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The cognitive interview: Is its benefit affected by the level of witness emotion?

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This research investigated whether a witness's emotion could influence the accuracy of statements obtained by the use of a cognitive interview. A total of 70 first-year university students viewed a video depicting a road accident. Electrodes were attached to their arms in order to send fictitious electric shocks during the video (high-arousal condition) or to measure physiological signs (low-arousal condition). One week later, they were interviewed using either a cognitive interview (CI) or a structured interview (SI). It was hypothesised that the beneficial effect of the cognitive interview would be amplified by a high level of arousal, particularly concerning central aspects of the video. Results indicated that a CI elicited more correct central and peripheral details recalled, whatever the level of arousal inducted during the encoding of the to-be remembered event. Furthermore, high-arousal participants produced more accurate testimonies concerning peripheral details than participants exposed to a low level of arousal. No interaction between interview and emotion was found. The theoretical and practical implications for interviewing witnesses are described.

Eyewitness reports are often crucial in criminal investigations and can have a considerable impact on a jury's verdict (Loftus, 1975; Nunez, McCoy, Clark, & Shaw, 1999). However, testimony of witnesses is often incomplete and inaccurate (Cutler & Penrod, 1995; Memon, Vrij, & Bull, 1998). Consequently, psychologists have tried to develop several interview techniques with the aim of enhancing eyewitness recall. Perhaps the most successful has been the cognitive interview (CI) (Fisher & Geiselman, 1992). Numerous studies have investigated the effect of the cognitive interview on the accuracy of witnesses' recall. In most of these studies it has been shown that the CI has the potential to enhance the amount of accurate details recalled compared to a standard police interview currently used by police officers and judicial officials, or compared to a structured interview that is equivalent to the CI minus its cognitive components (41% more correct details recalled in the CI compared to a standard interview: see Köhnken, Milne, Memon, & Bull, 1999, for a review). However, despite the violence and stress often associated with criminal incidents (Shepherd, Mortimer, Turner, & Watson, 1999), there has been no systematic investigation of how effective the CI is when the to-be-remembered (TBR) event is particularly arousing. This study addresses this issue.

THE COGNITIVE INTERVIEW

The CI consisted of four instructions for witnesses based on two widely accepted theoretical principles from psychological research concerning the retrieval of information: first, information is more likely to be recalled if the context in which the retrieval takes place is similar to that present during encoding. Second, it is assumed that there

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is a great variety of cues that may facilitate memory. Hence, information that is not accessible in one manner may be so in another (Tulving, 1974, 1983). The CI, in its original form, is composed of four instructions (a) the ''mental-reinstatement-of-context'' instruction, where the witness is asked to mentally reinstate both the physical surroundings of the TBR event as well as his or her own subjective state of mind at the time of the incident; (b) the ''report-everything'' instruction, where the witness is encouraged to recall as much information as possible, even seemingly partial and inconsequential information; (c) the ''different-order recall'' instruction, where the witness is asked to recall the event again in the order that he/she wishes, starting from the middle, the end, or the most memorable part of the event; (d) the ''change-of-perspective'' instruction, where the witness is encouraged to put him/herself in a different role, or in the place of another person who witnessed the event, and recall the event from that changed perspective (Geiselman et al., 1984). Later, Geiselman and his colleagues refined this interview procedure and developed an enhanced version of the CI (Fisher, Geiselman, Raymond, Jurkevich, & Warhaftig, 1987b). This differs from the original CI in several aspects: (a) rapport is established; (b) control of the interview is transferred to the witness; (c) a witness-compatible questioning is used; (d) the witness is encouraged to use focused memory techniques and imagery. This new form of the CI was found to have a greater potential to enhance recall of correct information (+45% more correct information than the original version in the Fisher et al., 1987b, study).

The majority of studies using original or enhanced CI show that the CI elicits more correct information relative to a standard police interview or a structured interview. Furthermore, the average accuracy rates reported are extremely similar for the CI and for the standard or structured interview, despite an increase in the amount of incorrect information in the CI sometimes reported (Köhnken et al., 1999). This suggests that the CI generates more information than a standard or a structured interview, and this increased amount of detail is no less accurate than the information obtained in a standard or a structured interview. CI studies have used diverse populations: adults (Ascherman, Mantwill, & Köhnken, 1991; Brock, Fisher, & Cutler, 1999; Campos & Alonso-Quecuty, 1998; Geiselman et al., 1984; Memon, Wark, Holley, Bull, & Köhnken, 1997), children (Akehurst, Milne, & Köhnken, 2003; Geiselman & Padilla, 1988; Holliday & Albon, 2004; Larsson & Granhag, 2005), populations with learning disabilities (Brown & Geiselman, 1990; Milne, Clare, & Bull, 1999), and the elderly (McMahon, 2000; Mello & Fisher, 1996). In all cases, a beneficial effect of the CI was observed. The interviewers are adults from the general population, experienced law-enforcement personnel (Geiselman, Fisher, MacKinnon, & Holland, 1985), and police officers (Clifford & George, 1996; Fisher, Geiselman, & Amador, 1989; Ginet & Py, 2001; Memon, Holley, Milne, Köhnken, & Bull, 1994).

A SHORTER VERSION: ARE ALL MNEMONICS EFFICIENT?

