Investigating the Impact of Cognitive Bias-Inducing Information on Decision Making Among Dutch Police Intelligence Employees

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Abstract

Due to increasing technological and information resources, the production of misinformation is increased. Although law enforcement plays a key role in regulating this, their work and decision making are also hampered by the activation of cognitive biases by misinformation. The current study investigated how decision making among Dutch police intelligence employees was affected by cognitive bias-inducing information compared to neutral information, thereby examining associations with rational thinking, expertise, and prior cognitive bias training. Additionally, the effectiveness of a cognitive debiasing video intervention was examined. Before undergoing a vignette study, 23 of the 71 participants were exposed to a cognitive debiasing video intervention. In contrast to neutral information, cognitive bias-inducing information led to a more critical assessment of both source reliability and information accuracy, while the recommendation for further investigation after reviewing cognitive bias-inducing information was greater for both the suspect and the case. Rational thinking appeared to dampen the effects found, whereby higher rational thinking dispositions did not lead to differences in information evaluation or decision making between bias-inducing and neutral information. The cognitive debiasing video intervention only led to the lowered assessment of information accuracy after reviewing cognitive bias-inducing information, which suggests the intervention to be helpful in establishing a more critical evaluation of information. Unlike police intelligence employees, university students rated sources within bias-inducing information as more reliable, and its information as more sufficient to make a statement about guilt. Moreover, after reviewing neutral information, university students were more likely to recommend further investigation into the suspect than police intelligence employees. These findings suggest that university students were less critical towards cognitive bias-inducing information and organisational resources. This study highlights that, when being confronted with information that could activate cognitive biases, police intelligence employees are critical during its evaluation, but also susceptible to cognitive pitfalls in ultimate decision making. More research is needed to develop domain-specific interventions and explore factors beyond rational thinking that influence the gap between bias-inducing information evaluation and ultimate decision making within police intelligence work.

Keywords: misinformation, cognitive biases, police intelligence decision making, information evaluation, debiasing intervention, rational thinking.

Introduction

After the deadly New Year's Day attack in New Orleans, online conspiracy theorists quickly claimed that terrorist cells were active. According to a retired police officer, this type of misinformation can have a real impact on police work. "When they start trying to run down leads, is it a lead or is it just somebody's Facebook post? And so now they've exhausted resources chasing a bunch of empty rabbit holes instead of focusing on what is true fact" (Maynard, 2025). Moreover, a recent national study by 'Sociaal en Cultureel Planbureau' shows that almost half of the Dutch (48%) are fairly to genuinely concerned about incorrect, misleading information on the internet. Some doubt whether they will still be able to recognize incorrect or misleading information in the future (Den Ridder et al., 2023). This shows that misinformation can have detrimental effects on many societal levels, including social fabric and trust, law enforcement, and intelligence services (Gradón, 2020).

Law enforcement agencies face challenges with misinformation as they both need to recognize and mitigate its effects (Gradón, 2020). However, with information spreading across various media ("Handreiking Omgaan Met Desinformatie," 2022) and police relying on (open source) intelligence analysis (Trottier, 2015), police intelligence employees inevitably encounter misinformation in both professional and personal contexts.

Although it is important that police intelligence employees make accurate decisions to combat misinformation, this process is complicated by the fact that misinformation may trigger the activation and reliance on cognitive biases and superficial information processing (Heuer, 1999; Heuer & Pherson, 2008). However, there is a scarcity of literature on how law enforcement officers manage the effects of misinformation at an individual level. Therefore, research is needed to gain deeper insights into how the activation of cognitive biases by misinformation shapes police intelligence decision making, and to identify factors or interventions that mitigate these effects (Dhami & Careless, 2019).

Specifically, by using a vignette-based design, this study investigates how Dutch police intelligence-oriented decision making is affected by information that triggers cognitive biases. In addition, this study examines whether individual factors such as rational thinking, expertise, and prior cognitive bias training play a role in this. Furthermore, an important aim is to evaluate whether a cognitive debiasing video intervention is effective when being exposed to cognitive bias-inducing information during intelligence-oriented decision making. Therefore, the research question is: "*What is the effect of cognitive bias-inducing information on intelligence-oriented decision making within the Dutch police, and is this moderated by a cognitive debiasing video intervention?*"

Information Disorders

Information disorders arise when facts are mingled with half-truths or untruths, leading to false or inaccurate information. Digitalisation and social media enable the production and dissemination of these information disorders (Benkler et al., 2018; Kapantai et al., 2020). While most concerns focus on disinformation, it is generally important to consider the umbrella term used for a wide variety of information disorders, misinformation, defined as 'false or misleading information masquerading as legitimate news, regardless of intent' (Van Der Linden, 2022; Pennycook & Rand, 2021).

Misinformation differs in its respective definition from disinformation due to a difference in its underlying harmful intent (Ministerie van Justitie en Veiligheid, 2023; Wardle & Derakhshan, 2017). However, misinformation can lead to similar consequences in practice ("Handreiking Omgaan Met Desinformatie," 2022). These include detrimental effects regarding criminal activity, law enforcement and intelligence services, public opinion, social fabric, and trust (Gradón, 2020), conspiracy theories and polarisation ("Handreiking Omgaan Met Desinformatie," 2022), public safety and harm at a strategic national level (Chesney & Citron, 2019). As misinformation and disinformation produce similar effects, it is especially beneficial to address misinformation in general, particularly because identifying intent is often not feasible in practice (Van Der Linden, 2022; Pennycook & Rand, 2021). In line with this, Europol (2019) emphasised a pressing need for proactive measures to counter the negative consequences of misinformation.

Misinformation Susceptibility

Susceptibility to misinformation arises from the ability of misinformation to exploit psychological vulnerabilities, such as cognitive biases, which impairs deception detection abilities and reduces the accuracy assessment of information (Millar & Millar, 1997). This can be explained by various phenomena. According to the general meta-cognitive myopia and the truth bias, people tend to be overly sensitive to believe available information. Even when meta-information about its accuracy is given, people tend to struggle to assess the quality of information (Fiedler, 2012). Therefore, they are more likely to recall false statements as true than true statements as false, even after a year-long experience with and expertise in distinguishing truthful from untruthful information (Pantazi et al., 2021). The illusory truth effect explains that repeated statements, in particular, are more likely to be perceived as true, regardless of their accuracy, due to a subjective feeling of familiarity (Bacon, 1979; Hasher et al., 1977). Thus, when misinformation is easy to process through repeated exposure, a cycle is created in which misinformation becomes increasingly accepted (Reber & Schwarz, 1999).

Secondly, people tend to make implicit assumptions, or presuppositions, about the context from explicit statement in conversation without verifying the accuracy (Pantazi et al., 2021). Coupled with the natural tendency to trust the truthfulness communication partners, as outlined by the truth-default theory (Levine, 2014), this can lead to the easy acceptance of misinformation (Pherson, 2024).

Finally, acceptance of misinformation and scepticism towards corrections (Pantazi et al., 2021) can be explained by the tendency to favour identity-relevant beliefs over conflicting information, (Kunda, 1990). This is demonstrated by the confirmation bias, where people seek and interpret evidence that fits existing beliefs (Nickerson, 1998), and the motivated reasoning account, where selective information is processed to support desired conclusions (Kunda, 1990).

However, contrary to the motivated reasoning account, susceptibility to misinformation may be influenced more by a lack of analytical thinking than by ideological predispositions (Pennycook & Rand, 2021). According to the classical reasoning account, people fall prey to misinformation because of a lack of willingness or ability to think analytically (Ziemer & Rothmund, 2022). This underscores the importance of active, rather than passive, analytical thinking in assessing misinformation (Van Der Linden, 2022). Moreover, susceptibility to misinformation varies by individual differences in their propensity for suggestibility, gullibility, and credulity (Ceci & Williams, 2022). Importantly, it is suggested that susceptibility to misinformation is not dependent on cognitive skills nor intelligence (Ceci & Williams, 2022; Merckelbach et al., 1998).

Misinformation in Police Intelligence Services

To combat mis- and disinformation, it is important to make correct decisions based on information ("Handreiking Omgaan Met Desinformatie," 2022). Proactive intelligence work enables police to do so, analysing crime using multiple sources and improving crime analysis capabilities (Innes et al., 2005). By identifying long- and short-term crime issues and understanding key individuals and groups, intelligence employees convert data into practical intelligence formats that support police operations (Joseph & Corkill, 2011). Evaluating information for accuracy, completeness, and meaning is essential for informed judgments, considering the credibility of sources. Therefore, employees rely on their subject knowledge, experience, and comparisons with relevant data (Joseph & Corkill, 2011). Information evaluation is thus an important process and failure to do so can lead to failures in police intelligence-based decision making.

Misinformation within Intelligence Employees

To make correct decisions, intelligence employees must effectively process information, while resisting potential misinformation. As explained by the classical reasoning account, effortful, analytical, and systematic evaluation of information, also known as System 2 reasoning, reduces susceptibility to misinformation (Kahneman & Sustein, 2005). This thinking process relies on rule-based, rational, conscious, and cognitively effortful processes (Evans, 2003; Petty & Cacioppo, 1986). In contrast, effortless information processing, using heuristics and cognitive shortcuts, or System 1 thinking (Kahneman & Sustein, 2005), can lead to a distorted belief in incorrect information (Pennycook & Rand, 2021; Van Der Linden, 2022). This system relies more on intuition, pattern recognition, and gut feelings.

However, the use of heuristics and cognitive shortcuts during intelligence-oriented decision making can be activated by numerous factors, including time pressure, cognitive workload, and difficulties in human judgement (Hutchins et al., 2004). Intelligence employees need to translate and review information to provide reliable intelligence (Cope, 2004). As information is rarely simply true or false, amplified by artificial intelligence, and comes from multiple sources, including citizens, difficulties in human judgement may manifest themselves during the evaluation of the plausibility of information (Burke, 2022; Chesney & Citron, 2019; Nemr & Gangware, 2019). Besides, challenges can arise when determining how much weight to place on specific information, and deciding which information to trust (Hutchins et al., 2004). Especially when time pressures arise and cognitive workload is high, intelligence employees may be hampered to use System 2 reasoning, leading them to rely more on System 1 reasoning within their decision making process (Heuer, 1999).

Misinformation in Intelligence Data Input

The information provided to intelligence services may be impacted by misinformation too. Because of preferring experiential knowledge and discretion, street-oriented officers may not effectively apply analytical insights (Chan, 1996). When high-risk situations force officers to make quick decisions (Mears et al., 2017), analytical System 2 decision making may be hindered (Hine et al., 2018). This can potentially lead to incomplete or incorrect police reports. Consequently, intelligence employees may struggle to interpret this information (Brown, 2020).

Combatting Misinformation in Intelligence Work

Previous research indicates that, while intelligence employees often engage in extensive analysis, maximise collaboration, consider influencing factors, and reformulate problems, they also rely on subjective judgments, overlook data, lack critical thinking, or

produce inaccurate conclusions (Dhami & Careless, 2019). Worsened by misinformation, there are increasing concerns that intelligence work is conducted superficially (McDowell, 2009; Sandow-Quirk, 2002). Employees often use strategies from formal training, which, though efficient, can result in biased and inaccurate conclusions (Heuer & Pherson, 2008). To guarantee the purpose and accuracy of intelligence work, there is a need to focus more on training on deliberative thinking and critical thinking (Dhami & Careless, 2019).

Nature of Information

As explained, it is rarely possible for police intelligence employees to assess the objectivity of information obtained. However, it can be determined whether it is presented to induce cognitive biases.

Cognitive Biases

Cognitive biases, as part of System 1 reasoning, are predictable mental tendencies that affect perception, memory, reasoning, and behaviour, and simplify decision making by reducing the effort needed to process information (Heuer, 1999). While useful, they can conflict with logical principles, lead to systematic errors in judgment (Janssen et al., 2019) and undermine accuracy when unnoticed (Lee et al., 2016; Meterko & Cooper, 2022). As a result, cognitive biases can impair decision making (French et al., 2023) and may lead to incorrect intelligence products (Groenewald, 2023). Even more challenging is the suggestion that intelligence agents may be more prone to cognitive biases than non-experts (Reyna et al., 2014). This suggests that expertise may even worsen employees' susceptibility to cognitive bias-inducing misinformation. To avoid biased judgment, System 2 reasoning must override System 1 thinking (Kahneman & Frederick, 2005).

However, as police intelligence employees use a large amount of data (Hillemann et al., 2015), reliance on expertise is crucial. As said, this can create biases through selective attention or reliance on experience-based expectations (Dror, 2020). Consequently, this may lead to errors in information assessment (Heuer, 1999), which can occur at any stage of the systematic intelligence cycle of the Dutch National Police - (1) planning and direction, (2) collection, (3) processing, (4) production and analysis, and (5) dissemination (Nationale Politie, 2020; Johnson, 1986). Cognitive biases in criminal investigations can undermine objectivity and methodology at multiple levels and fall into four categories. These include biases in evaluating evidence, biases in perception of cause and effect, biases in estimating probabilities, and biases in evaluation of intelligence reporting (Heuer, 1999). Per category, the most relevant cognitive biases for criminal intelligence employees are studied in the SIRIUS program (IARPA, 2011; MITRE et al., 2016), and include the confirmation bias,

fundamental attribution error, projection bias, anchoring bias, representativeness bias, and blind spot bias. The current research focused on the presentation of cognitive bias-inducing information to test how susceptible Dutch police intelligence employees are to cognitive biases within their decision making. Therefore, per category, the most relevant bias in their work was used. Definitions of the cognitive biases used are given in Table 1.

