Replication of

Memory's Penumbra:
Episodic Memory Decisions Induce Lingering Mnemonic Biases

by Duncan, K. / Sadanand, A. / Davachi, L. (2012)
in: Science, 337, pp. 485–487

Replication Authors:

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Duncan et al. (2012) investigate how people's memory formation and decisions are influenced by their recent engagement in episodic encoding and retrieval. Their findings suggest that the recent encoding of novel objects improve subsequent identification of subtle changes, a task thought to rely on pattern separation. Conversely, recent retrieval of old objects increases the subsequent integration of stored information into new memories, a process thought to rely on pattern completion.

Hypothesis to replicate and bet on:

Similar objects are more accurately identified as being similar if they are preceded by new objects than if they are preceded by old objects (a comparison of the fraction of objects rated as similar in trials where they are preceded by new objects compared to trials where they are preceded by old objects in Study 1b (within-subject variation), $t(14) = 3.41$, $p = 0.0042$, p. 486).

Power Analysis and Criteria for Replication: First Data Collection

The original sample size is 15 participants and the standardized effect size measured as the correlation coefficient (r) is 0.674. To have 90% power to detect 75% of the original effect size, a sample size of 36 is required. The criteria for replication are an effect in the same direction as the original study and a p-value < 0.05 (in a two-sided test).

Power Analysis and Criteria for Replication: Second Data Collection

If the original result is not replicated in the first data collection, a second data collection is carried out. To have 90% power to detect 50% of the original effect size in the pooled sample (first and second data collection), a sample size of 92 is required, i.e., a sample size of 56 in the second data collection is required. The criteria for replication are an effect in the same direction as in the original study and a p-value < 0.05 (in a two-sided test) in the pooled data.

Sample

The sample in the first data collection consists of 36 undergraduate students from the University of Innsbruck. If the original result is not replicated in the first data collec-

tion (two-sided *p*-value < 0.05 in the same direction as the original study), a second data collection consisting of 56 additional students from the University of Innsbruck will be carried out such that the pooled sample size is 92.

Materials

We use the material (software and pictures) of the original experiment programmed in MatLab along with the original instructions which have been made available by the authors. As the replication study is conducted in German, all materials from the original study are translated from English to German.

Procedure

We follow the procedure of the original study, with only slight but unavoidable deviations as outlined below. The following summary of the experimental procedure is therefore based on the section "Supporting Materials and Methods" (pp. 1–2) of the Supplementary Information. As Experiment 1a was only used in order to validate the task, only Experiment 1b is replicated.

Participants are presented with a series of objects on a computer screen and are asked to identify each object as new (first presentation), old (exact repetition), or similar (a modified version of a previously presented object) with a right handed button press (J, K, and L keys on a standard keyboard). The three response options appear on the bottom of the screen in the same order as the response keys. Each object is presented for 1500 milliseconds, during which participants make their response.

Participants are recruited via the subject pool of the Innsbruck EconLab and are invited to the experimental session one-by-one. At the beginning of the experimental session, participants are given written and oral in-structions about what constituted a similar object, followed by 12 practice trials containing examples of all trial types.

During the experimental session, participants view 676 new trials. Of these, 76 are never shown again, 200 are repeated (old trials) and 400 are presented again in a manipulated form (similar trials). The 1276 trials are split into 4 blocks of equal length, and participants are given a break between each block. Participants are also informed that there are no repetitions across blocks.

The probability of a similar trial following each trial type is constant (31%) such that participants are not able to make predictions about the upcoming trial. The probabilities of old (15–16%) and new trials (52–54%) following each trial type are controlled as well. A maximum of 5 new stimuli are presented in a row and the probability of a similar trial following a new stimulus in each of these positions is roughly equated.

Participants are run in pairs such that half of the participants see a given object as an old trial while the other half see the object as a similar trial. Additionally, six unique sequences of stimuli are generated and objects are randomly assigned to each condition such that across participants, there is no systematic relationship between a particular stimulus and the experimental condition.

Analysis

The analysis will be performed exactly as in the original study. That is, a matched-pair *t*-test is conducted to test for the difference in the fraction of objects rated as similar in trials where they are preceded by new objects compared to trials where they are preceded by old objects in Study 1b.

In the original study, similar trials were correctly identified as being similar when they were preceded by new trials in 67.6% while

only 61.7% were correctly identified as being similar when they were preceded by old ones. Based on a paired *t*-test, the difference between correctly identified trials following new and old ones is statistically significant with $t(14) = 3.41$ and $p = 0.0042$. The same test will be used in the replication study.

The results will first be estimated based on the first data collection. If the original result is replicated in the first data collection (a two-sided *p*-value < 0.05 in the same direction as the original study), the second data collection will not be carried out. If the original result is not replicated in the first data collection a second data collection will be carried out. The above statistical test will then be estimated for the pooled sample of the first and second data collection to test if the original result replicated (a two-sided *p*-value < 0.05 in the same direction as the original study).

Differences from Original Study

The replication procedure is identical to that of the original study, with some unavoidable deviations. The replication will be performed at the University of Innsbruck between September 2016 and September 2017, while the original data was gathered at New York University in 2010. The experiment will be conducted in German rather than in English (as the original study).

Participants in the original study have been incentivized by course credits. In contrast, monetary incentives will be used in the replication experiments with a flat payment of €15.00 per hour for each participant. Participants in the original study, on average, took about 75 to 90 minutes for the experiment. In order to comply with the terms of use of the Innsbruck EconLab, subjects are paid a flat participation fee of €20,00 for the experimental session of the replication experiment.

The original study contains three experiments: for the replication, the focus is only on testing for differences in the fraction of objects rated as similar in trials where they are preceded by new objects compared to trials where they were preceded by old objects in Study 1b.

Replication Results for the First Data Collection (90% power to detect 75% of the original effect size)

[To be added when replication experiments have been completed.]

Replication Results for the First and Second Data Collection Pooled (90% power to detect 50% of the original effect size)

[To be added when replication experiments have been completed.]

Unplanned Protocol Deviations

[To be added when replication experiments have been completed.]

Discussion

[To be added when replication experiments have been completed.]

References

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