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French gendarmes' ability to make inferences while listening to witnesses: Implicit and interfering information curbs their comprehension

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Summary

Forty French gendarmes from the *Gendarmerie Nationale*, and 40 laypersons completed two experiments to assess how they make inferences from testimonies. The first experiment targeted how inferences are made when the critical information on which a judgment has to be made is explicitly stated in the testimony or it is implicit and has to be inferred. The second experiment assessed the comprehension of statements when critical information about an event described by a witness was directly and clearly available in the testimony or embedded within irrelevant information and personal thoughts of the witness. Results showed that gendarmes had fewer false alarms than laypersons when the statements were explicit but had as many false alarms as laypersons when information was implicit and had to be inferred. It was also found that gendarmes had fewer false alarms than laypersons when the critical information was not embedded within irrelevant information but had as many false alarms as laypersons when irrelevant information was present. This study shows that being a gendarme involves better understanding of testimonies, but only as long as testimonies do not contain redundant, interfering, and implicit information. Otherwise, this superiority is lost.

KEYWORDS
comprehension, police officers, testimony, witnesses' interview

1 | INTRODUCTION

French gendarmes are security workers involved in many activities such as law enforcement, surveillance, crime prevention, or criminal investigation (Davies & Beech, 2017; Esteve, 2018). They receive special training and develop particular skills and strategies through several years of experiences and thousands of hours of practice (Esteve, 2018). French gendarmes are often the first to respond to crime scenes. Upon arrival, they are often faced with limited and unconfirmed information about the alleged crime. They are required to reconstruct events and deal with preliminary reports, witness statements and impressions, usually under time and resource pressure (Edmond et al., 2017; Fahsing & Ask, 2013, 2016). For instance, immediately after the horrific terror attack in Paris (the 13th of November 2015), police forces (*Gendarmerie Nationale* and *Police Nationale*) were deployed to determine the unfolding of events by interviewing the first witnesses. In these early stages of the crisis, investigators reported that they were faced with inconsistent and inaccurate information. For example, when witnesses or victims, inside or near the Bataclan concert hall, were asked to describe the attackers, some have reported that one of the attackers was female, whilst others reported seeing only male attackers (Seelow, Piel, & Cazi, 2015). Because witnesses focus their attention on different aspects of the scene, and because their memory may be affected by different factors, testimonies vary in accuracy and in the amount of relevant information reported (Bull, Valentine, & Williamson, 2009; Gudjonsson, 2003; Satin & Fisher, 2019). Personal perceptions, knowledge and thoughts are thus guiding their testimony. In such situations, one question remains poorly investigated: how do investigators deal

with witnesses' testimony, and what are the factors affecting its comprehension?

Studies about witness interviewing spend significant time and effort on understanding cognitive and social factors that influence the development of effective interviewing (see Satin & Fisher, 2019). Indeed, the information gathered has a direct influence on the criminal investigation (Kebbell & Milne, 1998; Yarmey, 2001). However, human perception does not operate like a video camera and, despite witnesses' best intentions, their memory often fails them (Bull et al., 2009; Loftus, 2003, 2005). Studies have shown that factors such as age, high levels of stress, weapon presence, schemata and script, or intoxication with psychoactive substances affect the quantity and the quality of information reported by witnesses (Davies & Hine, 2007; Overman, Wiseman, Allison, & Stephens, 2013; Palmer, Flowe, Takarangi, & Humphries, 2013; Pickel, 1998). Faced with confused or inaccurate statements, investigators can only rely on their own comprehension and interpretation abilities to resolve complex situations in which factual evidence is often missing (Canter & Youngs, 2009; Fahsing & Ask, 2016). To our knowledge, the role of expertise in assessing testimonies has not been tested directly yet. Empirical cognitive research in this area has been largely neglected, partially because professionals' assessment of testimonies and evidence is believed to be relatively objective and free from bias. However, this assumption is challenged by a growing number of investigations suggesting that an expert's assessment is far from being as objective as it should be (Dror, 2006; Edmond et al., 2017; Osborne, Woods, Kieser, & Zajac, 2014). Expertise can be understood as a socially recognized characteristic linked to knowledge, technique, skills, or a combination of them all, which distinguishes someone from novices and less experienced people within a discipline (Ericsson, Charness, Feltovich, & Hoffman, 2006). According to this definition of expertise, expert chess players almost always will win games against recreational chess players, expert medical specialists are more likely to diagnose a disease correctly than less experienced people, and so on. It also makes possible to conduct studies in different fields where expertise is likely to play a role and to include that experts could make errors or not differ from novice under particular circumstances (Ericsson et al., 2006). However, numerous studies across a wide range of fields have demonstrated that exposure to, or experience with, a given procedure or activity does not itself confer expertise (Ericsson, Hoffman, Kozbelt, & Williams, 2018). In general, the amount of training and experience displays only a weak relationship with objective measures of performance. Therefore, expertise does not always confer increased performance as compared to novices or layperson. Highly trained individuals with several years of experience and thousands of hours of practice may fare no better than novices (Edmond et al., 2017; Ericsson et al., 2006; Fahsing & Ask, 2016; White, Kemp, Jenkins, Matheson, & Burton, 2014). This is particularly the case in the field of lie detection, behavioral analyses, or detective expertise (Garrido, Masip, & Herrero, 2004; Kassin, Meissner, & Norwick, 2005; Koller, Wetter, & Hofer, 2015; Masip & Herrero, 2015; Vrij, 2008). In addition, other studies reported that experts in forensic fields may engage in incorrect or biased interpretation under particular situations or contexts (Dror, 2005; Dror, 2017; Dror & Hampikian, 2011; Edmond et al., 2017; Osborne, Taylor, Healey, & Zajac, 2016; Sunde & Dror, 2019). In accordance with these studies, we conducted a cognitive investigation on French gendarmes' inference and comprehension abilities during witness interviews.

Besides witnesses' failures, the quality of testimony may also depend on the ability of the listener to extract from statements what happened, where, when and who was involved (Bull et al., 2009; Davies & Beech, 2017; Gudjonsson, 2003). Therefore, understanding testimony could be compared to a comprehension task during which inferences are made on the basis of information given by the witness. During text or discourse comprehension, readers or listeners integrate information, and generate an overall coherent picture of stories, the goals and actions of protagonists, and about events unfolding in the real world or in some fictional world (Dijk & Kintsch, 1983; Johnson-Laird, 1983). Most current models of comprehension assume that readers or listeners generate three levels of representation of a text: lexical, semantic, and situation model representations (Dijk & Kintsch, 1983; Graesser, Singer, & Trabasso, 1994; Johnson-Laird, 1983; Tapiero, van den Broek, & Quintana, 2002). The lexical level corresponds to the exact wording and syntax of the speech. It is a verbatim representation of what is said (Kintsch, Welsch, Schmalhofer, & Zimny, 1990). The semantic level captures the meaning conveyed by the discourse, independently of its surface formulation, but remains closely linked with discourse formulation (Kintsch & van Dijk, 1978). The situation model is the third level of representation (Dijk & Kintsch, 1983). At this level, the situation described is represented separately from the speech structure and embedded in listeners' knowledge (Dijk & Kintsch, 1983; Johnson-Laird, 1983; Tapiero, 2007). This level of representation allows access to elements that are implicitly suggested by the discourse but not explicitly reported. In sum, during witness interviews, investigators combine, compare, and integrate incoming information with acquired knowledge, background context, schemata, scenarios, and experiences in order to construct a coherent mental representation of the situation described (Barbey, Colom, & Grafman, 2014; Graesser, Millis, & Zwaan, 1997; Powers, Bencic, Horton, & Beeman, 2012; Virtue, Haberman, Clancy, Parrish, & Jung Beeman, 2006). Therefore, to successfully understand what happened, who were involved, and where the crime took place, investigators are required not only to capture what is explicitly reported by witnesses, but also to go further. Because much of investigators' activities involve dealing with gathering and interpreting information, one might expect that they present an advantage in all levels of inferences, ranging from recalling precise verbatim sentences of the witnesses, to paraphrasing them and interpreting them (Canter & Youngs, 2009). There is however a real risk that investigators will engage in incorrect or biased interpretation related to their own experience (Edmond, Tangen, Searston, & Dror, 2015).

Correct and appropriate comprehension results from the construction of a coherent representation of the situation reported (Dijk & Kintsch, 1983; Oostendorp & Goldman, 1998; Tapiero, 2007).

