6-18-2022

AI for Situational Awareness in Situations With High Uncertainty: An Explorative Case Study

Henrik Aage Skaug
Norwegian National Authority for Investigation and Prosecution of Economic and Environmental Crime, henrik.skaug@politiet.no

Peter André Busch
University of Agder, peter.a.busch@uia.no

AI FOR SITUATIONAL AWARENESS IN SITUATIONS WITH HIGH UNCERTAINTY: AN EXPLORATIVE CASE STUDY

Research Paper

Henrik Skaug, National Authority for Investigation and Prosecution of Economic and Environmental Crime, Oslo, Norway, henrik.skaug@politiet.no

Peter André Busch, University of Agder, Kristiansand, Norway, peter.a.busch@uia.no

Abstract

Often, the police experience scenarios with much uncertainty. These scenarios can be characterized by high time pressure, huge amounts of information, and potentially severe consequences. In this paper, we study whether artificial intelligence (AI) can be a fit for the information processing needs of the police helping them achieve situational awareness and make better decisions. Given the potential severity of police situations, AI can potentially reduce the risk of fatal outcomes and wrong decisions. Investigating this issue with police officers and AI experts as our informants, our findings suggest that our informants are positive to AI as a support tool, but more skeptical to whether AI can make an impact in their daily police work due to the complexity of their work. The importance of implementing AI to suitable tasks is emphasized.

Keywords: artificial intelligence, information processing, situational awareness, police.

1 Introduction

The police face new developments of information and communications technology (ICT) used by the public as well as the criminals. One salient group of ICT is artificial intelligence (AI), common in everyday use today (Joh, 2018). AI is a collective term used to describe computer systems showing capabilities perceived as intelligent when performed by humans, and thereby, not relying on precise rules (Harfouche et al., 2017). AI challenges the limitations of rule-based systems through their ability to learn from data and act as autonomous agents.

It is expected that AI is utilized in the working methods of the police to keep up with developments in society and the work methods of criminals. A central part of everyday police work is collecting information in various situations occurring. Every situation is unique, and information must be obtained as efficiently as possible. This will be true for a dog handler looking for a perpetrator as well as for an investigator in need of bank statements. Often, there is much uncertainty in these situations, and the information needs and subsequent actions may change. Thus, there is an urgency for situational awareness (SA) in many police matters as further decisions depend on it. For example, human lives may be in danger and criminals may flee. SA can be defined as combining new information with existing knowledge in working memory to develop a composite picture of a situation along with projections of future status and subsequent decisions (Fracker, 1991).

Collecting information is time-consuming work and the process of assessing what information to obtain is based on the individual perceptions of the police officers involved. In addition, it is greatly affected by available time and resource capacity. As the amount of information grows, a gap between the information the police can handle, and what is expected of the police to handle, is growing (Joh, 2019). Thus, there is a risk that manual analyses become difficult and that large parts of the collected

information can either be superfluous, deficient, or biased. AI has the potential to collect information more efficiently, structured, and perhaps objectively than police officers can do today.

Whereas examples of utilizing AI in the police exist, research on the challenges and opportunities created by AI for information processing in police work is still in its infancy (Alsheibani et al., 2019; Joh, 2018; Jöhnk et al., 2021). Considering the characteristics of police work, the purpose of this study is to investigate how AI potentially does fit with the information processing needs of the police. To do so, we have conducted an explorative case study with interviews and full-day observations in a large police precinct in Norway as well as interviews with AI experts with knowledge of policing.

2 Information processing and situational awareness

To help us understand how AI can be utilized to achieve SA in police matters, we make use of two theoretical lenses: namely, organizational information processing theory (Galbraith, 1974) and the concept of SA (Endsley, 1995).

Organizational information processing theory (OIPT) suggests that organizations use quality information to handle uncertainty in their environment, and to improve their decision-making (Premkumar et al., 2005). By handling uncertainty, an organization can get a better understanding of a situation, and thus, achieve SA upon which subsequent decisions are based. Figure 1 visualizes the relationship between the important concepts in OIPT and SA.

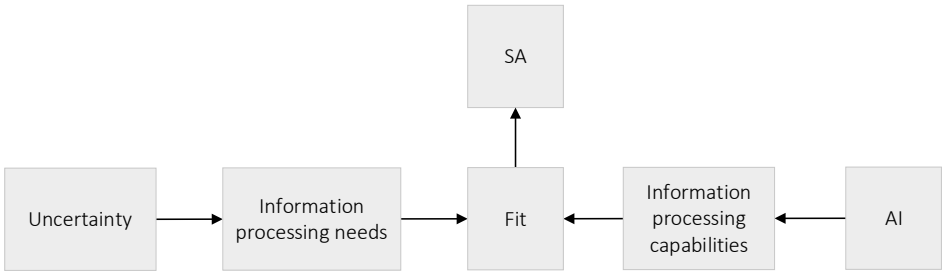

Figure 1. Research model.

Collecting information may encompass many different types of information. Whereas bureaucratic organizations to a large extent can follow organizational routines, the police are mainly event-driven (Lipsky, 2010; Manning, 1992). The situations the police encounter daily are sporadic and difficult to predict in terms of appearance, duration, extent, and risk potential (Manning, 1992). In the police, there is a need for information in almost every situation, whether it is used in urgent situations or situations with a more long-term perspective. In both types of situations, the need for information can rarely be fully foreseen. This means that the need for information can change during an assignment, whether it is an operational assignment or an investigation (Manning, 1992).

