortem) (Fig. 1A.), and after death (postmortem) (Fig. 1B.), traces of overexertion due to the person's occupation or posture, and in some cases, perform X-ray analysis and facial reconstruction yet (note that the HIFS does not perform facial reconstructions). In criminal cases, one of the most important examinations of bone remains is uncovering injuries sustained around the time of death and determining the circumstances under which they were inflicted. When forensic anthropologists find perimortem injuries, these are most often attributed to some kind of tool. For the forensic mark expert, the injury found on the bone is nothing more than a tangible alteration caused by the tool that left the mark. Therefore, evaluating the injury as a tool mark can be seen as a shared border between the two fields. Determining what kind of tool might have caused the alteration is the task of the forensic mark expert.

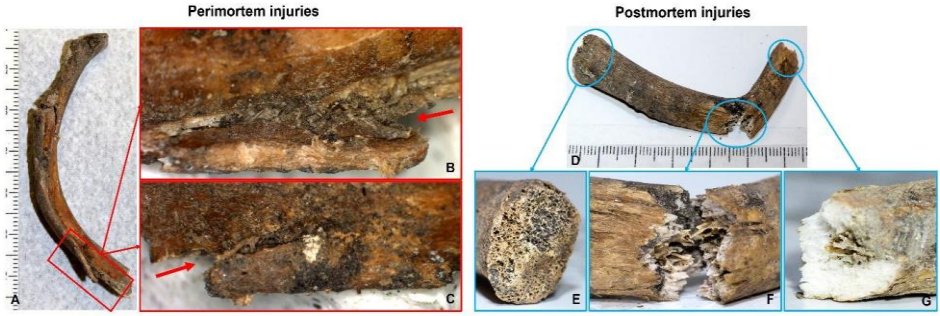


**Figure 1.**
**A-C: Perimortem injuries of the ribs. D-G: Postmortem injuries of the ribs. (The author's own recordings.)**

Our joint expert practice dates back many years, during which time we have refined and shaped the cooperation between the two fields into its current form. We have worked together on numerous appointments where new perspectives on the cooperation between the two fields have surfaced. One such situation arose in a criminal case where an unprofessional excavation of the burial site of a deceased person was conducted, and the data in the case files indicated that the suspects made several conflicting statements about the victim's assault and burial. During the excavation, a digging machine disturbed the original position of the bone remains, and neither a forensic anthropologist nor a properly informed medical expert was called to the scene in a timely manner. The forensic medical expert who was eventually called could only examine incomplete and broken bone remains placed in a body bag. Thus, during our appointment, we only had the photographs and site inspection report available to determine the position and direction in which the deceased was buried. By applying our combined examination methods, we were able to reconstruct that the body was buried face down, in an extended position, likely without clothing. The anthropological examination determined, with the help of age estimation methods, that the person found was most likely the individual being searched for. Later, a forensic genetic expert examination confirmed the forensic anthropologist's findings. The forensic mark examination, by identifying

objects visible in the upper layers of the grave in the photographs, corroborated part of the suspect's statement regarding the circumstances of the burial.

In our next case study, our joint cooperation revealed new perspectives, which required the use of new, previously rarely or not yet applied examination methods, with the involvement of additional expert fields. In a case related to a person’s disappearance, the appointing authority assigned a forensic anthropologist and a medical expert after the skeletal remains of the missing person, dressed in clothing, were found near the location of their disappearance years later. During the autopsy, the investigating authority found material discontinuities in the deceased's clothing, so the clothing items were also provided to the experts along with the bone remains, and the involvement of a forensic mark expert was authorized. The examination of the bone remains and clothing items was conducted simultaneously and at the same location, with representatives from all three expert fields present. The forensic anthropologist and medical expert discovered perimortem injuries on the deceased's facial and occipital regions of the skull, raising the possibility of tool-inflicted damage. The forensic mark examiner found overlapping material discontinuities on the right side of the deceased's upper clothing layers (Fig. 2A.). The morphology of the alteration observed on the outermost clothing layer partially differed from the tool marks underneath, as the material discontinuity extended linearly on the surface of the pullover's thermal material. Such marks could originate from a tool with a curved working edge (Fig. 2B.). By using the results of the forensic mark examination, a more thorough re-examination of the bone remains revealed a bone discontinuity, an injury on the external surface of the right scapula (Fig. 2C.). However, by examining only the tool marks found on the clothing items using forensic mark methods, it was not possible to determine whether they were caused by an axe-like tool or a knife-like tool with a curved blade. The location and morphological characteristics of the injuries found on the skull (Fig 2A. red mark) and scapula did not exclude the possibility of either tool type. To examine the mark formation mechanisms, we conducted a reconstruction model experiment

