The Effects of Investigator's Individual Factors on Investigative Decision Making: A Systemic Review

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Abstract

At the center of a criminal investigation is the ability of the lead investigator to identify all possible hypotheses, make sense of the information available and define appropriate investigative actions. These characteristics are usually dependent on what has been termed as investigative decision making, the process where an investigator analyzes the evidence and decides which actions to take. Previous research and reports have identified situational, organizational, and individual factors that may hinder or improve investigative decision-making. The present paper aims to identify which individual factors have been empirically tested concerning investigative decision making, and how they affect it. A systematic review was conducted, nine peer-reviewed papers were analyzed, and five factors were identified: Experience, Gender, Need for Cognitive Closure (NFC), Time-urgency, and Fluid Intelligence. Experience had mixed findings, suggesting that how officers developed expertise is more important than time on the job. Gender was only significantly related to investigative decision-making in a specific scenario. Low NFC, non-time-urgent individuals, and high fluid intelligence were related to effective investigative decision-making. Recommendations for the future academic development of the field, and how police forces can apply this knowledge are suggested.

Keywords

INTRODUCTION

During a criminal investigation, there are dozens of decisions that investigators must make (Spanoudaki, Ioannou, Synnott, Tzani-Pepelasi & Pylarinou, 2019). In a situation where a body has been found, they may want to explore the idea that it was a fatal accident, a robbery has gone wrong, a murder, or a suicide. Each of these possible hypotheses will require the allocation of resources and time to be followed up. Investigators must decide who needs to be interviewed, which forensic experts need to be consulted to solve the case, if/when someone must be considered a prime suspect, if/when this suspect should be accused and detained, among other considerations. This process of making sense of the available information and deciding which course of action to follow from several possible options has been termed investigative decision making.

Unlike day-to-day decision making, such as which route to take from work, or which product to buy from the store, investigative decision making is extremely complex due to the high number of possible explanations for a single incident, the ambiguity and incompleteness of information available, and pressure from multiple sources to quickly solve every criminal incident (Rossmo, 2009). On top of that, the consequences of faulty investigative decision making are disastrous; several reports have identified how it has led to misallocation of scarce police resources and miscarriages of justice such as wrongful arrests and wrongful convictions (Rossmo & Pollock, 2019). Given its uniqueness and far-reaching consequences that affect those directly involved (e.g., investigators and suspects) and public trust in the criminal justice system, investigative decision making has gained increased attention from researchers and practitioners seeking to improve it and avoid pitfalls.

Many high-profile cases have highlighted how investigators fell prey to cognitive biases when making decisions, which hindered their investigative capacity and led to wrongful arrests or convictions (Simon, 2012). The most commonly identified bias in the investigative context is the confirmation bias, a phenomenon where people tend to search for evidence that confirms (rather than falsify) an initial belief, position, or opinion held (Rossmo & Pollock, 2019). Under confirmation bias, investigators may develop tunnel vision, a state in which they focus on a single specific suspect or narrative of what has occurred, seeking only confirmatory evidence while neglecting

or misinterpreting any competing evidence (Ask & Fahsing, 2018).

In addition to cognitive biases, heuristics may also negatively affect investigative decision making. While biases are erroneous thought patterns, heuristics are mental shortcuts that help us make sense of large quantities of information and make decisions more easily (McLaughlin, Eva & Norman, 2014). A type of heuristics is the satisficing heuristic, where people will search for as many available options as they can before settling for one that is "good enough" (Bendor, Kumar & Siegel, 2009). It has been found that investigators may use satisficing heuristics when making decisions, given that they search for possible explanations or suspects only until they find a "good enough" fit, after which they would then focus on finding incriminating evidence (Ask & Alison, 2010).

Although heuristics have been proven to lead to accurate outcomes most of the time, even when compared to statistical approaches, it can lead people on the wrong course sometimes (McLaughlin et al., 2014). Snook and Cullen (2009) made a case for the use of heuristics in investigative decision making; however, there has been no further testing of their accuracy and applicability in this context. Considering that one mistake in a criminal investigation may lead to the imprisonment of an innocent person, heuristics should be avoided before its applicability and consequences to investigative decision making are thoroughly understood.

In light of this, efficient investigative decision making must avoid relying on heuristics or falling to cognitive biases, but how can investigators develop the necessary skills or adopt the investigative mindset to thoroughly investigate every criminal incident and overcome these obstacles? Academics and practitioners have proposed some characteristics and actions on how to improve investigative decision making. Investigators must have an "open-mind" perspective when investigating any case, no matter how simple it may seem they must not jump to conclusions and consider every possible alternative for the incident (Lepard & Campbell, 2009). On top of that, they must make an effort to avoid biases and heuristics, such as considering the opposite to avoid confirmation bias and exhaustively investigating possible hypotheses to avoid satisficing (Ask & Fahsing, 2018). These characteristics and actions can be summarised in an investigative decision making style that considers all possible hypotheses and works towards falsifying (instead of confirming) each hypothesis, the hypothesis that cannot be falsified is the most likely to be true.

Unfortunately, it is not that simple, interviews with experienced investigating

officers and reviews of high profile cases indicate that   are influencing effective investigative decision making (Ask & Fahsing, 2018; Spanoudaki et al., 2019; Rossmo & Pollock, 2019). These can be divided into three categories: organizational, situational, and individual. Organizational factors are those typical of policing or police forces' structure, such as training, work relations, policies, and guidelines. For example, some police forces require investigators to record all decisions made during a criminal investigation for future analysis of their decision making (Dando & Ormerod, 2017). However, it may lead investigators to avoid making decisions and let the case drift on because of anticipated regret, which can result in loss of important investigative leads due to the passage of time.

