



Memory for Cars Among a Female Population: Is the Cognitive Interview Beneficial in Reducing Stereotype Threat?

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Abstract

The first aim of the present study was to assess the effect of stereotype threat on recall of a visual event involving cars by female witnesses. It was expected that stereotyped women (by the interviewer) would provide a poorer description of the cars involved than non-stereotyped women. The second aim was to test if a modified cognitive interview (MCI) could reduce this negative effect. We expected that MCI reduce the harmful effect of stereotype threat on women's recall in comparison with a control interview (CI). Sixty-nine women watched a videotape of a criminal event involving cars. Two days later, they had to recall the to-be-remembered event and were given either a neutral or a threatening (= stereotyping) instruction. They were then interviewed using a CI or an MCI. Results showed that threatened women were less accurate and made more errors and confabulations than non-threatened women. They also produced more incorrect details about the cars involved. Moreover, the MCI elicited more correct details but without impairing accuracy for both threatened and non-threatened women. Our study supports the existing evidence that women's testimony may be affected by the social context and highlights the need to use the MCI during judicial interviews.

Keywords Stereotype threat · Women · Memory for cars · Eyewitness testimony · Cognitive interview

Introduction

In 2012, 270,599 automobile accidents occurred in France (due to drink-driving, speeding, etc.; Ministry of Justice 2013). In the light of these statistical data, descriptions of cars given by witnesses/victims can be of invaluable help in

investigating and resolving offenses. Descriptions of cars are all the more important since they may also provide valuable clues in cases not directly involving vehicles, such as cases of personal injury or damage to property. Indeed, the description of the car used by a murderer, a burglar, or a drug dealer could lead to the criminal's identification or arrest. However, despite the importance of vehicle descriptions, very few studies have examined the recall of cars by victims/witnesses (see Allison et al. 2014; Villegas et al. 2005). According to Allison et al. (2014, pp. 84), “the majority of eyewitness research has focused on memory for faces and events [...] and another avenue worthy of inquiry is memory for vehicles”. Furthermore, a small number of studies have shown that women have more difficulty in recognizing cars than men (e.g., Allison et al. 2014; McKelvie et al. 1993). The current explanation given for these results supports the idea of a difference in interest in cars between men and women. Women are thought to be less interested and therefore have limited knowledge about automobiles (Harris and Voorhees 1981; Hollingshead and Fraiddin 2003). However, we would like to propose another more psychosocial explanation: there is a negative stereotype that women are not capable of describing a car correctly (e.g., Félonneau and Becker 2011). Their poor recall of cars could in fact be induced by a stereotype threat effect (Steele and

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Aronson 1995). The first aim of this study was to examine whether the negative stereotype of women as being poorly informed about automobiles could impair their memories of visual events involving cars due to a stereotype threat phenomenon. A second objective was to assess whether a modified cognitive interview (MCI) can reduce this negative effect.

Stereotype Threat

It should be noted that the technical term “stereotype threat” does not refer to physical threats (e.g., interviewing under torture) leading to risk of physical harm or crimes against life. This term rather represents a psychological threat because of the impression of being stereotyped and the fear of confirming this negative belief.

The concept of stereotype threat was introduced into the social psychology literature by Steele and Aronson (1995). According to these authors, negative stereotypes associated with one’s membership group may affect performances in a manner consistent with these stereotypes. Based on the negative stereotype about the intellectual abilities of African Americans (“blacks are not intelligent”), these authors observed that when their ethnicity was made salient, African American students underperformed on certain tests selected from the Graduate Record Examinations compared with Caucasian students. However, when their ethnic identity was not made salient, African American students were as successful as Caucasian students. The authors found that the performance of an individual placed in a situation in which the stereotype about her/his membership group is activated and applicable may decline, thereby confirming the stereotype involved. More generally, Steele and Aronson (1995) suggested that this reduction in performance might be generated by individuals’ fear of confirming the stereotype associated with their social group.

Since the initial study of Steele and Aronson (1995), more than 300 experiments have been conducted either in the laboratory or in the field to examine the phenomenon of stereotype threat. This research has shown that many stigmatized populations, including women (Good et al. 2008; Shih et al. 1999; Spencer et al. 1999), are sensitive to the effect of stereotype threat. As in the case of African Americans, negative stereotypes targeting women can alter their intellectual performances in a manner that is consistent with these beliefs. Moreover, studies have reported that women may also suffer from stereotype threat in domains ranging far beyond academia and that this affects, for example, their ability to negotiate (Kray et al. 2001) or their athletic skills (Hively and El-Alayli 2014). One such stereotype holds that women have little knowledge of cars (Hollingshead and Fraidin 2003) and poor driving skills (Félonneau and Becker 2011). Yeung and Von Hippel (2008) observed that women using a car simulator and threatened by the stereotype of women as poor drivers had

twice as many collisions with jaywalkers as women in the same situation but not threatened by this stereotype. In the same vein, Félonneau and Becker (2011) observed that women threatened by the driving ability stereotype underperformed on a driving test compared with women in a non-threatening condition. Finally, Moé et al. (2015) found that women in a threatening condition made more errors (e.g., crossing the white line, trouble starting, going through a red traffic light, unnecessary stops, etc.) than women in a control condition or a boost condition.

