

Crime scene investigation with foresight

Anticipating alternative scenarios during the trace examination at the crime scene

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Abstract

If trace material of a suspect is found at a crime scene, it does not necessarily follow that the suspect is the perpetrator of the crime. A suspect can put forward an alternative scenario with regard to the presence of the trace material or with regard to his involvement in the crime. It is not easy to anticipate scenarios of a still unknown suspect during forensic trace examination. Nevertheless, this is very valuable. If such alternatives are not considered during forensic trace examination, there is a chance that the suspect's scenario, in relation to the crime scenario, cannot be tested at a later stage. In this article we show that it is possible to anticipate possible scenarios of a suspect in a structured and well-founded manner at the crime scene. Anticipating scenarios can make an important contribution to forensic examination for the purpose of finding the truth in criminal proceedings.

1. Introduction

In a case relating to the death of a 23-year-old woman, the accused invoked his right to remain silent during all interrogations. However, it has become sufficiently plausible for the Public Prosecution Service (OM) that the biological material found at the crime scene, here the victim's home, came from the accused. In criminal cases it is often no longer disputed from whom the DNA material originates (the question of the source). In recent years, attention has shifted to the question of how and when a suspect's DNA material ended up at the crime scene (the question of the activity) [1].

In this case, the Public Prosecution Service argues that the suspect's DNA material ended up at the crime scene because the suspect killed the victim. At the hearing, the accused states that he regularly entered the victim's home and that it is therefore not unusual for his biological material to be found at the locations sampled at the crime scene.

The Public Prosecutor's Office and the defense therefore outline different scenarios. The alternative scenario from the defense is made specific at a very late stage. The judge will weigh the two scenarios against each other in order to reach a verdict. That is why the judge will ask the public prosecutor whether this alternative scenario has been included in the criminal investigation and, if not, whether this scenario can still be investigated. These questions from the judge will often have to be answered negatively. The forensic traces needed to test the suspect's scenario are often not collected and can therefore no longer be examined. After all, the forensic trace examination at the crime scene took place well before the hearing and the crime scene has already been released. In this article we answer the question of how it is possible to anticipate scenarios of suspects that only become known later in the criminal proceedings during the examination at the crime scene.

2. Importance of trace examinations under different scenarios

During the forensic examination at a crime scene, crime scene examiners think about what happened there and who was responsible for it. It is clear that this is not easy. In addition to the presence of traces that were transferred during the crime, there are also all kinds of traces that have nothing to do with the crime. There are often several possibilities for how the traces got there. On the basis of the trace evidence, consideration must be given to the various ways in which the offence may have been committed and the actions that may have been central to it, the so-called crime scenarios [2].

Conversely, on the basis of these presumed acts, it is considered at which locations traces can be found, which traces must be collected and which traces must ultimately be examined [3]. The activities that would have been performed in the formulated scenarios are leading in this process.

In the event of a stabbing incident, for example, the perpetrator may have received blood from the victim on his hands. The perpetrator could also have injured himself. Therefore, the offender may have washed his hands before leaving the victim's home. For these reasons, the washbasin in the bathroom is examined. For example, if diluted blood is found on the button of the faucet, the examiner will consider whether to collect the trace. For example, it could be blood from the perpetrator who injured himself, or blood from the

victim. If it is the victim's blood, it could have been left behind by the offender when washing his hands. But it could also be diluted blood from the victim that has no connection with the crime, for example, because the victim injured himself that morning while shaving.

In the example, the forensic examiner¹ also considers possible noncriminal explanations for a trace found (the 'shaving scenario'). Such an innocence scenario is crucial for the evaluation of evidence. It is also from these innocence scenarios that it can be determined which traces can be collected in order to test these scenarios. In the example, in addition to the diluted blood on the faucet, this could be the razor blade. If there is blood from the victim on the razor, this supports the scenario that the victim injured himself while shaving. During the trace examination at the crime scene, no statements from suspects are usually known, which makes it difficult to formulate an innocence scenario. This also makes it difficult to determine whether -and if so which- additional traces should be collected and examined in order to be able to evaluate innocence scenarios (including the alternative scenario of the later suspect) in addition to various crime scenarios. In order to address this problem, this article sets out how traces from a crime scene can be selected in a structured way, also anticipating possible later scenarios of the defense.