Situational factors are external influencers, an environmental feature, characteristics of the crime, or contextual variables during the investigation. A frequent situational factor of criminal investigations is time pressure as detectives often have to quickly solve their cases and move on to the next. Under time pressure, investigators' abilities to keep an open mind, generate competing hypotheses from the same information, and avoid impulsive conclusions are hindered. (Ask & Alison, 2010). Other situational factors include emotional impact caused by each case (e.g., an especially brutal murder or child sexual abuse) and media attention (Crego & Alison, 2004; Spanoudaki et al., 2019).

Individual factors are related to the personal characteristics of the investigator, such as their gender, experience, personality traits, and cognitive abilities. Studies on gender differences in decision making have identified that men performed better than women on tasks related to heuristics and biases, such as statistical reasoning and actively open-minded thinking (Toplak et al., 2016; Weller et al., 2018). On the other hand, men have also been found to process information selectively, ignoring potential risks as long as they achieve their goal, while women are more considerate of the benefits and risks of a decision (Byrne & Worthy, 2016). These differences generate ambiguous expectations as to how investigative decision making may be affected by gender because male detectives appear to be less susceptible to heuristics and biases. However, their decision making style is impulsive and inconsiderate of the negative consequences, which could lead them to make hasty judgments and jump to conclusions.

Experience is often cited by investigators as a predictor of good decision making (Spanoudaki et al., 2019). Experienced decision-makers are expected to make

decisions faster and achieve better outcomes because of the larger mental database of cases they have access to. They can assess a situation, compare it to previous scenarios and choose a course of action that worked in the past for a similar case (Klein, 1993). Research on medical decision making found that domain-specific experts generated accurate diagnoses sooner than non-domain-specific experts (Stolper et al., 2011).

Although experience indeed leads to faster and accurate decisions, it can also lead professionals to consider fewer hypotheses and rely on heuristics to solve problems. The same research on medical decision making found that doctors relied on "gut instinct" to select the correct diagnoses and, since they identified the correct hypotheses sooner, they also generated fewer hypotheses (Stolper et al., 2011). This highlights that more hypotheses do not necessarily mean better hypotheses and that experts often use satisficing heuristics. However, when investigators do not consider all hypotheses, they may fall under the influence of tunnel vision, which has well-known negative consequences (Rossmo & Pollock, 2019).

Personality traits such as time-urgency and the Need for Cognitive Closure (NFC) are also thought to influence decision making. Time-urgency refers to how people perceive the passage of time, time-urgent (vs non-time-urgent) people often perceive time to pass faster than it does, which affects how they perform in problem-solving tasks (Conte, Mathieu & Landy, 1998). Considering that external time pressure hinders decision makers abilities to consider multiple hypotheses and fall prey to cognitive biases, it is expected that internal time pressure (time-urgent individuals) will have similar effects. On the other hand, non-time-urgent individuals may be better equipped to deal with external time pressure, reducing its negative consequences on decision making.

NFC is a psychological term that refers to how people deal with certainty and ambiguity, it has been described as "the desire for a definite answer on some topic, any answer as opposed to confusion and ambiguity" (Kruglanski, 1990, p. 337). High NFC people are prone to attain closure as soon as possible, looking for any suitable explanation or solution for a problem. For that reason, they are more likely to seize and freeze on an early judgment of the situation. Low NFC people deal better with uncertainty and suspend committing to an early judgment, they are comfortable with searching for alternative explanations or solutions. In light of this, the "open-minded" characteristic of a good investigator is opposite to high NFC because these individuals

do not deal effectively with the uncertainty of considering multiple possible hypotheses for a criminal investigation, they will search for quick suitable answers that provide them closure, which could lead to confirmation bias.

It has long been recognized that intelligence is not a single construct but a combination of different types of intelligence. The Cattel-Horn-Carroll (CHC) model posits that intelligence can be divided into three strata, one that is general intelligence, a second that consists of broad intellectual capacities, and a third that encompasses narrow intelligence abilities (Primi, 2003). Fluid intelligence is part of the second stratum, it is a broad intelligence capability that refers to ones' ability to reason and solve new problems (McGrew, 2009). Research on fluid intelligence has identified that it is linked to performance in different settings, such as better academic performance (Colom et al., 2007; Ali & Ara, 2017), better performance on intellectually demanding video games (Kokkinakis, Cowling, Drachen & Wade, 2017), and solving complex problems (Tschentscher, Mitchell & Duncan, 2017). Considering that investigative decision making is, in essence, solving problems ("what happened", "how it happened", "who did it") and is intellectually demanding, it is expected that individuals who score high on fluid intelligence measures will perform better at investigative decision making tasks.

Even though situational, organizational, and individual factors have significant influence over investigative decision making, individual ones seem to moderate the effect of the others. For example, time pressure has significant detrimental effects on investigative decision making, but if the investigators are non-time-urgent, these effects are diminished. In addition, every investigator will be subjected to situational and organizational factors, but how much they will be affected by it will vary according to their characteristics. Considering the importance of individual differences and the plethora of individual factors that can, in theory, affect investigative decision making, the present paper aims to: 1) Identify which individual factors have been empirically tested concerning investigative decision making; 2) Analyse how these factors influence investigative decision making.