To elaborate this coherence, researchers assumed that two fundamental processes are involved: the construction phase, and the integration phase. The construction phase consists in making inferences by activating elements stored in memory linked with the incoming information, such as background context, prior knowledge, schemata, scenarios, and experiences (Albrecht & Myers, 1995; Morton Ann Gernsbacher, 1995; Kintsch, 1988). However, all of the information generated would not be integrated into the mental representation, because some activated information will probably be useless for overall understanding. The second integration phase refers to mechanisms for selecting necessary information and eliminating that which is not relevant. This phase of inhibition is supposed to occur when readers or listeners are faced with incoherent or contradictory information (Gernsbacher, 1989; Gernsbacher & Faust, 1991). Although inferences are a powerful mechanism for comprehension, they may be affected by the presence of secondary and irrelevant information. Therefore, this kind of information may affect construction and integration phases and lead listeners to errors, distortions, and misinterpretations (Brainerd & Reyna, 2005; Guillory & Geraci, 2010; Hamm & Hasher, 1992; Hasher & Zacks, 1988; Loftus, Miller, & Burns, 1978). During a criminal investigation, this phenomenon can be exaggerated by the fact that witnesses are often interviewed several times and are required to communicate as much information as possible, including personal thoughts, feelings, and impressions (Bull et al., 2009; Gudjonsson, 2003). For example, techniques like the cognitive interview use this kind of information to help witnesses to mentally reinstate the context, by asking them to recall everything they remember, and recalling event details multiple times and in different ways (see Satin & Fisher, 2019). Although these techniques have been shown to increase the amount of information that witnesses recall (Anderson & Pichert, 1978; Odinot, Memon, La Rooy, & Millen, 2013; Rooy, Pipe, & Murray, 2005), there is also a potential increase in incorrect details recalled (Memon, Meissner, & Fraser, 2010). The difficulty for investigators remains that of generating an appropriate mental representation, by combining the information they received with prior knowledge, contextual background, and experiences, while minimizing the importance of, or rejecting irrelevant information (Guillory & Geraci, 2010; Hamm & Hasher, 1992; Hasher & Zacks, 1988; Mason & Just, 2006; Seifert, 2002; Tompkins, Lehman-Blake, Baumgaertner, & Fassbinder, 2001). Several studies have examined how exposure to irrelevant information, such as contextual or emotion-evoking information, mislead forensic experts in the analysis and the interpretation of latent fingerprints, DNA mixtures, or bloodstains (Dror, 2005; Dror, 2017; Dror & Hampikian, 2011; Osborne et al., 2016; Sunde & Dror, 2019). In the same vein, one could expect that secondary and irrelevant information including witnesses' personal thoughts and feelings may lead listeners to errors and misinterpretations. Then, the difficulty in correctly understanding statements as a whole could be due to the inability to set aside inferred information that is not relevant (Hamm & Hasher, 1992; Hasher & Zacks, 1988; Zacks, Hasher, Doren, Hamm, & Attig, 1987). Testimony investigation may be understood as a process of gathering information which is relevant to the facts that are described and identifying the best explanation while rejecting that information that is irrelevant and not related to the facts. As reported by Fahsing and Ask (2016), investigations are often complicated by the large number of potential explanations and the constant influx of information, and the many possible ways to combine, test, and develop competing investigative hypotheses to the most likely explanation. As a consequence, we hypothesized that French gendarmes may be less affected by secondary and irrelevant information. During their daily activities they face complex statements; hence, they could develop strategies that help them to focus on and integrate relevant information. However, there is also a risk that contextual information, expectations, and experiences may affect their interpretations (Gilovich, Griffin, Kahneman, & Press, 2002).

The purpose of the present study was to investigate French gendarmes' testimony comprehension abilities. In a first experiment (Experiment 1), we investigated how comprehension is affected when critical information is explicitly reported, or needs to be inferred. Then, in a second experiment (Experiment 2), we assessed the comprehension of statements when critical information was embedded in redundant and irrelevant information, including witnesses' thoughts and feelings about the event or about unrelated memories. In accordance with the above-mentioned literature, we expected French gendarmes to be better at comprehension than laypersons, whether the critical information on which inferences were to be made was explicit, implicit, or embedded in irrelevant information. However, recent studies suggest that experts conducting forensic examinations are far from being as objective as they should be (Edmond et al., 2017; Sunde & Dror, 2019), leading us to doubt whether the superiority of gendarmes would be ever-present. To examine our hypotheses, a set of participants from the *Gendarmerie Nationale*, and a set of participants with no involvement in law enforcement completed the two experiments of the present study.

2 | EXPERIMENT 1

2.1 | Method

This experiment was based on and adapted from the "La gestion de l'implicite" neuropsychological test (Duchêne May-Carle, 2000).

2.1.1 | Participants

A total of 80 participants took part in this study. Forty participants were French gendarmes (all male) from the *Gendarmerie Nationale*, Sathonay Camp, France, and 40 were laypersons (e.g., engineers, photographer, consultant, sales representative, farmer). Their age ranged from 19 to 55 years old (M = 30.80; SD = 9.40). The gendarmes were slightly younger (M = 28.55; SD = 5.46) than the laypersons (M = 33.05; SD = 11.78; $t[78] = 2.19$; $p < .031$; Cohen's $d = .49$). Therefore, whenever a group effect or a group interaction is observed, age will be used as a covariate in order to control this effect. Participants were excluded if they self-reported had taking any psychoactive

medication (antidepressant, anxiolytics, neuroleptics, anticonvulsants, hypnotics, tranquilizers, etc.) or regular use of other psychoactive substances (alcohol, marijuana, etc.) for a period of 6 months prior to the experiment. Participants were also excluded if French was not their mother tongue. They all reported normal vision and hearing, and gave their informed written consent for their participation. No prerequisite was necessary, and participation was voluntary. The study was conducted according to the ethical guidelines of the Declaration of Helsinki.

2.1.2 | Intelligence measure

An intelligence evaluation was carried out for each participant in order to verify that the two groups did not exhibit any differences of this type. Otherwise, whenever a group effect or a group interaction is observed, IQ would be used as a covariate to control that effect. A four-subtest short form of the Wechsler Adult Intelligence Scale, 3rd ed. (WAIS-III; (Grégoire & Wierzbicki, 2009), which has good predictive accuracy of total test scores in normal individuals, was administered to participants (test–retest reliability = 0.95; using the vocabulary, information, block design, and matrix reasoning subtests). The task lasted less than 30 min.

2.1.3 | Stimuli and apparatus

Inferences. This task was especially designed to assess inferences made on information that is explicit or implicit. It consisted in 10 brief narratives; each one was followed by four statements to be judged. All stimuli were videos. Four individuals (two males and two females) were recruited to be audio-video-recorded (Camera Panasonic LUMIX FZ-300, Resolution 1920 × 1080pi). The first male recorded five brief narratives, and the first female the five remaining narratives. The second male recorded the four statements to be judged relative to each narrative narrated by the first male. This was also the same for women. The narratives were simple sentences (e.g., Patrick said to his brother, "You should clean your car if you are hoping to sell it to someone."). As for the statements to be judged, half explicitly concerned the fact stated in the narrative (explicit condition: "According to Patrick, the car needs to be washed"), and the other half concerned facts that were not explicitly stated in the text, but that could be inferred (implicit condition: "Patrick doubts that his brother can find a buyer for his car"). More complete examples of this material could be found in the supporting information.

2.1.4 | Procedure

At the start, a slide explained the task to the participants. They were instructed that they would see male or female actors giving a brief narrative. Each narrative was immediately followed by short videos of other actors pronouncing sentences that the participants were required to judge (statements to be assessed). In each trial, participants were required to watch each of the narratives attentively, and, for each subsequent statement to be judged, to say whether the statement was what they had understood or not. Then, the task commenced, and the first narrative video was shown. Then, four statements to be assessed were presented in a random order for each participant. After each statement to be assessed, a display indicating "yes or no" encouraged the participants to answer using the keyboard. Then, the next narrative was shown, followed by four statements to be assessed, and so on, until the end of the experiment. Two conditions were randomly and equiprobably presented: (a) explicit condition, the critical information was explicitly reported in the narrative; (b) implicit condition, the critical information was not explicitly reported, but needed to be inferred from the narrative. A total of 10 narratives were presented each followed by statements to be assessed. For each condition, 50% of the videos to be assessed were correct ("yes" response), and 50% were incorrect ("no" response). The task was administered on a laptop computer with OpenSesame software (Mathôt, Schreij, & Theeuwes, 2012). The task lasted less than 8 min.

2.1.5 | Data analysis

Hit rates (i.e., responding "yes" when the expected response was "yes"), and false alarms (i.e., responding "yes" when the expected response was "no") were compiled. Then, the proportion of hits and the proportion of false alarms were calculated and analyzed separately for each condition. The proportion of hits reflects whether participants grasped critical information effectively, whereas the proportion of false alarms indicates whether misinterpretations occurred. The proportion of "yes" responses (i.e., responding "yes" whatever the expected response) was also calculated. This score reflects participants' tendency to accept the information that they heard.

2.2 | Results and discussion

2.2.1 | Intelligence measure

French gendarmes and the laypersons did not differ in terms of IQ (gendarmes M = 104.04; SD = 10.38; laypersons M = 99.96; SD = 13.21; t[78] = 1.54; >0.13; Cohen's d = .34).

2.2.2 | Inference

The results are displayed in Table 1.

