Function transformations of contingency components via stimulus-stimulus relations

Martin Finn, Matthias Raemaekers & Jan De Houwer

Ghent University

Experiment 3 preregistration

Author note

This work was funded by Ghent University grant BOF16/MET_V/002 awarded to Jan De Houwer.

Background

The purpose of the current experiments is to establish Crel and Cfunc functions for novel stimuli. The background for these experiments is provided in the preregistration document for Experiment 1 (https://osf.io/na2jp/). The current experiment – Experiment 3 – takes the form it does in response to the results from Experiments 1 and 2. The method and results from Experiments 1 and 2 are summarized below to contextualize the method for Experiment 3.

The procedures of Experiments 1 and 2 were highly similar. 20 participants completed training and testing of Crel and Cfunc functions in a novel bubble task. Participants were required to select between alternative bubble-clicking tasks that differed in the number of bubbles to be clicked within a time limit and the number of points each task returned for doing so. These between task differences in number of bubbles and points were indicated by four novel stimuli with the objective of establishing Crel and Cfunc properties for these stimuli such that they could indicate task differences involving more points, more bubbles, fewer points and fewer bubbles. Participants received points on any trial during which they successfully completed the bubble-clicking task. Importantly, when participant failed to successfully complete the bubble-clicking task they lost the number of points on offer during that task. For the purposes of monitoring performance, participant responses on a given trial were deemed accurate if they selected the pre-specified optimal task (e.g., more points, less bubbles, or more points and less bubbles than the alternatives) *and* successfully completed the subsequent bubble-clicking task. Experiment 2 differed from Experiment 1 in two respects. To increase the number of successfully completed trials relative to Experiment 1, the number of bubbles to be clicked in each task was reduced by one in Experiment 2. To make changes in the number of points easier to discriminate, the between task differences in the number of points was made larger in Experiment 2.

The training criterion (i.e., accuracy $\geq 17/20$ across the previous 20 trials) was met by 11/ 20 participants in Experiment 1, and 16/20 participants in Experiment 2. The testing criterion (i.e., accuracy $\geq$ 50/60) was met by 1/20 participants in Experiment 1, and 3/20 participants in Experiment 2. Failure to meet the testing

criterion could have resulted from failure to consistently complete the selected bubble-clicking tasks. However, 83% of bubble clicking tasks were successfully completed in the test phase of Experiment 1, and the corresponding figure from Experiment 2 was 90%. Failure to meet the testing criterion can be due to not consistently selecting the optimal task options (i.e., task options that, relative to the source, involved two increases in points, two decreases in number of bubbles, or an increase in points and a decrease in the number of bubbles). This is a plausible cause because in Experiment 1 participants selected optimal tasks in an average of 41% of test trials, which increased to 58% of test trials in Experiment 2. There is an apparent pattern in the choices deemed sub-optimal. When comparing the selected sub-optimal task options to the available task options, the selected task option could have involved more bubbles or offered fewer points than the alternatives. In trials where participants did not select the optimal task, participants more frequently chose tasks that offered fewer points than the alternatives than they chose tasks that involved more bubbles than the alternatives. That is, participants were more likely to avoid trials involving more points, than they were to avoid trials involving fewer bubbles. In Experiment 1 an average of 50% of chosen tasks offered fewer points than alternatives, and 31% of chosen tasks involved fewer bubbles than alternatives. In Experiment 2 an average an average of 33% of chosen tasks offered fewer points than alternatives, and 24% of chosen tasks involved fewer bubbles than alternatives. Note that failure to complete a bubble-clicking task resulted in the deduction of the number of points on offer for completing that task.

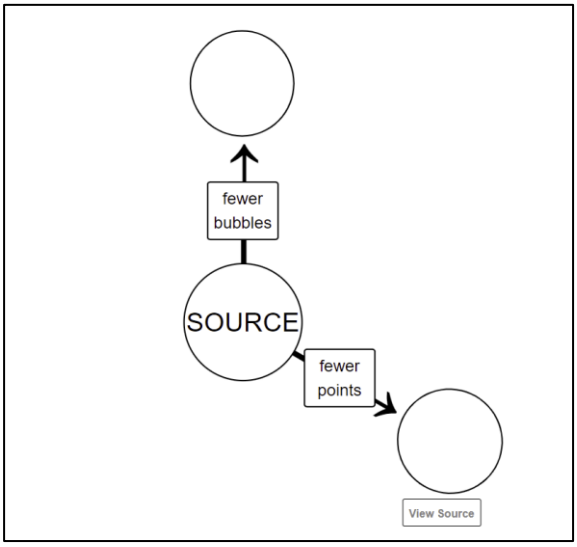
Participants choices reflect the fact that trials involving more points also involved a greater risk of losing points. Failure to select optimal tasks may also result from poor Crel and Cfunc control, or a failure to distinguish between the alternative task options.

