HABIT– Replication of the behavioral study in Tricomi et al., (2009). (#4844)

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1) Have any data been collected for this study already?
No, no data have been collected for this study yet

2) What's the main question being asked or hypothesis being tested in this study?
This study aims at a multi-site replication of the behavioral findings from Tricomi et al., (2009). Four laboratories will run the same paradigm to test whether overtraining instrumental responding in human participants can render the responding habitual, thereby becoming insensitive to outcome devaluation.

3) Describe the key dependent variable(s) specifying how they will be measured.
The experimental procedure involves four main parts: a snack selection, a free-operant task, an outcome devaluation procedure and an extinction test.

Snack selection phase
The main dependent variable will consist of forced choices between snacks. Participants will be presented with a selection of individual pieces of 6 snacks divided in two categories: sweet and savory. They will be asked to taste each sample and choose their favorite savory snack and their favorite sweet snack.

Free operant training phase
The main dependent variable will be key-pressing responses to fractal cues. These responses will be rewarded with two possible food outcomes (a sweet and a savory snack) to be consumed following the task. One group of participants will perform two training sessions on 1 day, whereas a second group of participants will perform four training sessions each day for 3 days. Each session will be divided into 12 task blocks and eight rest blocks. During the task blocks, a fractal image will be shown on the screen, along with a schematic indicating which button to press. Participants will be instructed to press the indicated button as often as they like; after each button press two possible outcomes could appear on the screen: either a gray circle, indicating no reward, or a picture of a sweet snack or savory snack, indicating a food reward corresponding to the picture. Different fractals and response keys will be paired with the two outcomes, and these stimulus–response–outcome associations will remain consistent throughout the experiment. A third fractal will indicate a rest block, during which participants will be instructed not to respond. Following the final session of training, one of the two food outcomes will be devalued.

Outcome devaluation procedure
The main dependent variable will be Likert-scale ratings of hunger (1, very full; 10 very hungry) and pleasantness (-5, very unpleasant; 5, very pleasant). These ratings will be collected prior to each day's training session and following the devaluation procedure. The devaluation procedure will occur through the selective satiation of one of the two food outcomes used in the free-operant task. As a control variable the amount of consumed food will be weighed.

Extinction phase
Finally, to test the effects of the devaluation procedure on behavior, an extinction session will be administered. The extinction test will be implemented in the same manner as for the free operant training sessions; however, no rewards will actually be delivered. Our key dependent variable will be calculated as follows: for each condition and each participant, we will calculate the responses per second in the last training block and in each of the three extinction blocks and then subtract the training press rate from the average press over the extinction blocks.

4) How many and which conditions will participants be assigned to?
We will have two factors with two conditions each:
1) A between participants factor consisting of the amount of training: 3-days vs. 1-day
2) A within participants factor consisting of the treatment to the associated food outcome: valued vs. devalued.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.
For the free-operant task the dependent variable will be calculated as the difference in the average press rate per second between the last training block and the extinction blocks. This will allow to control for baseline differences in the response rate when performing the tests of interest during the extinction phase. On this index, we will first run a repeated-measures ANOVA with participant as a random factor, food outcome (valued/devalued) as a within-participants factor, and training condition (1day/3day) as a between-participants factor. Secondly, we will run a t-test to confirm that the response rates for the devalued outcome decrease significantly more than for the valued outcome for the 1-day group. The same t-test will be run for the 3-day group, but we do not expect this to be significant. Thirdly, we will also use a t-test to show that during the extinction test, response rates for the devalued outcome decrease significantly more for the 1-day group than the 3-day group. The same t-test will be run for the valued outcome, but we do not expect

this to be significant. Finally, as a control, we will run t-tests to verify that the press rate during the last training session does not significantly differ between the two groups and the two food outcomes.

For the devaluation procedure, we will run a t-test to assess whether the pleasantness ratings from the beginning of the day's training significantly differ from after the devaluation of the valued versus devalued outcome. We will also perform two sets control t-tests: the first one to confirm that the pleasantness ratings for the valued food will not significantly differ between groups. The second one to control that both groups devalue equally well, by confirming that the changes in hunger and pleasantness of the devalued outcome will not significantly differ between the two groups.

6) Any secondary analyses?
A meta-analysis will be run on the results obtained by each one of the individual laboratories.

7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.
A power analysis based on the original study suggests that a sample of 22 participants (11 participants per group) is necessary to achieve a 90% power. Differently from the original study, we will run this experiment in a behavioral testing room and not in the fMRI scanner. We expect that this contextual difference will make habitual learning less robust. Therefore, each one of the four laboratories will run 60 participants (30 participants per group).

8) Anything else you would like to pre-register? (e.g., data exclusions, variables collected for exploratory purposes, unusual analyses planned?)
We will recruit participants who report that they like to snack, have no food allergies, are not currently dieting and that are willing not to eat for 6 hours prior to each day of the experiment; not complying with these instructions will be used as an exclusion criterion.
We will include the 26-item eating attitudes questionnaire (EAT-26): a cut-off of 20 will be used as an exclusion criterion to control for eating disorders.
In the demographic questionnaire, we will ask for weight and height, to account for the participants body mass index (BMI).