3. Types of alternative scenarios

During the forensic examination of the crime scene, many different scenarios are conceivable. It therefore seems impossible to anticipate every possible scenario of a (later) suspect. But when, on a more general level, one looks at the number of different types of alternatives put forward by suspects in practice, the variation does not appear to be that great at all. After studying more than 130 judgments of different types of offences from the period from 2010 up to and including 2014, Lettinga has identified five types of alternative scenarios put forward by the defense (see Table 1) [4].

Table 1. *Types of alternative scenarios distinguished by Lettinga (2015).*

Type	Alternative scenario	Example
1	No crime	The suspect states that it is not a crime, but an accident or suicide.
2	Other person (source disputed)	The suspect denies that the trace came from him. The trace found came from another person. The crime was committed by another person.
3	Not crime-related (mode of transfer disputed)	The suspect denies having committed the crime. The trace of the accused has been left behind at a different time and/or in a different way.
4	No opportunity	The suspect had an alibi or was physically incapable of committing the crime.
5	Other than argued	It is true that the accused had a part in the event, but he acted less badly than argued by the prosecution (no premeditation, no intention, etc.).

¹ As a rule, this is a person working in the forensic investigation of the police, but the NFI also employs investigators who can carry out investigations at the crime scene on behalf of the police.

The number of types of alternative scenarios that can be anticipated during forensic trace examination at the crime scene for life crimes can be further reduced. The following describes for each type of alternative scenario whether anticipation is required and whether this is feasible.

Type 1

In the investigation of trace evidence related to homicide, the identification of crime related activities and the identification of the associated traces is essential. The current way of working as described in the Best Practice Manual of the Scene of Crime Working Group of the European Network of Forensic Science Institutes (ENFSI) provides guidance for identifying such crime-related acts and identifying and collecting the associated traces [5].

In the example case with the stabbing incident above, the victim suffered a large number of stabbing injuries. As a result, there will usually be no doubt as to whether a crime has been committed. However, there are conceivable cases in which the ‘no crime’ scenario (Type 1) offers a possible explanation. Think, for example, of cases with an unclear cause of death (e.g. in the event of possible smothering) or unclear manner of death (e.g. whether or not pushed when falling down a staircase or balcony). In such a case, possible crime scenarios will usually be considered and the relevant traces or objects will be secured (the pillow in the possible smothering case, or a sample of the back of the victim’s clothing at the bottom of the stairs). Where no traces of unidentified persons or possible suspects are found, this may be neutral evidence (no distinction can be made between the relevant scenarios) or support either scenario. How, and to what extent, will depend on the exact nature of these scenarios [6].

When finding traces of a possible suspect, possible additional explanations of Type 3 above should also be taken into account, in addition to the crime scenario and the no-crime scenario. A suspect may claim that these traces have been legitimately left behind. For example, a suspect’s DNA material on a pillow with which a victim may have been smothered will be evaluated against a legitimate activity (changing a pillowcase, making a bed, sleeping in the bed at another time, etc.). The anticipation of an alternative scenario of Type 3 will be discussed later in this article.

Type 2

The current forensic trace examination at a crime scene already provides sufficient tools to anticipate the alternative scenario ‘other person’ (Type 2). If a suspect can be related to the crime scene by means of DNA evidence, the explanation that the trace found does not belong to the suspect is not a promising strategy for the defense, due to the often high evidential value for the question of source.

Type 3

In the example case from the introduction, the public prosecutor states that the victim was killed by stabbing and that the accused is the perpetrator of the offence. The evidence provided for this is the presence of the defendant’s DNA material on the stabbing weapon.

However, the suspect states that his DNA material was found on the stabbing weapon (the knife), because he has used the knife before. He sometimes visited the victim's home and cooked and ate there a few times. He sketches a non-criminal alternative scenario (Type 3). In order to test the suspect's hypothesis, information is needed about when and how the suspect used the knife. In addition, information is needed about the prevalence of DNA from the suspect in the home, and specifically on knives in the home. How this can be anticipated during the examination of the crime scene is discussed in the remainder of this article.

Type 4

Not having been able to commit the offence (Type 4) is not an alternative scenario that can be anticipated during the crime scene examination; after all, no alternative explanation is given for the traces found. Other evidence (for example, a witness statement or camera images) can say more about the reliability of the statement. During the crime scene examination, the examination team can fall back on the anticipation of alternative scenarios of Type 2 or 3, because these are often put forward in combination with a Type 4 scenario.