Proportions of hits

The participants' mean proportion of hits in the explicit condition was 0.883 (SD = 0.146), whereas the mean proportion of hits in the

TABLE 1 Proportions of hits, proportions of false alarms, and proportions of "yes" responses according to condition (explicit vs. implicit), and as a function of the group (laypersons vs. French gendarmes)

	Laypersons (*N* = 40)				French gendarmes (*N* = 40)			
	M	SD	Min	Max	M	SD	Min	Max
Proportion of hits								
Explicit condition	0.865	0.164	0.200	1.00	0.900	0.124	0.400	1.00
Implicit condition	0.783	0.211	0.200	1.00	0.768	0.162	0.400	1.00
Proportion of false alarms								
Explicit condition	0.103	0.183	0.00	1.00	0.018	0.050	0.00	0.200
Implicit condition	0.073	0.147	0.00	0.800	0.030	0.052	0.00	0.200
Proportion of "yes" responses								
Explicit condition	0.484	0.062	0.350	0.6	0.459	0.069	0.2	0.55
Implicit condition	0.428	0.117	0.100	0.65	0.399	0.083	0.2	0.55

Abbreviations: M, mean proportions; Max, maximum; Min, minimum; SD, standard deviation.

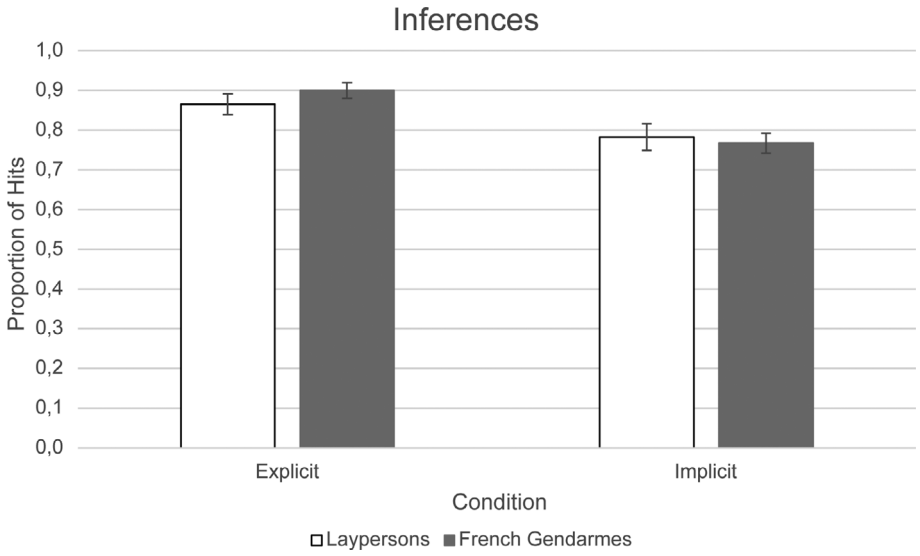

FIGURE 1 Mean proportions of hits as function of the condition (explicit vs. implicit) and group (French gendarmes vs. laypersons). Error bars represent 1 SEM

implicit condition was 0.775 (SD = 0.187). In both conditions, the participants' proportion of hits ranged between 0.2 and 1.

An analysis of variance (ANOVA) was computed on the proportion of hits with the condition (explicit vs. implicit) as the within-participant factor, and the group (laypersons vs. French gendarmes) as the between-group factor. The main condition effect was significant (F[1, 78] = 28.11; p = .000001; η^2_p = 0.265), the proportion of hits was greater in the explicit condition (M = 0.883; SD = 0.146) than in the implicit condition (M = 0.775; SD = 0.187), meaning that participants found correct information easier to understand when it was presented explicitly than when it was implicit. This is in line with our expectations because the comprehension of implicit information involves more processes such as previous knowledge and experiences (Barbey et al., 2014). The main group effect was not significant (F[1, 78] = 0.10; p = .753; η^2_p = 0.001), the performances of French gendarmes (M = 0.834; SD = 0.116) are similar to those of laypersons (M = 0.824; SD = 0.163), independently of the condition. The Condition × Group interaction did not reach significance (F[1, 78] = 1.52; p = .221; η^2_p = 0.019; Figure 1).

Proportions of false alarms

The participants' proportion of false alarms in the explicit condition ranged between 0 and 1 (M = 0.060; SD = 0.140), and between 0 and 0.8 (M = 0.051; SD = 0.111) in the implicit condition.

A separate ANOVA was conducted on the proportion of false alarms with the condition (explicit vs. implicit) as the within-participant factor, and the group (laypersons vs. French gendarmes) as the between-group factor. The main condition effect was not significant (F[1, 78] = 0.74; p = .393; η^2_p = 0.009), the proportion of false alarms did not differ between the explicit condition (M = 0.06; SD = 0.140) and the implicit condition (M = 0.05; SD = 0.111). The main group effect was significant (F[1, 78] = 6.25; p = .014; η^2_p = 0.074). French gendarmes overall had less false alarms (M = 0.024; SD = 0.032) than laypersons (M = 0.088; SD = 0.158). The Condition × Group interaction was also significant (F[1, 78] = 4.35; p = .040; η^2_p = 0.053). Newman–Keuls multiple corrected comparisons revealed that the French gendarmes' proportion of false alarms was significantly lower than the laypersons' proportion of false alarms in the explicit condition (gendarmes M = 0.018; SD = 0.050;

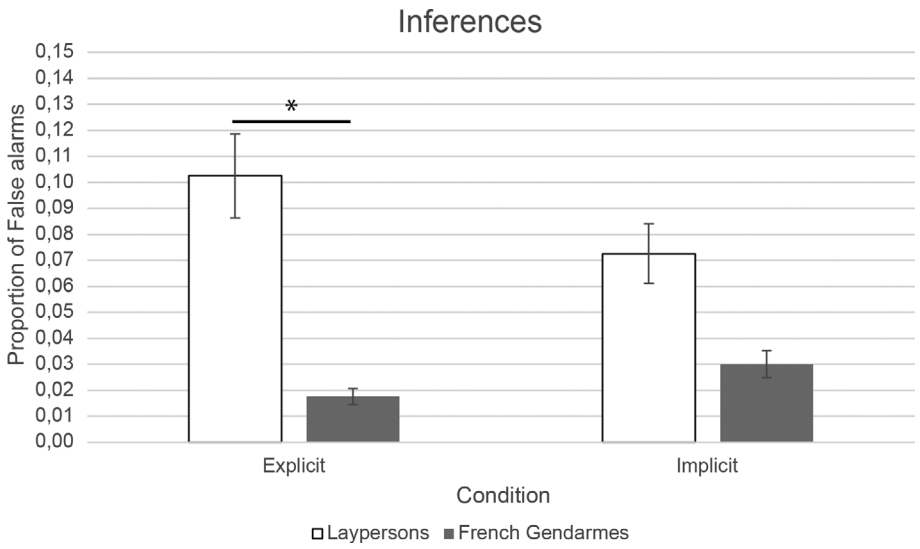

FIGURE 2 Mean proportions of false alarms as function of the condition (explicit vs. implicit) and group (French gendarmes vs. laypersons). The asterisk denotes a significant difference. Error bars represent 1 SEM

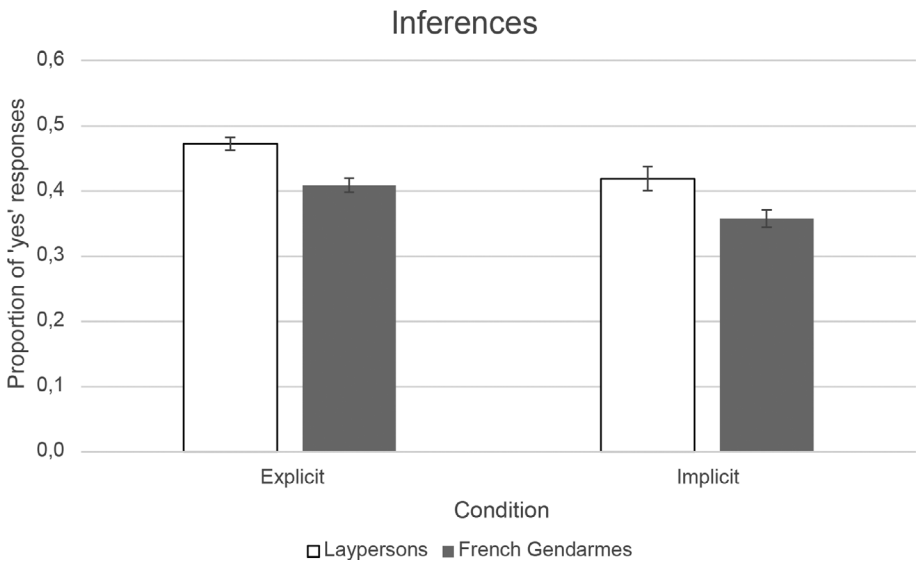

FIGURE 3 Mean proportions of "yes" responses as function of the condition (explicit vs. implicit) and group (French gendarmes vs. laypersons). Error bars represent 1 SEM

laypersons M = 0.103; SD = 0.183; p = .013). The French gendarmes' proportion of false alarms in the implicit condition (M = 0.030; SD = 0.052) was significantly lower than the laypersons' proportion of false alarms in the explicit condition (p = .026). Finally, laypersons had more false alarms in the explicit than the implicit condition (M = 0.073; SD = 0.147; p = .041). No other significant differences were revealed. Entering the age as a covariate did not affect the main group effect (F[1, 77] = 5.987; p = .017; η^2_p = 0.072), or the Condition × Group interaction which was still significant (F[1, 77] = 47.162; p = .045; η^2_p = 0.051; Figure 2). French gendarmes seem to differ from laypersons in the proportion of false alarms. The results showed that they had less false alarms than laypersons when the statements were explicit, but not when information had to be inferred.