The uncertainty the police experience can be understood as the difference between the amount of information needed about a specific situation and the amount of information already in possession (Galbraith, 1974). The more uncertain a situation is to a decision-maker, the riskier it will be perceived to make a decision (Heuvel et al., 2014). In the police, making a wrong decision could have serious consequences, and thus, a police officer may hesitate to make an important decision under adverse circumstances. In critical situations, the police can face extreme uncertainty and significant time pressure. In such situations, police officers may develop certain cognitive coping strategies to make the decisions they perceive as necessary (Heuvel et al., 2014).

High information uncertainty may be a problem for many organizations. The police do not possess a general theory of policing which could justify their practices (Manning, 1992). Since information uncertainty makes it difficult to achieve SA in police matters, the police interpret information based on experience to the best of their knowledge rather than a set of firm rules, regulations, and laws (Manning,

1992). The importance of SA is especially prevalent in urgent situations where even lives may depend upon it. SA is a term describing an understanding of a situation. The SA can be high or low. If SA is low, it reflects immediate reports from a situation. If it is high, it reflects a composite picture of a situation making it possible to assess a future situation (Endsley, 1995). Endsley (1995) divides SA into three levels.

At level 1, the SA will reflect the information received from people or systems close to the situation. For example, if a bank robbery has just occurred, information could come from bank employees and customers, video cameras, traffic sensors, and police officers at the scene. At level 2, the police need to synthesize the collected information and make sense of it. That is, they need to understand the implications of the information. For example, the behavior of the robbers may indicate any trauma of those present during the robbery, and thus how able they are to witness. If the police need to wait before they can ask people involved about the situation, they need to focus on other sources of information meanwhile. At level 3, future events and actions are projected. The police could use their knowledge and experience to predict actions that could occur. For example, the police could try to predict actions the robbers may take and the route they have chosen to flee the scene (Steen-Tveit, 2020).

Based on the OIPT view, the police could make use of two strategies to cope with uncertainty and increased information needs. Firstly, the police could develop buffers to reduce the effect of uncertainty (Premkumar et al., 2005). In a police context, this could mean information from surveillance. Whereas the use of surveillance is one of the areas that can prevent and detect crime, its privacy implications are much debated. To build up an information inventory of the population, large amounts of information have to be stored. Such a practice would be contrary to the principle of data minimization and must be weighed up against the intervention this entails for individuals. According to Interpol, attempts have been made to improve privacy by using AI to anonymize faces. The information can further be shared with other actors and facilitate better interdisciplinary collaboration. Although much information can be mapped in advance, events usually emerge that are unknown in advance. Thus, surveillance will not always contribute to reduce uncertainty.

Secondly, the police could implement structural mechanisms and information processing capabilities that could enhance the information flow and thereby reduce uncertainty (Premkumar et al., 2005). Today, much information is collected manually from various sources such as video cameras, witnesses, and other agencies the police work closely with (e.g., the tax administration, customs, and telecommunications operators). Collecting information is cumbersome and resource-intensive. Deciding what information to obtain depends on the assessment of the situation by the police officer collecting it (Endsley, 1995).

The information obtained needs to be interpreted as well. Each police officer has their own ability to interpret and evaluate information. These abilities are affected by experience and training. Thus, both tasks of collecting and interpreting information are challenging as different police officers may understand information differently. Furthermore, as the police face more complexity, the need for information will increase (Premkumar et al., 2005; Wuschke et al., 2018), and there is a risk that the amount of information may become too large for manual analyses. These challenges may lead to a SA picture that does not represent reality well.

It is especially as a part of the second strategy that AI may become an opportunity for the police. AI is a group of technologies simulating intelligent behavior (Russell & Norvig, 2016) capable of performing cognitive functions (Hofmann et al., 2020; Rai et al., 2019). Currently, machine-learning is a prominent AI technology, which can improve capabilities in, among others, natural language processing, speech recognition, and information retrieval (Jordan & Mitchell, 2015; LeCun et al., 2015). By changing the ways the police work, and make use of AI for information processing, they can avoid superfluous, deficient, and biased information, and thus, reduce uncertainty.

The most successful utilization of AI in the police would occur when an AI tool is ideal for a certain information processing need (e.g., analyzing camera footage). This concept is coined *fit* in OIPT and suggests that the police would improve SA if information processing capabilities are tailored for their information needs (Galbraith, 1974; Tushman & Nadler, 1978). On the other hand, a misfit could

increase the risk of neglecting important clues or relying on misleading clues (Moser et al., 2017). As uncertainty increases, more information must be processed. Thus, the police would need to devote more efforts to improve their capabilities in information gathering and information processing to improve SA. Despite the importance of aligning information processing needs with capabilities, the fit concept has received comparably little attention in empirical research (Moser et al., 2017).

In recent years, both research and testing of AI have been conducted in the police. These efforts aim to both process and analyze vast amounts of data in a short time period. For example, thousands of license-plates can be read per second by automated readers (Angwin & Valentino-DeVries, 2012), facial recognition is used to identify an individual in a large crowd (Joh, 2018), analyses of social networks may reveal who will become victims or perpetrators of gun violence (Eligon & Williams, 2015), and tools such as the Crime Anticipation System (CAS) can be used to predict crimes based on data from various sources (Dechesne et al., 2019).