Some authors have recently underlined the need to develop shorter versions of the CI (Davis, McMahon, & Greenwood, 2005; Kebbell & Wagstaff, 1999; Milne & Bull, 1999). Indeed, the CI constitutes a lengthy set of mnemonic instructions. The CI required more time to use, this additional time being either an objective fact (Davis et al., 2005; Fisher et al., 1987b; Geiselman et al., 1985) or a subjective feeling on the part of police officers (Kebbell, Milne, & Wagstaff, 1999; Kebbell & Wagstaff, 1999). Furthermore, there is some evidence about differences in the extent to which mnemonic instructions are effective in increasing the amount of information reported. An efficient alternative to the full CI would be a shortened interview that omits the less effective instructions. The scientific literature provided support for eliminating the change order and change perspectives mnemonics (Bekerian & Dennett, 1993; Boon & Noon, 1994; Davis et al., 2005). On the one hand, the beneficial effect of these instructions was not consistently supported by empirical evidence (Boon & Noon, 1994). Some studies, on the other hand, have shown that a modified version of the CI that omitted one of these instructions or both can be effective (Davis et al., 2005; Geiselman, Fisher, MacKinnon, & Holland, 1986; Mello & Fisher, 1996). Furthermore, police officers are reticent about using these mnemonics, and they are the least often used spontaneously (Clifford & George, 1996). Hence it is fundamental to develop a protocol that takes into account professional requirements.

The procedure used in the present study, therefore, involved a modified version of the CI

that eliminates change perspectives and change order instructions. However, the two mnemonics were replaced with an additional recall attempt in order to take advantage of reminiscence and hypermnesia, where recall is increased with repeated testing (Dunning & Stern, 1992; Payne, 1987). The beneficial effect of free recall attempts was supported by Davis et al. (2005). The authors used a modified version of the CI that replaced the change order and change perspectives techniques with additional free recall attempts. An instruction designed to avoid the possible demotivational effect of repeated questioning was added (''motivated recall''). Davis and his colleagues found that the change order and change perspectives mnemonics elicited less correct information than two motivated free recall attempts. A similar protocol was used in the present study.

In light of these results, the CI represents a reliable repertoire of techniques to maximise the recall of a criminal event. However, the experience of crime is often stressful and may be physically and psychologically traumatic for the witness or the victim (Shepherd et al., 1999). The efficiency of the CI may be lessened by the level of emotion that the witness/victim experienced during the criminal incident (Bekerian & Dennett, 1993). To our knowledge, no study has addressed this issue.

THE INFLUENCE OF EMOTION ON WITNESSES' TESTOMONIES

Christianson (1992) provided an extensive review of memory of negative emotional events. The author defined a negative emotional event as an event that is new, unexpected, and potentially threatening. According to the author, this kind of event enhances memory concerning the central aspects of the event and impairs memory of the background details. Indeed, several studies offer strong support for this notion (Burke, Heuer, & Reisberg, 1992; Christianson & Loftus, 1987, 1991; Libkuman, Stabler, & Otani, 2004). Easterbrook's (1959) cue-utilisation hypothesis is most frequently cited to account for these data. According to Easterbrook, high arousal narrows the focus of attention, which, in turn, benefits performance because relevant information is supposed to be given attention and irrelevant cues are excluded. Thus, relevant or central details of an event are well remembered, whereas irrelevant or peripheral details are not. Christianson (1992) suggested that several factors may also mediate this ''focus effect'', such as pre-attentive processing and post-stimulus elaboration. Christianson's (1992) theory leads to the prediction that a negative emotional event may be well remembered, at least concerning the central aspect of the event. Results of real-life studies (Christianson & Hübinette, 1993; Yuille & Cutshall, 1986) support this view.

Although it seems clear that part of the effect of emotional arousal on memory occurred during the encoding and retention stages, results from other studies indicate that the accessibility of information during retrieval constitutes another critical aspect of memory for emotional events. Context reinstated at the time of retrieval may be a key factor, particularly the mood-dependent memory (MDM) effect (Christianson, 1992). Indeed, several studies have shown that the recall or recognition of material is enhanced if the internal context in which the person perceived the initial event is reinstated at the time of retrieval (Balch, Myers, & Papotto, 1999; Bower, Monteiro, & Gilligan, 1978; Eich, Macaulay, & Ryan, 1994). Some authors have pointed out the need to differentiate arousal (intensity) and valence (pleasantness) dimensions in the MDM effect (Balch et al., 1999). Furthermore, according to the two-dimensional theory of emotion (Bradley, Greenwald, Petry, & Lang, 1992; Macaulay, Ryan, & Eich, 1993; Russell, 1980), emotional stimuli vary according to the two primary dimensions of arousal and pleasantness. Considering testimonies, the arousal dimension seems more relevant to assess. Indeed, it is indisputable that the majority of crimes concern events having a negative valence (theft, attacks, murders, etc.). However, these events, while being negative, can vary the intensity of the arousal that is generated in those who observe the crime or are implicated in it. For example, the level of arousal generated by the theft of a car radio will certainly not be identical to that generated by a murder committed in cold blood! In our study, only the arousal dimension was manipulated. Many studies have shown the relevance of an approach based only on the arousal dimension. Details of high-arousal stimuli are better remembered than details of low-arousal stimuli (Bradley et al., 1992; see Libkuman et al., 2004, for central details). Furthermore, arousal-dependent memory effect has been observed in the literature (Balch et al., 1999; Clark, Milberg, & Ross, 1983).

THE PRESENT STUDY

The major aim of this paper was to consider the benefits of the CI when the to-be-remembered event is accompanied by a high (compared to a low) level of arousal.

First, with regard to the two interviewing conditions, it was hypothesised that participants interviewed with the CI would recall more correct information than those in the SI condition, without a concomitant increase in incorrect or confabulated recall.

Second, in relation to arousal, a high level of arousal, compared to a low level of arousal, was expected to lead to enhanced memory concerning central details of the event. More precisely, participants in the high-arousal condition would recall more correct information concerning central details than those in the low-arousal condition, without an increase in incorrect or confabulated details recalled. However, this beneficial effect of high arousal should not be observed for background details. In fact, even a detrimental effect could be expected (fewer correct details and more incorrect or confabulated details) under high arousal.

In line with arousal-dependent memory literature, the context reinstatement instruction of the CI should reinstate the arousal context of the to-be-remembered event, which should not be the case with the SI. Hence, concerning central details, the beneficial effect of high arousal should be amplified in the CI condition compared to the SI condition. This amplification effect should be more moderate in a low-arousal condition since a lesser effect of a low arousal level on the recall of central details is expected. Concerning peripheral details, the opposite effect is expected since the recall of peripheral details should be better in the low-arousal condition compared to the high-arousal condition. Hence, in the low-arousal condition, a superior recall might be observed with the CI compared to the SI. In the high-arousal condition, the difference between the two interviews should be more moderate.

