Optimization process of the forensic investigation

Regarding home invasion robberies

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Lize Dirrix

TU Delft

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Lize Dirrix
Student number: 4733282

Thesis Committee Biomedical Engineering

Prof. dr. J. Dankelman	TU Delft, Biomechanical Engineering
Dr. ir. A.J. Loeve	TU Delft, Biomechanical Engineering
Dr. É. Kalmár	TU Delft, Science Education and Communication
Drs. C. Wehrmann	TU Delft, Science Education and Communication

Thesis Committee Communication Design for Innovation

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Dr. É. Kalmár	TU Delft, Science Education and Communication
Drs. C. Wehrmann	TU Delft, Science Education and Communication
Prof. dr. J. Dankelman	TU Delft, Biomechanical Engineering

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Preface

In this thesis you will find an optimization process of the forensic investigation regarding home invasion robberies. As this is a complex process, multiple factors needed to be taken into account. I believe that the most important factor are the involved partners. They all partners play a different role within the criminal investigation which make the partners' needs essential to the forensic investigation.

This thesis was written for my master's degree in *Biomedical Engineering* and *Communication Design for Innovation*. The combination of the two research directions ensured a multidisciplinary approach in the optimization process. Likewise, this study was performed as part of the CSI-PEEQ project, a multidisciplinary team of members with different expertise within the forensics.

Despite the CSI-PEEQ project being delayed due to various factors, I have been able to be part of the team during many phases of the project. I experienced what it is like to work in a multidisciplinary team and what elements of such a collaboration need extra attention.

I would like to thank my thesis supervisors, Éva Kalmár and Arjo Loeve, for their help and support during the process of graduating. Furthermore, I want to thank my second supervisors, Caroline Wehrmann and Jenny Dankelman, for their feedback and advice.

As I was part of the CSI-PEEQ team since February 2019 as a graduate student and intern, I want to thank Madeleine de Gruijter and Matthijs Zuidberg for their supervision during the internship, and Christianne de Poot and Paul van den Hoven for their advice and expertise during the CSI-PEEQ brainstorm meetings.

Finally, I want to thank my family and friends who supported me along the way.

Lize Dirrix
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Abstract

The forensic investigation is one of the first steps in the criminal investigation process concerning home invasion robberies. The forensic investigation consists of objectively capturing the crime scene as it is when starting the investigation. Regarding home invasion robberies, the most important traces are fingerprints and DNA which are used for identification of individual suspects. Currently, there is little knowledge about the process of a secured trace to a result used in court.

Crime scene investigators are confronted with multiple decisions during the investigation and it is important to know with what goal in mind an investigator acts on the crime scene, as this influences the decision-making. The forensic data obtained from the forensic investigation is shared within a forensic data infrastructure. This infrastructure consists of the following criminal justice system partners involved in the process from crime scene investigation to conviction: crime scene investigators, detectives, experts at forensic laboratories, prosecutors, defense attorneys and judges. These partners are all contributing in different ways and at different times.

The forensic data infrastructure comes with sensibilities and tensions, such as tunnel vision, incomplete crime scene investigation reports, misunderstandings and one-way communication. Solving these sensibilities and tensions is crucial to the functioning of the infrastructure.

By use of a questionnaire, insights are provided into the goals and aspects of the forensic investigation that are important to the involved partners. The goals important to crime scene investigators differ little from the goals of other involved partners. The questionnaire results are reflected on in an expert reflection session. This session is part of the participatory design, which contributes in creating a mutual understanding of needs between partners. A second expert session is developed to fulfill these needs and implement solutions to solve sensibilities and tensions in an optimized forensic investigation.

The optimization process includes the optimization of the forensic investigation itself and the optimization of the forensic data infrastructure by proposing a structured forensic investigation scheme. A new experiment is presented to analyze the optimized forensic investigation.

Glossary EN-NL

Partners
Crime scene investigator = Forensische opsporing (FO)
Detective = Tactisch rechercheur
Expert = Deskundige
Prosecutor = Officier van Justitie
Defense attorney = Advocaat
Judge = Rechter
Criminal justice system = strafrechtsketen
Public Prosecution Service = Openbaar Ministerie
The Council of Judiciary = Raad voor de rechtspraak
Administration of Justice = rechtspraak

Investigation
Criminal investigation = opsporingsonderzoek
Forensic investigation = plaats delict onderzoek
Trace exhibits = sporendrager
Trace sample = bemonstering

Aspects
Efficacy = doelmatigheid (*de mate waarin het forensisch plaats delict-onderzoek bijdraagt aan het behalen van het beoogde doel*)
Efficiency = efficiëntie (*kosten- gatenverhouding van het forensisch plaats delict-onderzoek*)
Quality = kwaliteit (*correcte uitvoer van de juiste keuzes, procedures en handelingen*)

Goals
Tracing the suspect = verdachte opsporen (*achterhalen wie er als verdachte in verband kan worden gebracht met het misdrijf*)
Reconstruct the crime = reconstrueren (*achterhalen hoe en wat zich heeft afgespeeld in plaats en tijd*)
Finding the motive = motief achterhalen (*achterhalen waarom een delict gepleegd is*)
Gathering the evidence = bewijsvoering opbouwen (*bewijs samenstellen voor gebruik in de rechtbank, hier valt ook het verkrijgen van bevoegdheden onder zoals tapbevoegdheden*)
Falsify/exclude = falsificeren/uitsluiten (*aantonen van onwaarheid van een theorie*)

Parameters
Timely results = tijdig resultaat leveren
Securing as many traces as possible = zo veel mogelijk sporen veiligstellen
Securing high quality traces = kwalitatief goede sporen veiligstellen
Securing person-identifying traces = persoons-identificerende spoken veiligstellen
Securing other crime-related traces = overige delictgerelateerde spores veiligstellen
Information exchange between criminal justice system partners = informatie-uitwisseling tussen strafrecht ketenpartners
Forensic investigation by CSI in the shortest possible time = plaats delict-onderzoek door FO in zo kort mogelijke tijd
As little displacement as possible by CSI on the crime scene = zo min mogelijk verplaatsing van FO-er over de plaats delict
As little use of items/materials as possible = zo min mogelijk verbruikte spullen/materialen
As little sampling as possible on crime scene = zo min mogelijk bemonsteringen ter plaatse doen
Taking as little exhibits as possible = zo min mogelijk voorwerpen of sporendragers meenemen
Objective = objectief (*gebaseerd op feiten, niet op meningen en/of gevoel*)
Reproducible = reproduceerbaar (*met dezelfde methode tot zelfde resultaten komen*)
Traceable = herleidbaar (*denk hierbij aan: transparantie van keuzes*)
Correct = correct (*denk hierbij aan: voldoen aan FO normen, juist gekozen aanpak, juiste uitvoer, juiste rapportage*)
Complete = compleet (*denk hierbij aan: alle benodigde sporen/foto's/registraties zijn veiliggesteld/gemaakt/compleet*)

1. Introduction

"Twaalf jaar geëist voor schieten bij woningoverval[1]" - 'On the 16th of April 2019 a man was victim of a home invasion robbery in The Hague. During the home invasion the man was shot in his leg with an automatic firearm. The suspect was identified by use of phone records and was then linked to another home invasion robbery a few days earlier in Rotterdam. His DNA was found on a tie-wrap which he had used to tie down the victim.'

1.1 Home invasion robberies

The crime rate of robberies in the Netherlands has been decreasing since 2009 [1]. The decrease of home invasion robberies, which account for 35-40% of the total amount of robberies [2], however, stabilized since 2017 [3]; [2]. A home invasion robbery is defined as 'forcibly removing or extorting possessions, or the attempt to, by use of violence or threats of violence against persons in a home' [1].

According to Mesu & van Nobelen [1], most home invasion robberies are committed by local robbers, data analysis showed that a majority of robbers live only several kilometers away and are often acquaintances of the victim. Regularly, these robberies tend to be chaotic as the robbers come unprepared and the victim reacts unpredictably. Compared to other types of robberies, more violence and sometimes excessive violence is used during home invasion robberies [1]; [4]. A weapon is used in 80% of these robberies, in almost 50% the victims are injured [1] and most robberies are committed by multiple robbers. Home invasion robberies have a major impact on victims and society [5]. Therefore, well-performed investigations are essential in solving these crimes.

1.2 Investigation

1.2.1 Criminal investigation process

The forensic investigation is one of the first steps in the criminal investigation process. The forensic investigation consists of objectively capturing the crime scene as it is when starting the investigation. This includes searching for traces, securing and interpreting them [6]; [7]; [8]. The aim of the forensic investigation is to find the truth of the circumstances of the potential crime [6]. The results of the forensic investigation can serve as identification and investigation means, or as forensic evidence [7]. These results can play an important role in the reconstruction of the crime [9].

In the last years, the demand for forensic investigations increased as well as the number of traces collected at a crime scene. Developments in DNA research make it possible to extract information of increasingly smaller traces [10]. The forensic investigation is, therefore, a crucial part of the criminal investigation process and is likely to take on a more guiding role in the future due to technological innovations, unreliable testimonies and the suspect's right to remain silent.

The forensic investigation is a complex process. After a crime has been reported to emergency services, the first responders are the ones to assess the situation on scene. Police officers have to decide if and to what extent the case needs investigation [9]. The crime scene investigator performs the forensic investigation and their expertise lies in the ability to recognize locations of possible evidence [11]. The crime scene investigator passes four phases of the forensic investigation. The first three phases are the identification of traces, categorizing those traces into groups and determining the source of these traces. The fourth phase concerns the evaluation of the crime-relatedness of the traces [12].

Regarding home invasion robberies, the most important traces are fingerprints and DNA which are used for identification of individual suspects. Occasionally, tool marks and shoe prints are used to link different robberies together, providing intelligence without identifying suspects [13]; [14]. The crime scene investigator is confronted with multiple decisions during the investigation. For example which traces to focus on and what consequences certain investigation techniques might have on further analysis [13]. Crime scene investigators are therefore used to making decision with uncertainty. They combine the relevance of a trace with the usability of the trace for analysis, which are both retrieved from the information at the crime scene. These decisions are mainly based on best practices and intuition. However, the factors prior to these

[1] https://www.om.nl/actueel/nieuws/2021/02/11/twaalf-jaar-geeist-voor-schieten-bij-woningovervallen visited on 01-03-2021.

intuitive decisions are unknown and could lead to biased decision making [15]. Due to these intuitive decision making and the unfamiliarity of what has really happened at the crime scene, crime scene investigators will in all probability have a different outcome at the same crime scene [13].

After the traces are secured, stored and transported, the analysis of traces can start [12]. Decisions have to be made again, regarding which traces will be sent to the laboratory for analysis. Some traces, like fingerprints, can be analyzed in the crime scene investigator's laboratory. If traces require multiple investigations, they are send to a more specialized laboratory [13]. In the Netherlands, practically all of these traces, including DNA, are send to the Netherlands Forensic Institute (NFI), which is the largest forensic institute in the Netherlands and the main supplier of forensic evidence [16]. However, the NFI has a limited capacity. Each police region is restricted to a certain number of traces they can send to the laboratory. Due to this limited capacity, the turnaround times are high which could cause traces to become irrelevant for the investigation. Currently, there is also little knowledge about the process of a secured trace to a result used in the criminal investigation process [15].

During the analysis, the traces are individualized by determining its unique source and compared to reference material. The four phases of the forensic investigation are all part of the reconstruction process of the crime, where scenarios are based on the evidence [12]. The fourth phase concerns the relation of the trace with the crime, which determines how and when the trace originated.

Next, the detective will try to interpret the results and connect the traces to persons, making them suspects or eliminating them from the investigation [8]. Detectives can use general investigation means like taking witness statements or questioning suspects [17]; [18]. Therefore, the detectives are providing the criminal investigation a context around the forensic evidence.

Formally, the prosecutor has the authorized supervision [16] and is leading in the criminal investigation in making decisions regarding the type of investigations and their costs [9]. The prosecutor has to make sure all investigations are in accordance with the law [19] and assembles the evidence into a convincing court case [18]. Prosecutors used to have limited knowledge of the forensic investigation. Therefore, the specialized role of forensic prosecutor was introduced. Now, each Public Prosecution Service in every district of the Netherlands has one forensic prosecutor with forensic knowledge to advise prosecutors in their criminal investigations [16].

The last stage of the criminal investigation process plays part in court, where the prosecutors make their case, attorneys defend their clients and judges assess the evidence as a whole [18]. Finally, the judges decide what the evidence means in the context of the crime and whether the suspect is delinquent or not [20].

1.2.2 Usefulness of forensic investigation

The forensic investigation is complex with an enormous amount of information, time pressure and limited resources. Not everything can be investigated and decisions have to be made at the crime scene. Therefore, some form of efficiency is needed to investigate the scene and find the offender with the available resources [21]. Recent developments show an increasing interest in demonstrating the efficiency by rationalizing processes and decisions made on scene. The value of collected traces becomes more important, as these traces are the start of the criminal investigation process. The traces provide knowledge for the decision-making in processes at other levels within the criminal justice system [22]. Due to these developments, the emphasis is gradually shifting towards looking for the right traces at the crime scene instead of collecting as many traces as possible [7]. Another factor highlighting the importance of selective trace collection is the limited capacity in the forensic lab [23].

Research into the efficiency, but also efficacy and quality of the forensic investigation, is limited. Most of this research is focused on time management and crime detection rates [9]; [22]. However, more important is to know with what goal in mind the crime scene investigator acts on the crime scene, how this influences the decisions that have to be made and if the goal is met [9].

There is no unambiguous definition for the usefulness of the forensic investigation. A trace can have multiple purposes, but these purposes are not explicitly registered as such. Factors that can contribute to the usability of traces are linked to the quality of traces, the location of traces, the working methods of offenders or any other circumstance influencing the trace. Which traces eventually contribute to conviction is hard to measure [13]. Besides these factors, the performance of crime scene investigators affects the outcomes, even within the same district [23].

1.2.3 Involved partners

Regarding the criminal investigation process described above, the following criminal justice system partners are involved in the process from crime scene investigation to conviction [10]: police, with crime scene investigators and detectives; Public Prosecution service with prosecutors; experts at forensic laboratories, in this case NFI experts; and the Administration of justice, with defense attorneys and judges.

During the criminal investigation, criminal justice system partners are contributing in different ways and at different times [18]. According to Lee & Pagliaro [24] the criminal investigation consists of three forensic processes: (1) scene process, (2) laboratory process and (3) court process. The scene process, which contains the four phases of the forensic investigation defined by Broeders [12], contains the recognition, documentation and collection of traces. In the laboratory process the traces are identified, compared and individualized for evidential use. Furthermore, the court process consists of the reconstruction of the crime and the interpretation of traces [24]. Different partners are involved in each forensic process, which is presented in Figure 1.

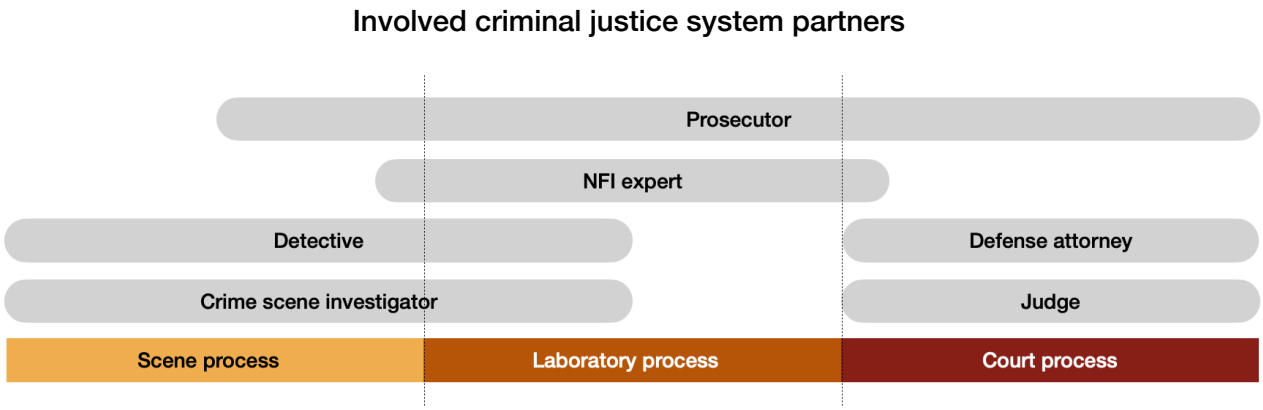

Figure 1: Criminal justice system partners contributing to the criminal investigation of home invasion robberies.

1.3 The CSI-PEEQ project

The Crime Scene Investigation - Parameters for Efficiency, Efficacy and Quality (CSI-PEEQ) project concerns aspects and associated parameters of the forensic investigation and the working methods contributing to an optimal use of the investigation by the partners of the criminal justice system. The CSI-PEEQ project focuses on home invasion robberies, as these are common crimes where the forensic investigation is of great value. Within the CSI-PEEQ project, there are three defined forensic investigation aspects:

- **Efficacy**: *the extent to which the forensic investigation contributes to achieving the intended goal*
- **Efficiency**: *cost-benefit ratio of the forensic investigation*
- **Quality**: *correct performance of the correct choices, procedures and actions*

The CSI-PEEQ project aims to determine the most important goals of the forensic investigation regarding home invasion robberies for all involved partners and the working methods contributing to the achievement of these goals. The objectives and corresponding research methods for the project are:

1. *Gaining insights into the goals of the forensic investigation of all partners of the criminal justice system and the efficacy, efficiency and quality aspects with their associated parameters.*
   - A questionnaire concerning the most important forensic investigation goals and the parameters associated to the three aspects.
2. *Determining which goals are met with use of the current forensic investigation and which (new) working methods could contribute to the achievement of the majority of the goals.*
   - Analyzing data of previously performed experiments with a staged home invasion robbery. The crime scenario and location of traces is known. The data can be used to determine the extent to which the current forensic investigation achieves the most important goals and parameters, and the working methods contributing to achieving these goals and parameters.

3. *Analyzing the effect of the (new) working methods in achieving the goals and the consequences for the forensic investigation.*
   - Developing a new staged crime scene experiment in which the determined contributing working methods will be integrated into the current forensic investigation. The effects of these working methods on achieving the goals and parameters will be analyzed.

1.4 Current study goals and questions

This study was part of the CSI-PEEQ project but had an additional focus on the collaboration between the involved partners. This study aims to gain an understanding of the different partners within the criminal justice system, their needs of the forensic investigation and to identify any potential improvements within the forensic investigation. Furthermore, the study aims to lay a foundation for a new staged crime scene experiment. Based on the CSI-PEEQ objectives, the main research question of this study is:

How to optimize the forensic investigation concerning home invasion robberies, with regard to the goals of involved partners?

The main research question will be answered based on individual research questions for each objective:

1. *Gaining insights into the goals of the forensic investigation of all partners of the criminal justice system and the efficacy, efficiency and quality aspects with their associated parameters*.

   A. What are the criminal justice system partners' goals of the forensic investigation? And what are the most important aspects regarding these goals?
   B. How do the partners collaborate?
   C. How can partners co-design the process?

2. *Determining which goals are met with use of the current forensic investigation and which (new) working methods could contribute to the achievement of the majority of the goals*.

   A. Are the goals met in the current forensic investigation? Which working methods contributed to the achievement of goals?
   B. How could the forensic investigation be optimized?
   C. How could the optimized forensic investigation be visualized for use?

3. *Analyzing the effect of the (new) working methods in achieving the goals and the consequences for the forensic investigation.*

   A. How could the optimized forensic investigation be analyzed in order to determine whether the forensic investigation goals are met?

Contribution to the CSI-PEEQ project

In this study two research directions are combined: Biomedical Engineering and Communication Design for Innovation. These two directions allow for a multidisciplinary approach to the optimization of the forensic investigation. The Biomedical Engineering part of this study focuses on the quantitative elements, while Communication Design for Innovation is focused on the social elements concerning the complex process of optimizing the forensic investigation. To translate the quantitative results of the study into an optimized process, the social elements must be taken into account as users are crucial to the criminal investigation.

A multidisciplinary approach is also present in the CSI-PEEQ project. This project is a collaboration between the Delft University of Technology, the Netherlands Forensic Institute (NFI), the Dutch Police and the Amsterdam University of Applied Sciences. Therefore, the project is a collaboration with different backgrounds in which joint decision are made. Concerning my contribution to the CSI-PEEQ project, I was responsible for integrating the questionnaire into the used software and analyze the questionnaire results and experiment data. Besides these project based responsibilities, I added the social element to the project which led to the creation of the forensic data infrastructure and development of the expert sessions. Furthermore, I developed a foundation for a new staged experiment to analyze an optimized forensic investigation.

1.5 Reading guide

In answering the research questions with a multidisciplinary approach, a communication framework and various research methods were used. Figure 2 shows the outline of this study, with the research questions per chapter and highlights of the discussed subjects.

Chapter 2 presents the communication framework which includes a forensic data infrastructure and defines sensibilities that come with the infrastructure. The chapters 3, 4, 5 and 6 focus on the three objectives and associated research questions.

In chapter 3, research question 1A is discussed regarding the goals and aspects of the forensic investigation based on a questionnaire. As this questionnaire focuses on partners with various backgrounds, the questionnaire results were reflected on in an expert reflection session.

Research questions 1B and 1C are discussed in chapter 4. The criminal justice system involves partners contributing in different ways and times, with use of results provided by the questionnaire, expert session and literature, I provide insights into the partner collaboration. Question 1C is answered by using literature regarding participatory design.

In chapter 5, the results of a previously performed staged crime scene experiment were used to answer research question 2A. These results were analyzed based on the questionnaire results provided in chapter 3. The optimization of the forensic investigation consists of integrating the results and visualizing the optimized process, concerning research questions 2B and 2C.

In chapter 6, a foundation is laid for achieving the last objective and focuses on developing a new staged crime scene experiment for the analysis of the optimized forensic investigation.

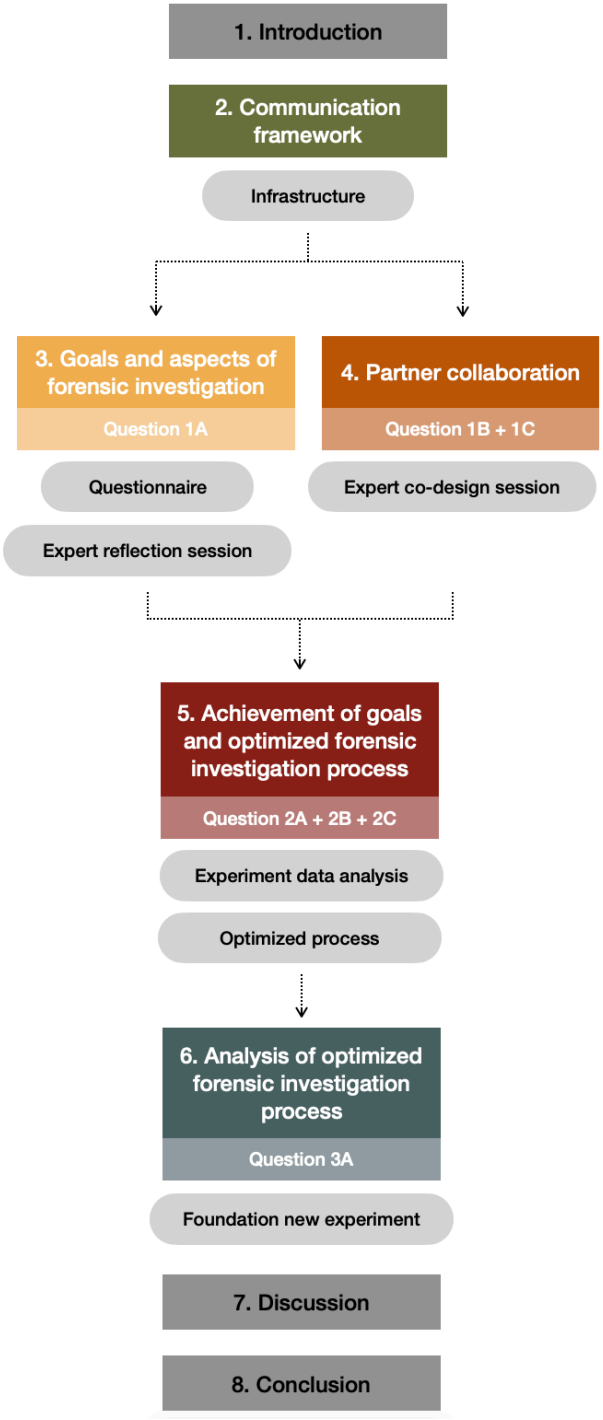

Figure 2: Study outline containing the chapters, associated research questions and highlights the discussed subjects.

2. Communication framework

The forensic investigation is a complex process in which multiple partners are involved at different points in the process. The social elements concerning this process are described based on a communication framework including an infrastructure (chapter 2.1) and a participatory design (chapter 2.2). This framework is used to interpret the results of the following chapters from a social perspective.

2.1 Infrastructure

Optimization and innovation processes are dependent on changes introduced by social actors. These actors, from start to end, all have different roles but are interacting within a dynamic social system [25]. Actors in a dynamic social system have shared models of reality and the roles of these actors are tied together by channels of communication [26]. When wanting to optimize or innovate in a social system, boundaries between involved actors (parts) and the social system (whole) itself have to be taken into account. These two elements can be found in a socio-technical system, giving insights into collaborations which are important to understand the development of the optimization or innovation [25]. Actors collaborate and co-create within a socio-technical system [25], as in an infrastructure where knowledge is shared [18].

Concerning the forensic investigation, the involved partners can be identified as the social actors within the criminal justice system. Between these partners, forensic data is shared and is, therefore, similar to a knowledge infrastructure [18], defining the current system as a forensic data infrastructure (Figure 3). Such an infrastructure comes with general sensibilities regarding a knowledge infrastructure and specific sensibilities regarding forensic data sharing.

2.1.1 Sensibilities in a knowledge infrastructure

A knowledge infrastructure comes with certain sensibilities: tensions, maintenance and inequalities. Solving tensions is crucial to the functioning of infrastructures. These tensions arise due to differences between partners, which can be seen as different knowledge cultures within the infrastructure [18]. Agreed-upon standards can solve certain tensions and contribute to a stable data sharing infrastructure. These standards can bridge the differences between knowledge cultures, for example, by templating crime scene investigation reports. Furthermore, crime scene investigators are taught to collect traces in a way that analysis can be performed at the forensic laboratory too. This teaching can be seen as intercultural standards. However, such infrastructures need constant work to remain functional, as standards are not applicable in every situation and have to evolve over time [18].

Another sensibility is the intertwined power and inequality within an infrastructure. There is a difference between visible and invisible work, which is often linked to hierarchy. Therefore, the socio-technical system has to keep in mind that standards can mean different things for different actors engaging in the system [18]. Data needs to be shared as stable as possible, meaning that the data should be understood in exactly the same way by all actors. When looking at crime scene investigation reports, results are currently not easily readable which leads to unstable data sharing between knowledge cultures [18]. So there is a need for a mutual understanding across the knowledge cultures to stably share the forensic data.

Midstream modulation can support actors to establish a mutual understanding of the sensibilities within a system [25]. Partners need to have a common language and develop aligning goals to effectively work together [27]. This common language can lead to dialogue on the sensibilities regarding the forensic data infrastructure and can, therefore, support the collaboration [25]. However, partners need to interact and be prepared to bridge the gaps between them in order to understand each others needs and goals [27]. Furthermore, establishing a mutual understanding and developing standards helps to resolve tensions. By aligning standards according to the needs of the involved knowledge cultures, the differences between standards and individual crime scenes are minimized. Therefore, aligning prevents standards from failing to resolve tensions within the infrastructure [18].

2.1.2 Sensibilities in a forensic data infrastructure

With the forensic data infrastructure additional sensibilities are present: decision-making, tunnel vision, one-way communication and complexity of the collaboration. Decision-making, or the transparency of decision-making, about what decisions are made on the crime scene and what scenarios come to mind. Valuable traces are based on multiple decisions, deciding whether or not to investigate the crime scene, which traces to collect and when to stop collecting traces [8].

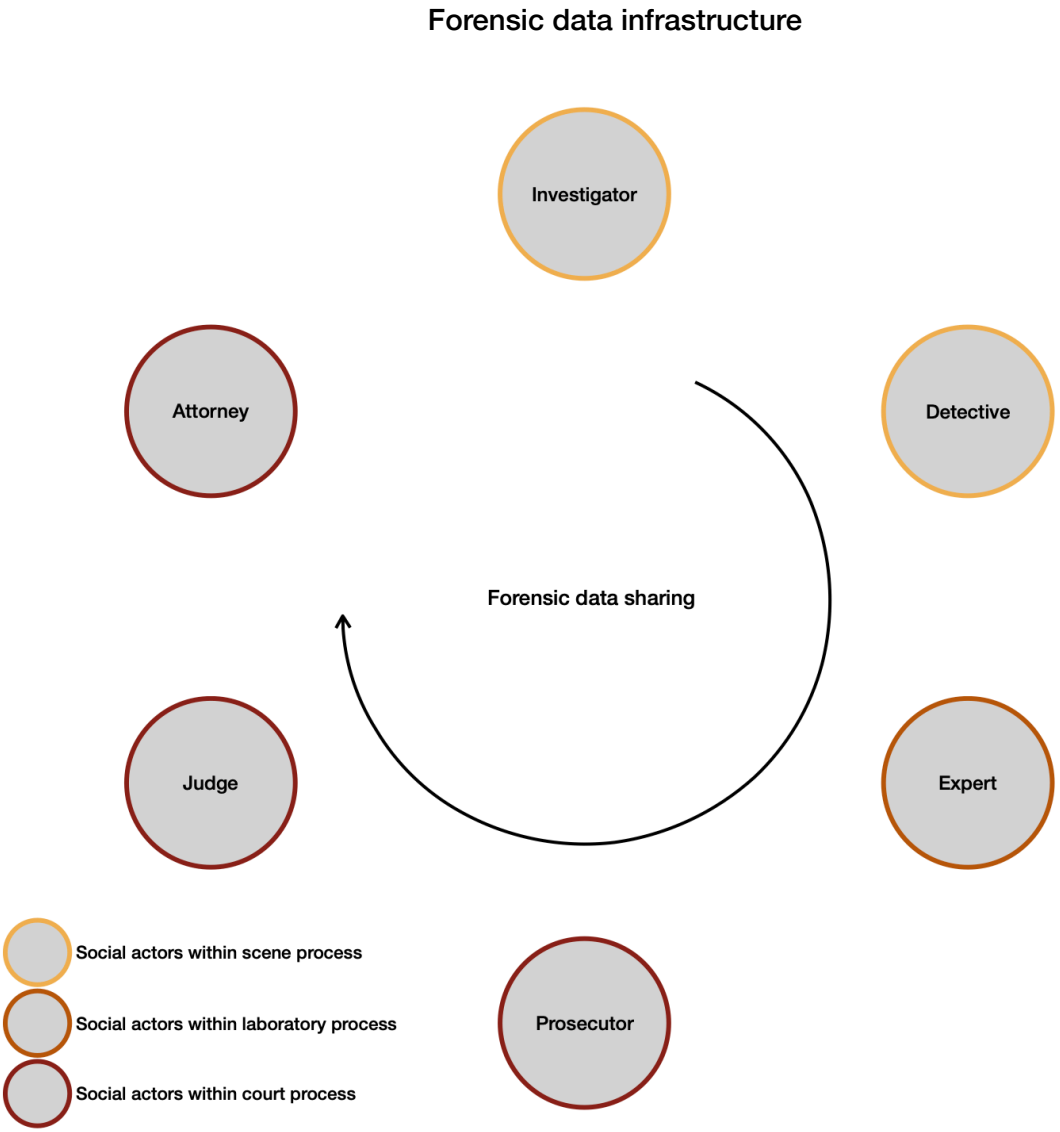

Figure 3: Schematic representation of the forensic data infrastructure including the social actors defined in Figure 1. The forensic data sharing starts at the partners involved in the *scene process* from which it moves towards the partners involved in the *court process*. The arrow represents the direction of the shared data.

According to Julian & Kelty [28] timely information sharing between partners is essential for decision-making.

Partners can become too convinced of one scenario which could lead to ignored information regarding a different scenario, and the evidence only focussing on the confirmation of that one scenario, also known as tunnel vision [21]. Alternative scenario's can minimize the effect of tunnel vision in the criminal investigation process [21]. By normalizing a 'devil's advocate' system, there will be a focus on these alternative scenario's, particularly in cases that seem to be easily solved. Tunnel vision is directly related to decision-making, if the decision-making is more transparent in why certain decisions were made, it will be easier to identify tunnel vision [29].

Every partner contributes in a different way and all of these contributions are essential for the system as a whole. However, these differences between partners, or knowledge cultures, can also cause misunderstandings [18]. Poor communication between partners is a risk factor within the infrastructure and, therefore, of the effectivity of the investigation [28]. The forensic data is mostly shared via one-way communication, whereas two-way communication includes dialogue and feedback [30]. There is little feedback in the system, partners are mostly unable to track what has happened to a case in which they contributed. Therefore, partners do not know how the forensic data is received by others [18]. Such complex problems can be tackled by using a multi stakeholder collaboration approach. It is a creative process in which partners contribute by bringing all knowledge together with the intention to, in this case, optimize the forensic

investigation. It is, however, not an easy process as it requires perseverance, resources and time [31].

The sensibilities defined above are integrated into the forensic data infrastructure in Figure 4. The decision-making and tunnel vision sensibilities are most applicable to the crime scene investigator, while other sensibilities apply to the socio-technical system as a whole. The forensic data infrastructure will be expanded on the basis of the results from chapters 3 and 4, which will provide insights into the tensions within the socio-technical system and the collaboration between the involved partners.

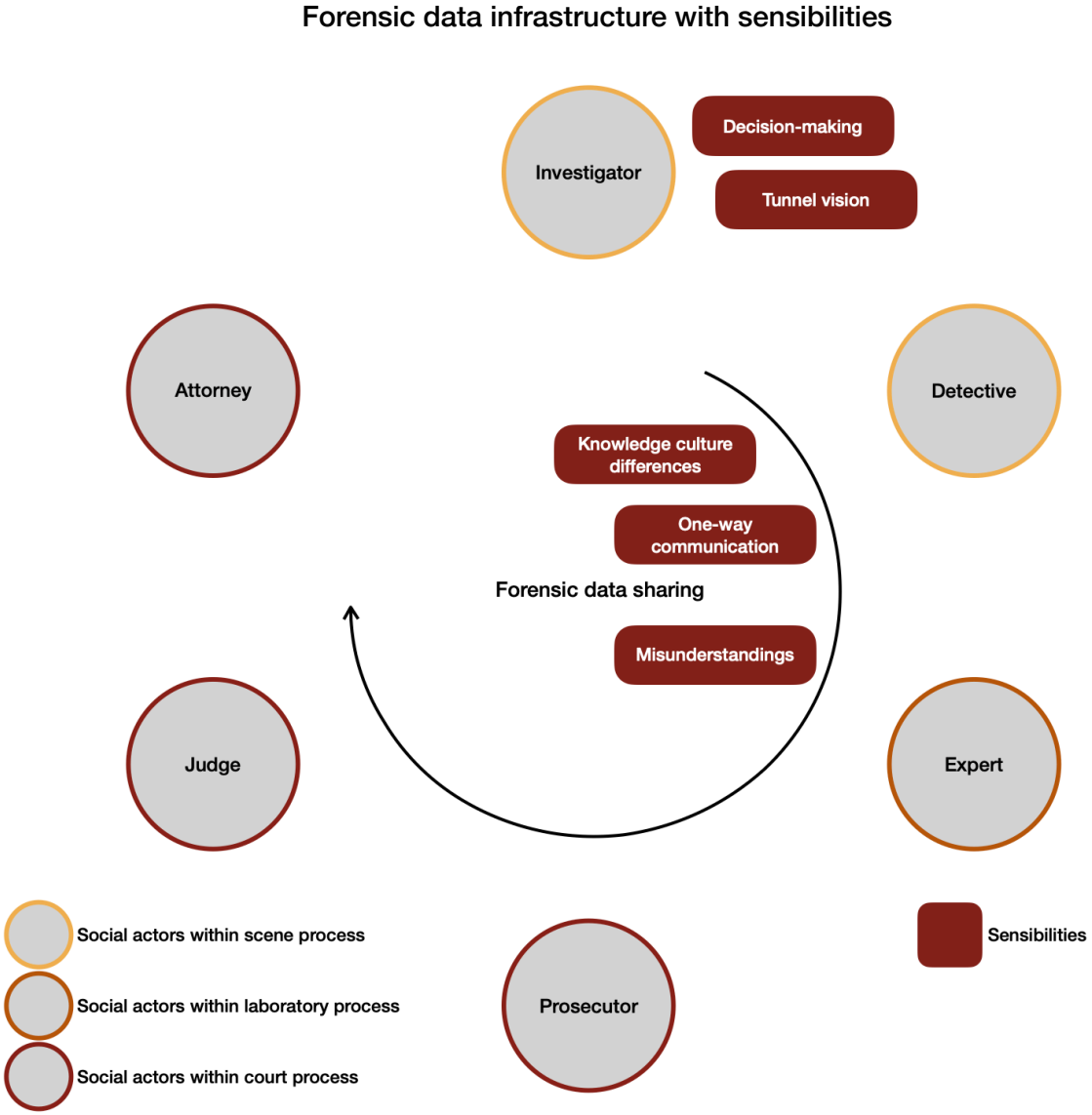

Figure 4: Schematic representation of the forensic data infrastructure with sensibilities that come with the infrastructure. Sensibilities applicable to the socio-technical system as a whole are presented within the forensic data sharing arrow.

2.2 Participatory design

To optimize a complex process, changes within a socio-technical system need to be activated by the actors interacting with the system [25]. Insights into the collaborations between actors and the infrastructure are crucial for optimization. For the optimization of a complex process and to deal with the sensibilities that come with the infrastructure, the system can make use of a participatory design in which the process is designed with users (co-design) instead of for users. Designers and users co-design the process by focusing on knowledge sharing. Furthermore, a participatory design can reduce resistance to changes within the system as all partners affected by the system were involved in the design process [32].

2.2.1 End-motives of participatory design

Bergvall-Kåreborn & Ståhlbrost [32] defined three end-motives of using participatory design. The first end-motive is *democracy* where actors within a socio-technical system have the right to influence decisions affecting their work. To do so, participating in the design process and decision-making process is necessary. Secondly, the *theoretical* end-motive involves actors in the participatory design, they can learn more about the nature of participation by exploring issues such as knowledge sharing and types of participation. The concepts for this motive are collaboration, communication and creating a mutual understanding between partners. With these concepts, gains for all partners are created. Finally, the *pragmatic* end-motive focusses on improving the quality of the system and system acceptance, in other words improving the cost-effectiveness. Quality can be improved by elaborating on the system requirements by using the partners' knowledge, skills and expertise. For the system acceptance, the commitment of actors is crucial.

2.2.2 Participatory design of current study

The participatory design for this study focusses on the optimization of a complex process with the sensibilities of the forensic data infrastructure. To involve the partners regarding the criminal investigation process of home invasion robberies, the participatory design is processed in two expert sessions (process design is visualized in Figure 5) [33].

These expert sessions are based on focus-group research [34], a qualitative way of data collection [35]. This base provides the sessions with the advantage of gaining new insights and shared opinions due to the possibility of discussion [35]. These sessions preferably consists of six to eight participants [34]; [36]. Before the start of each session, there is time for some 'small talk', according to Breen [35] an important element of focus-group research.

The sessions are led by a moderator and an assistant moderator [34], who observes the behavior of the participants. Information for the moderator and assistant moderator are provided with the session outline. This information contains suggestions, for example phrases or methods to keep the participants engaged or to involve more silent participants [34]; [33] (this information can be found in Appendices C and I). The sessions are recorded for transcription and will be deleted after use.

In the first session, the partners reflect on study results defining the partners' needs and thereby creating a start for a mutual understanding (discussed in Chapter 3). The participatory design in the first session is aimed at the *theoretical* end-motive defined by Bergvall-Kåreborn & Ståhlbrost [32]. A second session is necessary to promote co-design in overcoming tensions within the socio-technical system and fulfilling the needs of the partners (presented in Chapter 4). This session focuses on the improvement of the infrastructure and is, therefore, aimed at the *pragmatic* end-motive. These session outcomes are ultimately implemented into the optimized forensic investigation.

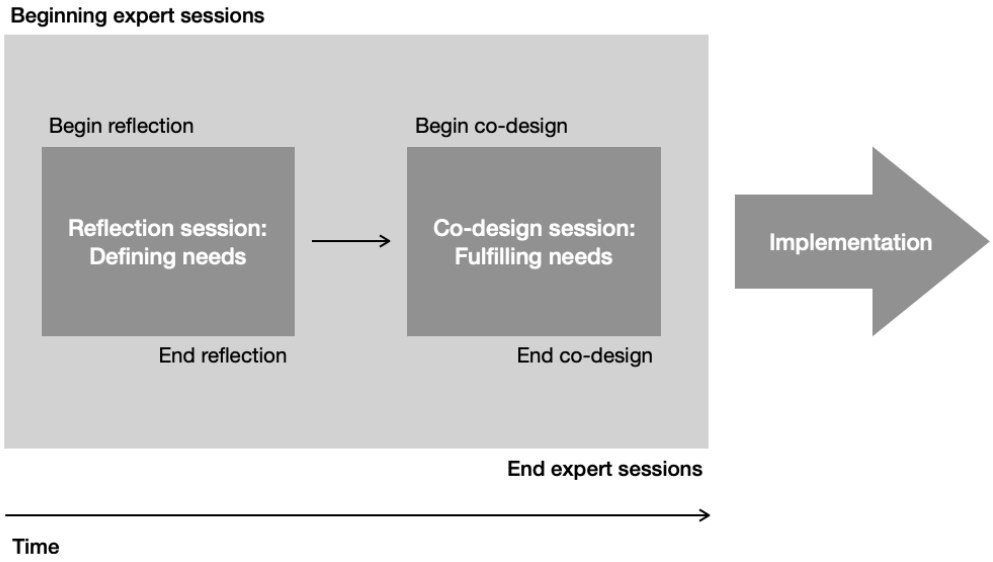

Figure 5: Participatory design for the involved partners processed in two expert sessions. Both sessions have to be completed before implementation into the optimized forensic investigation.

