This is the author's original manuscript of an article published by John Wiley & Sons, Ltd. in *Applied Cognitive Psychology* on 7 January 2015, available online:

http://dx.doi.org/10.1002/acp.3092

Eye Remember What Happened:

Eye-Closure Improves Recall of Events but not Face Recognition

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This research was supported by an AW Mellon postdoctoral fellowship awarded to Annelies Vredeveldt. We would like to thank Cheneal Puljević for her assistance with data collection.

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Abstract

Eye-closure improves event recall. We investigated whether eye-closure can also facilitate subsequent performance on lineup identification (Experiment 1) and face recognition tasks (Experiment 2). In Experiment 1, participants viewed a theft, recalled the event with eyes open or closed, mentally rehearsed the perpetrator's face with eyes open or closed, and viewed a target-present or target-absent lineup. Eye-closure improved event recall, but did not significantly affect lineup identification accuracy. Experiment 2 employed a face recognition paradigm with high statistical power to permit detection of potentially small effects. Participants viewed 20 faces and were later asked to recognise the faces. Thirty seconds before the recognition task, participants either completed an unrelated distracter task (control condition), or were instructed to think about the face with their eyes open (rehearsal condition) or closed (eye-closure condition). We found no differences between conditions in discrimination accuracy or response criterion. Potential explanations and practical implications are discussed.

Keywords: eye-closure, face recognition, lineup identification, eyewitness memory

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Incorrect eyewitness testimony has played an important role in the majority of known wrongful convictions (Gross & Shaffer, 2012). Although some of these eyewitness errors involved deliberate deception, the majority of errors were due to eyewitnesses who were genuinely mistaken. Many procedures have been developed to help eyewitnesses—some aimed at improving memory retrieval processes during investigative interviews (e.g., the Cognitive Interview; Fisher & Geiselman, 1992; for meta-analyses see Köhnken, Milne, Memon, & Bull, 1999; Memon, Meissner, & Fraser, 2010), and some aimed at improving lineup identification accuracy (e.g., double-blind administration of lineups; Greathouse & Kovera, 2009; see also Clark, 2012). Several authors recently showed that a very simple procedure—instructing witnesses to close their eyes during the interview—improves retrieval of accurate information about witnessed events (e.g., Perfect et al., 2008; Vredeveldt, Baddeley, & Hitch, 2013; Wagstaff et al., 2004). An important question that has not yet been answered, however, is whether eye-closure can also improve facial identification accuracy. Researchers and policy makers are constantly looking for ways to facilitate facial identification—hence, the present research investigates whether eye-closure during mental rehearsal of a perpetrator's face can improve subsequent lineup identification accuracy (Experiment 1) and face recognition performance (Experiment 2).

Eye-closure seems to be associated with at least two cognitive benefits: concentration and visualization. When people have their eyes closed, they are better able to concentrate on difficult cognitive tasks. This phenomenon was first demonstrated by Glenberg, Schroeder, and Robertson (1998), who found that people are more likely to spontaneously close their eyes or avert their gaze when completing more difficult tasks. Moreover, they found that participants instructed to close their eyes performed better on mathematical and general-knowledge questions. Similarly, children perform better on a wide range of cognitive tasks when they are instructed to close their eyes or look away (e.g., Doherty-Sneddon, Bonner, & Bruce, 2001; Phelps, Doherty-Sneddon, & Warnock, 2006). Further support for the idea that eye-closure improves general concentration comes from work showing that eye-closure helps participants to overcome the cross-modal memory impairment caused by auditory distraction (Perfect, Andrade, & Eagan, 2011). These combined findings may be explained in terms of Glenberg's (1997) embodied cognition account, which construes environmental monitoring and memory retrieval as two concurrent tasks competing for cognitive resources. When a person disengages from the environment (e.g., through eye-closure), more cognitive resources are available for the memory retrieval task, thus enhancing performance.

The working memory model (Baddeley & Hitch, 1974) predicts that concurrent tasks in the same modality interfere more with each other than tasks in different modalities. Much evidence has accumulated in support of this modality-specific interference hypothesis (for an overview see Baddeley, 2007). Of particular relevance to the current research is that visual tasks have been found to disrupt the vividness of visual imagery, but not auditory imagery (Baddeley & Andrade, 2000). This suggests that cutting out visual distractions through eye-closure should be particularly helpful for retrieving visual information from memory, which is what several studies have found (e.g., Perfect et al., 2008, Experiment 2; Vredeveldt, Baddeley, & Hitch, 2012; 2013; but see Perfect et al., 2008, Experiment 4 and 5). The idea that eye-closure facilitates visualization is further supported by findings that closing the eyes increases mental simulation of hypothetical events (Caruso & Gino, 2011) and improves performance on tasks requiring visual imagery (Rode, Revol, Rossetti, Boisson, & Bartolomeo, 2007). Indeed, individuals who keep their eyes closed during memory retrieval exhibit activity in brain regions associated with visual imagery (Wais & Gazzaley, 2014;

Wais, Rubens, Boccanfuso, & Gazzaley, 2010). In sum, eye-closure improves recall performance through a combination of enhanced concentration and visualization (see also Vredeveldt, Hitch, & Baddeley, 2011; Vredeveldt & Perfect, 2014).

However, it is not clear whether eye closure will also improve facial identification. Of course, eye-closure cannot be administered *during* a face recognition task—witnesses cannot recognise a face while they have their eyes closed. Eye-closure can be manipulated during mental rehearsal of a face just *prior* to the recognition task, but it is not evident that this will have the same effect. Mental rehearsal of faces has been subject to previous empirical investigations, which have typically found that the instruction to mentally rehearse a face improves subsequent recognition performance (e.g., Busey, Tunnicliff, Loftus, & Loftus, 2000; Graefe & Watkins, 1980; Read, Hammersley, Cross-Calvert, & McFadzen, 1989; Sporer, 1988; but see Sporer, 1996). Importantly, evidence suggests that these benefits are most likely due to the rehearsal of verbal labels, rather than truly visual rehearsal (Chance & Goldstein, 1976; Jones, Armstrong, Casey, Burson, & Memon, 2013; Kerr & Winograd, 1982; Nakabayashi, Burton, Brandimonte, & Lloyd-Jones, 2012; but see Sporer, 1989). In other words, it seems that witnesses assign verbal labels to the face during encoding (e.g., “big nose”), subsequently rehearse these verbal labels, and then apply them to the to-be-recognized face to decide whether it is the target face.

Putting it all together, how might eye-closure during mental rehearsal affect subsequent face recognition? There are (at least) two ways in which witnesses can perform a facial identification task. During the recognition phase, witnesses can compare their mental image of the perpetrator’s face to the to-be-recognized face. Because eye-closure during mental rehearsal likely helps witnesses to conjure up a more vivid mental image of the face (e.g., Baddeley & Andrade, 2000), it should facilitate the comparison between the mental image and the image presented during the recognition phase. However, comparing a mental image to a presented image is a cognitively demanding task, and the modality-specific interference hypothesis suggests that the mental visual image may be disrupted as soon as the witness is confronted with the to-be-recognized face. Therefore, a plausible alternative strategy would be to rely on some form of verbal processing during the recognition phase (see e.g., Jones et al., 2013). If the witness takes this approach, it is important that the verbal labels are accurate and discriminative (e.g., the label “two eyes” may not be very helpful to discriminate between different faces). Through enhanced concentration and visualization during rehearsal, eye-closure may help the witness to assign more helpful verbal labels to the face, and to rehearse them more effectively. Therefore, regardless of whether the witness relies on visual or verbal processes during face recognition, we predicted that eye-closure during mental rehearsal would improve facial identification performance.

In sum, eye-closure improves recall of events, but it is unclear whether eye-closure improves facial identification. Given that person identification plays a central role in criminal investigations, it is important to test this question empirically. In the present research, we investigated whether eye-closure during mental rehearsal would improve subsequent facial identification. Experiment 1 employed a lineup-identification paradigm to investigate whether eye-closure during rehearsal of a face immediately before viewing a lineup would improve performance on target-present and target-absent lineups. We predicted that eye-closure would facilitate mental rehearsal of the face, and that this would help witnesses to decide which face (if any) in the subsequent lineup was the target face. We also included free and cued recall measures to enable comparisons with previous studies showing that eye-closure improves event recall. Experiment 2 was a laboratory-based study with high power, using methods typical of the face recognition literature. We predicted (a) that participants who received the opportunity to mentally rehearse the face prior to recognition would perform better than participants who did not receive this opportunity, and (b) that eye-closure during mental rehearsal would increase its effectiveness.

