Behavioral and EEG Indicators of True versus False Memory

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Background

False Memories, the Deese-Roediger-McDermott (DRM) Paradigm, and Psychophysiology

The Deese-Roediger-McDermott (DRM) paradigm [4] is one prominent approach to study the "false-memory" phenomenon. Here, the presence of a catch word ("lure") is crucial for the recognition of unlearned words. Furthermore, previous studies were affected by single-item effects; a randomized categorical design was desirable.

Methods

Subjects

44 students (11 f, 13 m, age 24.4 ± 2.9 y, various faculties)

Stimuli and design

New scenic, pictorial stimuli (50% photographic, 50% by SceneCaster), 20 scenes; 1 lure and 3 controls plus 1 unrelated item per scene. Categorical design (randomized choice of the "lure" item out of 4 items within each scene, balanced across subjects). Within-subject manipulation of "gist" vs. "verbatim" attentional focus for encoding.

Procedure

Phase 1: encoding phase (presentation of 20 scenes for 55 seconds each, with cover story and pseudo-task) Phase 2: retention phase (Tellegen Absorption Scale and EEG preparation) Phase 3: retrieval phase (serial presentation of 2 x all 100 items, see figure 2, duration: 4 sec., SOA 5.6-6.0 sec.; yes-or-no answer) Phase 4: level of confidence rating (self-paced serial presentation of all 100 items, 7-step rating scale)

Recording and data analysis

Behavioral: memory accuracy; reaction time; level of confidence. Physiology: 15-channel EEG; reference: linked mastoids; sampling: 500 Hz; filter: 0.15-30 Hz; 2-channel EOG. Analysis: ANOVA for behavioral data; t-test and bootstrapped amplitude difference [5] for ERPs.

Results

Behavioral data

Figure 3: percentage of "yes" answers

Reaction time

Figure 4: reaction time with "yes" answers

Event-related potentials

Grand average of ERPs at Pz electrode site

Figure 7: rejected lures (red) vs. rejected unrelated items (black)

Figure 8: false memories (accepted lures, red) vs. true memories (accepted controls, black)

Discussion

1. The DRM study used a categorical design with new, scenic pictorial stimuli. Recognition rates indicated a good performance of the item set and design. Level-of-confidence ratings suggest that the typical "yes-or-no" answers in the DRM retrieval phase provide a shortened view on false memories.

2. Higher memory accuracy, faster responses and higher levels of confidence in the "verbatim" than in the "gist" condition were found, which would be in line with the Fuzzy-Trace Theory. Furthermore, memories tended to be more accurate for stimuli composed of photographic elements than for virtual images, although the latter were less complex.

3. ERPs differed between the two different types of "correct rejections" (i.e. schematically associated lures or unrelated items), which reflects the processing of different tasks. Contrary to our expectation however, ERP differences between true and false memories were not significant. ERPs in this study did not allow for a differentiation between recollection and familiarity.

Leading Questions:

1. Are true and false memories for details of visual scenes accompanied by different event-related potentials?

2. Is the DRM effect sensitive to a) the attentional ("gist" vs. "verbatim") instruction for the encoding phase, and b) the (photographic vs. virtual) type of the pictorial stimuli?

References