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**The Enhanced Cognitive Interview: Expressions of uncertainty, motivation and its relation with report accuracy**

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**Abstract**

The Enhanced Cognitive Interview (ECI) is one of the most widely studied and used methods to interview witnesses. However, ECI research has mainly focused on increasing report size and somewhat overlooked how to improve and evaluate report accuracy. No study evaluated if witnesses' spontaneous expressions of uncertainty are accurate metacognitive judgments, nor if witnesses' motivation during the interview affects report accuracy. This study examined how witnesses' judgments of recall 'uncertainty' and their motivation perception could relate to report accuracy. 44 psychology students watched a mock robbery video recording and were interviewed 48 hours later with either the Portuguese version of the ECI or a Structured Interview (SI). Afterward, participants' motivation was assessed and items of information were classified as 'certainties' or 'uncertainties'. Results suggest that our ECI protocol was effective, since participants interviewed with the ECI produced more information without compromising accuracy. 'Uncertainties' were less accurate than 'certainties', and their exclusion raised overall, ECI, and SI, accuracy. More motivated participants had better recall accuracy. Accounting for witnesses' motivation and spontaneous verbal expressions of

uncertainty may be effective and time-saving procedures to increase accuracy. These are key points that professionals and researchers should consider.

Keywords: Enhanced Cognitive Interview; Motivation; Certainty; Metacognition; Metamemory

### **Introduction**

As several researchers (Fisher & Geiselman, 1992; Prescott, Milne, & Clark, 2011) have acknowledged over the years, interviewing witnesses is a key procedure that frequently determines the outcome of a police investigation. However, memory is not so accurate and what witnesses actually report rarely corresponds fully with what they remember (Bower, 1967), particularly when inadequate interviewing techniques are used (Flin, Boon, Knox, & Bull, 1992).

To address this issue, Geiselman et al. (1984) developed the Cognitive Interview (CI). The Cognitive Interview originally included four cognitive mnemonics: report everything, mental reinstatement of context, change order, and change perspective. The report everything mnemonic consists of instructing witnesses to report everything they can remember, whether it seems trivial or not (Fisher & Geiselman, 2010). The mental reinstatement of context consists of asking witnesses to mentally recreate the to-be-recalled event, as well as their physiological, cognitive and emotional states at the time of the crime. Lastly, the change order (asking the witness to recall the event in a different chronological order – e.g., reverse order) and change perspective mnemonics (to recall the event from a different perspective - e.g., report what the witness saw from another witness' point of view) can be used to try to obtain information that has not yet been recalled. A few years later, this was further developed by

Fisher and Geiselman (1992) as the Enhanced Cognitive Interview (ECI). Several social and communicative components, such as rapport building, witness-compatible questioning, transferring control of the interview to the witness and mental imagery, crucial for conducting good investigative interviews, were added (see Geiselman and Fisher, 2014, or Paulo, Albuquerque, and Bull, 2013, for more information about the ECI mnemonics and components, as well as the theory underlying such procedures [Tulving, 1991; Tulving & Thomson, 1973]).

As Paulo et al. (2013) also reviewed, the ECI has been found to be effective in different countries (e.g., USA, UK, Australia, Brazil), with different types of witness (e.g., children, adults, elderly), with various delays between the crime and the interview (e.g., minutes to weeks), with a variety of events (e.g., crime, traffic accident, phone call), both in laboratory and field studies. These studies consistently showed that this interview technique increases the amount of correct information recalled by witnesses, while maintaining accuracy, i.e., the amount of correct items of information proportionate to all recalled items of information. Such a finding is commonly referred to as the ECI superiority effect (Akehurst, Milne, & Köhnken, 2003; Aschermann, Mantwill, & Köhnken, 1991; Campos & Alonso-Quecuty, 1999; Higham & Memon, 1999; Köhnken, Milne, Memon, & Bull, 1999; Dando & Milne, 2010; Memon, Wark, Bull, & Koehnken, 1997; Rivard, Fisher, Robertson, & Mueller, 2014). As mentioned above, most of the ECI research is focused on how to increase the amount of produced information without decreasing report accuracy. Nonetheless, actually increasing or evaluating report accuracy, i.e., the proportion of correct details in a given statement, is also crucial for police investigations (Milne & Bull, 1999). It could be very valuable if it could be determined which of the recalled information is more likely to be correct and which may be incorrect. One of the most promising methods to achieve this goal could be to use metacognitive techniques for monitoring recall (Evans & Fisher, 2010).

Metacognition refers to what we know about our own cognition and how we can use such knowledge to regulate cognition, as well as what we know about our own memory and mnemonic strategies (metamemory), and how we can use such knowledge to improve our memory, particularly, in terms of quality (Metcalfe & Shimamura, 1996). In fact, research on metacognition contributed to researchers changing their focus from improving report quantity to improving report quality (Koriat & Goldsmith, 1996). Subsequently, several studies addressed how metacognitive techniques can be used to improve or evaluate witnesses' accuracy (Higham, Luna, & Bloomfield, 2010; Roberts & Higham, 2002). For the purpose of the present study, we will focus on three of those techniques: confidence judgments; frequency judgments; and report option.