Experiment 1

Method

Power calculation. In recall contexts, various effect sizes for the eye-closure effect have been reported, usually within the range of medium to large (*d*s between 0.50 and 1.00; e.g., Perfect et al., 2008; Vredeveldt et al., 2012, 2013; Vredeveldt & Penrod, 2013; Wagstaff et al., 2004). However, these effect sizes are not directly relevant to the present study, since recall performance is typically measured on a continuous scale (e.g., number of correct details reported), whereas lineup identification performance is measured on a dichotomous (correct vs. incorrect decision) or categorical scale (correct identification, false identification, foil identification, correct rejection, or incorrect rejection). Therefore, we decided on a sample size that would allow us to detect a small- to medium-sized effect (d = 0.40 with power = .80) but would still be feasible to collect (viz., 96 participants per interview condition).

Participants. We recruited 192 undergraduate students (53 male) with a mean age of 20.08 (SD = 2.23) via the Student Research Participation Programme at the University of Cape Town. Under the Apartheid government (1948 – 1994), South Africans were classified, and segregated, into several population groups by law. In the region where we conducted our study, there were four main groups: Black (people of African descent), White (people of European descent), Coloured (people of mixed ethnicity, or Indonesian, or San descent), and Indian (people descended from the Indian subcontinent of Asia). This classification is no longer enforced by law, but is still used in the national census (Statistics South Africa, 2012), and implicitly affects life in South Africa in many ways (for an overview, see Worden, 2011).

Further, much previous research has shown that individuals have more difficulty recognising faces of other ethnicities compared to faces of their own ethnicity, a phenomenon that has become known as the *own-race bias* (Malpass & Kravitz, 1969; see Meissner & Brigham, 2001b, for a meta-analysis), although it may more accurately be described as an *own-group bias* (Bernstein, Young, & Hugenberg, 2007; Chiroro, Tredoux, Radaelli, & Meissner, 2008; Sporer, 2001). Therefore, we included participant ethnicity as a sampling variable, to ensure equal numbers of own-ethnicity and other-ethnicity identifications in each experimental condition. Thus, our sample included 96 participants of the same ethnicity as the perpetrator in this study (White) and 96 participants of another ethnicity (of which 47 Black, 29 Coloured, 14 Indian, and 6 of another ethnicity).

Design. Interview condition (eyes open or closed) was manipulated between-subjects. To control for potential extraneous influences, we used a counterbalanced design with the following sampling variables: participant ethnicity (half were of the same ethnicity as the perpetrator and half were of a different ethnicity), perpetrator identity (three different actors were used to portray the perpetrator), type of lineup (half were target-present and half were target-absent), and lineup position (the target or target replacement appeared either in position 3 or 7 in the lineup).

The data were collected in two phases. During the first data collection phase (N = 96), all participants recalled the event prior to the identification task. Additionally, half of them (N = 48) were questioned about the perpetrator's appearance, whereas the other half was not, to assess potential verbal overshadowing effects (Meissner & Brigham, 2001a; Schooler & Engstler-Schooler, 1990). However, we found no evidence for a verbal overshadowing effect (adding to the accumulating set of mixed findings and declining effect sizes with regard to verbal overshadowing; Francis, 2012; Schooler, 2011), and the perpetrator-description manipulation did not interact with the eye-closure manipulation; therefore, it is not discussed further. The second data collection phase (N = 96) was conducted one year later to boost statistical power for the lineup identification analysis. Because our sole aim was to provide a more powerful analysis of our primary research question (i.e., the effect of eye-closure on lineup performance), free and cued recall data were not collected during this phase. The distribution of lineup data in the two phases was virtually identical, hence the data were combined in the lineup analyses reported below.

Materials. Participants watched a 90-second video depicting a theft in a bookshop. In the video, a White male looks around in the shop, picks up a book, asks the cashier several questions about the book, and then runs out of the bookshop without paying. There were three versions of the video, each depicting a different White male perpetrator. The videos only differed in terms of the actor who stole the book, the appearance of the book that was stolen, and the passers-by in the background of the video. Each actor followed a detailed script, hence their actions and utterances were generally consistent across the three videos.

Lineups were constructed using a modal description procedure. For each perpetrator, six participants unfamiliar with the video inspected a photograph of the face, completed a brief filler task, and provided a description of the face. Descriptors that appeared in at least three descriptions were included in the modal description for each perpetrator. Next, six other participants selected 12 faces from a database of 370 White males that matched each modal description. Eight photographs, selected by at least three participants, were included as foils in the lineups. In target-absent lineups, the photograph selected most often by the participants replaced the photograph of the perpetrator. The target (replacement) appeared in position 3 or 7. To measure lineup fairness, 81 mock witnesses attempted to pick the perpetrator from each lineup based on the modal description associated with that perpetrator. All three lineups included at least five plausible choices, with effective size ranging from 5.37 to 6.33 (calculated using Tredoux's E, 1998; see also Malpass, 1981). There was no bias against

Perpetrators A and B, but there was some bias against Perpetrator C (p = .03, chosen by 14 out of 81 mock witnesses). However, because there was an even greater bias towards another member in the lineup (p < .001, chosen by 22 out of 81 mock witnesses), and because the lineup still included 5.78 fully appropriate members, it was deemed acceptable.

Procedure. Participants were tested individually. They were informed that they would be asked to provide ethical judgments about several hypothetical scenarios. After providing informed consent, participants watched the book theft video and completed a five-minute filler task, which comprised of providing ethicality ratings for five stories about unrelated ethical dilemmas (e.g., minor fraud). Subsequently, they were interviewed about the video, either with their eyes open or with their eyes closed (adherence to the eye-closure instruction was monitored by the interviewer). They were instructed to answer each question in as much detail as possible, but not to guess; a “don’t know” response was permissible. The interview started with a free-recall phase including one general prompt (“tell me everything you can remember about the events in the video”) followed by four open questions (probing descriptions of the shop, the customers, the verbal interaction, and the concluding scene). In the free-recall phase, participants provided a confidence rating for each answer as a whole (i.e., five ratings in total; one free-recall and four open questions), on a scale from 0% (not at all confident) to 100% (extremely confident). Finally, all participants answered eight specific questions about visual details in the video (e.g., “what did the book look like?”) and eight about auditory-verbal details (e.g., “what reason did he give to get a discount?”), in chronological order. In the cued-recall phase, participants provided confidence ratings for responses, except where they indicated “don’t know” (i.e., maximum 16 ratings in total).

After the interview, all participants were informed that they would see a lineup and were given 30 seconds to “think about the face of the book thief in the video”. The experimenter confirmed that participants in the eyes-closed condition kept their eyes closed throughout the 30-second period, and that participants in the eyes-open condition looked at a fixation cross. All participants were informed that the thief may or may not be present in the lineup. Participants viewed a target-absent or target-present lineup, indicated their decision by pressing the appropriate key on the keyboard, and rated their confidence on a scale of 0 to 100%.

Data Coding. All recorded interviews were transcribed verbatim. Two independent coders constructed a list of details about the event, and coded each detail as correct, incorrect, subjective (e.g., “he was ugly”), or repeated. Event details were also coded for modality (visual or auditory) and type of detail (person, action, object, or surrounding; cf. e.g., Milne & Bull, 2002). The two coding schemes were combined to create one final coding scheme (disagreements were resolved by discussion). One coder, blind to condition, coded all transcripts, and any statements made by participants that were not in the original coding scheme were added progressively. The second coder, blind to condition, double-coded 25% of the interviews. Interrater reliability for details provided in the free-recall phase (i.e., general prompt and open questions) was deemed acceptable for accuracy (correct, incorrect, subjective, or repeated), $\kappa = .78$, $p < .001$, modality (visual or auditory), $\kappa = .92$, $p < .001$, and type of detail (person, action, object, or surrounding), $\kappa = .85$, $p < .001$.