To achieve these objectives, a systematic review of the literature was conducted, given that it is the most reliable method for identifying, evaluating, and synthesizing the available scientific evidence on a given subject (Siddaway, Wood & Hedges, 2019). Furthermore, systematic reviews are particularly useful for informing practice and public policies. In this case, we as researchers, practitioners, and society need to

know which individual characteristics are connected to potentially better investigative outcomes. Virtually every police force in the world uses psychological assessment before admitting an officer into its ranks, especially if this officer is going to be responsible for conducting high complexity criminal investigations. Therefore, knowledge of which characteristics to look for or develop in investigating officers is essential to achieve a more complete and error-proof justice system.

Method

Systematic review protocol

A systematic search was carried out in four databases: PsycInfo, Microsoft Academics, PubMed, and *Periódicos Capes* (a Brazilian academic search database that encompasses over 48.000 journals worldwide). To identify every research that analyzed investigative decision making and potential individual factors influencing investigators abilities, the following descriptors were used: "Investigative Decision Making" AND (individual* OR personal*); "Police Decision Making" AND (individual* OR personal*); "Detective Decision Making" AND (individual* OR personal*). These Boolean operators were used to ensure that papers considering investigative decision making and either individual or personal characteristics were included in the present review, including any possible writing, derived from "individual" (e.g., individually, individuality) and "personal" (e.g., personality). The term "investigative decision making" was chosen because it is widely used by both researchers and practitioners to refer to the specific situation of making decisions when investigating a possible crime. However, to consider possible differentiation in terms used by researchers, "police decision making" and "detective decision making" were also used. Finally, no time cut was made to ensure that all available publications would be considered.

Inclusion and exclusion criteria

Publications were included if the full text was available in English and if it had been published in scientific journals and undergone peer-review. These criteria were used to ensure the quality and availability of the publications considered. Studies that

had not followed an empirical methodology, such as literature reviews were excluded. However, any publication that discussed the matter was analyzed in search of potential papers in the references that were not found through the databases. Only papers that a nalyzed individual or personal factors and their relation to investigative decision making were included. Finally, papers that addressed police or legal decision making in a different context than the process of a criminal investigation were excluded.

Selection process

According to this research protocol, a total of 690 studies were initially identified, of which 17 were collected through additional sources other than the scientific databases (analyses of references used in book chapters and papers on investigative decision making). After the initial assessment, 64 of them were excluded because they were duplicates present in more than one database or repeated documents in the same database. The title and abstracts of the remaining 626 studies were assessed, resulting in 21 papers being considered for further evaluation. Lastly, all 21 papers were read in full; however, only 9 of them met all inclusion and exclusion criteria. A flowchart of the systematic review process is presented in Figure 1.
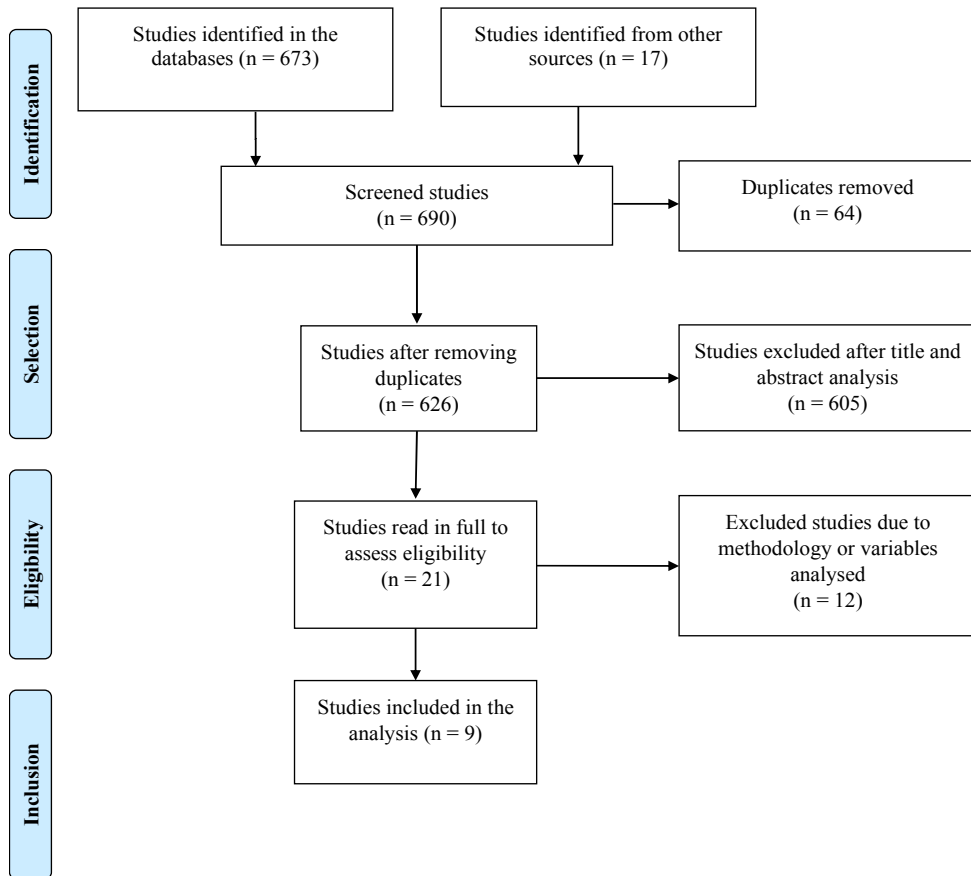
Figure 1: Flowchart of the systematic review

Results

Upon examination of all nine papers that met the inclusion criteria, it has been identified that they analyzed different variables or the same variables in different ways (Table 1 provides a summary of the nine studies). In these situations, a narrative synthesis is recommended because it analyses a collection of quantitative studies that used diverse methods, constructs, or relationships. This method of interpreting results from a systematic review synthesizes the results of individual quantitative studies and is useful to organize findings from different studies around the same subject, to understand how and why a variable has an effect over another (Siddaway et al., 2019).

