

Stereotypes We Can Not Forget: The Effect of Disciplinary Priming and Memory Instructions on Recognition Errors

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Abstract. This study was a replication experiment to explore the effects of priming type, memory instruction, and vocabulary type on false memory. The main research hypothesis was under psychological priming conditions, forgetting instructions significantly increased the false recognition rate of words. The experiment recruited 24 undergraduate students. It adopted a 2 (priming type: psychological priming vs. neutral priming) $\times$ 2 (instruction: remember vs. forget) $\times$ 2 (vocabulary type: stereotype-consistent vs. non-stereotype) mixed design. Participants completed vocabulary learning and recognition tasks, and the data were analyzed by 2 $\times$ 2 $\times$ 2 mixed ANOVA, with the dependent variable being the false recognition rate of words. The experimental results showed that under psychological priming conditions, forgetting instructions significantly increased the false recognition rate of words (H3), while this effect was not observed under neutral conditions (H4). Contrary to expectations, the experimental results found that non-stereotype words were more likely to be misrecognized. The triple interaction was not significant. The results showed that subjects might activate defense mechanisms of memory processing in specific socio-semantic contexts. Based on the research on stereotype-induced false memory, this experiment studied the influence of specific context on false memories in the context of new disciplinary stigma, broadened the understanding of memory processing mechanisms.

Key words: False memory, stereotype, memory instruction, psychological stigma, semantic priming, DRM paradigm.

1. Introduction

False memory is a phenomenon that frequently occurs in daily life. People remember things that did not happen. This kind of false memory sometimes significantly impacts cognition, which may lead to biased judgments of events and hurt life.

Usually, false memories do not appear out of thin air. They often rely on existing memories that are strongly related to false memories. False memories are induced under this high correlation. There is a classic paradigm called the DRM (Deese-Roediger-McDermott) paradigm for the mechanism of this false memory. This paradigm usually induces the misidentification of lure words that have not appeared by showing a set of semantically related words.

In addition to semantic induction, different contexts will also affect memory differently. Stereotypes and false memories may have a stronger induction relationship. As a discipline, psychology has long faced public prejudice. Psychology is often seen as a "mysterious and unscientific" discipline in the eyes of the public. This stereotype constitutes a psychological priming context that may affect people's memory processing of psychology-related information. Furthermore, intentional instructions can influence the process of memory encoding. Directed forgetting instructions may disrupt mechanisms of memory processing and strengthen the likelihood of false memories, especially for semantically related items that did not appear.

This experiment used stigma in psychology as a background to study the effects of different semantic contexts and instructions on false memories, aiming to replicate and extend the study of false memories caused by stereotypes by Araya et al. (2003).

1.1. Literature Review

As a widespread phenomenon, false memory has attracted extensive research in psychology. According to Deese (1959), recall is related to the strength of association. Roediger and McDermott (1995) continued to study the mechanism of false memory generation. They systematized Deese's (1959) experiment and proved that people would be induced to produce words that did not appear in a state of high association. Based on these results, the DRM paradigm was proposed (Deese, 1959; Roediger & McDermott, 1995). This paradigm helped study false memory generation under high semantic association.

After discovering that false memories are correlated with semantic contexts, psychologists began to study their manifestation in social situations. Stereotypes have been widely discussed as a social association mechanism. Fyock and Stangor (1994) found that participants were more likely to remember stereotype-congruent information, even if it had never appeared. Macrae et al. (1994) found that stereotypes simplified information processing, especially under high cognitive load. Stereotypes provide a framework for complex memories and cause people to fill in blank information, thus inducing false memories. Even people with low stereotypes find it difficult to avoid this behavior (Dunning et al., 1997).

Araya et al. (2003) confirmed this through different stereotype priming manipulations, proving that stereotypes affect memory processing and lead to false memories.

Psychology is often labeled with social stereotypes due to its interdisciplinary nature. Brinthaup et al. (2016) found that psychology students often hear stereotypes about psychology, mostly directed at the discipline. Supporting this, Lilienfeld (2012) reviewed psychology stigma and suggested it may cause distortions in memory processing and recall.