METHOD

Participants

The participants were 65 female and 5 male first-year university students. The mean age was 19.09 years ($SD = 1.58$). They were recruited via posted advertisements and were given course credit points in exchange for their participation. There were between 16 and 19 students per experimental condition.

Design

The design was a 2 (cognitive interview vs structured interview) $\times$ 2 (low arousal vs high arousal) between-subjects factorial design. Participants were randomly assigned to one of the four experimental conditions.

Materials

The study was conducted in two rooms and utilised a film lasting 3 minutes and 38 seconds for the encoding phase. At the time of recollection, a written questionnaire, a tape recorder, and a microphone were also used. The details of the experimental procedure are explained in the following section.

The witnessed event

The event consisted of a video lasting 3 minutes and 38 seconds, depicting a road accident. The film was custom-made for the present study. A group of young friends chat while walking in town. They meet several individuals (a knitwear salesman, a woman asking for directions, etc.). One of the young women in the group, realising that she has forgotten an important document, suddenly leaves her friends. She crosses the road without paying attention to the traffic and is hit violently by a car. (The accident itself was not shown to the participants; it was implied by the screeching of tyres and the squeal of brakes.) The injured victim is found unconscious in the middle of the road. Her friends, who did not see the accident, are worried because she has not returned and they set off to look for her. The same film was shown to all of the participants in the study.

Arousal induction

The experimental manipulation of arousal in the present experiment is inspired by the procedure

used in a study by Tooley, Brigham, Maass, and Bothwell (1987). Tooley et al. induced a high level of arousal by telling their participants that they would receive electric shocks (while they ran through a memory task). Similarly, in our study, half of the students were led to believe that they would receive electric shocks while they watched the to-be-remembered event (high arousal induction), while the other half did not receive such an instruction (low arousal induction). Of course no real shocks were administered. This procedure offers the advantage of being able to present the same to-be-remembered event in the two conditions, thus avoiding the problems of comparison when the content of the critical event differs. Moreover, this procedure directly implicates the participants who feel personally threatened. This allows one to induce arousal in a more ecological manner compared to a procedure where the participants passively watch an emotional event.

Arousal induction manipulation check. In order to evaluate the arousal induced by the electric shock manipulation, a pre-test (1) was performed with 46 first-year university students (mean age = 19.7; $SD = 1.12$). Participants were individually brought into a room equipped with a television and a computer, which was attached to a physiological measurement instrument linked to the electrodes. Then the experimenter explained that the participants had been recruited for research studying people's reactions to everyday events. In order to measure physiological signs, two electrodes were attached to the participants' arms. The instructions given to participants differed according to arousal conditions. The specific instructions for low-arousal condition ($N = 23$) were as follows: ''I am attaching electrodes to your arms in order to measure your physiological reactions during the video.'' These measures were fictitious. For the high-arousal condition ($N = 23$), the instructions were: ''I am attaching electrodes to your arms since I am interested in people's physiological reactions concerning certain pictures. That is why I need to send you a few electric shocks. Don't worry, these are very low. It can be a little painful but it is not dangerous. We will try it out and you will see.'' Participants then received a low electric shock in order to improve the credibility of the procedure and to show them that these shocks could be somewhat painful. The experimenter informed the participants that the electric shocks could happen randomly during the video. In fact, no real shocks were actually administered. Next, all the participants viewed the movie and then filled out a self-report scale assessing emotion induced in the video. More precisely, they rated the extent to which they felt themselves aroused (''To what extent did you feel aroused during the video?'') on a 7-point scale ranging from 1(*not at all*) to 7 (*extremely*). Similarly, their level of pleasantness (''To what extent did you feel pleasantness during the video?'') was evaluated on the same type of scale. In order to be certain that the arousal induced in our experiment was not confused with a surprise effect (see Christianson & Loftus, 1991, for the distinction between emotion and surprise), participants were invited to rate the level of surprise they experienced during the movie (''To what extent did you feel surprised during the video?''). Finally, Christianson (1992) stated that negative emotional events can be potentially threatening. In order to assess this dimension, participants were asked to evaluate at what point they felt themselves to be threatened while watching the film (''To what extent did you feel personally threatened during the video?''). Since the film was the same for the two conditions and the participants were faced with the electrode procedure in both cases, it was expected that the level of pleasantness rated by participants would not differ in the electric shock condition compared to the absence of the shock condition (same valence). However, the electric shock procedure was expected to be more arousing and more threatening than the absence of the shock procedure. Finally, no difference in surprise ratings was expected.

A series of independent groups t tests was performed on surprise, pleasantness, arousal, and threatening dependent measures. Consistent with expectations, the results showed no significant difference between the two conditions with regard to pleasantness ratings and surprise ratings, $t(44) = 0.17$, $p > .10$; $t(44) = 0.90$, $p > .10$, respectively (for pleasantness: $M_{shock} = 3.13$, $SD = 1.66$; $M_{no\ shock} = 3.22$, $SD = 1.79$; for surprise: $M_{shock} = 3.70$, $SD = 1.72$; $M_{no\ shock} = 4.09$, $SD = 1.16$). Moreover, participants felt themselves significantly more aroused, $t(44) = 2.04$, $p < .05$ ($M_{shock} = 3.83$, $SD = 1.67$; $M_{no\ shock} = 2.96$, $SD = 1.19$) and more threatened, $t(44) = 2.11$, $p < .05$ ($M_{shock} = 2.70$, $SD = 1.55$; $M_{no\ shock} = 1.83$, $SD = 1.23$) in the electric shock condition than in the absence of the electric shock condition.

In light of these results, we can conclude that the procedure of arousal induction was efficient.