Several studies suggest that in some situations, such as selections from lineups (Brewer, Weber, Wootton, & Lindsay, 2012; Lindsay et al., 2013), cued recall (Luna & Martín-Luengo, 2012), or free recall (Allwood, Ask, & Granhag, 2007), and when using the adequate measures - calibration approach (Luna & Martín-Luengo, 2012), a positive relation between confidence and accuracy can be found. Therefore, higher accuracy for a given response can be expected when witnesses are more confident that such response is accurate. However, only two studies have focused on how this procedure can be used to evaluate ECI report accuracy (Allwood, Ask, & Granhag, 2007; Roberts & Higham, 2002). These authors interviewed witnesses with either the ECI, or a Structured Interview (SI), which is very similar to the ECI, but does not include some of its cognitive and social components (see method section). Afterwards, they asked participants to provide confidence judgments for a small portion of their statements, using a numerical rating scale. Using this procedure, witnesses were able to distinguish between more and less accurate information, regardless of the interview condition. Therefore the statements portions assigned with high confidence were more accurate than the full set of statements. However, these studies focus on metacognitive

procedures that are applied after the interview is conducted. After finishing the interview, a small portion of the witness' report, which is selected by the interviewer, is rated in terms of confidence judgments. From this two main concerns can be identified. First, numerical confidence judgments, performed after the interview has been conducted do not reflect witnesses' capacity to spontaneously differentiate statements that are less likely to be correct in a natural fashion (O'Hagan et al., 2006). Second, such procedures require a considerable amount of the interviewer's time, for instance, for applying these scales and selecting the limited information which will be evaluated by the interviewee. Therefore, it is difficult to use such procedure, in a holistic manner, at a real police interview setting.

Asking witnesses to predict how many items of information are correct, or wrong, for a given part of their statement (frequency judgments) could be a less time demanding approach to evaluate report accuracy (Gigerenzer, Hoffrage, & Kleinbölting, 1991; Liberman, 2004; Sniezek & Buckley, 1991). However, several studies questioned the accuracy of frequency judgments in interview settings. For instance, Granhag, Jonsson, and Allwood (2004) interviewed participants with either the ECI, or a SI, and subsequently asked them to answer to 45 forced-choice questions and give a confidence judgment for each question. Participants were then asked to provide a frequency judgment (how many questions they had answered correctly) and the authors found that participants severely underestimated their actual performance. Paulo, Albuquerque, Saraiva, and Bull (2015) evaluated if witnesses were able to perform accurate frequency judgments for each interview phase as well as for overall recall, during an investigative interview. These authors presented the same (mock) crime recording to two groups of participants and interviewed them with either an ECI or a SI. After each interview phase (e.g., free recall, questioning phase, second retrieval, etc.) they asked participants to estimate their error rate for that particular phase (frequency judgment). The same question was asked at the end of the interview for overall recall. Regardless of the

interview phase, both groups were unable to successfully evaluate their error rate, there being no association between participants' frequency judgments and participants' 'real' error rate.

Other studies (Evans & Fisher, 2010; Koriat & Goldsmith, 1996) suggest that witnesses can improve their accuracy by using other metacognitive control techniques, namely exercising 'report option' or adjusting 'report precision'. Exercising 'report option' refers to giving witnesses an opportunity to withhold information. For instance, if the witness is not sure about her ability to accurately answer a question, or to recall part of the event, she can withhold such information – e.g., say "I do not remember". Using this procedure, witnesses seem to be capable of withholding more unreliable information, and maintaining the reliable recall, consequently improving report accuracy. Accordingly, most interview protocols, including the ECI and SI, instruct witnesses not to guess when they do not know the answer to a question or do not recall part of the event. However, there are more levels of confidence between a 'full guess' (e.g., I assume he had a black shirt because robbers always wear black shirts) and a 'full certainty' (e.g., I'm sure the robber had a black shirt). For instance, witnesses commonly use spontaneous verbal expressions of uncertainty (e.g., I think; maybe; I believe, etc.) to report somewhat uncertain information. ECI research (Dando & Milne, 2010; Prescott, Milne, & Clark, 2011) usually disregards such expressions in the coding and analysis. Thus, 'I think the robber had a gun' would (for example) simply be coded as 'the robber had a gun'. Instead of disregarding such prepositions, the interviewer could ask witnesses to withhold all 'uncertainties' (e.g., I think the robber had a black shirt) in order to increase report accuracy. However, such an instruction may have several problems: (1) it is somewhat incompatible with the "Report Everything" mnemonic. In the same way that "irrelevant" recall might activate "relevant" recall (Tulving, 1991), an 'uncertainty' might activate a 'certainty'. Therefore, asking witnesses to withhold such information might undermine report length; (2) even though the participant is not sure about that particular

information ('uncertainty') the interviewer might have other methods to verify the accuracy of such information (e.g., other witnesses' reports, crime scene analysis, etc.). This could lead to the omission of very valuable information; and (3) research has not yet evaluated if items of information that are spontaneously preceded, or followed (e.g., the robber had a black shirt, I think.), by wording that expresses uncertainty ('uncertainties') differ, in terms of accuracy, from items of information not preceded/ followed by such wording ('certainties').

To evaluate if spontaneous verbal expressions of uncertainty can be used to evaluate and improve report accuracy, we decided to treat these two separately, and test: (a) if 'certainties' would involve greater accuracy than 'uncertainties'; and (b) if the ECI superiority effect over a SI (in terms of quantity of information) does not affect other parameters, such as the proportion of 'uncertainties' or the accuracy of such information. To date, no study has evaluated if witnesses are able to perform spontaneous real-time memory monitoring for their account. This is crucial because, if witnesses are able to spontaneously discriminate less reliable information while reporting the crime, differentiating 'uncertainties' from 'certainties' can be an easy, intuitive, and time-saving way (O'Hagan et al., 2006) to differentiate less reliable information ('uncertainties') from more reliable information ('certainties').

Another method to improve, and estimate, report accuracy might involve witnesses' perception of their own motivation during the interview. Two studies (Read, Powell, Kebbell, & Milne, 2009; Walsh & Bull, 2011) recently acknowledged that witnesses' perceptions towards the interview process might determine how rapport is established and maintained throughout the interview, which might be crucial during investigative interviews and associated with better recall (Vallano & Compo, 2015). Fisher and Geiselman (2010) also suggested that interviewing witnesses involves more than mere use of cognitive techniques. They recognize the need for more studies addressing witnesses' attitudes towards the



interview process and the interviewer, which is a topic that has yet received very little attention from researchers. Recent findings (Ballardin, Stein, & Milne, 2013) suggest that witnesses' perceptions, such as the perception of interviewer effort and the perception of their own motivation during the interview can have a major influence on the outcome of the investigative interview. However, it is important to understand how these perceptions can influence witnesses' report, for instance, in terms of report accuracy (Fisher & Geiselman, 2010). To our knowledge, such research questions have not yet been addressed. Therefore, the present study examined how witnesses' perceptions can influence their report. We focused on whether witnesses' perception of their own motivation was related to their recall in terms of report accuracy because, as previously mentioned, improving report accuracy is the main focus of our study. If more motivated witnesses achieve better report accuracy, promoting witnesses' motivation can be another possible method to further increase report quality.