With respect to cued recall, several studies have found that eye-closure facilitates recall of precise responses, while leaving imprecise responses unaffected (Vredeveldt et al., 2011; Vredeveldt & Penrod, 2013; Vredeveldt & Sauer, 2014). Therefore, responses to the 16 specific questions about visual and auditory details were not only coded in terms of accuracy but also in terms of precision (see also Goldsmith, Koriat, & Weinberg-Eliezer, 2002; Weber & Brewer, 2008; on the related concept of "grain size"). Responses could be coded as precisely correct (e.g., “a red book with white writing”), imprecisely correct (e.g., “a red book”), incorrect (e.g., “a blue book”), or omitted (e.g., “don’t know”). Responses were coded as incorrect if they contained at least one inaccurate element. Due to insufficient data, incorrect responses were not coded for precision. Interrater reliability (for the decision to code an answer as precise-correct, imprecise-correct, incorrect, or omitted) was high, $\kappa = .86$, $p < .001$.

Results

Free recall. Table 1 shows the number of correct, incorrect, and subjective details reported about persons, actions, objects, and surroundings in the event, provided in the free-recall phase. Figure 1 shows the data broken down by modality of details. The data were examined using multivariate analyses of variance (MANOVA), followed by univariate analyses of variance (ANOVA) assessing modality and type of detail. To reduce positive skew, all free-recall variables were square-root transformed prior to analysis.

[INSERT FIGURE 1 AND TABLE 1 ABOUT HERE]

Correct details. A MANOVA using the number of visual and auditory correct details as dependent variables revealed a significant main effect of interview condition, F (2, 93) = 4.30, p = .016, η^2 = .09, d = 0.55. Participants who closed their eyes reported significantly more correct details (M = 39.92, SD = 11.94) than participants who kept their eyes open (M = 33.98, SD = 9.53). Univariate ANOVAs showed that the effect of interview condition was significant for auditory details, F (1, 94) = 7.33, p = .008, η^2 = .07, and marginally significant for visual details, F (1, 94) = 3.83, p = .053, η^2 = .04 (see Figure 2). Another set of univariate analyses showed that interview condition had a significant effect on correct details pertaining to persons, F (1, 94) = 4.53, p = .036, η^2 = .05, and objects, F (1, 94) = 9.29, p = .003, η^2 = .09, a marginally significant effect on details relating to actions, F (1, 94) = 3.78, p = .055, η^2

= .04, and no effect on details pertaining to surroundings (*F* < 1; see Table 1).

Incorrect details. A MANOVA using visual and auditory incorrect details as dependent variables revealed no difference between the eyes-open (*M* = 4.60, *SD* = 3.51) and eyes-closed (*M* = 5.71, *SD* = 4.92) conditions (*F* < 1). Univariate ANOVAs revealed no effects of eye-closure on auditory (*F* < 1) or visual incorrect details, *F* (1, 94) = 1.26, *p* = .264, η^2 = .01, *d* = 0.26. Because transformations did not correct the positive skew and leptokurtosis observed for the incorrect-recall data broken down by type of detail, Mann-Whitney tests were conducted for this analysis. Interview condition had no impact on the number of incorrect details about actions, *U* = 1086.00, *p* = .628, η^2 = .00, objects, *U* = 958.00, *p* = .119, η^2 = .03, or surroundings, *U* = 1039.00, *p* = .361, η^2 = .01, but eye-closure increased the number of incorrect details reported about persons, *U* = 936.00, *p* = .045, η^2 = .04. However, these findings need to be interpreted with caution, as the data revealed floor effects (see Table 1).

Subjective details. A MANOVA using visual and auditory subjective details as dependent variables revealed no difference between the eyes-open (*M* = 6.06, *SD* = 5.03) and eyes-closed (*M* = 7.64, *SD* = 6.18) conditions, *F* (2, 93) = 1.49, *p* = .231, η^2 = .03, *d* = 0.28. Univariate ANOVAs revealed no effects of eye-closure on auditory (*F* < 1) or visual subjective details, *F* (1, 94) = 2.95, *p* = .089, η^2 = .03. Mann-Whitney tests revealed that interview condition did not significantly affect the number of subjective details about actions, *U* = 1072.00, *p* = .556, η^2 = .00, objects, *U* = 1109.00, *p* = .719, η^2 = .00, or surroundings, *U* = 1035.00, *p* = .371, η^2 = .01, but eye-closure increased the number of subjective details reported about persons, *U* = 837.00, *p* = .012, η^2 = .07. Again, these findings need to be interpreted with caution, in light of floor effects (see Table 1).

Confidence. Proportion correct was calculated by dividing the number of correct details by the total number of details in that answer (excluding repetitions). There was a significant but weak positive correlation between expressed confidence in a particular answer (on a scale of 0 to 100%) and proportion correct for that answer, r (456) = .127, p = .007.

Cued recall. Figure 2 shows the number of precisely correct, imprecisely correct, incorrect, and "don't know" answers provided in response to the 16 specific questions. We conducted 2 (Interview Condition: eyes open, eyes closed) x 2 (Modality of Encoded Information: visual, auditory) mixed ANOVAs for each of the dependent variables.

[INSERT FIGURE 2 ABOUT HERE]

Precise-correct responses. As illustrated in Figure 2, eye-closure nearly doubled the number of precise-correct responses, F (1, 92) = 24.28, p < .001, η^2 = .21, d = 1.01. There was no effect of modality of encoded information, F (1, 92) = 2.15, p = .146, η^2 = .02, and no interaction between eye-closure and modality (F < 1).

Imprecise-correct responses. There was no effect of interview condition on the number of imprecise-correct answers, F (1, 92) = 2.81, p = .097, η^2 = .03, d = -0.34. Participants provided significantly more imprecise-correct answers to questions about auditory details (M = 3.53, SD = 1.24) compared to visual details (M = 2.28, SD = 1.19), F (1, 92) = 60.13, p < .001, η^2 = .39. There was no interaction between eye-closure and modality (F < 1).

Incorrect responses. Eye-closure did not significantly affect incorrect responding, F (1, 92) = 2.31, p = .132, η^2 = .02, d = -0.31. Participants provided significantly more incorrect responses to questions about auditory details (M = 1.64, SD = 1.23) compared to visual details (M = .85, SD = .82), F (1, 92) = 29.56, p < .001, η^2 = .24. There was no interaction between eye-closure and modality (F < 1).

"Don't know" responses. Eye-closure significantly decreased the number of "don't know" responses, F (1, 92) = 9.05, p = .003, η^2 = .09, d = -0.61 (see Figure 2). Additionally, there were significantly more "don't know" answers in response to questions about visual details (M = 2.72, SD = 1.37) compared to auditory details (M = .97, SD = .91), F (1, 92) = 128.04, p < .001, η^2 = .58. There was no interaction between eye-closure and modality (F < 1).

Confidence. Participants rated their confidence in each response (except "don't know" responses) on a scale of 0 to 100%. Correlational analyses revealed modest but significant positive correlations between confidence and accuracy (correct, incorrect), r_{pb} (1180) = .179, p < .001, and between confidence and response type (precise-correct, imprecise-correct, and incorrect), r_s (1215) = .129, p < .001. However, a 2 (Interview Condition: eyes open, eyes closed) x 3 (Response Type: precise-correct, imprecise-correct, incorrect) mixed ANOVA on confidence ratings with repeated measures on the second variable revealed no significant difference in confidence in precise-correct (M = 76.4%, SD = 14.8%), imprecise-correct (M = 75.7%, SD = 14.2%), and incorrect (M = 73.3%, SD = 19.0%) responses (F < 1). There was also no significant main effect of interview condition, F (1, 69) = 1.08, p = .30, η^2 = .02, and no interaction between condition and response type (F < 1).

Lineups. Table 2 shows the frequency of lineup decisions in the eyes-open and eyes-closed condition. When the perpetrator was not in the lineup, very few participants made an identification. Even when the perpetrator was present, nearly half of the participants rejected the lineup. The lineup task has five potential outcomes. Witnesses can identify the target on a target-present lineup (correct identification) or the innocent suspect on a target-absent lineup (false identification). Alternatively, on both types of lineup, witnesses can identify a different lineup member (foil identification), or say that the perpetrator is not present (correct or incorrect rejection). A chi-square test on these five possible outcomes revealed no effect of eye-closure on lineup outcome, $\chi^2(4, N = 192) = 2.34$, $p = .689$, Cramer's $V = .11$. To explore this finding further, we also assessed accuracy on the line-up task, which is achieved either by making a correct identification on a target-present lineup, or by correctly rejecting a target-absent lineup. A chi-square test also revealed no effect of eye-closure on lineup accuracy, $\chi^2(1, N = 192) = 0.80$, $p = .456$, Cramer's $V = .06$.