Proportion of "yes" responses

The participants' mean proportion of "yes" responses in the explicit condition ranged between 0.2 and 0.6 (M = 0.471; SD = 0.066), whereas it ranged between 0.1 and 0.65 (M = 0.413; SD = 0.102) in the implicit condition.

An ANOVA was conducted on the proportion of "yes" responses with the condition (explicit vs. implicit) as the within-participant factor, and the group (laypersons vs. French gendarmes) as the between-group factor. The main condition effect was significant (F[1, 78] = 31.85; p = .0001; η^2_p = 0.290), the proportion of "yes" responses was greater in the explicit condition (M = 0.471; SD = 0.066) than in the implicit condition (M = 0.413; SD = 0.102), meaning that participants tend to accept information that they had received explicitly more easily than when it was implicit. The main group effect was not significant (F[1, 78] = 2.790; p = .1; η^2_p = 0.035), the performances of French gendarmes (M = 0.429; SD = 0.06) were similar to those of laypersons (M = 0.456; SD = 0.082), independently of the tested condition. The Condition × Group interaction did not reach significance (F1, 78) = 0.033; p = .856; η^2_p = 0.0001; Figure 3).

These results suggest that French gendarmes performed as well as laypersons in grasping critical information effectively whether it was presented explicitly or required to be inferred. French gendarmes also had fewer false alarms than laypersons when the statements were explicit but had as many false alarms as laypersons when information was implicit and had to be inferred. These results suggest that French gendarmes do not exhibit response tendencies in comparison with laypersons, indicating that they exhibit correct understanding and interpretation due to their ability to reject information, and not due to response bias. Taken together these results suggest that, when faced with testimony, French gendarmes exhibit correct understanding and interpretation, and this is due to their ability to reject information. However, their tendency not to accept information that they have heard seems to fade when implicit processes are involved.

3 | EXPERIMENT 2

3.1 | Method

3.1.1 | Participants

The participants who took part in Experiment 2 were the same as those in Experiment 1.

3.1.2 | Stimuli and apparatus

Geoffrey inferences on testimony test (GI2T). The GI2T was especially designed to assess the ability to set aside interfering and distracting information during inferences. It consisted in a fictional testimony of assault reported by an eyewitness. The testimony included a full description of an event (e.g., "I headed for the bus stop, and I was waiting. Beside me a man was pacing on the phone …"). The facts and the description of the facts are considered here as being the critical information. A substantial amount of irrelevant information and personal thoughts were added and intermixed with some statements about facts (e.g., "night was falling, and the lit streetlights were diffusing a strange atmosphere.[1] Their lights made people's shadows dance like in the alleyways of Paris on rainy nights …") and was intended to interfere with the participants' correct understanding of some parts of the story. For example, participants could erroneously infer that the witness was returning from Paris. The fictional testimony was followed by 16 statements to be assessed that were all implicit, that is, were neither stated nor explicit in the testimony, but could be inferred. Two individuals (one female and one male) were recruited to be audio-video-recorded (Camera Panasonic Lumix FZ-300; 1920 × 1080pi). The female recorded the testimony, and the male the associated statements to be assessed. More complete examples of this material could be found in the supporting information.

3.1.3 | Procedure

At the start of the experiment, a slide explained the task to the participant, who was instructed that they would see a female actor giving testimony in audio–video format. The testimony recording would be immediately followed by short videos of the male actor pronouncing statements that the participants were required to assess. Participants were required to watch the testimony attentively, and, for each statement to be assessed, state whether that was what they understood. The task then commenced. At first, the video testimony was presented. Then, 16 statements to be assessed were presented in a random order for each participant. After each statement to be assessed, a display indicating "yes or no" prompted the participant to answer using the keyboard. Two conditions were randomly and equiprobably presented: (a) absence of interfering information: in the testimony, the critical information was not embedded in secondary and irrelevant information; (b) presence of interfering information: in the testimony, the critical information was embedded in secondary and irrelevant information. Setting irrelevant information aside was only required in this case. For each of the two conditions, 50% of the statements to be assessed were correct ("yes" response), and 50% were incorrect ("no" response). The task was administered on a laptop computer with OpenSesame software (Mathôt et al., 2012). The task lasted less than 10 min.

3.1.4 | Data analysis

The same analyses as for Experiment 1 were carried out.

3.2 | Results

The results are displayed in Table 2.

3.2.1 | Proportions of hits

The participants' proportion of hits in the absence of interfering information ranged between 0.00 and 1 (M = 0.681; SD = 0.261), whereas their proportion of hits in the presence of interfering information ranged between 0.250 and 1 (M = 0.753; SD = 0.209).

An ANOVA was computed on each proportion of hits with the condition (absence of interfering information vs. presence of interfering information) as the within-participant factor, and the group (laypersons vs. French gendarmes) as the between-participant factor. The main condition effect was significant (F[1, 78] = 4.59; p = .035; η^2_p = 0.056); the proportion of hits was greater in the presence of interfering information (M = 0.753; SD = 0.209) than in absence of interfering information (M = 0.681; SD = 0.261), meaning that participants found correct information easier to understand when it was embedded in secondary and irrelevant information. The main group effect was not significant (F[1, 78] = 0.28; p = .596; η^2_p = 0.004);

TABLE 2 Proportions of hits, proportions of false alarms, and proportions of "yes" responses according to the condition (absence of interfering information vs. presence of interfering information), and as a function of the group (laypersons vs. French gendarmes)

	Laypersons (N = 40)				French gendarmes (N = 40)			
	M	SD	Min	Max	M	SD	Min	Max
Proportion of hits								
Absence of interfering information	0.675	0.301	0.00	1.00	0.688	0.217	0.250	1.00
Presence of interfering information	0.738	0.226	0.250	1.00	0.769	0.191	0.250	1.00
Proportion of false alarms								
Absence of interfering information	0.313	0.258	0.00	0.750	0.163	0.192	0.00	0.750
Presence of interfering information	0.338	0.223	0.00	0.750	0.331	0.207	0.00	0.750
Proportion of "yes" responses								
Absence of interfering information	0.494	0.162	0.125	0.75	0.425	0.135	0.25	0.75
Presence of interfering information	0.538	0.142	0.25	0.875	0.550	0.135	0.25	0.75

Abbreviations: M, mean proportions; Max, maximum; Min, minimum; SD, standard deviation.

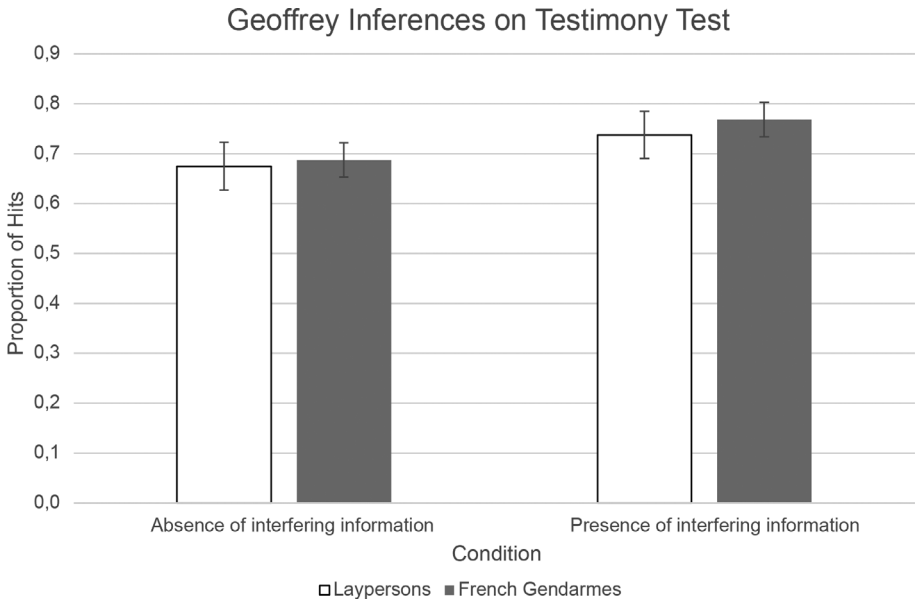

FIGURE 4 Mean proportions of hits as function of the condition (explicit vs. implicit) and group (French gendarmes vs. laypersons). Error bars represent 1 SEM

French gendarmes (M = 0.728; SD = 0.155) did not differ from laypersons (M = 0.706; SD = 0.209) whatever the condition. The Condition × Group interaction did not reach significance (F[1, 78] = 0.08; p = .781; η^2_p = 0.001; Figure 4).

3.2.2 | Proportions of false alarms

The participants' mean proportion of false alarms in the absence of interfering information was 0.238 (SD = 0.238), whereas the mean proportion of false alarms in the presence of interfering information was 0.334 (SD = 0.214). In both conditions, the proportions of false alarms ranged between 0 and 0.750.