3. Goals and aspects of the forensic investigation

This chapter focuses on research question 1A (described in chapter 3.1) of the first objective: *gaining insights into the goals of the forensic investigation of all partners of the criminal justice system and the efficacy, efficiency and quality aspects with their associated parameters*. This research question is answered by use of a questionnaire (chapter 3.2) and an expert reflection session (chapter 3.3).

3.1 What are the criminal justice system partners' goals of the forensic investigation? And what are the most important aspects regarding these goals?

To answer the first research question, a questionnaire was developed based on previously conducted semi-structured interviews. Both the interviews and questionnaire were developed by the CSI-PEEQ project team, I assisted the team in the development of the questionnaire. The aim of the questionnaire was to gain insights into the goals of the involved partners. In addition to the questionnaire, I developed an expert reflection session in consultation with the CSI-PEEQ project team for partners to reflect on the results of the questionnaire. Both the questionnaire and expert reflection session were conducted in Dutch and therefore translated for use in this study.

3.2 Questionnaire

3.2.1 Questionnaire methods

The questionnaire was made using the Qualtrics[2] (Qualtrics, Provo, UT) online survey software and designed with use of pre-built question types and additional Java programming. It was decided by the CSI-PEEQ project team to mostly use 'slider' type questions, as this type of question made it possible to score the importance of goals relative to each other (Figure 6). Java programming was used to add a 'mouse over' for definitions of terms used in the questionnaire, giving every participant the same understanding of the used terms.

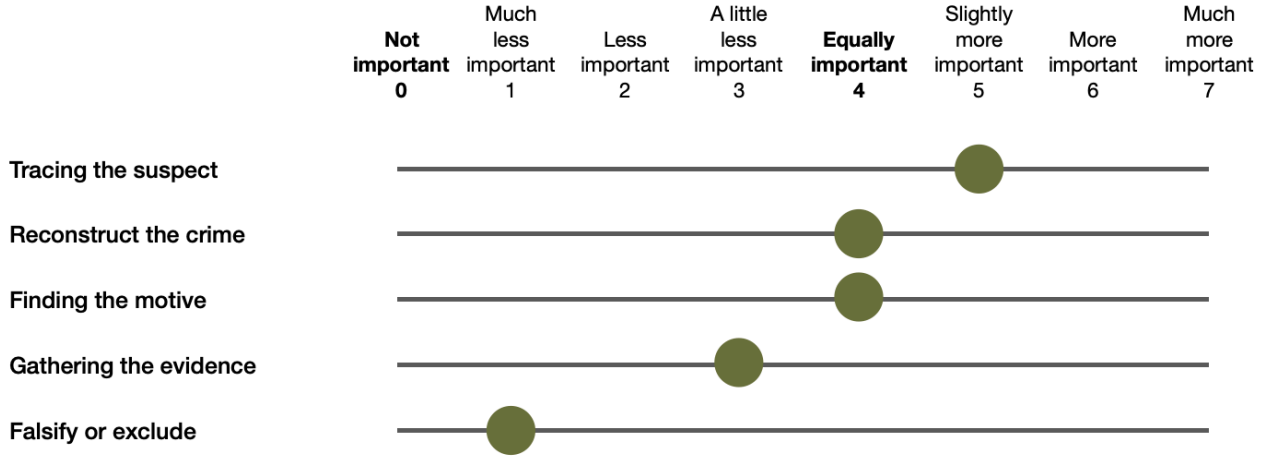

Figure 6: Example of the 'slider' type questions with the relative importance scale used in the questionnaire.

The questionnaire (Appendix A) started with a brief introduction on the CSI-PEEQ project. Next, the participants had to select to which criminal justice system partner they belonged: crime scene investigators, detectives, NFI experts, (forensic) prosecutors, defense attorneys or judges. For each of these partners the value of the questionnaire results was briefly explained.

The participants had to complete a test question to get familiar with the 'slider' type questions. After the test question, the questionnaire was divided into two parts: the goals of the forensic investigation in different situations and the most important aspects regarding these goals. For each aspect, various associated parameters were defined with the aim to make the forensic investigation measurable. In part one, a home invasion robbery case was introduced with five different variations in situation of this case:

Situation 1: there is a suspect, no use of violence, no part of a series of robberies

[2] https://www.qualtrics.com/core-xm/survey-software/

Situation 2: there is no suspect, no use of violence, no part of a series of robberies

Situation 3: there is a suspect, no use of violence, part of series of robberies

Situation 4: there is a suspect, use of violence, no part of a series of robberies

Situation 5: there is no suspect, use of violence, part of series of robberies

Five forensic investigation goals (Table 1) were introduced: **tracing the suspect**, **reconstruct the crime**, **finding the motive**, **gathering the evidence** and **falsify or exclude**. For each situation the goals had to be scored relatively on a scale from *much less important — less important — a little less important—equally important — slightly more important — more important — much more important* than another goal (Figure 6).

Table 1: Forensic investigation goals and definitions defined by the CSI-PEEQ project.

Goal	***Definition***
Tracing the suspect	*Find out who can be linked to the crime as a suspect*
Reconstruct the crime	*Find out what has happened where and when at the crime scene*
Finding the motive	*Find out why the crime has been committed*
Gathering the evidence	*Assemble the evidence for use in court, this also includes obtaining authorizations for investigation means (such as taps)*
Falsify or exclude	*Demonstrating the untruth of theories or hypotheses*

Part two of the questionnaire introduced the three defined aspects of the forensic investigation: efficacy, efficiency and quality. Each participant had to choose three most important goals regarding their view on the forensic investigation as a criminal justice system partner. For the chosen three goals, the participants had to answer questions regarding the importance of each aspect and their associated parameters, only the parameters prone to misinterpretation were defined (Table 2). The questions in part two used the same scale of relative importance as used in part one.

Table 2: Parameters associated to the efficacy, efficiency and quality aspects, with used definitions for parameters prone to misinterpretation.

Aspect	*Parameters*	Definition
Efficacy	*Timely delivery of results*	
	Securing as many traces as possible	
	Securing high quality traces	
	Securing person-identifying traces	Traces with which the identification of a person can be established, directly or through reference material
	Securing other crime-related traces	races that cannot be used to establish the identity of a person, but traces that are believed to provide information about how the crime was committed
	Information exchange between criminal justice system partners	Communication between criminal justice system partners during the duration of the forensic investigation (for example, information exchange between CSIs and detectives etc.)
Efficiency	*Forensic investigation by CSI in the shortest possible time*	

	As little displacement as possible by CSI on the crime scene	
	As little use of items/materials as possible	
	As little sampling as possible on crime scene	
	Taking as little trace exhibits as possible	
Quality	*Objective*	Based on facts, not on opinions or feelings
	Reproducible	With use of the same method to get the same results
	Traceable	Think about: transparent choices
	Correct	Think about: according to CSI standards, correct used method, correct performance, correct reportage
	Complete	Think about: secured and photographed all necessary traces

The aim was to have 40 participants of every involved criminal justice system partner in the Netherlands to complete the questionnaire. The CSI-PEEQ project members of the NFI used their network to recruit participants by asking their colleague experts, the eleven regional police units, the Public Prosecution Services in every district, the Council for the Judiciary and defense attorneys.

The initial plan was to have guided questionnaire sessions with the involved partners in which participants could complete the questionnaire and have the opportunity to ask questions concerning the questionnaire. Unfortunately, after the first seven sessions this plan was canceled due to the coronavirus pandemic. Alternatively, the questionnaire was performed online from that moment on and participants received additional information up front, which was the same for every partner (Appendix B).

Pilot

The questionnaire was pilot tested with one participant from each criminal justice system partner. The participant was asked to complete the questionnaire and describe all issues they ran into while completing the questionnaire. These issues varied from malfunctions in the software system to definitions of terms used in the questionnaire. The questionnaire was adjusted according to the feedback provided by the pilot test. During the pilot tests, observations and comments were written down for social perspective purposes.

3.2.2 Questionnaire analysis

The questionnaire results were exported from the Qualtrics software into a Microsoft Excel (Version 16.51) file. All participants were categorized into partner groups presenting the involved partners. For each participant, the scored items per question were normalized into fraction scores, so the relative importance between scores was maintained.

As the used relative importance scale consists of multiple Likert-type items, the results fall into the ordinal measurement scale with a non-parametric nature [37]. Due to the non-parametrical nature of the questionnaire results and the overall results not being normally distributed, the effect size was used to discuss the relative importance of differences between results. Although the effect size is different from statistical significance, it informs about how large the effect is and therefore how important the result is. In addition, using the effect size allows for comparisons between different sample sizes [38]. As the results are non-parametric, a suitable effect size is necessary. This study made use of Cliff's delta, which makes no assumptions regarding the underlying distribution of the results [39]. Vargha & Delaney [40] defined guidelines for the interpretation of Cliff's delta effect size: small effect .11, medium effect .28 and large effect .43.

3.2.3 Questionnaire results

A total of 148 respondents completed the questionnaire. The planned 40 participants per partner group were not realized for each group: detective (n=35), NFI expert (n=15), defense attorney (n=5) and judge (n=12). Firstly, the results of the crime scene investigators are described and secondly, the results of the other partners are compared to those of crime scene investigators. More detailed figures and tables of the results per partner can be found in Appendix C.

Crime scene investigator

As the crime scene investigator is performing the forensic investigation, it is crucial to obtain the goals with which they conduct the investigation. Figure 7 shows the goal distribution of crime scene investigators, where the y-axis contains the five forensic investigation goals (Table 1). The figure is intended to visualize the distribution, box plots with the upper and lower quartiles of these results can be found in Appendix C: *crime scene investigator*, Figure 2.

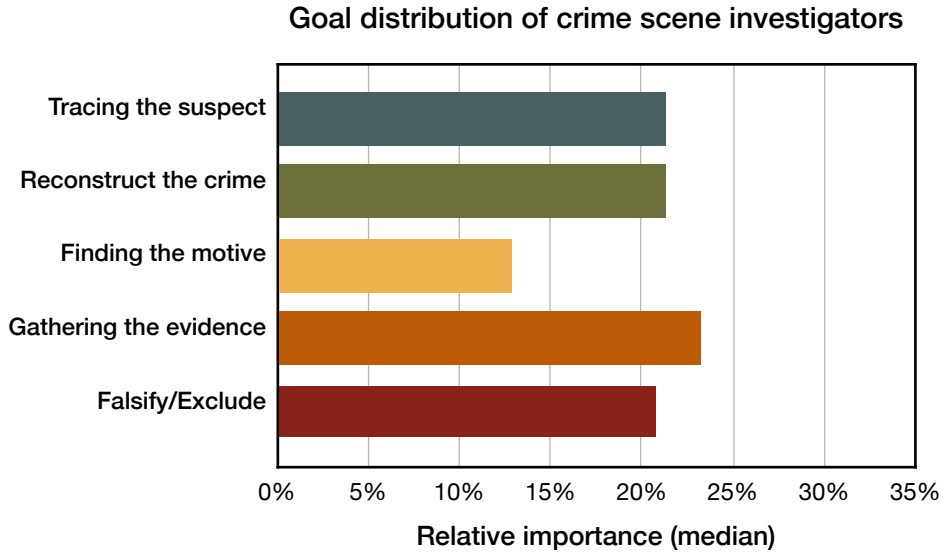

Figure 7: Goal distribution of the relative importance of the five forensic investigation goals for crime scene investigators (n=40).

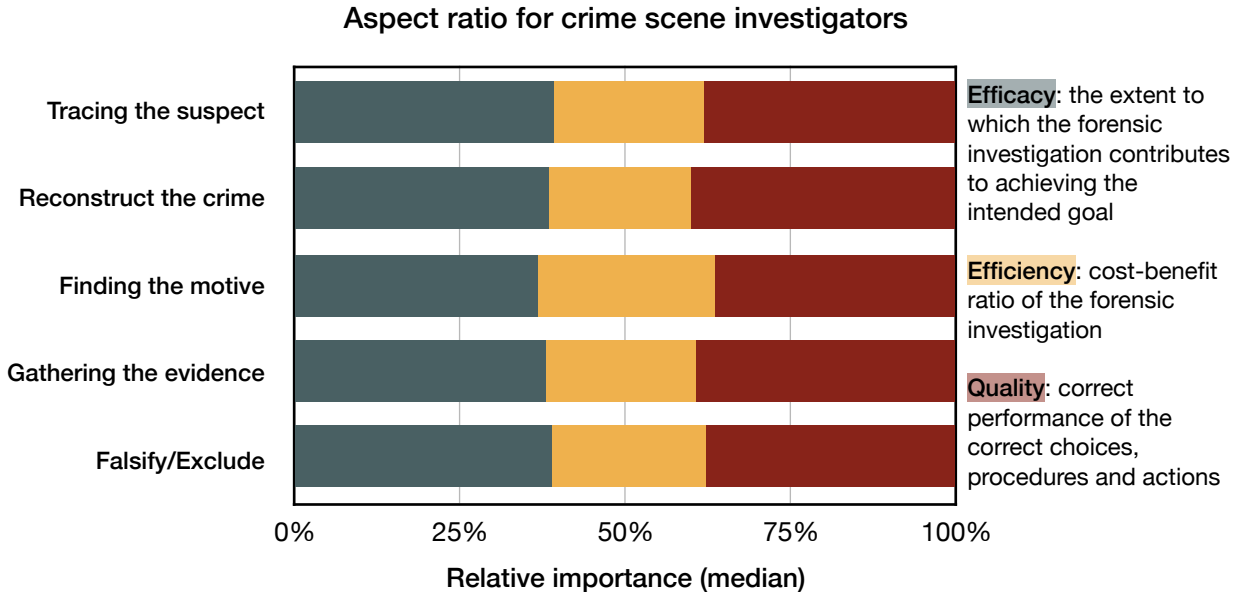

Figure 8: The relative importance of the efficacy, efficiency and quality aspect per goal for crime scene investigators (n=40).

Concerning the distribution of forensic investigation goals, the goals are equally valuable apart from finding the motive. The different situations showed no notable differences between goals, these figures are shown in Appendix C: *crime scene investigator*, Figure 1. The goals chosen as most important to crime scene investigators are: 95% tracing the suspect, 87,5% gathering the evidence, 60% reconstruct the crime, 52,5% falsify/exclude and 5% finding the motive.

The second part of the questionnaire contained the aspects and associated parameters of the forensic investigation. In Figure 8, the relative importance of the aspects are shown. Efficacy and quality are equally important, while efficiency is least significant to investigators. Regarding the associated parameters (Appendix C: *crime scene investigator*, Table 1), *securing as many traces as possible* is seen as the least important parameter of all. For the efficacy aspect, *securing person-identifying* and *high quality traces* are crucial to the investigation. Essential to efficiency is *as little displacement as possible* and *taking as little exhibits as possible*. Furthermore, all quality parameters are scored as equally important.

Comparisons between partners

When comparing the crime scene investigators with the other involved partners, the differences in relative importance are rather small (visualized in Figure 9). The different partners are compared separately below.

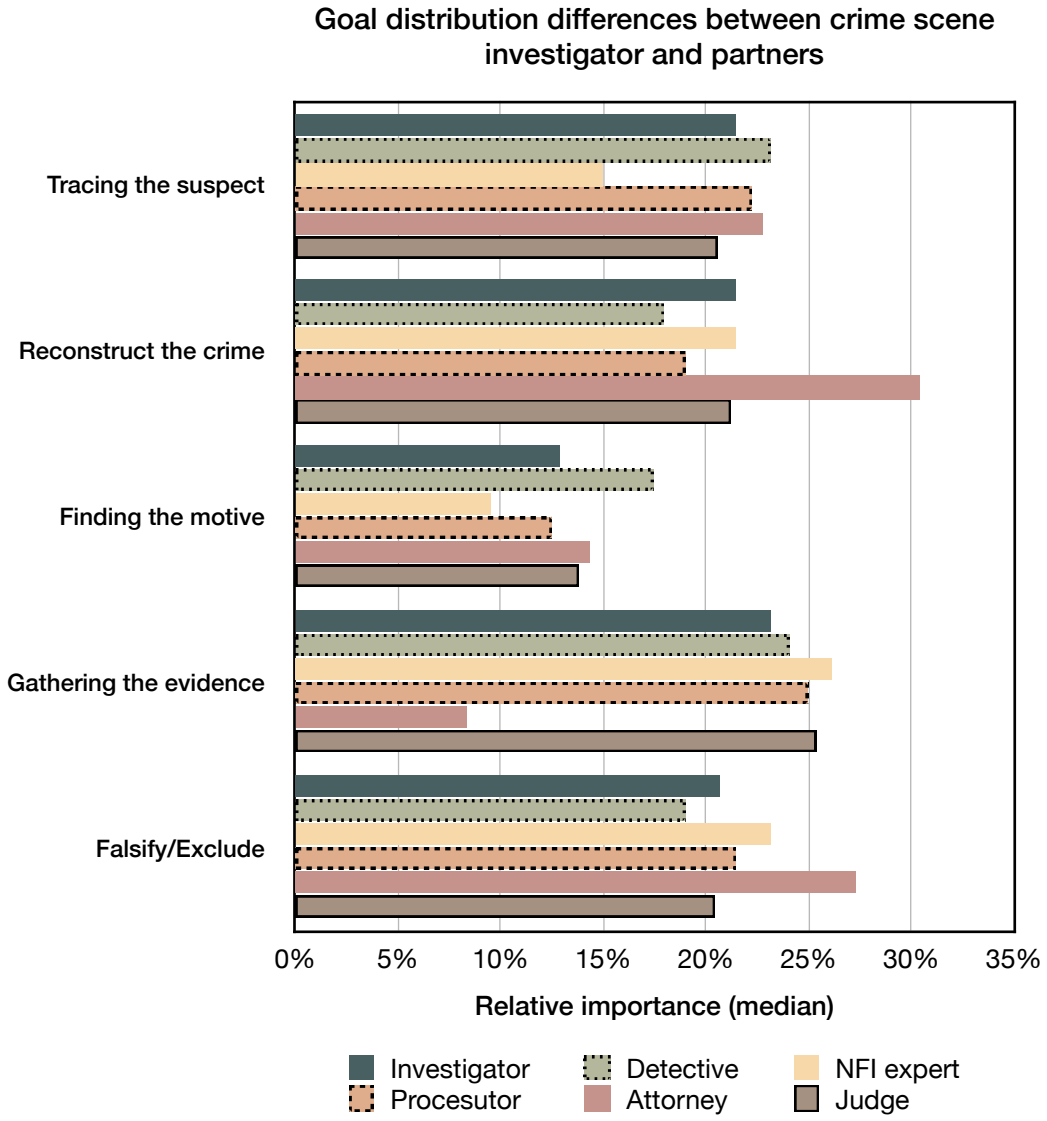

Figure 9: The goal distributions of crime scene investigator (n=40) and other partners (n=108). Each color represents a different involved partner.

‣ Crime scene investigator vs detective

The goals important to detectives all lay around 20% (visualized in Figure 10), however **tracing the suspect** and **gathering the evidence** are slightly more meaningful, which corresponds to the most chose goals shown in Figure 11. Interestingly, the **motive** is equally important as **reconstructing the crime** and **falsify/exclude**, and was scored higher compared to all partners (Figure 9). The **motive** seems to differ the most between detectives and crime scene investigators. The effect size of the differences between these partners for **finding the motive** in the first situation is -0.26 with a 95% confidence interval of [-0.50, 0.01], which is a medium effect, in the second situation -0.47 [-0.67, -0.21], in the third situation -0.32 [-0.54, -0.05], in the fourth situation -0.41 [-0.62, -0.15], and in the fifth situation -0.48 [-0.67, -0.23]. In the situations with no suspect, the effect seems to be larger, giving the impression that the **motive** is even less important to investigators in those situations.

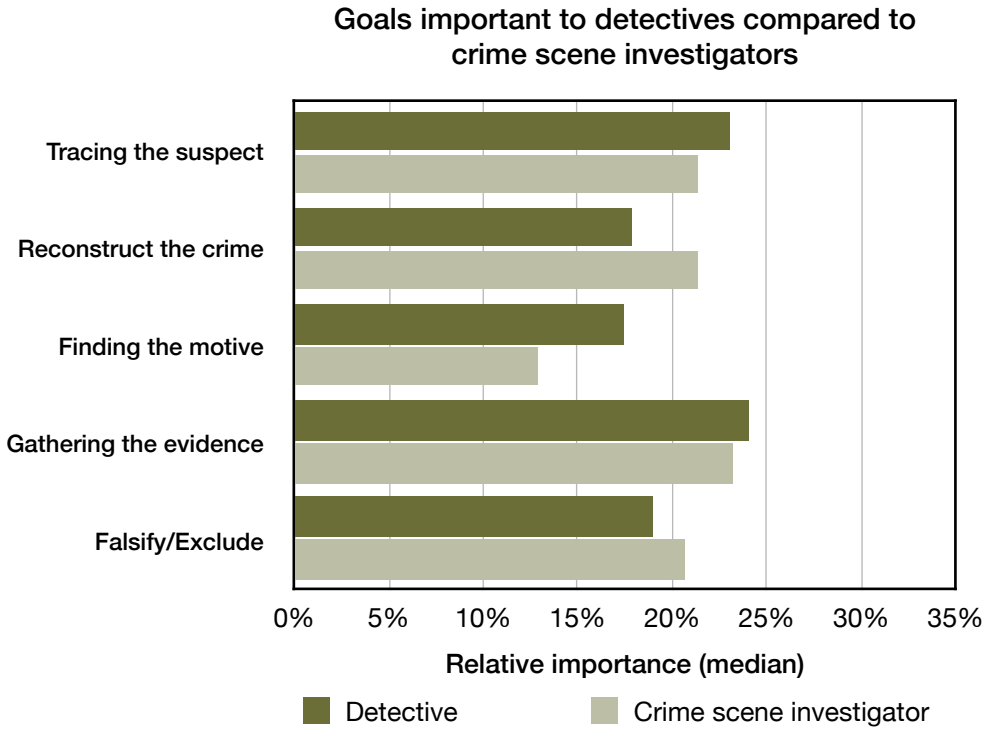

Figure 10: Relative importance of goals for detectives (n=35) compared to crime scene investigators (n=40). More detailed figure regarding the goal distribution per situation for detectives can be found in Appendix C: *detective* (Figure 5).

Reconstruct the crime seems to be more important to crime scene investigators than to detectives. The effect size value for this goal in situation 1 is 0.51 [0.26, 0.70], in situation 2 is 0.51 [0.25, 0.70], in situation 3 is 0.45 [0.20, 0.65], in situation 4 is 0.39 [0.12, 0.60] and in situation 5 is 0.45 [0.19, 0.65]. In almost all these situations, the effect is large, implying to goal to be more important to investigators.

The detectives scored similar to the crime scene investigators on the aspects and associated parameters (Appendix C: *detective*, respectively Figure 4 and Table 2).

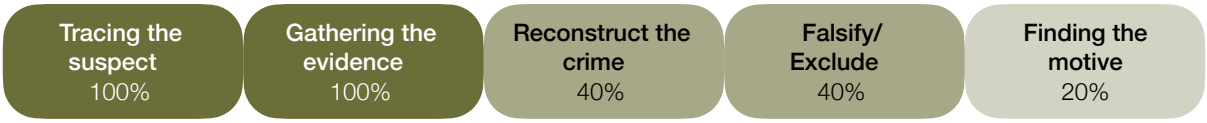

Figure 11: Most important goals chosen by detectives.

‣ Crime scene investigator vs NFI expert

Figure 9 shows a similar distribution of goals for the NFI experts. A visualization of the goal distribution for the NFI experts can be found in Appendix C: *expert*, Figure 6. The goals gathering the evidence, falsify/exclude and reconstruct the crime appear to be equally important, while the motive is least important to the experts, even compared to the other partners. What is notable is the shift in goal distribution for tracing the suspect. In Figure 12, the scores are shown for the different situations. In situation 2 and 5, tracing the suspect becomes relatively more important when there is no suspect. When comparing the first two situations, which only differ in having a suspect or not, the effect size results in a value of -0.80 with a confidence interval of [-0.94, -0.46]. This is a large effect, so not having a suspect increases the importance of the goal. The box plots presenting the other goals are shown in Appendix C: *expert*, Figure 8.

Out of the 15 NFI experts 86,7% chose gathering the evidence, 80% tracing the suspect, 73,3% falsify/exclude and 60% reconstruct the crime. None of the experts chose finding the motive as an important goal. The NFI experts showed a similar distribution of aspects and associated parameters as crime scene investigators (Appendix C: *expert*, respectively Figure 7 and Table 3).

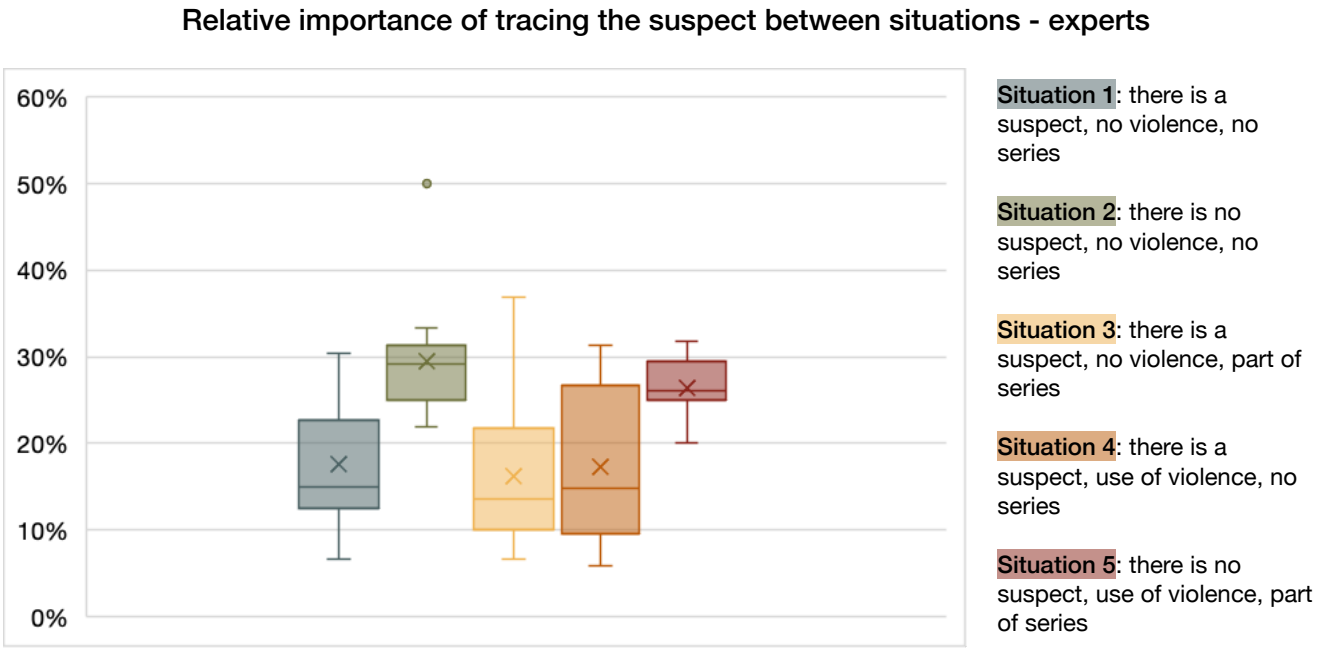

Figure 12: Box plot presenting the goal tracing the suspect in all situations for NFI experts (n=15). The y-axis contains the relative importance (median) and the different colors represent the different situations.

‣ Crime scene investigator vs prosecutor

The distribution of goals for prosecutors corresponds to a high degree with the distribution of crime scene investigators (Figure 9). There appears to be a small difference in the relative importance of reconstruct the crime, the effect size value for situation 1 is 0.44 [0.19, 0.64], for situation 2 is 0.46 [0.21, 0.65], for situation 3 is 0.31 [0.05, 0.52], for situation 4 is 0.11 [-0.14, 0.35] and for situation 5 is 0.20 [-0.05, 0.43]. Therefore, in the first three situations there is a medium effect, implying reconstructing the crime to be slightly more important to investigators in those situations.

Furthermore, the goal distribution (Appendix C: *prosecutor*, Figure 9) corresponds with the chosen goals: 97,6% tracing the suspect and gathering the evidence, 65,9% falsify/exclude, 34,1% reconstruct the crime and 4,9% finding the motive.

Concerning the aspects, the efficacy is more important to crime scene investigators, while the efficiency is slightly more important to prosecutors (visualized in Figure 13). There is a medium to large effect between the crime scene investigators and prosecutors for the efficacy, 0.27 [0.01, 0.49] for tracing the suspect, 0.55 [0.17, 0.79] for reconstruct the crime, 0.45 [0.20, 0.65] for gathering the evidence and 0.29 [-0.05, 0.56] for falsify/exclude. Only for reconstruct the crime and gathering the evidence there is a large effect, indicating efficacy to be more

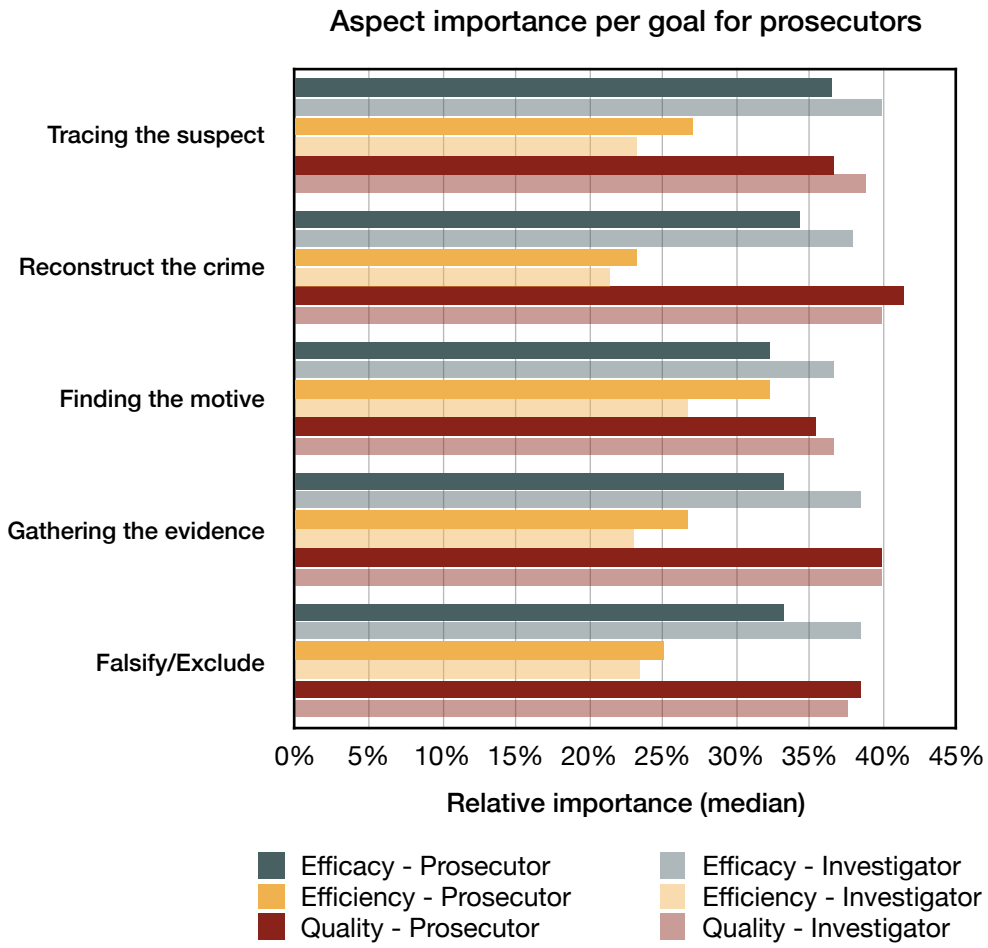

Figure 13: The relative importance of the efficacy, efficiency and quality aspect for prosecutors (n=41) compared to crime scene investigators (n=40).

important to investigators for these goals. As the number of respondents for finding the motive was less than 10, the effect size could not be calculated.

Regarding the efficiency, the effect size value for tracing the suspect is -0.25 [-0.48, 0.01], for reconstruct the crime -0.31 [-0.61, 0.07], for gathering the evidence -0.27 [-0.50, -0.01] and for falsify/exclude -0.14 [-0.45, 0.20]. These results imply the efficiency to be a little more important to prosecutors.

‣ Crime scene investigator vs defense attorney

Defense attorneys differ most from the crime scene investigators and other partners (visualized in Figure 14). The relative importance of goals seems to be especially contrasting for reconstruct the crime and gathering the evidence. The least chosen goal is finding the motive (20%), followed by gathering the evidence (40%), tracing the suspect (60%), reconstruct the crime (80%) and falsify/exclude chosen by all five defense attorneys (100%).

The quality of the forensic investigation is most important to defense attorneys, followed by the efficacy (Appendix C: *defense attorney*, Figure 12). Furthermore, scores of the parameters correspond to those of crime scene investigators (Appendix C: *defense attorney*, Table 5).

‣ Crime scene investigator vs judge

Crime scene investigators and judges seem to have a very similar distribution of goals important to the forensic investigation. Figure 9 only shows a small difference for gathering the evidence: the effect size for situation 1 is -0.35 with a confidence interval of [-0.67, 0.07], for situation 2 is 0.17 [-0.24, 0.52], for situation 3 is -0.29 [-0.60, 0.11], for situation 4 is -0.35 [-0.66, 0.06] and for situation 5 is 0.15 [-0.25, 0.51]. So, in situations with no suspect, gathering of evidence becomes slightly more important to crime scene investigators than to judges.

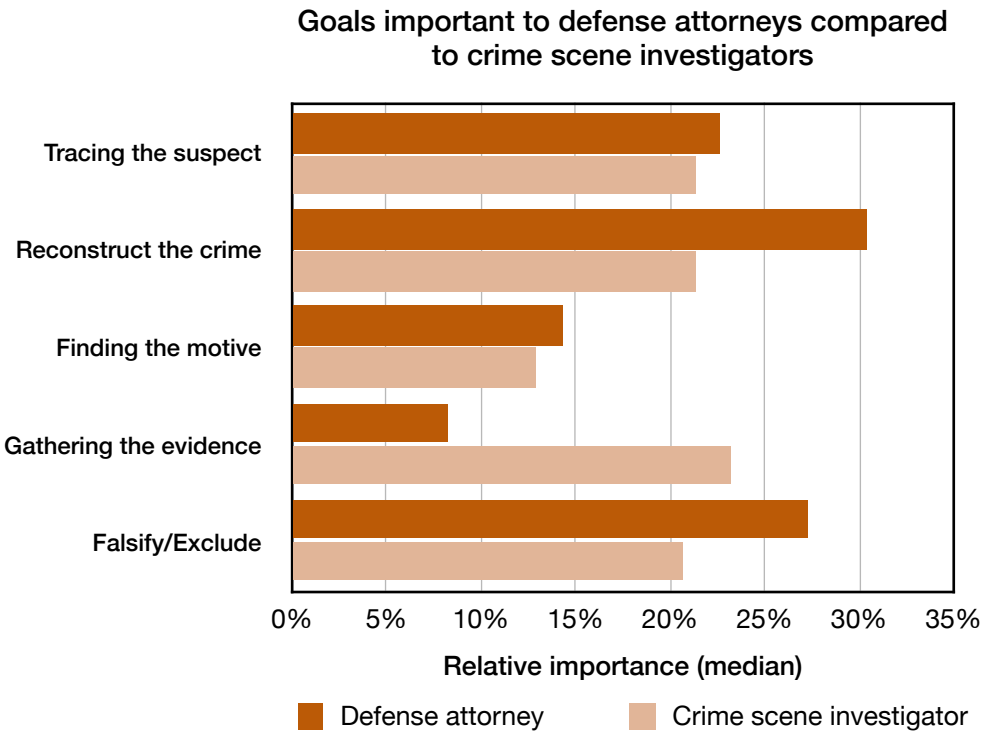

Figure 14: Relative importance of goals for defense attorneys (n=5) compared to crime scene investigators (n=40). More detailed figure regarding the goal distribution per situation for defense attorneys can be found in Appendix C: *defense attorneys* (Figure 11).

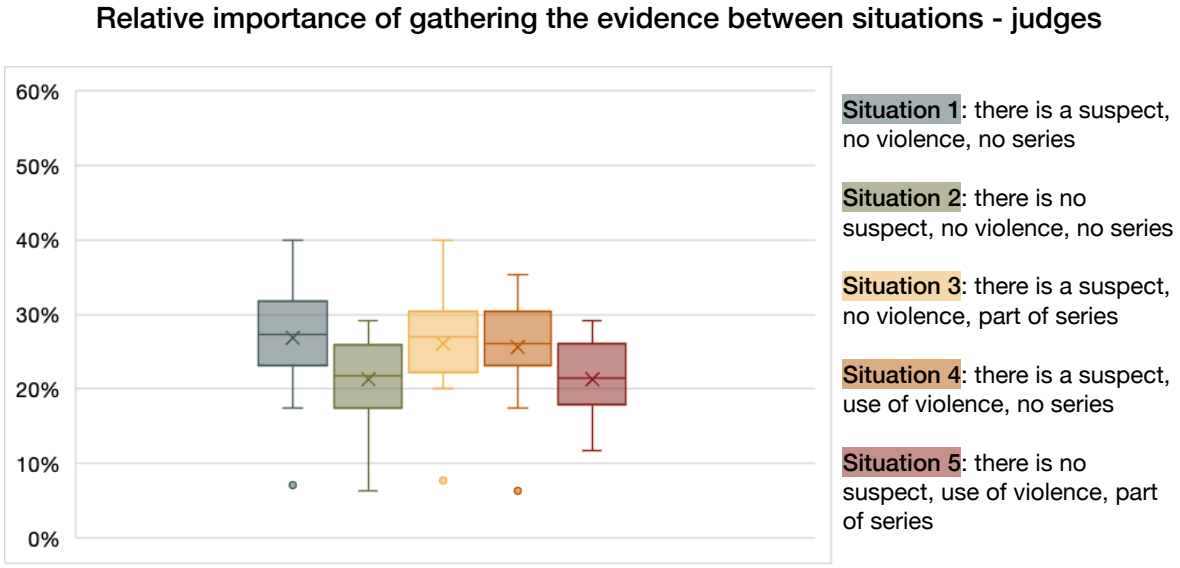

Figure 15: Box plot presenting gathering the evidence of all situations for judges (n=12). The y-axis contains the relative importance (median) and the different colors represent the different situations.

Figure 15 highlights the relative importance of gathering the evidence to judges. When comparing the first two situations, the effect of not having a suspect is medium with a value of 0.50 [0.07, 0.78], resulting in the goal being less important than in situations with a suspect. Having a suspects or not appears to have an effect, Figure 16 shows the different situations for tracing the suspect. The effect of comparing the first two situations shows a large effect of -0.80 [-0.94, -0.46].

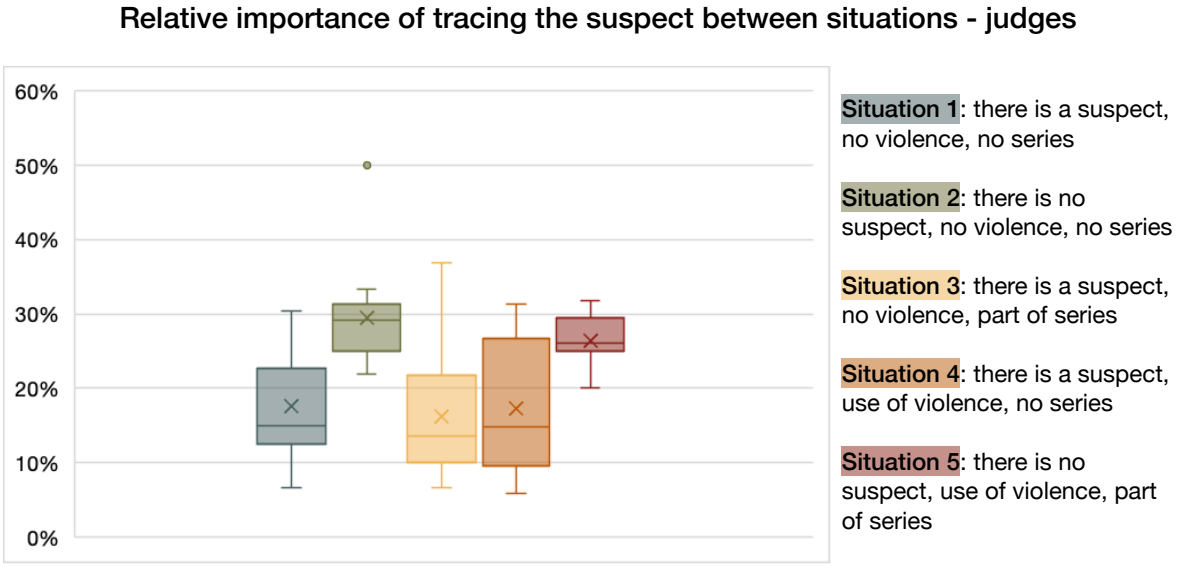

Figure 16: Box plot presenting tracing the suspect of all situations for judges (n=12). The y-axis contains the relative importance (median) and the different colors represent the different situations.

However, both goals are important to judges as 100% chose for gathering the evidence, and 91,7% for tracing the suspect. Reconstruct the crime and falsify/exclude were chosen by 50% and finding the motive by 8,3% of the respondents.

The same aspects and parameters are of interest to judges and crime scene investigators, see Appendix C: *judge*, respectively Figure 15 and Table 6.

Pilot observations

In addition to improvements in the questionnaire, the pilot yielded a number of observations. The crime scene investigator indicated that information about the case was similar to real life cases. Sometimes investigators are provided with false information prior to the forensic investigation, or crimes can be staged. In addition, too much information could lead to tunnel vision. Therefore, the least amount of information is best before starting the forensic investigation.

An interesting comment was made by the detective, who indicated that the questionnaire raised awareness about differences between situations. However, according to the crime scene investigator, the distribution of goals should be constant despite variation in situations. According to the expert, the goal distribution depends on expertise of those analyzing a trace, where one is more interested in a person, while the other focuses on reconstruction of the crime.

The defense attorney referred to misunderstandings in court between experts and judges. Judges misunderstand the expert's results, while the experts misunderstand the judge's questions. The capacity problem mentioned by the prosecutor affects all partners. The capacity is, therefore, an important factor regarding the efficacy, efficiency and quality of the forensic investigation process.