In the UK, AI was utilized to reduce police response time (Dunnett et al., 2018). They addressed the situation of dispatching patrols from their current location to a new location where a situation has occurred. Instead of sending a joint message to all patrol cars, AI took road data, the nature of the situation, driving characteristics, and the time of day into account to increase efficiency. A 28% decrease in response time was achieved (Dunnett et al., 2018). No single police officer or department has the resources required to scan such vast amounts of data in the required period. AI is changing the capabilities of the police, making them able to conduct tasks that were not possible before (Joh, 2018). In general, public service workers are positive to the influence of ICT as long as it supports their work and do not replace it (Busch et al., 2018).

Whereas there are several examples of AI use in the police, research on the opportunities and challenges of utilizing AI for various work tasks is still in its infancy (Alsheibani et al., 2019; Joh, 2018; Jöhnk et al., 2021). From the literature, we can summarize that AI has the potential to deal with information complexity as well as making police work more efficient. Considering the characteristics of police work, often engaging in situations of high information uncertainty, the purpose of this study is to investigate how AI potentially does fit with the information processing needs of the police. This question will be investigated through the perceptions of operational staff and AI experts in the police. Thus, we are not empirically identifying a fit between AI in use and police tasks, but rather its potential fit. This will enable us to better understand for which information processing needs in the police AI is most suitable.

3 Methodology

Since the purpose of this study is to explore a relatively unknown area, a qualitative approach was selected. A limited number of informants is often used, as the focus is an in-depth understanding of the phenomenon of interest (Oates et al., 2022). In this study, we conducted a single case study combining interviews with observations. Our methodological considerations are described below.

3.1 Case overview

Oslo police precinct is the largest in Norway and the main hub for several specialized police functions. The precinct is interesting to study as it is responsible for a wide range of tasks, of which some may be more prone to the use of AI. We therefore considered the precinct well suited for the study.

The selection of the departments in the precinct was made together with a central unit in the precinct, whereas the selection of the informants was made by the department heads. An important criterion was that the sample should represent various police tasks so that differences in the needs between the departments could be identified. Investigation, initial investigation intake, and the operations center were the three departments we recruited our informants from. The investigation department is responsible for the investigation of committed crimes. This department is divided into several sections based on the type of crime. Our informant was working in the section investigating economic crimes. The initial investigation intake is mainly concerned with investigations and interrogations in the initial

phases of crimes. The operations center is responsible for ongoing events leading patrol cars in their area. This work also involves handling communications from the citizens.

The police departments make use of several different systems and databases to collect information. Some of them gather information from several sources. Table 1 summarizes the systems referred to by the police officers in this study.

System	Database(s)	Content
Agent	Multiple	Collects a share of the information from FREG, Autosys, Indicia, PO, POF, ELYS, Strasak, and more.
Autosys	Vehicles and licenses	Status and history of vehicles and drivers' licenses.
BL	Report writing and criminal case database	Reports and other information regarding ongoing or finished investigations.
ELYS	Wanted lists	Information of wanted persons nationally and internationally.
Indicia	Intelligence	Intelligence register containing intern information published by officers.
Infotorg	Multiple	Collects information from multiple external registers, whereof real estates, vehicles, enterprises, and population lists (FREG).
PO	Mission loggings	Information for ongoing patrolling, and the primary logging system for operators.
POF	Photos	Photos of criminals – "mugshots".
PBS Web	Guidelines	Fundamental guidelines of police work in Norway.
Strasak	Criminal cases	Information within investigations of criminal cases.
Tellus	Maps	Map showing available patrol cars.
WebSak	Case processing	Allocations.

Table 1. Systems in use

3.2 Data collection

Observations and semi-structured interviews were conducted. The data was collected by the first author. Prior to the data collection, a permit was obtained from the precinct and the Norwegian center for research data (NSD). Anonymity is common in empirical research. In this study, it was particularly important due to the nature of the work by the operative informants. Consent was obtained well in advance of the data collection. The informants had the opportunity to withdraw their consent at any time.

Interviews were deemed suitable as they can reveal experiences and thoughts of the informants related to the potential use of AI in the police. Two interview guides were developed prior to the interviews; one for the operative staff and one for the experts. They contained semi-structured questions allowing the informants to speak more freely.

In addition, observations were deemed appropriate to increase the understanding of how the informants work. This combination of data collection methods gave us a better understanding of the phenomenon, making us able to triangulate the collected data. Moreover, the triangulation can function as a confrontation between the methods, so that one can discover any differences between the statements of the informants and their actual behavior. The data collection started with the observations before ending with the interviews. The disadvantage is that the informants could be tired after their working day when they participated in the interviews. On the other hand, this order was preferred to avoid their behavior during the observations to be influenced by the questions in the interviews. We developed an observation guide to structure the observations and be able to compare them.

3.2.1 Observations

Observations are conducted to provide a systematic account of how informants behave in their natural working conditions as well as how communication and interaction take place (Oates et al., 2022). Although observations are resource-intensive, they have important advantages. It is a method for us as researchers to gain first-hand experience with the problem. There is a lot of knowledge and experience that is challenging for informants to convey in a good way, and which can thus be omitted from their answers in the interviews. In addition, there may also be elements that the informants either forget or consider irrelevant, to the questions that are asked. Thus, we considered observations well suited as a supplement to the interviews. Table 2 provides a list of the observations made in this study.

#	**Department**	**Duration**
OBS1	Investigation	7 hours for each department (a full shift)
OBS2	Initial investigation intake	
OBS3	Operations center	

Table 2. Observations

3.2.2 Semi-structured interviews

Interviewing is an effective data collection method with great flexibility providing an informant with great freedom to express himself or herself. Semi-structured interviews were conducted being open to follow-up questions (Myers & Newman, 2007). The advantage is that questions can be adapted according to the answers, and thus help us rule out misunderstandings, and at the same time, get elaborate answers if desired. Interviews were made with operative staff and experts within AI and ICT use in the police. Table 3 provides a list of the informants in the operative sample.