Table 1

Definitions of the Cognitive Biases Used in the Current Study

Name	Definition	Type of Bias
Confirmation bias	If a theory is thought to be correct, then investigators are more likely to believe unsound arguments that support it (Cook et al., 2013)	Bias in evaluating evidence
Fundamental attribution error	"Tendency to over-emphasize personality-based explanations for behaviours observed in others while underestimating the role of situational influences on the same behaviour"	Bias in perception of cause and effect
Anchoring bias	"Tendency to rely too heavily or overly restrict one's attention to one trait or piece of information when making judgments." (Heuer, 1999)	Bias in estimating probabilities
Representativeness bias	"Tendency for people to judge the probability or frequency of a hypothesis by considering how much the hypothesis resembles available data." (MITRE et al., 2016)	Bias in estimating probabilities

The blind spot bias was excluded as it focuses on overlooking one's own mistakes while recognizing others', which is irrelevant since this research did not involve collaboration or comparison with other employees. Similarly, projection bias was not used, as it assumes others share the same values. Given the scope of this study and the number of participants, a comprehensive psychological assessment to compare personal beliefs with those of case-focused suspects was not feasible.

Rational Thinking Dispositions

As said, analytical thinking, as part of System 2 thinking, is associated with resistance to and improved detection of verified misinformation. Although it has been found that, particularly at the start and finish of their work, employees rely more on deliberate thinking strategies than intuitive ones (Dhami & Careless, 2019), System 1 is seen as the default mode in intelligence work when System 2 is not available (Heuer, 1999). Moreover, it is important to note that System 2 can also slow down decision making processes and is not free from

susceptibility to cognitive errors (Monteiro et al., 2019). Therefore, beyond the 'classical reasoning account', the 'integrative account' expands on critical thinking processes by highlighting that, alongside cognitive analytical elements, identity, and ideological factors are crucial in understanding susceptibility to misinformation (Roozenbeek et al., 2022)

While critical thinking is defined by abilities such as judgment, analysis, evaluation, and inference, it also encompasses dispositions like inquisitiveness, open-mindedness, and flexibility, extending beyond purely analytical skills (Abrami et al., 2008; Facione, 1990). By preventing biases in reasoning and decision making, critical thinking is found to be essential for improved intelligence analysis (Dhami & Careless, 2019). Similarly, the integrative account shows that actively open-minded thinking (AOT) is a stronger predictor of susceptibility to misinformation than cognitive analytical skills alone (Ceci & Williams, 2022; Roozenbeek et al., 2023).

Actively Open-Minded Thinking

Actively Open-Minded Thinking (AOT) is a cognitive style and predictor of rational thinking and includes the willingness to consider alternative opinions, the sensitivity to evidence contradictory to current beliefs, the willingness to postpone closure, and reflective thought. AOT involves differences in goal management, epistemic values, and self-regulation, affecting belief formation and decision making (Stanovich & Toplak, 2023). AOT involves cognitive decoupling and decontextualization of problems, which are common psychological dimensions with rational thinking and relevant to heuristics and biases tasks (Stanovich & Toplak, 2023). Cognitive decoupling helps override intuitive responses to these tasks and supports simulating alternative scenarios to reach correct answers. Decontextualizing involves ignoring irrelevant information (Stanovich & Toplak, 2023).

Individuals with high AOT seek more information, both in their environment and memory, before responding, leading to more accurate predictions (Haran et al., 2013) and a better evaluation of arguments, even after controlling for cognitive abilities (Stanovich & West, 1997). In line with this, studies suggest that a lack of AOT may result from not using System 2 reasoning (Mirhoseini et al., 2023), leading to more misinformation susceptibility (Swami et al., 2014). To address both the classical reasoning account and the integrative account, this study considered both AOT and System 2 thinking as relevant predictors of misinformation susceptibility. Both are rational thinking trait characteristics that enhance critical and analytical thinking processes, helping to reduce cognitive bias and misinformation susceptibility.

Cognitive Debiasing Intervention

Empirical evidence of computer-based tools and Structured Analytical Techniques (SATs) to combat cognitive biases caused by misinformation lacks. Therefore, empirically tested, psychologically informed approaches and debiasing techniques are suggested (Belton & Dhami, 2020). Drawing on the empirical evidence discussed, increase in critical thinking may be achieved by the prompt to think more thoroughly, such as by simply showing a review tool or checklist to increase awareness (Meterko & Cooper, 2022). In line with AOT's concepts of decontextualization and decoupling, one could try to elicit 'alternative views' (French et al., 2023; Lewandowsky et al., 2012), including the 'consider-the-opposite strategy' (COS) and the 'analysis of competing hypothesis' (ACH).

By providing opposing information, the tendency to anchor beliefs to available information can be mitigated, allowing users to process both the available information and the opposing information (COS). By presenting competing hypotheses, individuals are required to refute evidence to create a coherent story based on corresponding evidence (ACH). Moreover, the devil's advocate method, in which employees prepare themselves to defend their reasoning, is also found to be effective (Groenendaal & Helsloot, 2014; Hilleman et al., 2015).

The Current Study

The current study examined the effect of cognitive bias-inducing presented information on decision making among Dutch police intelligence employees. Participants were immersed into a vignette study in which they were exposed to police-oriented cases that presented either bias-inducing or neutral information. While bias-inducing information attempted to elicit cognitive biases, thereby serving as a risky aspect of misinformation, neutral information can be interpreted as information not intending to elicit cognitive biases. After reading each vignette case, participants' decision making was assessed. The outcomes of both vignette types were compared to assess differences in decision making. In this way, hypothesis 1, which was grounded in existing literature, was tested.

> H1: Among Dutch police intelligence employees, bias-inducing information causes less critical decision making than neutral information

To make police intelligence employees more resistant to misinformation, this study also investigated the effectiveness of a cognitive debiasing video intervention, which aimed to decrease reliance on cognitive biases during decision making. Its effectiveness can contribute to educational goals within the police academy and provides academic insights into the

effectiveness and ecological validity of similar interventions. Before the vignette study, half of the subjects underwent the video intervention by randomization. The other half did not undergo any intervention. Since related research is still in its infancy, current intervention was based on an already existing debiasing intervention, for which promising effect were found (Morewedge et al., 2015), and included teaching about biases, teaching the directional influence of each bias on judgment, and providing mitigation strategies. An overview of the intervention techniques used is given in the Methods section, Appendix B and Appendix C. To test hypothesis 2, the outcomes of both groups were compared to assess differences in decision making.

> H2: Among Dutch police intelligence employees, the difference in critical decision making between bias-inducing and neutral information is smaller in the cognitive debiasing intervention condition than in the no intervention condition

From an exploratory perspective, there was investigated how rational thinking, expertise and prior cognitive bias training played a role in hypothesis 1. As described, there is a strong theoretical foundation that rational thinking can be seen as a trait characteristic influencing critical thinking and decision making. Therefore, rational thinking was considered as a covariate to correct for individual differences. As the role of expertise and previous cognitive bias training on critical thinking decision making is less clear, these factors were only examined by means of correlations. The conceptual framework for this research, including the causes of cognitive biases, mitigation techniques, and the application to the vignettes is given in Appendix B.

Methods

Design

The present study had a 2 (Vignette Type: bias-inducing versus neutral) x 2 (Intervention: intervention versus no-intervention) mixed design, with Vignette Type as within-participant independent variable, Intervention as between-participants independent variable, and intelligence-oriented decision making as dependent variable. All participants were exposed to two bias-inducing and two neutral vignettes that acted as police-oriented intelligence cases (Appendix E). In the Intervention condition, half of the participants received a cognitive debiasing video intervention prior to measurements of the dependent variables. The dependent variable ‘intelligence-oriented decision making’ was measured by

source reliability, information accuracy, information sufficiency, recommended suspect investigation, and recommended case investigation.

The first covariate was Rational Thinking. The second covariate was Prior Cognitive Bias Training. The third covariate was Expertise, operationalised as Years of Work and Professional Scale. Exploratory open-ended insights were analysed to understand underlying cognitive processes involved in decision making.

Participants

The research sample consisted of individuals of all ages, gender, years of work and professional skill levels who were approached to participate in the study. The inclusion criteria were fulfilled by participants who were at least 18 years old, had a moderate understanding of Dutch or English, were able to complete an online survey via Qualtrics within a four-week timeframe, and were either a Dutch police intelligence employee or a student at the University of Twente. To comply with police policy and privacy regulation, Dutch police participants were recruited internally without direct involvement of the researcher. Therefore, these participants were approached by their supervisor via an invitation mail. Additionally, as police policy reasons could limit the recruitment of police participants, university student participants were recruited via the research platform BMS test subject pool SONA of the University of Twente. These university students were compensated by 0.25 SONA-point. Additionally, convenience sampling was used as university participants were also recruited through the researcher's social network.

A total of 120 participants took part in the study, of whom 81 were police intelligence employees and 39 were university students. One university student and 10 police intelligence employees were excluded because of withdrawal before the end of the study or a failure to meet the inclusion criteria. Among the 71 police intelligence employees, 36 identified as male, 34 identified as female, and one identified as gender fluid. The age ranged from 24 to 64, with a mean age of 44.92 (*SD* = 11.75). All police intelligence employees spoke Dutch. 23 (32.4%) out of 71 police intelligence employees were assigned to the intervention group. Years of Work ranged from zero to 46, with a mean of 17.43 (*SD* = 12.88). Prior Cognitive Bias Training ranged from 1 = 'Totally no experience' to 5 = 'Very much experience', with a mean of 2.37 (*SD* = 0.98). Nine participants indicated they did not know what cognitive biases are. Professional Scale, operationalised as Landelijk Functiehuis Nationale Politie ranged from scale 7 to scale 12, with a mean of 8.85 (*SD* = 0.98). All specific professional scale frequencies and percentages are given in Table 2.

Table 2

Frequencies and Percentages per Professional Scale (LFNP)

	Descriptives		
Name LFNP	*Professional Scale*	*n*	*%*
Generalist Intelligence	7	6	8.7
Senior Intelligence	8	19	26.5
Operationeel Specialist A Intelligence	9	19	26.5
Operationeel Specialist Intelligence	9.5	2	2.8
Operationeel Expert Intelligence	9.5	9	12.7
Inspecteur	9.5	2	2.8
Operationeel Specialist B Intelligence	10	11	15.5
Teamchef	12	1	1.4
Missing	-	2	2.8

Note. LFNP = Landelijk Functiehuis Nationale Politie (Dutch professional police scales)

Among the 38 university students, eight identified as male, and 30 identified as female. The age ranged from 18 to 43, with a mean age of 21.18 (*SD* = 4.20). Study years ranged from zero to fifteen, with a mean of 2.00 (*SD* = 2.96). Current year of study ranged from University Bachelor year 1 to Recently graduated MSc, with the most represented group (68.4%) is currently in their first Bachelor year of their university studies. Most of the university students filled out the questionnaire in English (95.74%), and 5.26% filled out the questionnaire in Dutch. Fifteen (39.5%) out of 38 university students were assigned to the intervention group. Prior Cognitive Bias Training ranged from 1 = 'Totally no experience' to 5 = 'Very much experience', with a mean of 2.24 (*SD* = 0.88). No participant indicated that they did not know what cognitive biases are.

Procedures, measures, and materials

Participants could take part in the study via a web link they received via an invitation email or after registering via SONA. The questionnaire was conducted via the online platform Qualtrics (*Qualtrics XM – Experience Management Software*, 2024). Within a four-week timeframe, participants had the opportunity to complete the survey. After reading the information letter, including background details, research purpose, instruction, and contact details, participants gave permission to participate via an informed consent letter. Participants agreed with voluntariness and accepted the promise not to talk about the survey with colleagues or other students. To avoid bias, hypotheses were not disclosed.

Consequently, participants completed the survey (20 – 30 minutes). The survey contained five sections, including socio-demographics and background information, Rational Thinking, the Intervention section, measurement of dependent variables via a vignette study, and Prior Cognitive Bias Training. The questionnaire was provided in Dutch and English to make it accessible to both Dutch police intelligence employees and university students. Participants were not able to go back to previous sections.

Socio-demographics and background information

Section one contained socio-demographics and background information, compromised by their level of expertise. To receive demographic information, participants indicated their age and gender. To receive background information, university students were asked to indicate their years of study and current year of study. The covariate Expertise was assessed by asking participants to indicate their Years of Work and Professional Scale. Professional Scale was operationalised by the Dutch police professional scale matrix, LFNP (Landelijk Functiehuis Nationale Politie), which could be indicated via an open answer.

