The Effects of Association and Emotion in False Memory

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Abstract
The purpose of this study was to discuss the effects of association and emotion in false memory by using a DRM paradigm procedure. This study employed a 3 (association: semantic association vs. category association vs. neighborhood association) × 3 (emotion: positive vs. neutral vs. negative) mixed design, to examine the effects of association and emotion on (1) the recognition of original-list-items, and (2) the false recognition of critical-lures-items with same association with the original-list-items and noncritical-lure-items without association with the original-list-items.
The major findings of the study are: First, all groups showed significant recognitions of original-list-items. Second, for the effect of association in false memory, subjects of the neighborhood association group and the semantic association group showed significant false memories on the critical-lure-items, yet those of the category association group did not. Third, for the effect of emotion in false memory, subjects showed significant false memories on the positive critical-lure-items and the neutral critical-lure-items, but not on the negative critical-lure-items. Forth, all groups showed no false memories on the noncritical-lure-items.

Keywords: false memory, association, motion

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Introduction

False memory is the psychological phenomena that a person recalls a memory that did not actually occur (Roediger & McDermott, 1995). The phenomenon is common in witness testimony (Loftus, 1979). A witness's false memory can result in misidentification of a suspects and wrongful sentence in court. Bartlett (1932) conducted the classic experiment, the 'War of the Ghosts'. In his experiment, a participant would read a story in an exotic cultural setting and then be asked to recall the content. The results showed that participants would construct the story according to their existing schemata rather than the given information.

Researches on false memory have been widely investigated since the 90s. Roediger and McDermott (1995) developed the Deese-Roediger-McDermott (DRM) paradigm. In their study, they selected words from the semantic association database as material. There were 24 study lists of 15 highly related words. The experiment session included two phases, learning and testing phase. In the learning phase, participant would hear the study lists displaying in the frequency of 1.5 seconds per word. Following the learning phase, a participant would do a recall task and a recognition task in the testing phase, adding one semantically related target word as lure for each list. The result showed a high false recognition rate on the target word. Most participants claimed to recognize those words which they never studied.

Semantic associates are common material in false memory researches (Deese, 1959; Gallo, Roberts, & Seamon, 1997; Robinson & Roediger, 1997; Roediger & McDermott, 1995; Roediger, Watson, McDermott, & Gallo, 2001). Beside, category associated words (Brainerd, Reyna, & Brandse, 1995; Dewhurst, 2001; Dewhurst & Anderson, 1999; Hintzman, 1988; Seamon, Luo, Schlegel, Greene, & Goldenberg, 2000) and phonological neighborhoods can also induce false memory (Schacter, Verfaellie, & Anes, 1997; Watson, Balota & Roediger, 2003; Watson, Balota & Sergent-Marshall, 2001). Hintzman (1988) adopted category associated words as material. He created word lists for each distinct category. For example, he would categorize jackets, shirts, and dresses in a list. A participant would learn randomly selected words from part of a list, followed by a recognition task including the whole list. Participants would falsely report that they recognized words which were not presented. In terms of phonological neighborhoods, Schacter, Verfaellie, and Anes (1997) used words with phonological similarities as material, such as target word 'fate' and its neighbors 'fame', 'face', 'fake', 'late', 'date' and 'rate'. The results showed high false recognition rates despite the fact that the target words had never been studied.

Beside conceptual and lexical elements, emotional content can also modulate false memory. When asked to recall an event, we report not only the factual information but also its effect on our emotions and personal opinions. The emotional content could enforce memory consolidation; however, it could induce false memory. Sharkawy, Groth, Vetter, Beraldi, & Fast (2008) and Brainerd, Stein, Silveira, Rohenkohl, & Reyna (2008) had separately conducted experiments on word-based emotion and false memory with consistent results. They created lists based on emotion and semantic associations. Participants prone to form false memory on negative target words than neutral targets.

Pesta, Murphy, and Sanders (2001) studied false recognition of emotional and neutral words. Their results demonstrated that participants form false memory on both false alarms to emotional words were lower than neutral lure. The distinctiveness of emotional targets in a neutral word list reduces false recognition. Therefore the high false alarm to emotional targets in Sharkawy's and Brainerd's studies might result from the low distinctiveness of the semantically congruent word lists and targets.

Lexical elements and emotional content can also modulate false memory; however, there are no existing studies on clarifying how these two factors generate false memory. The current study aims to investigate the interaction between emotion (positive, neutral, negative) and lexical association (semantic, categorical, neighborhood) on false memory.

Method

The current experiment is a 3 × 3 mixed design; three lexical association factors (semantic, categorical, neighborhood) are between subject conditions and three emotion factors (positive, neutral, negative) are within subject design. We created 12 word lists for each lexical association conditions, thus in sum, there will be 36 lists. Each list includes one target word and 12 studying words.

We recruited 96 postgraduate and undergraduate students for the experiment. Participants were randomly allocated into three groups of 32 subjects. A participant studied the studying word in 6 lists of the assigned condition. After the studying phase, a participant would complete a recognition task, in which a participant would see 60 words. Those words are 12 target words, 4 words from each studied and not presented lists.