Only the arousal was manipulated, not the valence. Nevertheless, the condition in which the participants thought they would receive shocks will be qualified as a high-arousal condition, while the other situation without the threat of shocks will be qualified as a low-arousal condition.

Interview protocol

Interviewer and interviewer training. A 25-year-old research assistant conducted all interviews. She was trained to use both of the interviewing strategies, the cognitive interview and the structured one. She participated in an interview training session that consisted of lectures (explaining the underlying theory: Tulving's theory, rapport building, transfer control of the interview to the interviewee, question wording, etc.), a video demonstration of the technique by psychologists and law-enforcement professionals trained in the cognitive interview, practice, and role-playing with comments from the instructor. Given the fact that the same person conducted the two interviews under the two interview conditions (CI and SI), a precise written interview protocol was drawn up (one for the CI and one for the SI) in order to avoid possible experimenter bias. The experimenter was given the instruction to scrupulously follow the written protocol during each interview. Consequently, the same instructions were used for all the participants in each condition.

Interviews

The interviews were audio-recorded for later transcription and scoring. The protocols for each interview are described as follows.

Cognitive interview (CI). The interviewer built up rapport and transferred control of the interview to the participant/witness. After the rapport was established, the experimenter began with the mnemonic instruction to report everything, ''Now I want you to tell me everything you can remember, every little detail you can remember even if you think it is not important or if you are not sure about it.'' Next, participants were given context reinstatement instruction in which participants were asked to reinstate the physical and personal context in which the video was shown:

> Try to picture yourself back in the room where you watched the video. You can close your eyes if you think it might help. Try to picture the room, where you were in the room, those eventually present, lights, noises, odours. Try to think about your mood at the time when you were watching the movie. How were you feeling? How was your physical state? Try to think about all of your reactions toward the movie, your emotional state, your feelings.

The instructions were read verbatim so that each participant heard the same instructions. Following Fisher, Geiselman, and Raymond (1987a), the interviewer did not interrupt the participant during the free recall.

After the free recall, a motivated recall instruction was read verbatim. This instruction replaced the final two mnemonic retrieval attempts of the cognitive interview (reverse order and change perspective). It was formulated as follows:

> I have a lot of details now. In order to help you to recall even more details, I suggest that you repeat your first narrative again. But now try to concentrate on specific details such as locations, objects, or persons. Don't focus only on actions, but also on all of the specific details you can report. Don't worry about repetition. Repeatedly describing the event may help you to recall.

Next, participants did a second free recall. In the closure phase, the interviewer summarised the participants' account of the videotape, inviting them to add new information and to correct him when appropriate.

Structured interview (SI). The SI was used as a control interview. According to Memon and Stevenage (1996, Section 9), the SI is appropriate for comparison in so far as ''it permits the theoretically driven examination of the importance of thecognitive techniques that define the CI''. In addition, the SI ''offers a stronger comparison than the standard interview by virtue of the greater degree of uniformity afforded by training''.

The structure of the SI was similar to the CI, minus the cognitive mnemonic techniques. The interviewer built up rapport and transferred control of the interview to the participant. Free recall was introduced as follows: ''You will be

interviewed about the videotape you watched last week. Please recall everything you saw in the film in as much detail as possible.'' The words ''as much detail as possible'' were used in order to increase the participants' motivation to provide a detailed account. The interviewer did not interrupt the participant during the free recall. After the first free recall, the second free recall was presented: ''I have a lot of details now. In order to help you to recall even more details, I suggest that you repeat your first narrative again. Please tell me again what you remember about the video.'' Again, this instruction (''help you to recall'') was used in order to keep the witness's motivation high.

Final questionnaire. Once the two recalls had been carried out, the participants were required to answer a series of questions. In order to design this final questionnaire, a pre-test (2) was performed with 30 first-year university students. Participants were brought into a room individually. They viewed the 3.38-minute road accident film. After the video they were asked to report each detail contained in the sequence. Free reports were transcribed verbatim. The most often reported details were kept to establish the specific questions used in the experiment. These were composed of 23 questions about the victim, the occupants of the car (physical appearance, clothes, etc.), and the main actions (examples of the questions: What was the colour of the driver's hair? Can you describe what the victim was wearing? Where was the victim injured?).These questions were open and neutral.

Procedure

The experiment was composed of two phases: an encoding phase and a recollection phase that followed a week later. Participants were not informed about the second phase until after the first phase was completed.

Encoding phase. The experimenter led the participants to a room. Then the same procedure and the same instructions as those given in the pre-test (1) were used. Half of the participants were told that they would receive electric shocks and the other half were told that their physiological reactions would be measured. The participants then watched the videotape attentively in the presence of the experimenter. They were then informed of the second phase of the experiment. The participants were requested to sign up for another session (lasting 30 minutes), but they were unaware of its aim.

Recollection phase. One week later, the participants were informed that they were to be interviewed about their recollections of the film viewed earlier. Each participant was led to a different room used for the encoding phase. They were interviewed using either a cognitive or a structured interview. Both interviews were composed of two free recalls. When participants indicated they had recalled all that they could, either by stating this or by recalling no further details after 1 minute, they answered the final questionnaire. Then they were debriefed and the experimenter answered all of the questions they had about the study.

Coding and scoring

Audiotapes of each interview were transcribed verbatim by a research assistant. Video details were first coded as correct, incorrect, and confabulated, with one point given for each unit of information. Units of information were categorised as to whether they were reported in the free recall or questioning phases. Details were then categorised as central and peripheral. In order to make this distinction, three raters (upper-level psychology students), blind to the hypothesis, evaluated each unit of information (organised in a pre-printed table) recalled by all the participants in the experiment. Libkuman et al.'s (2004) definition of central and peripheral was given before the task. Central detail was defined as detail associated with the central characters, whereas background detail was defined as detail unassociated with the central characters. The raters then watched the video. They were instructed to evaluate each unit of information for each scene by noting a ''C'' on the table when they considered a detail to be central, and a ''P'' when they considered a detail to be peripheral. Finally, a detail was considered to be central (or peripheral) when at least two raters evaluated it as such.