Rational Thinking

Section two assessed the exploratory covariate, Rational Thinking, by using the 24-item CTSQ scale by Newton et al. (2023). CTSQ integrates elements from multiple thinking styles and dual-process theory scales, has demonstrated predictive validity across several outcome variables, and has outperformed other thinking style measures (Newton et al., 2023). The scale aligns with AOT and System 2 by measuring the spectrum between intuitive and deliberative thinking through Actively Open-Minded Thinking (AOT), Closed-Minded Thinking (CMT), Preference for Intuitive Thinking (PIT), and Preference for Effortful Thinking (PET). A 6-point Likert scale, ranging from 1 = 'Strongly disagree' to 6 = 'Strongly agree' was used to give participants the ability to indicate their level of agreement on statements such as "Whether something feels true is more important than evidence". Item 1 - 6 and 19 - 24 were reversed questions (see Appendix D). The order of the item questions was randomized. All four subscales had an acceptable to excellent internal consistency. When including all participants, internal consistency was $\alpha_{AOT} = .84$, $\alpha_{CMT} = .75$, $\alpha_{PIT} = .91$ and $\alpha_{PET} = .84$. When including police intelligence employees only, internal consistency was $\alpha_{AOT} = .80$, $\alpha_{CMT} = .81$, $\alpha_{PIT} = .92$ and $\alpha_{PET} = .77$.

The reason for including section one and two before the intervention and vignette study was to prevent bias in responses due to the intervention or exposure to the subsequent vignette case scenarios.

Intervention

Section three contained the cognitive debiasing intervention for half of the participants. Through randomization, participants were assigned to one of the two between-subject conditions, intervention, or no intervention. This guaranteed the unbiased allocation of participants into the intervention condition. Participants in the intervention condition received a cognitive debiasing video intervention prior to the vignette study. Participants in the no-intervention condition directly moved into the vignette study. The debiasing video intervention was based on proven and potential techniques to recognize and mitigate cognitive biases (Morewedge et al., 2015). Trough explaining each bias, the intervention aimed to raise awareness about cognitive biases and provided recommendations to reduce these within police intelligence decision making. The intervention encouraged critical thinking by stimulating participants to formulate alternative explanations (ACH), consider information that proved innocence (COS), and use a checklist to simplify their thinking. A complete theoretical framework for this is given in Appendix B and Appendix C.

Vignette Study and Dependent Variables

Section four entailed a vignette study to measure the dependent variable, intelligence-oriented decision making. All vignettes and response options were checked by both in-house intelligence teachers and police academy investigators and university professors. All vignettes and conditions are described in Appendix E.

Vignette Study. In collaboration with intelligence teachers from the police academy, four police-oriented vignette cases were developed. Each vignette had a bias-inducing and a neutral variant, resulting in 4 x 2 vignettes. The vignettes functioned as case studies within police-oriented intelligence work, in which information about a possible suspect in a police case was given based on a general case description and four additional information cues. Both variants of each vignette started with the same general case description. Vignette variants differed in the four additional information cues that were developed. Except for the experimental manipulation between the variants, the vignette variants were identical.

For both vignette variants (bias-inducing and neutral), the objective burden of proof against the suspect was equally weak in each vignette, ensuring that both variants contained the same amount of uncertain information. However, in the bias-inducing vignette variants, participants were exposed to information cues that attempted to elicit the susceptibility of cognitive biases that are specifically relevant to Dutch intelligence officers, including confirmation bias, fundamental attribution error, anchoring bias, or representativeness bias. Within the bias-inducing vignette variants, this was done by manipulating each of the four

information such that they each elicited at least one of the four specific cognitive biases. The neutral vignettes were designed in such a way that they were less likely to evoke the specific cognitive biases than in the bias-inducing vignette variants. The bias-inducing vignette variants attempted to evoke the four biases mentioned at the same time. An example of a vignette is given in Table 3. This example only includes an additional information cue for one cognitive bias, representativeness bias. The complete vignette and the other vignettes are given in Appendix E.

Table 3

Example of Vignette 1

General Case Description		
A series of burglaries have taken place in the diamond district. You are investigating a possible Dutch suspect, M.A., and have the following information:		
Additional Information Cues		
	Vignette Variant	
	Neutral	Bias-Inducing
(**R**): M.A. has many tattoos all over his body, often wears dark clothing, and (1). According to the emergency response colleagues (2) was ultimately allowed to continue on his way.	1. was recently stopped during a traffic check in the diamond district. 2. there were no notable circumstances, and he	1. was stopped for a check in the diamond district at night. 2. he behaved suspiciously, but

Note. R = Representativeness Bias.

Each participant was exposed to all four vignettes. To ensure randomisation and control for order effects, the presentation order of the vignettes was randomised. Moreover, within the presentation of the four vignettes, each participant was exposed to two bias-inducing and two neutral variants. The sequences in which each vignette variant condition was presented (bias-inducing, neutral) was also randomised across participants. Thus, full counterbalancing was achieved.

Dependent Variables. To assess intelligence-oriented decision making, self-created independent items questions were designed. These item questions were all separate considerations about how people evaluated the information and made decisions. These were not expected to correlate with each other or form a scale. Item questions were based on the information evaluation systematic intelligence cycle used within the Dutch National Police (Nationale Politie, 2022), and were focused on source reliability, information accuracy (or information verification), and information sufficiency for decision making. The responses were scored on a 5-point Likert scale (1= strongly disagree; 5=strongly agree). Source reliability was measured by the item: "I trust that the information obtained comes from

reliable sources". Information accuracy was measured by the item: "I trust that the information obtained is correct". Information sufficiency was measured by the item: "I have obtained sufficient information to be able to make a statement about the likelihood that suspect X is guilty of case Y".

In addition to these questions that focused on information evaluation, additional questions were asked that focused on the recommendation for further investigation to get more decision making oriented insights. The responses were scored on a 5-point Likert scale (1= not at all; 5=strongly). Recommended investigation suspect was measured by the item question: "To what extent would you recommend further investigation into suspect X?". Recommended investigation case was measured by the item question: "To what extent would you recommend further investigation into this case?".

After investigating the specific work scenario vignette cases, participants were asked to indicate their level of agreement on the items. This served as a measure to capture the participant's intelligence-oriented decision making, either after exposure to bias inducing or neutral information. Before conducting analyses, per within-subject condition (bias-inducing and neutral) mean scores were generated for each dependent variable (source reliability, information accuracy, information sufficiency, recommended investigation suspect, recommended investigation case).

Consequently, participants were asked to answer the open-ended question: "Can you describe your thought process on which you based the decision on how much further investigation you will recommend (type of information, feeling, sources, own experience, etc.)?". This served as an exploratory measure to gain a deepening understanding of participant's decision making processes. After considering the open answers, a coding scheme was developed. The coding scheme was partly based on the aspects, described in the theoretical framework, which are important during both police intelligence decision making and the activation and mitigation of cognitive biases. These focused on source reliability, information accuracy, information sufficiency, rational thinking (intuitive – analytical), rational thinking (close-mindedness – actively open-mindedness), burden of proof, and bias awareness. Within each category, codes were generated. To conduct further analyses, dummy variables were created for all possible codes to indicate whether a code was assigned to specific open answer. This way, this study used triangulation. The coding scheme and the associated coding instructions can be found in Appendix G.

Moreover, only for police intelligence employees, vignette realism was additionally measured by the item "This scenario is realistic within intelligence work", which responses

were scored on a 5-point Likert scale (1=strongly disagree, 5=agree). This served as an additional check to assess whether the vignettes were realistic enough and representative of real-word police intelligence cases. All specific response options for the dependent variables and vignette realism are given in Appendix F.

Prior Cognitive Bias Training

Section five assessed the exploratory covariate, Prior Cognitive Bias Training, by the question: "How much experience have you had with cognitive bias training so far?". Responses were scored on a 5-point Likert scale (1=totally no experience, 5=very much experience). Participants were able to skip this question if they did not know what cognitive biases are. If participants have had prior cognitive bias training, an additional open-ended question is asked "What type of cognitive bias training have you had in the past?". All specific response options for Prior Cognitive Bias training are given in Appendix H.

Debriefing

After completing the questionnaire, participants were thanked, were given the opportunity to withdrawal, and received a debriefing including information about the purpose and design of the study. Moreover, information was given about the researchers' email addresses, which could have been used for further questions about the survey and if they wished to be informed about the results of the study.

Results

Preliminary Analyses

Sample Test

Given the potential for differences, it was necessary to evaluate whether the two Participant Groups (police intelligence employees, university students) could be analysed together or separately. To assess two-way and three-way interaction effects, a multivariate repeated-measures ANOVA was conducted with Vignette Type as within-subject factor, Participant Groups and Intervention as between-subject factors, and source reliability, information accuracy, information sufficiency, recommended investigation suspect, and recommended investigation case as dependent variables.

Multivariate analysis showed a significant two-way interaction effect between Participant Groups and Vignette Type, $F\,(5, 101) = 4.17$, $p = .002$, $\eta^2 = .17$. Significant interaction effects were found for source reliability ($F\,(1, 105) = 5.42$, $p = .022$, $\eta^2 = .05$), information sufficiency ($F\,(1, 105) = 5.45$, $p = .021$, $\eta^2 = .05$), and recommended investigation suspect ($F\,(1, 105) = 4{,}79$, $p = .031$, $\eta^2 = .04$). Planned comparisons showed that police intelligence employees rated source reliability in bias-inducing vignettes significantly

lower than in neutral vignettes, whereas university students did not. University students rated information sufficiency in bias-inducing vignettes significantly higher than in neutral vignettes, whereas police intelligence employees did not. In neutral vignettes, recommended investigation suspect was significantly higher rated by university students than by police intelligence employees (p = .025) whereas this was not true for bias-inducing vignettes (p = .974). This suggests a difference between police intelligence employees and university students in the extent to which they process different types of information and make decisions. Table 4 shows mean scores, standard deviations, and statistical values for the significant effects.

Table 4

Descriptive Statistics and Statistical Values for Differences between Participant Groups

Dependent Variable	Participant Group[a]	Vignette Type				Sig. Level
		Bias-Inducing		Neutral		
		M	*SD*	*M*	*SD*	*p*
Source Reliability	Police Employee	3.16	0.09	3.52	0.08	**<.001**
	University Student	3.41	0.12	3.41	0.11	.995
Information Sufficiency	Police Employee	1.83	0.10	1.92	0.11	.454
	University Student	2.79	0.14	2.42	0.15	*.020*
Rec. Investigation Suspect	Police Employee	4.08	0.10	2.75	0.14	-
	University Student	4.07	0.13	3.26	0.18	-

Note. **bold** = Significant at the .01 level (2-tailed), *italics* = Significant at the .05 level (2-tailed), Police Employee = Police Intelligence Employee. Rec. = Recommended.

Multivariate analyses showed no significant two-way interaction effect between Participant Groups and Intervention (F (5, 101) = .34, p = .866), and no significant three-way interaction effect between Participant Groups, Vignette Type, and Intervention (F (5, 101) = .92, p = .470). This suggests that the intervention did not have differential effects between police intelligence employees and university students, either after reviewing bias-inducing or neutral information. Given the interaction effect between Participant Group and Vignette Type, only police intelligence employees were included in the main analyses. Comparisons between police intelligence employees and university students were exploratively done.

Vignette Realism

To ensure that the created vignettes were representative of intelligence-oriented police case studies, police intelligence employees were asked how realistic they found the vignettes

on a 5-point Likert scale. To assess whether there were differences in vignette realism between the Vignette Types, independent-sample t-tests were conducted for each vignette. Significant differences in vignette realism were found within vignette 2, t (57.43) = -2.02, p = .048, 95% BI [-.79, -.00] with vignette realism rated on average .40 higher for the bias-inducing vignettes than for the neutral vignettes, and vignette 4, t (69) = -2.06, p = .044, 95% BI [-.48, -.01] with vignette realism rated on average .25 higher for the bias-inducing vignettes than for the neutral vignettes. No significant difference in vignette realism were found for vignette 1, t (69.00) = -.27, p = .786, and vignette 3, t (63.62) = -1.89, p = .064. This shows that bias-inducing vignettes were rated as more realistic police cases than neutral vignettes, at least within vignettes 2 and 4. Table 5 shows the mean and standard deviations of the ratings for vignette realism per Vignette Type. These show that vignette realism was rated as sufficient for each Vignette Type (all mean scores > 3.5).

Table 5

Descriptive Statistics for Vignette Realism per Vignette Type

	Bias-inducing		Neutral	
Vignettes	*M*	*SD*	*M*	*SD*
Vignette 1	3.89	0.76	3.85	0.67
Vignette 2	3.97	0.68	3.58	0.94
Vignette 3	4.18	0.58	3.84	0.92
Vignette 4	4.27	0.45	4.03	0.55

Descriptive Statistics

The descriptive statistics including the mean score, standard deviations, and correlation coefficients of the variables are presented in Table 6. The variables were not normally distributed, apart from the Rational Thinking scale. The correlations show that, for all dependent variables, there was a positive association between the Vignette Types (bias-inducing, neutral), suggesting that participants responded consistently across the Vignette Types. For both vignette types, source reliability was positively associated with information accuracy, which both indicate how information was evaluated. Moreover, recommended investigation suspect was positively associated with recommended investigation case, which both indicate actual decision making behaviour. Correlations suggest that between Vignette Types, information sufficiency was differently associated to the recommendation for further investigation. Moreover, correlations showed that Expertise was associated with information sufficiency, recommended investigation, and Prior Cognitive Bias Training.