Overall, our main goal was to see if report accuracy can be increased, and/or estimated, through two different procedures: (1) witnesses spontaneous metacognitive judgments and (2) witnesses' perception of their own motivation. We established three main hypotheses: (1) 'uncertainties' will be less accurate than 'certainties', because participants will be able to monitor the information they are providing homogeneously throughout the interview (Allwood, Ask, & Granhag, 2007; Evans & Fisher, 2010; Koriat & Goldsmith, 1996; Roberts & Higham, 2002). As a result, removing 'uncertainties' from the report will increase accuracy; (2) The ECI superiority effect over a SI (in terms of quantity of information) does not affect other parameters, such as the proportion of 'uncertainties' or, as several studies suggest (Aschermann, Mantwill, & Köhnken, 1991; Dando & Milne, 2010; Rivard, Fisher, Robertson, & Mueller, 2014), report accuracy. Therefore, longer reports are expected for the ECI condition as the result of using effective cognitive mnemonics to improve recall; (3) Witnesses who rate themselves as more motivated during the interview

will have greater accuracy, because they are more motivated to provide a good report, and possibly will apply more effort to monitor their report through spontaneous metacognitive/metamemory techniques.

## **Method**

### ***Participants***

A total of 44 Portuguese psychology students, 36 females and 8 males, with an age range from 17 to 46 years old ( $M = 21$ ,  $SD = 3$ ) participated in this study for course credits. We have used G\*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) to conduct power analysis based on the effect sizes reported in a recent ECI meta-analysis review (Memon, Meissner, & Fraser, 2010) to ensure that our sample size was adequate. Both interview groups had 22 participants, 18 females and 4 males each. The ECI group age ranged from 17 to 46 years old ( $M = 21$ ,  $SD = 6$ ) and the SI group age ranged from 18 to 34 years old ( $M = 21$ ,  $SD = 4$ ).

### ***Design***

A between subjects experimental design was used with interview condition as the independent variable with two levels: (1) Enhanced Cognitive Interview (ECI), and (2) Structured Interview. The amount of reported information and accuracy were measured in information units and proportion, respectively.

### ***Materials***

The participants watched the recording on a Fujitsu L7ZA LCD computer screen. The video recording, which was edited from the second episode of the first season of the 2004 Portuguese television drama “Inspector Max” (Riccó & Riccó, 2004), was three minutes and

eleven seconds long. This non-violent video recording shows a male armed subject walking inside a bank and taking several hostages to carry the robbery. He verbally and physically interacts with them, with the cashier and a police officer that later approaches the robber.

After the interview was conducted, participants were asked to evaluate their motivation during the interview (“How do you evaluate your motivation to testify during the interview?”) on a seven point Likert scale (1- very low; 2 – low; 3 – slightly low; 4 – moderate; 5 - slightly high; 6 – high; and 7- very high). All interviews were video and audio recorded.

### ***Procedure***

Ethics committee approval was obtained. Participants took part in two sessions. At the first session they were randomly assigned to one of the two conditions (ECI vs SI). Having signed a consent form after reading general information about the study, they were shown the video recording. They were asked to pay as much attention as possible to the video recording because they would be later interviewed about it. The second session took place approximately forty-eight hours later and each participant was interviewed with either the ECI or SI. After the interview, all participants immediately answered the question regarding motivation perception.

*Interview conditions.* The interview protocols employed were translated and adapted from Milne and Bull (2003) for the Portuguese language. Overall, the only differences between the ECI and SI protocols were the four cognitive mnemonics and the transfer of control instruction and mental imagery (see Table 1). Both interview protocols included procedures such as rapport building and appropriate questioning (e.g., witness-compatible questioning) because they are now considered an essential aspect of any investigative interview. Thus, we wanted to focus on the effect that the remaining components, only applied in the ECI

condition, would have on recall. All SI procedures were also included in the ECI. Fisher and Geilseman's (1992) guidelines for conducting the ECI were followed. All the cognitive, social and communicative components described in Fisher and Geiselman (1992) were included in the ECI protocol.

Insert Table 1

Both interview protocols enclosed seven main phases: (1) preliminary phase; (2) free report; (3) open-ended questioning; (4) second retrieval; (5) third retrieval (for new information only); (6) summary; and (7) closure.

During phase 1 (preliminary phase) procedures such as greeting, establishing rapport, explaining the instructions and purpose of the interview to the witness and asking not to guess, were followed for both interview protocols. However, the ECI condition included the transfer of control instruction: (...) *you are the only one who saw the video and have the ability to report all the important information (...) you can tell me what happened in the order you desire and pause whenever you want*; as well as the report everything instruction: (...) *please tell me everything that you remember with as much detail as you can (...) even the details that might seem irrelevant to you, are very important to me (...) tell me everything that pops into your mind.*

During phase 2 (free report) participants were asked to recall what they could remember about the video in any order and pace they desired. In the ECI condition, they were reminded to report everything they could remember with as much detail as possible, and mental reinstatement of context was applied: (...) *Try to remember the day you have watched the video (...) now picture the crime scene in your mind (...) as clear as possible (...) picture*

*all the sounds (...) all the objects (...) all the people (...) and now focus on what happened and tell me everything you can remember.*