By definition, eyewitnesses have to recall visual events involving locations, persons, actions, sounds, and objects, while trying to be as complete and accurate as possible. Witnesses may therefore feel pressurized to succeed in this task, which clearly involves their memory. What happens when such a witness belongs to a group subject to a negative memory stereotype? To our knowledge, this issue has received very little attention in the eyewitness testimony literature (see Henkel 2014 for an exception). Some studies have shown that the elderly, who are subject to a negative memory stereotype, exhibit memory performance impairment when the age-related stereotype is activated (e.g., Chasteen et al. 2005; Hess et al. 2003; Meisner 2012). However, these studies were not conducted in an eyewitness testimony paradigm (i.e., complex visual event, oral statement, etc.).

As mentioned above, an eyewitness’s recall of car descriptors (e.g., model, color, style, length, license plate numbers, etc.) may be crucial for investigators. Yet women are known to possess poor knowledge of cars. They could therefore feel threatened in a situation where they have to recall car descriptors, for example when their poor knowledge of cars is made salient by an interviewer. Consequently, they could confirm the negative stereotype by producing low-quality descriptions. The first aim of this paper was to test this hypothesis.

Our second objective consisted in proposing possible solutions in order to reduce the (supposed) negative effects induced by stereotype threat resulting from women’s supposed poor knowledge of cars. One of these solutions might be the cognitive interview (Geiselman et al. 1984).

The Cognitive Interview: an Overview

The cognitive interview (CI) was developed by Edward Geiselman and Ronald Fisher in the early 1980s as an interviewing protocol to be used by law enforcement professionals to enhance witness recall (see, for instance, Geiselman and Fisher 2014 for a review). In its original form (Geiselman et al. 1984), the CI consisted of four cognitive components based on two theoretical principles: (a) mental re-creation of the context of the crime at the time of retrieval facilitates memory (i.e., *encoding specificity* principle, Tulving and Thomson 1973), and (b) different retrieval cues can lead to the same memory record (i.e., *varied retrieval*, Bower 1967;

Tulving 1974). The four cognitive components were (a) the *report everything* instruction, (b) the *context reinstatement* instruction, (c) the *change order* instruction, and (d) the *change perspective* instruction. Several components designed to improve the social dynamics of the interview and communication between the witness and the interviewer were later added to the protocol (Fisher et al. 1987b). This new version of the protocol was referred to as the enhanced cognitive interview (ECI) (see Fisher and Geiselman 1992, for a detailed overview). In its current form (see Geiselman and Fisher 2014), the ECI protocol is divided into five sections: (a) in the introduction phase, the interviewer is encouraged to develop rapport with the witness. The witness is also invited to play an active role (transfer of control) and to provide extensive, detailed information (report everything instruction). (b) The interviewer then requests the witness to make an uninterrupted narration of what s/he experienced. The interviewer can also instruct the witness to mentally recreate the context of the original event (context reinstatement instruction) to facilitate his/her narration. (c) Based on the contents of the narrative, the interviewer asks a number of questions, with the emphasis being placed on open-ended questions and witness-compatible questioning. If necessary, a second free recall is performed using the change order or the change perspective instruction. (d) The interviewer then works with the witness to review the information that was obtained during the interview. (e) At the end of the interview, the interviewer thanks the witness, and also encourages them to get back in touch if they recall any new information.

In the scientific literature, some MCI protocols have been developed which omit the change perspective mnemonic (e.g., Wright and Holliday 2007), omit both the change perspective and the change temporal order instructions (e.g., Davis et al. 2004), or replace these two instructions with a new one (Colomb and Ginet 2012; Paulo et al. 2016). Given its efficiency in the field and its positive perception by police officers (Colomb et al. 2013), an MCI was used in the present study.

Many studies conducted over the past 30 years have investigated the effectiveness of the CI/ECI/MCI and have shown that in comparison with a *Standard Police Interview* (i.e., interview usually used by professionals without formal training) and a *Structured Interview* (i.e., similar to the ECI, but without the four mnemonics), the CI/ECI/MCI elicits between 25 and 50% more correct information without compromising the accuracy of the statements (Köhnken et al. 1999; Memon et al. 2010), even if a slight increase in errors is sometimes observed. Moreover, the CI/ECI/MCI reduces the effects of misleading questions (Geiselman et al. 1986; Milne and Bull 2003) and its benefit is observed with different populations (e.g., adults, adults with learning disabilities, children, and the elderly), across different countries (e.g., USA, UK, Brazil, Australia, Portugal, and France), and with victims and

witnesses of real crimes (Clifford and George 1996; Colomb et al. 2013; Fisher et al. 1989). This benefit is obtained both with the modified versions (MCIs) and the two initial versions (CI and ECI).

Stereotype Threat and the Modified Cognitive Interview

In general, studies on stereotype threat (Steele and Aronson 1995) have shown that the decrease in performances observed in a threatening situation is the result of many interrelated factors that seem to impair individual cognitions and behaviors. Among these factors, studies cite an increase in evaluative pressure (Désert et al. 2002), the establishment of a control process (Inzlicht et al. 2006; Smith and White 2002), the failure to use effective strategies to perform the task (Hess et al. 2004), more distractions related to the appearance of interfering negative thoughts (e.g., frustration, disappointment; Cadinu et al. 2005; Krendl et al. 2008), a reduction in cognitive resources (Beilock et al. 2007; Croizet et al. 2004; Stone and McWhinnie 2008), increased stress and anxiety (Croizet et al. 2004; Delgado and Prieto 2008), a diminution of self-confidence and the creation of expectations of lower performances (Kray et al. 2001; Rosenthal et al. 2007; Stangor et al. 1998; Van Bergen et al. 2010), and a loss of motivation and a reduction in effort (Steele and Aronson 1995; Schimel et al. 2004; Stone 2002). It clearly appears that the phenomenon of stereotype threat results from many factors that are more or less directly related to each other.