In addition to social stereotypes, memory accuracy can be regulated by intentional control. Sahakyan and Kelley (2002) showed that under "remember" or "forget" instructions, participants' mental context changed, resulting in a directed forgetting effect. Araya et al. (2003) found that forgetting instructions interacted with stereotypes to produce false memories.

However, no experiment has confirmed the link between psychology stigma and false memory. Therefore, based on Araya et al. (2003), this experiment replaced immigrant stereotypes with psychology stigma to explore false memory in this context.

1.2. Research Questions

The experiment used a 2 (word type: stereotype-consistent vs. non-stereotype) $\times$ 2 (priming condition: psychology vs. neutral) $\times$ 2 (memory instruction: remember vs. forget) mixed factorial design to explore how memory instruction and stereotyping affect false memory. The participants were asked to perform word memory and recognition tasks under different semantic contexts and instructions.

In this study, there are some research questions:

1. Does Word Type have any effect on word false recognition rate?
2. Does Instruction have any effect on word false recognition rate?
3. Is there an interactive effect between instruction and priming?
4. Is there a triple interaction effect among Instruction, Priming, and Word Type?

1.3. Hypotheses

This design helps the experiment discuss the main effects of the three independent variables on the dependent variable word false recognition rate and the possible interaction effects between them. Based on the previous literature review and experimental purpose, the following hypotheses are proposed:

H1: Non-stereotypical words (non-psychology-related negative words) are more likely to be misidentified than stereotypical words (psychology-related negative words).

H2: Participants in the forget group show higher false recognition rates than those in the remember group.

H3: Under psychological priming conditions, the false recognition rate of the forget group is higher than that of the remember group.

H4: Under neutral priming conditions, there is no significant difference in the false recognition rate between the remember group and the forget group.

H5: Under psychological priming conditions, the false recognition rate of stereotype words in the forget group is higher than that of non-stereotype words, while under neutral priming conditions, this effect is insignificant or weakened.

2. Method

2.1. Participants

A total of 24 participants were collected in the experiment, all of whom were undergraduate students from Wenzhou-Kean University from 18 to 22, with an average age of 20.79, including 8 males and 16 females, who were evenly distributed into four groups, with three females and two males in each group. This study adopted the snowball method of convenient sampling to collect participants.

2.2. Materials

The materials used in this experiment mainly included 24 words for memory tests, which can be divided into three parts.

The first part contains ten negative words related to psychology, which were selected based on the study of Brinthaup et al. (2016). This study explored the differences in beliefs about psychology degrees and stereotypes between psychology college students and non-psychology college students. Among them, they used the Likert scale in the experiment to show students' recognition of various psychological stereotypes. Based on this, my experiment summarized the content of the scale. It diluted the extracted keywords to avoid the subjects recalling words only through themes instead of memory in the recognition stage, thereby improving the experiment's validity. Ten words related to negative stereotypes of psychology disciplines were finally used in the experiment, including Unreliable, Biased, Folk wisdom, Simplistic, Ambiguous, Intrusive, Overthinking, Superstitious, Petty, and Temperamental.

The second part is ten negative words related to other university subjects. This part of the words mainly comes from Archer et al. (2010). They conducted a five-year study on the definition of science and scientist by primary school students. In their experiment, many interviews were involved, and many primary school students mentioned their negative impressions of some subjects in the interviews. By sorting out and summarizing these contents, ten negative words unrelated to the discipline of psychology were obtained, including Tedious, Empty, Tiresome, Obsolete, Narrow-minded, Redundant, Uneventful, Undemanding, Unrelated, and Unrealistic.

Four buffer words were also used in the experiment: Pencil, Window, Table, and Carpet. They are all nouns that appear frequently in daily life without any emotional connotation.