Table 1: Summary of studies analyzing individual factors and investigative decision making

Research paper	Sample	Independent Variable definition/measurement	Study design	Study aims	Key findings
Expertise and decision making in the linking of car crime series (Santtila, Korpela & Häkkänen, 2004)	n = 33 (9 experienced car crime investigators; 9 experienced investigators of other crimes; 7 novice investigators; 8 no investigative experience). Finnish sample.	Experience defined of at least one year full-time as an investigator (and 5 cases of car crime investigation monthly for experienced car crime investigator); novice had less than 6 months experience as a full-time investigator.	Comparative design measuring participants' abilities to link car thefts together; ANOVA analysis.	Identify whether the experience was related to accurate linking of car crime series.	Experienced investigators with domain-specific knowledge performed better than laypeople in linking car thefts.
Motivational Sources of Confirmation Bias in Criminal Investigations: The Need for Cognitive Closure (Ask & Granhag, 2005)	n = 118 (50 criminal investigators and 68 undergraduate students). Swedish sample.	Criminal investigators had varying degrees of investigative experience (between 2 and 30 years), while undergraduate students had no investigative experience. NFC scale was used to measure NFC (Kruglanski, Webster & Klem, 1993)	Experimental design using manipulated case vignettes about suspect's guilt. Comparison according to experience and NFC. Regression analyses	Verify if NFC and experience moderated the effect of hypothesis perception over the strength of evidence against the suspect.	Investigators presented a "guilt bias" when compared to students. Students were more responsive to potentially exonerating information. Investigators with high (vs low) NFC were less likely to acknowledge evidence contrary to their hypothesis of guilty over the suspect.
Gender Difference or Indifference? Detective Decision Making in Sexual Assault Cases (Alderden & Ullman, 2012).	n = 328 criminal sexual assault cases involving adult female victims reported to a large Midwestern police department in 2003. No cases with multiple, victims, suspects, or investigating detectives were included.	Gender was coded dichotomously (male or female).	Case analysis using logistic regression.	Examine whether gender differences exist in detectives' arrest decisions in sexual assault cases.	Female detectives were significantly less likely to arrest suspects in sexual assault cases even after controlling for the influence of other factors shown to predict arrest.
The Effects of Subjective Time Pressure and Individual Differences on Hypotheses Generation and	n = 76 police officers from a rural UK police force. (n = 35 under time	Experience is defined by the years of domain-specific experience in crime investigation. Used Time	Experimental design manipulating time pressure. Regression analyses.	Examine whether individual differences moderate the effect of time pressure on the	Under time pressure, the experience did not moderate the number of hypotheses generated, time-urgent investigators had a

Research paper	Sample	Independent Variable definition/measurement	Study design	Study aims	Key findings
Action Prioritization in Police Investigations (Alison, Doran, Long, Power & Humphrey, 2013).	pressure manipulation; n = 41 control group).	Paradigm 1.0 (Dougherty et al., 2003) to measure time-urgency. Raven's standard progressive matrices are used to evaluate fluid intelligence (Raven et al., 2003).		number of hypotheses generated.	larger reduction in the number of hypotheses generated than non-time-urgent investigators. Investigators with high (vs low) fluid intelligence generated more hypotheses.
Homicide Detectives' Intuition (Wright, 2013)	n = 40 homicide detectives (10 Detective Constable and Sergeants; 10 Detective Inspectors; 10 Detective Chief Inspectors; 10 Detective Superintendent). British sample.	Experience defined according to rank	Card sorting procedure using crime scene photographs; Think aloud method to categorize and verify number and quality of inferences made. t-test analysis.	Examine the thought processes of detectives when first notified of a homicide; how they categorize and conceptualize different homicide crime scenes and whether the cognitive processes of experienced detectives differ from those less experienced.	Higher-ranking officers (Detective superintendent) made significantly more inferences than the others. Accuracy of inferences has no significant differences across ranks.
The Making of an Expert Detective: The Role of Experience in English and Norwegian Police Officers' Investigative Decision Making (Fahsing & Ask 2016)	n = 124 police officers (31 experienced officers and 30 novice officers from England, 32 experienced officers and 31 novice officers from Norway)	Experienced homicide detectives must have at least 10 years of experience as a detective, and currently, be in charge of major crime investigations. Novice officers must currently work as patrolling officers, have no more than 2 years of policing experience, and have no further education as detective.	Quasi-experimental design comparing the quality of investigative decisions made by experienced detectives and novice police officers in England and Norway Mixed ANOVA analyses.	Compare detectives' ability to generate investigative hypotheses and actions, as well as their vulnerability to investigative tipping points, across different qualification and training regimes and different levels of experience.	Experienced British investigators generated more hypotheses and investigative actions than inexperienced officers. However, the experience did not have a significant effect on a Norwegian sample.
Analyzing Decision Logs to Understand Decision Making in Serious Crime Investigations (Dando &	n = 60 decision logs randomly selected, which accounts for the decision making of 14 Senior	Experienced investigators had over five years of experience in leading investigations, while less experienced investigators had	Quantitative analysis to identify the number of hypotheses generated and qualitative analysis	Study decision making by detectives when investigating serious crime through the	Experienced investigators generated more hypotheses than inexperienced investigators.