Points were only given to information when it was first recalled. A detail was coded as correct if it corresponded to the video, as incorrect if it was discrepant from the video (e.g., *grey car* instead of *blue car*), and confabulated if it did not appear in the video (e.g., *a dog crossed the road*). Following Geiselman et al. (1985, 1986),

statements of opinion, such as "the victim looked frightened", were ignored, as they were considered too subjective. This coding system produced a total of 181 units of information (119 correct units of information, 50 incorrect, and 12 confabulated details).

To assess inter-rater reliability, 11 interviews were scored independently by a different scorer (another research assistant). The following correlations of the scores of the two coders were found: total accurate, $r = .96$, $p < .001$, total error, $r = .94$, $p < .001$ and total confabulations, $r = 1$, $p < .001$.

RESULTS

Interview analyses

A series of 2 (interview: CI and SI) × 2 (arousal: high and low) two-way analyses of variance (ANOVA) were performed on the recall data. The dependent measures were the total number of correct details, errors, and confabulations elicited. Accuracy rate (proportion of correct responses relative to the total number of responses) was also used.

Recall across specific interview phases

The first set of analyses was performed on data collected on the whole interview (recall and questioning phases combined). This analysis allowed us to verify that the CI provided a global improvement, even when questions were added. This is an important verification from an ecological point of view since police officers need to ask some specific questions concerning units of information that witnesses cannot anticipate in their free recall.

Four separate 2 (interview) × 2 (arousal level) ANOVAs examined recall of the number of correct, incorrect, and confabulated details, and accuracy rate across interview phases (recall and questioning phases combined). Means and standard deviations for these measures for each of the conditions are presented in Table 1.

Correct details. As predicted, there was a significant main effect for each type of interview, $F(1, 64) = 5.75$, $p < .02$, with more correct information elicited in the CI condition than in the SI condition ($M_{CI} = 35.45$, $SD = 7.27$; $M_{SI} = 30.34$, $SD = 10.18$). Contrary to expectation, however, there were no significant effects for arousal, $F(1, 64) = 1.62$, $p > .10$, and interview × arousal interaction, $F < 1$.

Errors. There was a significant main effect of interview condition on errors, $F(1, 64) = 13.44$, $p < .002$, with more errors produced in the CI condition as compared to the SI condition ($M_{CI} = 4.03$, $SD = 1.67$; $M_{SI} = 2.60$, $SD = 1.75$). There was also a significant main effect for arousal, $F(1, 64) = 13.72$, $p < .001$. Participants in the high-arousal condition produced fewer errors than participants in the low-arousal condition ($M_{HA} = 2.61$, $SD = 1.50$; $M_{LA} = 4.06$, $SD = 1.92$). There was no significant interview × arousal interaction, $F < 1$.

Confabulations. There was no significant effect of interview condition on confabulations, $F < 1$. However, there was again a significant main effect for arousal, $F(1, 64) = 7.45$, $p < .01$. Participants in the high-arousal condition produced fewer confabulations than participants in the low-arousal condition ($M_{HA} = 0.25$, $SD = 0.60$; $M_{LA} = 0.69$, $SD = 0.74$). There was no significant interview × arousal interaction, $F(1, 64) = 2.53$, $p > .10$.

Accuracy rates. The accuracy rates for the CI and the SI were 88% and 91%, respectively. Despite a tendency in disfavour of the EC, this difference did not reach the significance level

TABLE 1
Mean recall under each condition across interview phases with recall and questioning phases combined

	SI		*CI*	
	Low arousal	*High arousal*	*Low arousal*	*High arousal*
Correct	28.75 (8.36)	31.68 (11.55)	34.12 (6.90)	36.71 (7.60)
Errors	3.25 (2.08)	2.05 (1.22)	4.88 (1.36)	3.24 (1.56)
Confabulations	.50 (.52)	.32 (.75)	.88 (.88)	.18 (.39)
Accuracy rate	.88 (.08)	.93 (.04)	.85 (.04)	.91 (.04)

Standard deviation in parentheses.

$F(1, 64) = 2.97$, $p < .09$. Additionally, there was a significant main effect for arousal on accuracy rate, $F(1, 64) = 15.64$, $p < .001$. Participants in the high-arousal condition were significantly more accurate than participants in the low-arousal condition ($M_{HA} = 92\%$, $SD = 4.20\%$; $M_{LA} = 87\%$, $SD = 6.46\%$). Again, there was no significant interview × arousal interaction, $F < 1$.

In short, the CI elicited more correct information than the SI, but concomitantly more errors were produced. High arousal did not lead to more complete narratives, but led to more accurate ones (less errors and confabulations). Finally, no interview × arousal interaction effect was found.

To account for the increase in errors observed in the CI condition, analyses of the two different phases of the interview (free recall and questioning phases) were performed on the number of correct details, errors, and confabulations reported. The analysis, which consisted in differentiating the free recall phase from questioning, allowed us to refine the understanding of the results obtained from the analysis concerning the whole interview (free recall and questioning combined). As a result, we could determine the source of the effects (from the free recall phase or from questioning).

Recall within specific interview phases

For the analysis on free recall, the two recall attempts were combined. Means and standard deviations for correct, incorrect, and confabulated recall, as well as the accuracy rate during the free recall and questioning phases for each of the conditions, are presented in Table 2.