Table 6

Descriptive Statistics and Correlations for the Study Variables

Variables	*M*	*SD*	1	2	3	4	5	6a	6b	7a	7b	8a	8b	9a	9b	10a	10b	11
Intervention	0.32	0.47	-															
Rational Thinking	3.98	0.32	.16	-														
Years of Work	17.42	12.88	.03	.18	-													
Professional Scale	8.85	0.98	-.11	-.19	-.04	-												
Prior Cognitive Bias Training	2.83	1.52	.19	.06	*-.24*	*.25*	-											
Source Reliability (a)	3.20	0.69	-.16	-.02	-.00	-.12	-.18	-										
Source Reliability (b)	3.54	0.59	-.07	-.00	-.11	-.10	.01	**.41**	-									
Info. Accuracy (a)	3.18	0.69	-.18	-.07	-.02	-.04	-.12	**.81**	**.37**									
Info. Accuracy (b)	3.35	0.61	.05	-.04	-.06	-.10	-.06	**.41**	**.76**	**.57**	-							
Info. Sufficiency (a)	1.84	0.77	-.03	.18	.23	-.22	-.19	.22	-.17	.09	-.16	-						
Info. Sufficiency (b)	1.94	0.87	-.05	-.05	*.24*	-.05	-.07	.13	-.09	.05	.01	**.46**	-					
Rec. Investigation Suspect (a)	4.10	0.87	-.06	.19	.13	*-.31*	-.02	.00	-.06	.06	-.04	*.24*	.08	-				
Rec. Investigation Suspect (b)	2.73	1.05	.05	.00	-.00	*-.25*	.06	-.01	-.04	.05	.06	.02	-.00	**.36**	-			
Rec. Investigation Case (a)	4.42	0.64	.02	.16	.07	*-.24*	.09	-.12	-.01	.01	.01	.09	-.00	**.60**	*.26*	-		
Rec. Investigation Case (b)	3.47	1.10	.14	.09	-.20	-.12	.17	-.13	.08	-.07	.11	-.21	*-.24*	.16	**.66**	**.31**	-	
Age	44.92	11.75	.12	.15	**.83**	.02	*-.27*	-.03	-.11	-.03	.01	.20	*.28*	.16	-.02	.10	-.13	-
Gender[a]	-	-	-.20	-.09	-.21	-.19	.06	-.04	-.07	-.11	-.14	-.22	-.21	-.04	-.02	-.01	-.04	**-.27**

Note. **bold** = Significant at the .01 level (2-tailed), *italics* = Significant at the .05 level (2- tailed), (a) = bias-inducing vignettes, (b) = neutral vignettes, Info. = Information. Rec. = Recommended [a:] 1 = male, 2 = female, 3 = non-binary/third gender, 4 = I prefer not to say, 5 = I would like to identify myself as:.

Hypothesis Tests

The multi-variate repeated-measures ANOVA was conducted, with Vignette Type as within-subject factor, Intervention as between-subject factor, and source reliability, information accuracy, information sufficiency, recommended investigation suspect, and recommended investigation case as dependent variables. Table 7 shows mean scores, standard deviations, and statistical values for all effects. Results showed a significant main effect of the within-subject factor Vignette Type (bias-inducing, neutral), F (5, 65) = 20.73, $p < .001$, $\eta^2 = .62$. Univariate tests revealed significant differences between the Vignette Types on all dependent variable, apart from information sufficiency. Source reliability and information accuracy were significantly higher rated in neutral vignettes compared to bias-inducing vignettes, rejecting hypothesis 1. Recommended investigation suspect and recommended investigation case were significantly higher rated in bias-inducing vignettes compared to neutral vignettes, supporting hypothesis 1. This shows that, bias-inducing information was evaluated more critically than neutral information but led to less critical decision making.

Table 7

Descriptive Statistics and Statistical Values for Effects of Vignette Type

Dependent Variables	Independent Variables				Hypothesis Test				
	Bias-inducing		Neutral						
	M	*SD*	*M*	*SD*	*F*	*df*1	*df*2	*p*	*η2*
Source Reliability	3.16	0.09	3.52	0.08	16.37	1	69	**<.001**	.19
Information Accuracy	3.14	0.09	3.36	0.08	9.10	1	69	**.004**	.12
Information Sufficiency	1.83	0.10	1.92	0.11	.68	1	69	.414	
Rec. Investigation Suspect	4.08	0.11	2.75	0.14	90.16	1	69	**<.001**	.57
Rec. Investigation Case	4.42	0.08	3.53	0.14	41.32	1	69	**<.001**	.38

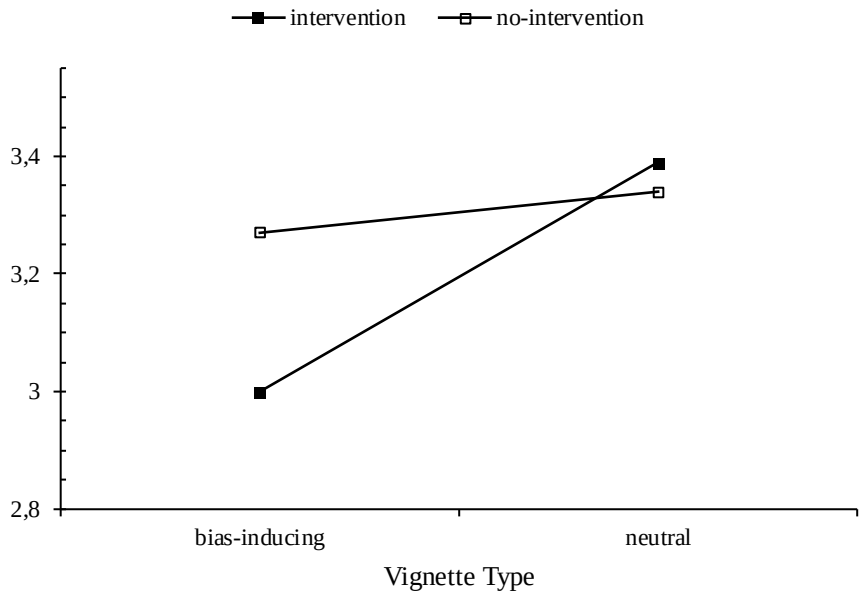
Note. **bold** = Significant at the .01 level (2-tailed). Rec. = Recommended

Despite absence of a significant interaction effect between Vignette Type and Intervention in the multivariate test (F (5, 65) = 1.51, $p = .200$), the univariate tests showed a significant interaction effect between Vignette Type and Intervention on information accuracy, F (1, 69) = 4.78, $p = .032$, $\eta^2 = .07$. Planned comparisons showed that, after receiving the intervention, information accuracy was significantly rated lower in bias-inducing vignettes (M = 3.00, SD = 0.14) than in neutral vignettes (M = 3.39, SD = 0.13), $Mdiff$ = -0.39, $p = .002$,

whereas this was not true for the no-intervention group (respectively $M = 3.27$, $SD = 0.10$ versus $M = 3.34$, $SD = 0.09$), $Mdiff = -0.06$, $p = .468$. Figure 1 shows this interaction effect. This suggests that the intervention was at least helpful in increasing critical information evaluation when reviewing bias-inducing information. While hypothesis 1 was rejected for information accuracy, this still shows effectiveness of the intervention, partly supporting hypothesis 2 in a reversed direction.

Figure 1

Interaction between Vignette Type and Intervention on Information Accuracy



From an exploratory perspective, no significant main effects of the between-subject factor Intervention were found (F (5, 65) = 0.56, $p = .734$). Due to violation of normality, additional non-parametric tests were performed to check all hypotheses tests. These found the exact same results for all analyses (Appendix I).

Exploratory Analyses

Covariate Analyses

Given the evidence-based potential of Rational Thinking to correct for differences susceptibility to bias-inducing information, Rational Thinking was additionally included as a covariate in the analysis. A multi-variate repeated-measures ANOVA was conducted, with Vignette Type as within-subject factor, Intervention as between-subject factor, Rational Thinking as covariate and source reliability, information accuracy, information sufficiency, recommended

investigation suspect, and recommended investigation case as dependent variables. This showed no significant main effect of Vignette Type (F (5, 64) = 0.94, p = .464), confirmed by univariate tests, which contradicts with original effects. $F_{SourceReliability}$ (1, 68) = 0.13, p = .716, $F_{InfoAccuracy}$ (1, 68) = 0.06, p = .813, $F_{InfoSufficiency}$ (1, 68) = 3.58, p = .063, $F_{InvestigationSuspecty}$ (1, 68) = 0.39, p = .533, $F_{InvestigationCasey}$ (1, 68) = 0.15, p = .696. This suggests that, after controlling for rational thinking, bias-inducing information did not lead to different outcomes in decision making than neutral information. However, there was no significant effect of Rational Thinking on the dependent variables (F (5, 64) = 0.51, p = .768) and no significant interaction effect between Vignette Type and Rational Thinking (F (5, 64) = 1.16, p = .337). This, in turn, suggests that rational thinking itself was not an influential variable.

Indeed, planned comparisons still showed that source reliability and information accuracy were significantly higher rated in neutral vignettes compared to bias-inducing vignettes. Recommended investigation suspect and recommended investigation case were significantly higher rated in bias-inducing vignettes compared to neutral vignettes. Planned comparisons showed no significance difference for information sufficiency between bias-inducing and neutral vignettes. Table 8 shows mean scores, standard deviations, and statistical values for all significant effects of planned comparisons. This does correspond with original effects, where bias-inducing information was evaluated more critically than neutral information but led to less critical decision making.

Table 8

Planned Comparisons of Vignette Type when corrected for Rational Thinking

Dependent Variables	Vignette Type				Hypothesis Test	
	Bias-inducing		Neutral			
	M	*SD*	*M*	*SD*	*Mdiff*	*p*
Source Reliability	3.16	0.09	3.52	0.08	-0.36	**<.001**
Information Accuracy	3.14	0.09	3.36	0.08	-0.23	**.004**
Information Sufficiency	1.82	0.10	1.92	0.11	-0.10	.353
Rec. Investigation Suspect	4.07	0.11	2.75	0.14	1.32	**<.001**
Rec. Investigation Case	4.42	0.08	3.53	0.14	0.89	**<.001**

Note. **bold** = Significant at the .01 level (2-tailed). Rec. = Recommended.

Multivariate tests showed no interaction effect between Vignette Type and Intervention (F (5, 64) = 1.41, p = .231). However, univariate tests showed that the original significant

interaction effect between Vignette Type and Intervention on information accuracy was retained (F (1, 68) = 4.58, p = .036, η^2 = .06). Planned comparisons showed that, after receiving the intervention, information accuracy was significantly rated lower in bias-inducing vignettes (M = 3.01, SD = 0.15) than in neutral vignettes (M = 3.40, SD = 0.13) $Mdiff$ = -0.39, p = .003, whereas this was not true for the no-intervention group (respectively M = 3.27, SD = 0.10 versus M = 3.33, SD = 0.09), $Mdiff$ = -0.06, p = .472. This suggests that, even after controlling for rational thinking, the intervention was at least helpful in increasing critical information evaluation. From an exploratory perspective, no significant main effects of the between-subject factor Intervention were found when corrected for Rational Thinking (F (5, 64) = 0.52, p = .757).

To get exploratory insights into how other covariates may correct for differences in both the between (Intervention: intervention versus no-intervention) and within (Vignette Type: bias-inducing versus neutral) factors, the covariates Expertise, operationalised as Years of Work and Professional Scale, and Prior Cognitive Bias Training were evaluated. This was done by considering the correlation coefficients between the covariates and the difference scores of Vignette Type on the dependent variables. The results can be found in Table 9. Years of Work is positively correlated with the difference score between the two Vignette Types for recommended investigation case. This suggest that as the number of Years of Work increases, the difference scores on recommended investigation case also increases, whereby these scores would be higher in bias-inducing vignettes than in neutral vignettes. No other significant correlation coefficients were found, suggesting that these variables would not impact the original effects.

Table 9

Correlations Between Vignette Type Difference Scores and Covariates

Variables	Years of Work	Professional Scale	Prior Cognitive Bias Training
Intervention	.03	-.11	.19
Source Reliability (a-b)	.08	-.04	-.18
Info. Accuracy (a-b)	.04	.06	-.07
Info. Sufficiency (a-b)	-.03	-.15	-.10
Rec. Investigation Suspect (a-b)	.10	-.00	-.07
Rec. Investigation Case (a-b)	*.24*	-.02	-.12

Note. *italics* = Significant at the .05 level (2- tailed), (a) = bias-inducing vignettes, (b) = neutral vignettes, Info. = Information, Rec. = Recommended.

Open-Ended Insights on Decision making Thinking Processes

To gain in-depth insights into the effects found, open-ended answers were analysed by conducting Chi-Square tests of independence. Dummy variables represented coded open-ended answer categories as dependent variables. Vignette Type, Intervention, and Participant Group were separately considered as a between factors.