3.3 Expert reflection session

Although the questionnaire provided insights into the goals of the forensic investigation for the involved partners, the partners' needs remain separate parts within the socio-technical system. With use of a complementary expert reflection session, the partners were able to reflect on the results together. The aim of this session was to reflect on the questionnaire results and to facilitate discussion between the involved partners about these results.

By reflecting on the results together, the involved partners start to establish a mutual understanding as they discuss why certain goals are important. This discussion gives the partners the opportunity to share their needs. As mentioned in the communication framework, such a discussion provides insight into sensibilities or tensions within the socio-technical system, but also supports the collaboration between partners [25]. As complex problems can be tackled by a multi stakeholder collaboration approach, this expert reflection session is based on bringing the knowledge of the involved partners together and understanding each others needs of the forensic investigation. The results of this session will be used as input for the expert co-design session (visualized in Figure 17).

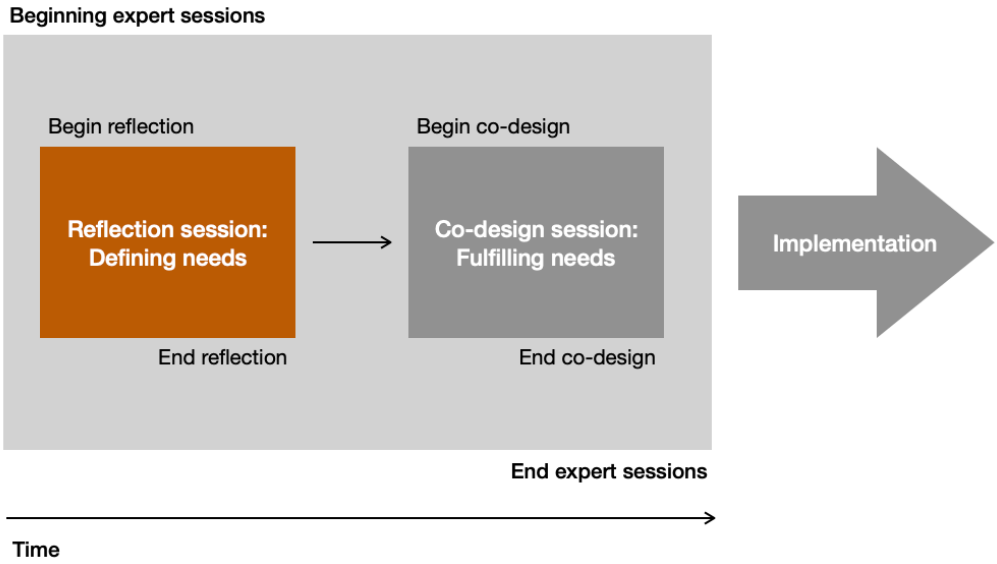

Figure 17: The first expert session in which the involved partner reflect on the results from the questionnaire and thereby defining their needs of the forensic investigation.

3.3.1 Session methods

It was intended that one participant form each partner group involved in the criminal investigation would be present at the expert reflection session, resulting in a multiple domain expert group [41]. The judge could not attend the session, so an individual session was prepared. Due to the coronavirus pandemic, the expert session was virtual using the Cisco Webex[3] software. The set-up of the virtual session was comparable to a live session. During the session PowerPoint slides were shown with information about the session and the results from the questionnaire (Appendix D).

The session consisted of four sections: introduction, reflection on results, remaining points of discussion and conclusion [34]; [35]; [36] (the complete session outline with additional information can be found in Appendix E). In the introduction the participants were welcomed, the study goals were explained and the guidelines were shared on screen.

During the reflection section, the results per partner and per part of the questionnaire were shown on screen (see Appendix D). Part one containing the results regarding the goals of the forensic investigation and part two containing the aspects and parameters associated to these goals. All results were provided with explanations by the moderator. The participants were asked about their expectations of the results and if these expectations were met. The participants could elaborate on for them remarkable results.

In the discussion section, the participants had the chance to elaborate on what these results could mean for the forensic investigation and their role within the criminal justice system, and how the goals and needs of the different partners could be served. The session ended with a summary by the moderator.

Observation criteria

As the assistant moderator, I made use of an observation scheme containing the following criteria: agreement and disagreement of results, agreement and disagreement between participants, influence of other participants, tensions between participants, the behavior of a participant, creativity of participants and other remarks. The completed scheme can be found in Appendix F.

3.3.2 Session results

‣ Crime scene investigator

Forming hypotheses and scenarios, and reconstructing the crime are mentioned as important goals regarding the forensic investigation. The crime scene investigator was relieved to see falsify/exclude scoring high in comparison to the other goals (Figure 7). Interestingly, the defense attorney was surprised to see falsify/exclude to be of value to the investigators. According to the

[3] https://www.webex.com

attorney, alternative scenarios are not described in the crime scene investigation report, causing the attorney to believe these are not necessary during the forensic investigation. The judge agreed that alternative scenarios are not sufficiently described in the reports. If the reports would be more comprehensive about why certain traces were collected, the defense would have information about which scenarios already have been ruled out. Nevertheless, this topic is receiving increasingly more attention from investigators, more traces are being collected to reconstruct or falsify certain scenarios.

Table 3: Efficacy parameters per goal for crime scene investigators. Parameters with the highest and lowest scores are presented in respectively green and red.

		Tracing the suspect	Reconstruct the crime	Finding the motive	Gathering the evidence	Falsify/ Exclude
Efficacy	**Timely results**	16,3%	13,6%	17,6%	15,6%	14,3%
	Securing as many traces as possible	10,5%	10,9%	12,2%	10,0%	11,8%
	Securing high quality traces	20,7%	18,6%	19,3%	20,0%	19,4%
	Securing person-identifying traces	21,2%	20,0%	19,3%	20,6%	20,7%
	Securing other crime-related traces	16,0%	18,8%	15,8%	16,7%	17,9%

Quality is most valuable to crime scene investigators regarding the aspects and parameters of the forensic investigation. Concerning the efficacy parameters (presented in Table 3, the results for the other two aspects can be found in Appendix C: *crime scene investigator*, Table 1), *securing person-identifying traces* is crucial as they can lead to further steps in the criminal investigation process regardless of the goal. *Other crime-related traces* are less important, which could be due to a higher priority of tracing the suspect before investigating the actions at a crime scene. Furthermore, the expert emphasized the limited number of traces they can investigate. If there were timely communication between experts and crime scene investigators, high quality traces could be delivered earlier to the forensic laboratory, reducing the required capacity and time later in the investigation process. The last efficacy parameter, *information exchange between partners* is therefore essential. However, according to the prosecutor and expert, the information exchange should be as little as possible before completing the forensic investigation.

Regarding the efficiency of the forensic investigation, *as little displacement as possible* corresponds to the prevention of contamination or loss of traces. *As little sampling as possible* should not be an issue if quality is the main priority. With regard to alternative scenarios, multiple objects require sampling to ensure that these scenarios can be taken into account. This also corresponds with the *completeness* and therefore with the quality of an investigation, according to the defense attorney.

‣ Detective

For the detective the most important goals of the forensic investigation are tracing the suspect and gathering the evidence. As the results of the questionnaire show similar results for all goals, the prosecutor mentioned the broader view of detectives leading to are more equal distribution of goals. Finding the motive is more relevant to detectives than to other partners. However, if detectives have a broader view, the defense attorney questions why falsify/exclude is less important.

Regarding the traces, detectives rely on the expertise of the crime scene investigators. The detective wishes to connect the traces to a person, the most valuable parameters are therefore *securing high quality* and *person-identifying traces*. It depends per crime case and if there is a suspect, whether *other crime-related traces* are relevant.

‣ NFI expert

The outcome of investigations performed by experts are mostly aimed at answering questions asked by the crime scene investigators. Experts are not interested in the motive of a crime, they focus on traces and need as little information as possible. In order to get the context of a trace,

reconstruction of a crime is necessary. Sometimes the quality of traces or pictures is too low causing the experts to fail to reconstruct the traces in the crime.

According to the expert the evidence gathering, falsifying/exclude and reconstruction are linked, these goals all contribute to answering the questions about what has happened.

‣ Prosecutor

The expert was surprised to see that the motive was not one of the most important goals to prosecutors. This was however expected by the prosecutor, as traces do not have to indicate anything about the motive of the crime. According to the defense attorney, the goal distribution of the prosecutor is similar to those of crime scene investigators, which is remarkable as the falsify/exclude goal is not always present or reflected on in the court report. The court report is composed by the prosecutor, they select the results and decide on what is included in the report. According to the judge, the role of the prosecutor is therefore crucial, also in reflecting on which scenarios have been investigated.

Quality is the most important aspect to prosecutors. Concerning the parameters, *securing person-identifying* and *other crime-related traces* are therefore crucial to answer questions related to who is involved and what has happened. *Information exchange* is the least important parameter for the efficacy aspect, however the prosecutor emphasized the importance of objectivity for this exchange, particularly before the forensic investigation is completed. As far as efficiency is concerned, the prosecutor has confidence in the expertise of the crime scene investigators without making a judgement about the conduction of forensic investigations.

‣ Defense attorney

As the results show, the defense attorney has the most contrasting distribution of goals compared to the other partners (Figure 9). According to the prosecutor, the cause of this difference is the moment of entering the criminal investigation process, defense attorneys enter at the end of the process. The most important goals match the activities of defense attorneys, as stated by the crime scene investigator. Although the results do not show a high importance of the reconstruction of the crime, the defense attorney emphasized its usefulness in their work. The judge indicated that defense attorneys often ask for a reconstruction after all evidence is presented. Therefore, the defense would benefit from information on alternative scenarios, which will speed up the court process benefiting the whole criminal investigation process.

‣ Judge

The judge's focus is on a suspect, making *person-identifying traces* crucial to the court process. According to the detective and prosecutor, falsify/exclude scored low in comparison to the other goals. It may be intertwined with the gathering of evidence, however the 'other' side of the evidence has to be taken into account too. The defense attorney dedicates this to strong evidence, so the chances of other scenarios is small. Nevertheless, the judge indicates that considering alternative scenarios is part of the quality aspect.

According to the prosecutor, the court can have difficulties interpreting the crime scene investigation report, fortunately the awareness is increasing, resulting in taking alternative scenarios into account.

General findings

The different goals could be linked to the moment of entering the criminal investigation process. Tracing the suspect would therefore be the first goal to focus on when starting the criminal investigation. Parallel to tracing the suspect is the gathering of evidence. According to the expert, prosecutor and judge, the gathering of evidence is intertwined with falsifying/excluding alternative scenarios.

Both the prosecutor and defense attorney point out that the descriptions in the crime scene investigation report could be more extensive. The reports only include results of the investigation but the reasoning behind certain decisions leading to these results is lacking. With this reasoning, results would have less chance of being wrongly interpreted by the partners in court.

According to the crime scene investigator, the size of a case matters because of the capacity for an investigation, as a larger case receives more capacity. Furthermore, the phase of the criminal investigation is related to the goals essential to that phase. At the start of the

investigation, a lot is unknown about the context of the crime case, therefore, it is hard to tell which traces need to be collected.

Interpretation by partners
All partners agreed that the forensic investigation is currently well-performed. However, the description of decisions made at the crime scene is limited. Especially the partners involved in the court process would benefit from a more comprehensive crime scene investigation report.

A form of visualization of the crime could increase the awareness of judges regarding the activities performed at the crime scene. The collaboration between partners in the scene- and laboratory process is satisfying, as long as the risk of tunnel vision is taken into account.

Alternative scenarios remain important, as these could benefit the *completeness* of the forensic investigation. The collaboration between the crime scene investigator and detective is crucial and can improve capacity with the right balance of responsibilities. Nevertheless, capacity will always have a major impact on the whole criminal investigation.

3.3.3 Session observations
During the session it was confirmed there is little feedback within the forensic data infrastructure. Each involved partner contributes to the system but the communication between partners is lacking, which corresponds with the *one-way communication* sensibility presented in the communication framework. The involved partners currently receive very little information about how forensic data is received by the other partners [18]. The expert session seemed to be a new way of communicating and expressing their needs.

Furthermore, the partners started creating a mutual understanding in which working methods were explained and tensions were shared. Also other tensions that come with the forensic data infrastructure were mentioned, the risk of tunnel vision was an important tension to the NFI expert, whereas the transparency of decision-making was a point of interest to the defense attorney.

The tensions obtained during the expert reflection session are added to the forensic data infrastructure defined within the communication framework (Figure 18). As was mentioned during the expert session, the crime scene investigator provides the system with a crime scene investigation report which is shared among the other involved partners. This forensic data is complemented with information from the detective and expert. However, the overall forensic data is filtered by the prosecutor according to the importance of data regarding the court case, resulting in a court report.

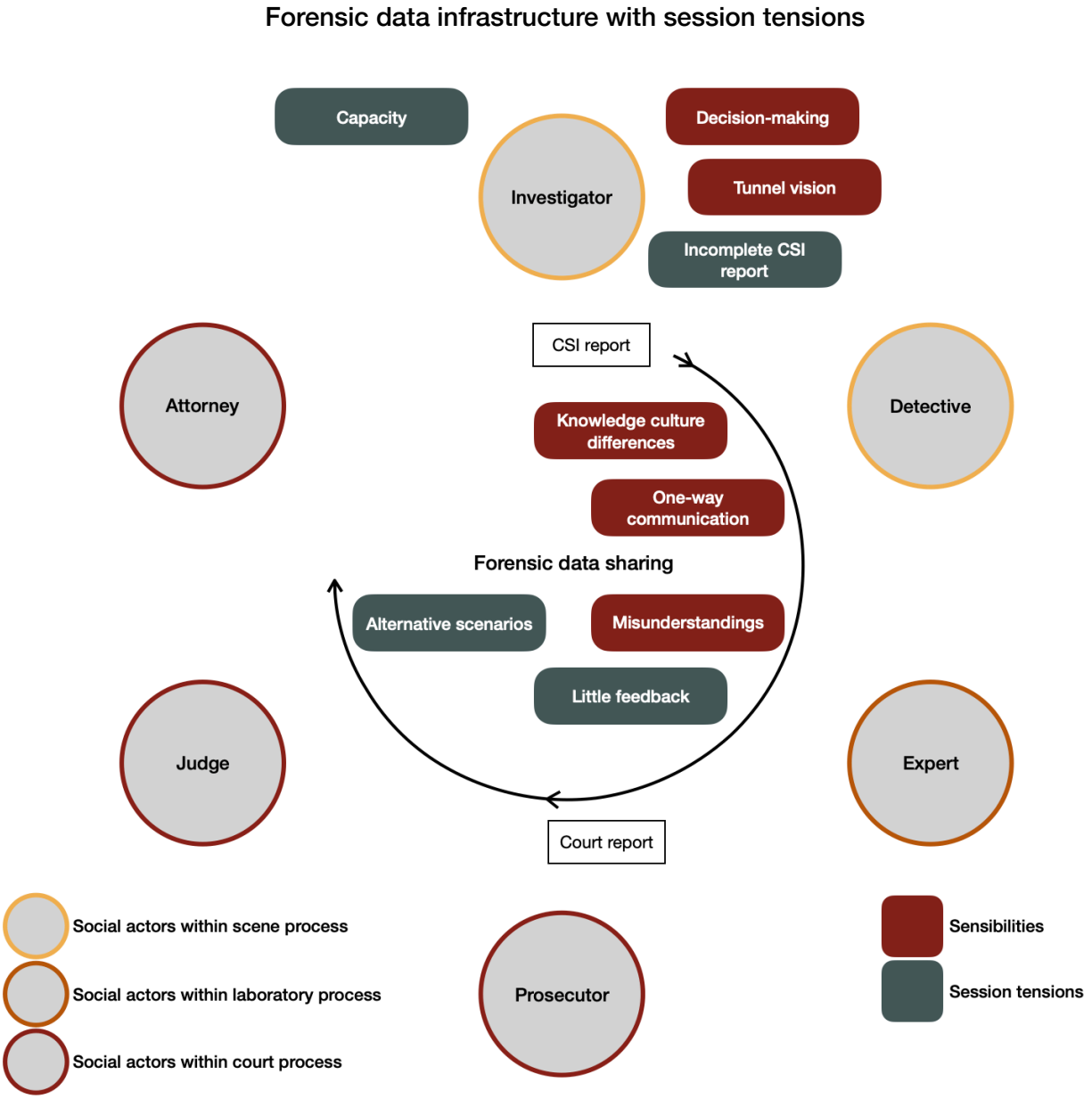

Figure 18: Schematic representation of the forensic data infrastructure with added tensions obtained form the expert reflection session. The data in the crime scene investigation (CSI) report is filtered by prosecutors into a court report used in the *court process*.

4. Partner collaboration

The previous chapter presented the distribution of the forensic investigation goals per involved partner. To put these insights into perspective, the collaboration between the partners should be analyzed. This chapter discusses research questions 1B (chapter 4.1) and 1C (chapter 4.2) of the first objective: *gaining insights into the goals of the forensic investigation of all partners of the criminal justice system and the efficacy, efficiency and quality aspects with their associated parameters*.

4.1 How do the partners collaborate?

To gain insight into the collaboration between the criminal justice system partners involved in home invasion robberies, English and Dutch literature was searched on (*collaboration* OR *involved partners)* AND (*forensic investigation* OR *crime scene investigation*). Other additional articles were found by snowballing.

4.1.1 Partner collaboration and tensions

The criminal investigation process depends on the socio-technical system which collaborates to establish the truth concerning a crime [42]. Due to the different backgrounds and contributions of the criminal justice system partners, the collaboration is complex [18]. As mentioned in Figure 1, not every partner is in direct contact with all other partners. Some partners are present during multiple forensic processes, whereas others only act in one process.

The crime scene investigator and detective are in direct contact with each other. The crime scene investigator starts the forensic investigation with only some basic information provided by the detective. Any additional information can be shared with the crime scene investigator, nevertheless too much information could lead to biased decision-making or tunnel vision [21]. Both partners share their findings, however, the detective mostly receives information.

The forensic data provides answers to questions relevant to the crime case, therefore these results need to be communicated across the partners [43]. The effectivity of the criminal justice system depends on this communication of forensic data [10]. Research by Dobbelaar, Visser & Muller [16], concluded that this communication was insufficient. The crime scene investigation reports only describe the results of performed investigations, the decisions prior to these investigations lack. Forensic data could, therefore, miss context and could be understood differently by other partners, as discussed in the communication framework [18].

Decisions about which traces need further analysis are made by detective and prosecutor together. In order for the NFI to stay objective, the experts have as little information as possible about the context of the trace [44]. Due to this objectivity, the analyses are performed thoroughly but takes time. Along with the limited capacity at the NFI the turnaround times, time from trace collection to reported results [45], are high. Nevertheless, low turnaround times are crucial in the criminal investigation process [10]. This limited capacity, which leads to a restricted number of traces that can be send in per police region, causes changes in trace collection by crime scene investigators. Not every trace is secured, and of all secured traces only some are send in for analysis. Furthermore, the focus of priority in sending crime scene investigators to crime scenes shifts towards more severe crimes with heavier verdicts [44]. This tension could affect the whole socio-technical system.

Another tension is the cultural difference between police and NFI. According to M'charek & Faber-Jonker [10], the police is used to work in a higher pace than the NFI. Moreover, the NFI reports differ in presentation and do not always match the level of knowledge of other partners [44], resulting in misunderstandings between partners. Therefore, a mutual understanding is needed, to limit the amount of misunderstandings.

These difference between knowledge cultures also plays part in court, not every partner is aware of the forensic possibilities [28]. The report presented in court contains a description of the crime scene, traces collected by crime scene investigators and results of the analyses performed by NFI experts. Such a court report can be misunderstood by over- or underestimating the outcomes of the forensic investigation [18]. The competence of prosecutors, defense attorneys and judges is in the law, so NFI experts are sometimes asked to elaborate on the evidence presented in the court room [16]. They might see connections which prosecutors, defense attorneys and judges do not see. Experts only analyze single traces and mostly have little knowledge about the other evidence. The judge is therefore an important partner, they decide what evidence means in context of the evidence as a whole [18].

Defense attorneys can try to devalue the experts statement by proposing alternative scenario's [43], which are other scenarios that could explain the evidence as a whole [46]. Having investigated multiple scenarios, does not only minimize the effect of tunnel vision as discussed in the communication framework, it also strengthens a court case.

The forensic data infrastructure is complemented by the collaboration tensions mentioned above that were not already discussed in the infrastructure (Figure 19). The provided information to crime scene investigators is important, yet has a chance of biased decision-making or tunnel vision. High turnaround times cause investigators, detectives and prosecutors to decide on a limited set of traces to send for analysis and could also affect the investigator's forensic investigation.

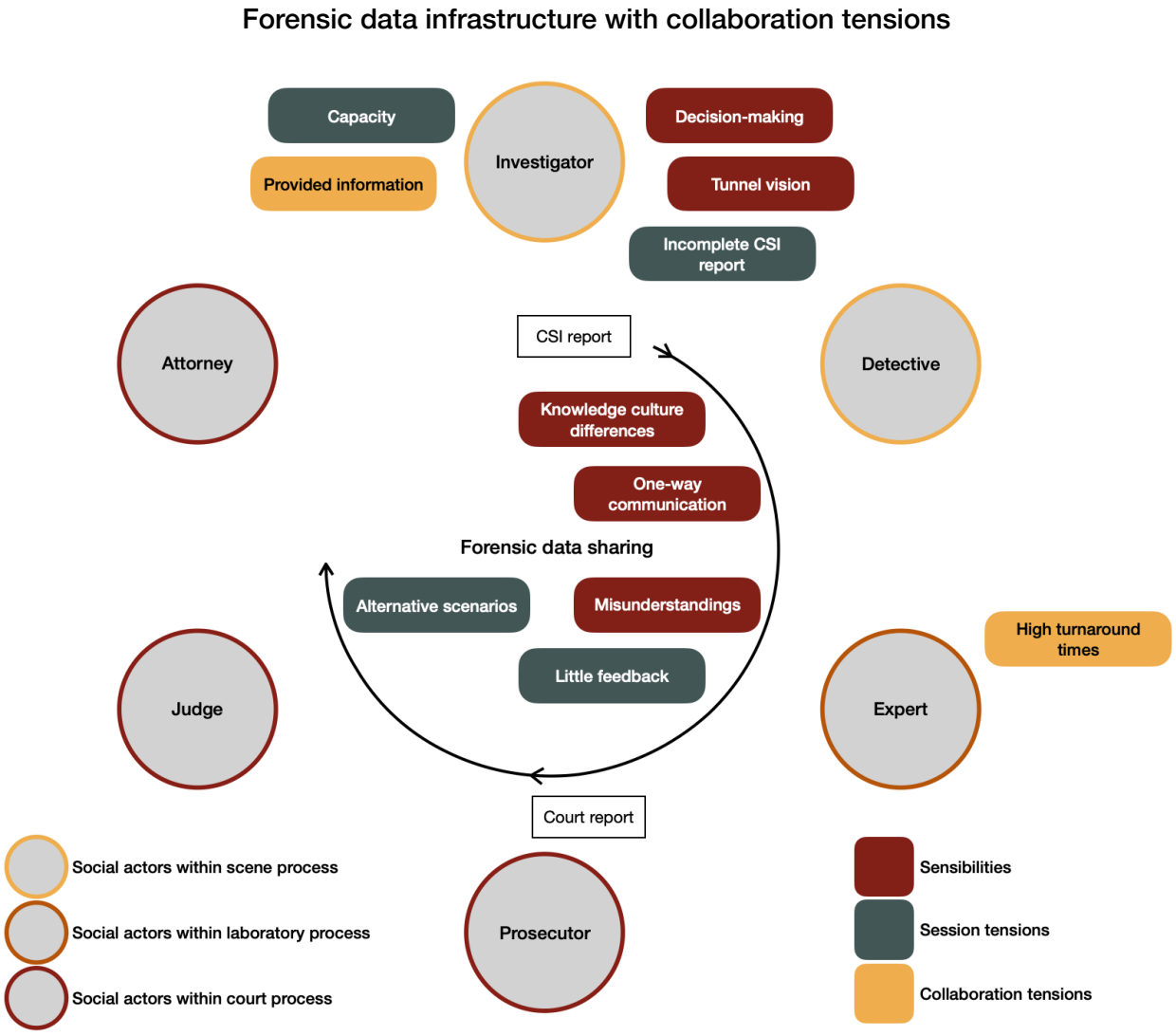

Figure 19: Schematic representation of the forensic data infrastructure with added collaboration tensions from literature.

4.2 How can partners co-design the process?

By using a participatory design, the involved criminal justice system partners are able to co-design the forensic investigation process as mentioned in the communication framework. By focussing on creating a mutual understanding and the forensic data sharing between partners, the needs of every partner are taken into account. Within a participatory design, partners make joint decisions improving the effectivity of the socio-technical system.

The second expert session promotes co-design to deal with the sensibilities that come with the forensic data infrastructure and to fulfill the needs of the involved partners

4.2.1 Expert co-design session

In order to apply the participatory design into this co-design session, participatory decision-making is required. This form of decision-making is beneficial to complex problem solving [33]. Figure 20 shows the 'Diamond of Participatory Decision-Making'. The Divergent Zone encourages partners to suspend their judgement through brainstorming, in the Groan Zone a mutual understanding is developed which comes with miscommunication and misunderstandings between partners, when this mutual understanding is developed refinements can be made in the Convergent Zone and the group makes decisions in the Closure Zone. Kaner [33] described four core values of decision-making: full participation in which every partner can express their opinions, mutual understanding of needs, inclusion of solutions and shared responsibilities for the content and process.

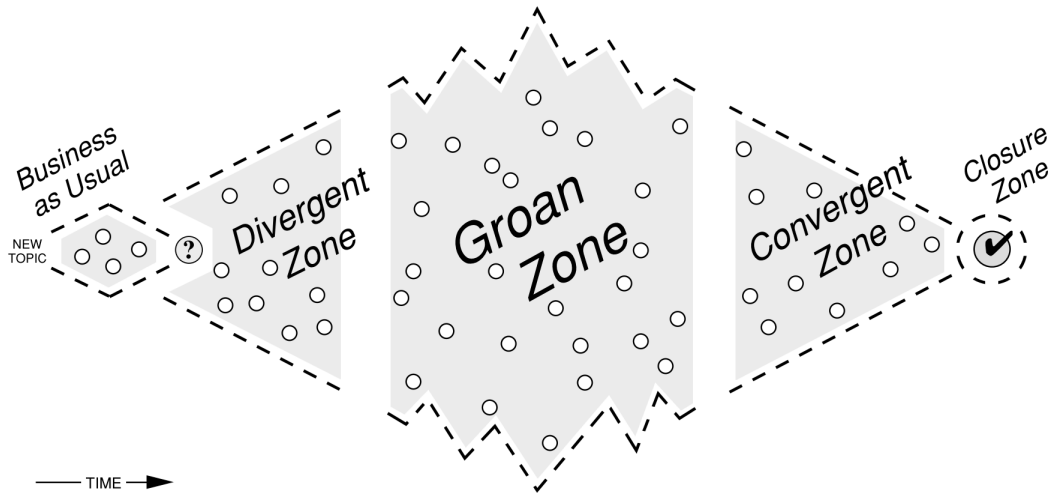

Figure 20: 'Diamond of Participatory Decision-Making' [33].

Another concept of decision-making applicable to this session is consensus decision-making proposed by McGraw & Seale [41]. Finding the best solution to a problem is fundamental to consensus decision-making. This concept differs from brainstorming, as the advantages and disadvantages of each idea are weighed by the participants. For the concept to be effective, each participant's needs and opinions have to be heard. Furthermore, it is necessary that each participant has a commitment to the decision-making process.

The participatory design of the session, is linked to a multi stakeholder collaboration approach. This approach, proposed by Kaner, Watts & Frison [31], involves diversity in the collaboration, therefore, the co-design session will have the same composition of multi domain experts as in the expert reflection session. Such a diverse group represents the different needs and backgrounds of the partners.

Participants within the multi stakeholder collaboration are expected to influence one another with the goal to co-design solutions. However, this collaboration comes with misunderstanding as their goals, assumptions of others and biases differ. By making a commitment to effective listening and also through the mutual understanding among partners, the communication can be improved. A 'gradient of agreement scale' is used to express the support to a certain solution [31].

These methods of decision-making in combination with the multi stakeholder collaboration provide the base of the co-design session (Appendix G with additional PowerPoint slides in Appendix H). The co-design session differs from the reflection session by the number of participants. By using more than one expert from every partner group, the co-design session will allow for different problem-solving strategies and applications. A multiple domain expert group has the ability to recognize and reject inaccurate suggestions and solutions [41]. Therefore, the session will include twelve instead of six participants. The session is guided by PowerPoint slides (Appendix H). After executing the co-design session, the decided on solutions can be implemented into the optimized forensic investigation (visualized in Figure 21).

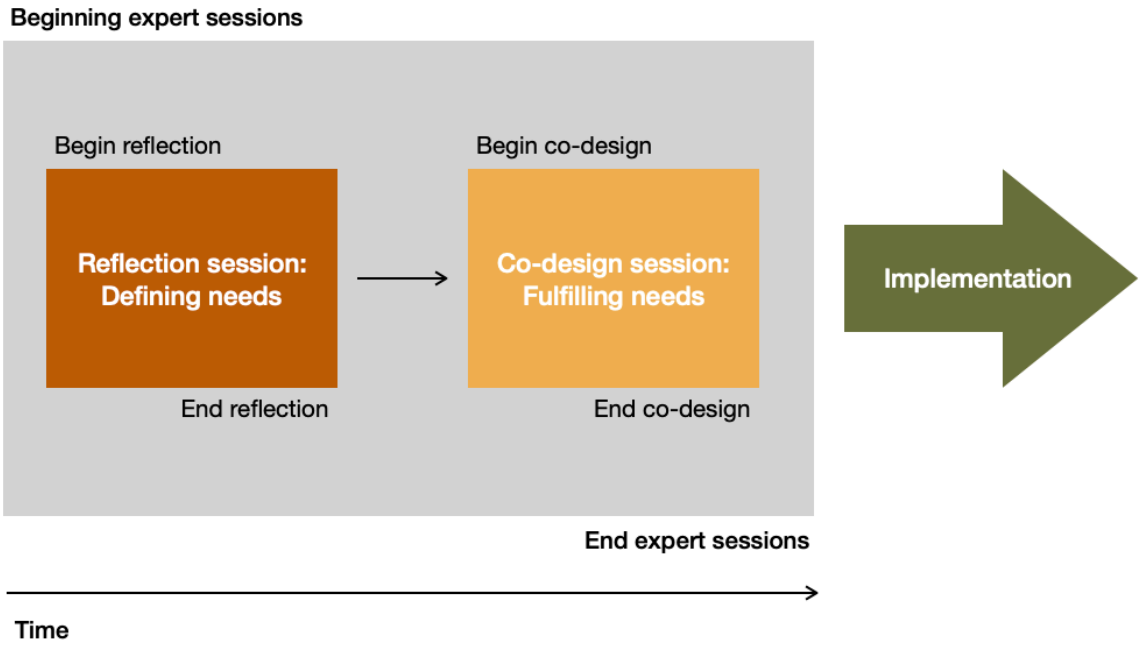

Figure 21: After completing both expert sessions regarding the participatory design, the results can be implemented into the optimized forensic investigation process.

5. Achievement of goals and optimized forensic investigation

The previous chapters presented the most important goals, aspects and parameters of the forensic investigation together with tensions existing in the forensic data infrastructure concerning the investigation. This chapter discusses research questions 2A in which experiment data is used to determine the achievement of goals (chapter 5.1 and 5.2), 2B which presents an optimized forensic investigation (chapter 5.3) and 2C that visualizes the optimized investigation (chapter 5.4).

5.1 Are the goals met in the current forensic investigation? Which working methods contributed to the achievement of goals?

For crime scene investigators, tracing the suspect, gathering the evidence, reconstruct the crime and falsify or exclude are all equally important to the forensic investigation. The efficacy and quality aspects appear to be valuable, while the efficiency is least significant to the investigation. Comparing the other involved partners to the investigators, the detective shows more interest in the motive, the expert values tracing the suspect more in situations with no suspect, prosecutors are more focussed on the efficiency, the defense attorneys differ most from all partners and judges value gathering the evidence most except in situations with no suspect.

The expert reflection session and literature concerning the collaboration, presented certain tensions affecting the forensic data infrastructure. Particularly the reporting of investigators did not fulfill the needs of the other partners. Furthermore, the importance of alternative scenarios and the limited capacity within the infrastructure were emphasized.

In answering questions related to the forensic investigation, data from forensic investigations is necessary. Therefore, the CSI-PEEQ project made use of previously performed forensic investigations at a staged crime scene. The CSI-PEEQ aspects and associated parameters were used to determine the achievement of goals and tried to establish which working methods contributed to this achievement.

5.2 Experiment data analysis

5.2.1 Analysis methods

Data was used from a previously performed study into the influence of rapid trace information on the interpretation of the crime scene and its traces [48]. In the study, an experiment was set up at the NFI with 40 participants investigating a staged crime scene of a home invasion robbery. The staged crime scene set up allowed for video and audio recording. The participants were divided into a control (n=20) and experimental group (n=20). The control group investigated the crime scene in the traditional way and the experimental group had the option to use rapid identification techniques for fingerprints and DNA.

The staged crime scene was performed in the CSI-lab at the NFI, where a predefined scenario was used. This scenario was seen as the ground truth and used as reference within the analysis. Table 4 shows a brief overview of the scenario with information from the traces, the complete scenario can be found in Appendix I. There was a total of 65 traces, of which 24 were *offense-related* and 41 *scenario-related* (Appendix J). *Offense-relatedness* was defined as having a direct link with the crime and possibly containing traces of the offender. *Scenario-related* traces had a link with the predefined scenario. Furthermore, there was a difference between *fixed* or *unconfined* traces.

Table 4: Overview of the scenario, traces and information used in the staged crime scene experiment study [48].

Scenario	Information from	Trace	Information from trace
Two youngsters, Alin Rady (A) and Wesley Markant (W), have heard that the inhabitant of the house Simon (victim) may have lots of cash	-	-	-
Offenders follow victim home and attack victim while he opens the front door	Colleagues at the hospital	Keys	DNA: mixed profile Fingerprints: partial match with victim

Offenders attack victim and throw him against bathroom door and victim leaves blood stain on bathroom door	-	Bloodstain on bathroom door	DNA: match with victim
Offender W puts duct-tape on mouth victim (which is later pulled off again) and ties the victim down in bedroom	-	Duct-tape short	DNA: match with victim Fingerprints: no usable prints
Offender A tries to tape hands of victim but this does not work and put gloves off	-	Latex gloves (1 and 2)	DNA: match with offender A Fingerprints: no usable prints
The duct-tape still does not work and offender A leaves tape on floor	-	Duct-tape roll Duct-tape long	DNA: not enough DNA Fingerprints: match with offender A
Offender A ties victim down with tie wrap	Police officer: finds victim tied down with tie wrap	Tie wrap	DNA: not enough DNA Fingerprints: match with victim
Victim leaves blood on bedroom floor	-	Bloodstains bedroom floor (1, 2 and 3)	DNA: match with victim
Offender W searches the house	House is turned upside down	Traces that indicate disorder	See Appendix J for complete list of traces
Offender W grabs a knife from kitchen and stabs victim (shallow wound through jacket)	Colleagues hospital: victim has a stab wound	-	-
Offender W gets wounded and washes hands in bathroom	-	Bloodstains bathroom (water tap and sink)	DNA: match with offender W
Offenders hear the neighbor yelling and run	Neighbor: states that she shouted to ask if victim was okay	-	-
Offender A throws balaclava in trash bin outside	-	Balaclava in trash bin	DNA: match with offender A

Prior to each investigation the participants were instructed to investigate the crime scene as in normal practice. There where some exceptions: the participants did not have to use powder when searching for fingerprints or shoe prints as the trace exhibits would not provide any useful traces, participants did not have to wear a face-mask due to the audio recording and a ‘trainee’ was present to takes notes about the investigation and could help the participants if needed. This trainee was said to join the participants for learning purposes and had to be explained which steps the participant was taking. However, the trainee was introduced to gain insights into the thought processes of the participants. The instructions about photographing were limited, if participants would take pictures they were only asked to take these in a certain format.

Every participant received the same information at the start of the investigation and was able to ask a police officer (played by a research member) about the crime. One hour into the investigation, the participant received feedback about the victims state. During the investigation participants were asked to decide on the purpose of the secured traces: sending it to the forensic laboratory for trace analysis or storing the trace. The complete study outline is shown in a flow chart in Figure 22. The participants had to explain the approach they used and the actions and decisions they made during the investigation. Furthermore, every participant’s forensic investigation was recorded for further analysis purposes. The way of following, interrogating and observing the participants was developed by the Amsterdam University of Applied Sciences [48].

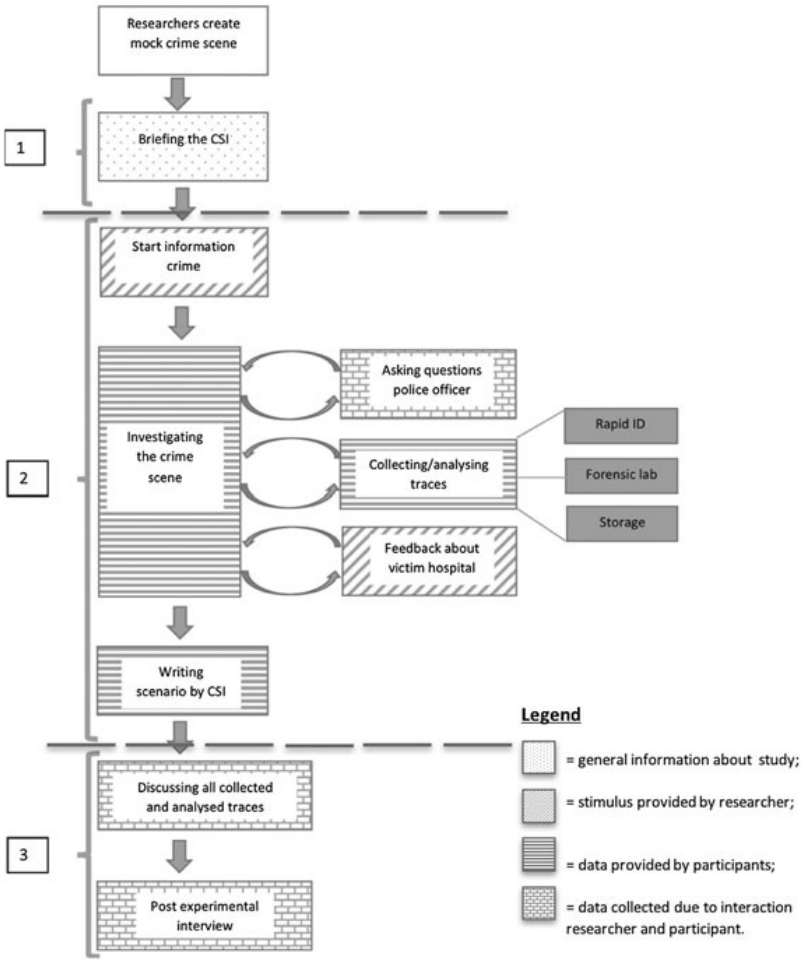

Figure 22: Flow chart of the study outline for the three phases of the staged crime scene experiment study [48].

Obtaining the parameters

The current study only used data of the control group to identify if the goals in the traditional way were met. Out of the 20 participants in the control group, the data of three participants were incomplete and therefore excluded from this study. The included participant data (n=17) had to be categorized into the parameter variables of the efficacy, efficiency and quality aspects before using the data for analysis in light of the second CSI-PEEQ objective: *determining which goals are met with use of the current forensic investigation*.

The original data showed if and when a participant collected a trace or sampled an object, what type of investigation they preferred and if they would send it to a forensic laboratory or store the trace. For the current study the traces were categorized into *object samples* (fixed traces) or *exhibits* (unconfined traces), *person-identifying* (if a trace could be traced back to a person) or *other crime-related traces* and *scenario-* or *offense-related* traces. Furthermore, the data was analyzed using path-analysis software to obtain the time, distance and method variables.

Not every parameter of the efficacy (Table 5), efficiency (Table 6) and quality (Table 7) aspect could be obtained with use of the available data. The staged crime scene did not include any time restrictions regarding the sharing of results, there was no way to measure the parameters of *timely results*. As mentioned above the exhibits would not provide any useful traces, so the *quality of traces* and the *use of items/materials* could not be obtained. Only the crime scene investigator participated in the experiment, therefore, there was no data regarding the *information exchange between partners*. Quality parameters in particular were unmeasurable. Concerning the *traceability* of the investigation, how choices were made during the experiment, is still unclear. This also affects the *objectivity*, whether the investigation was based on facts. Furthermore, the standards for the correct performance and reporting of the investigation are currently unknown. Therefore, only the available parameters were compared. The parameter measures are presented in the second column of Tables 5, 6 and 7.

Table 5: Efficacy associated parameters and their defined measures. Certain parameters were unmeasurable using the available data.

Efficacy		
Parameters		*Measures*
Timely results		-
Securing as many traces as possible	⇨	The number of traces
Securing high quality traces		-
Securing person-identifying traces	⇨	Secured traces - the number of scenario-related exhibits - the number of offense-related exhibits - the total number of secured exhibits - the number of scenario-related object samples - the number of offense-related object samples - the total number of object samples Submitted traces - the number of scenario-related exhibits - the number of offense-related exhibits - the total number of submitted exhibits - the number of scenario-related object samples - the number of offense-related object samples - the total number of object samples
Securing other crime-related traces	⇨	Secured traces - the number of scenario-related exhibits - the number of offense-related exhibits - the total number of secured exhibits - the number of scenario-related object samples - the number of offense-related object samples - the total number of object samples Submitted traces - the number of scenario-related exhibits - the number of offense-related exhibits - the total number of submitted exhibits - the number of scenario-related object samples - the number of offense-related object samples - the total number of object samples
Information exchange between criminal justice system partners		-

Table 6: Efficiency associated parameters and their defined measures. Certain parameters were unmeasurable using the available data. CSI: crime scene investigator.

Efficiency		
Parameters		*Measures*
Forensic investigation by CSI in the shortest possible time	⇨	Total time
As little displacement as possible by CSI on the crime scene	⇨	Walking distance on crime scene
As little use of items/materials as possible		-
As little sampling as possible on crime scene	⇨	The number of sampling
Taking as little exhibits as possible	⇨	The number of exhibits

Table 7: Quality associated parameters and their defined measures. Certain parameters were unmeasurable using the available data. CSI: crime scene investigator.