2.3. Procedure

The experiment was conducted one-on-one in an empty classroom. Participants signed an informed consent form and were divided into four groups by drawing lots. This study employed a 2 (Priming Types: Psychology, Neutral) x 2 (Instruction Types: Remembering, Forgetting) between-subjects factorial design, with Word Type (Stereotype vs. Non-stereotype) as a within-subjects factor, resulting in four experimental conditions. Subsequently, participants assigned to the psychology priming groups were asked to answer three keywords related to psychology, and participants assigned to neutral priming were asked to answer three keywords related to general university subjects. Afterward, participants saw a piece of paper with 12 words and were asked to study within 20 seconds. These included five negative words related to psychology and five negative words related to non-psychology subjects. The order of the ten words was shuffled, and two buffer words were placed at

the beginning and end, respectively. After completing the memory, participants assigned to the remembering instruction group were asked to remember the 12 words, and participants assigned to the forgetting instruction group were asked to forget the 12 words. After that, all participants did ten four-digit math problems to reduce the short-term priority effect and repetition effect. Afterward, the participants were given a paper of 24 words and were asked to circle the 12 words they had learned before within 30 seconds. The 24 words included the original 12 words, five newly added psychology-related negative words, five newly added psychology-irrelevant negative words, and two newly added buffer words. The four buffer words appeared at the beginning, and the end, and the order of the 20 words in the middle was disrupted. After completing the experiment, the participants were informed through debriefing that the real purpose of the experiment was to explore whether different priming and instructions would induce errors in memory.

2.4. Method of Data Analysis

The experiment employed a 2 (Prime: Psychology vs. Neutral) $\times$ 2 (Instruction: Remember vs. Forget) between-subjects design, with Word Type (Stereotype vs. Non-stereotype) as a within-subjects factor. Data were analyzed using a 2 $\times$ 2 $\times$ 2 mixed-design ANOVA conducted in SPSS.

2.5. Ethical Considerations

After submitting the IRB documents, this experiment was judged to be in the category of Exempt Research. The risk was relatively low as the task only involved basic recall. All participants were aware of the risks involved in the experiment and signed informed consent before participating. The data of this experiment strictly abided by the principle of confidentiality, and only researchers had the right to access these data. All participants received a debriefing after the experiment and knew the whole purpose of the experiment.

3. Results

3.1. Experimental Design

This experiment used a 2 $\times$ 2 $\times$ 2 factorial design, involving three independent variables, including priming type (psychological priming, neutral priming), memory instructions (remember instructions, forget instructions) and word types (stereotype words, non-stereotype words). The main dependent variable of interest was false recognition rate, that is, the proportion of participants who mistakenly recognized new words that were not presented as learned words. The false recognition rate was calculated for stereotype words and non-stereotype words respectively, and the denominator was the number of new words in this category (a total of 5). The 24 participants were divided into four groups, each with 6 people (2 males and 4 females). This experiment used a 2 $\times$ 2 $\times$ 2 mixed ANOVA to examine the main effects and interaction effects of word type, priming type, and memory instruction on the false recognition rate.

3.2. Main Effects

Table 1. ANOVA Results for Main Effects

Effect	$F(1, 20)$	p	Partial η^2
Word Type	3.72	.068	.157
Prime Type	0.03	.871	.001
Memory Instruction	0.68	.421	.033

Table 1 showed the main effects of the word type, prime type, and memory instruction on the false recognition rate. The main effect of word type was marginally significant, $F(1, 20) = 3.72$, $p = .068$, partial $\eta^2 = .157$. Participants made fewer false recognition rate for stereotype words ($M = 0.18$, SD

= 0.19) than for non-stereotype words ($M = 0.26$, $SD = 0.16$). The main effect of prime type was not significant, $F(1, 20) = 0.03$, $p = .871$, partial $\eta^2 = .001$.

There was no significant difference in the false recognition rate between the psychological priming group ($M = 0.23$) and the neutral priming group ($M = 0.23$). The main effect of memory instruction was also not significant. However, the forget group showed a higher-level false recognition rate ($M = 0.24$) compared to the remember group ($M = 0.20$).