#	**Position**	**Department**	**Duration**
O1	Police officer	Investigation	45 mins
O2	Police officer	Initial investigation intake	35 mins
O3	Police officer	Operations center	41 mins

Table 3. Interviews with operative staff

We identified experts who had knowledge about the phenomenon in a police context (Myers & Newman, 2007). Informants were selected based on an identification of key people who could provide valuable insights for the study. Table 4 provides a list of the experts participating in the study.

#	**Position and work area**	**Duration**
E1	Section leader with responsibility for robot process automation (RPA)	65 mins
E2	Section leader for innovation and digitization	45 mins
E3	Professor responsible for research on AI in the police	59 mins

Table 4. Interviews with AI experts

3.3 Data analysis

All the interviews were audio-recorded, transcribed, and sent to the informants for approval. The transcripts were completed shortly after the interviews. The transcriptions were verbatim, but disturbing sounds such as coughing, ahem, and the like were omitted.

As Yin (2014) states, the starting point for any data analysis is to "play" with your data. Therefore, we first went through the data searching for the most suitable methods to analyze the material. Since the informants consisted of two groups, namely the operative staff and the experts, the interviews from each group were analyzed separately before comparing them. Yin (2014) suggests making a matrix of contrasting categories and placing the evidence within. We used pattern matching, which means that we try to identify an empirically based pattern and compare it with one predicted from our literature review (Yin, 2014).

When analyzing the findings, we mapped our data to three important aspects identified in the literature: efficiency, complexity, and staff attitudes. By mapping our data to these aspects, we could easier compare the findings within each category to point out similarities and differences.

3.4 Validity of the findings and study limitations

To assess the quality of the case study, the internal and the external validity were considered. Internal validity concerns the extent to which the findings represent the views of our informants (Guba, 1981). External validity concerns to what extent our findings reflect opportunities and challenges of AI use in the police in general and in other similar contexts (Guba, 1981).

3.4.1 Internal validity

The assessment of the internal validity is guided by criteria developed by Dubé & Paré (2003). The aim of the study is clearly stated focusing on a what type of question, which is typical for case study research (Yin, 2014). The selection of informants was made to elicit the opinions of actors with different interests in and responsibilities for police tasks. Only one researcher was involved in the data collection, and more researchers would increase the validity of the findings (Benbasat et al., 1987; Eisenhardt, 1989). At the time of the data collection, the first author was employed as a police officer in the *Norwegian National Authority for Investigation and Prosecution of Economic and Environmental Crime*. Therefore, data were intentionally collected from departments and functions with which the first author did not have a relationship before. This way, we were able to reduce the likelihood of influencing the informants' behavior and statements. Multiple data sources are synthesized to support the findings. Interview and observation guides were developed prior to the data collection and based on the literature. The data were maintained through a case study database where audio files, transcripts, and notes were saved.

The first author, being a police officer, has sought to look at the data with the eyes of an outsider, but an influence of his own experiences cannot be ruled out. Moreover, we face the limitations of a single case study. During the analysis, we asked ourselves whether there could be other explanations for what we found (Yin, 2014).

We did not consult the informants after the data analysis, but they did receive a full summary of the findings resulting in positive feedback. We have compared our research findings with extant literature and theory building on the work of others. However, this may also be considered a weakness since previous research may bias the data analysis (Eisenhardt, 1989).

3.4.2 External validity

We do not claim statistical generalization (Yin, 2014). For that, the context and the data are limited. However, we have focused the study on tasks that require information processing, discretion, and situational awareness. These are tasks we believe are common for many types of public services (Lipsky, 2010). We expect our findings to be relevant for other police precincts, given that they reside in a country similar to Norway. But we do also expect that other organizations may find our findings relevant, e.g., those within emergency and crisis response services, and to some extent those characterized as street-level bureaucracies where decisions are made on the spot (Lipsky, 2010).

4 Findings

The operative informants had a somewhat limited understanding of AI associating the technology with automation and none of them claimed they had experience with the technology.

“When I think of artificial intelligence, I think [..] that [work] will be easier, less for us humans to do. That robots do the job. That is the first thought.” (O1)

Based on our review of the literature, we identified three prominent categories in which perceptions about AI for situational awareness in the police are discussed.

4.1 Efficiency

Police work can sometimes be very stressful since much uncertainty exists and at the same time more information is needed to make fast and important decisions. The observations revealed a variation in the tasks between the informants such as adding information into systems, handling phone calls and visits from colleagues, looking through a suspect’s cellphone, coordinating interrogations with defense attorney, gathering surveillance data, and handling communication with patrol cars. Time pressure was common for all of them having to handle many inquiries at the same time forcing them to prioritize the most important task. Usually, police officers find the information they need in the first place they look, but it was pointed out that sometimes it takes much time to try out different systems to find out where the needed information is. One of the informants worked in a department, which uses several systems. Many of them are used to obtain information, which again reflects what the informant spent most of his time on collecting data.