Vignette Type. Chi-Square tests of independence were conducted to investigate significant differences in thought processes between the Vignette Types (bias-inducing, neutral). The percentages and statistical value for significant results can be found in Table 10. Compared to neutral vignettes, within the bias-inducing vignettes, thought processes were significantly more critical about the information sufficiency, more intuitive, and more mixed about the burden of proof towards to suspect. Compared to bias-inducing vignettes, within neutral vignettes, thought processes were significantly more analytical, and more positive about the burden of proof towards to suspects. Thus, while bias-inducing information led to more critical thinking processes about the sufficiency of information and the burden of proof towards the suspect, it also led to more intuitive and less analytical thinking processes.

Table 10

Significant Percentages Differences of Open Answer Categories Between Vignette Types

Open Answers Categories	Percentages per Vignette Type				Test
	Bias-inducing		Neutral		Fisher's
	Presence	Absence	Presence	Absence	Exact
Information Sufficiency (Critical)	69.5	30.5	58.0	42.0	.049
Intuitive Thinking	13.5	86.5	3.5	96.5	.003
Analytical Thinking	47.5	52.5	70.6	29.6	<.001
Burden of Proof (Mixed)	5.7	94.3	0.7	99.3	.019
Burden of Proof (Positive)	2.8	97.2	17.5	82.5	< .001

Intervention. Chi-Square tests of independence were conducted to investigate significant differences in thought processes between the Intervention groups (intervention, no-intervention). Critical information sufficiency thought processes were significantly more prevalent in the intervention condition (72.3%) than in the no-intervention condition (59.5%), (p = .036 according to Fisher's Exact Test). This suggests that the cognitive debiasing intervention caused participants

to be more critical regarding information sufficiency in their self-reported open answers about their decision making than if participants had not undergone the intervention.

Participant group. Chi-Square tests of independence were conducted to investigate significant differences in thought processes between the Participant Groups (police intelligence employees, university students). The percentages and statistical value for significant results can be found in Table 11. The results showed that in self-reported open-ended responses about thought processes during decision making university students reported certain aspects significantly more often than police intelligence officers. This included consideration of information accuracy, intuitive thought processes, being mixed in intuitive and analytical thinking, being moderate in open-minded thinking, and being both aware and unaware of biases. In comparison with police intelligence employees, these results suggest that, in general, university students were more likely to report taking the accuracy of information into account when making a decision, although the direction (critical or positive) is undefined. Moreover, these results showed that university students' open-ended responses demonstrated more intuitive thought processes, mixed thought processes in intuitive versus analytic thinking, moderate open-minded thinking, and both more unawareness and awareness of biases compared to police intelligence employees' open-ended responses.

Besides, police intelligence employees reported other aspects significantly more often than university students. These included a critical consideration of the information sufficiency, analytical thought processes, and a critical consideration of the burden of proof. These results indicated that, in general, police intelligence employees had more analytical thought processes and a more critical consideration of both the information sufficiency and burden of proof compared to university students. The statistical values for significant results can be found in Table 11.

Table 11

Values of Significant Results of Open Answer Categories Between Participant Groups

Open Answers Categories	Percentages per Participant Group				Test
	PIE		University Student		Fisher's
	Presence	Absence	Presence	Absence	Exact
Information Accuracy	1.4	98.6	5.9	94.1	.015
Information Sufficiency (Critical)	63.7	36.3	41.4	58.6	<.001
Intuitive Thinking	8.5	91.5	23.0	77.0	<.001
Analytical Thinking	59.2	40.8	43.3	56.7	.002
Intuitive/Analytical Thinking	6.7	93.3	13.2	86.8	.034
Moderate Open-Minded Thinking	8.5	91.5	16.4	83.6	.016
Burden of Proof (Critical)	67.3	32.7	53.3	46.7	.005
Unaware of Biases	9.9	90.1	22.4	77.6	<.001
Aware of Biases	22.2	77.8	40.1	59.9	<.001

Note. PIE = Police Intelligence Employee

Discussion

Emerging deceptive or incomplete information flows can make it more difficult for police intelligence employees to identify misinformation (Heuer & Pherson, 2008). This is exacerbated by the fact that misinformation may trigger the activation and reliance on cognitive biases. This study was the first to experimentally compare differences in information evaluation and decision making among Dutch police intelligence employees when police cases were either influenced by cognitive bias-inducing or neutral information. Moreover, this study assessed whether a cognitive debiasing video intervention could play a potential helpful role in preventing cognitive bias-influenced intelligence decision making.

It was found that information evaluation and decision making differed depending on the presentation of the information given. Although bias-inducing vignettes aligned more with one's idea about a 'realistic intelligence case', sources were judged as less reliable and the information as less accurate than after reviewing neutral information. However, further investigation to both the suspect and the case was actually recommended more after reviewing bias-inducing information than after reviewing neutral information. It was found that the lowered evaluation of information accuracy in bias-inducing vignettes occurred only after the cognitive debiasing video

intervention, which thus enhanced critical evaluation of information accuracy in those vignettes. However, the cognitive debiasing intervention did not further influence the differences between vignette conditions on other dependent variables. Moreover, subtle effects seemed to persist when controlling for rational thinking as a beneficial trait.

Exploratory findings suggest that, only after reviewing bias-inducing information, years of work was associated with a higher recommendation to further investigate the case. Professional scale and prior cognitive bias training were not found to be associated with differences in decision making between the vignette types. Unlike police intelligence employees, university students were less critical towards bias-inducing information. Open-ended insights partially confirmed the effects found and gave additional insights.

Impact of Cognitive Bias-Inducing Information

After reviewing bias-inducing information, intelligence employees judged the sources as less reliable and the information as less accurate than after reviewing neutral information. This implicates awareness and critical thinking towards bias-inducing information. However, after reviewing bias-inducing information, the recommendation to further investigate both the suspect and the case was higher. From an organisational perspective, these recommendations are not grounded. Under the prism of proportionality, law enforcement must make informed decisions about where the best chance of success lies compared to the risk, harm and costs involved, including resources, money, and time. This means that not all crimes can be investigated equally (Wilkinson, 2010). From this idea, it is remarkable that, despite individuals were more critical of the information in bias-inducing vignettes, they still recommended further investigation.

However, exploratory open-ended responses showed there was more criticism about the sufficiency of information and greater uncertainty about the burden of proof towards the suspect in bias-inducing vignettes. Although uncertainty is inherent to intelligence work (Friedman & Zeckhauser, 2012), an increased sense of ambiguity and contradictions in bias-inducing vignettes could increase the need to reduce uncertainty (Mandel & Irwin, 2020). This aligns with the Uncertainty Reduction Theory, explaining that individuals seek additional information when experiencing uncertainty about their environment (Knobloch, 2008). As decisions based on uncertain information can potentially lead to profound consequences, a sense of vigilance or precautionary responsibility could explain why there is a heightened recommendation for further investigation, despite a critical evaluation of information.

Previous literature suggested that bias-inducing information would lead to reduced effort to process information (Heuer, 1999). Although the more critical evaluation of bias-inducing information seems to conflict with this, it will be explained later that this can be attributed to the intervention. However, the recommendations for further investigation seem to align with the idea that bias-inducing information impairs decision making by errors in judgment (French et al., 2023; Janssen et al., 2019). As the vignette types did not differ in the perceived sufficiency of information they contained and bias-inducing vignettes were even more realistic (especially for vignette two and four), the recommendation to further investigate these vignettes cannot be explained by a rational-driven need for information.

A gap between rational thinking and decision making behaviour may explain this. This aligns with Heuer (1999), stating that knowing that the information comes from an unreliable source does not necessarily reduce the impact of the information. Potentially, bias-inducing information created an internal imbalance between what one rationally knows and what one intuitively expects, leading to a less rational driven recommendation for further investigation. Despite that the intervention activated critical information evaluation, bias-inducing information may still have activated cognitive biases, leading to more intuitive System 1 and biased-driven decisions to verify beliefs, such as a search for additional evidence (Heuer, 1999; Kahneman & Sustein, 2005). Exploratory open-ended insights confirmed this. Individuals showed more intuitive thinking in their decision after reviewing biased information, while more analytical thinking was shown after reviewing neutral information. This is illustrated by quotes, such as "my feeling tells me that this could be right".

Furthermore, correlations suggested that bias-inducing and neutral vignettes activated different cognitive processes. When the information in neutral vignettes was perceived as more sufficient, the recommendation to further investigate the case decreased. However, when the information in bias-inducing vignettes was perceived as more sufficient, the recommendation to further investigate the suspect increased. This suggests that, contrary to neutral information, bias-inducing information served as a justification to at least conduct further investigation into the suspect. This is consistent with confirmation bias, where people seek information to reinforce existing assumptions (Nickerson, 1998). Again, this suggests that bias-inducing information activated cognitive biases, which guided decision making processes. This provides a stronger

foundation for the proposed gap between rational thinking and decision making behaviour than for the Uncertainty Reduction Theory.

Role of Rational Thinking

When controlled for rational thinking, bias-inducing information did not lead to different recommendations for further investigation than neutral information. This suggests that individuals with higher levels of rational thinking were less influenced by bias-inducing information, supporting the theory that rational thinking is a protective trait against susceptibility to cognitive biases (Dhami & Careless, 2019; Kahneman & Frederick, 2005; Stanovich & Toplak, 2023). However, after controlling for rational thinking, there were also no differences between bias-inducing and neutral information on the perceived reliability of the sources and the accuracy of the information. This challenges the protective role of rational thinking, which suggested that higher levels of rational thinking led to a more critical evaluation of bias-induced information.

The disappearing critical evaluation of bias-inducing information can be explained by the fact that rational thinking is operationalized as both effortful System 2 thinking and actively open-minded thinking (AOT). AOT is associated with openness to multiple possibilities (Stanovich & Toplak, 2023), higher persistence in information seeking, and lower levels of overconfidence (Haran et al., 2013). A less determined and more cautious attitude in individuals with higher levels of rational thinking would explain why there are fewer clear differences between the evaluation of bias-inducing and neutral information.

Nevertheless, as rational thinking itself was not an influential variable, subtle differences between vignette types remained visible. Even when controlling for rational thinking, bias-inducing information still led to a more critical evaluation of sources and information accuracy than neutral information, while the recommendation for further investigation of the suspect and the case was higher. The concept of bounded rationality in Simon's (1957) decision making approach explains why rational thinking alone may not be sufficient as a comprehensive defence against bias-driven decision making. It posits that people satisfy rather than maximize because optimal decision making may be hindered by humans' limited cognitive system of and the complexity of the environment. Accordingly, optimal decision making is determined by the type of task, the characteristics of the environment, and the distinct features of the individual that makes the decision, including expertise or previous knowledge (Campitelli & Gobet, 2010). This wide variety of determinants can explain why rational thinking diminished but not completely

vanished the observed effects of bias-inducing information. Other factors may have influenced decision making.

Thus, within police intelligence work, rational thinking is not necessarily a comprehensive protective factor against susceptibility to biases-inducing information, but rather a protective factor that dampens rigid biased-driven information processing and establishes more cautious decisions. This suggests that, to mitigate susceptibility to misinformation, it is not sufficient to rely solely on provoking System 2 thinking (Monteiro et al., 2019). Therefore, misinformation susceptibility mitigation also necessitates a focus on additional factors and interventions that go beyond the classical reasoning account and even the integrative account.

Role of Expertise

Only after reviewing bias-inducing information, the recommendation to further investigate the case became greater as individuals' tenure in the police increased. This may have been caused by the activation of cognitive biases, leading to experienced employees relying more on experienced-based expectations (Dror, 2020; Reyna et al., 2014). The lower level of prior cognitive bias training amongst experienced employees supports this. While experience does not change one's cognitive system, it makes it more efficient. This enables more selective decision making processes while avoiding irrelevant alternatives (Campitelli & Gobet, 2010; Chase & Simon, 1973). As explained by the Uncertainty Reduction Theory, prior experiences with under-investigated cases can create a precautionary need for information. In this way, prior experience can influence decision making of intelligence employees, leading to an increased likelihood of recommending further investigation in bias-inducing vignettes. This provides insights into how experience informs intelligence employees' decision making.

Nevertheless, after reviewing bias-inducing information, the recommendation to further investigate the suspect did not increase as years of work increased. Thus, despite possible activation of cognitive biases, experienced officers focused solely on gathering additional case information without unwarranted premature focus on a specific suspect.

Differences between bias-inducing and neutral information did not change as individuals moved up the career ladder to higher professional scales. This shows that susceptibility to falling prey to biasing or misleading is unrelated to police intelligence employees' cognitive capacities nor expertise (Ceci & Williams, 2022; Merckelbach et al., 1998; Pantazi et al., 2021).

Role of Prior Cognitive Bias Training

Differences between bias-inducing and neutral information did not change with more prior cognitive bias training. However, participants reported a broad spectrum of prior cognitive bias training, ranging from work-related workshops to writing a master's thesis on cognitive biases. Thus, the quality and effectiveness of prior cognitive bias training can vary considerably. This may explain why the current study found no differences between bias-inducing and neutral information with more prior cognitive bias training. As the quality of prior training could not be assessed in this study, the results should be interpreted with caution. Especially because the durability of the effects of most debiasing strategies is unknown (Belton & Dhami, 2020).

