



## Case Report

# Crime event 3D reconstruction based on incomplete or fragmentary evidence material – Case report



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## ABSTRACT

Using our own experience in 3D analysis, the authors will demonstrate the possibilities of 3D crime scene and event reconstruction in cases where originally collected material evidence is largely insufficient.

The necessity to repeat forensic evaluation is often down to the emergence of new facts in the course of case proceedings. Even in cases when a crime scene and its surroundings have undergone partial or complete transformation, with regard to elements significant to the course of the case, or when the scene was not satisfactorily secured, it is still possible to reconstruct it in a 3D environment based on the originally-collected, even incomplete, material evidence.

In particular cases when no image of the crime scene is available, its partial or even full reconstruction is still potentially feasible. Credibility of evidence for such reconstruction can still satisfy the evidence requirements in court.

Reconstruction of the missing elements of the crime scene is still possible with the use of information obtained from current publicly available databases. In the study, we demonstrate that these can include Google Maps<sup>®</sup>, Google Street View<sup>®</sup> and available construction and architecture archives.

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## 1. Introduction

Criminal and forensic practice proves that, in cases of criminal incidents, the analysis of mutual relations and spatial interactions between various elements of the crime scene and its involved participants is crucial [1–3]. In reality, such analysis can only be conducted on three-dimensional models [4]. Investigators specialised in forensic and criminal analysis assess the validity and efficacy of 3D animation analysis differently. To date, the issue has not been unambiguously resolved due to the small body of literature available. Nonetheless, the authors are convinced that the demonstrated example is representative of cases in which 3D analysis can broaden the evidence collected in the case, and influence the justification of elements crucial to the proceedings.

The necessity for forensic re-evaluation, often long after the perpetration of the crime, can be related to both the discovery of

new circumstances in the case and the availability of new tools and research methods.

The crime scene and its surroundings can undergo complete or partial transformation due to the passage of time. This means that elements considered part of the background of events, as well as those which turned out to be significantly crucial for the case, may change. Such situations mostly occur due to spatial adaptations for other uses, spatial devastations or natural degradation processes. Material evidence initially routinely collected for the case may also prove largely insufficient for additional or novel investigation practices. With this in mind it seems justified to reach out for alternative data sources, for example public information databases.

The analysed material is a specific case evaluated at the 3D Analysis Laboratory, in Wrocław Medical University's Department of Forensic Medicine ([www.medlab3d.umed.wroc.pl](http://www.medlab3d.umed.wroc.pl)) [5]. Court proceedings were re-initiated nine years after the event, with a new expertise order for crime scene and event reconstruction. The case in question dealt with a male homicide – a knife stabbing. Five participants (witnesses) of the event described its course in a largely self-contradictory manner and their delivered testimonies did not fit other findings in the case.

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The authority (Court) which ordered the expertise demanded that these contradictory testimonies be confronted and challenged. Moreover, the witnesses continued to change their testimonies over the course of the investigation; among other reasons, due to the fact that the initially collected evidence did not help to establish who the perpetrator was, or the possible course of events. The goal of the 3D reconstruction of the investigated area was to prove whether the delivered testimonies were credible within its parameters and conditions.

Having consulted expert witnesses, the authority ordering the expertise has acknowledged that a 3D animation technique may be used as a tool to verify the credibility of the witness testimonies and as a visual aid to confront those involved in the event.

The homicide took place in an area which has since undergone significant modifications. Thus it was necessary to use alternative information sources as well as modern forensic investigation IT tools [6–9].

## 2. Materials and methods

Material included testimonies collected from participants (witnesses) of the event, a video recording from a visit to the