Quality	
Parameters	*Measures*
Objective	-
Reproducible	⇨ Working method used by CSI during forensic investigation
Traceable	-
Correct	-
Complete	⇨ Percentage of secured scenario-related traces versus the total number of scenario-related traces

Next to the parameter variables, pictures taken by the participants during the investigation were used for comparisons between working methods at the scene. These pictures were analyzed regarding the following five methods: photographing an overview (trace in context) before taking detailed (trace itself) pictures, use of a ruler next to the trace, taking overview pictures of the entire room (putting the room in perspective), use of packaging and taking detailed pictures.

5.2.2 Analysis results

The experimental data resulted into three tables, containing parameter variables for each aspect. Table 8 shows the parameter variables regarding the efficacy aspect, which only includes the *person-identifying traces* as there were only two *other crime-related traces* (see Appendix J for the complete list of traces and see Appendix K for the complete table with efficacy parameter variables). The participants show varying results, the *number of collected traces* differs from 20 to 36, indicated with red and green for respectively the lowest and highest number (Table 8).

Table 8: Parameter variables regarding the efficacy aspect, obtained from the staged crime scene experiment. With a total of 41 scenario-related, 24 offense-related traces, 9 object samples and 56 trace exhibits. Red and green presents respectively the lowest and highest number.

Efficacy									
Participant nr.	*Number of traces*	*Person ID - exhibits*				*Person ID - object samples*			
		# Secured		*# Submitted*		*# Secured*		*# Submitted*	
		Scenario	Offense	Scenario	Offense	Scenario	Offense	Scenario	Offense
10	25	18	8	6	6	2	2	0	0
12	25	18	11	16	9	4	4	0	0
18	24	12	10	12	10	5	5	2	2
20	30	21	12	11	10	4	4	1	1
27	29	17	14	9	8	4	4	0	0
29	30	22	12	8	6	4	4	1	1
30	29	18	13	7	8	5	5	1	1
33	23	17	10	7	8	3	3	1	1
35	28	19	12	16	8	5	5	3	3
37	33	20	13	19	12	4	5	2	2
40	27	16	12	8	9	5	5	0	0
41	30	21	9	9	8	4	4	4	4
42	31	21	12	9	8	4	4	1	1
44	24	13	12	8	9	4	4	0	0
45	36	22	12	19	10	4	4	4	4
50	24	19	7	8	7	4	4	0	0
54	20	12	7	6	5	5	4	1	0

Likewise, the number of *secured* and *submitted trace exhibits* and *object samples* varies between participants. There seems to be no relation between the *number of collected* and *submitted traces*.

Concerning the efficiency parameter variables (Table 9), the time necessary to perform the forensic investigation varies between 1:45 and 3:35 hours and the walking distance varies between 448,99 and 1228,53 meters. On average the participants spend 2:21 hours on the staged crime scene and walked 832,49 meters. Furthermore, the total number of object samples and trace exhibits are given, with an average of respectively 7,6 and 22,7. The number of collected traces appears to have no connection to the total time spend on the investigation or the walking distance.

Table 9: Parameter variables regarding the efficiency aspect, obtained from the staged crime scene experiment. Red and green presents respectively the lowest and highest number.

Efficiency				
Participant nr.	*Total time (h)*	*Walking distance (m)*	*Number of object samples*	*Number of exhibits*
10	3:09	1228,53	11	22
12	2:31	1187,42	10	21
18	2:40	1059,53	8	18
20	2:35	630,68	8	26
27	2:14	929,69	7	24
29	2:08	692,01	9	26
30	1:48	579,48	7	22
33	2:18	992,03	3	20
35	2:14	448,99	9	23
37	3:35	1152,33	9	26
40	2:15	666,54	7	20
41	1:45	830,05	6	26
42	2:35	939,07	6	27
44	1:59	588,09	4	20
45	2:31	999,21	12	31
50	2:03	615,29	8	19
54	1:50	613,39	5	15

The quality parameter variables are presented in Table 10, showing the used working method and the percentage of collected traces regarding the total number of *scenario-* and *offense-related* traces. Comparing both working methods, the *iterative* working method scored an average of 54,5% on the scenario-related, 58,3% on the offense-related and 54,9% on the overall total of collected traces. The *stepwise* method scored an average of 53,9% on scenario-related, 65,2% on offense-related and 58,7% on the overall total. Therefore, the different methods only show small difference in favor of the stepwise method.

Achievement of goals

All together, the participants have varying outcomes regarding the staged crime scene experiment. Because the relative importance of the parameters show little differences between the forensic investigation goals (Appendix C: *crime scene investigator*, Table 1), it is hard to tell which goals are met. With regard to the crime scene investigators, the important efficacy parameters are the same for each goal: *securing as many traces as possible* is least and *securing person-identifying traces* is most important. The quality parameters are equally important to all goals.

Table 10: Parameter variables regarding the quality aspect, obtained from the staged crime scene experiment. Red and green presents respectively the lowest and highest number.

Quality				
Participant nr.	*Working method*	*Percentage*		
		Scenario total	Offense total	Overall total
10	Iterative	48,78	41,67	52,08
12	Iterative	53,66	62,50	52,08
18	Stepwise	41,46	62,50	50,00
20	Stepwise	60,98	66,67	62,50
27	Stepwise	51,22	75,00	60,42
29	Stepwise	63,41	66,67	62,50
30	Stepwise	56,10	75,00	60,42
33	Iterative	51,22	54,17	47,92
35	Iterative	58,54	70,83	58,33
37	Iterative	58,54	75,00	68,75
40	Stepwise	51,22	70,83	56,25
41	Stepwise	60,98	54,17	62,50
42	Stepwise	60,98	66,67	64,58
44	Stepwise	41,46	66,67	50,00
45	Stepwise	63,41	66,67	75,00
50	Iterative	56,10	45,83	50,00
54	Stepwise	41,46	45,83	41,67

Concerning the efficiency parameters, *as little displacement as possible* is mainly the most significant parameter followed by *taking as little exhibits as possible*. The *time* and *use of items/ materials* are least valuable to the forensic investigation.

Regarding *as little displacement as possible,* participant 35 walked the least amount of distance and scored above average on the *completeness* of the investigation. Participant 54 *took the least number of exhibits* and the *least number of traces* but scored low on the *completeness*. Concerning *the least amount of time* used on the investigation, participant 41 resulted in average scores on the *number of traces* and the *completeness* of the investigation.

If the *completeness* of the investigation is guiding in whether the forensic investigation was performed 'well', participant 45 would have performed best. This participant *secured* and *submitted* most traces in an almost average *time* and just above average *walking distance*, the participant used the *stepwise* method and had the highest percentage on the *completeness* of the investigation.

Picture analysis

Out of the 17 participants, pictures of 15 participants were available and analyzed. Only three of the 15 participants used packaging when collecting traces and 8 out of 15 used a ruler in their pictures. Comparing the methods of photographing, 9 out of 15 participants started with an overview picture before taking detailed pictures, 11 out of 15 made overview pictures of the entire room and 4 out of 15 did not take any detailed pictures.

5.3 How could the forensic investigation be optimized?

The forensic investigation with regard to home invasion robberies is a complex process and the forensic data is shared within a complex socio-technical system. Therefore, the optimization is twofold: optimizing the forensic investigation itself and optimizing the forensic data infrastructure in which the forensic data is shared.

5.3.1 Optimizing the forensic investigation

Essential to the efficacy, efficiency and quality aspects is knowledge of the goal for which the crime scene investigator performs the forensic investigation and how this influences the decisions made at the crime scene [9]. According to the questionnaire data, presented in Chapter 3, the crime scene investigator focuses mostly on tracing the suspect, gathering the evidence, reconstruct the crime and falsify or exclude. The majority of other involved criminal justice system partners also considered these goals to be important in the investigation.

The experiment data of the staged crime scene showed large variations between crime scene investigators. Although the variations do not show which working methods result in well-performed investigations, the variation itself is a point of improvement. A more systematic way to investigate the crime scene can be though the use of a structured forensic investigation scheme. The forensic investigation consists of multiple tasks, the performance of the investigation depends on the efficacy of each included task [42]. Such a structured forensic investigation scheme allows for better comparisons between forensic investigations and crime scene investigators.

5.3.2 Optimizing the forensic data infrastructure

By using a combination of the gained information, insights and data from the previous chapters, the sensibilities and tensions affecting the forensic investigation process have been identified (Figure 23).

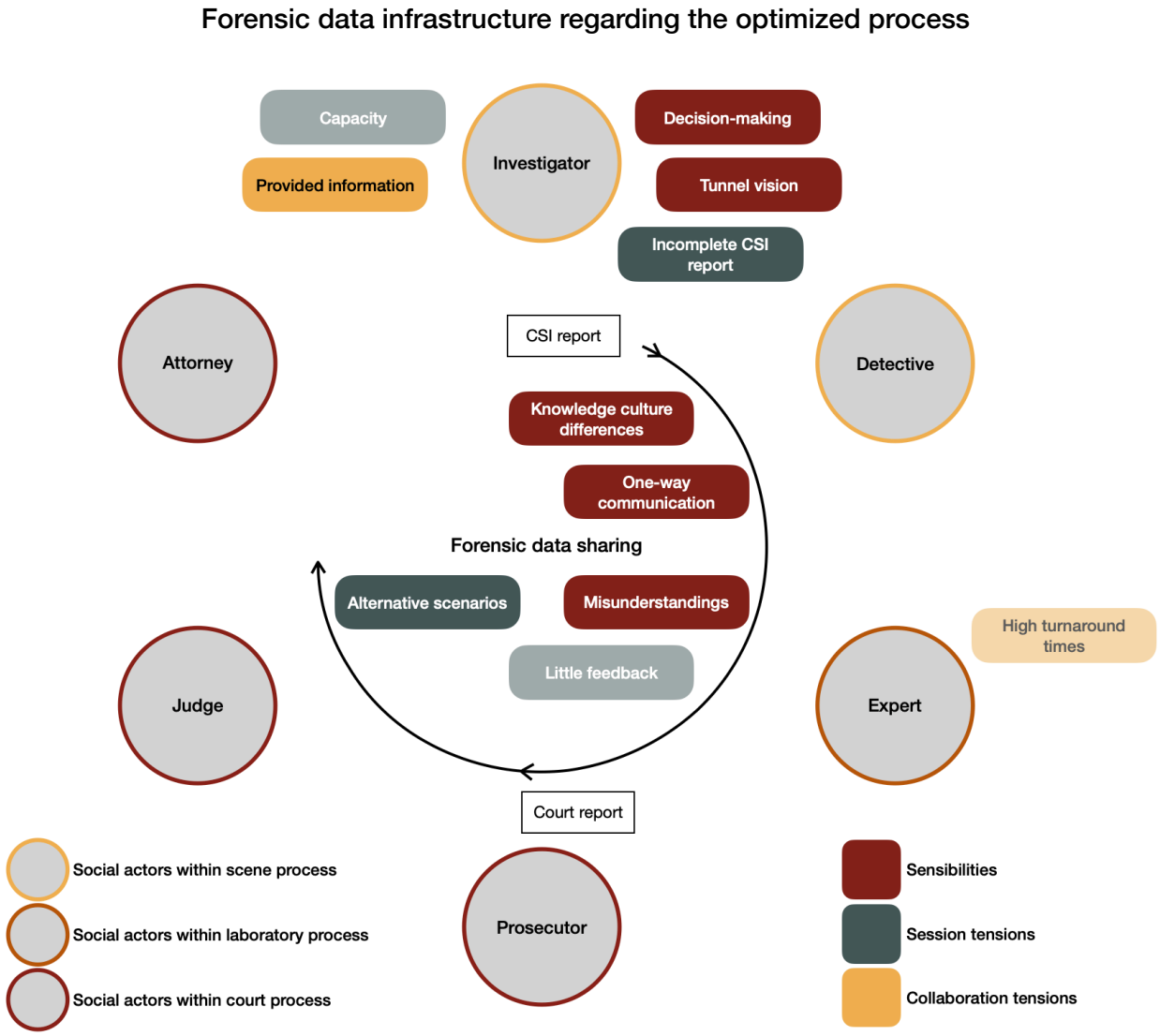

Figure 23: Schematic representation of the forensic data infrastructure regarding the optimized forensic investigation process. The sensibilities and tensions not addressed in the optimized process are represented by faded colors.

From the communication framework and the expert reflection session it became clear that the reporting of crime scene investigators is lacking, especially concerning the decision-making and the investigation of alternative scenarios. By providing transparency about decision-making, the discussion around the interpretation of evidence by partners involved in the court process will be decreased. Therefore, the crime scene investigation report should be readable to all involved partners. In other words, the forensic data needs to be understood in the same way by all partners [18]. For the forensic data infrastructure to be effective, collaboration between partners must be increased. By establishing a mutual understanding within the forensic data infrastructure, cultural differences can be bridged and misunderstandings in the interpretation of forensic data can be prevented.

Alternative scenarios are important to the investigation as they reduce the likelihood of tunnel vision and increase the information density. Both the questionnaire data and the results of the expert reflection session emphasized the importance of providing alternative scenarios. Investigating alternative scenarios should be integrated into the structured forensic investigation process.

According to Van den Eeden, de Poot & Van Koppen [49], the forensic investigation should start with a preliminary round on the crime scene with a preliminary hypothesis. This hypothesis is based on information provided prior to the investigation and the identification of the suspected crime. The information provided by detectives is, therefore, essential to crime scene investigators to form a preliminary hypothesis. Since additional information could alter the hypothesis, the information exchange between these partners should be increased.

In this study the expert co-design session was developed. With use of this session, information will be gained regarding the collaboration and decision-making of the involved partners. Therefore, after conducting the second expert session solutions can be implemented into the optimized forensic investigation process.

5.4 How could the optimized forensic investigation be visualized for use?

The structured forensic investigation scheme including improvements regarding the forensic data infrastructure is visualized based on the hierarchical task analysis developed by Smith et al. (2008) [42]. The tasks necessary to perform the forensic investigation and the efficacy, efficiency and quality parameters concerning these tasks are presented in Figure 24.

The forensic investigation is processed in the following four phases: begin investigation, investigate the scene, evaluate the investigation and process the forensic data. Each phase consists of multiple tasks in a certain order. The parameters linked to certain tasks are presented in the efficacy, efficiency and quality colors.

Structured forensic investigation scheme regarding home invasion robberies

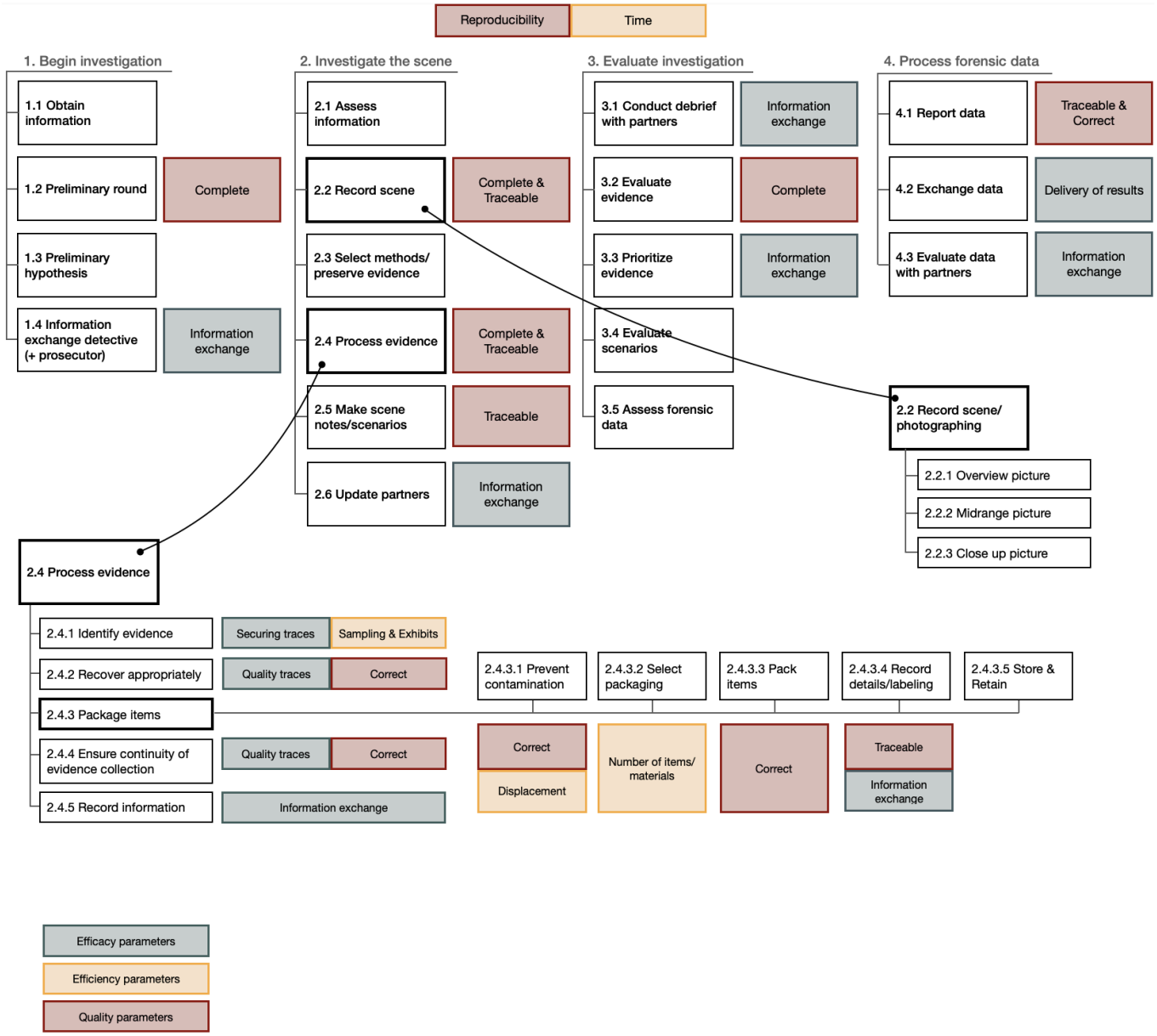

Figure 24: Representation of the optimized forensic investigation regarding home invasion robberies, including parameters associated per efficacy, efficiency and quality aspect. Tasks 2.2 and 2.4 both include multiple steps to complete the task.

6. Analysis of optimized forensic investigation

This chapter focuses on research question 3A (chapter 6.1) and presents a foundation of the new experiment to determine whether the goals are met in the optimized forensic investigation, and if the forensic data infrastructure is enhanced by the suggested improvements.

6.1 How could the optimized forensic investigation be analyzed in order to determine whether the forensic investigation goals are met?

The previous chapters presented the goals, aspects and associated parameters important to the forensic investigation. What also emerged form the questionnaire results was the shift in goal distributions in situations with or without a suspect. The new experiment will, therefore, incorporate this variation in situation to determine if the forensic investigation is influenced by this shift. Furthermore, the experiment tries to asses improvements implemented in the optimized forensic investigation.

6.1.1 Methods used for the new experiment

The new experimental setup is based on the previously performed experiment discussed in the previous chapter. Literature was searched for measures of efficacy, efficiency and quality used in other studies. This search focussed on *(efficacy OR effectiveness OR effectivity OR usefulness)*, *(efficiency OR productiveness OR (cost benefit ratio) OR performance OR functionality)*, *(quality OR value OR condition OR characteristic OR accreditation)* AND (*forensic investigation* OR *crime scene investigation*).

To facilitate comparisons between the traditional and optimized forensic investigation, the new experimental setup makes use of the same scenario (Appendix I) and experimental phases: (1) briefing, (2) investigation and (3) interview [48], used in the previously performed experiment.

6.1.2 New experiment goal

The goal of the new experiment is to analyze the optimized forensic investigation and to compare the traditional with the optimized forensic investigation. The previously performed experiment provided information regarding the traditional forensic investigation, whereas the new experiment provides insight into both the traditional and optimized investigation.

6.1.3 New experimental design

The new experimental design consists of four independent groups: 2 types of processes (optimized vs traditional) x 2 types of information provided prior to the investigation (information about suspect vs no information about suspect). The different types of information provided prior to the investigation could have an impact on the behavior at the crime scene [48], due to differences in goals distributions presented in the questionnaire results.

A total of 40 participants take part in the new experiment, 10 participants for each independent group. The participants did not participate in the previous experiment. Prior to the new experiment, the participants have to complete a questionnaire on background characteristics [49], also used in the previous experiment [48]. With use of this questionnaire, participants are divided into the four independent groups based on similar background characteristics. This negates the background effect of the participants, such as the amount of experience.

Briefing

During the briefing, the study is explained and instructions are given. Corresponding to the previous experiment, the goal of the study is stated as to examine decision-making during the forensic investigation and is not about personal performance [48].

The instructions include a verbal protocol in which participants ‘think-aloud’. Therefore, participants have to wear a microphone. There is a distinction in levels of verbalization, the first level is verbalization of information as *perceived*, the second as *encoded* indicating the focus of attention and the third as *explained* to others. The third level of verbalization should be avoided, as explaining verbalization can interfere in performing the investigation [11].

In the previous experiment, participants were joined by ‘trainees’ who wrote down notes provided by participants. However, in order to prevent third level verbalization, participants in the new experiment investigate the crime scene by themselves using the first or second level of verbalization and are instructed to search and secure as in real investigations. This includes recording of notes, photographing and packaging at the scene.

Participants in the *optimized* process group are asked to provide a preliminary hypothesis based on prior information and identification of the crime scene [49]. A hypothesis can help crime scene investigators to know what to look for. In addition, this group is explicitly asked to describe at what point in time they would want to contact other criminal justice system partners, regarding information exchange within the socio-technical system.

Investigation
Concerning the information provided by the 'police officer', there will be added information about a suspect for the *information about suspect* group. This information includes a witness statement claiming to have recognized the suspect.

Interview
The participants are asked about their impressions of the crime scene, their hypotheses regarding the crime and the most likely scenario about what happened [49]; [50]. They are asked to score how certain they are about their findings on a nine-point scale ranging form very uncertain to very certain. Furthermore, the participants have to score motivation and confidence on a nine-point scale ranging from very low tot very high [49].

Julian & Kelty [28] described the aspect efficacy being related to training and performance of the crime scene investigator. The performance can be determined by a set of critical skills: knowledge, life experience, professionalism, approach to life, communication, cognitive abilities and stress management. The interview will therefore be extended with questions regarding the skills set they believe is crucial to a good investigating. These skill sets are analyzed with regard to the outcomes of the forensic investigations performed in the new experiment.

Parameters
The defined aspects and associated parameters made it possible to measure certain elements of the forensic investigation. Multiple parameters variables were obtained using the available experiment data. However, for some parameters the necessary information was missing. Table 11 shows the known parameters regarding the available experiment data and the parameters requiring additional data. In order to acquire the additional data, elements need to be added to the experiment (presented in Table 11 with ⊕).

Table 11: Known parameters and measures following the experiment data. Elements necessary for missing parameters presented with ⊕.

Aspect	Parameters	Measures
Efficacy	Timely delivery of results	
	Securing as many traces as possible	The number of traces
	Securing high quality traces	
	Securing person-identifying traces	Number of secured and submitted scenario- and offense-related traces
	Securing other crime-related traces	Number of secured and submitted scenario- and offense-related traces
	Information exchange between criminal justice system partners	⊕ Indication of communication moments with partners
Efficiency	Forensic investigation by CSI in the shortest possible time	Total time
	As little displacement as possible by CSI on the crime	Walking distance on crime scene
	As little use of items/materials as possible	⊕ Usage of items/material

	As little sampling as possible on crime scene	The number of sampling
	Taking as little trace exhibits as possible	The number of exhibits
Quality	Objective	
	Reproducible	Working method used by investigator during forensic investigation
	Traceable	⊕ Recording and reporting of findings and scenarios
	Correct	⊕ Trace recovery, packaging and collecting continuity
	Complete	Percentage of secured scenario/offense-related traces versus the total number of scenario/offense-related traces

The adjustments in the new setup provide additional results regarding the efficacy, efficiency and quality aspects. The *indication of communication moments with partners* contributes to the insights in *information exchange between partners*. With the ability to tell at which point in time investigators would prefer to have information exchanged between partners, such points in time could be added to the structured forensic investigation scheme.

The *use of items/materials* provides data regarding the efficiency parameter *as little use of items/materials as possible*. Regarding the quality aspect of the forensic investigation, the decision-making (*traceability*) and performance (*correct*) are presented using respectively the recording of the verbal protocol and crime scene investigation report, and the used methods in recovery, packaging and collection of traces.

Three parameters remain undefined. The *timely delivery of results* is particularly necessary in crime cases with a suspect. Due to the limited capacity within the socio-technical system, the times of delivery are hard to implement in the experiment with only the crime scene investigator participating. Likewise, the quality of traces is determined in the laboratory, which falls outside the scope of this experiment.

Concerning the *objectivity* of the forensic investigation, the insights into decision-making contribute to the knowledge on which investigators base their decision. However, *objectivity* itself is difficult to measure.

6.1.4 New experimental analysis

The new experiment will the same analysis techniques used in this study, with additional techniques for the verbal protocol. The verbal protocol of each participant is transcribed and coding is applied to categorize the statements. Baber & Butler [11] use the following four categories: reference to modus operandi of the offender (working method, activities, possible motive), reference to objects in the room, reference to analysis (types of traces) and reference to room's features. This information contributes to the insights into decision-making at the crime scene. Furthermore, the verbal protocol reveals the thought process of developing a theory for the modus operandi of the suspect [11].

7. Discussion

The forensic investigation is crucial for the criminal investigation regarding home invasion robberies and the demand has increased over the years. During the forensic investigation, the crime scene investigator is confronted with a large amount of information and has to make decisions with uncertainty. It is important to know with what goal in mind crime scene investigators act on the crime scene as this influences the decision-making [9]. The forensic data collected by the investigator is shared within a forensic data infrastructure with all involved partners. This data also contributes to the decision-making in laboratory and court processes [22]. However, there is little knowledge about the contribution of forensic data to a conviction in court [13]; [15].

Partners involved in the forensic data infrastructure all contribute in different ways and at different points in the criminal investigation. As the communication framework discussed, the infrastructure is confronted with several sensibilities and tensions influencing the criminal investigation [18]. These sensibilities and tensions, such as decision-making and tunnel vision, in combination with the limited capacity affecting the socio-technical system, makes the infrastructure complex. The forensic investigation is, therefore, faced with the complexity of the process itself and the complexity of the forensic data sharing.

This study, therefore, aimed to gain an understanding of the involved partners within the forensic data infrastructure, their needs of the forensic investigation and potential improvements of the forensic investigation.

7.1 Goals and aspects

During the forensic investigation, not everything can be investigated and decisions are made regarding which traces to secure and when to stop collecting traces [8]. The emphasis of forensic investigations is shifting towards collecting the right traces at the crime scene [7]. To investigate the crime scene with the available resources, the forensic investigation comes with some form of efficacy, efficiency and quality. A great deal is unknown about these aspects and the usefulness of the forensic investigation, and little research was performed regarding the forensic investigation itself. Therefore, the questionnaire was developed in which the relative importance of goals, aspects and associated parameters was scored.

The goals of the investigation could be linked to the moment of entering the criminal investigation process, where tracing the suspect and gathering the evidence run parallel to each other at the beginning of the criminal investigation. According to the expert, prosecutor and judge, gathering the evidence could also be intertwined with falsifying or excluding alternative scenarios. Therefore, the scores might be influenced by this association.

The defense attorneys, showed the most contrasting distribution compared to the other involved partners. Their main focus is reconstruction of the crime and falsifying or excluding alternative scenarios. According to Kruse [43], these alternative scenarios are used to devalue statements in favor of the proposed scenario in the prosecutors court report. While attorneys may want these alternative scenarios investigated, it could also limit their options in defending their client. Nevertheless, because of the small sample size, it is difficult to interpret these results and additional data is necessary to put these results into perspective.

Finding the motive was found to be the least important goal. According to the prosecutor, traces reveal nothing about the motive of a crime. However, the motive could influence the context around collected traces and is, therefore, more significant to detectives as it is to crime scene investigators.

Having a *suspect* or not influenced the relative importance of goals, particularly to NFI experts and judges. The situations with *no suspect* showed a higher relative importance of tracing the suspect. For the judges, this increase in importance seemed to decrease the importance of gathering the evidence. The other variations in situation had no distinct effect on the distribution of goals. An interesting point was made by the crime scene investigator during the expert reflection session, the distribution of goals should be constant despite of any variations in the situation.

The literature mainly discussed the increasing interest in efficiency measurements [9]; [21]; [22] of the forensic investigation. However, all involved partners gave priority to the efficacy and quality aspects of the investigation. The prosecutor and detective dedicated the low importance of efficiency to the trust in the crime scene investigator's expertise. However, of all involved partners the prosecutors showed the most interest in the efficiency aspect, which could be

devoted to the prosecutor being the authorized supervisor of the investigation [16] and responsible for the decisions made regarding the type of investigation and costs [9].

Although the questionnaire results provided insights into this relative importance of the goals, aspects and associated parameters, the importance could only be visualized by use of figures due to the non-parametric nature. The differences between certain goals or partners was presented using the Cliff's delta. However, the questionnaire was the best method to gain insights into the involved partners' view on the forensic investigation and to reach as many participants as possible.

7.2 Partner collaboration

The communication framework showed that the criminal justice system can also be represented by a forensic data infrastructure with different knowledge cultures. It is through interactions between these cultures that criminal justice is achieved [18]. The effectivity of the forensic data infrastructure depends on sharing stable forensic data throughout the infrastructure [10]. The data sharing is hindered by certain sensibilities and tensions present in the infrastructure.

The possibility of tunnel vision was emphasized in literature [21]; [29] and the expert reflection session. According to the NFI expert in the reflection session, crime scene investigators should have a limited amount of information to prevent tunnel vision. However, information provided prior to the investigation is necessary to guide the search. By investigating alternative scenarios and transparency in the decision-making on scene, tunnel vision can be prevented or identified [29].

Currently, the investigation reports lack the reasoning behind decision made at the crime scene. Furthermore, the forensic data presented in the report are sometimes misunderstood [18] or do not match the level of knowledge of other involved partners [44]. A mutual understanding between partners could enhance the correct way of interpreting forensic data, so the data is shared in a more stable way. In addition, developing agreed-upon standards regarding the reporting of forensic data could contribute in solving this sensibility.

This study focused on the optimization of the forensic investigation and, therefore, mainly on the crime scene investigator's role within the forensic data infrastructure. The sharing of forensic data can benefit from improved reporting in the crime scene investigation report, however, the prosecutor has an important role in deciding which data is presented in the court report. The prosecutor should, therefore, be involved earlier on in the criminal investigation process, as they assemble the evidence [18].

To promote the development of a mutual understanding, the focus-group inspired expert reflection session provided the opportunity for a discussion between the involved partners [38], in which they could interact and bridge gaps to understand each others needs and goals [27]. It seemed to be one of the first settings in which the partners could express their tensions within the forensic data infrastructure. Corresponding to the literature, the partners are currently unable to track how the forensic data is received by the other partners [18]. The infrastructure regarding home invasion robberies lacks feedback within the system. In order to optimize the infrastructure, the system should transfer from a one-way to a two-way communication system.

The expert reflection session provided insights in the needs of the partners, whereas the expert co-design session can promote co-design to fulfill these needs. The complex forensic data infrastructure can benefit from a multi stakeholder approach that encourages co-design [31]. A participatory design in which the optimization process is designed with the involved partners, can reduce resistance to changes necessary for optimization [32]. In the expert co-design session, partners can think together and align standards by evaluating solutions. After completing both expert sessions, a mutual understanding is created, knowledge is shared and agreed-upon solutions are ready for implementation into the optimized forensic investigation.

Some sensibilities and tensions still remain unresolved in the optimized forensic investigation. The limited capacity within the criminal justice system is not easy to solve. In order to deal with this limited capacity, it is especially important that the involved partners create a mutual understanding and align agreed-upon standards. This way, the available resources can be used optimally.

7.3 Achievement of goals

Insights into the goals, aspects and associated parameters were obtained though the results of the questionnaire and expert reflection session. In determining whether these goals were met in the forensic investigation, experiment data of a previously performed study was used.

The experiment data and pictures showed varying outcomes regarding the staged crime scene investigation. This corresponds to the literature, which mentioned different outcomes of crime scene investigators on the same investigation due to decisions made on best practices and intuition [13]; [15]. Which is also emphasized by Ribaux, Baylon, Lock et al. [23], the performance of the investigator is of influence to the outcomes of the investigation.

There does not appear to be a relation between certain parameters and the overall performance. Securing many traces can lead to high percentages on the *completeness* of the investigation. However, the questionnaire results show a low importance of collecting *as many traces a possible*. This could then apply only to collecting traces for multiple scenarios. Nonetheless, there is a limit to the number of traces that can be submitted for analysis at the NFI. Collecting more traces will, therefore, not directly lead to a better outcome. The way in which traces are secured is more important.

The parameters were initially defined to measure the forensic investigation aspects regarding the goals. However, the goals were indistinguishable by the relative importance of these parameters. To determine the achievement of goals, certain thresholds are necessary to establish if a certain goal is achieved.

7.4 Optimized forensic investigation

The optimization process was twofold, optimizing the forensic investigation itself and optimizing the forensic data infrastructure in which data is shared. The optimization of the forensic investigation is mainly focused on providing a structured forensic investigation scheme [42], as the experiment data showed variations in the outcomes. The structured scheme contains all tasks included in the forensic investigation and allows for better comparisons between crime scene investigators. Furthermore, the structured scheme increases the *reproducibility* of the forensic investigation.

A number of improvements have been identified within the forensic data infrastructure. Certain sensibilities and tensions have been resolved in the optimized forensic investigation. By increasing the collaboration through discussion and dialogue, misunderstandings and cultural differences are bridged and agreed-upon standards are developed. The reporting of forensic data and the investigation of alternative scenarios are important elements in the decision-making and tunnel vision tensions. Because these elements are implemented in the optimized forensic investigation, transparency in decision-making is offered and tunnel vision can be prevented.

After completing the second expert session in which co-design is promoted, the optimized forensic investigation can be finalized. In this session, decisions are made together regarding solutions provided by the involved partners.

7.5 New staged experiment

The final objective of this study was to lay a foundation for a new staged crime scene experiment. This new experimental is developed to analyze the improvements implemented in the optimized forensic investigation. Based on the previously performed staged crime scene experiment, the new experimental setup contains four independent groups varying in the type of process and type of information provided prior to the investigation.

The experiment tries to obtain as many parameter variables as possible, however, certain parameters remain unmeasurable. The *delivery of timely results* and the *quality of traces* can not be obtained as only the crime scene investigators take part in the experiment. By including the NFI experts in the experiment, the *quality of traces* can in all probability be determined. Regarding the *objectivity* of the forensic investigation, insights into the decision-making are obtained but the *objectivity* remains difficult to measure.

7.6 Future research

The optimization process of the forensic investigation proposed in this study still faces the limited capacity affecting the criminal investigation. Particularly the crime scene investigators struggle with staff shortages. Because it is important for investigators to discuss alternative scenarios and the decisions to be made on scene, investigators can benefit from conducting an investigation together. Future experiments could, therefore, focus on the team performance versus the individual performance of crime scene investigators.

Another element affecting the criminal investigation is the high turnaround times at the NFI. These high turnaround times could cause traces to become irrelevant to the investigation and could cause crime scene investigators to make different choices as to which trace to secure [44].

The limited capacity regarding the criminal investigation is a research in itself and was not included in this study. Such research could focus on dividing the specializations of the NFI over several laboratories. Each laboratory would, therefore, be specialized in a specific trace investigation.

In optimizing the forensic investigation, the value of evidence could play an additional role. By implementing the value of traces into the structured forensic investigation scheme, crime scene investigators can focus on traces that are more likely to have a high quality outcome.

7.7 Contribution to research directions

The combination of the two research directions, Biomedical Engineering and Communication Design for Innovation, allowed for a multidisciplinary approach to the optimization process. The Biomedical Engineering element of this study provided insights into the measurements of the forensic investigation, defined by the efficacy, efficiency and quality aspects. Whereas the Communication Design for Innovation element added the holistic view of the optimization process. Such a complex process is not solved in one way and by implementing the needs of the involved partners, the improvements in the forensic investigation also give substance to the social perspective of this process.

This optimization process consists of quantitative elements combined with social elements surrounding this complex process. The steps taken in this process can be translated into optimizing other complex processes. By including the needs of the partners involved in the process, the knowledge of these partners is shared and decisions are made together, resulting in an optimized process that is suitable for all partners.

7.8 Reflection

The multidisciplinary approach of this study made it possible to look at the complexity of the forensic investigation with an holistic view. In optimization a process, the quantitative elements could be the focus point of a study. However, to make an optimized process successful, the actors involved in the system have to be taken into account. The advantage of combining the two research directions is, therefore, the social element of this optimization process being equally valuable as the quantitative element.

When I joined the CSI-PEEQ project, the objectives and methods were already decided on. However, by contributing to the project, the importance of including the needs and knowledge of the involved partners was emphasized. The expert reflection session was added to the project methods to provide a discussion on their needs and tensions within the system.

The CSI-PEEQ project could also be seen as a participatory design, in which different partners with varying expertises co-designed the project. Such a participatory design involves full participation, inclusion in decisions and shared responsibilities. These values require many hours of brainstorming and a mutual understanding. However, even then misunderstandings and tensions can arise.

8. Conclusion

How to optimize the forensic investigation concerning home invasion robberies, with regard to the goals of involved partners?

In optimizing the forensic investigation, this study focused on three objectives in answering the main research question, which were *gaining insights into the goals and aspects of the forensic investigation*, *determining whether these goals are met* and *analyzing the effect of the optimized forensic investigation*.

The optimization process implemented quantitative and social elements concerning the forensic investigation and the partners involved in the criminal justice system regarding home invasion robberies. The optimization process includes optimizing the forensic investigation itself and optimizing the forensic data infrastructure in which the forensic data is shared.

The questionnaire and expert reflection session presented insights into the relative importance of the goals, aspects and associated parameters of the forensic investigation. Overall the goal distributions are similar to all involved partners within the criminal justice system. For crime scene investigators: **tracing the suspect**, **gathering the evidence**, **reconstruct the crime** and **falsify or exclude** are all equally important. Whereas, **finding the motive** is least important in investigating a crime scene.

When comparing the **efficacy**, **efficiency** and **quality** aspects, the **efficiency** is valued as least important to the forensic investigation. Therefore, the **efficiency** parameters are less valued than the **efficacy** and **quality** parameters. All **quality** parameters appear to be equally important to the investigation. The *securing of person-identifying* and *high quality traces* are the most important **efficacy** parameters concerning the investigation.

The partner collaboration presented several sensibilities and tensions affecting the forensic data infrastructure in which forensic data is shared between the partners. The reporting of investigators is a tension within the infrastructure as it did not meet the needs of the other partners. Furthermore, the transparency in decision-making is lacking and the investigation of alternative scenarios need to be elaborated more in the report.

To optimize this complex process, this study used a participatory design to deal with the sensibilities and tensions. After creating the start of a mutual understanding in the expert reflection session, the second expert session will promote the co-design of the involved partners. In this session, participatory and consensus decision-making are required. So, the involved partners brainstorm, find solutions and discuss together to eventually decide on the best solutions for this optimization process.

As the involved partners showed similar goal distributions with equally important aspect parameters, it is hard to tell whether the goals are achieved in the current forensic investigation. Additional information and data is necessary to decide on the requirements for the achievement of goals. Experiment data showed varying outcomes of crime scene investigators on the same crime scene. Therefore, a structured forensic investigation scheme with improvements regarding the sensibilities and tensions in the infrastructure is developed, resulting in the optimized forensic investigation.

The optimized forensic investigation can be analyzed using the new experimental setup. This new experiment will provide additional data essential in determining whether goals are met and will provide insights necessary in measuring the forensic investigation.

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Appendix A: Complete questionnaire

Vragenlijst definitief

Start of Block: Introductie

Q3 Beste deelnemer, Hartelijk dank voor uw deelname aan dit onderzoek naar het belang van forensisch onderzoek op een plaats delict (PD) voor de verschillende partners in de strafrechtketen. Door deze vragenlijst in te vullen helpt u ons inzicht te krijgen in: 1. De belangrijkste **doelen** van het PD-onderzoek,
2. De **parameters** die bepalend zijn voor de **doelmatigheid, efficiëntie en kwaliteit** van een PD-onderzoek,
3. De mate waarin **opvattingen** hierover **variëren** tussen de verschillende partners in de strafrechtketen.
Deze kennis kan helpen het PD-onderzoek zo in te richten dat de resultaten zo goed mogelijk aansluiten bij de behoeften van **alle** partners in de strafrechtketen. In deze vragenlijst richten wij ons specifiek op PD-onderzoek bij woningovervallen. *Wij zijn geïnteresseerd in **uw** visie. Er zijn dan ook geen goede of foute antwoorden. Het invullen van de vragenlijst kan helaas niet even vlug tussen de bedrijven door; het duurt ongeveer 45 minuten. Zie het als een goed moment om, met een kop koffie in de hand, eens na te denken over het PD-onderzoek en uw mooie vakgebied. Uw kennis is voor ons essentieel. Maakt u alstublieft de volledige vragenlijst af, want alleen dan kan deze worden verwerkt. Om onze dank wat extra kracht bij te zetten worden onder alle ingevulde vragenlijsten gadgets verloot.* ***Alvast heel veel dank!***

Q5
Er worden in deze vragenlijst op geen enkele manier persoonsgegevens geregistreerd. Met uw deelname aan deze vragenlijst stemt u in met het gebruik van de door u ingevulde antwoorden voor onderzoeks-, ontwikkelings- en onderwijsdoeleinden door de opstellers van deze vragenlijst.

Q7 Vanuit welke rol vult u deze vragenlijst in?

- Forensisch onderzoeker (1)
- Rechercheur (2)
- (Forensisch) officier van justitie (3)
- Strafrechtadvocaat (4)
- Strafrechter (5)
- Deskundige (6)

Q48 Specificeer als u wilt eventueel uw rol/expertise:

_____

Display This Question:
If Q7 = 1

Q9 Voor u als forensisch onderzoeker is dit nuttig omdat dit u kan helpen bij het nemen van beslissingen op een plaats delict. Voor ons is uw visie noodzakelijk omdat u de basis legt voor het strafrechtelijk onderzoek.