However, because of its general interview framework and its cognitive instructions, it seems that the cognitive interview can modulate some of the mechanisms involved in the appearance of stereotype threat and thus be effective in limiting the harmful effects of this phenomenon. Stereotype threat could be linked to a fear of evaluation, especially when individuals perceive the situation as representing a test of their skills. In this perspective, some constituents of the cognitive interview may lead the witness to perceive the recall task as less evaluative and reduce the evaluative pressure of the interview.

For example, witnesses are often anxious about the interview process because they are uncertain about what is expected of them. Explaining the objectives and the structure of the interview at the beginning of the process may eliminate the ambiguity potentially perceived by witnesses about the situation, and thus limit the fear of being evaluated.

In addition, the use of certain instructions such as “you may ask questions if there is anything you do not understand” or “you have the right not to understand and/or not to know something” may convince the witness that the situation is not a performance test.

Furthermore, the techniques used to reduce emotional distress resulting from the description of crime-related details

(e.g., investigators adopting a calm and relaxed attitude, etc.) may also decrease witnesses' anxiety and stress (see Fisher and Geiselman 2010 for a similar hypothesis on stress).

Moreover, handing control of the interview over to the interviewee, using nonverbal or verbal positive reinforcements, adopting a listening attitude, avoidance of interrupting and judgmental comments, etc., will reinforce the self-confidence of the witness, his/her motivation and concentration, and could therefore potentially overcome the prejudicial effect of the stereotype threat phenomenon.

Similarly, and as previously noted, stereotype threat may impede the use of effective mnemonic strategies to complete the memory task (e.g., Hess et al. 2004). Some of the cognitive instructions given to the witness in the CI/MCI protocols (e.g., context reinstatement instruction) could compensate for these missing strategies. In addition, asking the witness to use the cognitive instructions could divert his/her attention away from the interfering negative thoughts or control processes that are believed to be present in situations of stereotype threat.

Finally, various studies have shown that the CI/MCI protocols increase the volume of information provided by witnesses without impairing accuracy. However, it is precisely on the dimensions of quality and quantity that the descriptions of cars provided by women might deteriorate in a threatening situation. We can therefore well imagine that the CI could overcome the negative effects (i.e., fewer correct details, and more errors and confabulations) caused by stereotype threat on women's recall of cars.

In view of the theoretical arguments and empirical studies presented, we made several hypotheses. First, we postulated that compared to a neutral condition, women threatened at the level of their knowledge of automobiles should experience a stereotype threat effect that results in a decline in their performances in a car description task. Specifically, we expected a reduction in the quantity of correct details recalled, notably about the cars involved, an increased production of errors and confabulations, and, therefore, a decrease in accuracy. Moreover, because we expected both the cognitive instructions and the social components of the MCI to have a beneficial effect, we compared this protocol with a control interview, that is to say an interview without the social and cognitive components of the MCI. We therefore expected women interviewed with the MCI to perform better in terms of correct details recalled than women interviewed with a control interview, but without any loss of accuracy. Finally, regarding the interaction between stereotype threat and the cognitive interview, we assumed that the MCI would overcome the negative effect expected in a threatening condition. Consequently, we expected women interviewed with a control interview to make more errors and confabulations, and to be less accurate in a threatening condition than in a non-threatening condition, in

particular regarding details linked to the description of cars (e.g., the visual appearance of cars). This negative outcome of stereotype threat should be reduced in the MCI condition.

Method

Participants and Design

Eighty first-year psychology students were recruited via announcements posted at Clermont Auvergne University, Clermont-Ferrand, France. No information was provided on the topics of the study (participants were only informed of the duration, and that the study was limited to female participants). Eleven of them were excluded because they discovered the aim of the study (see the debriefing section). The final sample consisted of 69 participants. All were women aged between 17 and 33 years old, $M = 19.42$, $SD = 2.27$, and they were given course credits for their participation.

A 2 (condition: control vs. stereotype threat) \times 2 (interview: control vs. modified cognitive interview) between-subjects design was used.

Procedure

The participants received a formal consent in which they were informed that their participation in this study was voluntary, anonymous, and could be interrupted when they wanted. After receiving their consent, the experiment was conducted in two phases, an encoding one and a recall one.

The Encoding Phase

The participants watched a videotape of a criminal event on a 13" screen. The film, which lasted 3 min and 13 s, involved two main characters and contained many details. It began with the presentation of a man holding a second man hostage and threatening him in order to get information about a car and its location. The second scene showed the hostage informing the perpetrator and then being murdered. The perpetrator then drove a car to a parking lot where he expected to find another car he wanted. Finally, the perpetrator found the car he was looking for, with a trunk full of money. The event scenario therefore contained two major scenes involving two cars, that is the one driven by the perpetrator on his way to the parking lot (a gray Peugeot convertible) and the one in which the money was hidden (a black Volkswagen Golf). The participants were asked to "watch the video carefully" and headphones were provided for listening. At the end of the encoding phase, an appointment was made for the second phase and the participants were told not to talk about the experiment.

