Factors underlying Eyewitness Memory Accuracy: Individual Differences and Confidence

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Abstract. False memory, modulated by factors, such as emotion and semantic information about an event, can impede accurate suspect identification. Negative mood and semantic processing are found to create false memory by establishing associations between events. The associations include confounding the events' order, mixing the events' contents, and using schemas that sometimes deviate from the actual circumstances. The inconsistency of emotion while encoding and retrieving information can also cause the failure of recalling correct crime scene details. To increase the value of eyewitness testimony, this review discussed several factors that can impact eyewitness memory accuracy. Lab studies are largely based on individual cognitive differences, the level of confidence made with suspect identifications, and individual cross-cultural differences. High executive functional (EF) availability and high confidence level were found to corroborate higher accuracy of identification across tasks. Individuals from individualistic cultures were found to focus more on central details than those from collectivistic cultures. Additionally, eyewitness memory accuracy can be assessed by the response time of witnesses, which is another powerful indicator of eyewitness memory accuracy besides confidence. The difference in eyewitness memory accuracy between lab studies and reality is a gap in this field. It is recommended to use the two one-sided tests (TOST) to show that there is no statistical association between suspect identification accuracy and memory strength to minimise the gap. This review analysed several factors impacting eyewitness memory accuracy and provided insights into how the lab studies can be applied to the real world.

Keywords: Eyewitness; Memory; Individual differences.

1. Introduction

False memory in eyewitness testimony threatens the accuracy of suspect identification. False memory may be created through the shortcut recall of related concepts kept in the memory store or the integration of old and new information [1]. It can also be triggered by the shared feature of old and new information [1]. False memory, which may lead to suspect misidentification, can cause irreversible tragedies. For example, a wrong witness testimony led the police to target and shoot an innocent suspect, Jean Charles de Menezes, who was innocent of the bombings in London in 2005 [2]. Therefore, to increase the credibility of the eyewitness testimony and reduce such tragic mistakes, it is important to decide which factors can modulate the eyewitness memory accuracy.

Semantic processing of associative memories can construct false memories. The Deese-Roediger-McDermott (DRM) paradigm illustrates how associations between previous and current semantic contents impact memory distortion. Unlike accurate recall of actual information which depends on individuals' capability of imagery and the quality of encoded information, false memory is related to the interpretation of a group of information. Individuals' familiarity with the semantic content and the reasonability of the information can determine the memory accuracy [3]. Hence, the way of processing and integrating information is likely to be crucial in determining the individual's eyewitness memory accuracy.

On the other hand, emotions are found to modulate the memory of certain events by changing the memory contents. Evidence suggested that the more arousal that emotion was embedded with the memory, the less memory capacity that an individual could attend to [4]. However, the findings are not always consistent. On one side, negative emotion are suggested to reduce false memory, as they enhance the contents of the memory by attracting individuals' attention while encoding information

[4]. On the other side, negative moods may foment false memory or distort memory. For example, traumatic patients can falsely remember what they did not experience [4]. Additionally, emotions establish associations between events and confound the accurate recall in tasks other than free recall tasks. This may involve confounded order of the events, mixed contents of several events, and schemas that sometimes deviate from the actual circumstances when individuals recall certain information [4]. Hence, it is still unclear whether negative emotions can increase or decrease false memory, and the influence of emotions on memory contents requires further research.

Emotions embedded in contextual memories can influence eyewitness memory accuracy as well. The inconsistency of emotion while encoding and retrieving information can impede recalling correct details of the event [4]. This is because emotions affect the route of extracting information from the memory store. Various emotional contexts can lead to differences in the retrieval routes, and thus the extracted contents of the memory may differ. However, compared to the impact of emotion on memory contents, contextual emotions are more disposed to influence the verbal description of the memory rather than the main plots of the memory [4]. Hence, the association between emotional context and false memory may not be as close as the impact of emotion on memory contents.

Individual differences in eyewitness memory accuracy were discussed in this review in several aspects. On the individual aspect, personal cognitive ability may influence suspect identification accuracy. Face recognition capability and working memory capacity are likely to determine the amount of information stored in individuals' brains. On the social background aspect, cultural backgrounds may decide the way of processing information and thus cause different testimony performances between individuals. The lab studies of which factors influence eyewitness memory accuracy are extensive, but few studies focused on how these factors impact eyewitness memory accuracy in reality. This review discussed potential factors impacting individuals' eyewitness testimony performances. It can provide future directions for applying the findings of lab studies to real-life events to reduce the gap between the ideal lab condition and the practical realistic situation.