In the *free recall phase*, there was a significant main effect of interview on the number of correct details reported, $F(1, 64) = 11.99$, $p < .01$, with more correct information reported with the CI compared to the SI ($M_{CI} = 22.33$, $SD = 5.62$; $M_{SI} = 17.23$, $SD = 6.57$). No main effect of arousal and no interaction effect was found on the total number of correct details recalled, $Fs < 1$. Concerning errors, there was no main effect of interview type, $F(1, 64) = 1.02$, $p > .10$, and no interaction effect, $F(1, 64) = 1.95$, $p > .10$. However, there was a significant main effect of arousal, $F(1, 64) = 8.34$, $p < .01$. Participants in the high-arousal condition produced fewer errors compared to the participants in the low-arousal condition ($M_{HA} = 0.28$, $SD = 0.57$; $M_{LA} = 0.88$, $SD = 1.10$). Finally, given the low scores of confabulations on free recall, statistical analysis cannot be used for this measure.

In the *questioning phase*, no main effect of interview type, $F < 1$, no main effect of arousal, $F(1, 64) = 1.58$, $p > .10$ and no interaction effect, $F < 1$, was revealed by the number of correct details obtained. However, there was a significant main effect of interview on the total number of errors produced, $F(1, 64) = 10.00$, $p < .01$. Participants interviewed under the CI condition gave more incorrect details than participants interviewed under the SI condition ($M_{CI} = 3.36$, $SD = 1.69$; $M_{SI} = 2.14$, $SD = 1.48$). There was also a significant main effect of arousal, $F(1, 64) = 4.70$, $p < .05$. Participants in the high-arousal condition produced fewer errors than those in the low-arousal condition ($M_{HA} = 2.33$, $SD = 1.55$; $M_{LA} = 3.19$, $SD = 1.75$).No interaction effect was observed on the total number of errors produced, $F < 1$. Concerning confabulations, there was no main effect of interview and no interaction interview × arousal effect, $Fs < 1$. However, a main effect of arousal was observed, $F(1, 64) = 5.47$, $p < .05$. Participants in the high-arousal condition produced fewer confabulations than those in the low-arousal condition ($M_{HA} = 0.14$, $SD = 0.35$; $M_{LA} = 0.41$, $SD = 0.56$).

To summarise, the benefits of the CI on the number of correct details obtained was observed mainly during the free recall phase. Furthermore, it can be noted that under the CI condition, 63% of the total correct details recalled were reported during the free recall phase (57% under the SI condition). The increase in errors reported with the CI occurred during the questioning phase. Finally, participants in the high-arousal condition produced fewer errors than those in the low-arousal condition, irrespective of the interview phase.

The major aim of this study was to assess the efficiency of the CI when the criminal event produced some arousal. In this perspective, the centrality of details recalled by witnesses should be differentiated, as different effects of arousal are expected on central and peripheral details. This analysis was made on the whole interview (free recall and question phases combined).

Centrality of information recalled (central and peripheral details)

Central and peripherical details recalled were examined across interview phases (recall and

TABLE 2
Mean recall under each condition across free recall and questioning

	SI		*CI*	
	Low arousal	*High arousal*	*Low arousal*	*High arousal*
Free recall				
Correct	16.06 (5.90)	18.21 (7.08)	22.25 (5.85)	22.41 (5.58)
Errors	.63 (.88)	.32 (.67)	1.13 (1.26)	.24 (.44)
Confabulations	.13 (.34)	.21 (.53)	.44 (.63)	.00 (.00)
Accuracy rate	.95 (.05)	.97 (.04)	.93 (.06)	.99 (.02)
Questions				
Correct	12.69 (4.91)	13.47 (6.13)	11.88 (4.44)	14.29 (5.13)
Errors	2.63 (1.63)	1.74 (1.24)	3.75 (1.73)	3.00 (1.62)
Confabulations	.37 (.50)	.11 (.31)	.44 (.63)	.18 (.39)
Accuracy rate	.80 (.12)	.87 (.08)	.74 (.06)	.81 (.09)

Standard deviation in parentheses.

questioning phases combined). Means and standard deviations for correct, incorrect, and confabulated details recalled, and the accuracy rate concerning central and peripheral details recalled for each of the conditions are presented in Table 3.

Concerning *correct central details* recalled, a significant main effect of interview was observed, $F(1, 64) = 4.02$, $p < .05$. Participants in the CI condition recalled more correct central details than those in the SI condition ($M_{CI} = 23.55$, $SD = 4.67$; $M_{SI} = 20.69$, $SD = 6.49$). Contrary to our hypothesis, no significant main effect of arousal was observed for this measure, nor was the condition by arousal interaction significant, all Fs < 1. Concerning *correct peripheral details* recalled, a significant main effect of interview was again observed, $F(1, 64) = 5.39$, $p < .03$, with more correct peripheral details reported with the CI compared to the SI ($M_{CI} = 11.91$, $SD = 3.92$; $M_{SI} = 9.66$, $SD = 5.10$). There was also a significant main effect of arousal, $F(1, 64) = 11.68$, $p < .01$. However, this effect did not conform to our expectations. Indeed, more correct peripheral details were recalled in the high-arousal condition compared to the low-arousal condition ($M_{HA} = 12.39$, $SD = 4.87$; $M_{LA} = 8.91$, $SD = 3.71$). Contrary to our expectations, no significant interaction interview $\times$ arousal effect was found on peripheral details correctly recalled, $F < 1$.

Concerning *incorrect central details* produced, there was a significant main effect of interview, $F(1, 64) = 9.55$, $p < .01$. Participants interviewed with the CI produced more incorrect central

TABLE 3
Mean correct, incorrect and confabulated details recalled, and accuracy rate as a function of centrality of information across interview phases

	SI		*CI*	
	Low arousal	*High arousal*	*Low arousal*	*High arousal*
Correct				
Central	21.44 (5.68)	20.05 (7.19)	23.62 (4.60)	23.47 (4.87)
Peripheral	7.31 (3.82)	11.63 (5.28)	10.50 (2.90)	13.24 (4.37)
Incorrect				
Central	1.13 (1.26)	.74 (.81)	1.81 (.91)	1.53 (.94)
Peripheral	2.13 (1.20)	1.32 (1.25)	3.06 (1.24)	1.71 (1.26)
Confabulated				
Central	.06 (.25)	.16 (.37)	.19 (.40)	.06 (.24)
Peripheral	.44 (.51)	.16 (.50)	.69 (.79)	.12 (.33)
Accuracy rate				
Central	.94 (.07)	.95 (.05)	.92 (.04)	.93 (.04)
Peripheral	.73 (.13)	.89 (.10)	.73 (.19)	.86 (.12)