The Recall Phase

The second session, during which each participant was interviewed individually either with a control interview or an MCI, took place 48 h later. All the interviews were conducted by a new experimenter and in a different room to avoid spontaneous context reinstatement in the control interview condition. Five female undergraduate psychology students conducted all the interviews. They had been trained to conduct control and MCI interviews by a senior researcher. The training consisted of lectures explaining the underlying notions (e.g., Tulving's theory, rapport building, transfer of control of the interview to the interviewee, question wording, non-verbal behavior, etc.), video demonstrations, and several interview techniques (i.e., role playing). The whole training session took around 12 h.

All the interviews began with a general explanation of the aim of the second phase, namely to recall the event seen 2 days earlier, followed by a specific instruction used to prompt the car descriptions. This instruction for the memory task differed depending on the “stereotype threat” condition. A control interview or an MCI was then conducted. Finally, the participants completed a debriefing questionnaire designed to collect various verification measures and they were then fully debriefed.

The Manipulation of Stereotype Threat

As mentioned above, the “stereotype threat” was manipulated by an instruction used to prompt the description of cars at the beginning of the interviews:

- *Stereotype threat condition:* Two instructions were used to prompt the car descriptions and to manipulate stereotype threat (see Appendix for an exact formulation of these instructions) so that the task either was or was not presented as being diagnostic of the participants' competences concerning cars and either did or did not stress the importance of knowledge of cars for success in this task. In the stereotype threat condition, the experimenter explained that the aim of the study was to assess the participants' ability to describe cars and that their knowledge in this field would determine their performance. This was expected to increase the evaluative pressure to perform.
- *Control condition:* The instruction used in the control group was more “neutral.” In this case, the participants were simply asked to recall the event in full and to “pay particular attention to the description of the cars involved in the event.”

Description of the Interviews

As mentioned above, the participants were interviewed using a control interview or an MCI. The instructions for both were

read verbatim to the participants and included an introductory phase, a free recall phase consisting of two recall attempts, and a questioning session.

- *The introductory phase.* In all the interview conditions, the introduction started with the general prompt to recall the event and especially the cars involved, as described in the section above and as a function of the stereotype threat condition. In the MCI condition only, the interviewer presented several social dynamics and communication principles: transfer of control of the interview to the interviewee, encouraging the witness to play an active role by volunteering information, no guessing, and the right to say “I do not know” and to ask questions.
- *The free recall phase.* In both conditions, the free recall phase consisted of two recall attempts. However, the instructions used to initiate them differed depending on the condition.
- *MCI condition:* The report everything and the context reinstatement instructions were presented together to initiate the first recall attempt. Through the report everything instruction, the participant was asked to report everything she remembered irrespective of the relevance or the completeness of the information. The interviewer then invited the participant to mentally reconstruct the physical and personal context surrounding the event to be recalled (context reinstatement instruction): “Close your eyes and picture yourself back in the room where you watched the video. Think about the things you can see in the room. What could you hear in the room? What could you smell? Where were you in the room? Were you alone or was there somebody with you in the room? Now, try to think about your mood at that time. How were you feeling?” The second recall attempt was conducted using the sequenced recall instruction (see Colomb and Ginot 2012 for an exact formulation of this instruction): the participants were asked to cut the event up into several sequences, communicate them to the interviewer (either by writing them down or by saying them out loud), and then to concentrate and focus in order to retrieve the details of each sequence taken independently.
- *Control interview condition:* Some minimal instructions were used in the control interview in order to control for a potential motivational effect that could be observed under MCI conditions (see Colomb and Ginot 2012 for an exact formulation of these instructions). To initiate the first free recall, the interviewer explained that she would allow the participant to freely recall the video without being interrupted as this was an effective way of remembering better. To initiate the second free recall, the interviewer explained to the participant that repeating an account several times can improve memories.

- *The questioning phase.* In both conditions, the interviews ended with 14 standardized questions. Eight questions referred to the cars involved in the scene, and two of them required a full description of the vehicle driven by the perpetrator (i.e., one describing the exterior and one describing the interior). The remaining six questions were related to the locations, objects, and actions of the main character.
- *The debriefing questionnaire.* A questionnaire was administered to all the participants at the end of the experiment. Some questions aimed at checking that none of the participants had understood the aim of the study (e.g., “In your opinion, what was the aim of this study? etc.). We considered that the participants had discovered the aim of the study if they mentioned both the stereotype about women’s poor knowledge about cars and linked this to their ability to describe cars in the interview. The analysis of the answers to these questions showed that 11 participants had discovered the aim of the study (SI/control condition = 3, SI/stereotype threat condition = 5, MCI/control condition = 0, MCI/stereotype threat condition = 3). These participants were therefore excluded from the final sample.

Certain other questions were designed to check various elements linked to stereotype threat. They all used 7-point Likert scales ranging from “not (agree) at all” to “totally (agree).” They measured (a) the extent to which the participants felt they were being evaluated during the memory task, (b) the extent to which the participants felt that their knowledge of cars was being evaluated during the memory task, (c) their knowledge of the stereotype at issue (“do you think that people generally agree that women have a good knowledge of cars?”), (d) their agreement with the stereotype (i.e., the extent to which I personally think that the stereotype is true, “do you think that women have a good knowledge of cars?”), and (e) self-evaluation (i.e., the extent to which I think that the stereotype is true for myself; “do you think you’ve got a good knowledge of cars?”). The results are presented below.

At the end of this study, the participants were debriefed, thanked for their contribution, and received their course credits.