2. Eyewitness Memory Accuracy in Lab Settings

2.1 The Impact of Cognitive Individual Differences on the Accuracy

Cognitive abilities are found to be related to the accuracy of memories. Specifically, executive functional (EF) availability, the capability to process and manipulate information, is suggested to correspond to the extent of memory distortion [5]. In Battista et al.'s study, after being asked to watch a mock crime video, participants completed a series of executive functioning assessments and two memory tests including memory recall scoring, cued recall, and free recall over ten days. As a result, high EF participants recalled significantly more correct details and made fewer omissions than low EF participants [5]. This indicates that high EF correlates to high memory accuracy, which thus provides explanations for the modulation of eyewitness memory accuracy by individual cognitive abilities.

Some studies investigated reasons for the individual EF differences. They suggested that learning abilities could reflect cognitive capability. For example, working memory capacity can be higher in good learners than in bad learners. If an individual has high learning ability, his cognitive capability is likely to be high. Thus, he possibly has high memory accuracy. A previous study investigated if there is a common integration process engaging to encode information under different paradigms including the DRM paradigm, Bransford and Franks task (BF), and self-derivation through integration paradigm (SDI). If there is a common integration process, the individual performances should be similar across the tasks [1]. Results showed that only in the BF paradigm (i.e., composite collections of sentences), the association between the false alarm on new items and the true hit rate for old items was significantly positive, which suggests that the ability to identify false composite memory is crucial in eyewitness memory accuracy [1]. A cross-task interaction was found between BF and SDI. The correct rejection rate of falsely integrated sentences in the SDI paradigm was positively correlated with individual scores on Scholastic Aptitude Test, showing that one's academic

performance can be based on memory recall, where the shared features of newly learnt facts and prior knowledge trigger the retrieval of prior, related content [1]. Therefore, the individual differences in memory accuracy may be due to different paradigms that various individuals use to process information.

2.2 The Effect of Confidence on the Accuracy

Based on previous studies, highly confident eyewitness testimony is more likely to be accurate. It may be because if an individual is uncertain whether he can correctly identify the suspect, he is more likely to be influenced by distractors and fail to focus on the target. Evidence has revealed that confidence in both facial recognition and target identification can influence eyewitness memory accuracy. That is, confidence can influence both visual and semantic memory accuracy during eyewitness testimony.

Facial recognition is widely studied in eyewitness testimony because it is highly heritable and distinct from other cognitive measures [6]. The results of the Cambridge Face Memory Test (CFMT) after the lineup memory recall revealed that when participants were confident, the CFMT score decreased as the accuracy rate decreased [6]. Hence, when the confidence level is high for both groups, good face recognisers are more likely to make accurate identifications [6]. Another finding was that increased decision time corresponded to decreased accuracy among poor face recognisers, revealing that both the reaction time and the level of confidence are key factors deciding eyewitness memory accuracy [6].

Since the relationship between confidence and accuracy is evidenced, the question comes to whether the correlation only exists among the group of individuals who are able to recognise faces well. The optimality account suggests that memory accuracy depends on the quality of memory representation of faces. The decision process account indicates that individual metacognitive skills determine memory performance. Gettleman et al.'s study compared the optimality account and the decision process account. In the study, highly-confidence responses from stronger face recognisers were more likely to be correct than from weaker face recognisers [7]. Moreover, the study found that the calibration scores of participants with different levels of capability in recognising faces were similar when the identification accuracy was high, while the difference was greater when the identification accuracy was low [7]. Therefore, individual metacognitive skills tend to correlate with memory performance, and the results support the decision processes account.

On the other hand, the relationship was also found in semantic tasks. It was suggested that the compared proportion of evidence for the target and the lure often determines the identification accuracy in the forced-choice recognition test. However, the absolute evidence, which directly supported the chosen target, was found to determine the confidence-accuracy association [8]. The study included three types of tests: the item test, the association test, and the combination of item and association test. The item test was to pick the target containing words previously present in the experiment. The association test was to distinguish the pairs of words present together during the study phase from those that appeared in different trials of the studying phase. Results did not show an association between confidence and memory accuracy in item and association tests. However, an association was found between the results of the item test and a combination of item and association tests [8]. The confidence level was higher in the combination test than in the item test when the memory accuracy was comparable in the two tests, which shows that confidence is predicted by absolute evidence [8]. In addition, participants were more confident when fewer similar lures were present with the target, but it did not meet the definition of the relative level of evidence that evidence supporting the lures was more than that supporting the target [8]. Hence, the absolute evidence, which can be interpreted as confidence, is a powerful indicator of memory accuracy.