Research paper	Sample	Independent Variable definition/measurement	Study design	Study aims	Key findings
Ormerod, 2017)	Investigating Officers. British sample	three years or less.	to consider the content of those hypotheses. ANOVA analysis.	examination of decision logs to explore hypothesis generation and evidence selection.	
In Search of Indicators of Detective Aptitude: Police Recruits' Logical Reasoning and Ability to Generate Investigative Hypotheses (Fahsing & Ask, 2017).	n = 166 newly recruited students at the Norwegian Police University College	Inductive and Deductive Reasoning skills measure by a cognitive aptitude test administered online by a recruitment company. The specific test is not mentioned. Non-significant variables are not explored.	Use of case vignettes to measure quantity and quality of hypotheses generated against independent variables. Multiple regression analysis.	Test if measures of inductive and deductive reasoning skills used for recruitment to the Norwegian police can predict recruits' ability to generate investigative hypotheses, and if these differences moderate participants' vulnerability to decisional tipping points.	Inductive and deductive reasoning abilities did not explain any of the variances in the generation of gold-standard hypotheses. Gender, age, previous higher education, or preference for future detective work were not related to the proportion of high-quality hypotheses.
The impact of individual differences on investigative hypothesis generation under time pressure (Kim, Alison & Christiansen, 2020)	n = 133 Korean detectives. (n = 66 under time pressure manipulation; n = 67 control group).	Used Time Paradigm 1.0 (Dougherty et al., 2003) to measure time-urgency. Raven's standard progressive matrices are used to evaluate fluid intelligence (Raven et al., 2003). NFC scale shortened version was used to measure NFC (Roets and Hiel, 2011). Experience is defined by the years of domain-specific experience in crime investigation.	Experimental design manipulating time pressure. Regression analyses.	Examine whether individual differences moderate the effect of time pressure on the number of hypotheses generated.	Under time pressure, experienced investigators generated hypotheses of higher quality but there was no significant effect on the number of hypotheses. High (vs low) NFC investigators generated significantly fewer hypotheses. Time-urgent investigators reduced the quantity and quality of hypotheses generated, while non-time-urgent investigator did not reduce their performance. Investigators with high (vs low) fluid intelligence had better performance in quantity and quality of hypotheses generated.

Demographic information differed across the included studies. The sample sizes varied from 14 to 166 participants, while there was one study, which did not allow to differentiate how many participants were considered (Alderden & Ullman, 2012). They analyzed 328 criminal sexual assault cases from police cases and investigatory files, but the same investigator could have been responsible for more than one case under analysis. The other eight studies, while delineating their participants, had different sampling methods according to the aims of their study. Some researchers used a sample of police officers and non-police officers (Ask & Granhag, 2005), others opted for varying degrees of experience among police officers (Dando & Ormerod, 2017; Fahsing & Ask, 2016; Wright, 2013), or a combination of both (Santtila et al., 2004), while some studies considered a homogeneous sample of police officers (Alison et al., 2013; Fahsing & Ask, 2017; Kim et al., 2020).

Demographic characteristics of the samples also varied according to country. A British sample was used, either completely or partially, in most of the studies (Alison et al., 2013; Dando & Ormerod, 2017; Fahsing & Ask, 2016; Wright, 2013), a Norwegian sample was used in two studies (Fahsing & Ask 2016; Fahsing & Ask, 2017) and each of the other four studies used samples from different countries: Finland (Santilla et al., 2004), Sweden (Ask & Granhad, 2005), USA (Alderden & Ullman, 2012) and South Korea (Kim et al., 2020). Most of the studies were conducted in European countries highlighting the need to expand research on the topic to other continents, particularly because different countries have different detective training.

Differences were also identified regarding the type of crime studied. Four different types of crimes were used to assess investigative decision making: Sex offenses (Alderden & Ullman, 2012; Alison et al., 2013; Kim et al., 2020), Homicide (Ask & Granhag, 2005; Wright, 2013); Missing person (Fahsing & Ask, 2016; 2017), Car theft (Santilla et al., 2004), and a single study used multiple crime types (Dando & Ormerod, 2017). Furthermore, sometimes researchers used real crimes as means to analyze decision making (Alderden & Ullman, 2012; Dando & Ormerod, 2017; Santilla et al., 2004; Wright, 2013), and sometimes they created a semi-fictitious case (Alison et al., 2013; Ask & Granhag, 2005; Fahsing & Ask, 2016; 2017; Kim et al., 2020).

Assessment of investigative decision making also varied across studies. Most of the studies considered either the number of investigative hypotheses generated, their

quality, or both (Alison et al., 2013; Dando & Ormerod, 2017; Fahsing & Ask, 2016; 2017; Kim et al., 2020; Wright, 2013). The other studies considered a specific decision made, such as whether two or more crimes were linked (Santilla et al., 2004), whether participants would acknowledge evidence contrary to their initial hypothesis (Ask & Granhag, 2005), or whether they decided to arrest a suspect (Alderden & Ullman, 2012).