Coding and Scoring the Interviews

We audio-recorded, transcribed verbatim, and coded all the interviews. One point was attributed for each piece of information mentioned. A distinction was made between correct information (i.e., information corresponding exactly to what existed in the film, e.g., the car was gray), errors (i.e., distortion of an existing element in the film, e.g., the car was white instead of gray), and confabulations (i.e., non-existent elements, inventions, e.g., a teddy bear was hanging from the rearview mirror,

even though there was actually nothing). The accuracy rate was also calculated (i.e., correct information recalled as a proportion of the total amount of information reported). We also differentiated between the information describing cars and the rest of the details. More precisely, in analyzing the information describing cars, we identified the descriptive elements which were negatively linked to the female stereotype, that is technical items (e.g., make of vehicle, model, etc.; see Granié and Papafava 2011 for the importance of technical skills in stereotypes of women drivers). Repetitions within and across the different phases of the interview were not coded and neither were judgments or statements of opinion (Geiselman et al. 1986). Eight randomly selected interviews (11%) were coded by two independent coders. The aim was to assess the reliability of the coding, which was confirmed using Pearson correlations (correct: $r(8) = .95$, $p < .001$; errors: $r(8) = .89$, $p < .005$; confabulations: $r(8) = .98$, $p < .001$).

Results

Analyses of variance (ANOVA) were conducted to examine the effect of condition (control vs. stereotype threat) and interview (control interview vs. MCI). The total number of correct details, errors, and confabulations elicited per interviewee and the accuracy rate were the dependent variables. Furthermore, the number of descriptive items recalled that were linked to cars were also measured: number of correct details elicited concerning the descriptive items linked to cars, errors, confabulations, and accuracy rate. Since the numbers of errors and confabulations linked to cars were too low to run separate analyses, a single index was computed. This was the number of incorrect details recalled. An alpha level of 0.05 was used for all the analyses. Several preliminary verifications were performed and these are presented below.

Preliminary Checking

The Experimenters

Five female experimenters conducted the interviews. In order to ensure that the interview outcomes were not related to the behavior of the experimenters, several ANOVAs including the between-factor “experimenter” were conducted on the four main dependent variables. They were all non-significant ($p > .05$), suggesting that no experimenter bias existed in this study.

Knowledge of the Stereotype

We examined whether the participants were aware of the stereotype concerning women’s knowledge of cars. This was

important as stereotype threat effects would only emerge if the target group is aware of this stereotype. This was confirmed by a *t* test which showed that knowledge of the stereotype ($M = 5.24$ on a 7-point scale) was significantly higher than the theoretical mean (i.e., 4) of the Likert scale from 1 (not at all) to 7 (completely) used to measure this knowledge, $t(67) = 5.81$, $p = .001$. We can thus conclude that our participants knew the stereotype that is attributed to them.

Agreement with the Stereotype

We also examined whether the participants agreed with this stereotype. However, the *t* test was not significant, $t(67) < 1$, *n.s.* The scores of the participants on this dimension ($M = 4.06$ on a 7-point scale) were not statistically different from the theoretical mean (i.e., 4).

Self-Evaluation

Another question we examined concerned the level of perceived validity of the stereotype for oneself, in other words, the perceived level of self-knowledge of cars. The *t* test was significant $t(67) = 7.29$, $p = .001$, and revealed that the self-evaluation concerning the stereotype ($M = 5.41$ on a 7-point scale) was significantly higher than the theoretical mean (i.e., 4).

Perception of Evaluation

Finally, we examined whether the participants felt they were evaluated differently depending on the level of stereotype threat induced in the memory task. Two questions were asked in order to assess this dimension: (a) the extent to which the participants felt they were being evaluated during the memory task, and (b) the extent to which the participants felt that their knowledge of cars was being evaluated during the memory task. Although the means ($M = 5.03$ for evaluation, and $M = 5.06$ for evaluation of knowledge on a 7-point scale) were above the median point of the scale (i.e., 4), they were not significantly above it, $F_s \leq 2.54$, $p \leq .11$.

Main Analyses

Means and standard deviations are shown in Table 1.

We conducted a series of ANOVAs, with “condition” (control vs. stereotype threat) and “interview” (control vs. MCI) as between-subjects factors, on the number of correct details recalled, on the number of errors and confabulations produced, and on the total accuracy rate and the accuracy rate regarding car knowledge in particular.

First, a significant effect of the manipulation of the stereotype threat was observed on the number of errors produced, $F(1,65) = 9.50$, $p = .003$, $\eta_p^2 = .13$, on the number of confabulations, $F(1,65) = 6.60$, $p = .013$, $\eta_p^2 = .09$, and on the accuracy

rate, $F(1,65) = 6.98$, $p = .01$, $\eta_p^2 = .10$. The participants in the stereotype threat condition produced more errors ($M = 9.45$, $SD = 3.96$) than those in the control condition ($M = 7.06$, $SD = 1.57$), and also produced more confabulations ($M_{\text{threat}} = 2.34$, $SD = 1.82$; $M_{\text{control}} = 1.39$, $SD = 1.14$). They were also less accurate ($M_{\text{threat}} = 85.87\%$, $SD = .06$; $M_{\text{control}} = 88.90\%$, $SD = 0.03$). This harmful effect of stereotype threat manipulation was also observed on the number of incorrect details (errors + confabulations) produced on car description items, $F(1,65) = 5.66$, $p = .02$, $\eta_p^2 = .080$. Participants in the stereotype threat condition produced more incorrect details about the cars ($M = 3.08$, $SD = 2.23$) than those in the control condition ($M = 2.00$, $SD = 1.32$). However, the stereotype threat manipulation did not have any significant effect on the total number of correct details recalled during the interview, $F(1,65) = .16$, $p = .69$, $\eta_p^2 = .002$, on the number of correct car description items recalled, $F(1,65) = .88$, $p = .35$, $\eta_p^2 = .013$, or on the accuracy rate for cars $F(1,65) = 1.34$, $p = .25$, $\eta_p^2 = .020$.