During phase 3 (open-ended questioning) three open-ended questions were asked to each participant according to his/her free report (e.g., Please describe the perpetrator – if the participant previously reported seeing the criminal). However, for the ECI condition, mental imagery instructions were used – e.g., *you told me that you looked at the perpetrator when he entered the bank, because he looked very anxious. Can you please close your eyes ..., think about everything that you remember concerning him ..., his clothes ..., his face ..., his behavior ... and when you have a full picture of him in your mind, describe everything that you can remember about him.*

During phase 4 (second retrieval) participants were asked to report what they could remember about the video once again: *(...) I know it may seem redundant, but it is actually highly important that you report one more time what happened on the video (...) report not only new information that you might recall, but also all the information you've already reported (...).* In both conditions participants were encouraged to give this second report and the importance of such procedure was explained: *It is very important that you focus as hard as you can and tell me one more time what happened on the video.* In the ECI condition, participants were asked to recall the video in the reverse order: *(...) Please tell me what happened in reverse order (...) Focus on the last episode that you remember ... then focus on the previous one ... and so on (...). What is the last episode that you remember?*

During phase 5 (third retrieval) participants were asked to focus one more time on the video and try to report any new detail they could remember, if possible. In both interview conditions the importance of such a procedure was explained and participants were encouraged to do the best they could. In the ECI condition, participants were asked to adopt a different internal perspective in order to try to remember new details: *(...) please focus on the*

*event as if it was a common event at the bank, instead of a robbery, as you probably assumed before seeing the robber entering the bank (...).*

On phase 6 (summary) the interviewer summarized what he understood of the witness account and asked her to correct him if he misheard, or misinterpreted, any part of the statement. He also told her to interrupt him if she/he could remember any new detail while hearing the summary. On the last phase (closure), appreciation for participants' hard work and cooperation was acknowledged and neutral topics were again discussed. These last two phases were exactly alike for both interview conditions.

*Interviewer training.* An expert in the ECI who had followed several qualified courses on investigative interview techniques, consisting of more than 50 hours of lectures, practice, role-playing exercises and feedback/ evaluation, conducted all the interviews. To assure that the interviewer performance was adequate and consistent across interview conditions, interview protocols were read verbatim whenever possible (e.g., open-ended questioning and summary phase need to be adapted according to the participant' previous recall) and an independent researcher, which is also an expert on human memory and forensic psychology, randomly checked 25% of the interviews, using a structured evaluation grid to evaluate verbal, and non-verbal, behavior.

*Coding.* Recordings of each interview were coded using the template scoring technique from Memon et al (1997). A comprehensive list of details in the video recording was compiled and items of information were categorized as referring to: (1) person; (2) action; (3) object; (4) location; (5) conversation; and (6) sound, resulting in 378 items of information. Recalled information was classified as either correct, incorrect (e.g., saying the pistol was brown when it was black), or confabulation (mentioning a detail or event that was not present or did not

happen). Also noted was the phase within the interview in which an item of information was recalled. If an item of information (correct or not) was repeated during the same, or a subsequent phase, that information was scored only the first time it was mentioned (Prescott et al., 2011). We classified items of information as either ‘certainties’ or ‘uncertainties’. As described above, when participants spontaneously used verbal expressions of uncertainty (e.g., I think; maybe; I believe, etc.) to report an item of information they were uncertain about, such item was classified as an ‘uncertainty’. Otherwise, items of information were labeled as ‘certainties’. Coders were provided with a list of Portuguese words that are commonly used to express uncertainty. They have used their best judgment to verify the intent of the participant when using this kind of expressions of uncertainty, because, in very rare situations, these expressions could be used with other purposes rather than express uncertainty. Therefore, in these exceptional cases, the adjacent information would not be rated as an ‘uncertainty’. Inter-rater reliability was assessed to measure agreement on this measure, as discussed in the following section. Subjective statements or opinions were disregarded (e.g., The robber was gorgeous).

*Inter-rater reliability.* To assess inter-rater reliability, 11 (25%) interviews were selected randomly and scored independently by a researcher who was naive to the aims of the experiment and hypothesis, but familiar with the template method of scoring interviews and had access to the crime video. Intraclass correlation coefficients (ICC) were calculated for correct information, incorrect information and confabulations, as well as for ‘certainties’ and ‘uncertainties’, and for the six information categories (person, action, etc.). High inter-rater reliability was found for all measures in that the values of the ICC ranged between .979 and 1.000, with an overall ICC of .992.

## Results

Bonferroni corrections were applied when multiple statistical tests were conducted on a single data set, to avoid type 1 error (Field, 2009).

### *General recall and accuracy.*

It was expected that participants in the ECI condition would provide more correct items of information, in comparison with a control group (SI), without compromising accuracy. Participants in the ECI condition recalled more correct items of information ( $M_{ECI} = 76, SD = 24.71$ ) in comparison with the control group ( $M_{SI} = 58, SD = 13.91$ ),  $t(42) = 2.96, p = .005, d = .89, 95\% CI [-30.11, -5.71]$ .

As seen on Table 2, no differences were found between the two interviews regarding the proportion values of (i) correct recall (ratio between the amount of correct items of information recalled over all the items of information),  $t(42) = .96, p = .343, d = .29$ ; (ii) errors (ratio between the amount of errors produced over all items of information),  $t(42) = 1.12, p = .269, d = .34$ ; and (iii) confabulations (ratio between the amount of confabulated information over all items of information),  $t(42) = .80, p = .431, d = .24$ . Thus, participants interviewed with the ECI were able to provide more information without increasing the proportion of errors and confabulations on their reports.

Insert Table 2

### *'Uncertainties' frequency.*



We first conducted a two-way mixed-design 2 X 5 ANOVA to see if ‘uncertainties’ proportion (i.e, information units which are preceded, or followed, by expressions of uncertainty over all information units) was stable across interview conditions (ECI vs. SI), and interview phases (phase 2 vs. phase 3 vs. phase 4 vs. phase 5 vs. phase 6). Phase 1 (preliminary phase) was not included in this analysis because participants were not asked to recall information at this part of the interview.