3.3. Interaction Effects for Two Factors

Table 2. Interaction Effects ANOVA Results

Interaction	$F(1, 20)$	p	Partial η^2
Prime $\times$ Instruction	7.81	.011	.281
Prime $\times$ Word Type	7.75	.011	.279
Instruction $\times$ Word Type	0.05	.833	.002

A $2 \times 2 \times 2$ factorial ANOVA showed two significant interaction effects (Table 2), Prime $\times$ Instruction, $F(1, 20) = 7.81$, $p = .011$, partial $\eta^2 = .281$, and Prime $\times$ Word Type, $F(1, 20) = 7.75$, $p = .011$, partial $\eta^2 = .279$. The interaction effect of Instruction $\times$ Word Type was not significant, $F(1, 20) = 0.05$, $p = .833$, partial $\eta^2 = .002$.

Table 3. Simple Main Effects of Instruction Under Different Prime Conditions

Prime Type	$F(1, 22)$	p
Psychology	6.54	.019
Neutral	1.95	.178

Table 4. Simple Main Effects of Word Type Under Different Prime Conditions

Prime Type	$F(1, 22)$	p
Psychology	3.48	.076
Neutral	1.8	.193

Among them, the Prime $\times$ Instruction interaction effect in the psychological priming group was significant (Table 3), $F(1, 22) = 6.54$, $p = .019$, while the Prime $\times$ Instruction interaction effect in the neutral priming group was not significant, $F(1, 22) = 1.95$, $p = .178$, partial $\eta^2 = .09$. The Prime $\times$ Word Type interaction effect in the psychological priming group was marginally significant (Table 4), $F(1, 22) = 3.48$, $p = .076$, while the Prime $\times$ Word Type interaction effect in the neutral priming group was not significant, $F(1, 22) = 1.80$, $p = .193$. For the interaction effect of Instruction $\times$ Word Type, both in the remember and forget condition, participants showed higher false recognition rate for non-stereotyped words ($M = 0.23$, $SD = 0.12$, $M = 0.28$, $SD = 0.20$)

3.4. Interaction Effects for Three Factors

Table 5. Three-Way ANOVA Result for the Interaction of Prime, Instruction, and Word Type

Interaction	$F(1, 20)$	p	Partial η^2
Prime $\times$ Instruction $\times$ Word Type	0.41	.528	.020

The interaction effect of Prime $\times$ Instruction $\times$ Word Type was not significant (Table 5), $F(1, 20) = 0.41$, $p = .528$, partial $\eta^2 = .020$.

The forget group had the highest false recognition rate for non-stereotype words under the psychological priming condition ($M = 0.40$). In psychological priming condition, the forget group

had a higher false recognition rate for all words ($M = 0.32$) than the remember group ($M = 0.13$). In contrast, under the neutral priming condition, the remember group had a higher false recognition rate ($M = 0.27$) than the forget group ($M = 0.17$). These differences, however, were not statistically significant.

4. Discussion

4.1. Interpretations

In the prediction of H1, stereotype words (negative words related to psychology) would be more likely to be misidentified than non-stereotype words (negative words unrelated to psychology). The data results show that the main effect of word type was marginally significant, $p = .068$. Contrary to the prediction, the misidentification rate of non-stereotype words ($M = 0.26$) was higher than that of stereotype words ($M = 0.18$). Therefore, H1 is rejected.

In the prediction of H2, the word false recognition rate of the forgotten group would be higher than that of the remembered group. According to the data results, although the mean recognition error rate of the forgot group ($M = 0.24$) was greater than that of the remember group ($M = 0.20$), the difference was not significant, $p = .421$. Therefore, H2 is rejected.

In the prediction of H3, under the psychological priming condition, the forget group will have a higher false recognition rate than the remember group. The results show an interaction effect between prime and instruction, $p = .011$. In the psychology priming group, the interaction effect was significant, $p = .019$, and the mean of the forget group ($M = .32$) was much higher than that of the remember group ($M = .13$). Therefore, H2 is supported and can be accepted.