Of course, the absence of a statistically significant difference between conditions does not mean that the means are statistically equivalent. To test for statistical equivalence, one must first determine the "minimum inconsequential difference"—that is, the value considered inconsequential based on substantive theoretical considerations and/or professional consensus (Tryon, 2001; Tryon & Lewis, 2008). Unfortunately, we do not have the requisite substantive theoretical grounds for estimating this value appropriately. However, we can turn the question around: in order to conclude on the basis of the present data that mean accuracy in the eyes-open and eyes-closed condition was statistically equivalent (using the alternative inferential confidence interval approach; Tryon & Lewis, 2008), one would have to consider the minimum inconsequential difference to be 21% accuracy. The reasonability of this assumption will be addressed in the General Discussion.

As a secondary interest, we examined the role of ethnicity in lineup identification performance. There was a marginally significant difference in overall lineup outcome between same-ethnicity and other-ethnicity participants, $\chi^2(4, N = 192) = 9.10$, $p = .057$, Cramer's $V = .22$. A more focused follow-up analysis on target-present lineups showed that same-ethnicity participants made significantly more correct identifications than other-ethnicity participants, $\chi^2(1, N = 192) = 8.18$, $p = .008$, Cramer's $V = .29$, thus providing some evidence for own-ethnicity bias in our data.

Discussion

Experiment 1 replicated previous findings regarding the benefits of eye-closure for recall of witnessed events. In free recall, eye-closure helped participants to retrieve more correct details about the event, while leaving incorrect and subjective details unaffected. In cued recall, eye-closure helped participants to provide more precise-correct responses and fewer “don’t know” responses, while leaving imprecise-correct and incorrect responses unaffected. The modality of encoded information did not interact significantly with interview condition (i.e., eye-closure was roughly equally effective for recall of visual and auditory details). These findings suggest that, in the present study, eye-closure had a general rather than a modality-specific effect on recall performance (see Perfect et al., 2011; Vredeveldt et al., 2011; Vredeveldt & Perfect, 2014, for more information on the modality issue).

The primary purpose of Experiment 1, however, was to investigate the effect of eye-closure during rehearsal of the perpetrator’s face on subsequent lineup identification performance. We found no significant benefits of eye-closure for identification accuracy, despite the fact that our sample size would have enabled us to detect a medium-sized effect (d = 0.40). However, because recall and recognition are distinct cognitive processes measured on different scales (see e.g., Smith, Glenberg, & Bjork, 1978; Tulving, 1982), we cannot assume that the medium to large effect size found for event recall extends to face recognition. Dichotomous and categorical scales to assess recognition accuracy are less sensitive to detect differences between conditions than continuous scales used for recall performance. That is, although eye-closure may help witnesses remember 18% additional information about an event (i.e., the increase from 34 to 40 details in free recall in Experiment 1), the eye-closure effect may only rarely be sufficiently strong to turn an incorrect identification decision into a correct decision. Hence, we might expect a smaller effect size for recognition measures than for recall measures. Therefore, we increased statistical power in Experiment 2, allowing us to detect even small differences between conditions, if they existed.

Experiment 2

In Experiment 2, we explored the effect of eye-closure during mental rehearsal in a face recognition paradigm. In this paradigm, each participant provides multiple recognition decisions, allowing for the application of signal detection analytic methods to participant performance, with the particular benefit of estimating both discrimination performance and response criterion. In addition, we added a control condition in which participants did not rehearse the face prior to recognition, to assess the effect of mental rehearsal itself. In line with previous research (e.g., Graefe & Watkins, 1980; Sporer, 1988), we predicted that mental rehearsal of the face would improve participants' ability to discriminate between old and new faces on a subsequent recognition test. We also predicted that eye-closure during mental rehearsal would increase its effectiveness, through facilitating concentration (e.g., Glenberg et al., 1998) and visualization (e.g., Wais et al., 2010). In addition, extrapolating from findings that eye-closure during recall reduces overconfidence in recall memory (Vredeveldt & Sauer, 2014), we hypothesized that eye-closure would make participants more conservative in their decisions.

In Experiment 1, we found that White participants were better at identifying the White book thief from the lineup than Black, Coloured, or other participants were. However, because the experimental design did not include targets with another ethnicity, it is difficult to draw conclusions about own-ethnicity bias based on these data. To explore own-ethnicity bias in more detail, we included both White and Black target faces in Experiment 2.

Method

Power calculation. We decided on a sample size that would allow us to detect even a small effect (*d* = 0.13 with power = .80), namely, 960 decisions per experimental condition.

Participants. We recruited 144 students (38 male) with a mean age of 20.08 (*SD* = 2.14) from the University of Cape Town, who each contributed 20 recognition decisions. Our sample comprised of 48 Black, 48 White, and 48 Coloured/Indian participants (henceforth referred to as "Coloured").

Design. Experimental condition (control, eyes-open, eyes-closed) and participant ethnicity (Black, White, or Coloured) were manipulated between-subjects, and face ethnicity (Black or White) was manipulated within-subjects. A counterbalanced design was used, in which pair member presented during encoding (A or B; see Materials section), and type of photo presented during encoding (frontal or profile) were included as within-subjects sampling variables (see Bruce, 1982, on the importance of changing the perspective of faces between presentation and test). Because none of the sampling variables interacted with experimental condition, they are not discussed further.

Materials. Photographs of 20 White males and 20 Black males were selected from databases of 371 and 398 photographs, respectively. The photographs were organized into pairs of similar-looking males, designated as person A and person B (i.e., 10 Black pairs and 10 White pairs). During encoding, participants were presented with person A on ten trials and with person B on the other ten, in random order. To ensure that the task involved person recognition rather than image recognition, there were two versions of each face—one frontal and one profile depiction (cf. Bruce, 1982). If participants saw a frontal depiction during encoding, they would see a profile depiction during recognition, and vice versa. None of the selected males had facial hair, necklaces, or head coverings, and all wore a plain dark-red T-shirt.

Procedure. The experiment consisted of 20 trials and was administered through E-

Prime 2.0 (Psychology Software Tools, Pittsburgh, PA). To keep expectations consistent across trials, participants were informed prior to participation that the study concerned memory for faces. Prior to participation, participants provided informed consent. At the start of each trial, participants were warned that they would see a face for less than a second on the next screen, and asked to pay close attention. After pressing a key, they saw a fixation cross for 1s, followed by a photograph of a face for 750 ms (either Person A or Person B of each pair). They then completed one of 20 filler tasks (appearing in random order; e.g., mathematical problems, anagrams, visual search tasks, general knowledge questions). After 90 seconds, participants in the eyes-open and eyes-closed rehearsal conditions were asked to "think about the face you saw" for 30 seconds, while participants in the control condition continued working on the filler task. Participants in the eyes-open condition were instructed to keep looking at the fixation cross on the screen while thinking about the face, whereas participants in the eyes-closed condition were instructed to keep their eyes closed. Two minutes after encoding the face, all participants were presented with a yes-no recognition task. Participants heard the following spoken instructions (delivered via headphones): "You will now see another photo of a face. Please indicate whether this is the same person you saw a few minutes ago". The face appeared on the screen for as long as it took participants to make their decision, via key press. On ten trials, participants were presented with the face they saw during encoding, and on ten other trials, they were presented with the face of the other pair member. Finally, participants rated their confidence in their decision on a scale of 0% (not confident at all) to 100% (extremely confident). The order of photos in the 20 trials was randomized.

Results

Accuracy. A 3 (Condition: control, eyes-open, eyes-closed) x 3 (Participant Ethnicity: Black, White, Coloured) x 2 (Face Ethnicity: Black, White) mixed ANOVA was conducted on the proportion of responses that were correct (i.e., accuracy rate). There were no significant differences between conditions (control: $M = .792$, $SD = .100$; rehearsal: $M = .790$, $SD = .105$; eye-closure: $M = .785$, $SD = .102$; $F < 1$). Thus, contrary to our hypotheses, mental rehearsal with or without eye-closure did not improve accuracy rate. There were also no main effects of participant ethnicity, F (2, 135) = 2.28, $p = .11$, or face ethnicity ($F < 1$), but there was a significant interaction between the two, F (2, 135) = 3.38, $p = .04$, $\eta^2 = .05$, revealing an asymmetrical own-ethnicity bias. Bonferroni-adjusted simple effects analyses showed that White participants were significantly better at recognising White faces ($M = .81$, $SD = .17$) than Black faces ($M = .71$, $SD = .26$), F (1, 135) = 5.61, $p = .02$, $\eta^2 = .04$, whereas Black participants, F (1, 135) = 1.11, $p = .30$, and Coloured participants ($F < 1$) performed equally well for both types of faces. There were no other significant interactions (all ps > .10).