Result

Correct Hit Rate of Studied Words Recognition

The results showed no significant difference among within and between subject variables. The average recognition accuracy on studied words was 73%. This indicated that semantic, categorical and neighborhood associations could benefit general word learning and recognition among words inducing positive, neutral and negative emotions.
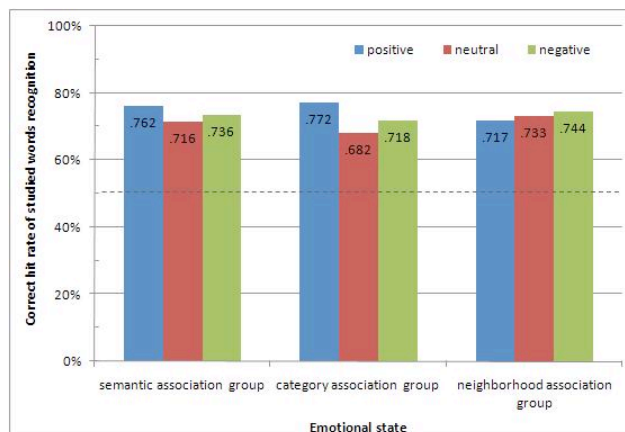
Figure 1: Correct hit rate of studied words recognition
False alarm rate of target words and non-target new words
Effect of lexical association. The result showed that, in Chinese character writing system, participants in the neighborhood and semantic condition generated more false memory than those in the categorical condition. (See Figure 2)
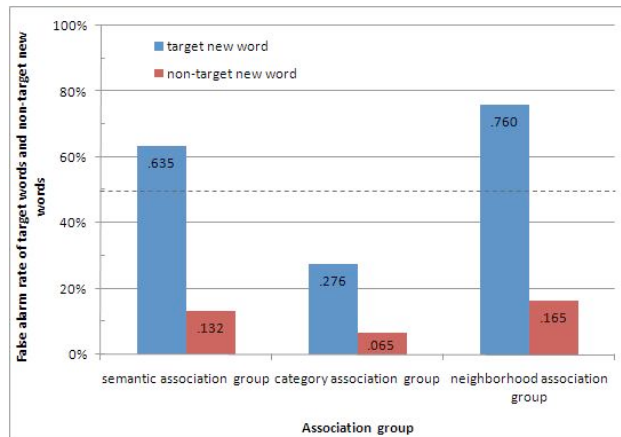

Figure 2: The Interaction Effect of New word types and Association.

Effect of emotion. In neighborhood and semantic conditions, people were prone to generate false memory on neutral and positive target words, comparing to negative words. (See Figure 3)
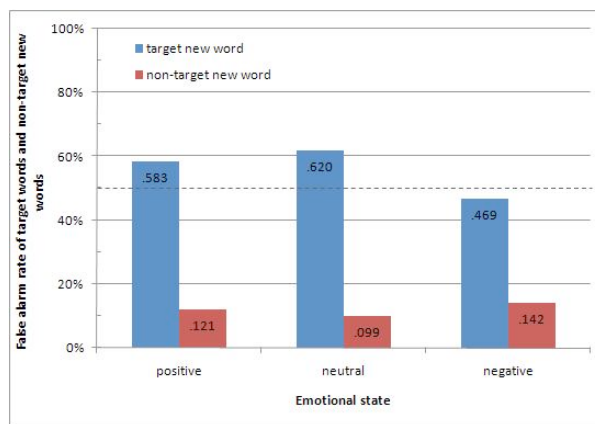

Figure 3: The Interaction Effect of New word types and Emotional State.

Discussions and Suggestions

We didn't find any significant difference in the recognition accuracy of the studied words among three emotion conditions. We suspected that effect of lexical association was stronger than that of emotion, hence this raised the recognition rate of neutral and positive emotional words, resulting in no significant difference across the emotion conditions in the current study. The false recognition rate in neighborhood condition was significantly higher than in semantic condition. Moreover, the false recognition rate in the semantic condition was significantly higher than in categorical condition. Therefore the false memory effect in the neighborhood condition was the strongest. We suggested this finding might related to the writing system of Chinese characters.

Chinese is a logographic language. There are rich ideographical and pictorial components than alphabetic languages, thus the neighborhood condition induced a stronger effect in memory. The result also showed a rather weak effect of categorical association in false memory. The underpinning reason might be the complex cognitive process of concept evaluation and inductive reasoning on category, thus participants couldn't generate gist memory for the studied word lists. False memory results from gist memory, hence the false alarm rate was low in the categorical association condition.

We suggest a few points for other researchers to follow up the current issue. Firstly, the individual difference in word list learning has not been investigated. A within subject design across the association conditions and a free recall task before the recognition task might clarify the adopted strategy. Second, the low false recognition rate in categorical association group would require further investigation. The reason could lay in the individual differences of information structure in memory. We propose a study comparing the performance of two groups implemented with and without memory strategy. Finally, we suggest a further investigation on the relation between false word recognition and the difference between Chinese writing system and alphabetical system. The structure of Chinese words more complicated than that of English, therefore a longer information process might happen to Chinese. We could manipulate the word display length to understand whether display length could be a factor of false memory in words.

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