We found no main effect of interview condition on uncertainties proportion,  $F(1, 12) = .09, p = .770, \eta^2 = 0$ . Therefore, our results do not suggest that participants in the ECI condition produce a higher ‘uncertainties’ proportion ( $M_{ECI} = .14, SD = .08$ ), in comparison to the SI group ( $M_{SI} = .12, SD = .07$ ). Although we found a main effect of the interview phase on ‘uncertainties’ proportion,  $F(4, 48) = 3.43, p = .02, \eta^2 = .21$ , pairwise comparisons revealed no significant differences between any of the different interview phases regarding this ( $M_{\text{phase2}} = .04; M_{\text{phase3}} = .14; M_{\text{phase4}} = .08; M_{\text{phase5}} = .03; M_{\text{phase6}} = .02$ ). There is also no interaction effect of interview condition and interview phase on ‘uncertainties’ proportion,  $F(4, 48) = 1.04, p = .394, \eta^2 = .06$ .

Further analysis revealed that report size (total amount of details) is not associated with the proportion of produced ‘uncertainties’ (proportion of ‘uncertainties’ in a given report),  $r = .29, p = .06$ . Therefore, our study does not support that participants who are providing more information units are more uncertain about such information. There is also no correlation between the proportion of produced ‘uncertainties’ in a report and proportion of correct recall for the remaining recall (proportion of correct information for ‘certainties’ only),  $r = .25, p = .10$ . Thus, our data does not support that participants who are providing more uncertainties are simultaneously committing more errors/ confabulations when recalling ‘certainties’.

*'Uncertainties' accuracy.*

The 'uncertainties' constituted a small proportion of the overall recall ( $M = .13$ ,  $SD = .08$ ). Furthermore, their exclusion from the accuracy analysis raised this proportion value from .86 (overall correct recall: amount of correct items of information over the total amount of produced items of information) to .90 (correct recall for 'certainties' only : amount of correct 'certainties' over all produced 'certainties'). Such difference was statistically significant,  $t(43) = 7.38$ ,  $p < .001$ ,  $d = 1.11$ , 95% CI [-0.04, -0.02]. Error proportion for 'certainties' only was significantly lower than overall error proportion (amount of errors over the total amount of produced items of information),  $t(43) = 6.65$ ,  $p < .001$ ,  $d = 1.02$ , 95% CI [-0.22, -0.11] and confabulation proportion for 'certainties' only was also lower than overall confabulation proportion,  $t(43) = 3.22$ ,  $p = .002$ ,  $d = .93$ , 95% CI [0.03, 0.11]. Such results occur because, as showed on Table 3, correct recall proportion for 'uncertainties' is low and significantly different from correct recall proportion for 'certainties' only,  $t(43) = 7.99$ ,  $p < .001$ ,  $d = 1.21$ , 95% CI [0.18, 0.30] in that .65 of 'uncertainties' were correct items of information, in comparison with 'certainties' that have a .90 correct recall rate.

Insert Table 3

Similar results were found for the ECI and SI conditions alone. The exclusion of 'uncertainties' within the ECI accuracy analysis raised this from .86 (overall proportion of correct recall) to .89 (proportion of correct recall for certainties only),  $t(21) = 7.01$ ,  $p < .001$ ,  $d = 1.49$ , 95% CI [-0.04, -0.02]. The exclusion of 'uncertainties' within the SI accuracy analyses also raised this from .87 (overall correct recall proportion) to .90 (correct recall proportion value for certainties only),  $t(21) = 4.30$ ,  $p < .001$ ,  $d = .92$ , 95% CI [-0.05, -0.02].

***Witnesses' motivation perception.***

Out of a seven point Likert scale (1- very low; 2 – low; 3 – slightly low; 4 – moderate; 5 - slightly high; 6 – high; and 7- very high), only the highest four levels of motivation were chosen by participants to rate their motivation,  $N_{\text{moderate}} = 4$  ( $N_{\text{ECI}} = 2$ ;  $N_{\text{SI}} = 2$ );  $N_{\text{slightly high}} = 13$  ( $N_{\text{ECI}} = 10$ ;  $N_{\text{SI}} = 3$ );  $N_{\text{high}} = 21$  ( $N_{\text{ECI}} = 15$ ;  $N_{\text{SI}} = 6$ );  $N_{\text{very high}} = 6$  ( $N_{\text{ECI}} = 4$ ;  $N_{\text{SI}} = 2$ ). Procedures such as rapport building and greeting, which were part of both interview conditions, might have precluded lower levels of motivation.

We found no effect of interview condition (ECI or SI) on participant' perception of their own motivation during the interview,  $U = 196$ ,  $p = .245$ ,  $r = .18$ . However, participants' perception of their own motivation during the interview was correlated to report accuracy, measured in correct recall proportion,  $r_s = .37$ ,  $p = .026$ , 95% CI [.10, .68].

Since 'moderate' and 'very high' motivation levels were chosen by only a few participants ( $N = 10$ ) we merged the two lowest levels of motivation ('moderate' and 'slightly high' motivation) and the two highest levels of motivation ('high' and 'very high' motivation) in order to have more participants in each group: 'lower' motivation ( $N = 17$ ) and 'higher motivation' ( $N = 27$ ). Afterwards, we've conducted a t-test for independent samples and found that witnesses who perceived themselves as more motivated during the interview had a higher correct recall proportion ( $M_{\text{high Mot}} = .88$ ,  $SD = .05$ ) than witnesses who reported having lower levels of motivation ( $M_{\text{low Mot}} = .84$ ,  $SD = .07$ ),  $t(42) = 2.35$ ,  $p = .023$ ,  $d = .73$ , 95% CI [-.08, -.01].