"It takes time to search the various systems, and then it takes time to get an overview of what kind of information is necessary and relevant. It varies a lot based on what you search for." (O3)

When information is obtained, the informant needs to spend time to identify what is important and what is less important in the material:

"But getting an overview is perhaps the thing that takes the longest time; finding the most relevant information for the assignment you are working on. [..] And to write down ... we should be provable and verifiable in what we do. I’m supposed to have a quick summary in the log of that information in the assignment." (O3)

The informants in the other departments did not emphasize this problem, probably because less systems are used in these departments. In addition, informant O3 had to summarize information continuously in another system, PO, to keep the patrols up to date. Therefore, it took a lot of time to log the information, which implied that there was less time for data collection. When pressured on the time available, the first priority is life and health and the potential for violence in a situation, which determine how much information a police officer can gather:

"When it is life-threatening [..] it is then it has to go quickly. More information can be collected when you have more time, where you can make more accurate assessments and take your time. It is the time factor that controls what kind of information is collected in various assignments." (O3)

This perspective also emerged from the observations. When there was little time available, the informant had to prioritize the information that was the most critical. It was seldom time to obtain further

information from other systems than Agent and Tellus, although it was desirable. The observing researcher noticed that if other operators were available, they assisted with additional searches. This could be installing a surveillance camera on-site or finding information about the depth of a water with ice. It was clear that there was useful information not obtained due to a lack of time.

The data collection appeared to be relatively similar throughout the various assignments, and PO, Tellus, Agent, and Indicia as well as communication where the main focuses of informant O3. If additional information was required, the informant was dependent on other operators.

The experts explained that AI will be able to do the job faster than humans increasing the information processing capability of the police and better match their information needs. Moreover, they pointed out that it is most relevant as a support tool for police officers, and not as a replacement:

"I think AI is much faster than police officers. So yes, it could do the job better in some areas. AI is a support tool, and we see that in automation, if you look at it big, then ... new technology, AI, the robot does not replace, but it takes away the parts that are repetitive and tiring for people. And then, the employees also work better with this support." (E2)

Since there are large variations in the different work processes, expert E2 was unable to estimate how much time the police can save:

"What AI can do today is to solve specific problems based on the data we have. So, when we say time usage, it's a bit like 'how much time can we save on digitalization?' Yes, a lot. But we have to look at each problem." (E2)

4.2 Complexity

All the informants used many different systems during the observations, often at the same time. One of the informants (O3) used five computer screens with as much as 14-15 software applications running all the time. Many of these applications were not properly connected with each other, which made the work cumbersome since many applications had to be checked to get the required information. For example, a specific surveillance camera should ideally be activated automatically when an incident had occurred in that area. Now, the informant (O3) had to manually identify the camera and activate it. Informant O1 illustrated this issue through other tasks where a social security number had to be registered for a person. The report lacked this information and the informant used 5-10 minutes just to register the number since two systems had to be consulted and tedious searches had to be made if many people were found to have the same name. When collecting information, this task was often based on discretionary assessments by all the informants. For example, when considering tips from the general public (O2). When asked what the most challenging in the process of collecting information is, there were differences in opinions. O1 described challenges as follows:

"It may be challenging to find relevant information. [..] miss out ... you are always a little scared to miss out on good information. [..] You probably never trust the system, so you take a double-check [..]" (O1)

Similar perspectives were noted when the informants were asked how discretionary assessments were made:

"If it is a question about a person having a gun, you have to make a discretionary assessment, search the weapons register; does he actually have access to a gun? Or does he drive drunk; does he have access to a car or which cars has he driven before? So, the information you do not get for free, then, you will need to make a discretionary assessment about". (O3)

The experts explained that the main challenge for using AI in the police is data quality:

"I guess data quality is the biggest problem. I remember we heard at the police academy that David Toska[1] is registered with 13 identities in PO, because people have not written his name correctly." (E2)

The experts highlighted BL as a suitable system for the use of AI to extract information:

"Retrieving information from BL, for example, could be something you use AI for. That it reads through the documents and presents this information. Because there is an incredible amount of information in BL that no one can get hold of because it is not searchable. [..] In BL, the data is semi-structured, which means that a lot of data is structured. So, speech-to-text is a good example of an area where benefits can be achieved. But again, this needs to be user-tested. We have a project on just that, and when we talk to police officers, they say that 'well, it's not certain we'll save that much time because you have to be trained to talk straight if you are going to transcribe using technology. If you just talk normally, the text will be largely unstructured, and you have to adjust a lot afterward." (E1)

It is also possible that assessments are more thought-through with AI compared to when officers carry out the data collection:

"It [AI] is defined by people who have made an assessment in collaboration with the legal department, security staff, and so on. So, it is actually more thought-through rather than if it was an employee who made the assessment." (E1)

In addition, it is easy to adjust the assessments along the way, so that police officers can correct any biases:

"And then it is possible to adjust this all the time, if there is something wrong that it reacts to, you can adjust this for the next time. I do not necessarily think it is a stupid idea for a robot to do this, but you have to take into account that it is wise to make some control searches from time to time. But as a base for information, I think it's a good idea. We see that it is so much information, you drown. As human beings, we are unable to extract all the information that is available and process it. We need help from machines that can pick out information that is unimportant." (E1)

Thus, AI is considered a potential tool to handle data complexity and present it to the police officers. If such a solution was implemented, it would be a significant improvement in the information processing capability of the police. Not only that, but it may also yield information that at present time is unknown since the systems contain so much data that it is difficult for police officers to search and impossible to analyze to discover relationships in the data material. If AI was able to identify new information based on the semi-structured data in the databases, expectations of information needs could increase since the police discovers information they did not know existed. It was pointed out that the police should make an assessment of which technology that is most suitable for the task to be solved. There may not be a need for AI, and search engine optimization may be a better solution to these challenges.

[1] Toska is the convicted mastermind behind the "NOKAS robbery" in Stavanger, Norway in 2004.