with the help of a mannequin and involved a forensic physicist, who found an appropriate examination method based on the literature to resolve the question of tool usage[5,6]. Since the procedure involved altering the bone remains, the tool marks on the bone remains were photographed using photogrammetry and archived by 3D modelling [7]. This allowed the injuries on the skull and right scapula to be examined on the computer, and the entire skeleton could be buried, as the otherwise individually unidentifiable tool marks were properly documented for possible future expert examinations thanks to the 3D model. Scanning electron microscopy examination confirmed that the injury was likely caused by a knife-like object with a single-edged blade (Fig. 2D-F.). The anatomical location of the injuries uncovered by the forensic anthropologist, the curved blade shape determined by the forensic mark expert, and the forensic physicist's examination results collectively suggested that the deceased person may have been attacked with a machete before death. Using these results, the forensic medical expert concluded that the injuries sustained could have indirectly led to the victim's death.

[5] Bartelink, E. J. – Wiersema, J. M. – Demaree, R. S. (2001): Quantitative analysis of sharp-force trauma: an application of scanning electron microscopy in forensic anthropology. Journal of Forensic Sciences, 46(6) 1288–1293

[6] McCardle, Penny – Stojanovski, E. (2018): Identifying Differences Between Cut Marks Made on Bone by a Machete and Katana: A Pilot Study. Journal of Forensic Sciences, 63(6) 1813–1818

[7] Metzger, M.– Újvári, Zs. – Gárdonyi, G. (2020): A fotogrammetria kriminalisztikai célú alkalmazása: helyszínek, holttestek, tárgyak rekonstrukciója három dimenzióban. [Application of photogrammetry for forensic purposes: reconstruction of locations, corpses, objects in three dimensions.] Belügyi szemle, 68(11) 57–70;
Ujvári, Zs. – Metzger, M.– Gárdonyi, G. (2023): A consistent methodology for forensic photogrammetry scanning of human remains using a single handheld DSLR camera. Forensic Sciences Research, 8(4) 295–307