Standard deviation in parentheses.

details than those interviewed with the SI ($M_{CI} = 1.67$, $SD = 0.92$; $M_{SI} = 0.91$, $SD = 1.04$). There was no significant main effect of arousal, $F(1, 64) = 1.96$, $p > .10$. There was also no significant interaction effect, $F < 1$. Concerning *incorrect peripheral details* produced, a significant main effect of interview was again found, $F(1, 64) = 4.85$, $p < .05$, with more incorrect peripheral details produced with the CI than with the SI ($M_{CI} = 2.36$, $SD = 1.41$; $M_{SI} = 1.69$, $SD = 1.28$). There was also a main effect of arousal, $F(1, 64) = 12.91$, $p < .01$. Participants in the high-arousal condition produced fewer peripheral errors than those in the low-arousal condition ($M_{HA} = 1.50$, $SD = 1.25$; $M_{LA} = 2.59$, $SD = 1.29$). This effect was again the opposite of the expected result.

Concerning *central confabulations*, there was no main effect of interview or arousal and no interaction interview × arousal effect, Fs < 1. There was no significant main effect of interview on *peripheral confabulations* produced, $F < 1$. However, there was a significant main effect of arousal, $F(1, 64) = 9.93$, $p < .01$. Contrary to our hypothesis, participants in the high-arousal condition produced fewer peripheral confabulations compared to participants in the low-arousal condition ($M_{HA} = 0.14$, $SD = 0.42$; $M_{LA} = 0.56$, $SD = 0.67$). There was no significant interaction interview × arousal, $F < 1$.

Concerning the *accuracy rate for central details*, despite a tendency in disfavour of the CI, the difference between the CI and the SI conditions did not reach the level of significance, $F(1, 64) = 3.12$, $p < .09$ ($M_{CI} = 0.93$, $SD = 0.04$; $M_{SI} = 0.95$, $SD = 0.06$).There was no main effect of arousal, $F(1, 64) = 2.31$, $p > .10$, and no interaction interview × arousal effect, $F < 1$. A main effect of arousal was observed concerning the *accuracy rate for peripheral details*, $F(1, 64) = 30.42$, $p < .001$. Contrary to our hypothesis, the accuracy rate was higher in the high-arousal condition compared to the low level of arousal ($M_{HA} = 0.88$, $SD = 0.11$; $M_{LA} = 0.73$, $SD = 0.10$). No significant main effect of interview and no significant effect of interaction were observed for this measure, Fs < 1.

To summarise, the benefits of the CI were observed on central and peripheral details. However, these benefits were accompanied by an increase in errors for the two categories of details. Concerning arousal, the effects were contrary to our hypothesis. We had expected a beneficial effect of high (compared to low) arousal on central details, and a detrimental effect on background details. Actually, no significant effect of arousal was observed on central details (whether it be on correct details, errors, or confabulations). However, more correct peripheral details were generated under the high- (compared to the low-) arousal condition, and these details were more accurate (fewer errors and confabulations, better accuracy rate). Finally, the expected interaction was not observed in the two categories of details.

DISCUSSION

This study enabled us to assess the effects of a shortened version of the CI compared to the SI. The results supported the hypothesis and showed that the CI elicited more correct details compared to the SI, without an increase in confabulations. The CI was found to be particularly effective in the free recall phase. This benefit concerned both central details and peripheral details. However, a concomitant significant increase in errors (both central and peripheral) was also observed with the CI. This detrimental effect was found mainly during the questioning phase.

Consistent with the results of Davis et al. (2005), the present study shows that a shortened version of the CI can be effective. This suggests that the report-all and mental reinstatement of context instructions were particularly efficient. This confirms the determinant role of context reinstatement, whose positive effects on memory have been extensively demonstrated in the literature (Smith, 1979, 1984), including that of the domain of testimony (Cutler & Penrod, 1995; Malpass & Devine, 1981). The essence of the benefit of the CI compared to the SI was observed during the free recall phase. Effectively, the CI leads to a significant improvement in the amount of correct information reported during free recall, but not during questioning. Moreover, it is during this phase of free recall that the majority of information is retrieved (63% of the total information in CI).

Concerning the centrality of details, the study showed that the CI enhanced the reporting of central and peripheral details. To our knowledge, this distinction has never been made in previous research. Indeed, a possible criticism is that the benefit of the CI concerned peripheral and irrelevant details for a police investigation. Few studies in the literature have raised this concern. For instance, Fisher et al. (1987b) have shown that

the CI increases the recall of facts with greater investigative value. However, no information was provided in Fisher et al.'s paper concerning the manner in which the facts were classified as important and not important. In our study, central details were defined in relation to the central characters of the story. One can conclude that these details would be particularly important in a real investigation. However, the most reliable test of the importance of the extra details generated by the CI would be an assessment made by police officers themselves in a real investigation. In all cases, the demonstration that the CI has the potential to enhance central information is particularly interesting from an applied perspective. By using the CI in an investigation, police officers could obtain significantly more relevant and secondary details from the witness.