"If we are going to collect data from banks; are we going to train it to get the right information or is it the same every time? Do we know what we want? Obtaining information from the banks is an automated task. There, we can develop our systems. If we are going to use artificial intelligence, it must be in those cases we do not know what information we want, we do not know what is relevant. That is perhaps where we could train artificial intelligence to obtain the right information." (E2)

4.3 Attitudes

The observations revealed that much of the work was tedious and cumbersome, and that they would prefer systems that could do the routine tasks. Furthermore, the informants were asked what they thought about using AI to select information. Whereas some were positive, voices of skepticism were also raised:

"No, if it works, then it's great. This, in turn, frees up capacity. If artificial intelligence knows exactly what information I need for the given situation, and I can trust that I will get all that information, and the right information at once, then that's great. [..] Then I must know that I get it every time. And my experience with police systems right now is that I would not trust it." (O3)

Trust in the AI was emphasized, naturally since it is important to have control over all relevant information. Leaving the selection to AI can seem daunting since you may feel that you have less control. The informants want to make sure that the AI is able to do the job as well as them:

"So, if a machine can be that good that it manages to assess it as well as we can, then of course it is ... it makes it more efficient and time-saving. But I can not answer whether I am for or against it, but if a machine is as good at distinguishing between information [as me], then one can only be positive about it." (O2)

The more skeptical informants pointed out that their knowledge of AI was minimal, and that skepticism could come from that. The findings also show that the informants believe it is important that employees gain good experience with such a solution before they can trust it. One of the experts presented some of the experiences from abroad:

"In the United States, for example, similar measures have been used as decision support for judges to assess whether to remand due to the risk of violence in family relationships. There you have really good results to show for, but there are still many who think that it is not acceptable because they are not happy about a tool that [..], it is formally just support, but it is very easy for the judge to base his decision on the algorithm's assessment. So, I do not rule out that it is possible to do, but I think there are several things to think about. That with transparency, and who needs to get an explanation. Having an explanation at a satisfactory level." (E3)

The experts pointed out that the biggest disadvantage is that police officers can begin to rely too much on the technology, and thus, not assure that the information is correct. This can also be problematic against the use of AI:

"Maybe it's about being able to trust the technology, do we get the right information? Do we get what we need? In many assignments where you get enough information, you may want to start relying on AI instead of making your own assessments. If there are too many technical aids, you stop making your own assessments and you stop doing your job. Then, we can hit the wall sooner or later. But we humans make mistakes too, so there is not much difference." (E2)

Thus, from the opinions of the informants, it is clear that they have reservations when it comes to AI's ability to do the tasks as well as they can do them. From a theoretical perspective, this would influence the police officers in that what is expected to be a good fit (AI can provide high-quality information fast) is not trusted, and thus, police officers would hesitate to act on the AI-provided information and could even return to traditional ways of working to ensure that they do not make any mistakes.

5 Discussion

This study aims to find out whether AI can be suitable for police tasks to achieve SA. Whereas police officers traditionally have enjoyed professional autonomy making decisions about what information to collect and how to interpret and make sense of it, now AI has the potential to assist and even replace police officers in these tasks. Emerging from an empirical analysis of police officers working with different tasks in the Norwegian police as well as experts within AI, we advance our understanding of how AI can support the process of collecting and analyzing information in situations where there is much uncertainty and where SA is sought.

AI can contribute to the support and improvement of police work. There was an agreement among the informants that AI should not replace police officers, but rather serve as a support tool so that they can prioritize resources differently. This is in congruence with literature on public service workers in the frontline stating that ICT is considered positively when utilized as a support tool rather than a replacement tool (e.g., Busch et al., 2018). Such an arrangement would lead to an increase in information processing capability as depicted in OIPT (Galbraith, 1974). Much research is needed to prepare for the widespread adoption of AI to achieve SA in police situations with high uncertainty. Whereas the police globally have tried out different AI initiatives, the use in more information-critical situations is under-researched.

The findings indicate that there is greater skepticism among police officers as to the extent to which AI can deliver as good results as they can provide themselves. At the same time, our findings suggest that if police officers can see good results in the use of AI, they will be positive about the technology. The experts believe that there are many opportunities, but there are mixed opinions as to how far it is possible to use AI for data collection in the police. Previous studies have shown good results for some applications areas with the use of AI, but police skepticism should be an important part of further research in the field. Especially, this concern refers to the complexity and unpredictability of police work on a daily basis. As such, the acceptance of AI is premised on the perception that police work, as a profession, is unique and cannot be replaced by ICT (cf., Lipsky, 2010). More specifically, the acceptance of AI among police officers is dependent on the situation in which it should be used. Whereas the unified theory of acceptance and use of technology (UTAUT) does not contain a context-specific construct as antecedent of performance expectancy and effort expectancy, there are studies that have taken context into account (e.g., Cao & Niu, 2019).

Moreover, the potential as to how AI can make police work more efficient is somewhat unclear. How can time-consuming tasks be done automatically or in a way that eases the burdens of police officers? Fully automated police would be very cost-effective, but hardly any interesting for professional police officers. Thus, the dichotomy between professionalism and managerialism still prevails.

The most challenging part of the data collection process is selecting information relevant to a situation. The great advantage of AI is nevertheless the ability to analyze large amounts of data in a short time to support or to make decisions. Thus, AI can assist both in terms of handling complexity and increase the efficiency of police work. Police officers are in general positive about getting help from AI since they are afraid of missing out on important information. It is experienced as a big responsibility to decide what information to collect or not. What makes the responsibility even more pressing is that these assessments can be of great significance for a case and impact the lives of others. Police officers are therefore careful when handling information in cases making sure that any errors are avoided. The potential is to save considerable time if AI is utilized for assessments and provided that AI is used as a tool for support, makes it possible to achieve better quality in policing while maintaining control.