**Discussion**

This study examined how use of witnesses' spontaneous metacognitive judgments of 'uncertainty', as well as their perception of their own motivation, could help to increase and/or evaluate report accuracy. Our major findings were that spontaneous 'uncertainties'

were less accurate than ‘certainties’ and thus their exclusion raised overall, ECI, and SI, accuracy values. Also, witnesses who perceived themselves as more motivated during the interview had better recall accuracy.

Since ECI research is mostly focused on how to increase the amount of produced information (Milne & Bull, 1999) we focused on how to increase report accuracy. We found that participants were capable of spontaneously distinguish more reliable information (‘certainties’) from less reliable information (‘uncertainties’). Our results are supported by previous findings suggesting that witnesses are able to use several metacognitive techniques to monitor their own report (Allwood et al., 2007; Evans & Fisher, 2010; Koriat & Goldsmith, 1996; Roberts & Higham, 2002; Sniezek & Buckley, 1991). However, to our knowledge, this is the first study to reveal that witnesses are able to spontaneously perform real-time memory monitoring while recalling information in an interview setting. Furthermore, such results were stable across both interview conditions (ECI or SI) which is consistent with previous findings suggesting that metacognitive techniques are effective in several different situations and contexts (Allwood et al., 2007; Lindsay et al., 2013; Luna & Martín-Luengo, 2012). Such findings can have major implications for real-life investigations.

Our study is also consistent with previous research (Aschermann, Mantwill, & Köhnken, 1991; Dando & Milne, 2010; Rivard, Fisher, Robertson, & Mueller, 2014) that suggest the ECI superiority effect over a SI (in terms of quantity of information) does not affect other parameters, such as the accuracy of such information and, as our study now suggests, the proportion of produced uncertainties. When confronted with consecutive retrieval attempts or instructions such as the “report everything” mnemonic, participants could provide ‘uncertain’ information that they might otherwise withhold, therefore explaining the increase in recall on the ECI condition. Our study does not support this, because even though the ECI participants are providing more details, they are not eliciting a higher proportion of

‘uncertainties’. Such results are highly important for ECI usage, because they suggest that more detailed reports, typically achieved when using the ECI, may well be the result of indeed using diversified and effective recall strategies (Fisher & Geiselman, 1992; Paulo et al., 2013). Witnesses could also be withholding ‘uncertain’ information’ at the beginning of the interview, and later choose to reveal it, assuming that, if the interviewer is asking for successive retrieval attempts, he/she expects more information from the witness, regardless of its accuracy. However, our study does not suggest this because pairwise comparisons revealed no differences between interview phases regarding the amount of produced uncertainties, proportion wise. Lastly, it is important to state that we found no correlation between the proportion of produced ‘uncertainties’ for a given report and accuracy for the remaining recall. Therefore, our study does not support that ‘uncertainties’ are the result of inferior memory traces since witnesses who provide more ‘uncertainties’ do not seem to be providing more errors and confabulations in their remaining recall. We believe ‘uncertainties’ are the result of metacognitive monitoring that is homogeneously performed throughout the interview, regardless of interview condition, interview phase, or report length. Such monitoring is effectively performed, since only 65% of the produced ‘uncertainties’ were correct items of information, in comparison with ‘certainties’ that have a 90% correct recall rate.

Our study purposely constrained motivation perception variability with procedures such as greeting and establishing rapport (Vallano & Compo, 2015; Walsh & Bull, 2011) that aim, among many other purposes, to preclude low levels of motivation (Read et al., 2009). Even though we focused on the effect that motivation perception could have on report accuracy when only moderate to high levels of motivation were reported, we found that more motivated witnesses were more accurate. Such results are supported by previous research which suggests that witness’ perceptions towards the interviewer and the interview process

might have an important role on witnesses' report (Ballardin et al., 2013; Walsh & Bull, 2011). However, to our knowledge, this is the first study that assessed the relation between witnesses' perception of their own motivation and report accuracy, suggesting that promoting witnesses' motivation, for instance, through rapport, might also be another effective procedure to further increasing report accuracy.

One could argue that accuracy is influencing witnesses' motivation: participants who provide a more accurate report consequently feel more motivated. However, as previously discussed, Paulo et al. (2015) found that witnesses were unable to successfully evaluate their accuracy for different interview phases, as well as for the whole interview. Similarly to Granhag et al. (2004), these authors found no association between participants' frequency judgments and participants' 'real' error rate. Therefore, if witnesses are unable to accurately evaluate accuracy for large portions of their statement, and for their overall statement, it is very unlikely that our participants who achieved higher accuracy rates were able to perceive so, and consequently felt more motivated. It is our believe that highly motivated witnesses may be applying more effort to successfully provide an accurate report, for instance, by effectively monitoring such information, which, as we previously established, has a major role on increasing report accuracy. However, this requires further testing as discussed in the following section.

### **Limitations and Future Directions**

Given the size of our sample, two motivation levels had only a few participants (see results section). This constrained our ability to further test if highly motivated participants are applying more effort to monitor their report, consequently providing a more accurate report. In the future, it would be interesting to develop a study with more participants to test if highly motivated witnesses present more signs of memory monitoring (e.g., elicit more 'uncertainties') than witnesses who report moderate/ lower levels of motivation. Furthermore,

only one measure of motivation was used in this study. Given that witnesses' motivation could have an effect on report accuracy; it is important to further test this hypothesis with other motivation measures, such as real time motivation assessments during the interview, as well as by manipulating participants' motivation levels. Lastly, it would be very interesting to separate 'certainties' in two new groups: (a) 'regular recall' – e.g., 'he had a black shirt'; and (b) 'full certainty' – e.g., 'I am definitely sure he had a black shirt'. However, participants seldom spontaneously report a 'full certainty'. Therefore a different research design which encourages participants to tell when they are absolutely sure about a piece of information they have previously reported is necessary.