An ANOVA was computed on each proportion of false alarms with the condition (absence of interfering information vs. presence interfering information) as the within-participant factor, and the group (laypersons vs. French gendarmes) as the between-participant factor. The main condition effect was significant (F[1, 78] = 11.11; p = .001; η^2_p = 0.125); the proportion of false alarms was greater in the presence of interfering information (M = 0.334; SD = 0.214) than in absence of interfering information condition (M = 0.238; SD = 0.238). It seems that participants committed more misinterpretations when interfering information was involved. The main group effect was only marginally significant (F[1, 78] = 3.80; p = .055; η^2_p = 0.046), suggesting that French gendarmes (M = 0.247; SD = 0.161) tended to have fewer false alarms than laypersons (M = 0.325; SD = 0.196). The Condition × Group interaction was significant (F[1, 78] = 6.11; p = .015; η^2_p = 0.073). Newman–Keuls multiple corrected comparisons revealed that the French gendarmes' proportion of false alarms in absence of interfering information (M = 0.163; SD = 0.192) was significantly lower than their proportion of false alarms in presence of interfering information (M = 0.331; SD = 0.207; p = .0004), and the

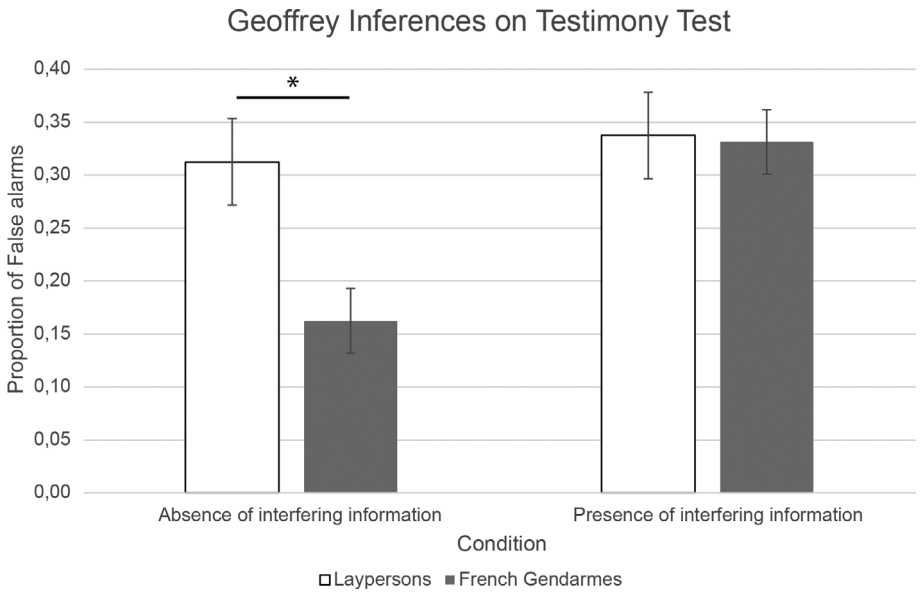

FIGURE 5 Mean proportions of false alarms as function of the condition (explicit vs. implicit) and group (French gendarmes vs. laypersons). The asterisk denotes a significant difference. Error bars represent 1 SEM

laypersons' proportion of false alarms in both conditions (absence of interfering information M = 0.313, SD = 0.258, p = .002; presence of interfering information M = 0.338, SD = 0.223, p = .002). When age was entered as a covariate, the main group effect remained marginally significant (F[1, 77] = 3.76; p = .056; η^2_p = 0.047). Finally, age as a covariate did not affect the Condition × Group interaction, which was still significant (F[1, 77] = 5.38; p = .023; η^2_p = 0.065; Figure 5). French gendarmes seem to differ from laypersons in the proportion of false alarms only when the statements do not involve interfering information. These results suggest that French gendarmes tend to reject false information more easily than laypersons as long as no interfering information is present, meaning that they are cautious not to accept any given information easily. However, this superiority seems to diminish when interfering information such as personal thoughts and feelings are included in the testimony.

3.2.3 | Proportion of "yes" responses

The participants' proportion of "yes" responses in the absence of interfering information ranged between 0.125 and 0.75 (M = 0.459; SD = 0.152), whereas their proportion of" yes "responses in the presence of interfering information ranged between 0.250 and 0.875 (M = 0.544; SD = 0.138).

An ANOVA was conducted on the proportion of "yes" responses with the condition (absence of interfering information vs. presence of interfering information) as the within-participant factor, and the group (laypersons vs. French gendarmes) as the between-group factor. The main condition effect was significant (F[1, 78] = 16.81; p = .0001; η^2_p = 0.177); the proportion of "yes" responses was greater in the presence of interfering information (M = 0.554; SD = 0.138) than in the absence of interfering information (M = 0.459; SD = 0.152), meaning that participants tend to say they heard information regardless of whether it was correct. In other words, interfering information disturbs understanding to the point of no longer differentiating between correct and incorrect information. The main group effect was not significant (F[1, 78] = 1.29; p = .261; η^2_p = 0.016); the performances of French gendarmes (M = 0.488; SD = 0.099) were similar to those of laypersons (M = 0.516; SD = 0.122) independently of the condition. The Condition × Group interaction was only marginally significant (F[1, 78] = 3.90; p = .052; η^2_p = 0.048). Newman–Keuls multiple corrected comparisons revealed that the French gendarmes' proportion of "yes" responses in the absence of interfering information (M = 0.425; SD = 0.135) was significantly lower than their proportion in the presence of interfering information (M = 0.550; SD = 0.135; p = .0004), and the laypersons' proportion in both conditions (absence of interfering information M = 0.494, SD = 0.162, p = .03; presence of interfering information M = 0.537, SD = 0.142, p = .001). When age was entered as a covariate, the Condition × Group interaction was still marginal (F[1, 77] = 3.51; p = .065; η^2_p = 0.044; Figure 6). These results confirm that French gendarmes tend to accept information less than laypersons only when interfering information was not involved.

These results suggest that French gendarmes performed as well as laypersons in grasping critical information embedded in secondary and irrelevant information. They appear to have had fewer false alarms than laypersons when the critical information was not embedded in irrelevant information, but had as many false alarms as laypersons when secondary and irrelevant information was present. The results also indicate that French gendarmes seem to exhibit a lower response tendency to accept information heard compared to laypersons when secondary and irrelevant information was not involved. Otherwise, it seems that they lose their advantage.

4 | DISCUSSION

Previous studies have demonstrated how people's perceptions and cognitions are affected by context, motivation, expectation, and experience in different forensic fields such as fingerprints or bloodstains (Dror, 2017; Gilovich et al., 2002; Osborne et al., 2016; Sunde &

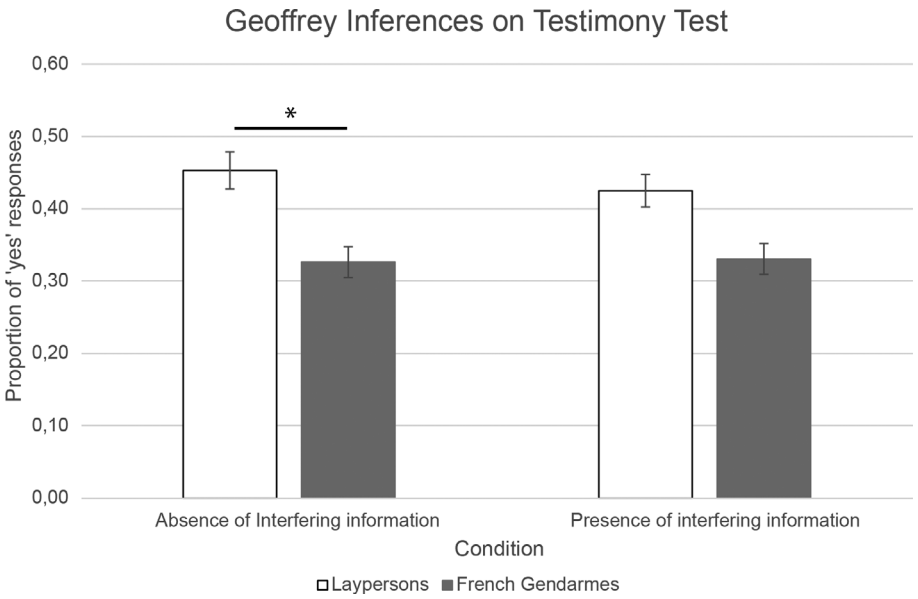

FIGURE 6 Mean proportions of "yes" responses as function of the condition (explicit vs. implicit) and group (French gendarmes vs. laypersons). Asterisks denote significant differences. Error bars represent 1 SEM

Dror, 2019). The present study investigates French gendarmes' comprehension abilities compared to those of laypersons for the first time. We examined comprehension when critical information is reported explicitly or required that inferences be drawn, and when inferring processes involve setting aside secondary irrelevant information. This work represents an exploratory investigation of this issue using paradigms evaluating the ability to make inferences and the ability to separate information from items that are not relevant for comprehension. French gendarmes are faced with complex situations on a daily basis, in which they are required to grasp or deduce important information in discourses quickly. For this reason, it was expected that French gendarmes would perform better than laypersons due to their activities (Canter & Youngs, 2009; Davies & Beech, 2017; Gudjonsson, 2003). Our results do not totally confirm these assumptions but support the idea that French gendarmes and laypersons have different strategies when having to make inferences on the basis of oral testimonies.