A challenge with AI is that of data quality. Much data in police systems is unstructured, and many databases have erroneous data. This is a phenomenon well-known from other fields such as in electronic health records where it is important for doctors to identify the most vital patient data for use in a perhaps critical situation (Berge, 2016). Therefore, it is challenging to filter information in such a way as to avoid duplication of data and imbalanced datasets. According to our AI experts, some systems contain more information about a certain type of crime than others. According to estimates, one of the databases contain 80% drug-related crimes, 18% sex-related crimes, and 2% of other crimes. If police officers should predict crime based on the information in this database, it would be done with an algorithm that is skewed towards drug-related crimes. Such biases are challenging because they can be perceived as discriminatory for those involved. In addition, it is a challenge to access training data due to confidential information. This would imply anonymization of data, which makes it difficult to develop good algorithms. Together with many different data formats, this development can be challenging. Training data is a necessary prerequisite to develop good algorithms in AI. The ICT acceptance literature has been developed considering ICT to perform in similar manners every time it is used in a specific context. AI, on the other hand, develop as it is trained with data. This can influence the performance expectancy of its users as AI's performance can differ from one time to another.

There are laws and rules defining requirements for how the police record their exercise of authority (Norwegian Police Authority, 2018). It is therefore important that ICT solutions provide sufficient verifiability in the processes and that the documentation retains its authenticity and readability in line with the requirement for retention time. There was a difference of opinions among the experts as to whether AI can strengthen or weaken the privacy of the population. Whereas some thought that better privacy is achieved by using AI since it has nothing to do with the data, other experts believed that one must consider the result of such mass collection of data. In Norway, there is a foundational privacy principle regarding data minimization; the amount of personal data collected must be limited to what is necessary to realize the purpose of the data collection. The experts believed that there should be a larger discussion about where to set the bar for the kind of information to be collected. However, it is entirely possible to use AI as long as you have strict control and a clear purpose, while at the same time assessing the proportionality of its use in relation to privacy. However, this would require both training and abilities to critically evaluate the amount of data collected at any given time. Since AI is dependent on much data, its ability to strengthen the information processing capabilities of the police may differ based on various police situations.

The possibility of supervision and control with algorithms used in the justice system has been problematized, arguing that the public should be able to gain insight into the assessments and assumptions that are the basis for analysis and how data are obtained (e.g., Freeman, 2016). Several of the experts agree with this arguing that transparency in the assessments will be central to gaining acceptance in the population referring to how much resistance the US has received due to lack of transparency (Liu, Lin, & Chen, 2018). When using AI, the tool must comply with the legislation and with ethical principles as well as be technically and socially robust. Whereas the skepticism of police officers is important, concerns of the citizens are also an important avenue for future research since the consequences of using AI are also relevant for them.

Even though the study has a limited data set, we put forth two recommendations for practice based on our findings. These recommendations are recognizable from the ICT adoption literature, although with other types of technologies. Firstly, we recommend that the police map and identify important tasks and situations that are suitable for the use of AI. There are differences regarding how much time AI can save on the various tasks that police officers do. In this study, the operations center used more diverse systems than investigators, and the time pressure was greater there. The operations center could therefore be a type of police department that is particularly suitable for streamlining the data collection with AI.

Secondly, police officers should be involved, before and during the implementation of AI. Research shows that involvement in ICT adoptions reduces resistance from employees. In our study, the police officers were positive regarding AI as a support tool in their existing work practices, but hesitant to whether AI could do their job equal to or better than them. It is therefore important that the police officers experience the benefits of AI, and in that way increase confidence in the technology.

References

Alsheibani, S., Cheung, Y., & Messom, C. (2019). Factors Inhibiting the Adoption of Artificial Intelligence at organizational-level: A Preliminary Investigation. *AMCIS Proceedings*. https://aisel.aisnet.org/amcis2019/adoption_diffusion_IT/adoption_diffusion_IT/2/

Angwin, J., & Valentino-DeVries, J. (2012). New tracking frontier: Your license plates. *Wall Street Journal*.

Benbasat, I., Goldstein, D., & Mead, M. (1987). The case research strategy in studies of information systems. *MIS Quarterly*, *11*(3). https://doi.org/10.2307/248684

Berge, G. (2016). Drivers and barriers to structuring information in electronic health records. *PACIS 2016 Proceedings*. https://aisel.aisnet.org/pacis2016/18/

Busch, P. A., Henriksen, H. Z., & Sæbø, Ø. (2018). Opportunities and challenges of digitized discretionary practices: a public service worker perspective. *Government Information Quarterly*, *35*(4), 547–556. https://doi.org/10.1016/j.giq.2018.09.003

Cao, Q., & Niu, X. (2019). Integrating context-awareness and UTAUT to explain Alipay user adoption. *International Journal of Industrial Ergonomics*, *69*, 9–13.

Dechesne, F., Dignum, V., Zardiashvili, L., & Bieger, J. (2019). AI & Ethics at the Police: Towards Responsible use of Artificial Intelligence in the Dutch Police. *Leiden University Center for Law and Digital Technologies (ELaw) and TU Delft Institute of Design For Values*.