### **Conclusion**

Our findings support that differentiating spontaneous 'certainties' from 'uncertainties' and promoting witnesses' motivation are key points that researchers and professionals should consider. Taking note of witnesses' motivation and ability to use spontaneous verbal expressions of uncertainty to naturally monitor their own report might be an effective and time-saving procedure to increase or evaluate report accuracy.

### **Conflict of interest statement**

The authors declare that there are no conflicts of interest.

### **References**

- Akehurst, L., Milne, R., & Köhnken, G. (2003). The effects of children's age and delay on recall in a cognitive or structured interview. *Psychology, Crime & Law*, 9, 97-107. doi: 10.1080=1068316021000057686

- Allwood, C., Ask, K., & Granhag, P. (2005). The cognitive interview: Effects on the realism in witnesses' confidence in their free recall. *Psychology, Crime & Law, 11*, 183-198. doi: 10.1080/10683160512331329943
- Aschermann, E., Mantwill, M., & Köhnken, G. (1991). An independent replication of the effectiveness of the cognitive interview. *Applied Cognitive Psychology, 5*, 489-495. doi: 10.1002/acp.2350050604
- Ballardin, M., Stein, L., & Milne, R. (2013). Além das técnicas de entrevista: características individuais em entrevista investigativa com testemunhas. [Beyond the interview techniques: individual characteristics in investigative interviews with witnesses]. *Revista Brasileira de Segurança Pública, 7*, 6-16.
- Bower, G. (1967). A multicomponent theory of the memory trace. In K.W. Spence and J. T. Spence (Eds.). *The psychology of learning and motivation* (Vol.1, pp. 229-325). New York, NY: Academic Press.
- Brewer, N., Weber, N., Wootton, D., & Lindsay, S. (2012). Identifying the bad guy in a lineup using confidence judgments under deadline pressure. *Psychological Science, 23*, 1208-1214. doi: 10.1177/0956797612441217
- Campos, L., & Alonso-Quecuty, M. L. (1999). The cognitive interview: Much more than simply "try again". *Psychology, Crime & Law, 5*, 47-59. doi: 10.1080/10683169908414993
- Dando, C., & Milne, R. (2010). The cognitive interview. In R. Kocsis (Ed.), *Applied criminal psychology: A guide to forensic behavioral sciences* (pp. 147–169). Sydney, NSW: Charles C. Thomas. doi: 10.1002/jip.124
- Evans, J. R., & Fisher, R. P. (2010). Eyewitness memory: Balancing the accuracy, precision and quantity of information through metacognitive monitoring and control. *Applied Cognitive Psychology, 25*, 501-508. doi: 10.1002/acp.1722



- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G\*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160.
- Fisher, R. P., & Geiselman, R. E. (1992). *Memory-enhancing techniques for investigative interviewing: The cognitive interview*. Springfield, IL: Charles C. Thomas.
- Fisher, R. P., & Geiselman, R. E. (2010). The Cognitive Interview method of conducting police interviews: Eliciting extensive information and promoting therapeutic jurisprudence. *International Journal of Law and Psychiatry, 33*, 321–328. doi: 10.1016/j.ijlp.2010.09.004
- Flin, R., Boon, J., Knox, A., & Bull, R. (1992). The effect of a five month-delay on children's and adult's eyewitness memory. *British Journal of Psychology, 83*, 323-336.
- Geiselman, R. E., & Fisher, R. P. (2014). Interviewing witnesses and victims. In M. St-Yves (Ed.). *Investigative interviewing: Handbook of best practices*. Toronto: Toronto, ON: Thomson Reuters Publishers
- Geiselman, R. E., Fisher, R. P., Firstenberg, I., Hutton, L., Sullivan, S. J., Avetissian, I. V., & Prosk, A. L. (1984). Enhancement of eyewitness memory: An empirical evaluation of the cognitive interview. *Journal of Police and Science Administration, 12*, 74-80.
- Gigerenzer, G. Hoffrage, U., & Kleinbölting, H. (1991). Probabilistic mental models: A Brunswikian theory of confidence. *Psychological Review, 98*, 506-528.  
<http://dx.doi.org/10.1037/0033-295X.98.4.506>
- Granhag, P. A., Jonsson, A., & Allwood, C. M. (2004). The cognitive interview and its effect on witnesses' confidence. *Psychology, Crime & Law, 10*, 37-52. doi: 10.1080/1068316021000030577

- Higham, P. A., Luna, K., & Bloomfield, J. (2010). Trace-strength and source-monitoring accounts of accuracy and metacognitive resolution in the misinformation paradigm. *Applied Cognitive Psychology, 25*, 324 -335. doi: 10.1002/acp.1694
- Higham, P. A., & Memon, A. (1999). A review of the cognitive interview. *Psychology, Crime, & Law, 5*, 177-196. doi: 10.1080/10683169908415000
- Köhnken, G., Milne, R., Memon, A., & Bull, R. (1999). The cognitive interview: A meta-analysis. *Psychology, Crime & Law, 5*, 3-27. doi: 10.1080/10683169908414991
- Koriat, A., & Goldsmith, M. (1996). Monitoring and control processes in the strategic regulation of memory accuracy. *Psychological Review, 103*, 490-517.
- Lieberman, V. (2004). Local and global judgements of confidence. *Journal of Experimental Psychology: Learning, Memory and Cognition, 30*, 729-732.  
<http://dx.doi.org/10.1037/0278-7393.30.3.729>
- Lindsay, R., Kalmet, N., Leung, J., Bertrand, M., Sauer, J., & Sauerland, M. (2013). Confidence and accuracy of lineup selections and rejections: Postdicting rejection accuracy with confidence. *Journal of Applied Research in Memory and Cognition, 2*, 179-184. <http://dx.doi.org/10.1016/j.jarmac.2013.06.002>
- Luna, K., & Martín-Luengo, B. (2012). Confidence-accuracy calibration with general knowledge and eyewitness memory cued recall questions. *Applied Cognitive Psychology, 26*, 289-295. doi: 10.1002/acp.1822
- Memon, A., Holley, A., Wark, L., Bull, R., & Köhnken, G. (1997). Isolating the effects of the cognitive interview techniques. *British Journal of Psychology, 88*, 179-197.  
doi: 10.1111/j.2044-8295.1997.tb02629.x
- Memon, A., Meissner, C. A., & Fraser, G. (2010). The cognitive interview: A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law, 16*, 340-372. <http://dx.doi.org/10.1037/a0020518>