Type 5

Alternative scenarios 'other than argued' (Type 5) may be more complex. There may be several offenders with different roles during the crime; for example, a victim has been hit by bullets from several weapons. Targeted trace examination can be used to investigate the different roles of the offenders in the crime. For example, the combination of RNA examination of the bullets (in which the nature of the tissue present on the bullet can be examined), ballistic examination, DNA or dactyloscopic examination of the guns and medical examination of the victim can possibly provide a definitive answer as to who fired the deadly shot. In such cases, the process of anticipating an alternative scenario is similar to that of Type 3; a scenario is outlined with alternative actions that can be anticipated during the trace examination.

It becomes more difficult if both the crime scenario and the alternative scenario would produce the same type of crime scene, for example in the case of manslaughter and self-defense with excessive use of force. In such cases, forensic examination will often offer little solace.

In conclusion, anticipating the alternative scenarios 'no crime' (Type 1) or 'other person' (Type 2) can be done by the current forensic technical examination. With regard to the alternative scenarios in which the accused was not able to commit the offence (Type 4) anticipation is not possible, because the defense does not explain anything about the traces found. However, during the crime scene examination the forensic examiner can fall back on anticipating alternative scenarios of Type 3, because the defense will often combine a scenario of Type 4 with a scenario of Type 3. Some alternative scenarios of the defense that the suspect acted less badly than argued by the Public Prosecution Service (Type 5) can be anticipated during forensic examination at the crime scene. The method of anticipation has parallels with the anticipation of non-criminal alternative scenarios (Type 3), because here too a specific act is disputed. The method of anticipating Type 3 is further elaborated below.

4. Anticipating the alternative scenario ‘not crime-related’

When an accused states that the trace was not transferred by a crime-related activity, but was left at another time, or in some other way (Type 3), it is necessary, in addition to establishing crime-related activities, to have information about activities that may have been performed at another time at the crime scene and/or with the trace carrier. However, which acts are these and what are the distinguishing features with respect to the crime scenario? In order to answer these questions, a dossier study was carried out to investigate which alternative scenarios were proposed in the past and which could have been anticipated. The dossier study analysed 55 DNA reports at activity level from 2012 to 2016 of the Netherlands Forensic Institute (NFI).

4.1. The accused declares to have been at the crime scene at another time

The analysis shows that suspects generally state that their DNA material was found at the crime scene because they were there at a different time than during the crime (Table 2) [7].

This implies that a non-criminal activity at another time can explain the presence of the suspect-related trace material on the crime-related object. This transfer can take place either directly or indirectly. This is reflected in the two further specified scenarios of suspects in the reports. The suspect states (1) that he did not handle the crime-related object (indirect non-criminal transfer; the suspect’s DNA material was transferred through another person or through another object), or (2) that he handled the crime-related object in another way or at another time (direct non-criminal transfer).

On the basis of the example case below, we consider what additional traces can be of added value to distinguish between the ultimately most relevant scenarios.

4.1.1. The accused states that he did not handle the crime-related object

During the examination of the crime scene, a crime scene examiner finds a knife under the pillow on the victim’s bed. Some blood traces on the knife suggest that the victim was stabbed with the knife. The knife is therefore recovered.

In court, the suspect is confronted with the presence of his DNA on the knife. However, he continues to deny that he is responsible for the stabbing of the victim and indicates that he has never seen the knife before. He claims that his DNA must have ended up on the knife because he slept on the pillow a day before the knife was found under it.

Table 2. *Type of alternative scenario of the defense observed in DNA reports at activity level of the Netherlands Forensic Institute.*

Type	Alternative scenario	Number (N = 62)*	Percentage (%)
1	No crime	0	0
2	Other person	13	21
3	Not crime-related	43	69
4	No opportunity	0	0
5	Other than argued	6	10

* Several proposition pairs are evaluated in some reports, resulting in a total of 62 alternative scenarios.

The first activity considered is the handling of the knife. For this, recovering the knife is sufficient. After the accused has stated his scenario about sleeping in the bed, the examination also focuses on this alternative activity. If only the knife is recovered, the sleeping scenario cannot be tested very well. The alternative scenario can be tested much better by also collecting traces from the surroundings of the knife.

The pillow and/or the underlying sheet can be examined for the presence of DNA material of the accused in order to test his statement about the earlier sleeping and the possibility of indirect transfer of DNA material from the bedding to the knife.

It is therefore valuable to take samples in the immediate vicinity of the contact location in addition to the crime-related object, in the example case this would concern the pillowcase or the underlying sheet.