Second, a significant benefit of the MCI over the control interview was also observed on the total number of correct details recalled, $F(1,65) = 7.98$, $p = .006$, $\eta_p^2 = .11$. The participants interviewed with an MCI reported significantly more correct information ($M = 76.16$, $SD = 15.41$) than the participants in the control interview condition ($M = 65.34$, $SD = 14.86$). This benefit was not accompanied by a significant concomitant increase in errors, $F(1,65) = .11$, $p = .74$, $\eta_p^2 = .002$, or confabulations, $F(1,65) = .22$, $p = .64$, $\eta_p^2 = .003$. The accuracy rates obtained in the two interview conditions were not statistically different, $F(1,65) = 1.57$, $p = .21$, $\eta_p^2 = .024$. Furthermore, no significant effect of interview type was observed on measures concerning the cars (correct: $F(1,65) = .38$, $p = .53$, $\eta_p^2 = .006$; incorrect: $F(1,65) = .41$, $p = .52$, $\eta_p^2 = .006$; accuracy rate: $F(1,65) = 1.08$, $p = .30$, $\eta_p^2 = .016$).

Finally, no significant interaction effects between the two factors of interest were observed (all $p > .05$), that is there were no interactions involving the overall memory of the event or the memory of the descriptive details about the cars.

Discussion

The first aim of this study was to examine if a stereotype about women’s poor knowledge of cars could impair their recall performance in a car description task due to the stereotype threat phenomenon. The results suggested that the instruction used to introduce the free recall task had an impact on the women’s ability to provide a complete and accurate report of the to-be-remembered event.

We observed that compared to a neutral instruction, an instruction emphasizing the evaluative nature of the task and highlighting the stereotype about women and their knowledge of cars led these participants to provide less accurate reports

Table 1 Means and standard deviations (in parentheses) related to the overall memory of the event depending on the condition (control vs. stereotype threat) and the interview (control vs. MCI)

| | Control | | Stereotype threat | |
|---------------------------|-------------------|------------------------------|-------------------|------------------------------|
| | Control interview | Modified cognitive interview | Control interview | Modified cognitive interview |
| Total | | | | |
| Correct | 66.71 (13.45) | 73.24 (16.70) | 64.28 (16.17) | 78.65 (14.17) |
| Errors | 7.07 (1.86) | 7.06 (1.34) | 9.17 (4.41) | 9.70 (3.60) |
| Confabulations | 1.14 (1.10) | 1.59 (1.18) | 2.39 (1.79) | 2.30 (1.89) |
| Accuracy rate | .89 (.04) | .89 (.02) | .85 (.07) | .87 (.04) |
| Car description items | | | | |
| Correct | 8.29 (3.79) | 7.76 (4.05) | 8.11 (5.43) | 10.00 (4.45) |
| Errors and confabulations | 2.00 (1.30) | 2.00 (1.37) | 3.39 (2.52) | 2.80 (1.96) |
| Accuracy rate | .78 (.17) | .78 (.16) | .70 (.20) | .78 (.13) |

and to make more errors and confabulations. The information specifically recalled about cars showed that women in the threatening condition produced more incorrect details than did those in the control condition. However, irrespective of the category of the information recalled, we observed that women in the threatening condition produced as much correct information as the women in the non-threatening condition.

These results are consistent with our predictions and the stereotype threat literature. Most research on this phenomenon has demonstrated a decrease in performance among women threatened in a task linked to the target stereotype. Moreover, the fact that there was no significant difference in the present study between the control and the stereotype threat conditions in terms of the number of correct details recalled echoes the results of previous studies. For instance, Leyens et al. (2000) obtained this pattern of responses with men in an affective decision task (affective words vs. non affective). They found that men threatened by their supposed poor skills in the emotional field recognized as many affective words as women, but that they were also more prepared to accept non-affective words as affective. According to signal detection theory (e.g., Green and Swets 1996; Tanner and Swets 1954), these observations could be explained by a reduction in the men's decision criterion. In order to maximize the chance of proving that men can be gifted in the affective field and to refute the stereotype associated with their group, the participants went too far and accepted even non-affective items. In other words, they tried too hard to show their knowledge and, as a result, they produced many false positives (judging a neutral word to be an affective word).

The results that we observed in our study of women threatened by a stereotype could reflect a similar reduction in their decision criterion. In other words, the women who wanted to prove that the stereotype about them is unfounded provided information about the to-be-remembered event and the cars involved that was as correct as the information provided by the women who were not threatened. However, like the men in the

study of Leyens et al. (2000), they also produced more errors and confabulations which could be assimilated to the false positives in the affective decision task used in the latter study.