Impact of a Cognitive Debiasing Video-Intervention

Only after exposure to the intervention, bias-inducing information was perceived as less accurate than neutral information. The intervention thus explains the previously found differences in information accuracy assessment between the vignettes. Even though cognitive biases can complicate the assessment of information accuracy, the intervention was helpful in the desired goal of critically evaluating bias-inducing information (Dhami & Careless, 2019; Heuer, 1999). As varying levels of rational thinking did not affect the transfer of training (Grossman & Salas, 2011), the increased critical assessment of bias-inducing information can be attributed with more certainty to the intervention. Although no additional effects of the intervention were found, it can be concluded that the intervention at least improved the evaluation of the accuracy of bias-inducing information. This supports the previous intervention, and the conceptual model used for the current intervention (Barton et al., 2016; Morewedge et al., 2015; Symborski et al., 2014).

Exploratory open-ended insights showed that, after receiving the intervention, there was more criticism about the sufficiency of the information in the vignettes. Perhaps the intervention also stimulated a critical holistic assessment of information. Increased awareness of the limitations of incomplete information may explain why bias-inducing information's accuracy was more critically assessed after receiving the intervention.

Contrary to expectations based on literature (Morewedge et al., 2015), no other differences between bias-inducing and neutral information were found after receiving a cognitive debiasing video-intervention. This may be explained by several phenomena. For example, the conviction that the intervention is not relevant to their work, individual differences, resistance towards debiasing training due to the bias blind spot (believe that one is free from biases, while

recognizing it in others), and the chance to backfire (Belton & Dhami, 2020). In line with the transfer problem, these phenomena show that the actual application of learned behaviour depends on many factors. Due to the convenience of heuristic, people rarely exert effort to override them, making mere awareness of cognitive biases perhaps insufficient for behavioural change (De Neys et al., 2008).

According to positive transfer of training, the ability to effectively generalise learned behaviour to the intended context depends on factors, such as trainee characteristics, training design, and the work environment. A lacking overall effectiveness of the intervention may be attributed to training design features, rather than trainee characteristics or the work environment (Baldwin & Ford, 1988; Grossman & Salas, 2011). Despite using the same conceptual framework (Appendix B; Appendix C) and procedures as a previous effective intervention (including teaching about biases, teaching the directional influence of each bias on judgment, and providing mitigation strategies) some design features differed (Barton et al., 2016; Fischhoff, 1982; Morewedge et al., 2015; Symborski et al., 2014). While the previous effective debiasing intervention was an extensive 30-min training video with narrated and reenacted scenarios, the current video lasted only 7 minutes and lacked role-play scenarios. Perhaps, due to its duration and reduced dynamics, the current intervention design was not sufficient to be effective.

Although the intervention increased a more critical evaluation of bias-inducing information, the intervention did not influence recommendations for further investigation. Therefore, its generalisability is questioned. To enhance the intervention's efficacy, a refinement of the intervention is advised, including a more extensive video intervention or an interactive serious game that is specific to Dutch police intelligence officers. After refinement of the intervention, future research could again explore its impact on decision making scenarios.

The Difference Between Police Intelligence Employees and University Students

As there were initial concerns about obtaining sufficient participants, university students were approached. However, this group did not seem to be representative of police intelligence employees. When reviewing neutral information, university students were more likely to recommend further investigation to the suspect than police intelligence employees. At least after reviewing neutral information, police intelligence employees seem to be more deliberate and critical about exhausting organisational police capacities and resources to conduct further investigation to the suspect. This aligns with the prism of proportionality (Wilkinson, 2010).

Given that university students do not work for the Dutch police and may therefore not be aware of or care about the resources, this result makes sense from a practical perspective.

In contrast to police intelligence employees, university students were not critical towards the sources and were even more positive about the extent to which the bias-inducing information was sufficient to make a judgment about guilt. Also, their self-reported thought processes were more effortless and ambiguous, while those of police intelligence employees were more critical and analytical. This implicates that university students were not representative to police intelligence employees regarding how they processed and analysed the different types of information. This strongly undermines the suggestion that police intelligence employees, as experts, are more susceptible to bias-led judgments (Lee et al., 2016; Reyna et al., 2014). In fact, police intelligence employees' experiential knowledge may have fostered more deliberate decision making (Campitelli et al., 2010). Lowered critical decision making among university students may be due to limited domain-specific knowledge or completing the questionnaire in a second language. As age is unrelated to cognitive biases susceptibility (Berthet, 2021), group differences can not be attributed to age.

There were two reasons to only include police intelligence employees within main analyses; (1) differences between participant groups in the two vignette types (2) the fact that investigating decisions within police intelligence employees' own domain of expertise is more ecologically valid than examining the same decisions among university students in domain unfamiliar to them (Campitelli et al., 2010).

The intervention did not work differently between the participant groups. However, given the differences between the groups, it is important for future interventions to consider the unique characteristics of specific target groups.

Strengths, Limitations and Future Research

A strength of the current study is the experimental approach and use of realistic and representative vignettes that favour external validity. Vignettes were closely related to the practice of decision making in the police context. The use of full randomization and counterbalancing ensured that order effects were minimized, which means that the effects found can be attributed to the experimental manipulation with more certainty. The combination of both quantitative and open-ended insights strengthens confidence in the present findings.

A limitation of the current study is the unequal distribution of participants who did and did not receive the intervention. As a result, differences may not only be attributed to the intervention, but also to sample characteristics, which affects the robustness of the results. Moreover, approaching participants without direct control by the researcher may lead to selection bias and incomplete randomisation. External factors may have influenced participation. Methodological limitations are also present in the results obtained. Despite the use of a coding scheme, the coding remains subject to human interpretation and open answers were not assessed by a second rater. This may have led to coding bias. Therefore, these results should also be taken with caution. Future studies should focus on a more standardized sample acquisition and coding method, including open-ended data into main analyses for more significant insights.

Furthermore, the choice of an online questionnaire may have introduced confounding variables, such as the context in which the questions are answered. This may lead to variability in the answers that is not caused by the independent variables. Nevertheless, internet methods align and are representative with findings from traditional methods of psychological research (Gosling et al., 2004).

Perhaps the most important limitation of the current study is that it is unknown whether the designed bias-inducing vignettes actually activated cognitive biases, at least more than the information given in neutral vignettes. Although the vignette types were subject to almost identical designs and only differed in the manipulation, the increased reality assessment in bias-inducing vignettes may imply that these vignettes are actually in line with 'what one expects' based on representativeness biases and probabilities. This suggests that the designed bias-inducing vignettes may indeed activate cognitive biases. However, if so, it may also illustrate a practical concern. It implies that the content of bias-inducing vignette may be somewhat more applicable in practice that that of neutral vignettes. This raises the question of whether biased information is routinely present in police intelligence cases. If this is the case, it again highlights the need for ongoing and future research on this topic.

Finally, as noted, future research may examine the impact of an intervention on a broader range of intelligence-oriented decision making aspects when exposed to bias-inducing and neutral information. However, a more extensive video intervention or interactive serious game that is specific to Dutch police intelligence employees is advised to enhance an intervention's applicability and efficacy in mitigating cognitive biased-driven decision making.

Conclusion

Increased and improved information possibilities make the production and dissemination of misinformation increasingly possible. Partly by activating cognitive biases, misinformation complicates the work and decision making processes of police intelligence employees. To gain an insight into the impact and susceptibility to misinformation within Dutch police-oriented intelligence work, current study investigated how cognitive bias-inducing information can influence decision making within intelligence-oriented police work and to what extent a cognitive debiasing video intervention can limit this influence. It can be stated that bias-inducing information activates duality between rational and intuitive thinking and decision making. On the one hand, there is a more critical assessment of source reliability and information accuracy. On the other hand, further investigation into the suspect and the case is recommended within those cases. Current study showed that these thinking and decision making processes may be influenced by debiasing intervention techniques and individual factors, such as rational thinking dispositions, years of work, and familiarity with the task-related context. Therefore, it can be concluded that misinformation susceptibility depends on a wide variety of factors and has no comprehensive solution to date. These results offer encouraging insights into how police intelligence employees deal with potential bias-inducing misinformation but also highlight the need for domain-specific interventions that align rational information evaluation with final decision making processes.

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Appendix A

During the preparation of this work, the author used Google Translate and ChatGPT to generate well-formed English sentences at an academic level and to translate created vignettes from Dutch to English. After using this tool/service, the author thoroughly reviewed and edited the content as needed, taking full responsibility for the final outcome.

Appendix B

Conceptual framework

This study expands the cognitive bias framework of Symborski et al. (2014) and Barton et al. (2016), discussing the specific cognitive biases relevant to intelligence operatives, their causes, and mitigation approaches. The conceptual framework is based on the dual-process systems of reasoning (Evans, 2007; Forster & Liberman, 2007), including System 1 reasoning, characterized by automatic, intuitive, and reactive thinking, and System 2 reasoning, characterized by analytical reasoning and rule-driven thinking. According to Morewedge and Kahneman (2010), judgment biases arise when the automatic and intuitive processes of System 1 reasoning lead to erroneous conclusions, which are not noticed and mitigated by the logical, controlled processes of System 2 reasoning. The conceptual framework distinguishes the cognitive processes underlying each bias (System 1 reasoning processes) and suggests promising mitigation strategies (System 2 reasoning processes).

Confirmation bias (C)

"If a theory is thought to be correct, then investigators are more likely to believe unsound arguments that support it (Cook et al., 2013)"

Theory-based cause

This is the result of confirmatory search (Klayman & Ha, 1987), which leads to an increase in the selective accessibility of hypothesis-consistent information. When searching for information, individuals tend to look for evidence that confirms the hypothesis rather than looking for evidence that refutes the hypothesis or supports alternatives (Morewedge & Kahneman, 2010). It is suggested that individuals have an unconscious tendency to form a hypothesis early in a task, influenced by the internal consistency of the information, its diagnostic weight, the type of information, and the priming effects of hypothesis testing. This early formation of a hypothesis can cause susceptibility to confirmation bias. In addition, confirmation bias affects the work of intelligence employees and is more common in tasks involving diagnostically weighted initial information and mixed types of information (Whitesmith, 2020).

Theory-based mitigation

Ask people to consider not only the central hypothesis, but also the evidence that supports or refutes the alternatives (Morewedge & Kahneman, 2010), This may increase the accessibility of and deliberate attention to hypothesis-inconsistent information (Koriat et al., 1980). This can

be done through Analysis of Competing Hypothesis (ACH) and the 'consider-the-opposite' strategy. ACH involves identifying and comparing all reasonable statements and conclusions to determine which is most likely to be correct. Presenting or actively seeking conflicting information and competing hypotheses can stimulate critical thinking (French et al., 2023), reduce persistence in beliefs (Lewandowsky et al., 2012), and reduce confirmation bias (Lam, 2007). By suggesting 'consider-the-opposite', confirmation bias can also be reduced by individuals imagining how they would react to contrary evidence. This can lead to a reduced tendency to ignore conflicting evidence. Presenting conflicting evidence before a search for information can reduce the bias of that search for supporting evidence (Lord et al., 1984).

Confirmation Bias Vignette

The bias is generated when investigating informative clues in a vignette scenario that are specifically aimed at intelligence work in the police. For example, the intelligence employee is asked to investigate a series of burglaries. In the scenario, a potential suspect is described, and the participant is given a series of informative clues, which activate a particular hypothesis (for example, an eyewitness has seen someone wearing similar clothing to the main suspect at the time of the burglary). After examining the informational clues, the participant is subjected to statements that are relevant within intelligence-oriented decision making. The probability scores given by the participants will reveal the confirmation bias; for example, focusing on information that confirms the primed hypothesis ('I have obtained sufficient information to be able to make a statement about the likelihood that suspect X is guilty of case Y'), while overlooking other alternatives, may indicate biased thought patterns and behaviour.

Fundamental Attribution Error (F)

"The tendency to overemphasize personality-based explanations for other behaviours and underestimate the role of situational influences on the same behaviour."

Theory-based cause

When individuals try to understand why others do what they do, they often focus on the personal characteristics of others, while overlooking the potential influence of environmental or situational factors (Gilbert, 2002). This can lead to a personality-based explanation for the behaviour of others being anchored or overemphasised, while underestimating the role and power of situational influences on the same behaviour (Gilbert, 2002).

Theory-based mitigation

Explicitly considering situational influences has been previously suggested to reduce biased reasoning (Krull, 1993). By focusing on possible situational influences on behaviour, reflective, rule-driven System 2 thinking can be strengthened (Gilbert, 2002). Moreover, to mitigate the fundamental attribution error, as with confirmation bias, one could explicitly consider alternatives and analyse the behaviour of the majority under the same conditions (Gilbert, 2002).

Fundamental Attribution Error Vignettes

This bias is induced in the vignettes by focusing on both personality and situational explanations for specific behaviours. In the bias-inducing vignette, slightly more personality explanations than situational explanations will be given, increasing the likelihood of falling prey to the fundamental attribution error. For example, for a drug trafficking suspect, the neutral vignette indicates that his expensive lifestyle can be financed by an inheritance, while the bias-inducing vignette offers no evidence for this. The extent to which a participant still chooses personality-based explanations for a character's behaviour, while not considering situational influences, suggests the presence of the fundamental attribution error in his or her judgment.