Next, we explored whether mean accuracy between conditions was statistically equivalent, though again without sufficient theoretical grounds to determine the minimum inconsequential difference prior to analysis. Based on the data obtained in Experiment 2, however, the means for all pairwise comparisons between the three conditions would be considered statistically equivalent if a difference of 5% accuracy or less was considered inconsequential. This finding will be discussed in more detail in the General Discussion.

Signal detection analysis. Hits and false alarms were combined to calculate discrimination accuracy (*d'*) and response criterion (*c*). Prior to calculation, proportions of 0 and 1 were converted to 1/(2N) = .025 and 1-1/(2N) = .975, respectively. A 3 x 3 x 2 mixed ANOVA on *d'* revealed no significant differences between conditions (control: $M = 1.88$, $SD = 0.72$; rehearsal: $M = 1.95$, $SD = 0.81$; eye-closure: $M = 1.89$, $SD = 0.76$; $F < 1$), and no other significant main effects or interactions (all ps > .07). Thus, mental rehearsal with or without eye-closure did not improve discrimination accuracy. Participants in the rehearsal (M

= 0.19, *SD* = 0.57) and eye-closure (*M* = 0.18, *SD* = 0.55) conditions were slightly more conservative in their decisions than participants in the control condition (*M* = 0.03, *SD* = 0.52), but a corresponding ANOVA on *c* revealed no significant effect of condition ($F < 1$), and no other significant effects (all *p*s > .06). Thus, contrary to our hypothesis, eye-closure did not significantly affect participants' response criterion.

Discussion

In Experiment 2, we assessed the effects of mental rehearsal with or without eye-closure on face recognition performance, as compared to a control condition in which participants were prevented from rehearsing the face. Contrary to our predictions, mental rehearsal prior to recognition did not improve participants' ability to discriminate between old and new faces, and eye-closure did not significantly enhance the effectiveness of instructed mental rehearsal. This will be addressed in the General Discussion.

In Experiment 2, we systematically varied the ethnicity of the target faces, to further explore own-ethnicity bias. We found an asymmetrical bias that affected White participants but not Black or Coloured participants. Comprehensive discussion of this finding is outside of the scope of the current paper, but it is worth noting that similar asymmetrical own-ethnicity biases have been reported in previous research (e.g., Nakabayashi et al., 2014; Walker & Hewstone, 2006; Wright, Boyd, & Tredoux, 2003). We refer the interested reader to Chiroro and colleagues (2008) for a more detailed discussion.

General Discussion

The present research examined whether eye-closure during mental rehearsal of a face could improve subsequent facial identification performance. In Experiment 1, we replicated the benefits of eye-closure for event recall, but eye-closure during mental rehearsal of a face did not significantly help participants to identify the perpetrator from a subsequent lineup (or reject the lineup if the perpetrator was not present). In Experiment 2, we used a face recognition paradigm, enabling us to detect even small differences between conditions. Despite this, we found no significant effects of mental rehearsal with or without eye-closure on overall accuracy rate, discrimination accuracy (*d'*), or response criterion (*c*). Thus, the findings suggest that eye-closure improves recall of events, but not face recognition.

Because absence of evidence is not the same as evidence of absence, we also explored statistical equivalence between conditions (Tryon, 2001; Tryon & Lewis, 2008). In Experiment 1, we found that mean accuracy in the eyes-open and eyes-closed condition could only be considered statistically equivalent under the assumption that 21% accuracy is an inconsequential difference. If one considers this assumption to be unreasonable (as we do), then the difference between conditions in Experiment 1 was neither statistically significant nor statistically equivalent. To surpass this state of statistical indeterminacy, we explored the phenomenon further in a second study with more statistical power. In Experiment 2, the assumed minimal inconsequential difference for statistical equivalence decreased to 5% accuracy. Of course, it is difficult to determine whether 5% accuracy, or 1 out of 20 decisions, is an inconsequential difference. A parallel can be drawn with the problem of how many guilty persons to set free before one innocent person is convicted; the most well-known proposed ratio is 10 to 1 (Blackstone, 1769), but opinions vary widely (Volokh, 1997). Ultimately, it is up to policy makers to decide what constitutes an inconsequential difference. Nevertheless, policy makers need relevant empirical data to make informed decisions (cf. Clark, 2012). Based on our second study with high power, we can conclude that eye-closure does not affect subsequent face recognition, provided that we believe that a 5% accuracy difference is of minimal practical consequence.

The null findings for face recognition performance in the present studies correspond with previous failures to replicate the benefits of other memory-enhancing techniques in facial identification contexts. For example, although some studies have found that mental context reinstatement—a procedure in which witnesses are encouraged to mentally place themselves back into the context of the crime—improves lineup identification accuracy (Cutler, Penrod, & Martens, 1987; Gibling & Davies, 1988; Krafka & Penrod, 1985; Malpass & Devine, 1981; see also Shapiro & Penrod, 1986), others have failed to replicate these benefits (Cutler, Penrod, O'Rourke, & Martens, 1986; Davies & Milne, 1985; Searcy, Bartlett, Memon, & Swanson, 2001; Smith & Vela, 1992; Sporer, 1996). The most frequently cited explanation for the absence of effects of memory-enhancing techniques on recognition tasks is the *outshining hypothesis* (Smith, 1988; Smith & Vela, 1992). Memory-enhancing techniques typically improve recall performance by providing retrieval cues to the witness. In recognition tasks, however, the witness is presented with the most effective retrieval cue possible, namely, a copy of the to-be-remembered stimulus (i.e., the perpetrator's face). Therefore, any retrieval cues provided by the memory-enhancing technique are *outshone* by the presence of this potent retrieval cue. In other words, the eye-closure technique should be most effective when there are few other cues to prompt the witness's memory (cf. Fisher & Schreiber, 2009).

One potentially suitable context in which to explore the outshining hypothesis in further detail is that of facial composite construction. Because composite construction involves a combination of recall processes (when describing the face) and recognition processes (e.g., when selecting facial features from a book or computer system), it is ideally situated to explore differences between recall and recognition tasks. Other memory-enhancing techniques, such as mental and physical context reinstatement (Davies & Milne, 1985) and the holistic Cognitive Interview (Frowd, Bruce, Smith, & Hancock, 2008), have been found to improve the quality of facial composites. Future research should investigate whether eye-closure also affects facial composite construction, and if so, under what conditions. For example, the timing of instructed eye-closure could be varied to explore during which phase it is most effective: (a) before describing the face, (b) during description of the face, (c) before selecting facial features, (d) during selection of facial features (i.e., before presentation of each feature), or (e) before viewing and adjusting the whole-face image. This type of research would provide valuable insights into eye-closure's potential effectiveness in other applied contexts in the legal domain.

In the present research, we were predominantly concerned with applied issues surrounding facial identification, and further research is required to learn more about the cognitive underpinnings of eye-closure's effects on recall and recognition. Ideas for future research include investigating the role of the to-be-recognized stimuli and the degree of environmental distraction. First, we know from previous research that faces are a special type of visual stimulus; they activate a specific set of brain regions (Haxby, Hoffman, & Gobbini, 2000) and appear to rely on holistic processing to a greater degree than other objects do (Tanaka & Farah, 1993; Wilford & Wells, 2010). Therefore, it remains to be seen whether the present findings extend to recognition of other potentially relevant visual stimuli, such as images of the suspect's car. Second, because the effectiveness of eye-closure may depend on the level of distractions in the environment (e.g., Perfect et al., 2011; Vredeveldt et al., 2011), future studies should manipulate the level of visual and auditory distractions experienced by witnesses during the rehearsal period prior to face recognition.