2.3 Cross-Cultural Differences in the Accuracy

Cultural backgrounds can change how individuals view materials and process information. Since short-term memory has limited capacity, some information is filtered out of the memory store. Thus,

individuals from various cultural backgrounds may perceive the same event differently and have various eyewitness memory accuracy. For example, individualistic culture is more concentrated on the individual elements and the most prominent element in the view, while collectivist culture is more focused on background information and associations between different elements. A study was done on the sample from rural and urban regions of Ghana and the Netherlands with two crime settings (i.e., Ghanaian and Dutch settings). Participants viewed the stimulus scenes first and took a distractor task. Consequently, they were asked to complete a free recall task that described the stimulus verbally and a cued recall task on retrieving central and background details in the stimulus. Results showed that central details were significantly better reported by participants from the Netherlands (individualistic culture) than those from Ghana (collectivistic culture) [9]. Participants from urban Ghana performed better than those from rural Ghana [9]. Participants from Ghana generally had worse performance to recall central details than those from the Netherlands [9]. These results show that participants from individualistic cultures are more likely to pay attention to central details, and a native setting facilitated the recall of correct central details.

3. Issues of Eyewitness Memory Accuracy in Real Life and Possible Solutions

There are differences in eyewitness-related research between lab settings and real-life situations. For example, the experimenter knows who the suspect in lab studies is, so they can control variables to establish a nearly perfect lineup that excludes bias. However, the actual lineup cannot be manipulated and perfectly fair [10]. Furthermore, the suspect identification accuracy in lab settings is not adjusted by the base rate, which thus differs from the accuracy in actual identifications [10]. The gap between the lab studies and the reality was shown as inconsistent conclusions on the relationship between the suspect identification accuracy and memory strength. Though empirical evidence showed that suspect identification accuracy made with high levels of confidence did not fluctuate with various memory strengths, much research found the opposite [10]. Two reasons may account for the inconsistency. First, the Bonferroni correction constricted the alpha criterion, and thus the difference between the experimental and control group was less likely to be significant. Second, though the difference between conditions was significant, some researchers insisted that the suspect identification accuracy varies in memory strength [10].

To solve this problem, the study suggested using the two one-sided tests (TOST) to show that the association between suspect identification accuracy and memory strength is not present statistically [10]. After the sample size is determined, if the difference in the high-confidence accuracy between the experimental and control group is equal to or greater than the value of the smallest effect size of interest (SESOI), the accuracy is assumed to be equivalent between the two conditions [10]. Importantly, as the base rate of finding a suspect guilty fluctuates at various stages of legal procedures, it is crucial to decide when to use the TOST as well [10]. The pleading effect, which is a phenomenon that more guilty suspects accept guilt pleas than innocent suspects, lowers the base rate of identifying a guilty suspect at the time of the trial than that of the identification [11]. In turn, the lowered base rate and an unfair lineup exacerbate the pleading effect, which further causes the base rate to fall. Hence, it is recommended to use the experimental method during the identification procedure instead of the trial [10].

Other studies seek to find the relationship between response time and memory accuracy. As the responder may not take enough time to make decisions, a quicker response may cause inaccuracy. However, since participants can only depend on their memories to recall relevant information in eyewitness testimony, the studies of suspect identification accuracy had different findings. A previous study examined the response time-accuracy characteristic (RAC) analysis that reveals the correlation between witnesses' response time and the suspect identification accuracy. Results of the lab study showed that as response time increased, accuracy decreased [12]. In the field study on a police department, response time was associated with confidence identifications in both suspect and filler identification, but only significant when the level of confidence was high [12]. Hence, response time

is another strong indicator of suspect identification accuracy besides confidence level, and the RAC analysis should be used along with the confidence-accuracy characteristic analysis.

4. Conclusion

Lab studies on eyewitness memory accuracy are mainly based on individual cognitive differences, level of confidence made with suspect identifications, and individual cross-cultural differences. Individual cognitive differences are shown as EF availability, where high EF individuals tend to make more accurate suspect identifications than low EF individuals. Additionally, confident identifications are shown to be more accurate than unconfident identifications in both facial recognition and semantic recall tasks. Moreover, individuals from individualistic cultures were found to focus more on central details than those from collectivistic cultures, and individuals from both cultures recalled more details in their native settings. A gap lies between the findings of lab studies and real-life situations. Several methods are suggested to reduce the gap. A TOST is suggested to be used during the identification procedure to assess the highly confident suspect identification accuracy. The prediction is that the suspect identification accuracy should be equivalent across conditions, supported by a between-condition accuracy difference equal to or greater than the SESOI. On the other hand, as response time is found to be a powerful indicator of eyewitness memory accuracy, the RAC analysis is recommended to be used along with the CAC analysis. In this way, this review scrutinised potential factors that can influence eyewitness memory accuracy. It also identified and explained differences between lab studies and reality, and finally integrated tenable solutions to raise the suspect identification accuracy. This review can provide some suggestions to the assessment of eyewitness memory in both research and practice.

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