Anchoring bias (A)

"The tendency to lean too heavily on or pay too much attention to one property or single piece of information when making a decision" (Kahneman, 2011)

Theory-based cause

Anchor bias occurs when decision-makers first focus on the anchor before making a judgment or decision (Gilbert, 2002). Irrelevant information, which is given prior to a decision, is then overvalued and used as a reference point, while additional information is undervalued (French et al., 2023). Anchor bias is caused by testing whether there is a match between the anchor and the target, with the initial thought or exposure disproportionately fixated on the utility or accuracy of that idea. It is likely that individuals do not adjust their initial judgement enough with additional information, leading to biased judgements (Jacowitz & Kahneman, 1995). Especially when there is a lack of effort or cognitive resources, individuals place too much value on one type of information. In addition, an anchor is often considered a plausible value, making individuals more likely to retrieve information that confirms the anchor, while selectively making the confirming information more accessible in their evaluations, in line with selective accessibility or the confirmatory search mechanism (Strack & Mussweiler, 1997; Chapman &

Johnson, 1994). Anchor bias can be caused in two ways, externally or internally (Epley & Gilovich, 2005). An externally given anchor can increase the selective accessibility of information consistent with the anchor, which is given more weight in making judgments, potentially leading to bias (Barton et al., 2016). An internally provided anchor can be caused by prior knowledge, leading to making bias judgments about a conscious anchor by not deviating far enough from the anchor (Epley & Gilovich, 2001). It is also suggested to criminal intelligence employees that they rarely deviate from their anchor when additional information is considered, caused by familiarity with the information (Heuer, 1999). This is consistent with the suggestion that expertise in the subject does not seem to1 significantly reduce anchoring.

Theory-based mitigation

To reduce anchoring bias effects, it is useful to deliberately consider alternative information and to incite the logical processes of System 2 reasoning (Chapman & Johnson, 1999; Barton et al., 2016). This can be done by explicitly considering alternatives and thinking about the reasoning for rejecting the anchor as an estimate. To provide an alternative perspective, the information can be linked to opposing viewpoints (Lord et al., 1984). Considering the opposite can trigger anchor inconsistent information that is normally overlooked, leading to processing both the information they already have and opposing information. (Adame, 2016).

Anchor bias vignettes

This bias is evoked in the 'bias-inducing' vignettes by providing an anchoring-specific information cue at the beginning, which already induces that the suspect is indeed the perpetrator. This is how an anchor is formed. In addition, the neutral vignette provides more information that weakens this anchor. For example, in a burglary case, the neutral vignette argues that the suspect had a verified alibi for past burglaries, while the bias-inducing vignette argues that there is insufficient evidence for this. In this way, it is more likely that the anchoring bias will be more present in the bias-inducing vignette than in the neutral vignette.

Representativeness bias (R)

"The tendency of people to assess the probability or frequency of a hypothesis by taking too much account of how similar the hypothesis is to available data and by using the similarity of an outcome to a prototypical outcome, rather than analysing useful descriptive information (Kahneman & Tversky, 1972; MITRE et al., 2016)" There is too much reliance on appearances of what 'seems right' to make judgments by considering the possibility that something is more

similar to one group than another, based on the characteristics it exhibits. Relevant principles of statistics and probability are neglected (Tversky & Kahneman, 1974).

Theory-based cause

The representativeness heuristic occurs when there is a similarity judgment for a probability judgment, also known as 'attribute substitution' (Kahneman and Frederick 2002), leading to neglect of probability information or base rates. When individuals believe that a sample of information is representative of the population and correlates with each other, the estimation of true probabilities will be distorted.

Theory-based mitigation

To reduce representativeness bias effects, invoking System 2 reasoning is useful to reduce 'attribute substitution' and neglect of the base rate. In addition, providing statistical training helps to increase attention to probability information and baseline velocities (Tversky & Kahneman, 1983). Other methods to reduce representativeness bias include benchmarking (where a decision rule is established prior to decision making), a scenario-based approach (in which decision-makers say 'what if?' scenarios), a search for disproving evidence, as well as highlighting potentially unreliable descriptions, searching for disproving evidence, looking for anomalies, considering specific exceptions, and making the bias salient by reminding decision-makers of its harmful effects on judgment (Lee et al., 2016).

Representativeness heuristic vignettes

This bias is generated in the bias-inducing vignettes by describing the suspect in such a way that it corresponds to the stereotypical image of the crime. This increases the likelihood that the reader will see similarities between the suspect and the crime without considering relevant statistical principles or probabilities. For example, in a sexual abuse case, the neutral vignette states that the defendant is a young adult, social woman, while the bias-inducing vignette states that the defendant is a middle-aged man with a lack of empathy. In this way, it is more likely that the representativeness bias will be stronger in the bias-inducing vignette than in the neutral vignette.

Overall mitigation strategies

To mitigate cognitive biases by System 2 reasoning, the current research based the cognitive biasing video intervention on techniques focused on the consideration of alternative information. A combination of the Analysis of Competing Hypothesis (ACH) and the Consider-

The-Opposite technique was used. Both encourage the use of competing and additional (hypothetical) information within decision making and judgment.

ACH attempts to circumvent natural tendencies by identifying and comparing all reasonable statements and conclusions to determine which one is most likely to be correct. By presenting competing hypotheses, consumers are expected to debunk evidence to create a coherent narrative based on corresponding evidence.

Presenting opposing information and competing hypotheses can stimulate critical thinking (French et al., 2023) and is proposed to be an effective technique to reduce cognitive biases within intelligence employees. This technique has been proven effective in raising awareness and focus on relevant alternatives. However, this effect was only found for situations where generating alternatives was easy (Kretz, 2018).

However, from a practical point of view, it is suggested that a lighter, less time-consuming way to perform the ACH steps should be found (Kretz, 2018). For example, checking off a checklist can be helpful, as some steps can be skipped due to stress, time constraints, and distractions. This technique is consistent with disfluency techniques, where the interruption of the smooth flow of information can create a deeper, more strenuous cognitive process and lead to greater reflection and objectivity (Kretz, 2018).

The intervention from the present study was designed based on these recommendations. In line with ACH, participants were asked to formulate a hypothesis or alternative explanation based on the information that proved the suspect's innocence. To respond to 'considering the opposite', participants were asked to write down what information proved the suspect's innocence. Finally, participants were encouraged to use a checklist to simplify their thinking and to ensure that important steps in intelligence work were not missed (Appendix C).

Appendix C

Debiasing Intervention

The cognitive debiasing intervention was a 7-minute video intervention explaining the most common cognitive biases for police intelligence employees. This video was based on a previously proven effective debiasing video intervention 'Unbiasing Your Biases' (Morewedge et al., 2015). In addition, based on the conceptual framework, recommendations for mitigation techniques against cognitive biases were made within police-oriented intelligence work (Appendix B). The concrete recommended mitigation techniques are explained in Table 18.

Table 18

Recommended Mitigation Techniques Within the Debiasing Video Intervention

Mitigation Technique	Meaning	Recommendation
Disfluency Techniques	Ticking off a checklist to interrupt the smooth flow of information and create a more strenuous cognitive process	Simplify thought processes by using a checklist
Analysis of Competing Hypotheses	Producing alternative possibilities for the situation	Based on the information, form an alternative possibility that shows that suspect X is innocent
Consider-The-Opposite	Actively studying information that supports an opposite statement to one's own initial statement	Describe what information indicates that suspect X may be innocent

English debiasing video intervention: https://youtu.be/_enPIILdz6Y

Dutch debiasing video intervention: https://youtu.be/QNYRuDHry7w

Appendix D

Comprehensive Thinking Styles Questionnaire

To assess Rational Thinking, the Comprehensive Thinking Style Questionnaire was used by Newton et al. (2023). The scale included 24 items, which could be answered on a 6-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree) by the prompt: *"Please indicate to what extent you agree or disagree with the following statements"*. Mean scores were calculated. The item questions, and corresponding subscales are given in Table 12

Table 12

Comprehensive Thinking Style Questionnaire (CTSQ) by Newton et al. (2023)

Number	Item	Subscale
1.	It's important to stay true to your beliefs, even when evidence is presented against them. (R)	AOT
2.	Whether something feels true is more important than evidence.	AOT
3.	The fact that evidence contradicts my current beliefs does not mean that my beliefs are wrong. (R)	AOT
4.	There may be evidence that contradicts what you believe, but that doesn't mean you should change your beliefs. (R)	AOT
5.	Even if there's concrete evidence against what you believe to be true, it's okay to hold on to held beliefs. (R)	AOT
6.	Regardless of the topic, what you believe to be true is more important than evidence against your beliefs. (R)	AOT
7.	I think there are many wrong ways, but only one right way, to do almost anything.	CMT
8.	In my experience, the truth is often black and white.	CMT
9.	Truth is never relative.	CMT
10.	The truth doesn't change.	CMT
11.	Either something is true or it is false; There is nothing in between.	CMT
12.	There is no middle ground between what is true and what is false.	CMT
13.	I like to trust my intuitive impressions.	PIT
14.	I believe in trusting my intuitions.	PIT
15.	When I make decisions, I usually trust my intuition.	PIT
16.	Using my "gut feeling" usually works well for me when solving problems in my life.	PIT
17.	Intuition is the best guide in making decisions.	PIT
18.	I often follow my instincts when choosing a course of action.	PIT
19.	I'm not very good at solving complicated problems. (R)	PET
20.	Thinking is not my idea of a pleasurable activity. (R)	PET
21.	I try to avoid situations that require deep thought. (R)	PET
22.	I'm not a very analytical thinker. (R)	PET
23.	Reasoning things out carefully is not one of my strong suits. (R)	PET
24	Thinking hard and long about something doesn't give me much satisfaction. (R)	PET

Note. (R) = Reserved scored items. AOT = Actively Open-minded Thinking, CMT = Close-Minded Thinking, PIT = Preference for Intuitive Thinking, PET = Preference for Effortful Thinking.

Appendix E

Vignette study

Four vignettes were designed that functioned as case studies within intelligence police work. Within vignettes, information was given about a possible suspect in a police case on the basis of four information cues. For both vignette variants (bias-inducing and neutral), the objective burden of proof against the suspect was equally weak in each vignette, ensuring that both variants contained the same amount of uncertain information. However, in the bias-inducing vignette variants, participants were exposed to information cues that attempted to elicit the susceptibility of cognitive biases that are specifically relevant to Dutch police intelligence employees, confirmation bias, fundamental attribution error, anchoring bias, or representativeness bias. Within the bias-inducing vignette variants, this was done by manipulating each of the four information such that they each elicited at least one of the four specific cognitive biases. The neutral vignettes were designed in such a way that they were less likely to evoke the specific cognitive biases than in the bias-inducing vignette variants. The four created vignette cases are given in Table 13, 14, 15, and 16.

General Note. R = Representativeness Bias, A = Anchoring Bias, C = Confirmation Bias, F = Fundamental Attribution Error

Table 13

Vignette 1

General Case Description		
A series of burglaries have taken place in the diamond district. You are investigating a possible Dutch suspect, M.A., and have the following information:		
Additional Information Cues		
	Vignette Variant	
	Neutral	Bias-Inducing
(**R**): M.A. has many tattoos all over his body, often wears dark clothing, and (1). According to the emergency response colleagues (2) was ultimately allowed to continue on his way.	3. was recently stopped during a traffic check in the diamond district. 4. there were no notable circumstances, and he	3. was stopped for a check in the diamond district at night. 4. he behaved suspiciously, but
(**A**): A BVH notification (a police system for recording incidents, filing reports, and preparing criminal case files) states that M.A. was convicted of residential burglary in 2020. A few months ago he was already identified as a possible perpetrator of previous residential burglaries, (3)	5. but he had a verified alibi.	5. but there was insufficient evidence.
(**C**): A local resident stated that he saw a suspicious man in the neighborhood around the time of one of the burglaries, wearing a (4) sweater.	6. yellow	6. black
(**F**) The local police officer (5)	7. is aware that mobile burglary gangs from Eastern Europe are active in the city.	7. knows that M.A. funds his expensive lifestyle of brand-name clothing and expensive watches through theft.