Dubé, L., & Paré, G. (2003). Rigor in information systems positivist case research: current practices, trends, and recommendations. *MIS Quarterly*, *27*(4), 597–635. https://doi.org/10.2307/30036550

Dunnett, S., Leigh, J., Operational, L. J.-J. of the, & 2019, undefined. (2018). Optimising police dispatch for incident response in real time. *Taylor & Francis*, *70*(2), 269–279. https://doi.org/10.1080/01605682.2018.1434401

Eisenhardt, K. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550. https://doi.org/10.5465/amr.1989.4308385

Eligon, J., & Williams, T. (2015). Police program aims to pinpoint those most likely to commit crimes. *New York Times*.

Endsley, M. R. (1995). Toward a theory of situation awareness in dynamic systems. *Human Factors*, *37*(1), 32–64. https://doi.org/10.1518/001872095779049543

Fracker, M. (1991). *Measures of situation awareness: Review and future directions*.

Freeman, K. (2016). Algorithmic injustice: How the Wisconsin Supreme Court failed to protect due process rights in State v. Loomis. *North Carolina Journal of Law & Technology*, *18*(5), 75–106. https://scholarship.law.unc.edu/ncjolt/vol18/iss5/3?utm_source=scholarship.law.unc.edu%2Fncjolt%2Fvol18%2Fiss5%2F3&utm_medium=PDF&utm_campaign=PDFCoverPages

Galbraith, J. R. (1974). Organization Design: An Information Processing View. *Interfaces*, *4*(3), 28–36. https://doi.org/10.1287/INTE.4.3.28

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication & Technology*, *29*(2), 75–91. https://doi.org/10.1007/BF02766777

Harfouche, A., Quinio, B., Skandrani, S. R., & Marciniak, R. (2017). A Framework for Artificial Knowledge Creation in Organizations. *Proceedings of the 38th International Conference on Information Systems (ICIS)*.

Heuvel, C. van den, Alison, L., & Power, N. (2014). Coping with uncertainty: Police strategies for resilient decision-making and action implementation. *Cognition, Technology & Work Volume*, *16*, 25–45. https://doi.org/10.1007/s10111-012-0241-8

Hofmann, P., Jöhnk, J., Protschky, D., & Urbach, N. (2020). Developing Purposeful AI Use Cases: A Structured Method and Its Application in Project Management. *15th International Conference on Wirtschaftsinformatik (WI)*. https://doi.org/10.30844/wi_2020_a3-hofmann

Joh, E. E. (2018). Artificial Intelligence and Policing: Hints in the Carpenter Decision. *Ohio State Journal of Criminal Law*, *16*(281). https://ssrn.com/abstract=3238212

Jöhnk, J., Weißert, M., & Wyrtki, K. (2021). Ready or Not, AI Comes— An Interview Study of Organizational AI Readiness Factors. *Business and Information Systems Engineering*, *63*(1), 5–20. https://doi.org/10.1007/S12599-020-00676-7

Jordan, M., & Mitchell, T. (2015). Machine learning: Trends, perspectives, and prospects. *Science*, *349*(6245). https://doi.org/10.1126/science.aac4520

LeCun, Y., Bengio, Y., nature, G. H.-, & 2015, undefined. (2015). Deep learning. *Nature.Com*. https://doi.org/10.1038/nature14539

Lipsky, M. (2010). *Street-level bureaucracy: Dilemmas of the individual in public service* (2nd ed.). Russell Sage Foundation.

Manning, P. K. (1992). Information Technologies and the Police. *Crime and Justice*, *15*, 349–398. https://doi.org/10.1086/449197

Moser, R., Kuklinski, C., & Srivastava, M. (2017). Information processing fit in the context of emerging markets: An analysis of foreign SBUs in China. *Journal of Business Research*, *70*. https://doi.org/10.1016/j.jbusres.2016.08.015

Myers, M., & Newman, M. (2007). The qualitative interview in IS research: Examining the craft. *Information and Organization*, *17*(1). https://doi.org/10.1016/j.infoandorg.2006.11.001

Norwegian Police Authority. (2018). *Strategy for the future ICT function in the police [Norwegian]*. https://pox.no/stou

Oates, B., Griffiths, M., & McLean, R. (2022). *Researching Information Systems and Computing: Vol.* (2nd ed.). SAGE.

Premkumar, G., … K. R.-J. of M., & 2005, undefined. (2005). Information processing view of organizations: an exploratory examination of fit in the context of interorganizational relationships. *Taylor & Francis*, *22*(1), 257–294. https://doi.org/10.1080/07421222.2003.11045841

Rai, A., Constantinides, P., & Sarker, S. (2019). Editor's Comments: Next-Generation Digital Platforms: Toward Human-AI Hybrids. *MIS Quarterly*, *43*(1), iii–ix.

Russell, S., & Norvig, P. (2016). *Artificial intelligence: a modern approach*. Pearson Education Limited.

Steen-Tveit, K. (2020). Identifying information requirements for improving the common operational picture in multi-agency operations. *Proceedings of the 17th ISCRAM Conference*.

Tushman, M. L., & Nadler, D. A. (1978). Information Processing as an Integrating Concept in Organizational Design. *Academy of Management Review*, *3*(3), 613–624. https://doi.org/10.5465/AMR.1978.4305791

Wuschke, K. E., Andresen, M. A., Brantingham, P. J., Rattenbury, C., & Richards, A. (2018). What do police do and where do they do it? *International Journal of Police Science and Management*, *20*(1), 19–27. https://doi.org/10.1177/1461355717748973

Yin, R. (2014). *Case Study Research: Design and Methods*. SAGE.