It is interesting to note a shift in how investigative decision making has been studied, from a narrower perspective (a specific decision made in a specific scenario), to a broader one that considers other aspects of the investigation (generating multiple hypotheses), without missing on how accurate investigators are (quality of hypothesis). However, narrow studies are necessary to understand which variables influence important decisions in the course of an investigation, such as when to arrest someone, when to interview a suspect, which forensic experts to consult with, etc.

Eight different individual factors were analyzed by the studies included in the present review: Age, Experience, Fluid Intelligence, Gender, Inductive and Deductive Reasoning, Need for Cognitive Closure, Previous Higher Education and Time-Urgency. The experience was the most investigated individual factor as seven papers analyzed it. On the other hand, Age, Inductive and Deductive Reasoning, and Previous Higher Education were only analyzed in one study (Fahsing & Ask, 2017), while every other individual factor was studied in two different papers.

The studies that considered Experience used different measurements to define or analyze it. Some of them compared only police officers with the general public (Ask & Granhag, 2005), others used officers' rank as the measure for experience (Wright, 2013), while most researchers considered experience in terms of years on the job (Alison et al., 2013; Dando & Ormerod, 2017; Fahsing & Ask, 2016; Kim et al., 2020; Santilla et al., 2004). This issue of variable measurement was not identified with the other individual factors given that they are either straightforward (e.g., age) or have been measured using reliable psychometric testing (e.g., NFC).

There is a high number of individual factors that have been found to influence decision making in different contexts. These factors could, in theory, also influence investigative decision making; however, only eight of them have been empirically tested. Relying on theory is not necessarily bad but follow-up testing of such theories must be conducted to validate or refute them. In a first look, it seems that not many individual factors have been tested concerning investigative decision making but

empirical research on the subject has only started in the past two decades and only nine studies have endeavored to test it. In addition, there has been an increasing number of publications on the topic, nearly half of the identified studies were published in the last five years. Therefore, it is expected, from this increased attention, that researchers will continue to test other individual factors as well as try to replicate studies to verify if the findings are consistent.

Out of the eight individual factors empirically tested, only five had a significant effect on investigative decision making: Experience, Gender, Need for Cognitive Closure (NFC), Time-urgency, and Fluid Intelligence. Experienced investigators who were constantly dealing with car crimes were more capable of identifying crimes that were committed by the same offender when compared to the general population (Santilla et al., 2004). Investigators with more years of experience generated significantly more investigative hypotheses than investigators with fewer years of experience. This has been found under a quasi-experimental design using semi-fictitious cases (Fahsing & Ask, 2016), and an analysis of real decisions made during investigations (Dando & Ormerod, 2017). Using ranks to determine expertise in a laboratory analysis using real cases, Wright (2013) also identified that experienced officers generated more hypotheses; however, the accuracy or quality of them was not significantly different across groups.

Under time pressure, less experienced officers produced hypotheses of lower quality, which did not happen with more experienced officers (Kim et al., 2020). However, the number of hypotheses generated was not moderated by experience under the same circumstances, that is, experienced investigators under time pressure generate the same number of hypotheses as those with less experience, but their hypotheses are of better quality (Alison et al., 2013; Kim et al., 2020). Even though most of the results point to either a positive or null effect over investigative decision making, experience may have detrimental effects. Ask and Granhag (2005) found those police officers were more likely to perceive someone as guilty when compared to the general population even when presented with potentially exonerating evidence (Ask & Granhag, 2005).

Gender was only analyzed in two papers. The first used a quasi-experimental design and a missing person case to analyze the gender of newly recruited students to become police officers and their investigative hypotheses (Fahsing & Ask, 2017). Results showed no relation between participants' gender and the quality of hypotheses

generated. The second study analyzed criminal cases to verify if gender influenced investigators' decision to arrest a suspect of sexual assault (Alderden & Ullman, 2012). Its results identified that female detectives were significantly less likely to arrest suspects of sexual assault, even after controlling for common situational variables that influence this decision.

The need for Cognitive Closure was assessed in two different papers. In the study by Ask & Granhag (2005), high (vs low) NFC individuals were less likely to acknowledge evidence contrary to their hypothesis of guilty over the suspect, while Kim et al. (2020) found that high (vs low) NFC participants generated significantly fewer hypotheses under time pressure. Therefore, high NFC influences investigative decision making by preventing investigators to keep an "open mind", consider and generate multiple hypotheses, and avoid confirmation bias.

Time-urgency and fluid intelligence were analyzed by the same two papers, which used a sample of investigators and manipulated time pressure to verify if individual differences moderate its effect over investigative decision making (combined sample of 209 investigators from the UK and South Korea). Findings from both individual factors were consistent across studies. In a sample of British investigators, time-urgent participants had a larger reduction in the number of hypotheses generated than non-time-urgent investigators, while individuals who scored high (vs low) on fluid intelligence measures generated more hypotheses (Alison et al., 2013). In a sample of South Korean investigators, time-urgent participants reduced quantity and quality of hypotheses generated, an effect not found on non-time-urgent individuals, while high (vs low) fluid intelligent participants had better performance both in terms of quantity and quality of hypotheses generated (Kim et al., 2020). Therefore, it has been found that time-urgency and fluid intelligence have opposing effects over investigative decision making. Time-urgent individuals and those who score lower on fluid intelligence assessments reduce their performance in both quantity and quality of hypotheses generated.