Table 14

Vignette 2

General Case Description		
In the past three months, the number of unwanted sexual advances has increased during nightlife in the city centre. None of the complainants have seen their perpetrator clearly. You are investigating a possible suspect, D.L., and have the following information:		
Additional Information Cues		
	Vignette Variant	
	Neutral	Bias-Inducing
(**R**): D.L. is a (1) receiving specialized psychiatric care for the treatment of aggression problems. The probation officer and case manager describe D.L. as someone with (2)	1. 26-year-old woman 2. an open demeanour, who quickly establishes contact but has a short temper. D.L. appears to have a large social network of friends and family.	1. 42-year-old man 2. a closed-off demeanour, who makes little eye contact and lacks empathy. D.L. appears to have few social contacts.
(**A**): D.L. appears to follow a large number of 18+ content creators on social media and responds to their content with sexually suggestive comments. Moreover, one of these content creators filed a complaint against D.L. in 2019 for cyberstalking (3)	3. Investigation revealed evidence that D.L. was innocent of cyberstalking	3. No investigation took place, due to the withdrawal of the complaint.
(**C**): Security staff and emergency officers state that they have increasingly seen D.L. in the city centre during nightlife over the past six months. Previously, they (4). (5) complainants confirm having seen D.L. on the nights of the incidents in the same club.	4. occasionally saw her 5. One of the six	4. had never seen him there. 5. Four of the six
(**F**) All incidents have occurred on Thursday nights. On Thursdays, nightlife venues are always very crowded, (6) and bouncers often receive reports about young people making sexual remarks to women	8. there is little freedom of movement	6. D.L. is often seen

Table 15

Vignette 3

General Case Description		
Together with your intelligence team, you are investigating a drug trafficking network. Potential leaders of the network have been arrested. You are investigating a possible suspect, K.H., and have the following information:		
Additional Information Cues		
	Vignette Variant	
	Neutral	Bias-Inducing
(**R**): K.H. is a (1) man, wears (2) clothing and comes across as (3) Upon reviewing his background, it is noticeable that, despite involvement in minor violent incidents in the past and a disadvantaged background, he is now a (4) and lives in a luxury apartment. Reports of previous incidents indicate that K.H. was willing to cooperate (5)	1. 65-year-old 2. casual 3. restless 4. shareholder of a successful company 5. and voluntarily provided evidence to prove his innocence	1. 29-year-old 2. expensive 3. calculating 4. successful electrician 5. but often tried to steer the conversation
(**A**): The local police officer mentions that residents have previously reported seeing many suspicious people and activities around K.H.'s house. This included smells of weed and brief meetings in cars that would come and go. To date, the local police officer has not found anything suspicious, (6)	6. even though the local police officer has been conducting more surveillance at the apartment.	6. but has not yet conducted extra surveillance at the apartment.
(**C**): In the past, during a search of a street dealer's home, a notebook was found with names and phone numbers. K.H.'s details were also on it. Upon further investigation, these were found to be linked to a (7)	7. class reunion	7. drug-related issues
(**F**) Neighbours have expressed suspicion about K.H.'s sudden luxurious lifestyle, which includes expensive cars and designer clothes. They say this style does not fit with his previously modest lifestyle (8)	8. K.H. claims that he owes his wealth to the inheritance from a beloved family member. Evidence of this has been found in the form of bank statements and legal documents	8. Despite evidence of receiving an inheritance, they consider him as a cunning and unreliable man, who likely acquired his wealth illegally.

Table 16

Vignette 4

General Case Description		
Together with your team, you investigate a possible money laundering network that is probably involved in concealing illegal income via legitimate companies. You investigate a potential suspect, M.S., a 45-year-old entrepreneur who runs several hospitality establishments in the city centre. You have the following information:		
Additional Information Cue		
	Vignette Variant	
	Neutral	Bias-Inducing
(**R**): M.S. is known to other hospitality entrepreneurs as (1) They describe that M.S. surrounds himself with many friends from the past (2) They also say that M.S. as an entrepreneur (3)	1. open and trustworthy 2. who also have successful businesses 3. M.S. as an entrepreneur often comes up with strategic and innovative plans	1. closed and cunning 2. who have some criminal past. 3. is strategic as an entrepreneur and occasionally tries to circumvent the rules.
(**A**): The local police officer has received reports from residents about suspicious visitors at the M.S.'s nightclub. The officer has not observed any criminal activity during surveillance. (4)	4. He expects that these reports are based on the character of the neighbourhood	4. However, he suggests that the nightclub may be serving as a cover for illegal activities.
(**C**): M.S.'s financial records show an unexpectedly high flow of money into his bank accounts over the past two years. M.S. claims that this money came from investors and loans. (5)	5. Upon further investigation, indeed contracts for investments and loans are found.	5. However, much of this money flow remains unexplained and unproven.
(**F**) Other hospitality entrepreneurs wonder how M.S. finances his luxurious lifestyle since his hospitality businesses are not very busy. M.S. claims that his wealth comes from real estate investments. (6)	6. Found evidence confirms that M.S. has made significant profits from real estate investments in successful residential projects. This explains his luxurious lifestyle.	6. Due to his closed and manipulative attitude, other entrepreneurs remain convinced that he is involved in illegal activities.

Appendix F

Dependent Variables and Vignette Realism Measures

Table 17 shows the specific response options for the closed-ended measures that were assessed after investigating each vignette regarding the dependent variable, susceptibility to bias-inducing (mis)information during intelligence-oriented decision making, and vignette realism.

Table 17

Measures of the Dependent Variables and Vignette Realism

Name	Item	Response Options				
Dependent Variables						
Source Reliability	I trust that the information obtained comes from reliable sources	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Information Accuracy	I trust that the information obtained is correct.*	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Information Sufficiency	I have obtained sufficient information to be able to make a statement about the likelihood that suspect X is guilty of this case.*	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Rec. Investigation Suspect	To what extent would you recommend further investigation into suspect X?*	Not at all	Little	Neutral /No opinion	Some what	Strongly
Rec. Investigation Case	To what extent would you recommend further research into this case?*	Not at all	Little	Neutral /No opinion	Some what	Strongly
Vignette Realism						
Vignette Realism	This scenario is realistic within intelligence work	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Note. Rec. = Recommended

Appendix G

Coding Scheme for Open-Ended Answers About Thinking Processes During Intelligence-Oriented Decision making

Category	Direction	Code
1. Source Reliability	No direction	1
	Critical about source reliability	1.1
	Positive about source reliability	1.2
2. Information Accuracy	No direction	2
	Critical about information accuracy	2.1
	Mixed about information accuracy	2.2
	Positive about information accuracy	2.3
3. Information Sufficiency	Critical about information sufficiency	3.1
	Positive about information sufficiency	3.2
4.1. Rational Thinking (intuitive – analytical)	Intuitive thinking process	4.1.1
	Mixed (intuitive/analytical) thinking process	4.1.2
	Analytical thinking process	4.1.3
4.2. Rational Thinking (closed-mindedness - open-mindedness)	Closed-minded thinking process	4.2.1
	Moderate open-minded thinking process	4.2.2
	Actively open-minded thinking process	4.2.3
5. Burden of Proof	Critical about burden of proof	5.1
	Mixed about burden of proof	5.2
	Positive about burden of proof	5.3
6. Bias Awareness	Unaware of own or other's biases	6.1
	Aware of own other's biases	6.2

Coding Method

During the coding of the open answers, the open answers were first read by means of open coding and categorized into main themes (e.g. focus on alternatives and focus on situational factors). By means of axial coding, corresponding codes were combined within overarching codes (e.g. actively open-minded thinking). Finally, selective coding was performed, whereby

each open answer that fitted within a theoretical construct represented a specific direction on a scale (rational thinking: close-mindedness - actively open-mindedness).

Coding Instructions

Only when participants explicitly mentioned something that fitted within a certain theme, a code was assigned.

If indicated something about the reliability of the source, the direction was specifically assessed (1=no direction, 1.1=critical, 1.2=positive). Examples of this are 1= “source”, 1.1= “most sources are very subjective” and 1.2 = “lots of information with a reliable background”.

If indicated something about the accuracy of the information, the direction was specifically assessed (2=no direction, 2.1=critical, 2.2=mixed, 2.3=positive). Examples of this are 2= “I decided because of the type of information”, 2.1= “I wonder how the informants were questioned”, 2.2= “I take the information as truth. This is police information ... Is there camera footage, multiple witnesses, fingerprints?”, 2.3= “The findings point very strongly towards the person”

If indicated something about the sufficiency of the information, the direction was specifically assessed (3.1= critical, 3.2=positive). Examples of this are 3.1= “There needs to be more evidence than just the local police officer saying he steals” and 3.2= “Enough information to launch a follow-up investigation”.

If open answers indicated something about rational thinking processes on a scale from system 1 (intuitive) to system 2 (analytical), the direction was specifically assessed (4.1.1= intuitive, 4.1.2= mixed, 4.1.3= analytical). Examples of this are 4.1.1= “my feeling tells me that this could be right”, 4.1.2= “From the sources it can be seen that there are not many witnesses who are reliable, because they can benefit from substantiating the suspect's case. Also legal people can be bribed. Moreover, the suspicious situations are something to keep an eye on.”, 4.1.3= “Collecting and further investigating/interpreting the available information”.

If open answers indicated something about rational thinking processes on a scale from close-minded thinking to actively open-minded thinking, the direction was specifically assessed (4.2.1= close-minded, 4.2.2= moderate open-minded, 4.2.3= open-minded). Examples of this are 4.2.1= “The findings point very strongly towards the person, there is no such thing as coincidence.”, 4.2.2= “In particular, the fact that only information has been provided about D.L. is a reason for me to want to conduct broader research, but the information provided is also

enough for me to investigate D.L. further.", 4.1.3= "You can not just bet on him, but you have to keep your eyes open for other information".

If indicated something about the burden of proof, the direction was specifically assessed (5.1= critical, 5.2=mixed, 5.3=positive). Examples of this are 5.1= "There is no evidence to suggest the suspect was involved", 5.2= "No evidence has been presented that M.A. is innocent of the crime … So far all evidence points against him" and 5.3= "If there is so much evidence that K.H. is not guilty".

If indicated something about the bias awareness, the direction was specifically assessed (6.1= unaware, 6.2= aware). Examples of this are 6.1= "M.A. fits the suspect profile stereotype", and 6.2= "Avoid tunnel vision based on qualitatively poor information".

However, it is important to be aware that the coded open responses only indicated whether specific theoretical constructs were present. No statements are made about the correctness or 'goodness' of the answers. For example, when answers are coded as 'positive about burden of proof', this means that the participant felt that there was sufficient evidence, whether this was either about the guilt or the innocence of the suspect.

Appendix H

Covariate Measures

Prior Cognitive Bias Training

How much experience have you had with cognitive bias training so far? [1]

1	2	3	4	5
Totally no experience				Very much experience

What type of cognitive bias training have you had in the past? [2]

[Open answer]

1. *additional option (6): "I don't know what cognitive biases are, so I can't answer this question."*
2. *is not displayed when the answer 'No experience at all' is selected for the question 'How much experience have you had with cognitive bias training so far?'.*

Appendix I

Non-parametric Tests for Hypothesis Tests

A Related-Sample non-parametric Wilcoxon Signed Rank Tests with exact approximation was conducted, with Vignette Type as within-subject factor, and source reliability, information accuracy, information sufficiency, recommended investigation suspect, and recommended investigation case as dependent variables. Results revealed significant differences between the Vignette Types on all dependent variable, apart from information sufficiency. Source reliability and information accuracy were significantly higher rated in neutral vignettes compared to bias-inducing vignettes, rejecting hypothesis 1. Recommended investigation suspect and recommended investigation case were significantly higher rated in bias-inducing vignettes compared to neutral vignettes, supporting hypothesis 1. Table 19 shows median scores, z-values, and p-values.

Table 19

Statistical Values for Effects of Vignette Type (Wilcoxon Signed Rank Test)

Dependent Variables	Independent Variables		Hypothesis Test	
	Bias-inducing	Neutral		
	Mdn	*Mdn*	*z*	*p*
Source Reliability	3.0	3.5	-3.82	**<.001**
Information Accuracy	3.0	3.5	-2.23	*.026*
Information Sufficiency	1.5	2.0	-.98	.338
Rec. Investigation Suspect	4.0	2.5	-6.46	**<.001**
Rec. Investigation Case	4.5	3.5	-5.56	**<.001**

Note. **bold** = Exact significant at the .01 level (2-tailed). *italics* = Exact significant at the .05 level (2-tailed). Rec. = Recommended

By assessing the between-subject conditions (intervention, no-intervention) separately, two Related-Sample non-parametric Wilcoxon Signed Rank Tests with exact approximation were conducted, with Vignette Type as within-subject factor, and source reliability, information accuracy, information sufficiency, recommended investigation suspect, and recommended investigation case as dependent variables. Results revealed a significant interaction effect only between Vignette Type and Intervention on information accuracy. In the intervention group, there was a significant difference in information accuracy between the neutral condition (*Med* = 3.25)

and the cognitive bias primed condition (*Med* = 3.00), with z = -3.08, p = .001 (Exact Sig., 2-tailed). This suggests that the effect of the Vignette Type depends on the Intervention for information accuracy. In the no-intervention condition, this significant difference was not found (z = -.67, p = .532). This aligns with the previously found interaction effect between Vignette Type and Intervention on information accuracy, suggesting that the intervention was at least helpful in increasing critical information evaluation. While hypothesis 1 was rejected for information accuracy, this still shows effectiveness of the intervention, partly support hypothesis 2 in a reversed direction.

From an exploratory perspective, a Mann-Whitney U Tests showed no significant main effects of the between-subject factor Intervention for none of the dependent variables for each vignette type. These results are given in Table 20.

Table 20

Mann-Whitney U Test Between-Subject Factor Intervention

Value	Dependent Variables									
	Source Reliability		Information Accuracy		Information Sufficiency		Rec. Investigation Case		Rec. Investigation Suspect	
	BI	N	BI	N	BI	N	BI	N	BI	N
U	439.5	492.5	434.5	508.0	537.5	525.5	460.0	537.0	539.5	438.5
p	.155	.435	.139	.574	.855	.738	.243	.852	.871	.157

Note. BI = Bias-Inducing, N = Neutral, Rec. = Recommended.