In the prediction of H4, there would be no significant difference in the false recognition rate between the remember group and the forget group under the neutral condition. Although the interaction effect between Prime and Instruction showed a significant difference, $p = .011$, the difference was not significant under the neutral condition, $p = .178$. Therefore, H4 was supported and accepted.

In the prediction of H5, under the psychological priming condition, forgetting the instruction would more strongly induce the false recognition of stereotype words, while under the neutral priming condition, this effect would be insignificant or weakened. The results showed that Prime $\times$ Instruction $\times$ Word Type's triple interaction effect was not significant, $p = .528$. Therefore, H5 was rejected.

It is imperative to emphasize that although there is no hypothesis for the interaction effect between Prime and Word Type, the data results show that the interaction effect between the two was significant, $p = .011$. Based on this result, an exploratory analysis was conducted, and the results showed that under the psychological priming condition, the effect of word type was marginally significant, $p = .076$, indicating that there may be differences in the false recognition rate of stereotype words and non-stereotype words. However, under the neutral condition, the difference was not significant, $p = .193$.

4.2. Hypothesis Evaluation

This study proposed five hypotheses to explore the effects of priming type, memory instructions, and vocabulary type on vocabulary misrecognition rate. The results showed that only two hypotheses, H3 and H4, were statistically supported, and the other three were not confirmed. H3 showed that forgetting instructions under psychological priming conditions enhanced false memory, while H4 showed that instructions had no effect under neutral priming conditions. It should be mentioned that H1 was that stereotype words were more likely to be misidentified. However, the experimental results were contrary to the hypothesis. H2 and H5 were not statistically supported. All three hypotheses were rejected. However, in the experiment of Araya et al. (2003), a triple interaction effect was confirmed, which is inconsistent with the results of H5 in this experiment.

4.3. Implications

The results of this experiment partially support the conclusions of the original experiment on stereotypes and false memories (Araya et al., 2003). The results showed that the participants had a higher false recognition rate for non-stereotyped words than for stereotyped words. This may be because words with high semantic associations activate memory defense mechanisms, making participants more cautious in choosing stereotyped words. This phenomenon suggests that there may be a potential new memory processing mechanism.

In addition, priming and instructions can affect memory under interactive conditions. Under psychological priming conditions, forgetting instructions significantly increased the false recognition rate of words, while this phenomenon was not evident under neutral conditions. This shows that in specific semantic and social situations, directed forgetting instructions can affect the subjects' memory, indicating that memory processing can also be affected by external information.

4.4. Limitations

This experiment has many limitations. First, the overall sample size of this experiment was too small ($n = 24$). And the imbalance between men and women may impact the experimental results and limit the discovery of the triple interaction effect. This may lead to unstable statistical effects and limit to detect the interaction effects. Second, more than half of the participants in this experiment are psychology majors, and they may be more familiar with psychological stereotype words, which may affect the event's results. Third, when statistically analyzing the experimental data, it was found that the word *Unrealistic* was misidentified by 15 of the 24 participants. This may be because the word itself is highly ambiguous. Fourth, participants reported that the difference between some stereotype words and non-stereotype words was not noticeable. Even though this experiment has tried to control the word as much as possible, and all words are from related studies, some words are still highly confusing, which may affect the memory processing of participants. Finally, the experiment did not test the memory ability of the participants, which led to significant individual differences between the participants. The experiment did not control participants' memory ability, which may cause personal ability to affect the experimental results.

4.5. Future Direction

In the future, we can continue to study the defensive mechanisms caused by false memory induction and explore the possibility of more memory processing mechanisms. At the same time, the experiment can further expand the sample size and achieve a balance between male and female participants. Secondly, the experiment can further standardize the words used and delete strong interference words. In addition, the experiment can also try to introduce more variables, including answer time, to obtain more detailed data. Finally, the experiment can further study the public's stigma against psychology to explore the relationship between stereotypes and memory.

5. Summary

This experiment found that context and directed forgetting can affect the pattern of memory processing, and there will be an interactive effect between context and directed forgetting. This experiment expanded the understanding of the memory processing mechanism.

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