This explanation is all the more plausible given that researchers such as Kray et al. (2001) have noted that when the stereotype threat is blatant, as was the case in our study, it should create an effect of stereotype reactance or a tendency to act inconsistently with the stereotype in question. In this case, individuals tend to choose more promotion strategies in order to maximize their success and their earnings rather than to try to avoid failure. Faced with our blatant induction, the women may have experienced such a reactance effect, and the results that we obtained would therefore be a reflection of their choice of promotion strategy.

In view of the participants' answers concerning their knowledge of the stereotype, their agreement with the stereotype, and their perception of this evaluation, we can state that the participants in our study satisfied all the conditions necessary for the emergence of the stereotype threat phenomenon. Indeed, previous works on the stereotype threat have shown that stigma consciousness toward one's social group is a necessary condition for the stereotype threat phenomenon to emerge (Pinel 1999; Brown and Pinel 2003). However, on the whole, the participants in our sample experienced a high level of stigma consciousness regarding the gender stereotype that holds that women know less about cars than men. Moreover, research has also shown that even if agreement with the stereotype is not essential for generating a stereotype threat effect (Félonneau and Becker 2011), individuals are more likely to accept the stigma the more they are impacted by the stereotype threat phenomenon (e.g., Schmader et al. 2004). In our study, even though the participants did not obtain high agreement scores, they nevertheless obtained high stereotype self-evaluation scores. This means that even though most of our participants disagreed with the stereotype at the group level, most of them applied the stereotype about women's poor knowledge of cars

at the personal level. Furthermore, Steele and Aronson (1995) observed that stereotype threat occurs when individuals feel that the encountered situation is diagnostic of their capacities in the domain concerned by the stereotype. In other words, for stereotype threat to occur, individuals have to feel that they are being evaluated. The majority of our participants had high scores on the scales measuring this perception of being assessed. These results clearly indicate that our participants felt judged both on their ability to produce a testimony and on their ability to report car-related details. It is worth mentioning that in our study, there was no difference in the perception of evaluation between the women in the threatening condition and those in the control condition. Although some studies of stereotype threat have partially explained the diminished performance of threatened persons in terms of an exacerbation of the evaluative pressure (e.g., Croizet et al. 2001; Désert et al. 2002), we are not surprised that the mean values we obtained did not differ between experimental groups. Indeed, in our experimental protocol, the women in the control condition also received an instruction requiring them to describe the cars. This instruction was not formulated in terms of the diagnostic aspects of their knowledge but rather in terms of the attention allocated to car-related details for the purposes of testimony. However, from our point of view, even if both groups of participants felt a similar evaluative pressure, this pressure would not have involved the same strategy in the two cases and these choices of strategy would explain the differences in performance observed in the car descriptions. Indeed, according to the above-mentioned signal detection theory (Green and Swets 1996; Tanner and Swets 1954), we might imagine that the neutral instruction in the control condition caused evaluative pressure directed at preventing failure among the participants in this condition, whereas the diagnostic instruction in the threatening condition resulted in evaluative pressure on the participants to achieve success in this condition.

Finally, the results showed that when the social context is highlighted in a blatant way, it can have a major impact on the quality of testimony. Indeed, the increase in errors and confabulations produced by women subject to a blatant stereotype threat might in turn increase the risk of false leads and judicial errors.

However, in the legal field, it is unlikely that interviewers would directly convey this negative stereotype about women and their poor ability to describe cars as was done in the present study. Thus, in future research, it would be interesting to explore whether the same pattern of results is observed if more subtle stereotype threat cues are used. For instance, the witness's gender is always cited during a judicial interview. Studies on the phenomenon of stereotype threat have shown that priming a social category such as gender is sufficient to activate a negative stereotype related to this category, and that this can impair performances in the corresponding field in members of the group concerned by the stereotype (Steele and Aronson 1995). Moreover, Nguyen and Ryan (2008)

observed that women are more sensitive to subtle stereotype threat than to blatant threat. Similarly, all the interviewers in the present study were female. In the field, most interviewers are men. The fact that the witnesses in this study were interviewed by women might have reduced the stereotype threat effects. To overcome this limitation and create a more ecological situation, it would be interesting to include interviewers of both genders in future research.

A second aim of this study was to examine whether the MCI can enhance the recall of the details of a visual event. The results confirmed the effectiveness of a modified version of the CI in improving the volume of information provided by eyewitnesses without impairing accuracy. Moreover, this study allowed us to evaluate the benefit of the MCI protocol on the recall of details about vehicles. To our knowledge, this measure has not been used in previous studies on the CI. More precisely, researchers in the field usually distinguish between recall of the persons involved in the to-be-remembered event, on the one hand, and the objects, actions, and sometimes locations, on the other hand. Details recalled about vehicles usually fall within the object category. It is therefore impossible to evaluate the benefit of the CI on this precise category of details as little research has been undertaken on this topic. However, as previously mentioned, the recall of details about cars can be of vital importance in investigations in the field.

Nonetheless, in our study, no benefit of the MCI was observed on the recall of this category of details. Furthermore, the accuracy rate associated with details recalled about cars (between 69 and 78% according to the condition) was much lower than the accuracy rate for all other details (between 84 and 89%). This result confirms the difficulty that witnesses have in describing cars, as has previously been reported in the literature (Villegas et al. 2005).