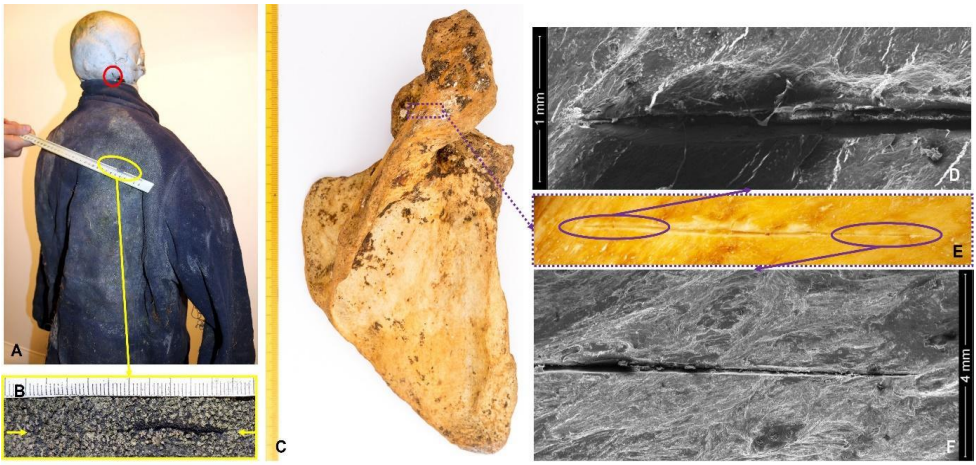


**Figure 2.**
**A: Reconstruction model experiment by placing the skull and the deceased's upper clothing on a dummy. B: Metric recording of a material discontinuity detected on his late outerwear. C: Metric recording of the late right scapula and the discontinuity of bone found on the apical process of the shoulder. E: Magnified view of the discontinuity of the bone at the apical process of the scapula. (The author's own recordings.) D and F: Scanning electron micrographs of the ends of bone discontinuity. (Recordings by Péter Fülöp.)**

## Identification of Persons and Objects Based on Photographs and Video Recordings

In the daily practice of forensic anthropologists, the identification of persons seen in various surveillance camera recordings based on comparative photographs or video recordings is becoming increasingly common. In such cases, the forensic anthropologist examines the body shape, proportions, and facial morphological features of the person seen on the recording, and looks for unique identifying characteristics such as scars, birthmarks, and tattoos[8]. The biological profile of the perpetrator established in this way

[8] Martin, R. – Saller, K. (2004): Lehrbuch der Anthropologie, I-II. Fischer Verlag, Stuttgart, 1957.;

is then compared with the reference person, who is usually depicted in a photograph or video recording. However, not only the forensic anthropologist can work from these recordings, but also the forensic mark expert, who examines the clothing and objects used by the persons seen in the recordings. Therefore, the comparative examination of photographs and video recordings is another area where forensic anthropologists and forensic mark experts can cooperate effectively. We most frequently have the opportunity for joint work when appointed in cases involving serial crimes. Primarily, our task in cases related to serial crimes, coordinated by the National Police Headquarters' (ORFK) working group, is to examine recordings made at different locations, compare them with each other, and compare them with comparative recordings or marks sent about potential perpetrators seen in the recordings. In these cases, continuous information exchange between the investigative authority and the experts is of great importance, as well as the timely optimization and coordination of the numerous appointments on both the appointing and expert sides. Let us examine some practical examples of cooperation opportunities in such cases!

The quality of camera recordings obtained from different locations can vary widely due to the characteristics, positioning of the recording devices, and the behaviour of the individuals being observed during the commission of the crime. In the initial pre-selection phase of the examinations, it is often already a big challenge to determine whether the individuals seen in recordings made at different locations and times might be members of the same perpetrator group (Fig. 3.). There was a case where the similarity factors arising from the familial relationship of the perpetrators (father-son pair) made it even more difficult to distinguish the two individuals from each other. In such cases, it can be a great help to the forensic anthropolo-

Bodzsár, É. – Zsákai, A.: Humánbiológia: gyakorlati kézikönyv. [Human biology: practical manual.] ELTE Eötvös Kiadó, Budapest. 135-182;
Farkas, L. Gy. (2005): Fejezetek a biológiai antropológiából I. rész [Chapters from biological anthropology, part I. ], JATE Press, Szeged. 2005. 65-77

gist attempting identification that the forensic mark expert makes some level of probability-based determinations regarding the individual perpetrators by uncovering similarities in clothing items and objects used.


**Figure 3.**
**A-C: The same group of criminals in three different locations, on different quality camera recordings. (The author's own recordings.)**