In summary, each factor had its effect on investigative decision making. Experience had mixed findings. Some studies found that more experienced investigators had more effective decision making, while others found an inverted or non-significant relationship. Gender was found to be significantly related to a specific decision in a specific context (decision to arrest on sexual assault cases). High (vs low) NFC investigators produced significantly fewer hypotheses and were more prone

to confirmation bias. Time-urgency also had similar effects; investigators who were time-urgent produced hypotheses in lower quantity and quality under time pressure. Similarly, fluid intelligence was also found to be significantly related to effective investigative decision making, as individuals with high fluid intelligence produced better quality and a greater number of hypotheses.

DISCUSSION

The present paper set to identify which individual factors have been empirically tested in relation to investigative decision making, and how these factors influence investigative decision making. Through a systematic review of the literature, nine scientific papers were identified, which revealed that eight individual factors have been empirically tested, five of which had a significant impact on investigative decision making.

Despite the low number of studies, nearly all of them analyzed if experience had any effect on investigative decision making. Scientific theory and research point to an uncertain relationship between experience and decision making. On one hand, it is expected that experts will perform better than novices because they have a much greater mental database with relevant information about the task at hand (Alison et al., 2013). On the other hand, the experience can lead professionals to consider fewer hypotheses, rely on heuristics, and be more susceptible to confirmation bias.

The present review, unsurprisingly, found mixed results for the effect of experience. Some studies found that it played an important role in improving decision making, while others did not. Interestingly, one of the studies that used samples from two different countries achieved different results regarding the role of experience in investigative decision making depending on the country (Fahsing & Ask, 2016). It identified that experienced British detectives generated more hypotheses than experienced Norwegian detectives, and their hypotheses were also of better quality. The authors argue that differences in training were responsible for these differences in performance, even though both samples had the similar number of years of experience.

Considering the current findings, it would be wrong to condemn experience as a promoter of bad investigative decision making. It is more likely that experienced

officers will perform better than novices. However, only experience is not sufficient in leading to expertise and better performance. Fahsing and Ask (2016) suggest that a nationwide qualification program for investigators, mandatory training on the generation of hypotheses, consistent training, and procedural guides may facilitate this experience to be well developed over the years. Thus, police forces should invest in consistently training their investigators, providing supervision and feedback throughout their careers to develop experienced professionals that will perform at the highest level even under external negative influences such as media or time pressure.

It should be noted that there is a major methodological inconsistency around the definition of experience used by each paper. Nearly every one of them used a different method for considering experience, which hampers the direct comparison across samples. It is unknown whether the results would be the same if a study used a different definition, for example, considering years of experience investigating homicides instead of officers' rank. Therefore, readers must keep in mind how researchers have defined experience in their paper, while researchers must carefully select, and make explicit, the independent variables of the study.

Research on gender differences and general decision making pointed to ambiguous expectations in relation to the effects of this individual factor on investigative decision making, given that males are less susceptible to biases and heuristics, but also more likely to make hasty judgments (Byrne & Worthy, 2016; Toplak et al., 2016; Weller et al., 2018). The findings from both studies that analyzed gender do not provide an answer as to whether male or female detectives would have better investigative decision making. The only study that found a significant relationship between gender and investigative decision making did not investigate if female detectives also kept an "open mind" if they followed a confirmation bias, or even if the arrested suspect was guilty (Alderden & Ullman, 2012). Therefore, gender seems to have different effects on investigative decision making depending on the type of crime and context, but further research is needed to verify the replicability of and expand such findings.

Need for Cognitive Closure (NFC) was another salient individual factor identified in the present review to influence investigative decision making. Research on decision making has already identified that high NFC consumers used much faster decision making strategies, which relied on a small number of characteristics, while low NFC consumers took longer and analyzed more information to conclude (Choi et al., 2008).

In clinical settings, NFC has also been related to suboptimal information searching and decision making. Raglan et al. (2014) found that high NFC obstetricians/gynecologists often asked fewer screening questions about certain conditions, indicating that they could have searched further for treatable diseases. The results of the present systematic review corroborate this understanding. Even though NFC was only analyzed in two separate studies, both identified a negative relationship between NFC and effective investigative decision making.

One of the studies found that high NFC investigators had difficulty in modifying their perception of guilty even when presented with confronting evidence (Ask & Granhag, 2005), while the other study found that high NFC investigators generated fewer hypotheses under time pressure (Kim et al., 2020). As already pointed out, both of these outcomes can have devastating effects in the form of tunnel vision and miscarriages of justice. However, knowledge of this relation is quite beneficial because NFC can be reliably measured through the Need for Cognitive Closure Scale (NFCS), which has been validated in many countries (Kruglanski et al., 1993; Kossowska, Van Hiel, Chun & Kruglanski, 2002). Both studies under analysis used this scale, either in its full or shortened version (Roets & Hiel, 2011). Therefore, police forces should consider using the NFCS to recruit and select potential investigating officers, as well as identifying which officers require further training to prevent them from falling into the cognitive trap of need for closure.

There are different sources of pressure in the course of a criminal investigation, while some of them are occasional, such as media pressure in high profile cases, others are more frequent, which is the case of time pressure. There is never-ending pressure on investigating officers to solve crimes, when they solve one there are many others that need to be solved. The effects of time pressure may be moderated by how investigators perceive the passage of time, which is subjective, that is, there are individual differences in how people perceive the passage of time (Wittmann & Paulus, 2008). Time-urgent individuals feel time pressure much more overwhelmingly, regardless of the amount of time available.