In addition, research on samples taken in the wider environment can provide an assessment of the presence (of DNA material) of a suspect at locations at the crime scene that are not crime-related and thus contribute to assessing the probability of the observations given the suspect's scenario. This could include environmental sampling in the bedroom, such as collecting and sampling the remaining bedding.

4.1.2. The accused declares to have handled the crime-related object at another time

The accused could also argue that he is not the perpetrator of the crime, but does recognize the knife, which has been identified as the stabbing weapon. He claims that he used the knives present in the house at earlier moments.

Environmental sampling is less relevant in such a scenario, since the use of this specific knife is not disputed by the suspect. According to him, the suspect's DNA material ended up on the crime-related object at an earlier point in time. In order to test this scenario against the crime scenario, it is valuable to sample or collect other similar objects. In this example, it is important that the other similar knives from the house are also collected and examined. In this case, it can be investigated whether DNA material of the suspect is also present on the other (not crime-related) knives. Combined with context information about the location where it was found, the history of use of the specific knife and of the similar objects, this gives the DNA expert information about the probability of the presence of DNA material on the crime-related knife as a result of use at an earlier moment.

In some cases it can also be valuable to take several samples on the same (crime-related) object, but in other places. Similar to the samples taken in the home, in this case it concerns the presence or absence of trace material at crime-related and (possibly) not crime-related places. If, for example, the samples from the locations around the stab damage in the victim's T-shirt contain DNA material from the suspect, it is informative to find out whether or not DNA material from the suspect is also present at not crime-related locations of the T-shirt (depending on the possible previous social contact).

Such information enables the expert to evaluate the findings in the light of propositions about the crime-related contact and not crime-related contact.

4.2. Types of additional sampling

On the basis of the outlined case study, it appears that four types of additional sampling can be important in anticipating the alternative scenario ‘not crime-related’ (Type 3). These are: (a) sampling in the immediate vicinity of the crime-related object, (b) sampling in the wider area, (c) sampling or collecting similar objects and (d) intra-object sampling (see Figure 1).

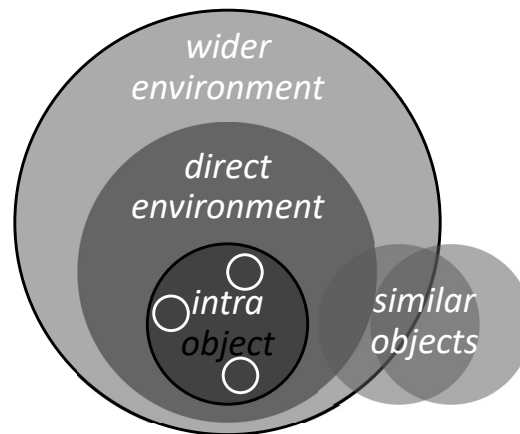


Figure 1. Summary of additional sampling and similar objects needed to anticipate the alternative scenario of suspect(s).

4.3. Status quo regarding the anticipation of the alternative scenario ‘not crime-related’

In the light of the above findings, the forensic-technical process was considered in 15 closed criminal cases of homicide on the basis of trace lists and images of crime scenes. The collected traces on the trace lists were compared with the traces theoretically available, as seen on the crime scene images. In this way we identified which additional traces could already be secured by examiners at the crime scene according to the existing procedure. After analysis of the trace lists and crime scene images, only similar objects appear to have been collected during the crime scene investigation. Intra-object sampling on the crime-related object does not seem to be carried out. However, it should be noted that this type of sampling is often still possible at a later stage (e.g. when clothing has been collected).

It is essential that sampling, packaging and transport of the object do not result in the loss or displacement of DNA material on the object in question [8]. Taking environmental samples (in the wide and immediate vicinity) is hardly ever done. In order to anticipate the alternative scenarios of suspects, such additional objects and sampling may be crucial. Securing objects or taking samples from the immediate vicinity of a crime-related object is relatively easy to perform.

This also applies to securing relevant similar objects. However, additional scientific research is needed to identify which samples in the wider area can be informative with regard to the presence of a person at another time. Further scientific research can, for example, be focused on the presence of background DNA at an indoor location and on the degradation of DNA material at an indoor location.

5. Advantages of anticipating alternative scenarios

Anticipating alternative scenarios during the investigation at the crime scene is very important. This is because of the increased possibilities to weigh the investigation results for the relevant scenarios at a later stage, including at the trial.