Display This Question:
If Q7 = 2

Q11 Voor u als rechercheur is dit nuttig omdat u hiermee mede beïnvloedt hoe forensisch onderzoekers keuzes maken op de PD ten dienste van uw onderzoek. Het is hierbij niet de bedoeling dat u als forensisch onderzoeker naar de vragen kijkt, maar juist vanuit uw rol als rechercheur nadenkt over wat voor ú belangrijk is: wat zorgt er bij het PD-onderzoek voor dat u optimaal gebruik kunt maken van de resultaten van dit onderzoek? Voor ons is uw visie noodzakelijk omdat wij alleen dan het PD-onderzoek goed kunnen laten aansluiten bij de behoeften van de tactische recherche.

Skip To: End of Block If Q11 Is Displayed

Display This Question:
If Q7 = 3

Q13 Voor u als (forensisch) officier van justitie is dit nuttig omdat u hiermee mede beïnvloedt hoe forensisch onderzoekers keuzes maken op de PD in het kader van het strafrechtelijk onderzoek. Het is hierbij niet de bedoeling dat u als forensisch onderzoeker naar de vragen kijkt, maar juist vanuit uw rol als (forensisch) officier nadenkt over wat voor ú belangrijk is: wat zorgt er bij het PD-onderzoek voor dat u optimaal gebruik kunt maken van de resultaten van dit onderzoek? Voor ons is uw visie noodzakelijk omdat alleen u goed weet welke PD-resultaten nodig zijn voor een succesvolle vervolging.

Skip To: End of Block If Q13 Is Displayed

Display This Question:
If Q7 = 4

Q15 Voor u als strafrechtadvocaat is dit nuttig omdat u hiermee mede beïnvloedt hoe forensisch onderzoekers keuzes maken op de PD. Het is hierbij niet de bedoeling dat u als forensisch onderzoeker naar de vragen kijkt, maar juist vanuit uw rol als advocaat nadenkt over wat voor ú belangrijk is: wat zorgt er bij het PD-onderzoek voor dat u optimaal gebruik kunt maken van de resultaten van dit onderzoek? Voor ons is uw visie noodzakelijk omdat alleen u goed weet welke PD-resultaten nodig zijn voor een adequate verdediging van uw cliënt.

Skip To: End of Block If Q15 Is Displayed

Display This Question:
If Q7 = 5

Q17 Voor u als strafrechter is dit nuttig omdat u hiermee mede beïnvloedt hoe forensisch onderzoekers keuzes maken op de PD ten dienste van een zo volledig mogelijke afweging van scenario's. Het is hierbij niet de bedoeling dat u als forensisch onderzoeker naar de vragen kijkt, maar juist vanuit uw rol als strafrechter nadenkt over wat voor ú belangrijk is: wat zorgt er bij het PD-onderzoek voor dat u optimaal gebruik kunt maken van de resultaten van dit onderzoek? Voor ons is uw visie noodzakelijk omdat alleen u goed weet welke PD-resultaten doorslaggevend zijn voor het nemen van uw beslissingen.

Skip To: End of Block If Q17 Is Displayed

Display This Question:
If Q7 = 6

Q19 Voor u als deskundige is dit nuttig omdat u hiermee mede beïnvloedt hoe forensisch onderzoekers het PD-onderzoek zo uitvoeren dat resultaten voor u zo goed mogelijk bruikbaar zijn. Het is hierbij niet de bedoeling dat u als forensisch onderzoeker naar de vragen kijkt, maar juist vanuit uw rol als deskundige nadenkt over wat voor ú belangrijk is: wat zorgt er bij het PD-onderzoek voor dat u optimaal gebruik kunt maken van de resultaten van dit onderzoek? Voor ons is uw visie noodzakelijk omdat alleen u weet wat daarvoor nodig is.

Skip To: End of Block If Q19 Is Displayed

End of Block: Introductie

Start of Block: Oefenvraag

Q47 **Oefenvraag:** Om even te oefenen met het soort vragen dat wij u zullen stellen in deze vragenlijst, starten we met een oefenvraag.

U bent gevraagd deze vragenlijst in te vullen. U heeft daar bepaalde middelen voor nodig, zoals bijvoorbeeld tijd of een pen. Welke middelen zijn daarbij voor u van belang?
Prioriteer de onderstaande middelen door aan te geven van welk belang ze zijn ten opzichte van elkaar, d.w.z. alle genoemde middelen in deze vraag. Mocht een middel niet van belang zijn, schuif het bolletje dan naar 0.

Let op: wanneer er een *beschikbaar is, kunt u deze raadplegen voor meer informatie. Mocht het schildje niet werken, dan kan het zijn dat deze optie niet in uw web-browser werkt. U kunt proberen de vragenlijst in een andere browser te openen.*

Let op: u dient een antwoord te geven om door te gaan naar de volgende vraag. Ook als u het bolletje op de basispositite wilt laten staan, moet u deze toch even aanklikken!

	Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter
	0	1	2	3	4	5	6	7
Tijd ()								
Computer / telefoon / tablet ()								
Pen ()								
Kat ()								

Q63
Wilt u voordat u verder gaat eerst een uitgebreidere uitleg? Klik dan hier om een extra uitlegpagina te openen in een nieuw tabblad en kom dan terug naar deze pagina om verder te gaan of ga nu direct verder met de vragenlijst.

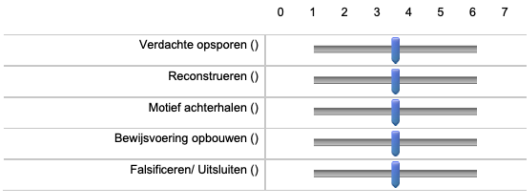
End of Block: Oefenvraag

Start of Block: Deel 1

Q12 **DEEL 1 van 2: Doelen van forensisch PD-onderzoek** **UITGANGSCASUS** Stelt u zich de volgende casus van een woningoverval voor: Om 17:00 uur 's middags wordt via de meldkamer gemeld dat er een woningoverval heeft plaatsgevonden in een woning aan Melkweg 20 in uw regio. De Forensische Opsporing gaat erheen. De PD is afgezet door de agent die ook het slachtoffer heeft opgevangen. Het slachtoffer is overstuur en nog niet beschikbaar voor een verklaring.
Kenmerken van de PD Woning met 2 verdiepingen: Op de begane grond een woonkamer, keuken en slaapkamer. Op de eerste verdieping 2 slaapkamers en een badkamer. De woonkamer en slaapkamers zijn overhoop gehaald. Er zijn geld en kostbaarheden buitgemaakt, maar de grootte van de buit is nog onbekend. Er is sprake geweest van bedreiging. Het is nog niet duidelijk of er ook fysiek geweld is gebruikt.
Houd deze casus in gedachten bij de vragen die u zo worden gesteld. Het PD-onderzoek kent verschillende doelen. Wij willen graag van u weten **hoe belangrijk verschillende doelen** van PD-onderzoek **ten opzichte van elkaar** volgens u zijn in **verschillende situaties**. Bij het invullen van de vragen is bovenstaande casus van de woningoverval steeds uw uitgangspunt. Bij elke nieuwe vraag krijgt u steeds een nieuwe situatie van deze casus voorgesteld. Zo kan er **nieuwe** informatie aan u bekend worden gemaakt. Wij willen steeds van u weten welke doelen voor u van groter belang zijn in deze nieuwe situatie en welke doelen van kleiner belang zijn. *Probeert u zich zo goed mogelijk in te leven in de geschetste situaties en echt na te gaan wat volgens u in die situatie in de dagelijkse praktijk belangrijk is. Alleen zo kunnen wij bouwen op de resultaten van dit onderzoek.*

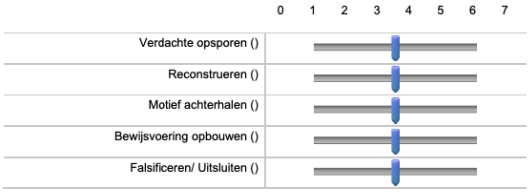
Q15 Beschouw de uitgangscasus.
Situatie: Er is **wel een concrete verdachte** in beeld Er is **geen fysiek geweld** gebruikt De overval lijkt **geen deel uit te maken van een serie** overvallen
Prioriteer de onderstaande doelen door aan te geven van welk belang ze zijn ten opzichte van alle doelen in deze vraag.

Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter



Q17 Beschouw de uitgangscasus.
Situatie: Er is **geen verdachte** in beeld Er is **geen fysiek geweld** gebruikt De overval lijkt **geen deel uit te maken van een serie** overvallen
Prioriteer de onderstaande doelen door aan te geven van welk belang ze zijn ten opzichte van alle doelen in deze vraag.

Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter

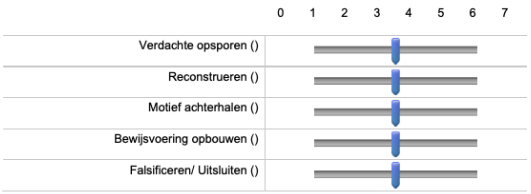


Q19

Beschouw de uitgangscasus.

Situatie: Er is **wel een concrete verdachte** in beeld Er is **geen fysiek geweld** gebruikt De overval lijkt **wel deel uit te maken van een serie** overvallen
Prioriteer de onderstaande doelen door aan te geven van welk belang ze zijn ten opzichte van alle doelen in deze vraag.

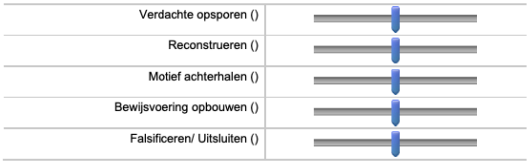
Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter



Q18 Beschouw de uitgangscasus.
Situatie: Er is **wel een concrete verdachte** in beeld Er is **wel fysiek geweld** gebruikt De overval lijkt **geen deel uit te maken van een serie** overvallen
Prioriteer de onderstaande doelen door aan te geven van welk belang ze zijn ten opzichte van alle doelen in deze vraag.

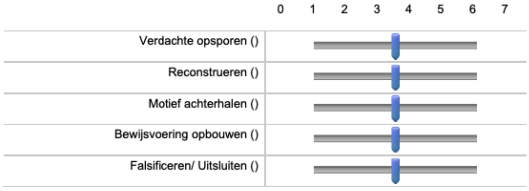
Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter

0 1 2 3 4 5 6 7



Q19 Beschouw de uitgangscasus. **Situatie:** Er is **geen verdachte** in beeld Er is **wel fysiek geweld** gebruikt De overval lijkt **wel deel uit te maken van een serie** overvallen
Prioriteer de onderstaande doelen door aan te geven van welk belang ze zijn ten opzichte van alle doelen in deze vraag.

Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter



End of Block: Deel 1

Start of Block: Deel 2

Q21 DEEL 2 van 2: Parameters voor doelmatigheid, efficiëntie en kwaliteit van forensisch PD-onderzoek Nu u hebt nagedacht over de verschillende doelen van PD-onderzoek in de verschillende situaties die werden geschetst, komen we bij de volgende stap. Om te kunnen

onderzoeken hoe een PD-onderzoek er voor een bepaald doel idealiter uit zou moeten zien is nog meer informatie nodig.

Wij vragen u hierna eerst de drie doelen te kiezen die u in het algemeen het belangrijkst vindt. Vervolgens vragen wij u voor elk doel het onderling belang van de volgende drie aspecten aan te geven: **Doelmatigheid (effectiviteit):** De mate waarin het forensisch PD-onderzoek bijdraagt aan het behalen van het beoogde doel. **Efficiëntie:** Kosten- batenverhouding van het forensisch PD-onderzoek, bijvoorbeeld de verhouding tussen gespendeerde tijd of mankracht en de opbrengst aan relevante sporen. **Kwaliteit:** Correcte uitvoer van de juiste keuzes, procedures en handelingen. Bijvoorbeeld, als u een verdachte wilt opsporen, wat is dan het meest van belang? En hoe zit dat als u een reconstructie wilt maken? Als laatste stap helpt u ons te bepalen wat een doelmatig, efficient of kwalitatief goed PD-onderzoek eigenlijk is. Onder elk van de drie aspecten krijgt u daarom een lijst met parameters die hiervoor bepalend kunnen zijn. Wij stellen u bij elk doel dus steeds twee vragen: **Prioriteer doelmatigheid, efficiëntie en kwaliteit in het algemeen:** Wat is voor een gegeven doel volgens u van groter belang en welk aspect vindt u van kleiner belang. **Prioriteer** vervolgens onder doelmatigheid, efficiëntie en kwaliteit van PD-onderzoek **de lijst met parameters die hiervoor bepalend zijn:** Welke parameter vindt u bij een gegeven doel van groter belang en welke vindt u van kleiner belang?

Wij vragen u hierover na te denken **vanuit uw eigen rol en realistische situatie**.

Q41 Kies **3 doelen** die voor uw rol in het algemeen het meest van belang zijn bij woningovervallen.

- [ ] Verdachte opsporen (1)
- [ ] Reconstrueren (2)
- [ ] Motief achterhalen (3)
- [ ] Bewijsvoering opbouwen (4)
- [ ] Falsificeren/uitsluiten (5)

End of Block: Deel 2

Start of Block: Extra Uitleg Deel 2 - Extern Venster

Q51
Als u wilt, kunt een pagina openen met extra, uitgebreidere uitleg over de aspecten en parameters die u straks mag scoren. Deze pagina zal in een nieuw tabblad of venster worden geopend, zodat u deze erbij kunt houden. Klik hier om de uitlegpagina te openen en kom dan terug naar deze pagina om verder te gaan of ga nu direct verder met de vragenlijst.

End of Block: Extra Uitleg Deel 2 - Extern Venster

Start of Block: Verdachte opsporen

Q53
Vul deze vragen in voor het DOEL:
Verdachte opsporen: het achterhalen wie er als verdachte in verband kan worden gebracht met het misdrijf.

Q23 *Prioriteer voor dit doel de aspecten doelmatigheid, efficiëntie en kwaliteit door aan te geven van welk belang ze zijn ten opzichte van elkaar.*

Mocht u de introductie van Deel 2 nog eens willen lezen, klik hier: Toelichting Deel 2

	Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter
	0	1	2	3	4	5	6	7
Doelmatigheid ()								
Efficiëntie ()								
Kwaliteit ()								

Q25 **Doelmatigheid** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter
	0	1	2	3	4	5	6	7
Tijdig resultaat leveren ()								
Zo veel mogelijk sporen veiligstellen ()								
Kwalitatief goede sporen veiligstellen ()								
Persoons -identificerende sporen veiligstellen ()								
Overige delictgerelateerde sporen veiligstellen ()								
Informatie-uitwisseling tussen strafrecht ketenpartners ()								

Q27 **Efficiëntie** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter
	0	1	2	3	4	5	6	7
PD-onderzoek door FO in zo kort mogelijke tijd ()								
Zo min mogelijk verplaatsing van FO-er over de PD ()								
Zo min mogelijk verbruikte spullen/materialen ()								
Zo min mogelijk bemonsteringen **ter plaatse** doen ()								
Zo min mogelijk voorwerpen of sporendragers **meenemen** ()								

Q29 **Kwaliteit** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter
	0	1	2	3	4	5	6	7
Objectief ()								
Reproduceerbaar ()								
Herleidbaar ()								
Correct ()								
Compleet ()								

End of Block: Verdachte opsporen

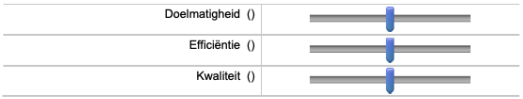
Start of Block: Reconstrueren

Q59
Vul deze vragen in voor het DOEL:
Reconstrueren: het achterhalen hoe en wat er zich heeft afgespeeld in plaats en tijd.

Q30 *Prioriteer voor dit doel de aspecten doelmatigheid, efficiëntie en kwaliteit door aan te geven van welk belang ze zijn ten opzichte van elkaar.*

Mocht u de introductie van Deel 2 nog eens willen lezen, klik hier: Toelichting Deel 2

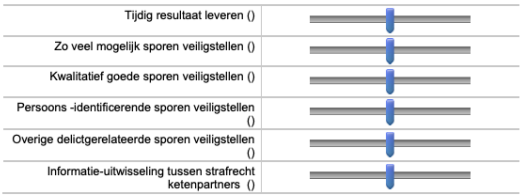
	Geen belang	Veel kleiner	Kleiner	Iets kleiner	**Even groot belang**	Iets groter	Groter	Veel groter
	0	1	2	3	4	5	6	7



Q31 **Doelmatigheid** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

Geen belang Veel kleiner Kleiner Iets kleiner **Even groot belang** Iets groter Groter Veel groter

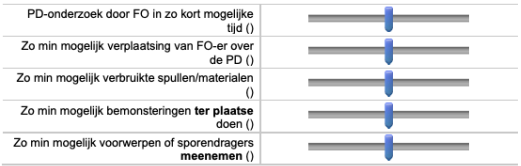
0 1 2 3 4 5 6 7



Q32 **Efficiëntie** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

Geen belang Veel kleiner Kleiner Iets kleiner **Even groot belang** Iets groter Groter Veel groter

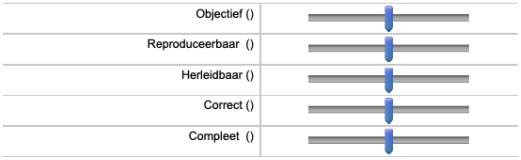
0 1 2 3 4 5 6 7



Q33 **Kwaliteit** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

Geen belang Veel kleiner Kleiner Iets kleiner **Even groot belang** Iets groter Groter Veel groter

0 1 2 3 4 5 6 7



End of Block: Reconstrueren

Start of Block: Motief achterhalen

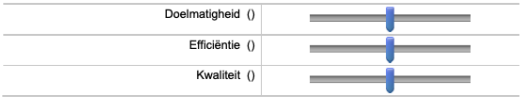
Q60
Vul deze vragen in voor het DOEL:
Motief achterhalen: het achterhalen waarom het delict is gepleegd.

Q34 *Prioriteer voor dit doel de aspecten doelmatigheid, efficiëntie en kwaliteit door aan te geven van welk belang ze zijn ten opzichte van elkaar.*

Mocht u de introductie van Deel 2 nog eens willen lezen, klik hier: Toelichting Deel 2

Geen belang Veel kleiner Kleiner Iets kleiner **Even groot belang** Iets groter Groter Veel groter

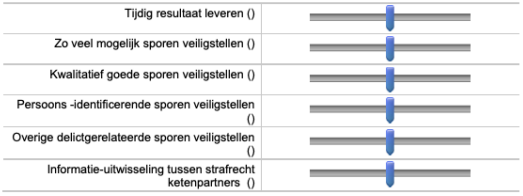
0 1 2 3 4 5 6 7



Q35 **Doelmatigheid** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

Geen belang Veel kleiner Kleiner Iets kleiner **Even groot belang** Iets groter Groter Veel groter

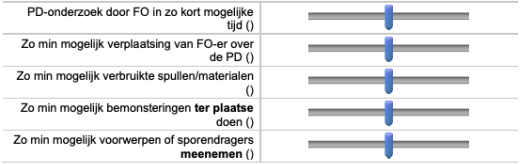
0 1 2 3 4 5 6 7



Q36 **Efficiëntie** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

Geen belang Veel kleiner Kleiner Iets kleiner **Even groot belang** Iets groter Groter Veel groter

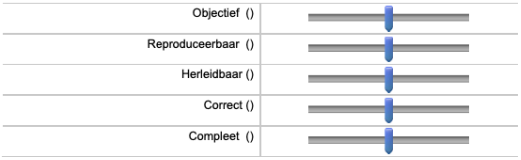
0 1 2 3 4 5 6 7



Q37 **Kwaliteit** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

Geen belang Veel kleiner Kleiner Iets kleiner **Even groot belang** Iets groter Groter Veel groter

0 1 2 3 4 5 6 7



End of Block: Motief achterhalen

Start of Block: Bewijsvoering opbouwen

Q61
Vul deze vragen in voor het DOEL:
Bewijsvoering opbouwen: bewijs samenstellen voor gebruik in de rechtbank.

Q30 *Prioriteer voor dit doel de aspecten doelmatigheid, efficiëntie en kwaliteit door aan te geven van welk belang ze zijn ten opzichte van elkaar.*

Mocht u de introductie van Deel 2 nog eens willen lezen, klik hier: Toelichting Deel 2

	0 **Geen belang**	1 Veel kleiner	2 Kleiner	3 Iets kleiner	4 **Even groot belang**	5 Iets groter	6 Groter	7 Veel groter
Doelmatigheid ()								
Efficiëntie ()								
Kwaliteit ()								

Q31 **Doelmatigheid** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	0 **Geen belang**	1 Veel kleiner	2 Kleiner	3 Iets kleiner	4 **Even groot belang**	5 Iets groter	6 Groter	7 Veel groter
Tijdig resultaat leveren ()								
Zo veel mogelijk sporen veiligstellen ()								
Kwalitatief goede sporen veiligstellen ()								
Persoons -identificerende sporen veiligstellen ()								
Overige delictgerelateerde sporen veiligstellen ()								
Informatie-uitwisseling tussen strafrecht ketenpartners ()								

Q32 **Efficiëntie** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	0 **Geen belang**	1 Veel kleiner	2 Kleiner	3 Iets kleiner	4 **Even groot belang**	5 Iets groter	6 Groter	7 Veel groter
PD-onderzoek door FO in zo kort mogelijke tijd ()								
Zo min mogelijk verplaatsing van FO-er over de PD ()								
Zo min mogelijk verbruikte spullen/materialen ()								
Zo min mogelijk bemonsteringen **ter plaatse** doen ()								
Zo min mogelijk voorwerpen of sporendragers **meenemen** ()								

Q33 **Kwaliteit** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	0 **Geen belang**	1 Veel kleiner	2 Kleiner	3 Iets kleiner	4 **Even groot belang**	5 Iets groter	6 Groter	7 Veel groter
Objectief ()								
Reproduceerbaar ()								
Herleidbaar ()								
Correct ()								
Compleet ()								

End of Block: Bewijsvoering opbouwen

Start of Block: Falsificeren/uitsluiten

Q62
Vul deze vragen in voor het DOEL:
Falsificeren/Uitsluiten: aantonen van onwaarheid van een theorie.

Q34 *Prioriteer voor dit doel de aspecten doelmatigheid, efficiëntie en kwaliteit door aan te geven van welk belang ze zijn ten opzichte van elkaar.*

Mocht u de introductie van Deel 2 nog eens willen lezen, klik hier: Toelichting Deel 2

	0 **Geen belang**	1 Veel kleiner	2 Kleiner	3 Iets kleiner	4 **Even groot belang**	5 Iets groter	6 Groter	7 Veel groter
Doelmatigheid ()								
Efficiëntie ()								
Kwaliteit ()								

Q35 **Doelmatigheid** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	0 **Geen belang**	1 Veel kleiner	2 Kleiner	3 Iets kleiner	4 **Even groot belang**	5 Iets groter	6 Groter	7 Veel groter
Tijdig resultaat leveren ()								
Zo veel mogelijk sporen veiligstellen ()								
Kwalitatief goede sporen veiligstellen ()								
Persoons -identificerende sporen veiligstellen ()								
Overige delictgerelateerde sporen veiligstellen ()								
Informatie-uitwisseling tussen strafrecht ketenpartners ()								

Q36 **Efficiëntie** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	0 **Geen belang**	1 Veel kleiner	2 Kleiner	3 Iets kleiner	4 **Even groot belang**	5 Iets groter	6 Groter	7 Veel groter
PD-onderzoek door FO in zo kort mogelijke tijd ()								
Zo min mogelijk verplaatsing van FO-er over de PD ()								
Zo min mogelijk verbruikte spullen/materialen ()								
Zo min mogelijk bemonsteringen **ter plaatse** doen ()								
Zo min mogelijk voorwerpen of sporendragers **meenemen** ()								

Q37 **Kwaliteit** *Prioriteer voor dit doel de onderstaande parameters door aan te geven van welk belang ze zijn ten opzichte van alle parameters in deze vraag.*

	Geen belang 0	Veel kleiner 1	Kleiner 2	Iets kleiner 3	**Even groot belang** 4	Iets groter 5	Groter 6	Veel groter 7
Objectief ()								
Reproduceerbaar ()								
Herleidbaar ()								
Correct ()								
Compleet ()								

End of Block: Falsificeren/uitsluiten

Start of Block: Afsluitende vragen

Q39
De lijsten met parameters waarover wij u hebben bevraagd zijn afgeleid uit interviews met uw collega's uit de gehele strafrechtketen.

Desondanks kan het zo zijn dat wij belangrijke parameters hebben gemist of verkeerd formuleren. Als u hierover opmerkingen, aanvullingen of correcties aan ons wilt meegeven, kunt u die hieronder kwijt.

_____

_____

_____

_____

_____

Q42 Hieronder volgen een aantal korte vragen:

Wat is uw geslacht?

- Vrouw (1)
- Man (2)
- Zeg ik liever niet (3)

Q44 Hoeveel jaren bent u al werkzaam in deze rol?

- <1 jaar (4)
- 1-5 jaar (5)
- 5-10 jaar (6)
- 10-15 jaar (7)
- >15 jaar (8)

Q45 In welke regio bent u werkzaam?

_____

Q46 Heeft u nog verdere opmerkingen?

_____

_____

_____

_____

_____

Q49 Wilt u mee dingen naar onze gadget? Laat dan hier uw email-adres achter.

_____

End of Block: Afsluitende vragen

Appendix B: Information CSI-PEEQ questionnaire

Script uitleg vragenlijst CSI-PEEQ

[Schema ophangen of op beamer/scherm tonen]

Omdat de vragenlijst wat complex is, geef ik u eerst een introductie voordat we starten met het invullen van de vragenlijst.

Op een plaats delict moet een forensisch onderzoeker talloze keuzes maken over welke scenario's worden onderzocht en wat hiervoor moet worden bemonsterd of veiliggesteld. Daarnaast kunnen technische innovaties misschien helpen om het onderzoek te verbeteren, versnellen of versimpelen. Wij onderzoeken wat nodig is tijdens het plaats delict onderzoek om te zorgen dat alle partners binnen de strafrechtketen zoveel mogelijk baat hebben bij de resultaten van het PD-onderzoek. Dit doen wij specifiek voor PD-onderzoek bij woningovervallen.

Deel 1

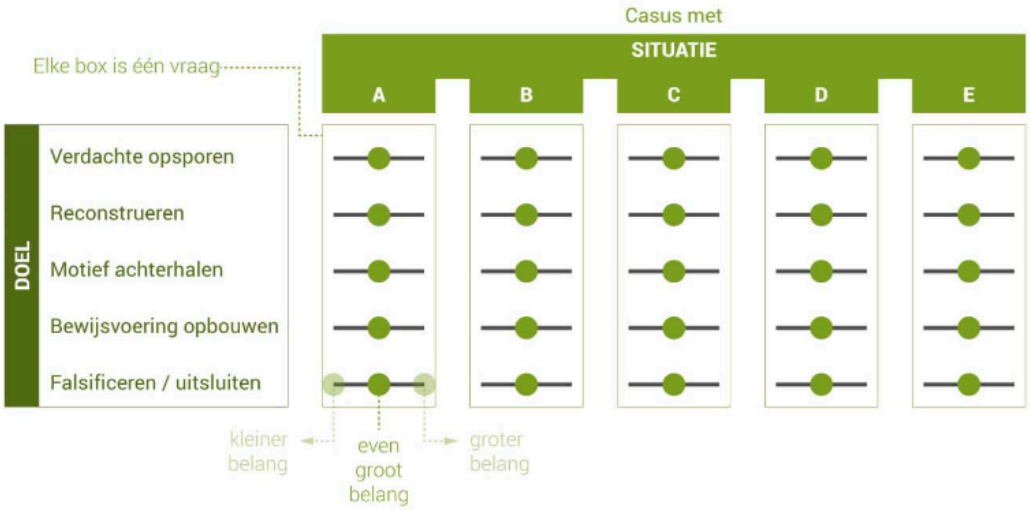
Om dit te kunnen doen is het eerst nodig om de belangrijkste doelen van het PD-onderzoek te achterhalen. Dit zou per ketenpartner én per situatie kunnen verschillen. Dat klinkt waarschijnlijk wat abstract, dus stelt u zich een woningoverval voor… De forensische opsporing gaat onderzoek doen op de plaats delict. Er is op dat moment nog geen concrete verdachte in beeld. Het lijkt er wel op dat dit al de zoveelste soortgelijke overval is in de buurt waarbij ook nog veel fysiek geweld is gebruikt.

Welk doel van PD-onderzoek is voor u, bij uw werkzaamheden en uw rol in de strafrechtketen in een zaak met deze kenmerken het meest van belang? Dit zou per ketenpartner en per zaak kunnen verschillen, omdat verschillende professionals de resultaten van het PD-onderzoek op een andere manier in hun werk gebruiken, en omdat de manier waarop dit gebeurt ook weer per zaak kan verschillen. Zou het meest belangrijke doel voor u bijvoorbeeld veranderen als er wel al een concrete verdachte in beeld is bij aanvang van het PD-onderzoek?

Wij vragen u het belang van de doelen per situatie aan te gegeven met schuifjes (**zie figuur Deel 1**). U doet dit voor de doelen ten opzichte van elkaar. Vindt u alle doelen van even groot belang? Dan zet u de schuifjes allemaal op 4 'even groot belang'. Let op, het is ook in dit geval nodig om op de bolletjes te klikken om verder te kunnen naar de volgende vraag, Probeer dus steeds vanuit uw eigen perspectief en rol binnen de strafrechtketen goed te bedenken of er in de geschetste situaties bepaalde doelen meer of juist minder van belang zijn voor u.

Als u klaar bent met deel 1 wil ik u vragen om te wachten met deel 2 totdat iedereen deel 1 af heeft, zodat ik deel 2 aan jullie kan introduceren.

Deel 1 - DOELEN prioriteren per situatie



Deel 2

[Schema ophangen of op beamer/scherm tonen]

Nu u hebt nagedacht over de verschillende doelen van PD-onderzoek in de verschillende situaties die werden geschetst, komen we bij de volgende stap. Hierbij kijken we niet meer naar de specifieke situaties, maar naar woningovervallen in het algemeen.

Om te kunnen onderzoeken hoe een PD-onderzoek er voor een bepaald doel idealiter uit zou moeten zien is nog meer informatie nodig. Dit helpt u ons te bepalen door het onderling belang van de aspecten doelmatigheid, efficiëntie en kwaliteit per doelstelling aan te geven.

*Onder **doelmatigheid** wordt verstaan:* de mate waarin het forensisch PD-onderzoek bijdraagt aan het behalen van het beoogde doel.
*Onder **efficiëntie**:* de kosten- batenverhouding van het forensisch PD-onderzoek, bijvoorbeeld de verhouding tussen gespendeerde tijd of mankracht en de opbrengst aan relevante sporen.
*Onder **kwaliteit** wordt verstaan:* correcte uitvoer van de juiste keuzes, procedures en handelingen.

De definities vindt u zo ook terug in de vragenlijst.

We leggen deze stap van de vragenlijst verder uit aan de hand van een schema (**zie figuur Deel 2**). Stel dat **het opsporen van de verdachte** een belangrijk doel is in een bepaalde situatie. Wat is er dan voor het opsporen van de verdachte in die situatie het meest van belang? Dat er tijdens het PD-onderzoek zoveel mogelijk bruikbaar resultaat wordt geboekt, of dat het onderzoek zo efficiënt mogelijk – dus bijvoorbeeld met zo min mogelijk mankracht of in zo min mogelijk tijd – wordt uitgevoerd? Of is de kwaliteit van het PD-onderzoek in dit geval van het grootste belang? En als u kijkt naar een ander doel – bijvoorbeeld **het maken van een reconstructie** – is de verhouding tussen die 3 aspecten dan anders? De ervaring leert dat de verhouding tussen die 3 aspecten kan verschillen per doel.

Om te weten wat een PD-onderzoek doelmatig, efficiënt of kwalitatief goed maakt, vragen we u voor elk van deze aspecten aanvullende informatie te beoordelen. Daarom ziet u onder elk van deze drie aspecten een aantal termen – parameters – staan die iets vertellen over het uitgevoerde PD-onderzoek. Door van elk van deze parameters aan te geven wat hun onderling belang is, helpt u ons voor elk gekozen doel te bepalen wat een doelmatig, efficiënt of kwalitatief goed PD-onderzoek voor u inhoudt.

Als u bijvoorbeeld kijkt naar het aspect doelmatigheid, ziet u dat daaronder parameters vallen zoals:

- 'de tijdigheid van het leveren van het resultaat',
- 'het veiligstellen van dadersporen'
- en 'het veiligstellen van zo veel mogelijk sporen'.

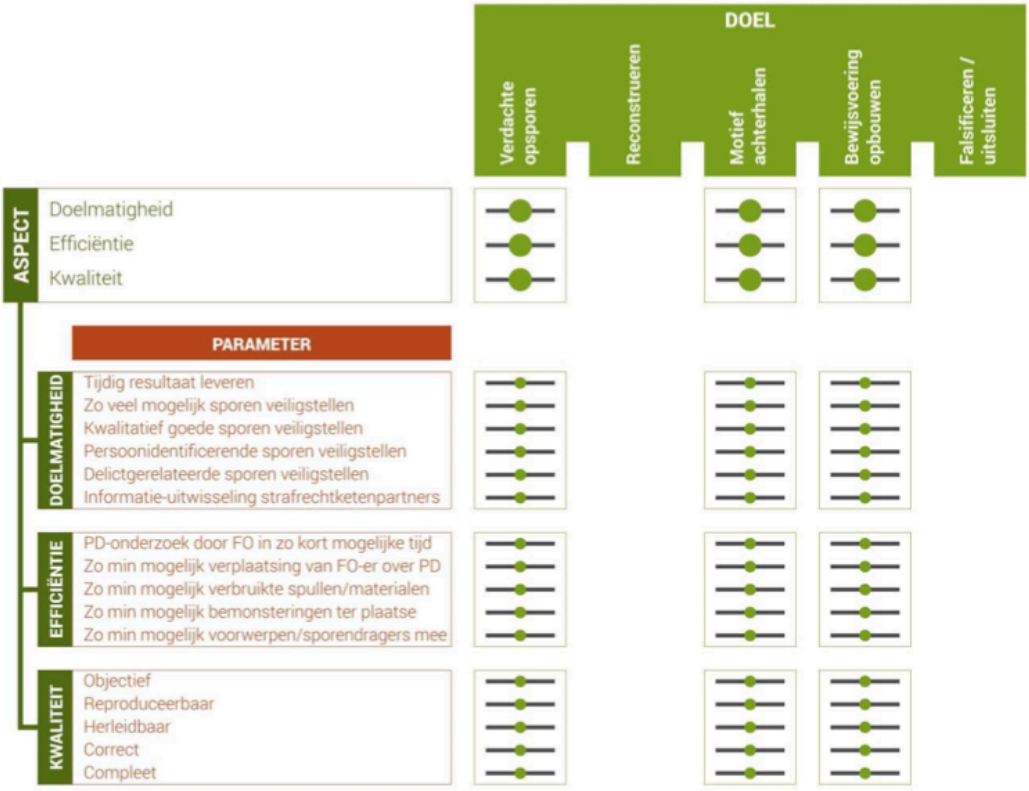
U krijgt daarbij dan in de vragenlijst straks bijvoorbeeld de vraag aan te geven welke parameters voor u van meer of minder onderling belang zijn voor het zo doelmatig mogelijk maken van het PD-onderzoek als het gestelde doel is: **"het opsporen van de verdachte"**. Hetzelfde vragen wij u te doen voor de parameters die vallen onder efficiëntie en kwaliteit.

De verhouding tussen de belangen van de parameters binnen een aspect kan verschillen, afhankelijk van het doel waarvoor u het invult. Wij willen u vragen om bij elk doel waarvoor u de vragen invult heel goed na te denken hoe belangrijk de verschillende parameters zijn **binnen dit doel.** Dit helpt ons te bepalen welke parameters meer of minder aandacht zouden moeten krijgen tijdens een specifiek PD-onderzoek, afhankelijk van wat bij die PD de belangrijkste doelen zijn. Wij vragen u hierover steeds goed na te denken **vanuit uw eigen rol en huidige situatie**.

Kort samengevat bestaat deel 2 uit de volgende stappen:

1. U kiest de voor u 3 belangrijkste doelen,
2. U geeft uw oordeel over de gewenste verhouding tussen de aspecten doelmatigheid, efficiëntie en kwaliteit voor elk van de gekozen doelen afzonderlijk,
3. U geeft bij elk doel voor elk van de drie aspecten (doelmatigheid, efficiëntie en kwaliteit) uw oordeel over de gewenste onderlinge verhouding tussen de parameters die daarbij worden gegeven.

Deel 2 - ASPECTEN & PARAMETERS prioriteren voor 3 doelen naar keuze



Appendix C: Additional figures & tables

Crime scene investigator

Goal distribution per situation for crime scene investigators, shown in Figure 1. Table 1 shows the scores on the different parameters coherent to the EEQ-aspects.

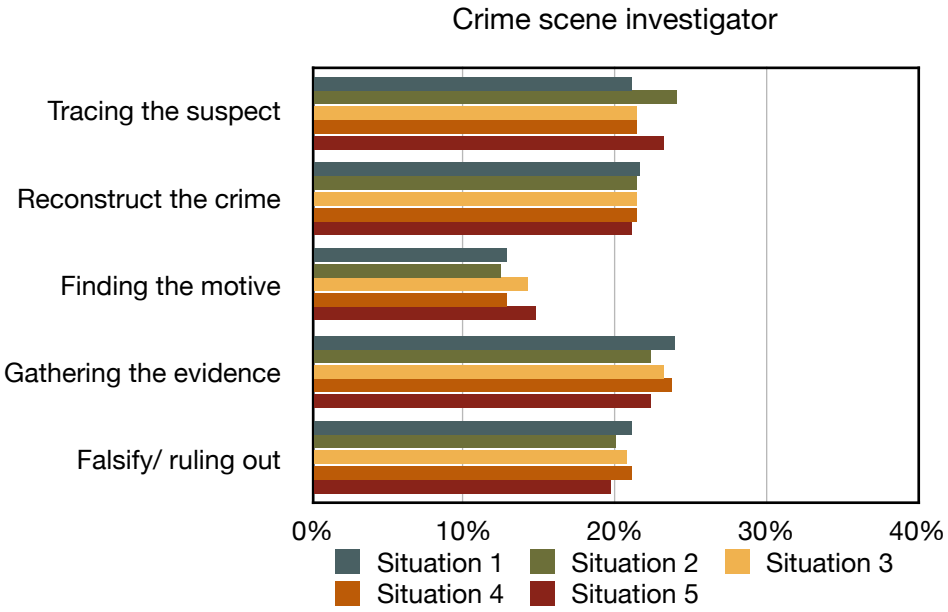


Figure 1: Goal distribution for crime scene investigators (n=40)

Table 1: Parameters per aspect and goal for crime scene investigator.

		Tracing the suspect	Reconstruct the crime	Finding the motive	Gathering the evidence	Falsify/ Ruling out
Efficacy	**Timely results**	16,3%	13,6%	17,6%	15,6%	14,3%
	Securing as many traces as possible	10,5%	10,9%	12,2%	10,0%	11,8%
	Securing high quality traces	20,7%	18,6%	19,3%	20,0%	19,4%
	Securing person-identifying traces	21,2%	20,0%	19,3%	20,6%	20,7%
	Securing other crime-related traces	16,0%	18,8%	15,8%	16,7%	17,9%
	Information exchange between criminal justice system partners	17,3%	17,6%	15,8%	17,6%	16,1%
Efficiency	**Forensic investigation by CSI in the shortest possible time**	16,7%	14,8%	16,0%	18,2%	20,0%
	As little displacement as possible by CSI on the crime scene	22,2%	23,3%	26,1%	21,4%	20,5%
	As little use of items/materials as possible	14,0%	15,4%	18,9%	15,8%	17,2%
	As little sampling as possible on crime scene	19,1%	19,5%	23,1%	18,8%	19,4%
	Taking as little exhibits as possible	22,2%	23,3%	16,0%	20,8%	25,0%
Quality	**Objectively**	20,6%	20,0%	21,1%	20,0%	20,0%
	Reproducible	18,6%	20,0%	17,3%	19,2%	19,2%

	Traceable	20,0%	20,0%	17,3%	20,0%	19,4%
	Correct	20,0%	20,0%	21,1%	20,6%	20,0%
	Complete	20,0%	20,0%	23,2%	20,0%	20,8%

The box plots of the different situations are shown in Figure 2.

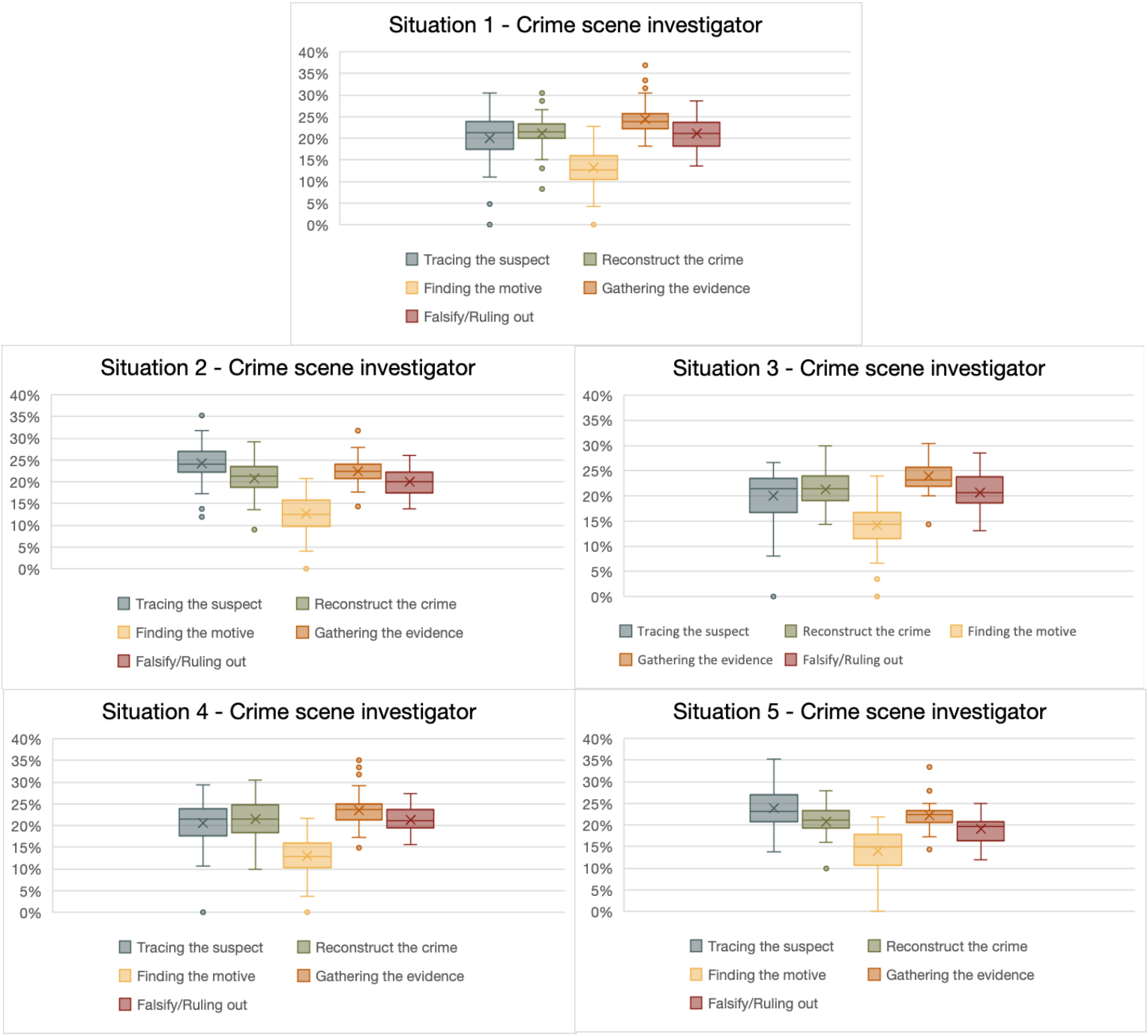


Figure 2: Box plots per situations, with goals distributions for the crime scene investigators (n=40).

