Replication of

Some Consequences of Having Too Little

by Shah, A. K. / Mullainathan, S. / Shafir, E. (2012)
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Replication Authors:

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Shah et. al. (2012) study the effect of financial scarcity on decision making. The paper consists of five experiments where the authors explore this issue. The main hypothesis is that scarcity has an effect on how people allocate their attention, that one engages more when relevant constraints are closer to binding. The authors show that scarcity affects attention through a number of experiments, and argue that it could explain phenomena such as over-borrowing.

Following our protocol, we chose the first experiment that fulfills our criteria for replication, namely Experiment 1 in the paper (although it should be noted that the original authors argued that Experiment 1 is less central to the paper than Experiments 2–5 which test the prediction that scarcity will lead to over-borrowing). In Experiment 1, 60 subjects from Amazon Mechanical Turk (AMT) were randomly selected to be poor or rich and to be allowed to borrow or not. They played a "Wheel of Fortune" word guessing game, in which rich participants have more tries and then complete a task to measure their cognitive fatigue (the Dots-Mixed task). Under strict time pressure, subjects complete randomly varying congruent and incongruent trials and their accuracy is taken as a measure of cognitive fatigue. A simple model would predict that wealthy individuals are more fatigued since they have played the Wheel of Fortune game for longer and made more guesses. However, the authors find that poor participants performed worse than rich participants on the Dots-Mixed task in line with their hypothesis.

> **Hypothesis to replicate and bet on:**
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> Low-wealth subjects, that are given fewer chances to win in repeated "Wheel of Fortune" type word puzzle games, perform worse in a subsequent attention task (Dots-Mixed task) than do high-wealth individuals (a comparison of the mean performance on the Dots-Mixed task between the "poor treatment" and the "rich treatment"; ANOVA test, $F(1, 54) = 4.16$ and $p = 0.046$, p. 683).

Power Analysis and Criteria for Replication: First Data Collection

The original sample size was of 56 individuals, after excluding 4 subjects for having zero correct responses. The standardized effect size measured as the correlation coefficient (r) was 0.267. To have 90% power to detect 75% of the original effect size a sample size of 263 (after excluding subjects) is required. The criteria for replication is 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 of 339 (after excluding subjects) additional individuals will be carried out so that the total sample size is 602 (after excluding subjects), which gives 90% power to detect 50% of the original effect size.

If a second data collection is carried out, it will be tested if the original result replicates in the pooled sample of the first and second data collection. The criteria for replication is an effect in the same direction as the original and a p-value < 0.05 (in a two-sided test) in the pooled data.

Sample

The sample size in the first data collection consists of 263 individuals from AMT. If the original result is not replicated in the first data collection (two-sided p-value < 0.05 in the original direction) a second data collection of 339 additional individuals from AMT will be carried out so that the total sample size is 602 (after excluding subjects using the same exclusion criteria as in the original study). For the data collection we will use a new AMT Requester account.

Materials

We use the same website code as used in the original article. Only the consent form, which is the landing page of the web interface, was adjusted to the current study changing researcher info, etc.

Procedure

We follow the procedure of the original paper (with the exception of a higher compensation for completing the HIT). The show-up fee (or reimbursement for completing the HIT) will be $2.00 (rather than $0.35 as used in the original study). If necessary to recruit a sufficient number of participants the show-up fee will be increased. The whole experiment takes between 10 and 30 minutes depending on treatment.

This summary of the procedure is based on the summary on page 683 of the original article and page 2–3 of the supplementary material. First, the participants play a "Wheel of Fortune" word guessing game. Subjects are randomly assigned to be poor or rich (the "poor treatment" and the "rich treatment") and to either be allowed to borrow or not. Poor subjects have 6 guesses on letters for each round and rich participants have 20. Both types of players play 14 rounds. Subjects that are allowed to use credit can borrow guesses from future rounds at a cost of 3 future guesses for one guess in the current period ($R = 3$). Each successful round gives the player a point towards winning $10.00 Amazon gift certificates.

In the original experiment, 2 gift cards were awarded among 56 individuals, one was raffled among the poor and one among the wealthy participants. To keep the winning probabilities as close to the original experiment as possible, we will in the first data collection (second data collection) raffle 10 (12) gift cards; 5 (6) among the poor and 5 (6) among the wealthy participants (with the restriction that every participant can only win one gift card). Each point is converted into one lottery entry. As in the original experiments, subjects are not told about this procedure and are unaware of the actual winning probabilities.

Subsequently, to measure cognitive fatigue, the subjects then complete the Dots-Mixed task, in which they respond to symbols (green apples and limes) which appear on the screen, left and right of a fixation cross. In congruent trials (apples) participants press a key ("Q" on the left and "P" on the right) on the

same side as the symbol, and on incongruent (limes) ones a key on the opposite side is to be pressed. A total of 80 trials are displayed, 40 of each type, equally distributed to the left and right and in a random order. Each trial displays the fixation cross for 500ms before the symbol is presented for 750ms while the system awaits a keypress. It should be noted that just like in the original experiments subjects do not know that the Dots-Mixed task will follow the WOF until they reach this stage of the experiment.

The experiment will be in English as in the original study.

Analysis

The analysis will be performed exactly as in the original article (we will program the statistical analysis ourselves following the authors' instructions).

As in the original article, subjects that had no correct answers in the Dots-Mixed task (the attention task) will be removed. The mean correct answers in the Dots-Mixed task are then compared between the "poor treatment" and the "rich treatment" in an ANOVA test.

In the original article the mean performance on the Dots-Mixed task was 45.12 ($SD = 15.87$) in the "poor treatment" and 52.93 ($SE = 12.79$) in the "rich treatment" (after excluding four subjects with no correct answers); $F(1, 54) = 4.16$ and $p = 0.046$. The same test will be used in the replication.

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 esti-

mated 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 the same as that of the original study, with some deviations. The replication will be performed at AMT between September 2016 and September 2017, whereas the data in the original study was carried out at AMT in 2011. The consent form was also adjusted to the current study. The participation payment for completing the HIT was $0.35 in the original study and will be $2.00 in the replication, to be able to recruit a sufficient number of participants to the study. If necessary to recruit a sufficient number of participants the $2.00 show-up fee will be increased.

Instead of awarding 2 $10.00 gift cards among 56 participants as was done in the original study we will award 10 gift cards among 263 subjects in the first data collection and 12 gift cards among 339 participants in the second data collection. This keeps the winning probability similar, but not identical, to the original study.

The original paper contains five studies: for the replication the focus is only on Experiment 1.

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

Shah, A. K. / Mullainathan, S. / Shafir, E. (2012): *Some Consequences of Having Too Little*, Science, 338, pp. 682–685.