Both studies that analyzed time perception and investigative decision making arrived at similar conclusions: time-urgent individuals had a significant loss in terms of quantity and quality of hypotheses generated under time pressure (Alison et al., 2013; Kim et al., 2020). In practical terms, when under pressure to quickly solve a case, some investigators may have worse performance due to their subjective

perception of time. Therefore, identifying time-urgent investigators and developing strategies to help them cope with this pressure without underperforming will likely lead to better investigative decision making and subsequent judicial process.

Finally, the last individual factor identified to lead to effective investigative decision making is fluid intelligence. In the present review, both papers that analyzed time-urgency also assessed fluid intelligence (Alison et al., 2013; Kim et al., 2020). They achieved similar results: investigators with high fluid intelligence generated more hypotheses and hypotheses of better quality when compared to those with low fluid intelligence. Criminal investigations are almost exclusively novel, each new case demands new investigative actions and, even though there are similarities among cases, it cannot be assumed that there are two identical crimes. Even homicide investigators with 20 years of experience on the job can find themselves dealing with new challenging cases daily, which requires them to adapt and direct the investigation accordingly.

In light of the novelty of criminal investigation, it would be important that investigators have the cognitive ability (high fluid intelligence) to adapt to each new case while maintaining high job performance. Like NFC, there is a reliable way, used by both studies, to measure fluid intelligence using Raven's standard progressive matrices (Raven, Court, & Raven, 1977). Therefore, police forces can measure their officers' fluid intelligence and identify who is best suited for investigative positions, who is more likely to achieve better results in novel cases, as well as who needs the training to develop fluid intelligence abilities.

While non-significant statistical results are not easily accepted by the scientific community in general, even leading to diminished chances of publication, they are a relevant source of data (Siddaway et al., 2019). In this particular context, understanding which factors are unrelated to investigative decision making can facilitate and direct the training and selection of future detectives. Considering that Age, Inductive and Deductive Reasoning, and Previous Higher Education were not shown to influence the quality of investigative hypotheses (Fahsing & Ask, 2017), police forces may want to reconsider minimum age, specific higher education requirements, or the use of psychological assessment of inductive and deductive reasoning to determine acceptance into police training.

Although researchers must select one or a couple of individual factors to analyze due to feasibility issues, all factors are simultaneously present when investigators make decisions. However, no research was identified that considered how multiple

individual factors interact with one another, and how this combination of factors can influence investigative decision making. Considering the main issues of a criminal investigation and circumstances that lead to miscarriages of justice, a combination of these individual factors may help prevent them.

LIMITATIONS

This systematic review was not without its limitations. First, the small number of studies identified and differences in methodology did not allow for a more comprehensive comparison among results. The biggest issue regards how investigative decision making was measured, some studies considered it in the form of hypotheses generation and their quality, while others focused on a more specific decision to be made (e.g., whether two crimes are linked). These issues, coupled with the small sample sizes, hinder result generalization. Furthermore, included studies consisted of only those that were published in peer-reviewed scientific journals, which makes the systematic review vulnerable to publication bias considering that non-significant findings are often rejected for publication. Finally, only studies published in English were considered, consequently, some papers on the subject may not have been included.

Implications for practice and policy

Because of the individual factors found to be related to effective investigative decision making, some actions can be taken to improve criminal investigations. Police forces should use reliable psychological tests (Need for Cognitive Closure Scale and Raven's standard progressive matrices) to recruit and select prospective candidates to become investigators. In addition, currently employed investigators could also be tested on these factors not to promote a working environment that excludes these officers, but to develop training programs designed specifically to build on these abilities. Finally, police forces around the world would benefit from developing a nationwide qualification program for investigators that includes training on generating hypotheses, while also developing procedural guides and frequently conducting refresher training courses to ensure that expertise is built on top of the experience.

Future research

At the academic level, there is still much to be understood about the individual factors relevant for investigative decision making. More research is needed to evaluate the effects of individual factors over investigative decision making in different types of crimes, samples from other backgrounds and nationalities may also lead to varying results due to differences in training and investigative practices. Developing more empirical evidence is necessary to replicate findings, identify other relevant individual factors and provide much more robust evidence to support the training and recruiting of investigators throughout the world.

Other factors that would be relevant to analyze are personality traits, such as those from the Big Five Model of Personality. Conscientiousness, for example, refers to how people regulate their impulses when engaging in goal-directed behavior, so it may influence how thorough investigators are in considering all possible hypotheses. Cognitive abilities such as crystallized intelligence may also be of relevance, especially considering that investigators attempt to solve problems (crimes) using learned knowledge from training and courses. Critical thinking has also been highlighted as a necessary skill for effective investigative decision making, given that it would allow investigators to be more aware of potential biases and avoid them, but no published studies testing the relation between the two variables were identified (Turvey, 2011). On top of that, future research should endeavor to analyze how multiple individual factors interact with each other to influence investigative decision making

Conclusion

Five individual factors were found to be relevant for effective investigative decision making: Experience, Gender, NFC, Time-urgency, and Fluid Intelligence. Even though these factors are not sufficient to ensure that a criminal investigation is conducted thoroughly and that mistakes or miscarriages of justice will never occur, they are mitigating factors. These factors are linked to investigators considering a wider variety of hypotheses for each investigation, which will reduce confirmation bias and tunnel vision. They are also likely to lead to crimes being more quickly solved, since they are linked to better hypotheses. Understanding how individual factors play a role in the outcome of criminal investigations will serve to guide police forces' recruitment and training programs.

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