Detective

Goal distribution per situation for detective, shown in Figure 3. The EEQ-aspects are shown in Figure 4. Table 2 shows the scores on the different parameters coherent to the EEQ-aspects. The box plots of the different situations are shown in Figure 5.

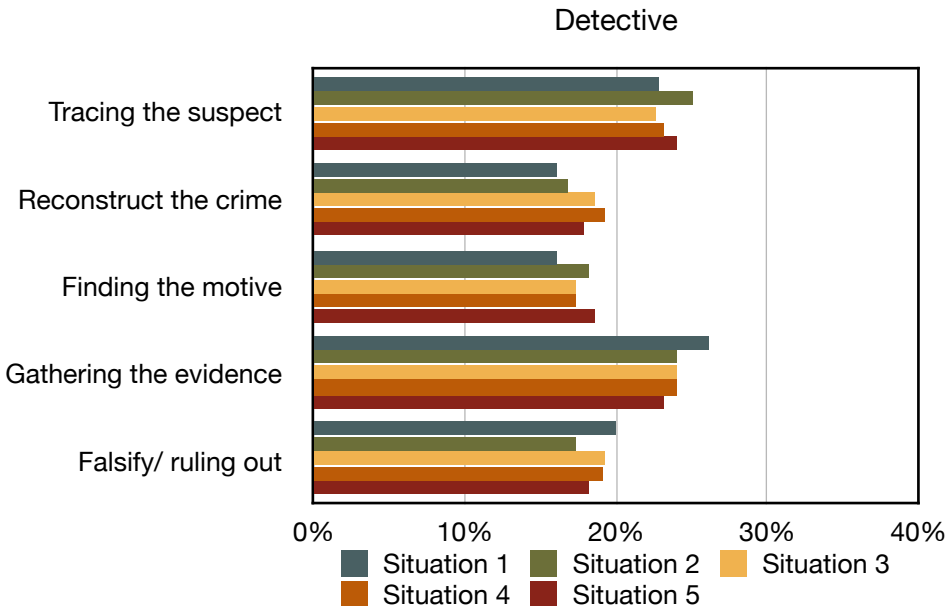


Figure 3: Goal distribution for detectives (n=35).

Table 2: Parameters per aspect and goal for detective.

		Tracing the suspect	Reconstruct the crime	Finding the motive	Gathering the evidence	Falsify/ Ruling out
Efficacy	**Timely results**	16,7%	16,4%	16,7%	16,2%	13,3%
	Securing as many traces as possible	14,3%	15,6%	12,5%	13,8%	12,9%
	Securing high quality traces	20,0%	19,0%	20,0%	20,6%	21,0%
	Securing person-identifying traces	19,4%	19,3%	17,6%	20,6%	20,0%
	Securing other crime-related traces	14,7%	18,1%	16,0%	16,2%	18,2%
	Information exchange between criminal justice system partners	15,6%	15,1%	17,6%	14,7%	16,0%
Efficiency	**Forensic investigation by CSI in the shortest possible time**	17,6%	20,0%	18,8%	20,0%	20,0%
	As little displacement as possible by CSI on the crime scene	22,2%	20,0%	23,5%	21,1%	21,1%
	As little use of items/materials as possible	16,7%	20,0%	17,6%	16,7%	18,8%
	As little sampling as possible on crime scene	17,6%	20,0%	17,6%	20,0%	20,0%
	Taking as little exhibits as possible	20,0%	20,0%	17,6%	20,0%	20,0%
Quality	**Objectively**	21,2%	20,0%	20,7%	20,0%	21,1%
	Reproducible	17,2%	20,0%	18,2%	18,2%	17,2%
	Traceable	19,4%	19,7%	18,5%	20,0%	20,0%
	Correct	21,2%	20,0%	20,7%	21,2%	21,5%
	Complete	21,1%	20,0%	24,0%	21,2%	20,0%

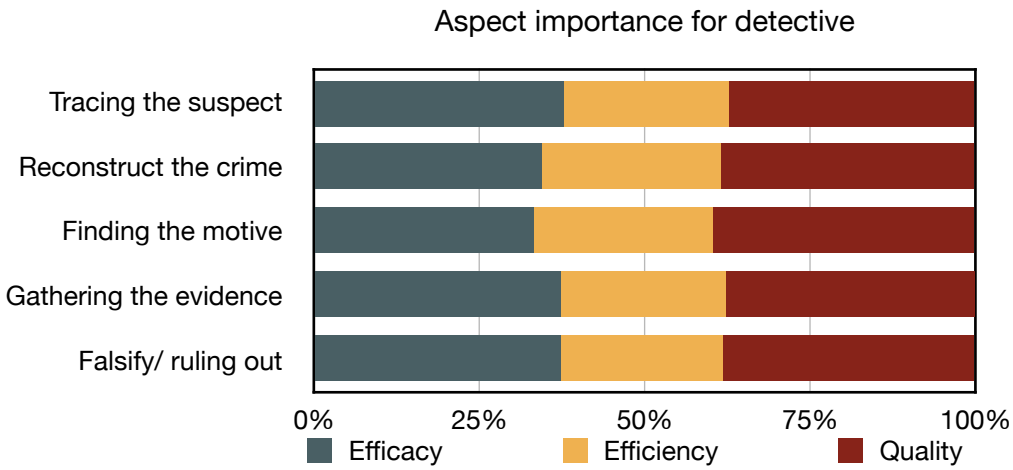


Figure 4: The EEQ-aspects for detectives (n=35)

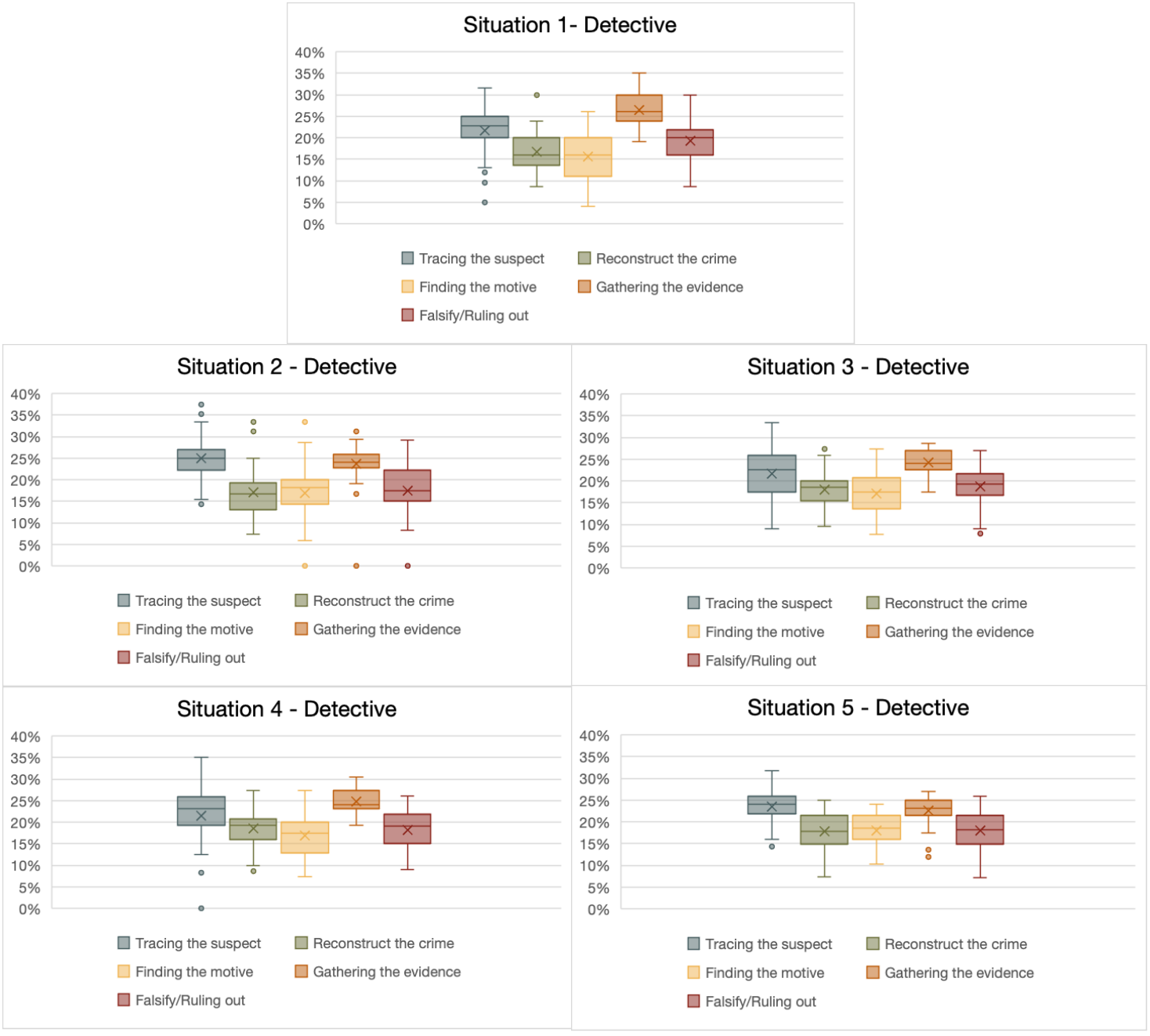


Figure 5: Box plots per situations, with goals distributions for the detectives (n=35).

Expert

Goal distribution per situation for detective, shown in Figure 6. The EEQ-aspects are shown in Figure 7. Table 3 shows the scores on the different parameters coherent to the EEQ-aspects.

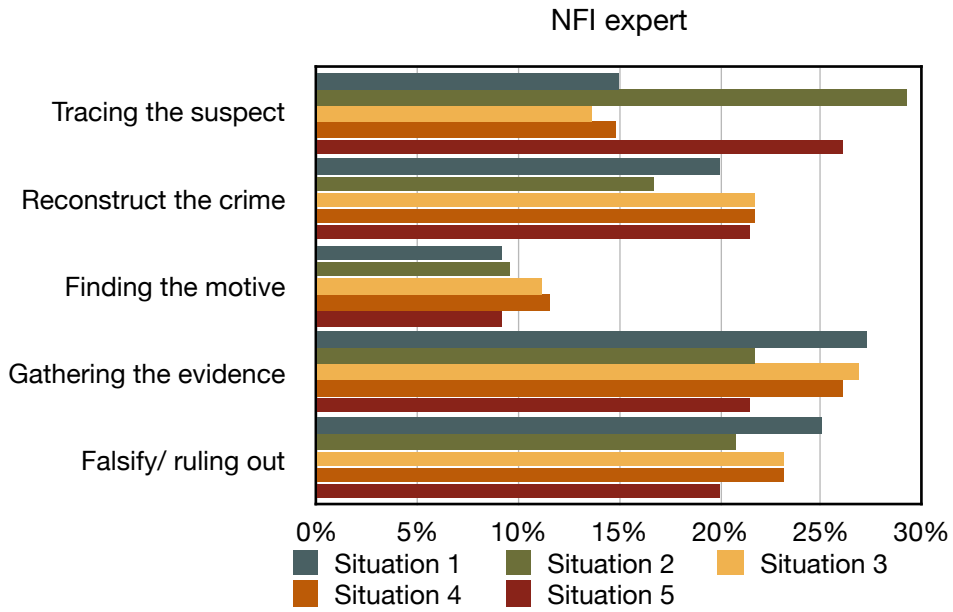


Figure 6: Goal distribution for NFI experts (n=15).

Table 3: Parameters per aspect and goal for NFI expert.

		Tracing the suspect	Reconstruct the crime	Finding the motive	Gathering the evidence	Falsify/ Ruling out
Efficacy	**Timely results**	14,8%	10,5%		14,8%	12,5%
	Securing as many traces as possible	8,0%	12,9%		11,8%	15,6%
	Securing high quality traces	20,3%	22,6%		19,4%	20,0%
	Securing person-identifying traces	23,2%	18,4%		18,5%	17,9%
	Securing other crime-related traces	15,6%	16,7%		17,6%	17,5%
	Information exchange between criminal justice system partners	17,9%	18,5%		17,6%	18,5%
Efficiency	**Forensic investigation by CSI in the shortest possible time**	22,5%	11,8%		15,8%	17,4%
	As little displacement as possible by CSI on the crime scene	22,9%	22,2%		26,3%	21,4%
	As little use of items/materials as possible	17,2%	11,8%		13,3%	14,3%
	As little sampling as possible on crime scene	17,2%	23,5%		20,0%	20,0%
	Taking as little exhibits as possible	19,6%	17,6%		18,8%	18,2%
Quality	**Objectively**	20,3%	19,4%		20,6%	20,0%
	Reproducible	18,3%	19,4%		17,6%	18,2%
	Traceable	21,4%	20,6%		22,2%	20,0%
	Correct	23,3%	21,1%		21,9%	21,9%
	Complete	19,1%	21,1%		19,2%	20,0%

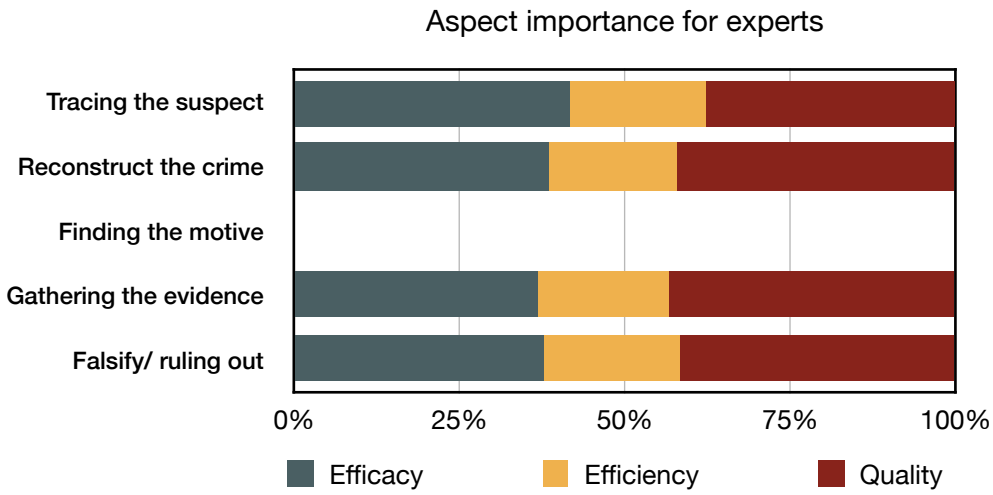


Figure 7: The EEQ-aspects for experts (n=15).

The box plots of the different situations are shown in Figure 8.

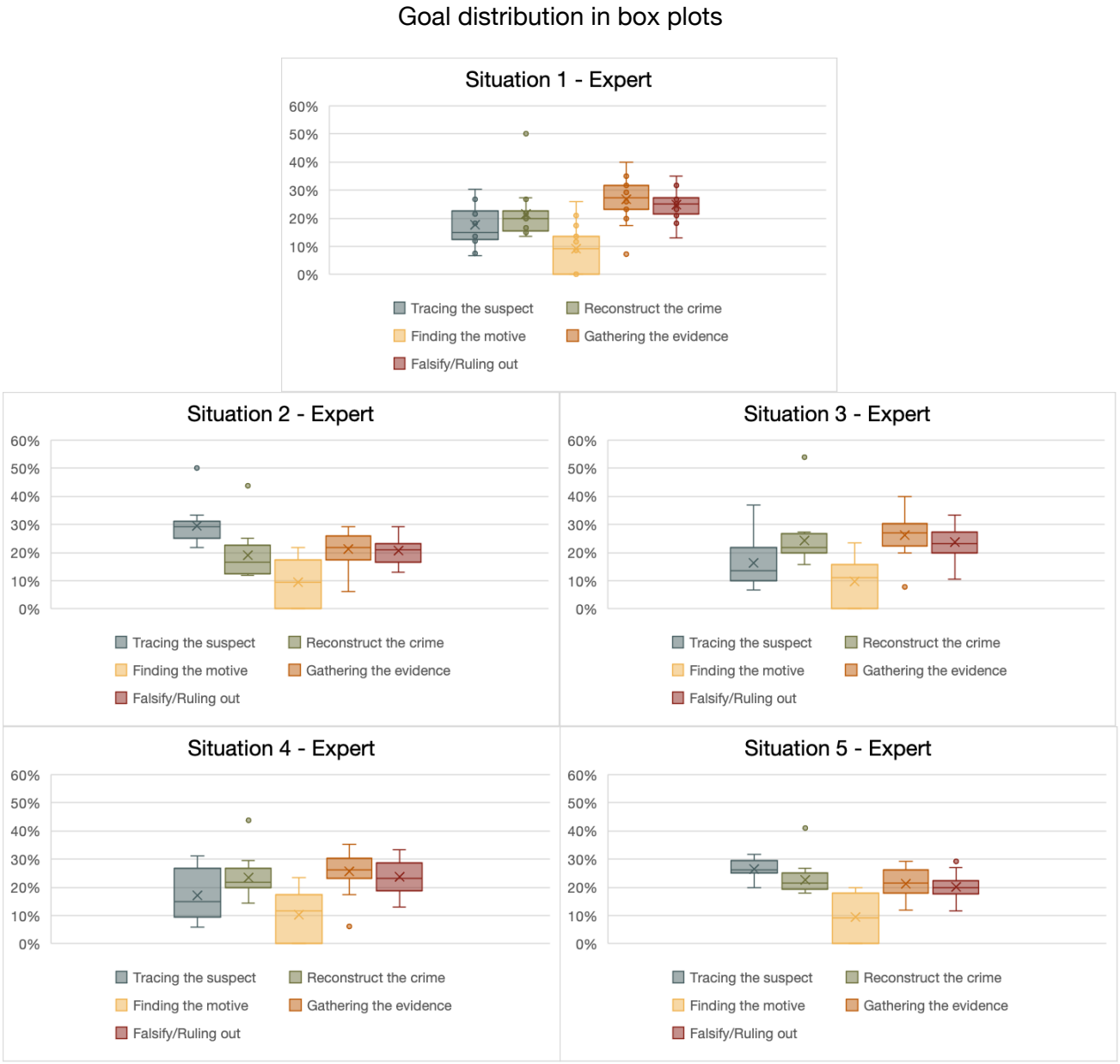


Figure 8: Box plots per situations, with goals distributions for the experts (n=15).

Prosecutor

Goal distribution per situation for prosecutors, shown in Figure 9. Table 4 shows the scores on the different parameters coherent to the EEQ-aspects.

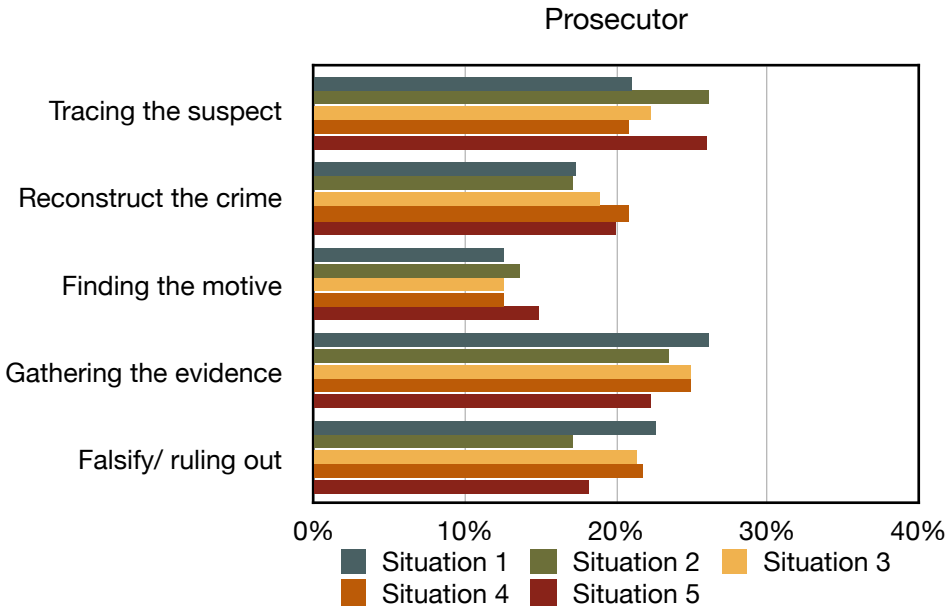


Figure 9: Goal distribution for prosecutors (n=41).

Table 4: Parameters per aspect and goal for prosecutor.

		Tracing the suspect	Reconstruct the crime	Finding the motive	Gathering the evidence	Falsify/ Ruling out
Efficacy	**Timely results**	17,3%	13,5%	14,4%	17,0%	14,8%
	Securing as many traces as possible	12,0%	11,3%	16,2%	11,1%	14,8%
	Securing high quality traces	19,4%	19,3%	19,8%	20,7%	21,1%
	Securing person-identifying traces	21,7%	20,0%	19,8%	20,8%	19,2%
	Securing other crime-related traces	15,8%	18,5%	14,7%	16,7%	18,2%
	Information exchange between criminal justice system partners	12,9%	15,1%	15,0%	14,3%	13,0%
Efficiency	**Forensic investigation by CSI in the shortest possible time**	20,0%	19,5%	23,0%	20,0%	20,0%
	As little displacement as possible by CSI on the crime scene	21,2%	22,1%	28,6%	23,5%	21,1%
	As little use of items/materials as possible	17,0%	18,5%	18,3%	17,6%	17,6%
	As little sampling as possible on crime scene	20,0%	20,0%	12,7%	19,0%	18,8%
	Taking as little exhibits as possible	20,0%	19,5%	17,5%	19,5%	18,8%
Quality	**Objectively**	21,2%	20,0%	21,1%	21,2%	21,4%
	Reproducible	18,9%	19,2%	15,6%	19,0%	19,4%
	Traceable	20,0%	19,7%	19,3%	20,0%	20,0%
	Correct	21,8%	20,9%	23,0%	22,0%	20,8%
	Complete	19,0%	20,0%	21,1%	19,1%	20,0%

The box plots of the different situations are shown in Figure 10.

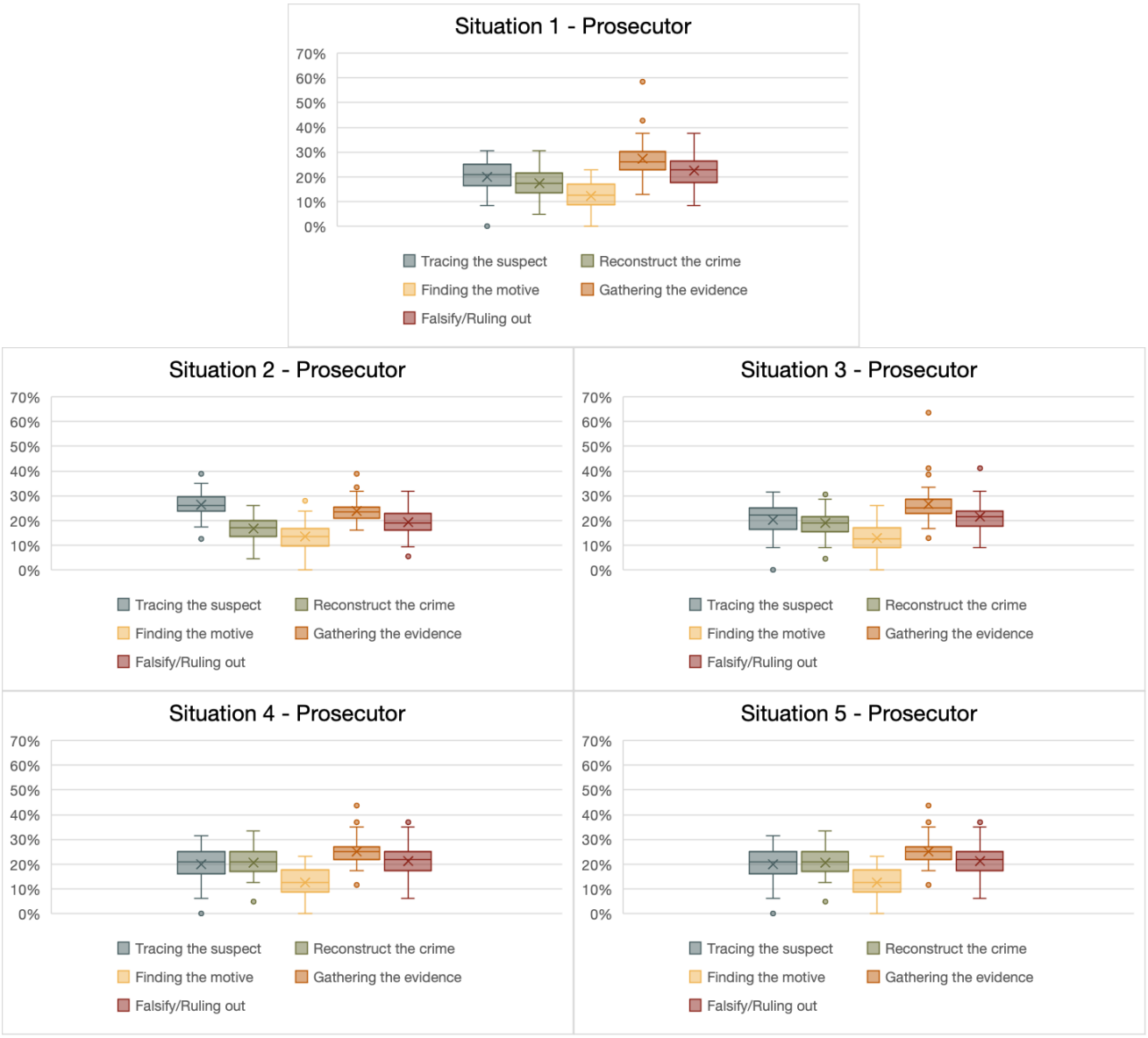


Figure 10: Box plots per situations, with goals distributions for the prosecutors (n=41).

Defense attorney

Goal distribution per situation for defense attorneys, shown in Figure 11. The EEQ-aspects are shown in Figure 12. Table 5 shows the scores on the different parameters coherent to the EEQ-aspects.

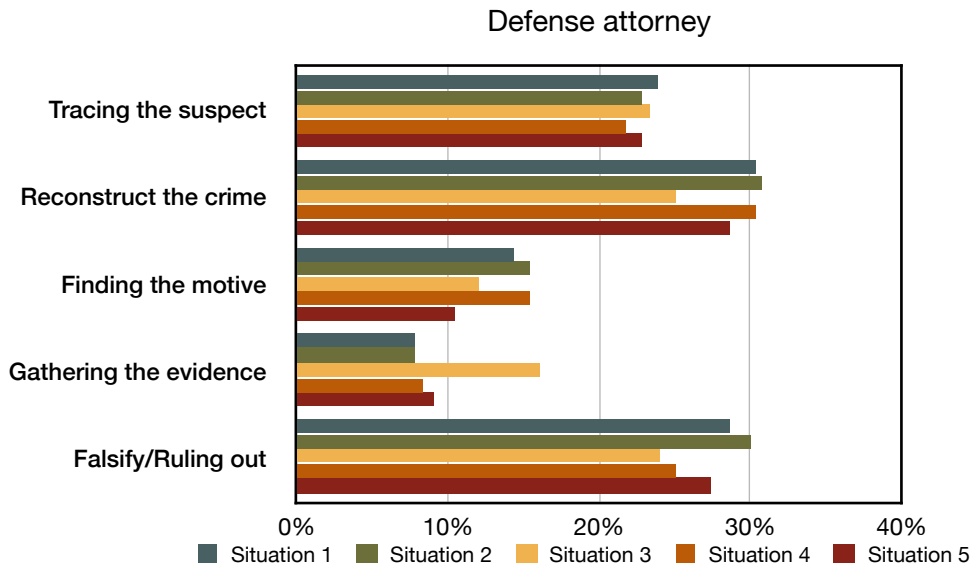


Figure 11: Goal distribution for defense attorneys (n=5).

Table 5: Parameters per aspect and goal for defense attorney.

		Tracing the suspect	Reconstruct the crime	Finding the motive	Gathering the evidence	Falsify/ Ruling out
Efficacy	Timely results	13,2%	9,0%	8,7%	5,8%	8,0%
	Securing as many traces as possible	16,1%	17,8%	17,4%	19,9%	20,0%
	Securing high quality traces	19,4%	20,1%	17,4%	24,0%	20,6%
	Securing person-identifying traces	18,4%	19,0%	17,4%	22,2%	19,4%
	Securing other crime-related traces	15,8%	17,0%	17,4%	18,8%	16,0%
	Information exchange between criminal justice system partners	16,1%	16,2%	21,7%	9,3%	16,1%
Efficiency	Forensic investigation by CSI in the shortest possible time	31,6%	19,9%	22,2%	12,9%	14,3%
	As little displacement as possible by CSI on the crime scene	33,3%	35,9%	44,4%	47,7%	42,9%
	As little use of items/materials as possible	7,7%	14,8%	11,1%	9,1%	10,0%
	As little sampling as possible on crime scene	15,8%	12,7%	11,1%	17,4%	14,3%
	Taking as little exhibits as possible	7,7%	8,8%	11,1%	12,9%	16,7%
Quality	Objectively	20,6%	20,3%	25,0%	20,0%	21,2%
	Reproducible	20,0%	19,4%	20,8%	16,9%	20,0%
	Traceable	20,6%	21,2%	16,7%	20,0%	19,4%
	Correct	20,0%	19,1%	16,7%	21,6%	20,0%
	Complete	19,4%	20,3%	20,8%	21,6%	20,0%

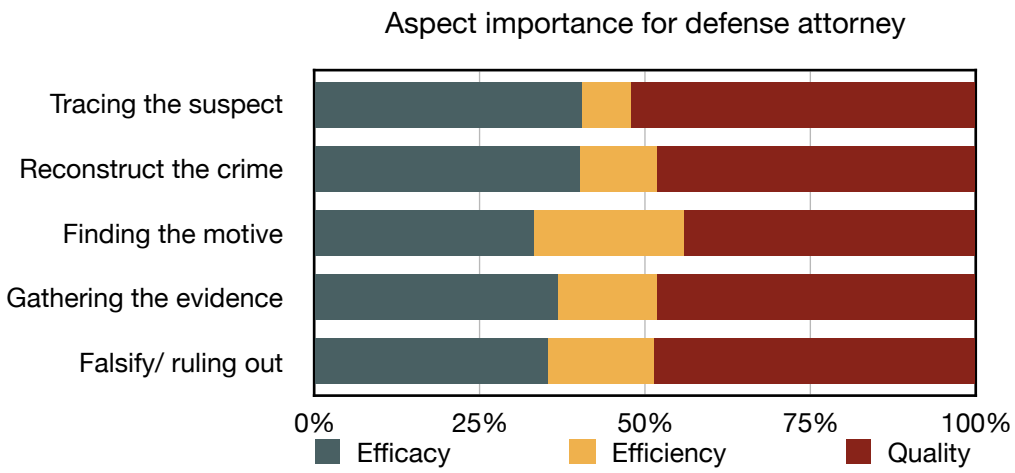


Figure 12: The EEQ-aspects for defense attorneys (n=5).

The different situations for each respondent are shown in Figure 13.

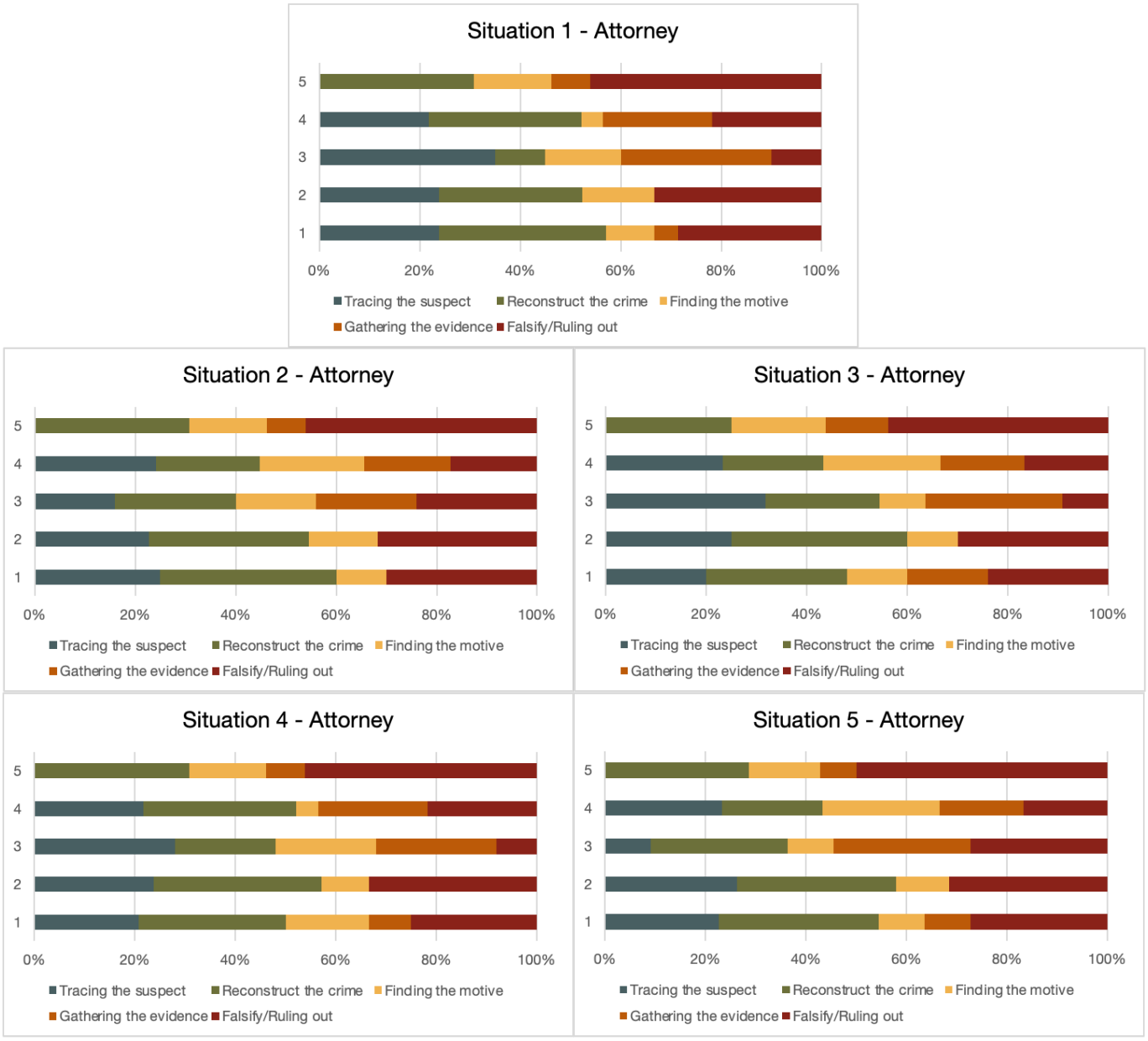


Figure 13: Column chart for each participant regarding the different situations (n=5).

Judge

Goal distribution per situation for judges, shown in Figure 13. The EEQ-aspects are shown in Figure 14. Table 6 shows the scores on the different parameters coherent to the EEQ-aspects. The box plots of the different situations are shown in Figure 15.

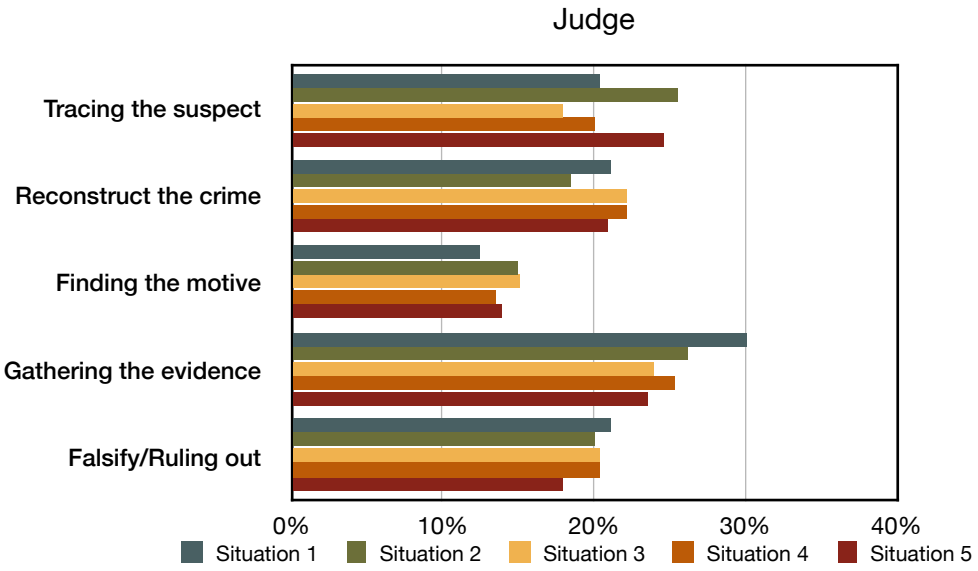


Figure 13: Goal distribution for judges (n=12).

Table 6: Parameters per aspect and goal for judge.

		Tracing the suspect	Reconstruct the crime	Finding the motive	Gathering the evidence	Falsify/ Ruling out
Efficacy	Timely results	13,6%	17,0%	16,7%	15,5%	10,3%
	Securing as many traces as possible	10,7%	14,9%	16,7%	11,8%	15,1%
	Securing high quality traces	21,4%	22,0%	20,8%	20,9%	23,1%
	Securing person-identifying traces	22,2%	17,0%	16,7%	20,9%	20,4%
	Securing other crime-related traces	17,9%	17,6%	16,7%	18,5%	19,0%
	Information exchange between criminal justice system partners	13,6%	13,7%	12,5%	13,5%	9,9%
Efficiency	Forensic investigation by CSI in the shortest possible time	20,0%	18,6%	20,0%	20,0%	20,0%
	As little displacement as possible by CSI on the crime scene	23,1%	23,2%	20,0%	20,5%	25,0%
	As little use of items/materials as possible	15,0%	20,5%	20,0%	17,0%	16,3%
	As little sampling as possible on crime scene	20,0%	20,5%	20,0%	20,0%	19,4%
	Taking as little exhibits as possible	20,0%	20,5%	20,0%	20,0%	13,8%
Quality	Objectively	22,2%	22,8%	23,8%	22,6%	22,8%
	Reproducible	16,7%	17,9%	19,0%	17,9%	17,6%
	Traceable	20,0%	17,9%	14,3%	20,0%	17,2%
	Correct	23,1%	22,6%	23,8%	22,6%	22,4%
	Complete	20,0%	20,8%	19,0%	19,3%	20,0%

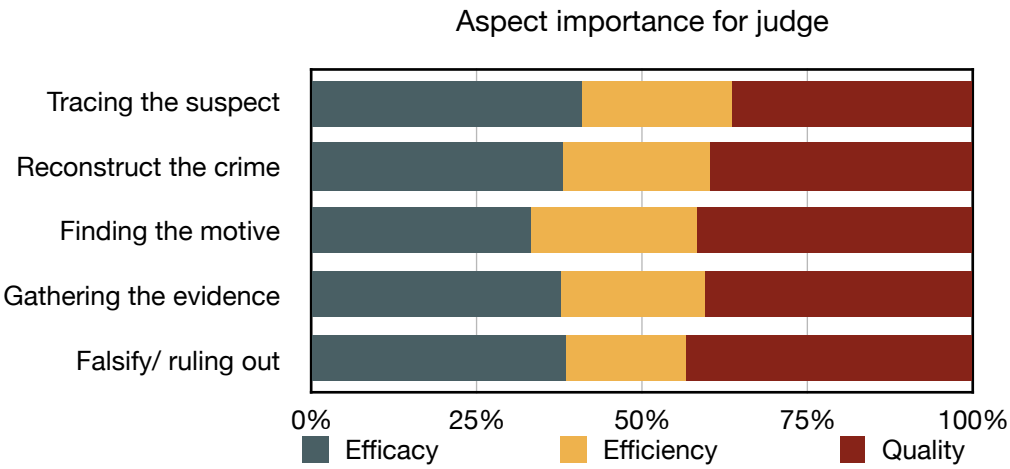


Figure 14: The EEQ-aspects for judges (n=12).