If comparative photographs or video recordings of the reference persons are also available, it provides a greater opportunity to observe and compare unique characteristics when establishing the biological profile. Such unique characteristics can include a birthmark, scar, or even a tattoo, based on which results can be communicated even at the highest level of identification. In a case related to the migration topic addressed by Brigadier General Dr Sándor Gömbös at the plenary session of the conference, the results of the cooperation between the two fields were also utilized. The daily lives of the professional staff serving at the southern border are filled with struggles against human traffickers. Border surveillance cameras frequently captured images of an individual who not only assisted illegal immigrants in crossing border fences but also attacked members of law enforcement agencies. Therefore, it was necessary to examine the submitted camera recordings in two separate proceedings. In the criminal case initiated due to human trafficking, the perpetrator's video recordings uploaded to a

social media platform served as comparative samples (reference recordings). Our task was to select from the recordings made at different times those in which the individual seen in the comparative recordings was visible. In the case of the attack against law enforcement personnel, the forensic mark expert's task was, in addition to identifying the individual, to determine what objects the person threw over the border fence towards the law enforcement staff and how many times. Some close-up recordings made at the scene allowed for high-level identification of the individual. Both the jewellery and clothing items of the perpetrator seen in the on-site and comparative recordings showed similarities with each other (Fig 4.). The results of the combined forensic anthropologist and forensic mark expert opinion provided sufficient evidence for the arrest of the individual under investigation.

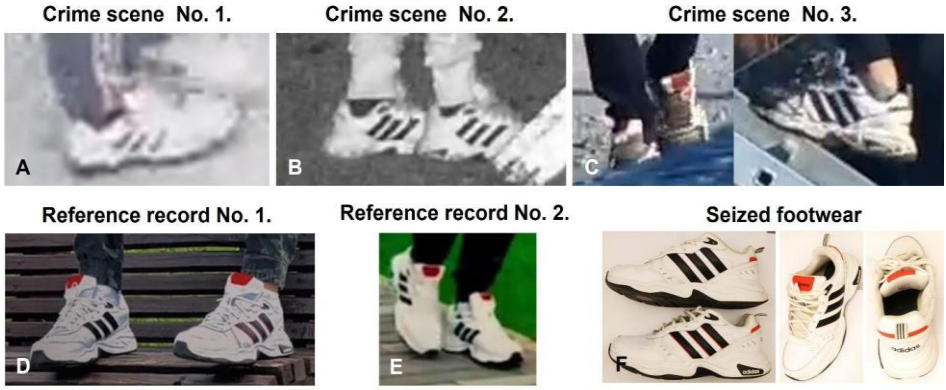


**Figure 4.**
**A-C: The same offender's footwear was captured on camera at three different locations and times. D-E: Photographs of the same reference person's footwear were taken at two times. F: A pair of footwear was seized from the suspect. (The author's own recordings.)**

In the forensic mark examination of camera recordings captured during serial crimes, there is also the opportunity to compare what is seen in the recordings with the evidence items and marks recorded during on-site ins-

pections. A great example of this is a case where the upper part of the perpetrator's footwear, bearing a brand logo, was visible in the recordings. If a footwear print fragment is also recorded at the scene, the characteristics reflected in the recording and the mark can narrow down the type of footwear being sought, so that with an internet search, we can provide the appointing authority with very precise information about the sought-after footwear. By linking the camera recording and the mark, the perpetrator's footwear can be associated with the scene in time and space. There was also a case where the perpetrator group repeatedly robbed tobacco shops, prying open the entrances with a crowbar. After their capture, the crowbar was not found, but the comparative forensic mark examination of the tool marks found at different locations determined the highest level of identity, and a crowbar-like object was visible in the hand of one of the individuals in the recordings. In addition to the probability-based identification of the perpetrators, the highest level of identification of the tool marks, evaluated as a whole, was sufficient to attribute almost all of the examined actions to the perpetrator group and to have them placed in pre-trial detention by the court.

## Conclusion

With our presentation at the Conference of Saint László Day in the criminalistics section and this publication, we aim to draw attention to the importance of close cooperation between forensic experts. The legal possibility of combined expertise is more easily leveraged within institutional frameworks, but it can also be realized among experts working in different expert institutions or those performing expert tasks independently. The specificities of forensic anthropology and forensic mark examination allow for the closest cooperation in the identification of individuals during the examination of bone remains and photographs or video recordings.

## Acknowledgements

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