We conclude that eye-closure has consistent benefits for witnesses' recall of events, but does not improve recognition of the perpetrator. It is important that this finding is entered into the public record. Given that one of the main questions in eyewitness contexts involves person identity, we ought to investigate why interventions that promote mental imagery (such as eye-closure, mental context reinstatement, and the Cognitive Interview) consistently improve event recall but do not consistently improve face recognition. To begin solving this puzzle, we need to know more about the conditions in which these interventions do and do not work. In the present research, we used both a naturalistic study (i.e., lineup identification after a witnessed theft) and a laboratory study that had high statistical power to detect an effect (i.e., face recognition). In both of these studies, eye-closure during mental rehearsal of a face did not affect subsequent recognition performance. Of course, this finding does not detract from the technique's usefulness in witness interviewing. Accumulating evidence from laboratory studies in various settings (e.g., Perfect et al., 2008; Vredeveldt et al., 2013; Wagstaff et al., 2004) suggest that witnesses remember more about events if they close their eyes during recall. Furthermore, field research with witnesses of serious crimes suggests that eye-closure can improve the forensic relevance of information provided by witnesses in police interviews (Vredeveldt et al., 2014). The eye-closure technique is a simple and time-efficient tool that could be implemented relatively easily. Although eye-closure may not help witnesses to identify the perpetrator, it will likely help them to remember additional information about the event, which could provide important new leads for investigations.

References

Baddeley, A. D. (2007). *Working memory, thought, and action*. New York: Oxford University Press.

Baddeley, A. D., & Andrade, J. (2000). Working memory and the vividness of imagery. *Journal of Experimental Psychology: General*, *129*, 126–145.

Baddeley, A. D., & Hitch, G. J. (1974). Working memory. In G. A. Bower (Ed.), *Recent advances in learning and motivation* (Vol. 8, pp. 47–89). New York: Academic Press.

Bernstein, M. J., Young, S. G., & Hugenberg, K. (2007). The cross-category effect: Mere social categorization is sufficient to elicit an own-group bias in face recognition. *Psychological Science*, *18*, 706–712. doi: 10.1111/j.1467-9280.2007.01964.x

Blackstone, W. (1769). *Commentaries on the Laws of England* (Vol. II, Book IV). New York, NY: Duyckinck, Long, Collins & Hannay, and Collins & Co.

Bruce, V. (1982). Changing faces: Visual and non-visual coding processes in face recognition. *British Journal of Psychology*, *73*, 105-116. doi: 10.1111/j.2044-8295.1982.tb01795.x

Busey, T. A., Tunnicliff, J., Loftus, G. R., & Loftus, E. F. (2000). Accounts of the confidence-accuracy relation in recognition memory. *Psychonomic Bulletin & Review*, *7*, 26-48. doi: 10.3758/bf03210724

Caruso, E. M., & Gino, F. (2011). Blind ethics: Closing one's eyes polarizes moral judgments and discourages dishonest behavior. *Cognition*, *118*, 280–285. doi: 10.1016/j.cognition.2010.11.008

Chance, J., & Goldstein, A. G. (1976). Recognition of faces and verbal labels. *Bulletin of the Psychonomic Society*, *7*, 384-386. doi: 10.3758/BF03337223

Chiroro, P., Tredoux, C. G., Radaelli, S., & Meissner, C. A. (2008). Recognizing faces across continents: The effect of within-race variations on the own-race bias in face recognition. *Psychonomic Bulletin & Review, 15*, 1089–1092. doi: 10.3758/pbr.15.6.1089

Clark, S. E. (2012). Costs and benefits of eyewitness identification reform: Psychological science and public policy. *Perspectives on Psychological Science, 7*, 238-259. doi: 10.1177/1745691612439584

Cutler, B. L., Penrod, S. D., & Martens, T. K. (1987). Improving the reliability of eyewitness identification: Putting context into context. *Journal of Applied Psychology, 72*, 629–637. doi: 10.1037/0021-9010.72.4.629

Cutler, B. L., Penrod, S. D., O'Rourke, T. E., & Martens, T. K. (1986). Unconfounding the effects of contextual cues on eyewitness identification accuracy. *Social Behaviour, 1*, 113–134. doi: n/a

Davies, G. M., & Milne, A. B. (1985). Eyewitness composite production as a function of mental or physical reinstatement of context. *Criminal Justice and Behavior, 12*, 209–220. doi: 10.1177/0093854885012002004

Doherty-Sneddon, G., Bonner, L., & Bruce, V. (2001). Cognitive demands of face monitoring: Evidence for visuospatial overload. *Memory & Cognition, 29*, 909–919. doi: 10.3758/BF03195753

Fisher, R. P., & Geiselman, R. E. (1992). *Memory-enhancing techniques for investigative interviewing: The cognitive interview*. Springfield: Charles Thomas.

Fisher, R. P., & Schreiber, N. (2009). Interviewing protocols to improve eyewitness memory. In M. P. Toglia, R. C. L. Lindsay, D. Ross & J. Reed (Eds.), *The handbook of eyewitness psychology: Vol. 1. Memory for events*. Mahwah, NJ: Erlbaum.

Francis, G. (2012). Too good to be true: Publication bias in two prominent studies from experimental psychology. *Psychonomic Bulletin & Review, 19*, 151-156. doi: 10.3758/s13423-012-0227-9

Frowd, C. D., Bruce, V., Smith, A. J., & Hancock, P. J. B. (2008). Improving the quality of facial composites using a holistic cognitive interview. *Journal of Experimental Psychology: Applied, 14*, 276-287. doi: 10.1037/1076-898X.14.3.276

Gibling, F., & Davies, G. (1988). Reinstatement of context following exposure to post-event information. *British Journal of Psychology, 79*, 129–141. doi: 10.1111/j.2044-8295.1988.tb02278.x

Glenberg, A. M. (1997). What memory is for: Creating meaning in the service of action. *Behavioral and Brain Sciences, 20*, 1–55. doi: 10.1017/S0140525X97470012

Glenberg, A. M., Schroeder, J. L., & Robertson, D. A. (1998). Averting the gaze disengages the environment and facilitates remembering. *Memory & Cognition, 26*, 651–658. doi: 10.3758/BF03211385

Goldsmith, M., Koriat, A., & Weinberg-Eliezer, A. (2002). Strategic regulation of grain size in memory reporting. *Journal of Experimental Psychology: General, 131*, 73–95. doi: 10.1037//0096-3445.131.1.73

Graefe, T. M., & Watkins, M. J. (1980). Picture rehearsal: An effect of selectively attending to pictures no longer in view. *Journal of Experimental Psychology: Human Learning and Memory, 6*, 156-162. doi: 10.1037/0278-7393.6.2.156

Greathouse, S. M., & Kovera, M. B. (2009). Instruction bias and lineup presentation moderate the effects of administrator knowledge on eyewitness identification. *Law and Human Behavior, 33*, 70-82. doi: 10.1007/s10979-008-9136-x

Gross, S. R., & Shaffer, M. (2012). Exonerations in the United States, 1989 Through 2012: Report by the National Registry of Exonerations: University of Michigan Law School.

Haxby, J. V., Hoffman, E. A., & Gobbini, M. I. (2000). The distributed human neural system for face perception. *Trends in Cognitive Sciences, 4*, 223-233. doi: 10.1016/s1364-6613(00)01482-0

Jones, T. C., Armstrong, R., Casey, A., Burson, R. A., & Memon, A. (2013). Verbal description benefits for faces when description conditions are unknown a priori. *The Quarterly Journal of Experimental Psychology*, 1-22. doi: 10.1080/17470218.2013.771688

Kerr, N. H., & Winograd, E. (1982). Effects of contextual elaboration on face recognition. *Memory & Cognition, 10*, 603-609. doi: 10.3758/bf03202443

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

Krafka, C., & Penrod, S. D. (1985). Reinstatement of context in a field experiment on eyewitness identification. *Journal of Personality and Social Psychology, 49*, 58–69. doi: 10.1037/0022-3514.49.1.58

Malpass, R. S. (1981). Effective size and defendant bias in eyewitness identification lineups. *Law and Human Behavior, 5*, 299-309.