First, we showed that French gendarmes were as accurate as laypersons in reporting correct critical information in both conditions, when information was explicitly available, and when it required implicit processing. Differences between the groups appeared when considering incorrect information mistakenly understood as having been given (false alarms). The results revealed that French gendarmes had fewer false alarms than laypersons when the critical information was explicitly reported, meaning that they were reluctant to accept false information, and correctly rejected it more frequently. Models of discourse comprehension state that the lexical and semantical level of comprehension captures the meaning conveyed by statements and requires activation of the knowledge directly associated with the wording (Dijk & Kintsch, 1983; Kintsch et al., 1990; Tapiero, 2007). However, the French gendarmes' advantage was lost when the information provided was implicit and more ambiguous, with a need to match it to stored knowledge and create a mental representation of the situation described (Dijk & Kintsch, 1983; Johnson-Laird, 1983; Tapiero, 2007) before making inferences. This is disappointing since, as professionals collecting and integrating information within a larger framework of various testimonies and other kinds of information, French gendarmes could be expected to perform better than laypersons. Why is this the case?

Due to limited capacity, individuals, including experts in any field, have to be selective in the information receiving attention in manners fitting with preexisting knowledge, experiences, and well-learned scenarios (Dror, 2017; Edmond et al., 2015; Edmond et al., 2017). These cognitive heuristics are efficient strategies that are largely automatic and beyond conscious awareness, resulting in efficiency in the task at hand, but also constitute the bedrock of expertise (Dror et al., 2011; MacLean & Dror, 2016). Although several studies have demonstrated that heuristics can facilitate the processing of information by making it more efficient and faster (Kosslyn, 1998), others have suggested that they could lead to errors and misinterpretation by considering incorrect information as correct (Darley & Gross, 1983; Dror, 2017; Dror, Péron, Hind, & Charlton, 2005). Indeed, previous studies investigating forensic experts' interpretations demonstrated that if the information is ambiguous, such as a small amount of DNA or degraded fingerprints, experts tended to interpret information as supporting their pre-established hypothesis or initial impression (Nickerson, 1998; Tversky & Kahneman, 1974). Like many other cognitive processes, comprehension and inferences are partially data-driven by the information reported in statements. In this case, experts' experience would help them and prompt them to reject incorrect information that is explicitly presented and, thus, immediately available more effectively (Ashworth & Dror, 2000). However, many interactions, especially witness interviews, are far from perfect (Gudjonsson, 2003; Satin & Fisher, 2019). Statements are often confused, incoherent, inconsistent, and contain such ambiguous information that comprehension and inferences may be more difficult (Barbey et al., 2014; Gudjonsson, 2003). Faced with these difficulties and ambiguities, listeners have to go beyond what it is explicitly reported, and previous knowledge and experience need to be mobilized

(Baggett, 1975; Barbey et al., 2014; Potts, Keenan, & Golding, 1988; Powers et al., 2012; Thorndyke, 1976). The use of such heuristics would probably be the source of the differences observed between the French gendarmes and laypersons when inferring on the basis of explicit and implicit information.

Another factor that may influence comprehension and inference is the degree to which critical information is embedded in and intermingled with secondary irrelevant information, and, therefore, the ability to keep tracking relevant information in a noisy background. The ability to disentangle critical information from the witnesses' own thoughts and impressions was assessed in Experiment 2. The results showed that French gendarmes were as good as laypersons in spotting critical and accurate information, whether interfering information was added or not. However, the two groups differed when spotting inaccuracies. In cases where inferences had to be made on information that was not intermingled with the witness's personal thoughts and impressions, French gendarmes were superior. This advantage disappeared when irrelevant information was present. It seems that French gendarmes' background, knowledge, and experience result in them being more effective at setting incorrect and inaccurate information aside in the absence of irrelevant information. When irrelevant information made testimony more difficult and ambiguous to understand, French gendarmes accepted inaccurate information as being correct just as frequently as laypersons. Once again, the observation that French gendarmes are no better than laypersons in complex situations goes beyond experts' expectations, and once again it may be disappointing. How can these results be explained?

One mechanism that may explain why people have difficulties rejecting incorrectly inferred information can be found in studies on the memory of inferences. These studies suggest that once made, inferences are very difficult to correct (Guillory & Geraci, 2010; Johnson & Seifert, 1994; Wilkes & Leatherbarrow, 1988). Indeed, inferential information is incorporated online in discourse representation, and integrated with related information to determine event sequences or resolve incoherence and inconsistencies (Baggett, 1975; Barbey et al., 2014; Potts et al., 1988; Powers et al., 2012; Thorndyke, 1976). Some studies have reported that individuals' response times for identifying words associated with inferences are as quick as those of explicitly stated words (Potts et al., 1988), and individuals often report inferred information as being factual in a recall (Baggett, 1975; Thorndyke, 1976). Hence irrelevant information may result in incorrect inferences that will be then difficult to ignore, to revise and to discard being drawn. Wilkes and Leatherbarrow (1988) demonstrated that when participants read incorrect information and then received the correct information, they failed to use the corrected information when asked to make inferences about what they had just read. Thus, it seems that once people come across information, they will continue to rely on that information to make future inferences about an event even if that information is incorrect. Therefore, it appears that inferences are powerful sources of information that can be difficult to modify when distracting or secondary information is not properly inhibited, leading individuals to consider incorrect information to be true (Hamm & Hasher, 1992; Hasher & Zacks, 1988; Zacks et al., 1987). Our study is in line with the work of Wilkes and Leatherbarrow (1988) and shows that police officers are not immune to this effect.

To our knowledge, this is the first study to examine cognitive factors that determine law enforcement professionals' comprehension and inferences on witness testimony. It was found that French gendarmes indeed understand testimonies better when information is easily accessible, either because it is explicitly stated or otherwise embedded within a background of secondary and irrelevant information given by the witness. However, they perform in the same way as laypersons when they are required to discard inaccuracies. Some limitations should be considered here. One of these concerns the inference task. This task was composed of separate short narratives, each followed by sentences that participants were required to assess. This experimental constraint does not simulate the challenge of interviewing a witness and understanding testimony as a whole. Future investigations could focus on a more realistic task making it possible to evaluate explicit and implicit comprehension levels. In addition, it is regularly argued that studies involving forensic experts do not measure people's performances accurately due to a lack of realism of the manipulation. In this sense, the GI2T was designed from true testimony of a young woman to which interfering information and personal thoughts were added. This was done in order to assess the ability of participants to set aside this kind of information during inferential processing and comprehension. These manipulations may not be optimal; therefore, future studies may use actual testimonies to investigate experts' ability to grasp relevant information. Our study supplements the growing number of findings supporting the idea that experts may not outperform novice individuals in specific tasks (Kassin, Dror, & Kukucka, 2013). Experts' performance and accuracy are an important issue in almost all specialized domains. In contrast to novices, experts possess specialized knowledge, specific abilities and skills, experience, and decision-making processes that enable them to perform certain tasks and make correct decisions (Dror, Kosslyn, & Waag, 1993). However, being an expert does not necessarily mean error-free performance; in fact almost every specialist domain is subject to error (Dror, Charlton, & Péron, 2006). It is clear that the acquisition of expertise requires more than just an accumulation of experience (Kahneman, 1973; Tversky & Kahneman, 1974). Indeed, these professionals must also be able to avoid and mitigate extraneous contexts and other influences that may interfere with their ability to examine, evaluate, and assess relevant information. Their decisions should be based on the information relevant to the task at hand and its unbiased interpretation. This involves independent thinking that ignores extraneous pressures and influences to a large extent. There are many varied external pressures and influences (Dror et al., 2006; Edmond et al., 2017). Our study is a continuation of the new framework which aim to better understand of factors and cognitive mechanisms involved in experts' work and efficiency to help to inform the design of training, procedure and environments, and to identify people who are likely to make good experts.

This study shows that an expert, who collects, records, and compiles testimonies full of redundant, irrelevant information, as well as

witnesses' personal views and thoughts in order to build a coherent scenario, is quite sensitive to information that is not directly and easily accessible. The present results provide new findings and enhance our understanding as to how information is gathered and processed during witness interviews in criminal investigations. It examines cognitive mechanisms and biases in the collection and interpretation of information by experts. Therefore, we believe that considerable efforts should be made to gain a better understanding of this issue, appealing to a broad audience. We encourage future investigation to examine how factors such as external contextual and emotional information related to the case or external pressure to solve the case affect experts' judgment and comprehension of situations.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

https://recherche.univ-lyon2.fr/etmeco/data/Data-ability-to-make-inferences-while-listening-to-witnesses.xlsx.zip.