- Metcalfe, J., & Shimamura, A. P. (1996). *Metacognition: Knowing about knowing*. Cambridge, MA: The MIT Press.
- Milne, R. & Bull, R. (1999). *Investigative Interviewing: Psychology and Practice*. Chichester, WS: Wiley. doi: 10.1002/cbm.444
- Milne, R., & Bull, R. (2003). Does the cognitive interview help children to resist the effects of suggestive questioning? *Legal and Criminological Psychology*, 8, 21-38. doi: 10.1348/135532503762871219
- O'Hagan, A., Buck, C. E., Daneshkhah, A., Eiser, J. R., Garthwaite, P. H., Jenkinson, D. J., Oakley, J. E., & Rakow, T. (2006). *Uncertain judgements: Eliciting experts' probabilities*. Chichester, WS: Wiley. doi: 10.1002/0470033312
- Paulo, R. M., Albuquerque, P. B., Saraiva, M., & Bull, R. (2015). The enhanced cognitive interview: Testing appropriateness perception, memory capacity and error estimate relation with report quality. *Applied Cognitive Psychology*. doi: 10.1002/acp.3132
- Paulo, R. M., Albuquerque, P. B., & Bull, R. (2013). The enhanced cognitive interview: Towards a better use and understanding of this procedure. *International Journal of Police Science & Management*, 15, 190-199. <http://dx.doi.org/10.1350/ijps.2013.15.3.311>
- Prescott, K., Milne, R., Clark, J. (2011). How effective is the enhanced cognitive interview when aiding recall retrieval of older adults including memory for conversation? *Journal of Investigative Psychology and Offender Profiling*, 8, 257-270. doi: 10.1002/jip.142
- Read, J. M., Powell, M. B., Kebbell, M. R., & Milne, R. (2009). Investigative interviewing of suspected sex offenders: a review of what constitutes best practice. *International Journal of Police Science & Management*, 11, 442-459. doi: 10.1350/ijps.2009.00.0.143

- Riccó, A. (Director), & Riccó, R. (Director). (2004). O Assalto [The robbery] [Television series episode]. In V. Castelo (Producer), *Inspector Max*. Lisbon: Produções Fictícias.
- Rivard, J. R., Fisher, R. P., Robertson, B., & Mueller, D. H. (2014). Testing the cognitive interview with professional interviewers: Enhancing recall of specific details of recurring events. *Applied Cognitive Psychology*. Retrieved from <http://onlinelibrary.wiley.com/doi/10.1002/acp.3026/full>
- Roberts, W.T., & Higham, P.A. (2002). Selecting accurate statements from the cognitive interview using confidence ratings. *Journal of Experimental Psychology: Applied*, 8, 33-43. doi: 10.1037/1076-898X.8.1.33
- Snizek, J. A. & Buckley, T. (1991). Confidence depends on level of aggregation. *Journal of Behavioral Decision Making*, 4, 263-272. doi: 10.1002/bdm.3960040404
- Stein, L. M., & Memon, A. (2006). Testing the efficacy of the cognitive interview in a developing country. *Applied Cognitive Psychology*, 20, 597-605.  
doi: 10.1002/acp.1211
- Tulving, E. (1991). Concepts of human memory. In L. R. Squire, N. M. Weinberger, G. Lynch, & J. L. McGaugh (Eds.), *Memory: Organization and locus of change* (pp. 3-32). New York: Oxford University Press.
- Tulving, E., & Thomson, D. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological Review*, 80, 352-373.
- Vallano, J. P., Compo, N. S. (2015). Rapport-building with cooperative witnesses and criminal suspects: A theoretical and empirical review. *Psychology, Public Policy, and Law*, 21, 85-99. <http://dx.doi.org/10.1037/law0000035>
- Walsh, D., & Bull, R. (2011). Examining rapport in investigative interviews with suspects: Does its building and maintenance work? *Journal of Police and Criminal Psychology*, 27, 73-84. doi:10.1007/s11896-011-9087-x

**Table 1**

Differences between the two interview protocols: procedures that were only applied in the ECI condition according to the interview phase.

	<b>Phase 1 Preliminary</b>	<b>Phase 2 Free Report</b>	<b>Phase 3 Open-ended questioning</b>	<b>Phase 4 Second Retrieval</b>	<b>Phase 5 Third Retrieval</b>	<b>Phase 6 Summary</b>
<b>ECI</b>	Transfer of control Report everything	Context reinstatement Report everything	Mental imagery	Change order	Change perspective	<b>x</b>

X – No procedure specific to the ECI

**Table 2.** Proportion values (Mean and Standard Deviation) for correct recall, errors and confabulations, according to the interview condition.

	Correct recall	Errors	Confabulations
ECI	.86 (.07)	.09 (.04)	.05 (.04)
SI	.87 (.05)	.08 (.05)	.05 (.03)

**Table 3.** Proportion values (Mean and Standard Deviation) for correct recall, errors and confabulations for ‘certainties’, ‘uncertainties’ and both types of information together (overall)

	Correct recall	Errors	Confabulations
‘Certainties’	.90 (.06)	.06 (.04)	.04 (.04)
‘Uncertainties’	.65 (.21)	.23 (.19)	.12 (.15)
Overall	.86 (.06)	.09 (.04)	.05 (.04)