Malpass, R. S., & Devine, P. G. (1981). Guided memory in eyewitness identification. *Journal of Applied Psychology, 66*, 343–350. doi: 10.1037/0021-9010.66.3.343

Malpass, R. S., & Kravitz, J. (1969). Recognition for faces of own and other race. *Journal of Personality and Social Psychology, 13*, 330–334. doi: 10.1037/h0028434

Meissner, C. A., & Brigham, J. C. (2001a). A meta-analysis of the verbal overshadowing effect in face identification. *Applied Cognitive Psychology, 15*, 603-616. doi: 10.1002/acp.728

Meissner, C. A., & Brigham, J. C. (2001b). Thirty years of investigating the own-race bias in memory for faces: A meta-analytic review. *Psychology, Public Policy, and Law, 7*, 3–35. doi: 10.1037/1076-8971.7.1.3

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

Milne, R., & Bull, R. (2002). Back to basics: A componential analysis of the original cognitive interview mnemonics with three age groups. *Applied Cognitive Psychology, 16*, 743–753. doi: 10.1002/acp.825

Nakabayashi, K., Burton, A. M., Brandimonte, M. A., & Lloyd-Jones, T. J. (2012). Dissociating positive and negative influences of verbal processing on the recognition of pictures of faces and objects. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 38*, 376-390. doi: 10.1037/a0025782

Nakabayashi, K., Lloyd-Jones, T. J., Butcher, N., Carter, N., Kawabata, Y., & Naka, M. (2014). Cross cultural differences in attention allocation during picture and face recognition: An eye movement study. *Manuscript in preparation*.

Perfect, T. J., Andrade, J., & Eagan, I. (2011). Eye-closure reduces the cross-modal memory impairment caused by auditory distraction. *Journal of Experimental Psychology: Learning, Memory and Cognition, 37*, 1008–1013. doi: 10.1037/a0022930

Perfect, T. J., Wagstaff, G. F., Moore, D., Andrews, B., Cleveland, V., Newcombe, S., . . . Brown, L. (2008). How can we help witnesses to remember more? It's an (eyes) open and shut case. *Law and Human Behavior, 32*, 314–324. doi: 10.1007/s10979-007-9109-5

Phelps, F. G., Doherty-Sneddon, G., & Warnock, H. (2006). Helping children think: Gaze aversion and teaching. *British Journal of Developmental Psychology, 24*, 577–588. doi: 10.1348/026151005X49872

Read, J. D., Hammersley, R., Cross-Calvert, S., & McFadzen, E. (1989). Rehearsal of faces and details in action events. *Applied Cognitive Psychology, 3*, 295-311. doi: 10.1002/acp.2350030403

Rode, G., Revol, P., Rossetti, Y., Boisson, D., & Bartolomeo, P. (2007). Looking while imagining: The influence of visual input on representational neglect. *Neurology, 68*, 432–437.

Schooler, J. W. (2011). Unpublished results hide the decline effect. *Nature, 470*, 437-437. doi: 10.1038/470437a

Schooler, J. W., & Engstler-Schooler, T. Y. (1990). Verbal overshadowing of visual memories: Some things are better left unsaid. *Cognitive Psychology, 22*, 36–71. doi: 10.1016/0010-0285(90)90003-M

Searcy, J. H., Bartlett, J. C., Memon, A., & Swanson, K. (2001). Aging and lineup performance at long retention intervals: Effects of metamemory and context reinstatement. *Journal of Applied Psychology, 86*, 207–214. doi: 10.1037//0021-9010.86.2.207

Shapiro, P. N., & Penrod, S. D. (1986). Meta-analysis of facial identification studies. *Psychological Bulletin, 100*, 139–156. doi: 10.1037/0033-2909.100.2.139

Smith, S. M. (1988). Environmental context dependent memory. In G. M. Davies & D. M. Thomson (Eds.), *Memory in context: Context in memory* (pp. 13–34). Chichester: Wiley.

Smith, S. M., Glenberg, A. M., & Bjork, R. (1978). Environmental context and human memory. *Memory & Cognition, 6*, 342–353. doi: 10.3758/bf03197465

Smith, S. M., & Vela, E. (1992). Environmental context-dependent eyewitness recognition. *Applied Cognitive Psychology, 6*, 125-139. doi: 10.1002/acp.2350060204

Sporer, S. L. (1988). Long-term improvement of facial recognition through visual rehearsal. In M. M. Gruneberg, P. E. Morris & R. N. Sykes (Eds.), *Practical aspects of memory: Current research and issues, Vol. 1: Memory in everyday life* (pp. 182-188). Oxford, England: John Wiley & Sons.

Sporer, S. L. (1989). Verbal and visual processes in person identification. In H. Wegener, F. Lösel & J. Haisch (Eds.), *Criminal Behavior and the Justice System* (pp. 303-324): Springer Berlin Heidelberg.

Sporer, S. L. (1996). Experimentally induced person mix-ups through media exposure and ways to avoid them. In G. Davies, S. M. A. Lloyd-Bostock, M. McMurran & C. D. Wilson (Eds.), *Psychology, law, and criminal justice: International developments in research and practice*. Berlin: Walter de Gruyter.

Sporer, S. L. (2001). Recognizing faces of other ethnic groups: An integration of theories. *Psychology, Public Policy, and Law, 7*, 36–97. doi: 10.1037/1076-8971.7.1.36

Statistics South Africa. (2012). Census 2011 Statistical release (P0301.4).

Tanaka, J. W., & Farah, M. J. (1993). Parts and wholes in face recognition. *The Quarterly Journal of Experimental Psychology Section A*, *46*, 225-245. doi: 10.1080/14640749308401045

Tredoux, C. G. (1998). Statistical inference on lineup measures. *Law and Human Behavior, 22*, 217–237. doi: 10.1023/a:1025746220886

Tryon, W. W. (2001). Evaluating statistical difference, equivalence, and indeterminacy using inferential confidence intervals: An integrated alternative method of conducting null hypothesis statistical tests. *Psychological Methods, 6*, 371-386. doi: 10.1037/1082-989X.6.4.371

Tryon, W. W., & Lewis, C. (2008). An inferential confidence interval method of establishing statistical equivalence that corrects Tryon's (2001) reduction factor. *Psychological Methods, 13,* 272-277. doi: 10.1037/a0013158

Tulving, E. (1982). Synergistic ecphory in recall and recognition. *Canadian Journal of Psychology/Revue canadienne de psychologie, 36,* 130–147. doi: 10.1037/h0080641

Volokh, A. (1997). N guilty men. *146 University of Pennsylvania Law Review, 173.*

Vredeveldt, A., Baddeley, A. D., & Hitch, G. J. (2012). The effects of eye-closure and "ear-closure" on recall of visual and auditory aspects of a criminal event. *Europe's Journal of Psychology, 8,* 284-299. doi: 10.5964/ejop.v8i2.472

Vredeveldt, A., Baddeley, A. D., & Hitch, G. J. (2013). The effectiveness of eye-closure in repeated interviews. *Legal and Criminological Psychology, Advance online publication*. doi: 10.1111/lcrp.12013

Vredeveldt, A., Hitch, G. J., & Baddeley, A. D. (2011). Eyeclosure helps memory by reducing cognitive load and enhancing visualisation. *Memory & Cognition, 39*, 1253–1263. doi: 10.3758/s13421-011-0098-8

Vredeveldt, A., & Penrod, S. D. (2013). Eye-closure improves memory for a witnessed event under naturalistic conditions. *Psychology, Crime & Law, 19*, 893-905. doi: 10.1080/1068316x.2012.700313

Vredeveldt, A., & Perfect, T. J. (2014). Reduction of environmental distraction to facilitate cognitive performance. *Frontiers in Psychology*. doi: 10.3389/fpsyg.2014.00860

Vredeveldt, A., & Sauer, J. D. (2014). Effects of eye-closure on confidence-accuracy relations in eyewitness testimony. *Manuscript under review*.

Vredeveldt, A., Tredoux, C. G., Nortje, A., Kempen, K., Puljevic, C., & Labuschagne, G. N. (2014). A field evaluation of the Eye-Closure Interview with witnesses of serious crimes. *Manuscript under review*.