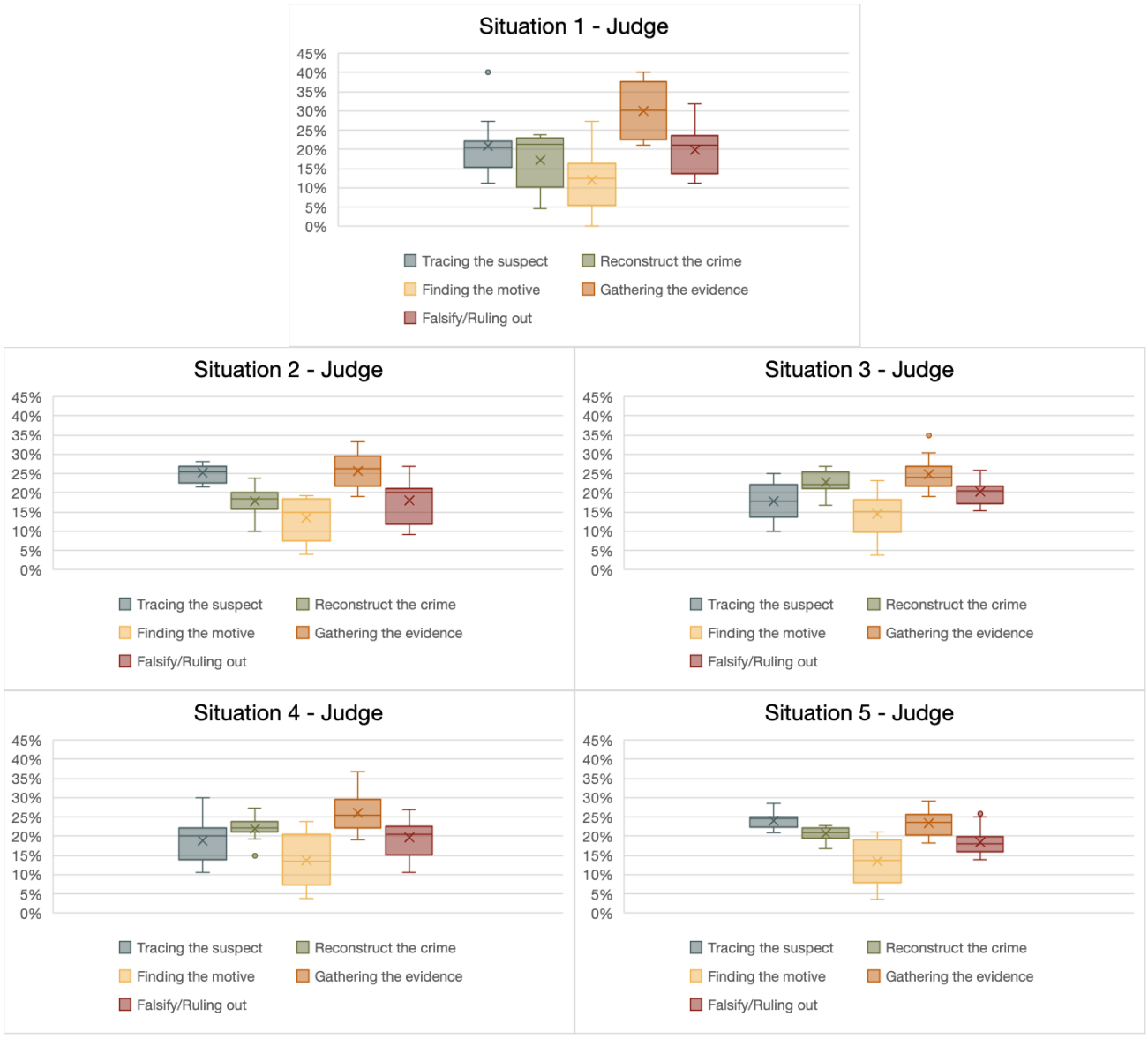


Figure 15: Box plots per situations, with goals distributions for the judges (n=12).

Appendix D: Expert reflection session slides

Welkom bij de CSI-PEEQ Expert sessie

Moderator: Madeleine de Gruijter
Assistent moderator: Lize Dirrix

Agenda

Tijdsschema 00:00 **Introductie**
- Welkom
- CSI-PEEQ vragenlijst
- Richtlijnen

00:15 **Reflectie op resultaten per partner**
- Doelen
- Parameters

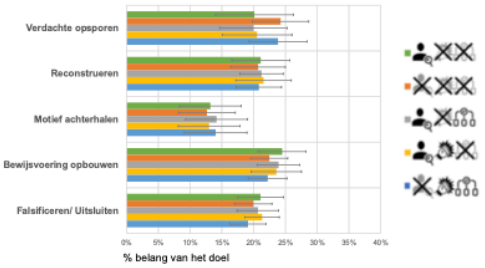
01:15 **Overige punten**

02:00 **Afsluiting**

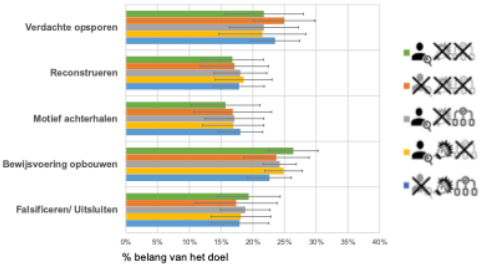
Richtlijnen

- Er zijn geen goede of foute antwoorden, alleen verschillen in inzichten
- Laat anderen uitpraten, ook wanneer je het niet eens bent met de uitspraken
- Steek een virtueel handje op wanneer je wat wilt delen
- Zouden jullie de camera willen aanhouden tijdens de sessie en alleen de microfoon willen inschakelen wanneer je iets wilt delen
- We vragen jullie je telefoon weg te leggen, zodat er zo min mogelijk afleidingen zijn. Mocht dit niet mogelijk zijn, dan vragen we jullie om de microfoon kort te dempen en zo snel mogelijk weer deel te nemen
- Mocht het voorkomen dat de verbinding per ongeluk verbroken wordt, zullen we je opnieuw toelaten tot de groep

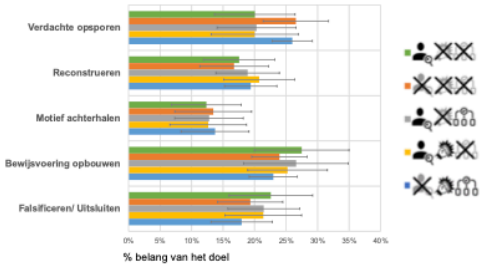
Resultaten: FO (n=40)



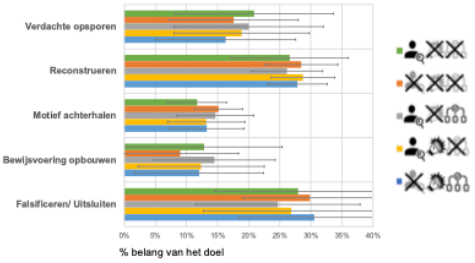
Resultaten: Recherche (n=35)



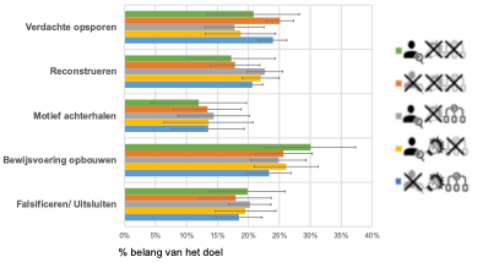
Resultaten: OvJ (n=41)



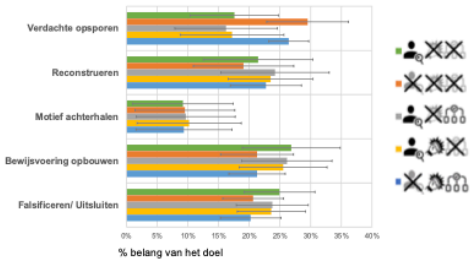
Resultaten: **Advocaat** (n=5)

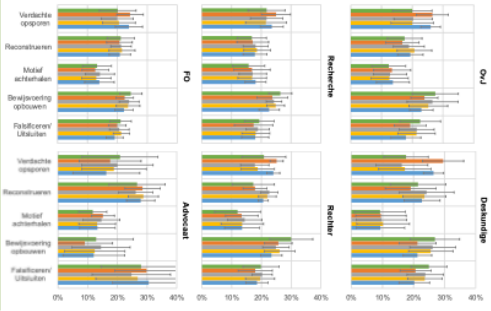


Resultaten: **Rechter** (n=12)



Resultaten: **Deskundige** (n=15)





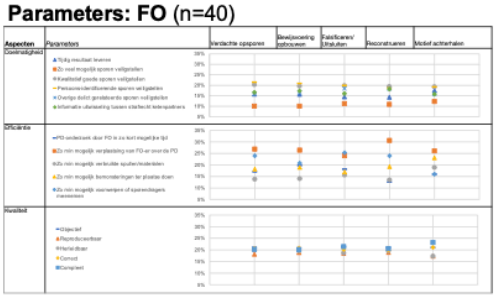
Resultaten: alle partners

- Wat waren jullie verwachtingen voor deze partner(groep)?
- Komen deze verwachtingen overeen met de resultaten die we hier laten zien?
- Zijn er bepaalde uitkomsten die opvallend zijn?

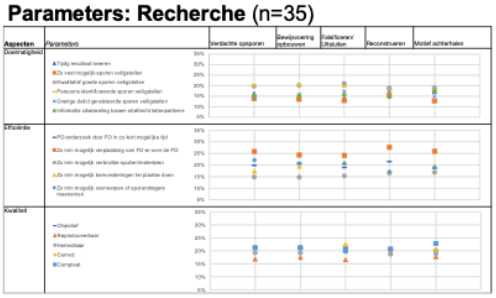
Parameters

Doelmatigheid	Tijdig resultaat leveren	
	Zo veel mogelijk sporen veiligstellen	
	Kwalitatief goede sporen veiligstellen	
	Persoons-identificerende sporen veiligstellen	
	Overige delict gerelateerde sporen veiligstellen	
	Informatie uitwisseling tussen strafrecht ketenpartners	
Efficiëntie	PD-onderzoek door FO in zo kort mogelijke tijd	
	Zo min mogelijk verplaatsing van FO-er over de PD	
	Zo min mogelijk verbruikte spullen/materialen	
	Zo min mogelijk bemonsteringen ter plaatse	
	Zo min mogelijk voorwerpen of sporendragers meenemen	
Kwaliteit	Objectief	(feiten, geen mening/gevoel)
	Reproduceerbaar	(zelfde gebruikte methode)
	Herleidbaar	(transparante keuzes)
	Correct	(volgens FO normen)
	Compleet	(alle benodigde sporen etc. veiliggesteld)

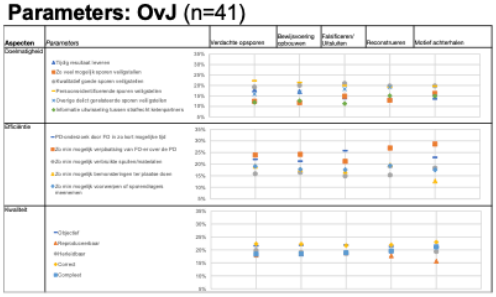
Parameters: FO (n=40)



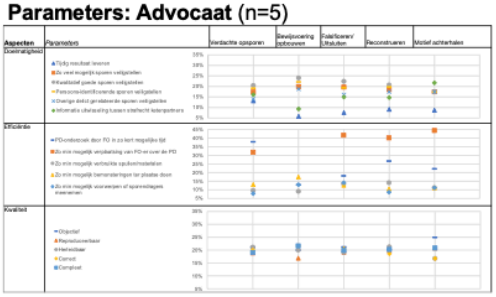
Parameters: Recherche (n=35)



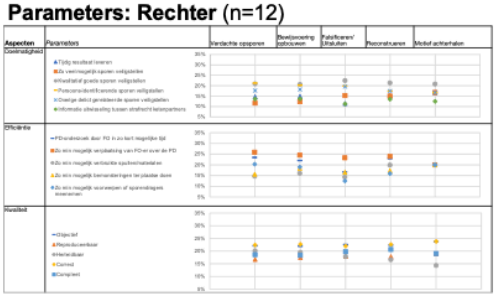
Parameters: OvJ (n=41)



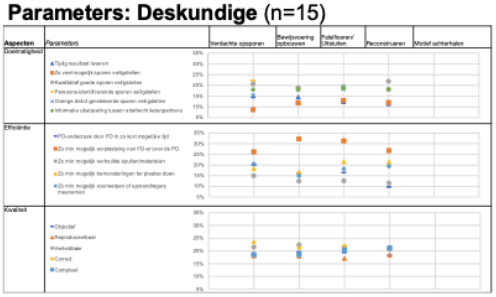
Parameters: Advocaat (n=5)



Parameters: Rechter (n=12)



Parameters: Deskundige (n=15)



Overige punten

- Wat betekenen deze resultaten voor het PD-onderzoek?
- Wat betekenen deze resultaten voor jouw rol in de keten?

Conclusie & Afsluiting

CSI PEEQ

Bedankt voor jullie deelname!

Appendix E: Expert reflection session outline

Expert reflectie sessie

Doelen

- Reflectie op resultaten van de vragenlijst
  - *Kloppen de resultaten met de verwachtingen?*

Voorbereiding

- Resultaten slides laten zien per partner
- Input vragen van partners:
  - Welke punten laten voorkomen in de sessie

Tijd [3]

00.00

Voordat we starten met de sessie eerst wat praten over koetjes en kalfjes om zo een vriendelijke omgeving te creëeren. Observeer ook tijdens deze 'small talk' hoe de deelnemers zich gedragen.

CSI-PEEQ slide

Sessie outline [1, 3 & 4]

1. Introductie

- **Welkom**

00.10

Welkom allen bij deze expert sessie, dank dat jullie de tijd nemen om hier aanwezig te zijn. Tijdens deze sessie willen we met jullie de resultaten van de vragenlijst bespreken, deze zullen per partner worden weergeven. Daarnaast zijn we geïnteresseerd in jullie inzichten en ideeën over het plaats delict onderzoek en de parameters die hiermee samenhangen.

Agenda slide

De sessie zal in totaal twee uur duren en wordt opgenomen, de opname zal na het transcriberen in de komende maand worden vernietigd. De assistent moderator zal tijdens de sessie aantekeningen bijhouden. Alle informatie zal anoniem verwerkt worden.

Als moderator zal ik de sessie vandaag leiden, ik ben tevens ook een van de projectleiders. Lize is de assistent moderator en de overig aanwezige projectleden zullen observeren.
Zouden jullie jezelf kunnen voorstellen?

- **Onderwerp**

De CSI-PEEQ vragenlijst, waar gaat het ook alweer over?:
De resultaten van het sporenonderzoek op de plaats delict (PD) spelen een belangrijke rol tijdens het gehele strafrechtelijk onderzoek. Het gebruik van de forensische resultaten beperkt zich niet alleen tot het opsporingsproces, maar is ook van waarde bij de reconstructie en bij de bewijsvoering van het vermeende misdrijf dat wordt onderzocht. Elke toepassing van de resultaten stelt vermoedelijk andere eisen aan het PD-onderzoek.

Om inzicht te geven in efficient, effectief/doelmatig en kwalitatief goed sporenonderzoek, en welke werkwijzen bijdragen aan optimaal gebruik van het forensische onderzoek door alle partijen van de strafrechtketen, hebben jullie de online vragenlijst ingevuld. Deze resultaten zullen we met jullie bespreken.

- **Richtlijnen**

Er zijn een aantal richtlijnen die we graag willen hanteren tijdens deze sessie:

Richtlijnen slide

- Er zijn geen goede of foute antwoorden, alleen verschillen in inzichten
- Laat anderen uitpraten, ook wanneer je het niet eens bent met de uitspraken
- Steek een virtueel handje op wanneer je wat wilt delen
- Zouden jullie de camera willen aanhouden tijdens de sessie en alleen de microfoon willen inschakelen wanneer je iets wilt delen
- We vragen jullie je telefoon weg te leggen, zodat er zo min mogelijk afleidingen zijn. Mocht dit niet mogelijk zijn, dan vragen we jullie om de microfoon kort te dempen en zo snel mogelijk weer deel te nemen
- Mocht het voorkomen dat de verbinding per ongeluk verbroken wordt, zullen we je opnieuw toelaten tot de groep

00.15 2. Reflectie op resultaten

- *Verwachtingen en resultaten van elke partner door de aanwezige partners*
- *Collectieve kijk/inzicht van de partner*
- *Zijn alle onderdelen/begrippen van de vragenlijst goed begrepen?*
- Hoofdvraag
  - Overige vragen voor input discussie

Resultaten slide per partner

▸ **Resultaten doelen**

- Wat waren jullie verwachtingen voor deze partner(groep)?
  - Komen deze verwachtingen overeen met de resultaten die we hier laten zien?
  - Zijn er bepaalde uitkomsten die opvallend zijn?

▸ **Resultaten parameters**

Parameter slide per partner

- Wat waren jullie verwachtingen voor deze partner(groep)?
  - Komen deze verwachtingen overeen met de resultaten die we hier laten zien?
  - Zijn er bepaalde uitkomsten die opvallend zijn?

  - Wordt er in het huidige protocol bewust aandacht besteed aan de parameters?
  - Is hier verandering in nodig?
  - In hoeverre wordt er aan de parameters voldaan?
  - Wat maakt een parameter belangrijk?
  - Hoe wordt er geprobeerd de parameters te behalen?

01.15 3. Overige discussie punten

▸ **Overig punten**

- Wat betekenen deze resultaten voor het PD-onderzoek?
- Wat betekenen deze resultaten voor jouw rol in de keten?
- Hoe kunnen de doelen van alle partners worden behartigd?

  - Wat wordt er ook belangrijk gevonden naast de punten in de vragenlijst?
  - Wordt de kijk van de andere partners begrepen?
  - Waar is verbetering nodig?
  - Is er een duidelijk protocol voor PD-onderzoek? En heb je daar wat aan? Zo ja, welke?

01.45 4. Conclusie en afsluitende vragen

▸ **Conclusie besproken punten**

Afsluitende slide

- *"Klopt deze samenvatting?"*
- *"Van alle punten die we besproken hebben, wat is voor jou het belangrijkst?"*
- *"Zijn je inzichten veranderd na deze groepssessie?"*
- Als laatste vraag: *"Hebben we wat gemist? Zijn er bepaalde punten die we niet hebben besproken?"*

▸ **Reflectie van deelnemers op de gehele discussie**

- Hoe hebben jullie deze sessie ervaren?
- Zouden dit soort sessies vaker gehouden moeten worden?

02.00

▸ **Afsluiting**

- "Bedankt voor jullie deelname aan deze expert sessie, we zullen jullie op de hoogte houden van het CSI-PEEQ project".

———————————————————————————————

Moderator [1]

De moderator accepteert het feit dat misverstanden zullen plaatsvinden tijdens de sessie. Deze misverstanden kunnen als stressvol worden ervaren en daardoor is het belangrijk dat alle standpunten worden gehoord zodat elke deelnemer het gevoel krijgt dat diegene begrepen wordt [2].

De 'warming up' is belangrijk, laat de deelnemers dan ook over een onderwerp praten totdat tweederde van de tijd is verstreken voor dat de hoofdvraag (opnieuw) gesteld wordt. Daarnaast is het ook van belang dat het tempo niet verzwakt en dat er aan de tijd gehouden wordt [3].

Vragen stellen [1]

- Probeer gesloten vragen te vermijden
- Gebruik verschillende soorten vragen
  - Opening vragen, introductie vragen, transitie vragen, hoofd vragen en einde vragen
- Gebruik vragen waardoor deelnemers betrokken raken
  - Gebruik reflecties, voorbeelden, keuzen, prioritering

Interventie zinnen [1]

- Gebruik pauzes van ongeveer 5 seconden
- "Zou je dat verder willen toelichten?"
- "Kun je hier een voorbeeld van geven?"
- "Sorry, maar ik begrijp het niet helemaal"

Reacties op deelnemers [1]

- Verbale en non-verbale communicatie
- Ja knikken
- Korte verbale reacties

Faciliterende luistervaardigheden [2]

Parafraseren

- In eigen woorden herhalen van wat jij denkt dat de deelnemer verteld heeft
- Wanneer het een lang verhaal is, vat het samen
- Wanneer er maar 1 of 2 zinnen gebruikt worden, gebruik dan ongeveer dezelfde hoeveelheid aan woorden
- Om de objectiviteit te benadrukken kunnen de volgende voorwoorden gebruikt worden:
  - *"Het lijkt erop dat je zegt dat…"*
  - *"Even kijken of ik het begrijp …"*
  - *"Bedoel je dit? …"*
- Wanneer je klaar bent met parafraseren, kijk de deelnemer aan om de reactie te waarnemen, je kant hierbij ook vragen of dit klopt. Wanneer dit niet het geval is kun je doorgaan met vragen totdat je begrijpt wat de deelnemer bedoelt

'Drawing people out': ondersteun deelnemers in het ontwikkelen en verfijnen van hun ideeën

- Door te parafraseren en daarna niet-gerichte open vragen te stellen
  - *"Kan je daar meer over vertellen?"*
  - *"Wat bedoel je met …?"*
  - *"Kan je me een voorbeeld geven?"*
  - *"Wat is er voor jou belangrijk aan?"*
  - *"Hoe komt dat?"*
- Er kan ook eerst geparafraseerd worden waarna 'connectors' gebruikt worden zoals: "dus …", "omdat …" of "en …"

Spiegelen: het herhalen van de deelnemer zijn/haar woorden

- Wanneer er één zin wordt gebruikt, kan deze letterlijk worden herhaald
- Wanneer er meerdere zinnen worden gebruikt, herhaal dan de belangrijkste woorden of zinnen
- Gebruik de woorden van de deelnemer en niet eigen woorden, verander alleen wel 'ik' in 'jij'

- Het spiegelen van woorden is iets anders dan de toon spiegelen, gebruik een eigen en accepterende toon wanneer er gespiegeld wordt
- Het doel van spiegelen is het creëren van vertrouwen

'Stacking': procedure om iedereen aan het woord te laten komen
Aan de hand van vier stappen komt iedere spreken die wat over het onderwerp wil zeggen aan het woord.
1. Vraag wie hier wat over wil zeggen door virtueel zijn/haar hand op te steken
2. Benoem de volgorde van deelnemers
3. Laat iedereen volgens volgorde spreken
4. Nadat iedereen aan de beurt is geweest, vraag of er nog anderen zijn die hier wat over willen zeggen

'Tracking': de verschillende verhaallijnen tijdens de discussie in de gaten houden
Tracking is een process bestaande uit vier stappen:
1. Geef aan dat je een stap terug neemt en de discussie tot nu toe zal samenvatten
2. Benoem de verschillende verhaallijnen
3. Vraag bevestiging bij de groep
4. Vraag de groep door te gaan met de discussie

Aanmoedigen: een opening creëren voor deelnemers om deel te nemen aan de discussie
- Voorbeelden:
  - *"Zijn er nog anderen met een idee?"*
  - *"Hoe denkt de rest hierover?"*
  - *"Roept deze discussie ook andere vragen op?"*
- Hieraan gerelateerd is de techniek om het onderwerp van de discussie opnieuw te benoemen en daarmee anderen aan te moedigen deel te nemen
  - *"We hebben het tot nu toe gehad over [probleem/oplossing], zijn er nog andere mogelijkheden?"*

Balanceren: de richting van de discussie wordt vaak gestuurd door de eerste paar deelnemers die spreken, door middel van balanceren kan je de groep helpen om andere perspectieven die nog niet gehoord zijn aan bod te brengen
- *"Zijn er andere manieren om naar dit onderwerp te kijken?"*
- *"Is iedereen het hiermee eens?"*
- *"We hebben van verschillende deelnemers gehoord hoe ze hierin staan, heeft iemand anders een andere kijk?"*
- *"Kan er iemand een paar minuten voor de advocaat van de duivel spelen?"*
- *"We hebben kijk [x] en kijk [y] gehad op dit onderwerp, is er nog een derde manier om hiernaar te kijken?"*

Ruimte maken voor de stille deelnemers
- Hou de stille deelnemers in de gaten, kijk naar lichaamstaal of gezichtsuitdrukkingen die kunnen duiden op willen spreken
- Nodig ze uit: *"Was er iets dat u/jij wilde zeggen?"* Of *"Wilde u/je daar iets aan toevoegen?"*
- Wanneer ze de uitnodiging afwijzen, ga gewoon door met de rest
- Wanneer het nodig is, maak ruimte door te zeggen: *"Laten we één voor één aan het woord zijn, [naam] wilde u/jij iets zeggen?"*
- Wanneer de discussie compleet uit balans is, kun je gestructureerd de groep rond gaan

Valideren: de mening van een deelnemer accepteren zonder dat je de mening als correct bevestigt

Bestaat uit drie stappen
1. Parafraseer de mening van de deelnemer
2. Bepaal of de deelnemer ondersteuning nodig heeft
3. Bied eventueel deze ondersteuning door bijvoorbeeld te zeggen:
   - *“Ik begrijp wat je bedoelt”*
   - *“Ik kan me voorstellen dat dit belangrijk voor je is”*
   - *“Ik snap waar je vandaan komt”*

Opzettelijke stilte
Een pauze van een aantal seconden om de spreker wat extra tijd te geven om te bedenken wat hij/zij wil zeggen. Blijf wel opletten, zeg helemaal niks en knik niet eens mee. Je kunt anderen eventueel laten wachten met spreken, door een hand op te steken.

‘Linking’: luister skill die de deelnemer laat uitleggen wat de relevantie is van het gemaakte punt
Bestaat uit vier stappen:
1. Parafraseer het gemaakte punt
2. Vraag de deelnemer om de link uit te leggen met het onderwerp (*“Kun je ons helpen het verband te zien tussen [x] en [y]?”*)
3. Parafraseer en valideer de uitleg
4. Maak daarna gebruik van andere vaardigheden:
   - Gebruik aanmoediging om de reactie van anderen te krijgen
   - Gebruik stacking om door te gaan met een andere mening

Het gemeenschappelijke laten zien
Vooral te gebruiken wanneer deelnemers verdeeld zijn, focust op de gemeenschappelijke punten.
Bestaat uit vier stappen:
1. Geef aan dat je de verschillen en overeenkomsten gaat samenvatten
2. Vat de verschillen samen
3. Benoem de overeenkomsten
4. Vraag om bevestiging

Let op dat je iedereen meeneemt!

Samenvatten
Een process van vijf stappen:
1. Herformulier de vraag die de discussie begon
2. Benoem het aantal thema’s die naar voren zijn gekomen
3. Benoem voor het eerste thema één of twee hoofdpunten
4. Doe dit ook voor de andere thema’s
5. Maak een brug naar het volgende onderwerp

Conclusies trekken

- Gebruik de 3-stappen conclusie
  - Samenvatting met bevestiging
  - Vraag of er iets gemist is
  - Bedank en ga door

Assistent moderator [1]

Observaties [1]

- Spanningen tussen partners of behoeften van partners
- Partners hun beweegredenen of perspectieven
- Hoe gaan ze om met meningsverschillen
- Non-verbale communicatie voor zover dat mogelijk is

Aantekeningen maken [1]

- Blijf consistent, anderen moeten de aantekeningen ook kunnen begrijpen
- De aantekeningen moeten verschillende typen informatie bevatten
  - Quotes: schrijf op zoveel mogelijk op, gebruik … om aan te geven dat een deel van de quote mist
  - Belangrijkste punten en thema's
    Deze worden aan het eind van de sessie gedeeld voor bevestiging van de deelnemers
  - Nieuwe ideeën of inzichten over het onderwerp
- Verzamel de ideeën gedeeld door de deelnemers

Analyse [1]

1. Start tijdens de sessie
- Let op tegenstrijdige opmerkingen
- Let op vage of cryptische opmerkingen

2. Gelijk na de sessie
- Korte nabespreking met projectgroep
- Noteer the thema's, interpretaties en ideeën die besproken zijn
- Label alle documenten

3. Snel na de sessie - binnen aantal uur
- Back up maken van de documenten en opsturen naar de rest van de projectgroep
- Transcriberen
- Rapport met de gestelde vragen, antwoorden en opvallende quotes
- Rapport delen met projectgroep voor verificatie

4. Later - binnen aantal dagen
- Kijk naar opvallende thema's
- Beschrijf de bevindingen en gebruik de quotes om dit te illustreren

5. Rapport [3]
- Per belangrijkste thema's of per vraag
- Meest interessante quote's om te illustreren
- Onverwachte resultaten

Referenties

[1] Krueger, R. A., & Casey, M. A. (2002). Designing and conducting focus group interviews.

[2] Kaner, S. (2007). Facilitator's guide to participatory decision-making. John Wiley & Sons.

[3] Breen, R. L. (2006). A practical guide to focus-group research. *Journal of Geography in Higher Education*, *30*(3), 463-475.

[4] Sweet, C. (2001). Designing and conducting virtual focus groups. *Qualitative Market Research: An International Journal*.

Appendix F: Observation scheme expert reflection session

Expert sessie 14-01-2021
Doelen en parameters:

	Agreement results	*Disagreement results*	*Agreement partner*	*Disagreement partner*	*Influence of others*	*Tensions*	*Behavior*	*Creativity*	*Other*
FO	FO: niet afwijkend, blij dat falsificeren ook belangrijk wordt gevonden, herken me in de resultaten. Reconstructie ook zeker van belang dat daar van te voren rekening mee wordt gehouden. D: ligt er natuurlijk erg aan welke deskundige je bent, en daar hangt doel misschien vanaf. Parameters: Kloppen wel, met persoons identificerende sporen kun je verder gaan. Eerst wie, dan handeling en wat	Het ligt ook aan capaciteit en soort delict	A: resultaten passen bij het doel, client verdedigen. Daarom is het begrijpelijk dat advocaten een ander beeld laten zien. Advocaten doen meer aan scenario denken		Wel eens met OvJ over resultaten FO	Vraagt zich af wat er wordt gemist in verslaglegging van FO. Wil wel aanpassingen doen in verslaglegging Advocaten doen meer aan scenario denken, FO denkt hier al over na wat de advocaat zou kunnen doen.	Herkent zich in OvJ, op PD ben je met brede blik. Je moet met alle mogelijkheden rekening houden. Gebruikt veel voorbeelden		Hypotheses kan gebruik maken van scenario specialist, maar van ten eerste vanuit PD onderzoeker zelf is het belangrijk
Recherche	FO: opzoek naar waarheidsvinding, dus falsificeren zeker van belang. R: kan me hierin vinden, motief achterhalen zit daar zeker bij. Reconstrueren/falsificeren komt daar ook bij. FO moet daar wel aandacht aan besteden, FO met coordinator aan de slag met wat kunnen we.	R: Je wil een verdachte aanhouden, bewijsvoering loopt parallel mee. Daar hoort falsificeren wel bij, iets meer balans tussen bewijsvoering en falsificeren. Loopt door elkaar heen.	Is ook eens met het verschil tussen de fases, en dus ook voor de verschillende partners.			Ziet het beeld van FO ook, zit er misschien beetje tussenin (tussen FO en overige partners).	Houdt zich wat meer op de achtergrond	Snelle DNA straat, voor FO en OM snel keuzes te maken, nieuwe ontwikkeling	
OvJ	FO: Niet echt afwijkend, motief achterhalen is FO niet speciaal mee bezig R: komt wel overeen. FO hoeft niet voor R bezig te zijn voor het motief, sporen zijn sporen A: ja klopt, advocaat komt achteraf erbij en met verdachte, gaat terug redeneren. Parameter informatie uitwisseling: als het maar objectief is, in het begin zo min mogelijk met FO zodat FO blanco in het onderzoek gaat	O: motief is onafhankelijk van de sporen, die zeggen niet speciaal iets van het motief. Wat doe je op een PD met sporen, die zeggen niet specifiek iets over het motief. Rechter: verwacht dat falsificeren hoger zou liggen (A ook me eens) Rechter: rechtbank worstelt ook, maar worden zich er wel van bewust, falsificeren wordt wel meer betrokken. Bewijsvoering opbouwen en falsificeren zijn eigenlijk één kolom.	Verschil met moment waarin je meedoet qua partner. Dus voor falsificeren is voor advocaat belangrijker omdat deze later betrokken wordt. Die kijkt mee terug het onderzoek in terwijl wij vooruit het onderzoek inkijken O: is het eens met verslaglegging, maar als alles in het dossier moet dan kom je om in het papier. Dit onderzoek gaat uit van de begin fase. OvJ en Advocaat toch wel meer op eenzelfde lijn qua inzichten in algemeen, maar dit komt niet uit de resultaten	O: Na Pd onderzoek komt opnieuw bij fase met falsificeren, maar deze resultaten zijn specifiek voor het PD onderzoek.	O: Is het eens met falsificeren parallel loopt aan bewijsvoering opbouwen, loopt beetje door elkaar heen.				Dit is echt voor op de PD, de resultaten Rechter: zou FO verslag echt goed kunnen gebruiken Nu vaak alleen info van NFI, gaan daar vanuit. Meenemen in verslaglegging zou rechter veel informatie geven.

Advocaat	FO: Ook onderlinge verschillen zijn klein, in ieder situatie wordt het even belangrijk beschouwd.	FO: bewijsvoering opbouwen blijft voor op falsificeren, het aandeel falsificeren is nog wel aanzienlijk hoog, goed om te zien. Niet direct verwacht dat falsificeren zo hoog staat, verbaasde het meest. Niet verwacht dat het gelijk op zou gaan met andere situaties R: minder belangrijk is falsificeren dan voor FO Rechter: hoe sterker het bewijs, hoe minder scenario's mogelijk Rechter: kennis en ervaring FO gebruiken, hoe beschouwt die expert	O: FO en OvJ lijken erg op elkaar, zelfde achterliggende gedachte. Geruststellend dat falsificeren ook weer hoog scoort, dat het kennelijk wel van belang is. Of het daarna ook gerapporteerd wordt is een tweede punt. IS het eens met OvJ over vraag waarom ene spoor wel mee gaat en andere niet.	Niet alle alternatieve scenario's kun je meenemen, maar in het algemeen is verslaglegging van forensisch onderzoek summier is, zeker in DNA zaken of andere complexe zaken. Zou het graag ruimer willen zien, in sommige landen wordt het opgenomen of meer foto's dan die in het dossier staan. Completere verslaglegging zou meer vragen vanuit verdediging voorkomen kunnen worden.	Gaat er wel tegenin, maar gaat niet speciaal mee met de antwoorden van de anderen		Gaat het meest in tegen de resultaten, neemt meer in twijfel. Wel oplettend, heeft wel eigen mening/beeld	Ook van snelle straat gehoord	Focust erg op falsificeren Verslaglegging: wordt veel geïnterpreteerd
Deskundige	FO: wil je laten kunnen reconstrueren moet je daar wel rekening mee houden, het belang wordt daar van in gezien. Stelt FO zelf de hypotheses op? D: ja motief achterhalen minst belangrijk, reconstrueren wel belangrijk. Herkent het beeld.	Ligt ook aan fase van het onderzoek, dus falsificeren eerst nog niet zo belangrijk. Eigenlijk zou het gelijk moeten zijn qua doelen verdeling met falsificeren O: had verwacht dat motief wel hoger zou liggen, heeft toch ook met bewijsvoering te maken					Gaat zich meer afvragen: wil je weten wat de verdachte heeft gezegd?		Belangrijk: wat is er gebeurd Worden opgeroepen bij rechtbank om verslag uit te leggen, het rapport van NFI
Group	Zijn in het begin meer met elkaar eens, vanaf OvJ resultaten meer verschillen genoemd, ook algemene verschillen Parameters: praten vooral over eigen partner, gaan niet in op de resultaten van andere partners.		Zijn het meer met elkaar eens, komen ook meer los. Herleidbaarheid wordt door veel partners als belangrijk gevonden, in combinatie met verslaglegging OvJ en R hadden verwachten dat partners op elkaar lijken qua verdeling, ze zijn met hetzelfde bezig en met hetzelfde doel.		Door inzichten van anderen wordt er beetje afgeweken van het onderwerp, zoals tijdens de resultaten van de advocaten. Nadat advocaat verslaglegging heeft benoemd, werd dit vaker door de andere partners benoemd.		Tijdens de parameters is het vooral voor FO van belang en de rest haakt een beetje af, is wat afwezig, gaat hen blijkbaar minder aan.		

Per rij is de partner weergeven en wat diegene heeft gezegd over/in belang van andere partners.
Waarbij:
A = advocaat
R = recherche
O = OvJ
D = deskundige
FO = FO

Discussie punten
OvJ:

- Verslaglegging kwam naar voren
- Rechter misschien meer bewust maken van hoe het werkt op de PD, door visualiseren

FO:

- Rechters en officieren zijn wel eens meegenomen om kennis te geven over FO
- Het zit dus blijkbaar in het hoofd van de PD onderzoeker maar wordt te weinig opgeschreven
- Bij de uitvoering gebeuren dus de goede dingen
- Scenario specialist is van meerwaarde, ook voor de compleetheid

Opvallende observaties

- FO is het meest bereid om aan te passen, is het vaak eens met de inzichten van andere partners
  - Maar zo lijkt het ook dat andere partners zich minder verantwoordelijk voelen
- FO concludeert dat er eigenlijk niet zoveel hoeft te veranderen aan de hand van de parameters
- Meer communicatie tussen de partners is nodig om hier echt op in te kunnen gaan, nu zijn meer algemenere punten besproken en niet specifiek punten over dit onderzoek
- Sturing is ook een vaak genoemd punt, de sturing van FO (tunnelvisie)

Voor een volgende sessie misschien stellingen gebruiken om discussie uit te lokken, bv ‘hoe zie je kwaliteit, hoe bereken je een parameter’

Appendix G: Expert co-design session outline

Expert co-design sessie

Doelen

- ‘Goal setting’
  - *Hoe komen experts tot gezamenlijke doelen?*
- Promoten van co-design

Voorbereiding

- Behoeften op slides laten zien per partner

Tijd [3] ———————————————————————————————————————

00:00 CSI-PEEQ slide

Voordat we starten met de sessie eerst wat praten over koetjes en kalfjes om zo een vriendelijke omgeving te creëeren. Observeer ook tijdens deze ‘small talk’ hoe de deelnemers zich gedragen.

Sessie outline [1, 3, 4 & 5]

1. Introductie

00:10

Welkom

Welkom allen bij deze expert co-design sessie, dank dat jullie de tijd nemen om hier aanwezig te zijn. Tijdens deze sessie willen we met jullie de behoeftes van alle partners binnen de strafrechtketen vervullen. Om samen spanningen en oplossingen te delen met elkaar, zal deze sessie aan de hand van bepaalde methodes uitgevoerd worden.
Tijdens de sessie zullen PowerPoints slides getoond worden waarop verschillende standpunten te zien zijn. De sessie zal in totaal twee en een half uur duren met halverwege een korte pauze, daarnaast wordt de sessie opgenomen, de opname zal na het transcriberen in de komende maand worden vernietigd. De assistent moderator zal tijdens de sessie aantekeningen bijhouden. Alle informatie zal anoniem verwerkt worden.

Als moderator zal ik de sessie vandaag leiden. Zouden jullie jezelf kunnen voorstellen?

Onderwerp

Het CSI-PEEQ project, waar gaat het ook alweer over?:
De resultaten van het sporenonderzoek op de plaats delict (PD) spelen een belangrijke rol tijdens het gehele strafrechtelijk onderzoek. Het gebruik van de forensische resultaten beperkt zich niet alleen tot het opsporingsproces, maar is ook van waarde bij de reconstructie en bij de bewijsvoering van het vermeende misdrijf dat wordt onderzocht. Elke toepassing van de resultaten stelt vermoedelijk andere eisen aan het PD-onderzoek.

Om inzicht te geven in effectief/doelmatig, efficient en kwalitatief goed sporenonderzoek, en welke werkwijzen bijdragen aan optimaal gebruik van het forensische onderzoek door alle partijen van de strafrechtketen, hebben jullie de online vragenlijst ingevuld. Deze resultaten zijn is een vorige sessie met alle partners besproken. Daarbij zijn de behoeftes van de verschillende partners in kaart gebracht. Maar hoe kan het sporenonderzoek de behoeftes van alle partners vervullen?

Richtlijnen slide

Richtlijnen

Er zijn een aantal richtlijnen die we graag willen hanteren tijdens deze sessie:

- Er zijn geen goede of foute antwoorden, alleen verschillen in inzichten
- Laat anderen uitpraten, ook wanneer je het niet eens bent met de uitspraken
- Steek een virtueel handje op wanneer je wat wilt delen
- Zouden jullie de camera willen aanhouden tijdens de sessie en alleen de microfoon willen inschakelen wanneer je iets wilt delen
- We vragen jullie je telefoon weg te leggen, zodat er zo min mogelijk afleidingen zijn. Mocht dit niet mogelijk zijn, dan vragen we jullie om de microfoon kort te dempen en zo snel mogelijk weer deel te nemen
- Mocht het voorkomen dat de verbinding per ongeluk verbroken wordt, zullen we je opnieuw toelaten tot de groep

00:15 ◉ Behoeftes per partner

2. Behoeftes van partners

▸ **Behoeftes per partner**

• We zullen kort per partner de behoeftes die uit de vragenlijst en expert reflectie sessie naar voren zijn gekomen laten zien

00:30

3. Spanningen

▸ **Spanningen tussen partners**

• De partners vragen naar spanningen

- Waar lopen jullie tegenaan in de samenwerking tijdens het onderzoeksproces?
- Wat voor spanningen ondervinden jullie tijdens het onderzoeksproces?
- Zijn dit spanningen die vaker voorkomen?

◉ Stand-punten uit de literatuur

▸ **Spanningen in de gehele keten**

• We zullen de spanningen die voort komen uit de literatuur als standpunten weergeven
• De partners kunnen hier op reageren

- Zijn deze spanningen voor jullie ook bekend?

01:15

PAUZE - Tijdens de pauze kunnen de deelnemers nadenken over verschillende oplossingen voor het vervullen van hun behoeftes.