In addition, securing additional traces already offers advantages at an earlier stage of the criminal investigation. Given that alternative scenarios have been considered, tactical investigators can take into account these alternative scenarios during interrogations. Does the suspect indeed say that he is a frequent visitor? Does he indicate what he came into contact with at the crime scene? In an interrogation, the suspect may be invited to make statements on this, which may contribute to finding the truth in a criminal investigation.

Anticipating alternative scenarios also makes sense when it comes to other types of crimes. Consider, for example, securing the clothing of a sex offender. Is the clothing in the laundry basket? Then also secure other clothing from this laundry basket ('immediate vicinity'). Especially if there is or could be a relation between the suspect and the house. This makes it possible to investigate the chance of indirect transfer from other clothes in the laundry basket (e.g. if the suspect declares that his clothes are also in the laundry basket).

Evaluations at activity level also play a role in forensic areas of expertise other than DNA, and anticipating alternative scenarios is crucial there too.

As set out in this article, it is useful and possible to take into account alternative scenarios of suspects during forensic examinations, which are only suggested at a later stage. Forensic examinations can be structured in such a way as to allow examination of additional samples and objects at a later stage. Although numerous alternative scenarios and activities are conceivable, it is possible to anticipate alternative activities that are commonly suggested in practice. Moreover, this anticipation is usually possible by collecting a relatively small number of additional traces or trace carriers.

We gave a number of concrete examples of this approach in this article. Not all of the additional traces need to be examined immediately. If the scenarios in view of which the traces or trace carriers were secured are documented, they can make an important contribution to the finding of the truth, when alternative scenarios are put forward in a criminal case. In this way we can optimally anticipate the evaluation of scenarios at the activity level.

References

- [1] B. Kokshoorn, B.J. Blankers, J. de Zoete & C.E.H. Berger, 'Activity level DNA evidence evaluation: On propositions addressing the actor or the activity', *Forensic Science International* 2017, 278, p. 115-124.
- B. Kokshoorn, L.H.J. Aarts, T.J.P. de Blaeij, P.A. Maaskant-van Wijk & B.J. Blankers, 'Bewijskracht van onderzoek naar biologische sporen en DNA. Deel 1. Theoretisch kader en aandachtspunten bij conclusies in het deskundigenrapport', *Expertise en Recht* 2014, afl. 6, p. 197-203.
- C. Champod, 'DNA transfer: Informed judgment or mere guesswork?', *Frontiers in Genetics* 2013, 4, p. 1-3.
- A.P.A. Broeders, 'Het forensisch tekort', *Expertise en Recht* 2011, afl. 4, p. 142-151.
- I.W. Evett, P.D. Gill, G. Jackson, J. Whitaker & C. Champod, 'Interpreting small quantities of DNA: the hierarchy of propositions and the use of Bayesian networks', *Journal of Forensic Sciences* 2002, 47, p. 520-530.
- [2] C. Epskamp-Dudink, 'Niet te filmen! Over retrospectief scenariodenken in de opsporingspraktijk', *Lectoraat Intelligence* 2016, Politieacademie.
- [3] M. de Gruijter & C.J. de Poot, 'Rationele keuzes van onderzoekers en rechercheurs', in: S. Ruijter, W. Bernasco, W. Huisman & G. Bruinsma (red.), *Eenvoud en verscheidenheid: Liber Amicorum voor Henk Elffers*, Amsterdam: NSCR/VU 2013, p. 187-200.
- [4] B. Lettinga, 'Recht doen aan alternatieve scenario's', *PROCES* 2015, 94, p. 50-61.
- [5] K. Fryer, *Scenes Of Crime Examination Best Practice Manual*, European Network of Forensic Science Institutes 2012.
- [6] D. Taylor, 'The evaluation of exclusionary DNA results: a discussion of issues in R v. Drummond', *Law, Probability and Risk* 2016, 15, p. 175-197.
- [7] E.M. Ton, *Aandacht voor Alternatieve Verklaringen tijdens Forensisch Sporenonderzoek bij Levensdelicten*, Masterscriptie Forensische Criminologie, Faculteit der Rechtsgeleerdheid, Universiteit Leiden 2016.
- [8] M. Goray, R.A.H. van Oorschot & J.R. Mitchell, 'DNA transfer within forensic exhibit packaging: Potential for DNA loss and relocation', *Forensic Science International Genetics* 2012, 6, p. 158-166.