If the CI facilitates the recall of correct information in the present study, it also produces more errors. This tendency was also found in a meta-analysis carried out by Köhnken et al., 1999, based on the results of 42 studies. The authors showed that the increase in errors with the use of the CI compared to the SI was observed particularly in studies that employed the enhanced version of the CI, as in our study. Nevertheless, this effect, according to Köhnken et al., is not due to a criterion shift for reporting details. Indeed, the effect sizes for correct and incorrect details were not correlated in the meta-analysis. Moreover, the average accuracy rates for information generated with a CI are almost identical to that observed with the SI in the studies analysed. Likewise, in the present study, the accuracy rate was not significantly different in the CI compared to the SI condition, despite a tendency in disfavour of the CI. Considering the nature of the errors, analyses revealed that incorrect details on central details, as well as peripheral ones, were generated by the CI. Thus, it is important to remain vigilant about errors made with the CI, since they can concern significant details. However, accuracy rates concerning these two categories of errors were not significantly different with the CI compared to the SI. Despite the increase in central and peripheral errors, testimonies obtained with the CI are not necessarily less accurate. When the interview phases are differentiated, the results of the present study show that the increase in errors was observed mainly in the questioning phase, while the CI does not produce more correct details than the SI during this phase. The CI then becomes less efficient when supplementary retrieval cues, such as questions, are supplied. This observation implies that the maximum amount of information must be retrieved during the recall phase in order to limit the number of questions that should be asked. This reinforces the idea of conserving a second recall attempt (for example, a motivated free recall) in order to further enrich the accounts collected in free recall. Let us also recall that in our study, the same questionnaire was used for all of the participants independently of what they had already recalled during the recall phase. This procedure permits one to control with consistency the number of questions asked. However, it demonstrates the inconvenience of not being in an ecological situation. Furthermore, it probably resulted in asking neutral questions, which could have been avoided in CI by considering details already gathered during the free recall phase. An inferior rate of errors connected to a more limited number of questions asked in CI would be observed if a personalised questionnaire is used for each participant. Finally, the instructions that introduce the questioning phase could be optimised. The instructions, for example, could be repeated (as the report-all instruction) or added at the start of the questioning (such as ''You have the right to say I don't know or I don't remember'', ''take all the time that you need to answer'', etc.). Perhaps this would reduce the number of errors produced during this phase of the CI.

In conclusion, our study showed that the CI improved the number of correct details recalled, but at the same time increased the amount of errors generated by witnesses, even if the accuracy rates were not significantly different from the SI. However, almost all the participants in our study were female, which limits the external validity of the results. Therefore we suggest that a more representative population should be used in a further replication.

The major aim of this study was to test the efficiency of the CI in relation to the level of arousal experienced by the participants. It was hypothesised that a high arousal level compared to a low level should improve recall performance, and this all the more so since a high level of arousal is associated with the CI. Conforming to our hypothesis, the results showed a positive benefit of high arousal on recall. However, contrary to our expectations and the existent data in the literature, high arousal aids in the recall of peripheral information. Moreover, it leads to fewer errors and confabulations whatever

the phase of the interview. Therefore, its leads to a better accuracy rate concerning exclusively peripheral details. Finally, contrary to the hypothesis, arousal and the CI do not interact except at the level of confabulations produced during the free recall phase.

Consistent with numerous findings (Burke et al., 1992; Christianson & Loftus, 1987; Heuer & Reisberg, 1990; Libkuman,Griffith, Nichols-Whitehead, & Thomas, 1999, Libkuman et al., 2004), we found that a to-be-remembered event associated with a high level of arousal was remembered better than with a low level of arousal. However, these benefits concern exclusively peripheral information (more correct details, fewer errors and confabulations, and thus a better accuracy rate). This result is opposite to those observed in the literature. Actually, a positive effect regarding central details was generally observed, which was consistent with the notion of focus of attention (Christianson, 1992). At least two explanations could account for these contradictory results. First, the details classed as peripheral in our study could have been more central than expected. Actually, they were part of the film. Participants were exposed to many details that could have been more peripheral compared to the video, such as the environmental context in which the film was seen (e.g., the room where they watched the film, the objects present in the room, the lighting, etc.) or details about the experimenter. Further research replicating this study should take into account questions concerning these details. A second explanation could be linked to the manipulated level of arousal in our study. We induced arousal among the participants by creating a personally threatening situation in which the individuals were directly implicated. This procedure presents the advantage of approaching an ecological situation of testimony. Nevertheless, it is possible that the manipulated level of arousal in the ''high-arousal condition'' was quite low compared to the level of emotion felt by a witness in a criminal event. Thus, in the ''high-arousal condition'' a limited focus would have occurred, leading participants to be simply more attentive to peripheral details. Nevertheless, the level of arousal for the ''high condition'' was not sufficiently important to permit a stronger narrowing of attention and a focus on the central details. Replication of the present work, while enhancing the level of arousal induced in the ''high condition'', is thus important to more fully understand the nature of this effect (for example, by administering real shocks during the encoding phase).

Finally, in our study, the arousal effect was considered in relation to context effects during retrieval. In this context, it was hypothesised that a dependent memory arousal effect would be observed with the CI. However, no interaction effect was found concerning either central or background details. It is possible that a spontaneous reinstatement context occurred in the two interview conditions, which could explain the main effect of arousal and the absence of interaction. It is also possible that the reinstatement instruction context of the CI was not sufficiently focused on the internal context of the participants to induce the dependent arousal effect. Again, it is possible that a higher level of arousal produces stronger effects on the memory and dependent memory arousal effects, which were not observed in this study. Moreover, a source of arousal linked to the TBR event should lead to some more pronounced results. Indeed, according to Christianson (1992, p. 293), ''details of emotional events will be remembered quite well when the emotional arousal is evoked by the TBR event rather than being evoked by a source that is causally unrelated to the TBR event''. Replication of this work with the introduction of a casual link between arousal and the TBR event is thus necessary (arousal and the TBR event are always linked in real situations of testimony).

In conclusion, the body of the CI protocol used in the present study enables a streamlined tool to be offered to law-enforcement professionals, one that corresponds to the time constraints of fieldwork and presents a significant effectiveness, taking into account the conditions in which the to-be-remembered event is a generator of a high level of arousal. Future research must be done in order to understand the processes at work in the arousal effect on memory in relation to the use of the CI. Indeed, this type of study raises interesting theoretical questions. Studies dealing with real event generators of a higher level of arousal could also be contemplated.

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