Wagstaff, G. F., Brunas-Wagstaff, J., Cole, J., Knapton, L., Winterbottom, J., Crean, V., & Wheatcroft, J. (2004). Facilitating memory with hypnosis, focused meditation, and eye closure. *International Journal of Clinical & Experimental Hypnosis, 52*, 434–455. doi: 10.1080/00207140490889062

Wais, P. E., & Gazzaley, A. (2014). Distractibility during retrieval of long-term memory: Domain-general interference, neural networks and increased susceptibility in normal aging. *Frontiers in Psychology, 5:280*. doi: 10.3389/fpsyg.2014.00280

Wais, P. E., Rubens, M. T., Boccanfuso, J., & Gazzaley, A. (2010). Neural mechanisms underlying the impact of visual distraction on retrieval of long-term memory. *Journal of Neuroscience, 30,* 8541–8550. doi: 10.1523/JNEUROSCI.1478-10.2010

Walker, P. M., & Hewstone, M. (2006). A perceptual discrimination investigation of the own-race effect and intergroup experience. *Applied Cognitive Psychology, 20,* 461-475. doi: 10.1002/acp.1191

Weber, N., & Brewer, N. (2008). Eyewitness recall: Regulation of grain size and the role of confidence. *Journal of Experimental Psychology: Applied, 14*, 50–60. doi: 10.1037/1076-898X.14.1.50

Wilford, M. M., & Wells, G. L. (2010). Does facial processing prioritize change detection? Change blindness illustrates costs and benefits of holistic processing. *Psychological Science, 21*, 1611-1615. doi: 10.1177/0956797610385952

Worden, N. (2011). *The making of modern South Africa. Chichester: Wiley-Blackwell.* Chichester: Wiley-Blackwell.

Wright, D. B., Boyd, C. E., & Tredoux, C. G. (2003). Inter-racial contact and the own-race bias for face recognition in South Africa and England. *Applied Cognitive Psychology, 17,* 365–373. doi: 10.1002/acp.898

Table 1. Means (*M*) and standard deviations (*SD*) for the number of correct, incorrect, and subjective details about persons, actions, objects, and surroundings provided in the free-recall phase in Experiment 1.

	Condition					
	Eyes open		Eyes closed		*Total*	
	M	*SD*	*M*	*SD*	*M*	*SD*
Person						
Correct	4.38	2.17	5.58	3.29	*4.98*	*2.84*
Incorrect	0.21	0.50	0.46	0.71	*0.33*	*0.63*
Subjective	0.58	0.96	1.19	1.30	*0.89*	*1.18*
Action						
Correct	16.10	4.63	18.00	4.62	*17.05*	*4.70*
Incorrect	3.19	2.13	3.27	2.97	*3.23*	*2.57*
Subjective	3.63	3.32	4.02	3.72	*3.82*	*3.51*
Object						
Correct	6.83	3.33	9.15	4.24	*7.99*	*3.97*
Incorrect	0.58	0.87	1.15	1.87	*0.86*	*1.48*
Subjective	0.58	0.92	0.71	1.20	*0.65*	*1.07*
Surrounding						
Correct	6.67	3.60	7.19	3.61	*6.93*	*3.60*
Incorrect	0.63	1.04	0.83	1.10	*0.73*	*1.07*
Subjective	1.27	1.82	1.73	2.21	*1.50*	*2.03*
Total						
Correct	33.98	9.53	39.92	11.94	*36.95*	*11.15*
Incorrect	4.60	3.51	5.71	4.92	*5.16*	*4.29*
Subjective	6.06	5.03	7.65	6.18	*6.85*	*5.66*

Table 2. Number of correct identifications (of the target), false identifications (of the target replacement), foil identifications (of a known innocent lineup member), and no identifications for target-present and target-absent lineups in Experiment 1.

	Condition					
	Eyes open		Eyes closed		*Total*	
	N	%	*N*	%	*N*	%
Target-present						
Correct identification	20	42%	26	54%	*46*	*48%*
Foil identification	2	4%	1	2%	*3*	*3%*
No identification	26	54%	21	44%	*47*	*49%*
Target-absent						
False identification	3	6%	5	10%	*8*	*8%*
Foil identification	8	17%	6	13%	*14*	*15%*
No identification	37	77%	37	77%	*74*	*77%*

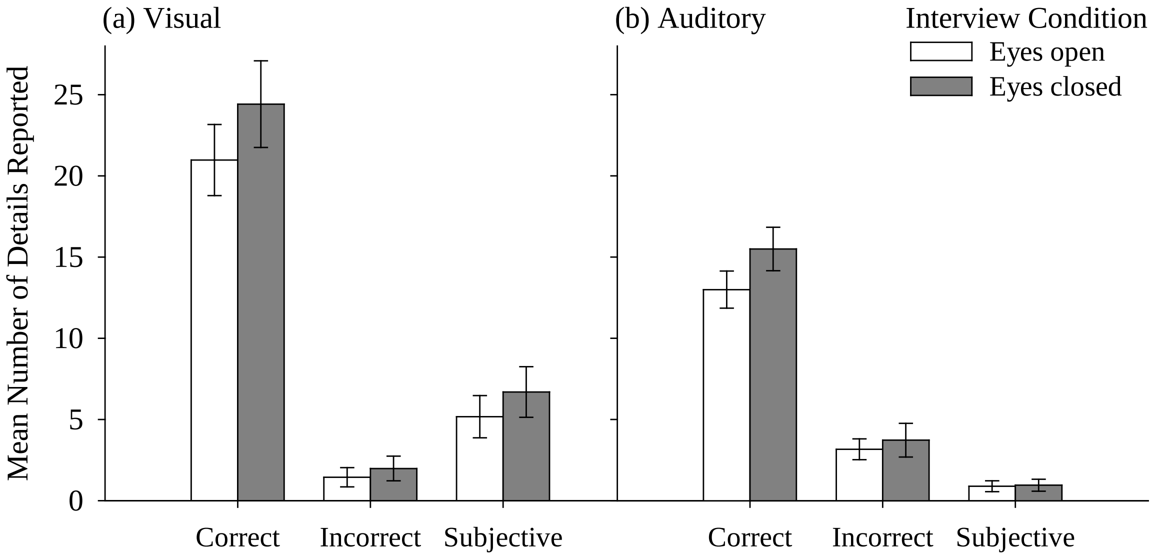

Figure 1. Mean number of correct, incorrect, and subjective details provided in the free-recall phase in Experiment 1. Panel (a) shows visual details and panel (b) shows auditory details. Error bars represent 95% confidence intervals.

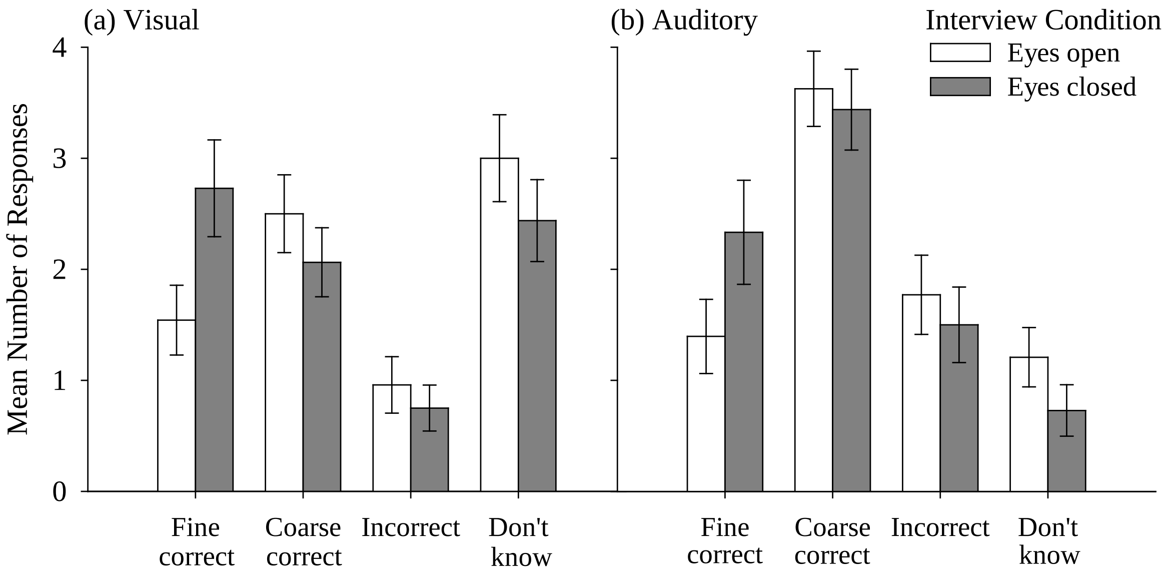

Figure 2. Mean number of precise-correct, imprecise-correct, incorrect, and “don’t know” responses provided in the cued-recall phase in Experiment 1. Panel (a) shows visual details and panel (b) shows auditory details. Error bars represent 95% confidence intervals.