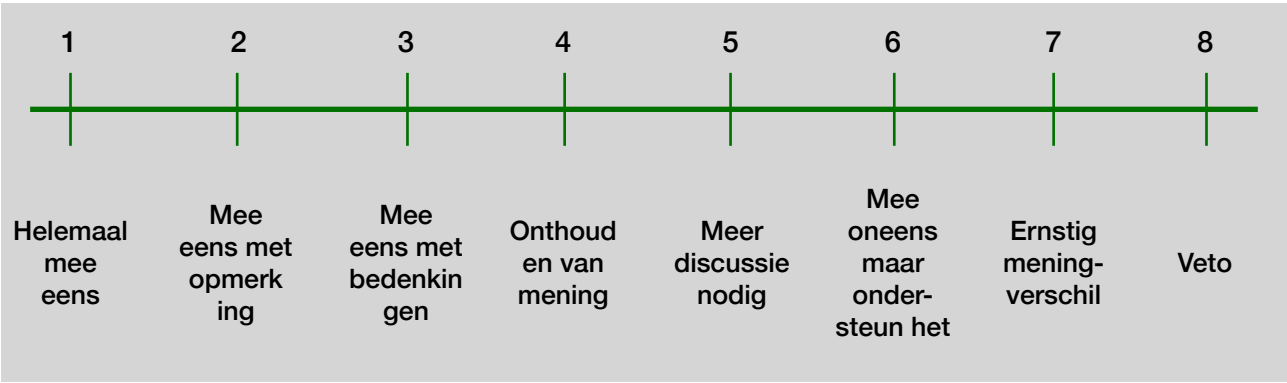
01:30

4. Oplossingen

• Laat elke partner aan het woord, geef aan dat wanneer een oplossing niet mogelijk is dit pas nadat de deelnemer is uitgepraat aangegeven wordt

- Met welke oplossingen zouden jullie behoeftes worden vervuld?
- Zijn hier compromissen voor nodig met andere partners?
- Welke oplossingen zouden voor jullie allen kunnen werken?

• Er kan hiervoor gebruik gemaakt worden van een instemming-schaal [5]



02:15

◉ Afsluitende slide

5. Conclusie en afsluitende vragen

- **Conclusie besproken punten**
  - *“Klopt deze samenvatting?”*
  - *“Van alle punten die we besproken hebben, wat is voor jou het belangrijkst?”*
  - *“Zijn je inzichten veranderd na deze groepssessie?”*
  - Als laatste vraag: *“Van alle punten die we besproken hebben, wat was het belangrijkst voor jou als partner zijnde?”*

- **Reflectie van deelnemers op de gehele discussie**
  - *Hoe hebben jullie deze sessie ervaren?*
  - *Zouden dit soort sessies vaker gehouden moeten worden?*

- **Afsluiting**
  - *“Bedankt voor jullie deelname aan deze expert co-design sessie, we zullen jullie op de hoogte houden van het CSI-PEEQ project”.*

Moderator [1]

De moderator accepteert het feit dat misverstanden zullen plaatsvinden tijdens de sessie. Deze misverstanden kunnen als stressvol worden ervaren en daardoor is het belangrijk dat alle standpunten worden gehoord zodat elke deelnemer het gevoel krijgt dat diegene begrepen wordt [2].

De 'warming up' is belangrijk, laat de deelnemers dan ook over een onderwerp praten totdat tweederde van de tijd is verstreken voor dat de hoofdvraag (opnieuw) gesteld wordt. Daarnaast is het ook van belang dat het tempo niet verzwakt en dat er aan de tijd gehouden wordt [3].

Vragen stellen [1]

- Probeer gesloten vragen te vermijden
- Gebruik verschillende soorten vragen
  - Opening vragen, introductie vragen, transitie vragen, hoofd vragen en einde vragen
- Gebruik vragen waardoor deelnemers betrokken raken
  - Gebruik reflecties, voorbeelden, keuzen, prioritering

Interventie zinnen [1]

- Gebruik pauzes van ongeveer 5 seconden
- "Zou je dat verder willen toelichten?"
- "Kun je hier een voorbeeld van geven?"
- "Sorry, maar ik begrijp het niet helemaal"

Reacties op deelnemers [1]

- Verbale en non-verbale communicatie
- Ja knikken
- Korte verbale reacties

Tot overeenkomsten komen [2]

- Moedig 'out of the box' denken aan
- Help de deelnemers door de 'groan zone' te komen wanneer zij een gezamenlijk doel vormen
- Help de deelnemers bij het formuleren van creatieve ideeën en voorstellen die verschillende perspectieven bevatten
- Zorg ervoor dat de discussie ook tot een eind gebracht wordt

Faciliterende luistervaardigheden [2]

Parafraseren

- In eigen woorden herhalen van wat jij denkt dat de deelnemer verteld heeft
- Wanneer het een lang verhaal is, vat het samen
- Wanneer er maar 1 of 2 zinnen gebruikt worden, gebruik dan ongeveer dezelfde hoeveelheid aan woorden
- Om de objectiviteit te benadrukken kunnen de volgende voorwoorden gebruikt worden:
  - *"Het lijkt erop dat je zegt dat…"*
  - *"Even kijken of ik het begrijp …"*
  - *"Bedoel je dit? …"*
- Wanneer je klaar bent met parafraseren, kijk de deelnemer aan om de reactie te waarnemen, je kant hierbij ook vragen of dit klopt. Wanneer dit niet het geval is kun je doorgaan met vragen totdat je begrijpt wat de deelnemer bedoelt

'Drawing people out': ondersteun deelnemers in het ontwikkelen en verfijnen van hun ideeën

- Door te parafraseren en daarna niet-gerichte open vragen te stellen
  - *"Kan je daar meer over vertellen?"*
  - *"Wat bedoel je met …?"*
  - *"Kan je me een voorbeeld geven?"*
  - *"Wat is er voor jou belangrijk aan?"*
  - *"Hoe komt dat?"*

- Er kan ook eerst geparafraseerd worden waarna ‘connectors’ gebruikt worden zoals: “dus …”, “omdat …” of “en …”

Spiegelen: het herhalen van de deelnemer zijn/haar woorden
- Wanneer er één zin wordt gebruikt, kan deze letterlijk worden herhaald
- Wanneer er meerdere zinnen worden gebruikt, herhaal dan de belangrijkste woorden of zinnen
- Gebruik de woorden van de deelnemer en niet eigen woorden, verander alleen wel ‘ik’ in ‘jij’
- Het spiegelen van woorden is iets anders dan de toon spiegelen, gebruik een eigen en accepterende toon wanneer er gespiegeld wordt
- Het doel van spiegelen is het creëren van vertrouwen

‘Stacking’: procedure om iedereen aan het woord te laten komen
Aan de hand van vier stappen komt iedere spreken die wat over het onderwerp wil zeggen aan het woord.
1. Vraag wie hier wat over wil zeggen door virtueel zijn/haar hand op te steken
2. Benoem de volgorde van deelnemers
3. Laat iedereen volgens volgorde spreken
4. Nadat iedereen aan de beurt is geweest, vraag of er nog anderen zijn die hier wat over willen zeggen

‘Tracking’: de verschillende verhaallijnen tijdens de discussie in de gaten houden
Tracking is een process bestaande uit vier stappen:
1. Geef aan dat je een stap terug neemt en de discussie tot nu toe zal samenvatten
2. Benoem de verschillende verhaallijnen
3. Vraag bevestiging bij de groep
4. Vraag de groep door te gaan met de discussie

Aanmoedigen: een opening creëren voor deelnemers om deel te nemen aan de discussie
- Voorbeelden:
  - *“Zijn er nog anderen met een idee?”*
  - *“Hoe denkt de rest hierover?”*
  - *“Roept deze discussie ook andere vragen op?”*
- Hieraan gerelateerd is de techniek om het onderwerp van de discussie opnieuw te benoemen en daarmee anderen aan te moedigen deel te nemen
  - *“We hebben het tot nu toe gehad over [probleem/oplossing], zijn er nog andere mogelijkheden?”*

Balanceren: de richting van de discussie wordt vaak gestuurd door de eerste paar deelnemers die spreken, door middel van balanceren kan je de groep helpen om andere perspectieven die nog niet gehoord zijn aan bod te brengen
- *“Zijn er andere manieren om naar dit onderwerp te kijken?”*
- *“Is iedereen het hiermee eens?”*
- *“We hebben van verschillende deelnemers gehoord hoe ze hierin staan, heeft iemand anders een andere kijk?”*
- *“Kan er iemand een paar minuten voor de advocaat van de duivel spelen?”*
- *“We hebben kijk [x] en kijk [y] gehad op dit onderwerp, is er nog een derde manier om hiernaar te kijken?”*

Ruimte maken voor de stille deelnemers
- Hou de stille deelnemers in de gaten, kijk naar lichaamstaal of gezichtsuitdrukkingen die kunnen duiden op willen spreken
- Nodig ze uit: *“Was er iets dat u/jij wilde zeggen?”* Of *“Wilde u/je daar iets aan toevoegen?”*
- Wanneer ze de uitnodiging afwijzen, ga gewoon door met de rest
- Wanneer het nodig is, maak ruimte door te zeggen: *“Laten we één voor één aan het woord zijn, [naam] wilde u/jij iets zeggen?”*
- Wanneer de discussie compleet uit balans is, kun je gestructureerd de groep rond gaan

Valideren: de mening van een deelnemer accepteren zonder dat je de mening als correct bevestigt
Bestaat uit drie stappen
1. Parafraseer de mening van de deelnemer
2. Bepaal of de deelnemer ondersteuning nodig heeft
3. Bied eventueel deze ondersteuning door bijvoorbeeld te zeggen:
   - *"Ik begrijp wat je bedoelt"*
   - *"Ik kan me voorstellen dat dit belangrijk voor je is"*
   - *"Ik snap waar je vandaan komt"*

Opzettelijke stilte
Een pauze van een aantal seconden om de spreker wat extra tijd te geven om te bedenken wat hij/zij wil zeggen. Blijf wel opletten, zeg helemaal niks en knik niet eens mee. Je kunt anderen eventueel laten wachten met spreken, door een hand op te steken.

'Linking': luister skill die de deelnemer laat uitleggen wat de relevantie is van het gemaakte punt
Bestaat uit vier stappen:
1. Parafraseer het gemaakte punt
2. Vraag de deelnemer om de link uit te leggen met het onderwerp (*"Kun je ons helpen het verband te zien tussen [x] en [y]?"*)
3. Parafraseer en valideer de uitleg
4. Maak daarna gebruik van andere vaardigheden:
   - Gebruik aanmoediging om de reactie van anderen te krijgen
   - Gebruik stacking om door te gaan met een andere mening

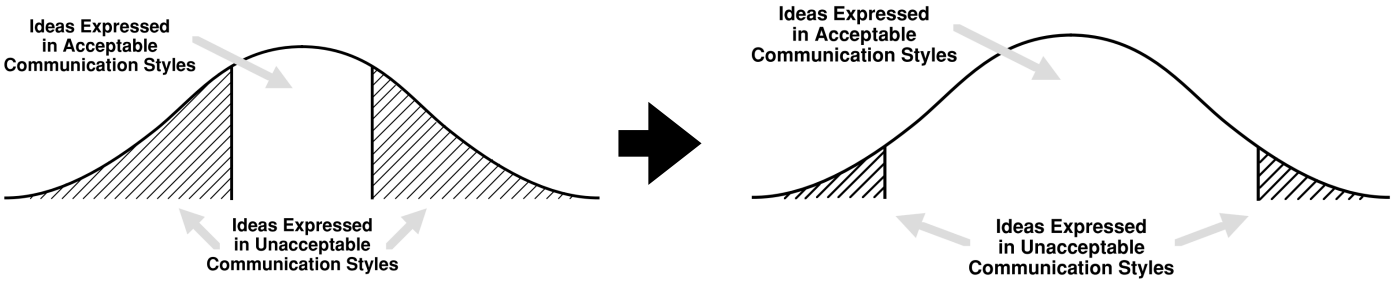
Het gemeenschappelijke laten zien
Vooral te gebruiken wanneer deelnemers verdeeld zijn, focust op de gemeenschappelijke punten.
Bestaat uit vier stappen:
1. Geef aan dat je de verschillen en overeenkomsten gaat samenvatten
2. Vat de verschillen samen
3. Benoem de overeenkomsten
4. Vraag om bevestiging

Let op dat je iedereen meeneemt!

Samenvatten
Een process van vijf stappen:
1. Herformulier de vraag die de discussie begon
2. Benoem het aantal thema's die naar voren zijn gekomen
3. Benoem voor het eerste thema één of twee hoofdpunten
4. Doe dit ook voor de andere thema's
5. Maak een brug naar het volgende onderwerp

Speciaal voor de co-design sessie

'Stretch the limits' van ideeën

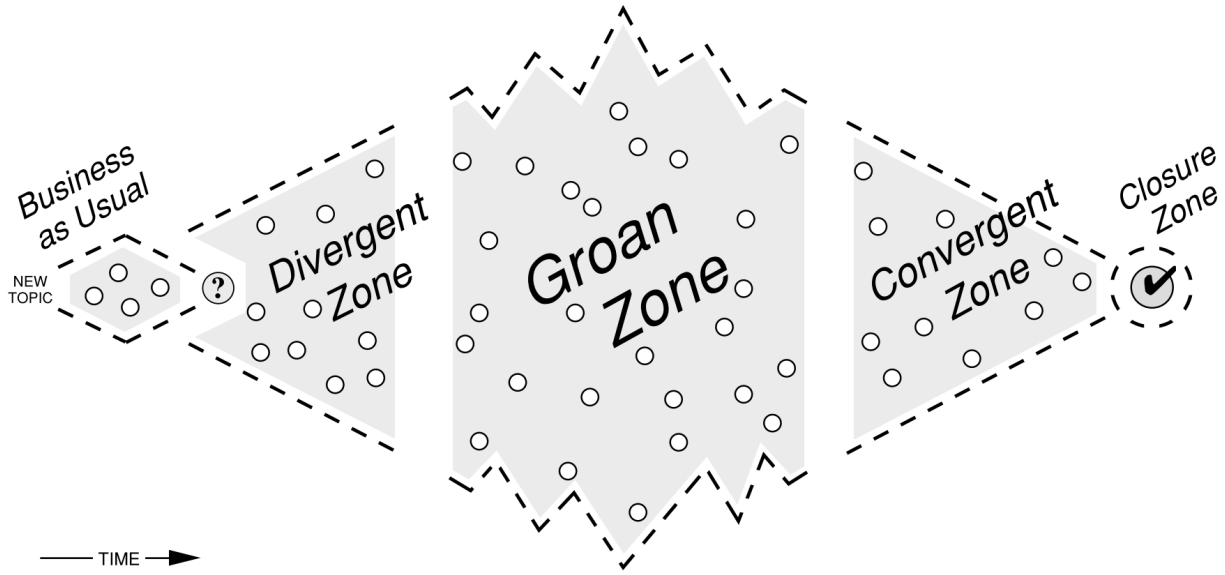


Groepen die meerdere communicatie stijlen accepteren kunnen gebruik maken van meer ideeën dan groepen die binnen het 'acceptabele' blijven. Door het gebruik van goede luister skills kan een moderator de groep hierin ondersteunen.

- Wanneer een deelnemer in herhaling valt, kan de moderator parafraseren om de deelnemer zo te helpen om zijn/haar gedachtes samen te vatten
- Wanneer een deelnemer niet uit zijn/haar woorden komt, kan de moderator helpen door open vragen te stellen om zo het verhaal te leiden
- Wanneer een deelnemer overdrijft, kan de moderator het belangrijkste punt benoemen ter bevestiging van het verhaal
- Wanneer een deelnemer op een zijpad raakt, kan de moderator de deelnemer vragen om uit te leggen hoe dit in een breder perspectief met het onderwerp verbonden is
- Wanneer een deelnemer zich met gevoelens uit, kan de moderator de emotie erkennen en dan de gedachtes parafraseren zodat het punt van de deelnemer niet verloren gaat

Decision making [2]

1. Gezamenlijk doel (mutual understanding)
2. Divergent zone: ideeën verzamelen
3. Goan zone: hierin vindt miscommunicatie en misverstand plaats, maar dit is wel onderdeel van decision making
4. Convergent zone: de beste ideeën kiezen en verder uitwerken
5. Closure zone: keuzes maken



Figuur 1: 'Diamond of Participatory Decision-Making' [2].

Rational decision theory [6]
Veel keuzes worden in onzekerheid genomen, daardoor zijn de consequenties van keuzes niet altijd te voorspellen. Om het keuze maken meer structuur te geven kunnen de risico's van een oplossing in beeld worden gebracht. Na het beoordelen van de risico's in relation tot de oplossingen kan elke deelnemer de voorkeur geven aan een bepaalde oplossing.

Multi stakeholder collaboration [5]
- Zorg dat de deelnemers zich inzetten om te luisteren: dit kan door wederzijds begrip, de basis hiervoor is in de expert reflection session gelegd.
- Let op de energie van de groep: zorg voor een mix van activiteiten, laat iedereen bijvoorbeeld om de beurt aan het woord, laat de deelnemers brainstormen zonder te discussiëren, laat de deelnemers individueel oplossing opschrijven of zorg voor een korte pauze
- Maak gebruik van de instemming-schaal zodat elke deelnemer zijn steun voor een voorstel kan geven

Group think [7]
Let op dat er geen neiging ontstaat tot Group Think. Symptomen hiervan zijn:
- Overschatting van de groep
- Bekrompenheid
- Druk op uniformiteit

Symptomen van gebrekkige keuzes maken:
- Incomplete lijst van alternatieven
- Incomplete lijst van doelen
- Het niet in staat zijn om de risico's te onderzoeken
- Het niet in staat zijn om afgewezen initiatieven opnieuw te beoordelen
- Slechte informatie voorziening
- Selectieve bias in het beoordelen van informatie
- Het niet uitwerken van noodplannen

Assistent moderator [1]

Observaties [1]

- Spanningen tussen partners of behoeften van partners
- Partners hun beweegredenen of perspectieven
- Hoe gaan ze om met meningsverschillen
- Non-verbale communicatie voor zover dat mogelijk is

Aantekeningen maken [1]

- Blijf consistent, anderen moeten de aantekeningen ook kunnen begrijpen
- De aantekeningen moeten verschillende typen informatie bevatten
  - Quotes: schrijf op zoveel mogelijk op, gebruik … om aan te geven dat een deel van de quote mist
  - Belangrijkste punten en thema's
    Deze worden aan het eind van de sessie gedeeld voor bevestiging van de deelnemers
  - Nieuwe ideeën of inzichten over het onderwerp
- Verzamel de ideeën gedeeld door de deelnemers

Analyse [1]

1. Start tijdens de sessie
- Let op tegenstrijdige opmerkingen
- Let op vage of cryptische opmerkingen
- Let op creatieve ideeën

2. Gelijk na de sessie
- Korte nabespreking met projectgroep
- Noteer the thema's, interpretaties, ideeën en suggesties die besproken zijn
- Label alle documenten

3. Snel na de sessie - binnen aantal uur
- Back up maken van de documenten en opsturen naar de rest van de projectgroep
- Transcriberen
- Rapport met de gestelde vragen, antwoorden, opvallende quotes en uitkomsten
- Rapport delen met projectgroep voor verificatie

4. Later - binnen aantal dagen
- Kijk naar opvallende thema's en ideeën of uitkomsten
- Beschrijf de bevindingen en gebruik de quotes om dit te illustreren

5. Rapport [3]
- Per belangrijkste thema's of per idee
- Meest interessante quote's om te illustreren
- Onverwachte resultaten

Referenties

[1] Krueger, R. A., & Casey, M. A. (2002). Designing and conducting focus group interviews.

[2] Kaner, S. (2007). Facilitator's guide to participatory decision-making. John Wiley & Sons.

[3] Breen, R. L. (2006). A practical guide to focus-group research. *Journal of Geography in Higher Education*, *30*(3), 463-475.

[4] Sweet, C. (2001). Designing and conducting virtual focus groups. *Qualitative Market Research: An International Journal*.

[5] Kaner, S., Watts, J., & Frison, E. (2008). Participatory decision-making: The core of multi-stakeholder collaboration (No. 563-2016-38901).

[6] Parmigiani, G., & Inoue, L. (2009). Decision theory: Principles and approaches (Vol. 812). John Wiley & Sons.

[7] Janis, I. L. (2008). Groupthink. IEEE Engineering Management Review, 36(1), 36.

Appendix H: Expert co-design session slides

Welkom bij de CSI-PEEQ Expert sessie

Moderator:
Assistent moderator:

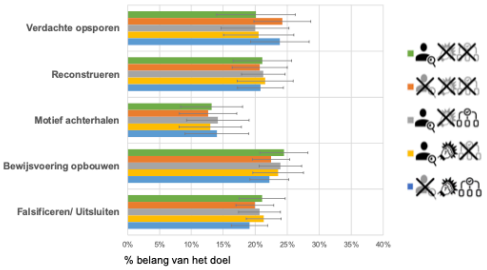
Agenda

Tijdsschema	
00:00	Introductie o Welkom o Richtlijnen
00:15	Behoeftes per partner o Vragenlijst o Reflectie sessie
00:30	Spanningen o Tussen partners o In de gehele keten
01:15	Pauze
01:30	Oplossingen
02:15	Afsluiting

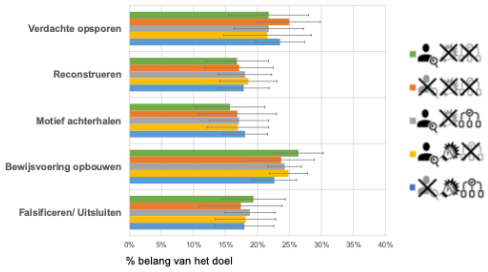
Richtlijnen

- Er zijn geen goede of foute antwoorden, alleen verschillen in inzichten
- Laat anderen uitpraten, ook wanneer je het niet eens bent met de uitspraken
- Steek een virtueel handje op wanneer je wat wilt delen
- Zouden jullie de camera willen aanhouden tijdens de sessie en alleen de microfoon willen inschakelen wanneer je iets wilt delen
- We vragen jullie je telefoon weg te leggen, zodat er zo min mogelijk afleidingen zijn. Mocht dit niet mogelijk zijn, dan vragen we jullie om de microfoon kort te dempen en zo snel mogelijk weer deel te nemen
- Mocht het voorkomen dat de verbinding per ongeluk verbroken wordt, zullen we je opnieuw toelaten tot de groep

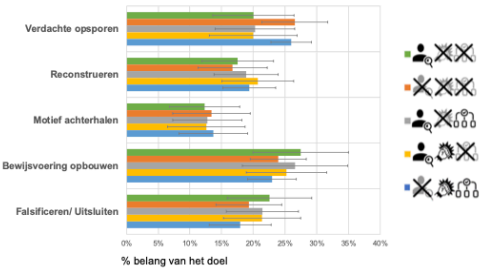
Resultaten: FO (n=40)



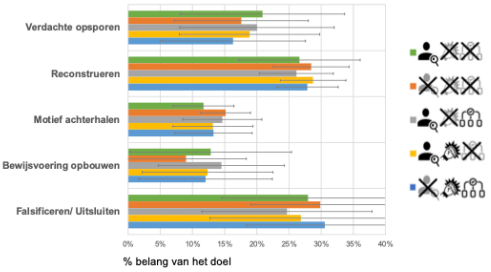
Resultaten: Recherche (n=35)



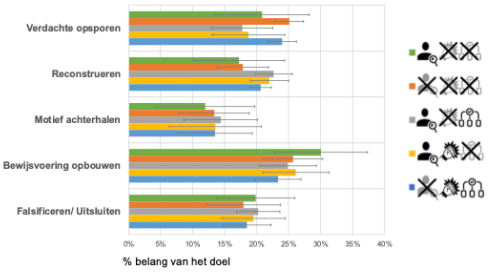
Resultaten: OvJ (n=41)



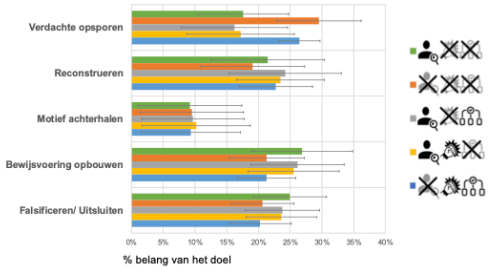
Resultaten: Advocaat (n=5)

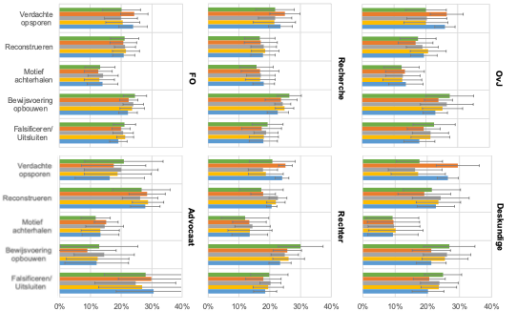


Resultaten: Rechter (n=12)



Resultaten: Deskundige (n=15)





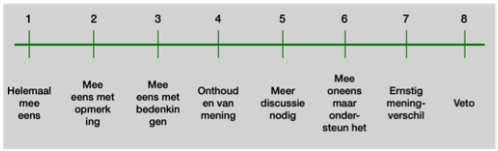
Spanningen tussen partners

- Waar lopen jullie tegenaan in de samenwerking tijdens het onderzoeksproces?
- Wat voor spanningen ondervinden jullie tijdens het onderzoeksproces?
- Zijn dit spanningen die vaker voorkomen?

Spanningen in de gehele keten

- Transparantie keuzes mist in reportage
- Misverstanden tussen partners
- Eenrichtings-communicatie
- Weinig feedback

Oplossingen



Conclusie & Afsluiting

Bedankt voor jullie deelname!

Appendix I: Scenario staged crime scene experiment

Scenario

EN- Simon Oud is 28 years old and lives by himself in a small apartment. He is at a bar late at night with an old study friend. Simon tell his friend about his father (Piet Oud) coming over at his place the day before. His father, with whom he has little contact, was standing in front of his door with a lot of stuff without telling him. His father gave hime €5000 euro as a present. He also got a safe from his father. This safe contained a pakkage which belonged to his father and if Simon wanted he could also store his money there. Simon was aware of the fact that his father has been in prison for dealing drugs, he wasn't feeling comfortable with the event but could use the money too. He thought the safe was crazy so he stored the money in a 'safer' spot.

Close to the table where Simon and his friend were sitting while telling the story, two guys (offender 1 and 2) were ear dropping on the conversation. Offender 1 and 2 already tried to rob an elderly women, but this attempt failed (Offender 1 and 2 are both antecedents and can be found in Havank and the DNA database).

At 1:00 AM Simon is walking back home by himself, his friend is walking in another direction. The two guys are following Simon. When Simon arrives home and opens the door with his key, offender 1 grabs Simon from behind and pushes him against the bathroom door in the hallway [2.1 Bloodstain on bathroom door]. Both offenders are wearing white latex gloves and covered their faces with a balaclava or scarf. Offender 1 forces Simon to get on his knees and tells him to shut up and sit still. Offender 2 places a piece of duct tape on Simon his mouth [5.8 Duct-tape short]. He folded the end in half so the tape would stick to his gloves.

Offender 2 is walking towards the living room to search for the money. Offender 1 pushes the front door with his shoe. Offender 1 takes Simon to the bedroom en pushes him on the floor. He pushes his knee in Simon his neck and tries to tape Simon his hands together [5.9 Duct-tape long]. As this isn't working, offender 1 takes off his gloves [5.5/5.6 Latex gloves] however it still doesn't work. He drops the duct tape roll [5.7 Duct-tape roll] and gets a tie-wrap from his pocket. He uses this to tie Simons hands together [5.4 Tie wrap].

In the mean time, offender 2 found the safe in the bedroom, which is empty [5.10 Safe]. He walks up to Simon and yells at him where the money is. As Simon his mouth is taped he can not respond. Offender 1 and 2 start hitting and kicking him. Offender 2 walks to the living room and takes a knife from the kitchen drawer. He demands Simon to tell them where the money is and threatens him with the knife. Offender 2 removes the tape from Simon his mouth. He sticks the tape on the floor [5.8 Duct-tape short]. Simon tells the offender he doesn't have the money anymore. Offender 2 stabs Simon with the knife, but the wound is small because of the knife being blunt and Simon still wearing his jacket. Offender 2 however wounded his own finger, he puts the knife and gloves in his pocket and walks to the bathroom to rinse his hands leaving blood stains on the tap and sink [3.1/3.2 Bloodstains on water tap and sink].

As the apartments are very noisy the neighbor call if Simon is alright. The offenders are shocked and run away, offender 1 throws his balaclava in the bin outside of the house [1.8 Balaclava]. The neighbor didn't receive any answer by Simon, so she looks outside and sees someone running away. That is when she calls 112 and hurries herself to the house of Simon where she peaks through the window [1.9 Window/viewing track]. She sees Simon laying on the floor. The police and ambulance are there quickly. The police finds Simon in his house and with hand gloves the tie-wrap is removed from Simon his hands. They leave the tie-wrap on the floor of the bedroom [5.4 Tie wrap]. Simon is brought to the hospital, he is confused and not approachable.

NL- Simon Oud is 28 jaar en woont alleen in een appartementje. Hij is ‘s avonds in de kroeg met een oud- studievriend. Simon vertelt aan deze vriend dat zijn vader (Piet Oud) gisteravond bij hem is geweest. Zijn vader –met wie hij weinig contact heeft- stond ineens aan de deur met allemaal spullen. Zijn vader gaf hem 5000 euro cadeau. Hij kreeg ook een kluis van zijn vader. In deze kluis zat een pakketje van zijn vader en in de kluis kon Simon volgens zijn vader ook het geld bewaren. Simon weet dat zijn vader Piet in het verleden heeft vastgezeten o.a. voor het dealen van drugs, en voelt zich niet zo prettig bij het gebeurde, maar hij kan het geld goed gebruiken. Hij vond het idee van een kluis echt gestoord en heeft het op ‘een veiliger plek’ opgeborgen.

Vlakbij het tafeltje waaraan Simon dit vertelt, zitten 2 jongens (dader 1 en 2) die het gesprek gedeeltelijk opvangen. Dader 1 en 2 hebben eerder op de avond geprobeerd met een babbeltruc bij een oudere dame binnen te komen, maar dit mislukte (Dader 1 en 2 hebben beide antecedenten en zitten in Havank en de DNA databank).

Om 1:00 loopt Simon alleen naar huis vanaf de kroeg, zijn vriend loopt een andere kant op. De 2 jongens lopen achter Simon aan. Als Simon bij zijn huis is aangekomen en de sleutel in het slot heeft gestoken en de deur heeft geopend pakt dader 1 hem van achter vast en duwt hem hard tegen de deur van de badkamer in de hal [2.1 Bloedspoor buitenkant badkamerdeur]. Beide daders dragen witte latex handschoenen en bedekken hun gezichten met een bivakmuts dan weleen sjaal. Dader 1 dwingt Simon op zijn knieën en zegt dat hij zijn bek moet houden en stil moet zitten. Dader 2 plakt een stuk duct-tape dat hij al klaar had over de mond van Simon [5.8 Kort stuk duct-tape]. Hij heeft een eindje dubbelgevouwen zodat de tape niet aan zijn handschoenen plakt.

Dader 2 loopt naar de woonkamer en gaat op zoek naar het geld. Dader 1 duwt de voordeur dicht met zijn schoen. Dader 1 neemt Simon mee naar de slaapkamer en duwt hem plat op de grond op zijn buik. Hij zet zijn knie in de nek van Simon en probeert ook de handen van Simon bij elkaar te plakken met duct-tape [5.9 Lang stuk duct-tape]. Dit lukt niet, hij trekt zijn handschoenen uit [5.5/5.6 Latex handschoenen], dan lukt het nog steeds niet. Hij laat de rol tape vallen [5.7 Rol duct-tape] en pakt een tie-wrap uit zijn zak. Deze bindt hij om de handen van Simon [5.4 Tie wrap].

Dader 2 heeft intussen de kluis gevonden in de slaapkamer, maar deze staat open en is leeg [5.10 Kluis]. Hij loopt naar Simon en schreeuwt naar hem waar het geld is. Omdat Simons mond is afgeplakt kan hij niet antwoorden. Dader 1 en 2 beginnen te schoppen en te slaan. Dader 2 loopt naar de woonkamer en pakt een mes uit de keukenla. Hij eist nogmaals van Simon dat hij vertelt waar het geld is en dreigt daarbij met het mes. Dader 2 verwijdert de tape van de mond van Simon. Hij plakt de tape aan de vloer [5.8 Kort stuk duct-tape]. Simon zegt dat hij het geld weg heeft gebracht en niet meer in huis heeft. Dader 2 steekt Simon met het mes in zijn zij maar verwondt hem nauwelijks doordat het mes bot is en Simon zijn jas nog aan heeft. Dader 2 verwondt hierbij wel zijn eigen vinger. Dader 2 stopt het mes en zijn handschoenen in zijn jaszak, loopt naar de badkamer en wast zijn handen. Hij laat hierbij bloed achter op de knop van de kraan [3.1 Bloedvlek kraan] en er blijft wat bloed achter in de wasbak [3.2 Bloed wasbak].

De appartementen zijn erg gehorig en een buurvrouw hoort eigenaardige geluiden. Zij roept naar Simon of alles oké is. De daders schrikken hiervan en rennen weg, tijdens het wegrennen gooit dader 1 zijn bivakmuts in de rolcontainer die op straat staat [1.8 Bivakmuts]. Doordat de buurvrouw geen antwoord kreeg, wierp ze een blik naar buiten en zag 1 persoon wegrennen. Ze belt 112 en begeeft zich snel naar het huis van haar buurjongen en gluurt naar binnen in de slaapkamer [1.9 Handafdrukken en condens op raam slaapkamer]. Ze ziet al snel dat Simon daar gekneveld ligt. De politie en ambulance zijn snel ter plaatse. De politie vindt Simon in zijn huis en met handschoenen aan wordt de de tie wrap om Simons handen doorgeknipt. Deze tie wrap laten ze op de grond liggen in de slaapkamer [5.4 Tie wrap]. Simon wordt meegenomen naar de ambulance en overgedragen aan het ambulancepersoneel waarop hij naar het ziekenhuis gebracht wordt. Hij is volledig in de war en niet aanspreekbaar.

Appendix J: List of traces

1. Outside

	Trace	Crime-related	Scenario-related	Fixed/ Unconfined	Relevance
1.1	Keys	No	Yes	Unconfined	DNA: mixed profile Fingerprint: partial match with victim
1.2	Opener	No	No	Unconfined	
1.3	Doorbell	No	No	Fixed	
1.4	Cigarette butt 1	No	Yes	Unconfined	DNA: no match
1.5	Cigarette butt 2	No	Yes	Unconfined	DNA: no match
1.6	Cigarette butt 3	No	Yes	Unconfined	DNA: incomplete profile
1.7	Cigarette butt 4	No	Yes	Unconfined	DNA: no match
1.8	Balaclava in trash bin	Yes	Yes	Unconfined	DNA: match with offender A
1.9	Window/viewing track	No	Yes	Fixed	DNA: match neighbor
1.10	Doorknob	Yes	No	Fixed	DNA: mixed profile
1.11	Trash bin	Yes	No	Unconfined	DNA: mixed profile/not usable Fingerprints: no usable prints

2. Hallway

	Trace	Crime-related	Scenario-related	Fixed/ Unconfined	Relevance
2.1	Bloodstain on bathroom door	Yes	Yes	Fixed	DNA: match with victim
2.2	Drugs	No	Yes	Unconfined	DNA: not enough DNA Fingerprints: match with father of victim
2.3	Jacket	No	No	Unconfined	

3. Bathroom

	Trace	Crime-related	Scenario-related	Fixed/ Unconfined	Relevance
3.1	Bloodstain water tap bathroom	Yes	Yes	Fixed	DNA: match with offender W
3.2	Bloodstain sink bathroom	Yes	Yes	Fixed	DNA: match with offender W
3.3	Towel	No	No	Unconfined	

4. Living room/kitchen

	Trace	Crime-related	Scenario-related	Fixed/ Unconfined	Relevance
4.1	Money	No	Yes	Unconfined	DNA: not enough DNA Fingerprints: match with father of victim
4.2	Speakerfronts (1 and 2)	Yes	Yes	Unconfined	DNA: not enough DNA Fingerprints: no usable prints
4.3	Speakers	Yes	Yes	Unconfined	DNA: not enough DNA Fingerprints: no usable prints
4.4	Beer bottle 1	No	Yes	Unconfined	DNA: match with father of victim Fingerprints: match with victim and father of victim
4.5	Beer bottle 2	No	Yes	Unconfined	DNA: match with victim Fingerprints: match with victim

4.6	Knife block	No	Yes	Unconfined	DNA: mixed profile Fingerprint: partial match with victim
4.7	Sunglasses	No	No	Unconfined	
4.8	Knives	No	Yes	Unconfined	DNA: not enough DNA Fingerprints: partial match with victim
4.9	Scotch tape roll	No	No	Unconfined	
4.10	Tool box	No	No	Unconfined	
4.11	Laptop 1	No	Yes	Unconfined	DNA: mixed profile Fingerprint: match with victim and partial match unknown
4.12	Laptop 2	No	Yes	Unconfined	DNA: mixed profile Fingerprint: match with victim and partial match unknown
4.13	Mobile phone	No	Yes	Unconfined	DNA: incomplete profile Fingerprints: partial match with victim
4.14	Cash box	Yes	No	Unconfined	DNA: not enough DNA Fingerprints: no usable prints
4.15	Cash box drawer	Yes	No	Unconfined	DNA: not enough DNA Fingerprints: no usable prints
4.16	Keys to cash box	Yes	No	Unconfined	DNA: incomplete profile Fingerprints: partial match with victim
4.17	Soda can 1	No	Yes	Unconfined	DNA: no match Fingerprints: no match
4.18	Cup	No	Yes	Unconfined	DNA: no match Fingerprints: no match
4.19	Soda can 2	No	Yes	Unconfined	DNA: match with victim Fingerprints: match with victim
4.20	DVDs	No	No	Unconfined	
4.21	Rope	No	No	Unconfined	
4.22	Biscuit tin	No	No	Unconfined	
4.23	Plastic bags	No	No	Unconfined	
4.24	Dish-towel	No	No	Unconfined	
4.25	Dish-cloth	No	Yes	Unconfined	DNA: incomplete profile
4.26	Glass in sink	No	Yes	Unconfined	DNA: match with victim Fingerprints: partial match with victim
4.27	Coffee cup in sink	No	Yes	Unconfined	DNA: incomplete profile Fingerprints: no usable prints
4.28	Plates in sink	No	Yes	Unconfined	DNA: not enough DNA Fingerprints: no usable prints
4.29	Fork in sink	No	Yes	Unconfined	DNA: match with victim Fingerprints: no usable prints
4.30	Chair	No	No	Unconfined	
4.31	Shelf	No	No	Fixed	

5. Bedroom

	Trace	**Crime-related**	**Scenario-related**	**Fixed/ Unconfined**	**Relevance**
5.1	Bloodstain 1 on floor	Yes	Yes	Fixed	DNA: match with victim
5.2	Bloodstain 2 on floor	Yes	Yes	Fixed	DNA: match with victim
5.3	Bloodstain 3 on floor	Yes	Yes	Fixed	DNA: match with victim

5.4	Tie wrap	Yes	Yes	Unconfined	DNA: not enough DNA Fingerprints: match with victim
5.5	Latex glove 1	Yes	Yes	Unconfined	DNA: match with offender A Fingerprints: no usable prints
5.6	Latex glove 2	Yes	Yes	Unconfined	DNA: match with offender A Fingerprints: no usable prints
5.7	Duct-tape roll	Yes	Yes	Unconfined	DNA: not enough DNA Fingerprints: match with offender A
5.8	Duct-tape short	Yes	Yes	Unconfined	DNA: match with victim Fingerprints: no usable prints
5.9	Duct-tape long	Yes	Yes	Unconfined	DNA: not enough DNA Fingerprints: no usable prints
5.10	Safe	Yes	Yes	Unconfined	DNA: incomplete profile Fingerprints: match with victim
5.11	Key to safe	Yes	No	Unconfined	DNA: mixed profile Fingerprints: no usable prints
5.12	Safe rotary lock	Yes	No	Unconfined	DNA: match with father of victim Fingerprints: no usable prints
5.13	Wallet	No	No	Unconfined	
5.14	Content of wallet	No	Yes	Unconfined	DNA: not enough DNA Fingerprints: match with victim
5.15	Earring	No	No	Unconfined	
5.16	Note	No	No	Unconfined	
	Total	*24*	*41*		

6. Other

	Trace	**Crime-related**	**Scenario-related**	**Fixed/ Unconfined**	**Relevance**
6.1	Nail dirt victim	-	-	-	DNA: not enough DNA

Legend
Crime-related traces
Scenario-related traces

Person-identifying traces
Other crime-related traces

Appendix K: Complete efficacy table

Efficacy																					
		Person-identifying traces												Other crime-related traces							
		Secured						*Submitted*						*Secured*				*Submitted*			
Participant	*Number of traces*	Scenario-related exhibits	Total number of exhibits	Offense-related exhibits	Scenario-related sampling	Total number of sampling	Offense-related sampling	Scenario-related exhibits	Total number of exhibits	Offense-related exhibits	Scenario-related sampling	Total number of sampling	Offense-related sampling	Scenario-related exhibits	Total number of exhibits	Scenario-related sampling	Total number of sampling	Scenario-related exhibits	Total number of exhibits	Scenario-related sampling	Total number of sampling
10	25	18	22	8	2	3	2	6	6	6	0	0	0	0	0	0	0	0	0	0	0
12	25	18	21	11	4	4	4	16	17	9	0	0	0	0	0	0	0	0	0	0	0
18	24	12	17	10	5	6	5	12	13	10	2	3	2	0	1	0	0	0	0	0	0
20	30	21	26	12	4	4	4	11	12	10	1	1	1	0	0	0	0	0	0	0	0
27	29	17	24	14	4	5	4	9	10	8	0	1	0	0	0	0	0	0	0	0	0
29	30	22	26	12	4	4	4	8	8	6	1	1	1	0	0	0	0	0	0	0	0
30	29	18	22	13	5	7	5	7	8	8	1	2	1	0	0	0	0	0	0	0	0
33	23	17	19	10	3	3	3	7	8	8	1	1	1	1	1	0	0	0	0	0	0
35	28	19	23	12	5	5	5	16	18	8	3	3	3	0	0	0	0	0	0	0	0
37	33	20	26	13	4	7	5	19	22	12	2	3	2	0	0	0	0	0	0	0	0
40	27	16	20	12	5	7	5	8	9	9	0	1	0	0	0	0	0	0	0	0	0
41	30	21	26	9	4	4	4	9	11	8	4	4	4	0	0	0	0	0	0	0	0
42	31	21	27	12	4	4	4	9	11	8	1	1	1	0	0	0	0	0	0	0	0
44	24	13	20	12	4	4	4	8	9	9	0	0	0	0	0	0	0	0	0	0	0
45	36	22	31	12	4	5	4	19	23	10	4	5	4	0	0	0	0	0	0	0	0
50	24	19	19	7	4	5	4	8	8	7	0	1	0	0	0	0	0	0	0	0	0
54	20	12	15	7	5	5	4	6	7	5	1	1	0	0	0	0	0	0	0	0	0