

# Memory Conjunction Error: Effects of Semantic Relatedness between Study and Test Compound Words and Warning against False Positives

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## Abstract

A memory conjunction error (MCE) is said to occur when a novel test item composed of parts of previously studied items is falsely recognized as old. This study investigated the effects of warning against false positives and the semantic relatedness between study and test items on the magnitude of the MCE. Results indicate that while the MCE depends critically on the semantic relatedness, warning in itself is not of much help in preventing the MCE, suggesting that conjunction occur at an early stage of memory processes, probably at the time when study items are presented.

**Keywords:** memory conjunction error; warning against false positives; semantic relatedness.

## Introduction

A memory conjunction error (MCE) is said to occur when a novel test item composed of parts of previously studied items is falsely recognized as “old” (i.e., having been previously presented) (e.g., Reinitz, Lammers, & Cochran, 1992). Using Japanese compound words of four Kanji characters that are composed of two words of two Kanji characters, Kato, Kuniyama, Maruya, and Tawaramoto (2000) investigated the role of the semantic relatedness between study and test compound words in the occurrence of the MCE.

The results of their experiments show (1) that study and test compound words need be semantically related in order for sizable MCEs to occur, and (2) that such semantic relatedness can still make a significant difference in the magnitude of the MCE even when study compound words are presented together to increase perceptual priming for conjunction. These results are consistent with the claim that the MCE is more likely to occur in memory tasks involving a conceptual, rather than perceptual, component (e.g., Reinitz & Demb, 1994).

The purpose of the present study was to investigate the effect of warning against “false positives” (i.e., false recognition of novel test items as old) on the magnitude of the MCE. One particular interest was to see whether the effectiveness, if any, of such warning might depend on the strength of the semantic relatedness between study and test compound words. It might be the case that warning could be effective in reducing MCEs only for those test compound words that are barely or moderately related to corresponding study compound words. When study and test compound words are highly related, memory conjunction might be so

potent that warning would have little effect in preventing false positives to novel test compound words.

## Method

### Participants

A total of 144 undergraduate students participated in the experiment for partial course credit. They were randomly divided into three groups of 48 participants each and assigned to one of the three warning conditions described below.

### Materials and design

The experimental stimuli were the same as those used in the Kato *et al.* (2000) study. They were 80 common Japanese compound words of four Kanji characters, each composed of two common words of two Kanji characters. These 80 compound words were chosen to create 16 sets of five (one test and four study) compound words that met two critical requirements. One was that the first two Kanji characters of the test compound word be the same as those of two study compound words and the last two Kanji characters of the test compound word be the same as those of the remaining two study compound words. The other requirement was that the test compound word be semantically related to only one of the two study compound words containing the same first two Kanji characters and only one of the other two study compound words containing the same last two Kanji characters.

There were four memory test conditions where test compound words were presented as novel items to probe the occurrence of false positives (or MCEs in the present study). In three of such false positive conditions, the presentation of a test compound word from a given set was preceded by the presentation of two study compound words from the same set, one containing the same first two and the other containing the same last two Kanji characters of the test compound word. Three levels of the semantic relatedness between the test and its study compound words were defined depending on whether neither (Low), either (Medium), or both (High) of the study compound words were semantically related to the test compound word. One remaining false positive condition was a control condition (UnP) where test compound words were presented without prior presentations of their corresponding study compound words. For each participant, two test compound words were assigned to each of the four false positive conditions.

There was also a memory test condition where study compound words were presented again at test to probe correct recognition of old items (i.e., hits). Their corresponding test compound words were not presented under this memory test condition.

### Procedure

At study participants were presented with 24 compound words in such a way that two study compound words from a given set were displayed together (one above the other) on the computer monitor for the duration of three seconds. They were asked to choose one that they thought appeared more frequently in everyday life.

Immediately following the study phase, participants were given the recognition memory test where they were presented with 20 compound words, one at a time, and were asked to judge whether they remembered having seen them during the preceding task.

One group of participants was warned that there might be some compound words that were partly similar to those presented at study (Weak Warning). The second group was given stronger warning such that there might be some compound words that were partly similar to those presented at study but that they should respond positively only if test items were completely identical to study items (Strong Warning). The third group was a control group to which no explicit warning against false positives was given (No Warning).

The presentation order of the compound words was randomized for both the study and the test phases across participants.

### Results and Discussion

Shown in Table 1 are proportions of hits and false positives as a function of the strength of warning against false positives and the semantic relatedness between study and test compound words. It is clear that the rates of false positives were much higher when parts of the test compound words had been presented at study (i.e., Low, Medium, and High) than when they had not (i.e., UnP) and that such MCEs increased as the semantic relatedness increased from Low to Medium and to High.

Table 1: Proportions of hits and false positives as a function of the strength of warning and semantic relatedness.

| Warning | Hits | False Positives |                      |        |      |
|---------|------|-----------------|----------------------|--------|------|
|         |      | UnP             | Semantic Relatedness |        |      |
|         |      |                 | Low                  | Medium | High |
| No      | .73  | .02             | .24                  | .33    | .41  |
| Weak    | .76  | .00             | .24                  | .39    | .43  |
| Strong  | .74  | .02             | .18                  | .24    | .38  |

A 3 (levels of warning) x 3 (levels of semantic relatedness) two-way analysis of variance applied to the false positive data showed that while the main effect of the semantic relatedness was significant:  $F(2, 282)=13.31, p<.0001$ , that of the warning failed to reach the significance level:  $F(2, 141)=2.24, p>.1$ . There was no significant interaction between the strength of the warning and the semantic relatedness:  $F<1$ .

As in the Kato *et al.* (2000) study, the results in the No Warning condition indicate that study and test compound words need be semantically related in order for sizable MCEs to occur. Both the levels and the patterns of the MCEs as a function of the semantic relatedness were comparable to those obtained in the Kato *et al.* study.

Warning against false positives does not seem to significantly reduce the occurrence of the MCE. Although the stronger warning appears to reduce MCEs, especially for the test compound words in the Medium condition of the semantic relatedness, neither the main effect of the warning levels nor the interaction between the levels of the warning and the semantic relatedness was found to be significant. Also, there was no significant difference in the hit rates between the warning levels:  $F<1$ . These results indicate that no significant shift occurred in the recognition-judgment criteria among the warning conditions.

Although Lampinen, Odegard, and Neuschatz (2004) showed that warnings could reduce MCEs, they “had to” go further into explicitly disclosing to participants the deceptive nature of the memory conjunction paradigm. It seems safe to say that while the MCE depends critically on the semantic relatedness between study and test compound words, warning against false positives in itself is NOT of much help in actually preventing the MCE, suggesting that conjunction occur at an early stage of memory processes, probably at the time when study compound words are presented.

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