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ENDNOTE

[1] Note the GI2T task is different from evaluating a false testimony. Although the material is built from a true testimony of a young woman to which interfering information has been added, there is no goal to deceive listeners. The task was designed to be as close as possible to situations encountered by French gendarmes and, at the same time, it was designed to control and manipulate the conditions of interest.

REFERENCES

Albrecht, J. E., & Myers, J. L. (1995). Role of context in accessing distant information during reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*(6), 1459–1468. https://doi.org/10.1037/0278-7393.21.6.1459

Anderson, R. C., & Pichert, J. W. (1978). Recall of previously unrecallable information following a shift in perspective. *Journal of Verbal Learning and Verbal Behavior*, *17*(1), 1–12. https://doi.org/10.1016/S0022-5371(78)90485-1

Ashworth, A. R., & Dror, I. E. (2000). Object identification as a function of discriminability and learning presentations: The effect of stimulus similarity and canonical frame alignment on aircraft identification. *Journal of Experimental Psychology. Applied*, *6*(2), 148–157. https://doi.org/10.1037//1076-898X.6.2.148

Baggett, P. (1975). Memory for explicit and implicit information in picture stories. *Journal of Verbal Learning and Verbal Behavior*, *14*(5), 538–548. https://doi.org/10.1016/S0022-5371(75)80031-4

Barbey, A. K., Colom, R., & Grafman, J. (2014). Neural mechanisms of discourse comprehension: A human lesion study. *Brain*, *137*(1), 277–287. https://doi.org/10.1093/brain/awt312

Brainerd, C. J., & Reyna, V. F. (2005). *The science of false memory*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195154054.001.0001

Bull, R., Valentine, T., & Williamson, T. (Eds.). (2009). *Handbook of psychology of investigative interviewing: Current developments and future directions*. Wiley-Blackwell.

Canter, D., & Youngs, D. (2009). *Investigative psychology: Offender profiling and the analysis of criminal action*. John Wiley & Sons.

Darley, J. M., & Gross, P. H. (1983). A hypothesis-confirming bias in labeling effects. *Journal of Personality and Social Psychology*, *44*(1), 20–33.

Davies, G., & Hine, S. (2007). Change blindness and eyewitness testimony. *Journal of Psychology*, *141*(4), 423–434. https://doi.org/10.3200/JRLP.141.4.423-434

Davies, G. M., & Beech, A. R. (2017). *Forensic psychology: Crime, justice, law, interventions*. John Wiley & Sons.

Dijk, T. A. V., Kintsch, W. (1983). *Strategies of discourse comprehension*. New York: Academic Press.

Dror, I. (2006). Cognitive science serving security: Assuring useable and efficient biometric and technological solutions. *Aviation Security International*, *12*(3), 21–28.

Dror, I. E. (2005). Experts and technology: Do's & don'ts. *Biometric Technology Today*, *13*(9), 7–9. https://doi.org/10.1016/S0969-4765(05)70429-X

Dror, I. E. (2017). Human expert performance in forensic decision making: Seven different sources of bias. *Australian Journal of Forensic Sciences*, *49*(5), 541–547. https://doi.org/10.1080/00450618.2017.1281348

Dror, I. E., Champod, C., Langenburg, G., Charlton, D., Hunt, H., & Rosenthal, R. (2011). Cognitive issues in fingerprint analysis: Inter- and intra-expert consistency and the effect of a 'target' comparison. *Forensic Science International*, *208*(1), 10–17. https://doi.org/10.1016/j.forsciint.2010.10.013

Dror, I. E., Charlton, D., & Péron, A. E. (2006). Contextual information renders experts vulnerable to making erroneous identifications. *Forensic Science International*, *156*(1), 74–78. https://doi.org/10.1016/j.forsciint.2005.10.017

Dror, I. E., & Hampikian, G. (2011). Subjectivity and bias in forensic DNA mixture interpretation. *Science & Justice*, *51*(4), 204–208. https://doi.org/10.1016/j.scijus.2011.08.004

Dror, I. E., Kosslyn, S. M., & Waag, W. L. (1993). Visual–spatial abilities of pilots. *Journal of Applied Psychology*, *78*(5), 763–773. https://doi.org/10.1037/0021-9010.78.5.763

Dror, I. E., Péron, A. E., Hind, S.-L., & Charlton, D. (2005). When emotions get the better of us: The effect of contextual top-down processing on matching fingerprints. *Applied Cognitive Psychology*, *19*(6), 799–809. https://doi.org/10.1002/acp.1130

Duchêne May-Carle A. (2000). La gestion de l'implicite. Isbergues, France: Ortho Edition.

Edmond, G., Tangen, J. M., Searston, R. A., & Dror, I. E. (2015). Contextual bias and cross-contamination in the forensic sciences: The corrosive implications for investigations, plea bargains, trials and appeals. *Law, Probability and Risk*, *14*(1), 1–25. https://doi.org/10.1093/lpr/mgu018

Edmond, G., Towler, A., Growns, B., Ribeiro, G., Found, B., White, D., Ballantyne, K., Searston, R. A., Thompson, M. B., Tangen, J. M.,

Kemp, R. I., & Martire, K. (2017). Thinking forensics: Cognitive science for forensic practitioners. *Science and Justice*, *57*(2), 144–154. https://doi.org/10.1016/j.scijus.2016.11.005

Ericsson, K. A., Charness, N., Feltovich, P. J., & Hoffman, R. R. (Eds.). (2006). *The Cambridge handbook of expertise and expert performance*. Cambridge University Press. https://doi.org/10.1017/CBO9780511816796

Ericsson, K. A., Hoffman, R. R., Kozbelt, A., & Williams, A. M. (Eds.). (2018). *The Cambridge handbook of expertise and expert performance* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/9781316480748

Esteve, P. (2018). *La Gendarmerie pour les Nuls* (First). https://www.pourlesnuls.fr/livres/culture-generale/la-gendarmerie-pour-les-nuls-9782412033890

Fahsing, I., & Ask, K. (2013). Decision making and decisional tipping points in homicide investigations: An interview study of British and Norwegian detectives: Investigative tipping points. *Journal of Investigative Psychology and Offender Profiling*, *10*(2), 155–165. https://doi.org/10.1002/jip.1384

Fahsing, I., & Ask, K. (2016). The making of an expert detective: The role of experience in English and Norwegian police officers' investigative decision-makingg. *Psychology, Crime & Law*, *22*(3), 203–223. https://doi.org/10.1080/1068316X.2015.1077249

Garrido, E., Masip, J., & Herrero, C. (2004). Police officers' credibility judgments: Accuracy and estimated ability. *International Journal of Psychology*, *39*(4), 254–275. https://doi.org/10.1080/00207590344000411

Gernsbacher, M. A. (1989). Mechanisms that improve referential access. *Cognition*, *32*(2), 99–156. https://doi.org/10.1016/0010-0277(89)90001-2

Gernsbacher, M. A. (1995). The mechanisms of suppression and enhancement in comprehension. *Canadian Psychology/Psychologie Canadienne*, *36*(1), 49–50. https://doi.org/10.1037/h0084720

Gernsbacher, M. A., & Faust, M. E. (1991). The mechanism of suppression: A component of general comprehension skill. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *17*(2), 245–262. https://doi.org/10.1037/0278-7393.17.2.245

Gilovich, T., Griffin, D., Kahneman, D., & Press, C. U. (2002). *Heuristics and biases: The psychology of intuitive judgment*. Cambridge University Press.

Graesser, A., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review*, *101*(3), 371–395.

Graesser, A. C., Millis, K. K., & Zwaan, R. A. (1997). Discourse comprehension. *Annual Review of Psychology*, *48*(1), 163–189. https://doi.org/10.1146/annurev.psych.48.1.163

Grégoire, J., & Wierzbicki, C. (2009). Comparaison de quatre formes abrégées de l'échelle d'intelligence de Wechsler pour adultes – troisième édition (WAIS-III). *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology*, *59*(1), 17–24. https://doi.org/10.1016/j.erap.2007.08.003

Gudjonsson, G. H. (2003). *The psychology of interrogations and confessions: A handbook*. John Wiley & Sons.

Guillory, J. J., & Geraci, L. (2010). The persistence of inferences in memory for younger and older adults: Remembering facts and believing inferences. *Psychonomic Bulletin & Review*, *17*(1), 73–81. https://doi.org/10.3758/PBR.17.1.73

Hamm, V. P., & Hasher, L. (1992). Age and the availability of inferences. *Psychology and Aging*, *7*(1), 56–64. https://doi.org/10.1037/0882-7974.7.1.56

Hasher, L., & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. H. Bower (Ed.), *Psychology of learning and motivation* (Vol. 22, pp. 193–225). Academic Press. https://doi.org/10.1016/S0079-7421(08)60041-9

Johnson, H. M., & Seifert, C. M. (1994). Sources of the continued influence effect: When misinformation in memory affects later inferences. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*, 1420–1436.

Johnson-Laird, P. N. (1983). *Mental models: Towards a cognitive science of language, inference, and consciousness*. Harvard University Press.

Kahneman, D. (1973). *Attention and effort*. Prentice Hall.