Because little work has been done on this question, it is difficult to explain the lack of benefit of the MCI observed in the present study. Nevertheless, according to Rossion and Curran (2010), people's level of car expertise could have a positive impact on their ability to recall this category of details. Thus witnesses' semantic knowledge about cars (e.g., knowledge of models, technical characteristics, etc.) is undoubtedly involved in this task, and probably more so than the semantic knowledge required to describe a person or an action. However, given that it is underpinned at the theoretical level by the action of context effects in memory (Tulving and Thomson 1973), the CI should, above all, promote the recall of episodic details. Thus, if the level of witnesses' prior knowledge of cars determines their ability to describe a vehicle successfully, it is not surprising that the effectiveness of the CI is limited since it is semantic memory that is primarily involved in this case. Given the difficulty encountered by our witnesses in recalling information about cars, our study highlights the need to conduct more work on the effectiveness of the CI in order to improve eyewitnesses' memory for this specific category of

details. This lack of benefit on the recall of car information could limit the effectiveness of the tool in this area.

The final aim of this study was to examine the potential benefit of the MCI in reducing the stereotype threat that may be aroused when women have to describe cars. We hypothesized that the MCI could decrease the effects of stereotype threat, in particular by reducing the fear of evaluation and the level of anxiety, and by improving witnesses' self-confidence and the effectiveness of the recall strategies used.

However, in this study, no interaction effect was observed on the measures considered. Several explanations can be put forward for this lack of interaction. First, the sample size used in this study was undoubtedly too small (effect sizes were all moderate). Second, it is possible that the instruction intended to induce stereotype threat given at the beginning of the interview decreased the ability of the subsequent MCI instructions to reduce the stereotype threat effect. Indeed, the stereotype threat instruction was totally inconsistent with what the participants were told in the MCI protocol (e.g., on the one hand, the investigator reassured the participant by saying that she had the right to say "I don't know, I don't understand," etc., and, on the other hand, the interviewer said that the aim of the interview was to evaluate the witness's ability to describe cars). To what extent did the stereotype threat manipulation discredit the CI instructions in the eyes of the participants, thus leading them to distrust these instructions?

Another explanation could be linked to the fact that the control interview protocol used in the present study was already of good quality. It contained some elements which might possibly have counteracted the harmful effect of stereotype threat manipulation. For example, it was expected that the MCI would decrease the effect of stereotype threat by increasing the witnesses' level of concentration. However, in the control interview protocol, as in the MCI condition, open-ended narration was used because it is known to improve witnesses' concentration levels (Fisher and Geiselman 1992). It is therefore possible that the participants' concentration levels were high in both conditions. Furthermore, it was expected that by eliminating interruptions and unpleasant comments, the MCI would decrease the effects of stereotype threat and that this, in turn, could improve the self-confidence and motivation of the witnesses. However, the control interview protocol used in the present study did not contain these harmful components. If this explanation is correct, the beneficial effects of the MCI on stereotype threat might be observed more clearly in the field when this type of interview is compared to the interviewing protocols used by law enforcement professionals (containing less positive and more negative components, cf. Fisher et al. 1987a; Ginet and Py 2001).

One final explanation could be based on the fact that the interviews were conducted by fourth-year psychology students who had just been trained. It was expected that the MCI protocol would reduce the effect of stereotype threat by

decreasing the witnesses' anxiety, particularly if the investigators were calm and relaxed in their behavior. However, inexperienced interviewers may find it hard to adopt such an attitude. Furthermore, the MCI interviewers had to administer a more complex protocol than in the control interview condition and this might have led them to feel globally less comfortable.

It would therefore be useful in the future to take precautions or to integrate new instructions in the MCI protocol that are specifically directed at reducing the effects of stereotype threat. Investigators could follow these guidelines in risk situations, in other words in situations where the witness interviewed is a member of a group associated with a negative stereotype (i.e., older adults, women, persons of low socioeconomic status, etc.) that could prejudice her/his ability to complete a recall task (i.e., recall, recall of cars, verbal skills, etc.). For instance, if the witness is a woman and the to-be-remembered event involves a car, it would be better for her to be interviewed by a female investigator in order to reduce stereotype threat (Marx and Roman 2002). Some instructions designed to reduce the threatening aspects of the recall task could also be added. For instance, the interviewer can say that describing a car is a difficult task for everyone. In this way, the witness may feel less individual pressure to succeed in this situation.

Our results offer two potential perspectives for future research. First, we observed a decrease in the response criterion in a threatening condition (no significant decrease in correct information recalled accompanied by an increase in the number of errors and confabulations produced and a lower accuracy rate). Consequently, we propose that a negative stereotype holding that women have poor knowledge of cars may negatively influence their performance in a recall task concerning vehicles. This highlights the potentially important influence of the social context on eyewitness memory as well as the need to focus more on social variables, which, in our opinions, have not been the object of sufficient research in this area.

Second, regarding the MCI, even though no interaction effect involving stereotype threat was observed, an increase in the number of correct details recalled without loss of accuracy was confirmed. However, this benefit did not extend to the recall of vehicles and this could constitute a limitation to this technique. However, other studies with greater ecological validity must be conducted to confirm this result (e.g., a real to-be-remembered event rather than a film made specifically for the study, more participants, female and male participants, female and male interviewers, police officers as interviewers, more subtle stereotype induction, etc.).

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Appendix

Neutral instruction

Of course you are going to talk about the details of the whole film, but please pay particular attention to the description of the cars involved.

Instruction reinforcing the threat related to the stereotype

Of course you are going to talk about the details of the whole film as well as about the cars involved. In fact, the aim of this study is actually to evaluate your knowledge about cars and your ability to describe them. Therefore, please pay particular attention to this description. And remember that your knowledge about cars will determine how well you do.

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