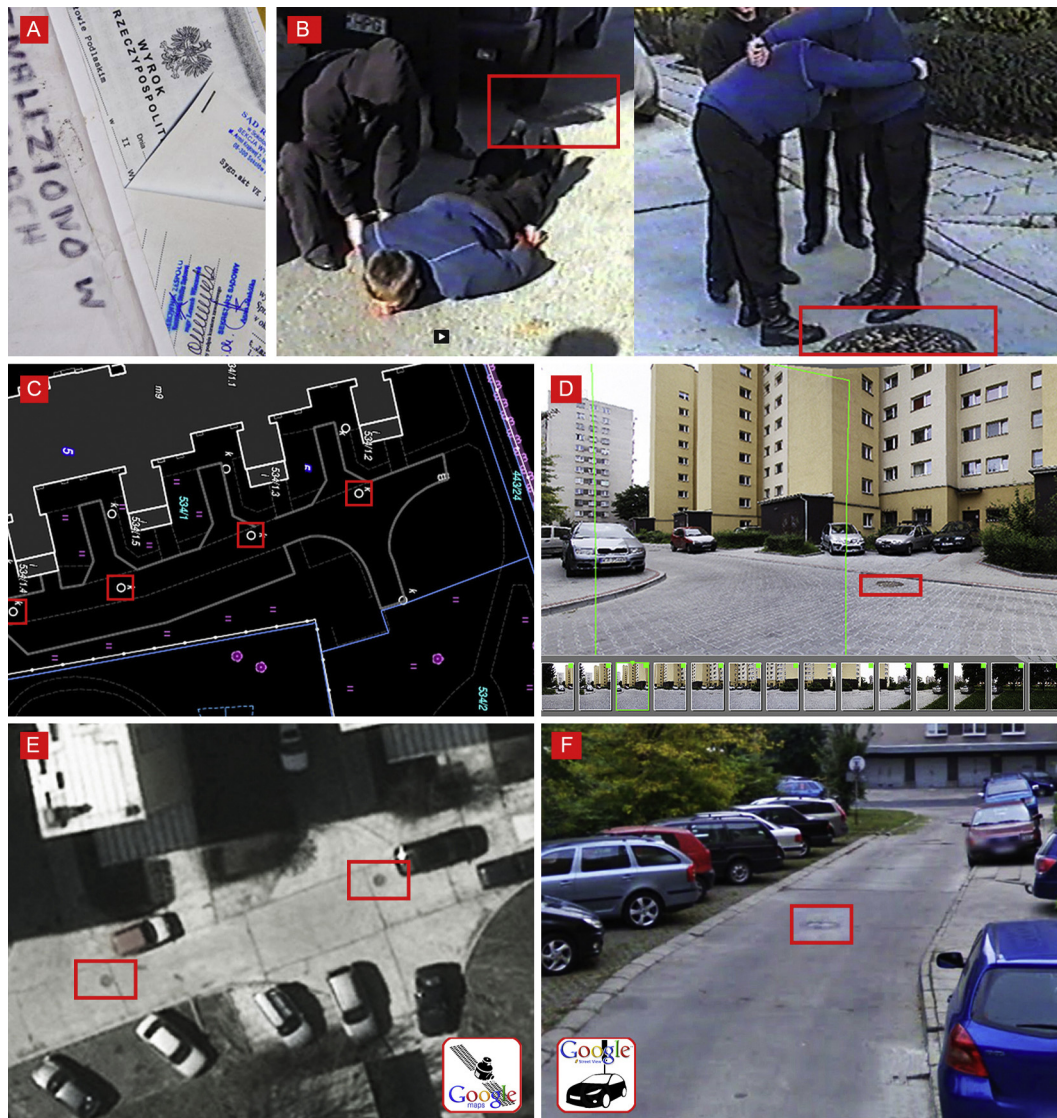
crime scene (initially collected in the case), photographic documentation, Google Maps<sup>®</sup> [10], Google Street View<sup>®</sup> [11] and construction archive documentation (secondary material obtained by the authors) (Fig. 1).

The inconsistency of the participants' testimonies did not facilitate reconstruction of the crime scene or course of events. The visual recordings made during the visit to the scene were low quality and largely fragmentary, with no full view of the scene. The authors assessed the suitability of this material and developed the methodology for its application (Fig. 2).

Selection of scenes significant to the investigation was taken from video recordings. Selection of significant descriptions of environmental elements was taken from participants' testimonies.

Collection of information about the context of the whole area – production of complete photographic documentation of the area in its current state.

In order to produce an area plan (top view), the authors obtained archive geodetic maps of the area as they use a valid scale and correct geometry. However, as they have very little detail themselves, localisation of items visible in recordings made at the site required the addition of those details to the plan.



**Fig. 1.** Material samples (red rectangles show reference information): (a) testimonies from participants of the event, (b) visit to the scene, (c) Geo map, (d) photography, (e) Google maps, (f) Google street view.

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