Kassin, S. M., Dror, I. E., & Kukucka, J. (2013). The forensic confirmation bias: Problems, perspectives, and proposed solutions. *Journal of Applied Research in Memory and Cognition*, *2*(1), 42–52. https://doi.org/10.1016/j.jarmac.2013.01.001

Kassin, S. M., Meissner, C. A., & Norwick, R. J. (2005). "I'd know a false confession if I saw one": A comparative study of college students and police investigators. *Law and Human Behavior*, *29*(2), 211–227. https://doi.org/10.1007/s10979-005-2416-9

Kebbell, M. R., & Milne, R. (1998). Police officers' perceptions of eyewitness performance in forensic investigations. *Journal of Social Psychology*, *138*(3), 323–330. https://doi.org/10.1080/00224549809600384

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. *Psychological Review*, *95*(2), 163–182.

Kintsch, W., & van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Psychological Review*, *85*(5), 363–394. https://doi.org/10.1037/0033-295X.85.5.363

Kintsch, W., Welsch, D., Schmalhofer, F., & Zimny, S. (1990). Sentence memory: A theoretical analysis. *Journal of Memory and Language*, *29*(2), 133–159. https://doi.org/10.1016/0749-596X(90)90069-C

Koller, C. I., Wetter, O. E., & Hofer, F. (2015). What is suspicious when trying to be inconspicuous? Criminal intentions inferred from nonverbal behavioral cues. *Perception*, *44*(6), 679–708. https://doi.org/10.1177/0301006615594271

Kosslyn, I. E. D. S. M. (1998). Age degradation in top-down processing: Identifying objects from canonical and noncanonical viewpoints. *Experimental Aging Research*, *24*, 203–216. https://doi.org/10.1080/036107398244210

Loftus, E. F. (2003). Make-believe memories. *American Psychologist*, *58*(11), 867–873. https://doi.org/10.1037/0003-066X.58.11.867

Loftus, E. F. (2005). Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory*, *12*(4), 361–366. https://doi.org/10.1101/lm.94705

Loftus, E. F., Miller, D. G., & Burns, H. J. (1978). Semantic integration of verbal information into a visual memory. *Journal of Experimental Psychology: Human Learning and Memory*, *4*(1), 19–31. https://doi.org/10.1037/0278-7393.4.1.19

MacLean, C. L., & Dror, I. E. (2016). A primer on the psychology of cognitive bias. In *Blinding as a solution to bias* (pp. 13–24). Elsevier. https://doi.org/10.1016/B978-0-12-802460-7.00001-2

Masip, J., & Herrero, C. (2015). Police detection of deception: Beliefs about behavioral cues to deception are strong even though contextual evidence is more useful. *Journal of Communication*, *65*(1), 125–145. https://doi.org/10.1111/jcom.12135

Mason, R. A., & Just, M. A. (2006). Chapter 19—Neuroimaging contributions to the understanding of discourse processes. In M. J. T. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (2nd ed., pp. 765–799). Academic Press. http://www.sciencedirect.com/science/article/pii/B9780123693747500201

Mathôt, S., Schreij, D., & Theeuwes, J. (2012). OpenSesame: An open-source, graphical experiment builder for the social sciences. *Behavior Research Methods*, *44*(2), 314–324. https://doi.org/10.3758/s13428-011-0168-7

Memon, A., Meissner, C., & Fraser, J. (2010). The cognitive interview: A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law*, *16*(4), 340–372. https://doi.org/10.1037/a0020518

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology*, *2*(2), 175–220. https://doi.org/10.1037/1089-2680.2.2.175

Odinot, G., Memon, A., La Rooy, D., & Millen, A. (2013). Are two interviews better than one? Eyewitness memory across repeated cognitive interviews. *PLoS ONE*, *8*(10), e76305. https://doi.org/10.1371/journal.pone.0076305

Oostendorp, H. v., & Goldman, S. R. (1998). *The construction of mental representations during reading*. Psychology Press.

Osborne, N. K. P., Taylor, M. C., Healey, M., & Zajac, R. (2016). Bloodstain pattern classification: Accuracy, effect of contextual information and the role of analyst characteristics. *Science & Justice*, *56*(2), 123–128. https://doi.org/10.1016/j.scijus.2015.12.005

Osborne, N. K. P., Woods, S., Kieser, J., & Zajac, R. (2014). Does contextual information bias bitemark comparisons? *Science & Justice*, *54*(4), 267–273. https://doi.org/10.1016/j.scijus.2013.12.005

Overman, A. A., Wiseman, K. D., Allison, M., & Stephens, J. D. W. (2013). Age differences and schema effects in memory for crime information. *Experimental Aging Research*, *39*(2), 215–234. https://doi.org/10.1080/0361073X.2013.761914

Palmer, F. T., Flowe, H. D., Takarangi, M. K. T., & Humphries, J. E. (2013). Intoxicated witnesses and suspects: An archival analysis of their involvement in criminal case processing. *Law and Human Behavior*, *37*(1), 54–59. https://doi.org/10.1037/lhb0000010

Pickel, K. L. (1998). Unusualness and threat as possible causes of "weapon focus". *Memory*, *6*(3), 277–295. https://doi.org/10.1080/741942361

Potts, G. R., Keenan, J. M., & Golding, J. M. (1988). Assessing the occurrence of elaborative inferences: Lexical decision versus naming. *Journal of Memory and Language*, *27*(4), 399–415. https://doi.org/10.1016/0749-596X(88)90064-2

Powers, C., Bencic, R., Horton, W. S., & Beeman, M. (2012). Hemispheric inference priming during comprehension of conversations and narratives. *Neuropsychologia*, *50*(11), 2577–2583. https://doi.org/10.1016/j.neuropsychologia.2012.07.008

Rooy, D. L., Pipe, M.-E., & Murray, J. E. (2005). Reminiscence and hypermnesia in children's eyewitness memory. *Journal of Experimental Child Psychology*, *90*(3), 235–254. https://doi.org/10.1016/j.jecp.2004.11.002

Satin, G. E., & Fisher, R. P. (2019). Investigative utility of the cognitive interview: Describing and finding perpetrators. *Law and Human Behavior*, *43*(5), 491–506. https://doi.org/10.1037/lhb0000326

Seelow, S., Piel, S., & Cazi, E. (2015). *Attentats de Paris: L'assaut du Bataclan, raconté heure par heure*. https://www.lemonde.fr/attaques-a-paris/article/2015/12/30/13-novembre-l-assaut-du-bataclan-heure-par-heure_4839440_4809495.html

Seifert, C. M. (2002). The continued influence of misinformation in memory: What makes a correction effective? In *Psychology of learning and motivation* (Vol. 41, pp. 265–292). Academic Press. https://doi.org/10.1016/S0079-7421(02)80009-3

Sunde, N., & Dror, I. E. (2019). Cognitive and human factors in digital forensics: Problems, challenges, and the way forward. *Digital Investigation*, *29*, 101–108. https://doi.org/10.1016/j.diin.2019.03.011

Tapiero, I. (2007). *Situation models and levels of coherence: Toward a definition of comprehension*. Taylor & Francis.

Tapiero, I., van den Broek, P., & Quintana, M.-P. (2002). The mental representation of narrative texts as networks: The role of necessity and sufficiency in the detection of different types of causal relations. *Discourse Processes*, *34*(3), 237–258. https://doi.org/10.1207/S15326950DP3403_1

Thorndyke, P. W. (1976). The role of inferences in discourse comprehension. *Journal of Verbal Learning & Verbal Behavior*, *15*(4), 437–446. https://doi.org/10.1016/S0022-5371(76)90039-6

Tompkins, C. A., Lehman-Blake, M. T., Baumgaertner, A., & Fassbinder, W. (2001). Mechanisms of discourse comprehension impairment after right hemisphere brain damage: Suppression in inferential ambiguity resolution. *Journal of Speech, Language, and Hearing Research*, *44*(2), 400–415. https://doi.org/10.1044/1092-4388(2001/033)

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

Virtue, S., Haberman, J., Clancy, Z., Parrish, T., & Jung Beeman, M. (2006). Neural activity of inferences during story comprehension. *Brain Research*, *1084*(1), 104–114. https://doi.org/10.1016/j.brainres.2006.02.053

Vrij, A. (2008). *Detecting lies and deceit: Pitfalls and opportunities* (2nd ed.). John Wiley & Sons.

White, D., Kemp, R. I., Jenkins, R., Matheson, M., & Burton, A. M. (2014). Passport officers' errors in face matching. *PLoS ONE*, *9*(8), e103510. https://doi.org/10.1371/journal.pone.0103510

Wilkes, A. L., & Leatherbarrow, M. (1988). Editing episodic memory following the identification of error. *The Quarterly Journal of Experimental Psychology Section A*, *40*(2), 361–387. https://doi.org/10.1080/02724988843000168

Yarmey, A. D. (2001). Expert testimony: Does eyewitness memory research have probative value for the courts? *Canadian Psychology*, *42*(2), 92–100.

Zacks, R. T., Hasher, L., Doren, B., Hamm, V., & Attig, M. S. (1987). Encoding and memory of explicit and implicit information. *Journal of Gerontology*, *42*(4), 418–422. https://doi.org/10.1093/geronj/42.4.418

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