Alterations

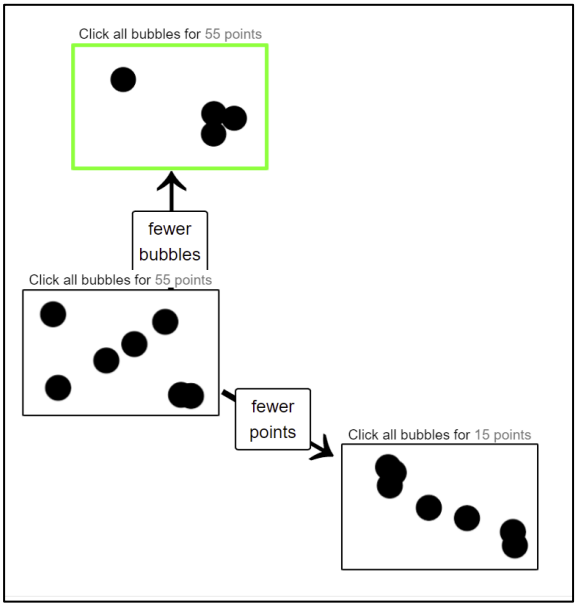
Experiment 3 will make three alterations relative to Experiment 2. The purpose of these alterations is to see whether participants will select the task-options deemed optimal under idealized conditions.

1. The same point loss contingency will be employed for all bubble-clicking tasks. Failure to complete a bubble-clicking task will result in the loss of 50 points, regardless of the task-option selected.

2. Natural language words will be used as Crels and Cfuncs in place of the symbols presented in the task in Experiment 2. The phrases "more points", "fewer points", "more bubbles", and "fewer bubbles" will be presented between task-options during training and testing (see right).



3. To help participants discriminate the difference between the task options post-choice feedback screen will be included (see right). This screen will be presented for between 3 and 10 seconds and can be terminated by participants by clicking a continue button after three seconds. The screen will display a miniature version of each of the alternative task options including the number of bubbles and the message indicating the number of points on offer. The task the participant has selected on the previous screen will appear within a green border.



Method

Sample

Data collection will be conducted online via Prolific Academic. Participants will be paid at a rate of £7.50 per hour.

Planned sample size & stopping rules

Data collection will stop when 20 participants have been exposed to Cfunc testing.

Inclusion criteria. English as a first language, between the ages of 18-65, 90% approval rating for previous studies on Prolific, no previous participation in similar studies from our research group.

Exclusion criteria. Incomplete data, responding "yes, exclude my data" on the self-exclusion question, or failing to complete any trial during the calibration.

IVs.

None.

DVs.

1. Response accuracy
2. Response time

Procedure

The procedure is designed to assess the efficacy of natural language stimuli in specifying derived transformations of functions. The procedure centers on the bubbles task described in the pre-registration document for Experiment 2. This version of the task involves three alterations from that procedure.

1. The natural language stimuli "more points", "fewer points", "more bubbles", and "fewer bubbles" will be employed as Crels and Cfuncs.
2. Failure to complete a bubble-clicking task will result in a loss of 50 points, and this is the same for all bubble-clicking tasks within the procedure.
3. In the training phase of the procedure, post-choice feedback will be presented for between 3 and 10 seconds after each selection screen. This feedback will not be presented during test phase trials.

Measures

All measures implemented in lab.js (Henninger, Shevchenko, Mertens, Kieslich, & Hilbig, 2019).

Statistics of interest

1. Number of optimal choices selected in training

2. Number of bubbles tasks successfully completed in training
3. Number of trials to complete Cfunc training
4. Number of participants successfully completing training
5. Number of optimal choices selected during testing
6. Number of bubbles tasks successfully completed during testing
7. Number of participants successfully completing the test phase (i.e., selecting the optimal choice in ≥ 50/60 (i.e., 83%) of test trials)

Hypotheses

H1. This procedure will produce accurate responding in the test of established Crels and Cfuncs.

Results

Analytic strategy

Data processing and exclusions. Data will be processed and analyzed in R.

Hypothesis test.

H1. The primary hypotheses will be investigated with a one sample t-test with a 50% null and a one tailed alpha of 0.05. We predict that participants responding will be at more than 50% accuracy. Note that the Crel and Cfunc test provides six response options. Thus, 16.7% accuracy is chance level responding. However, this represents a low bar for demonstrating stimulus control via Cfuncs, and so we adopt a higher null.

References

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