CONFIDENTIAL - FOR PEER-REVIEW ONLY

Image Inference – Reconstructing paths from indirect evidence (#36638)

Created: 03/02/2020 02:51 PM (PT)
Shared: 04/13/2021 06:48 PM (PT)

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?
In a previous study (see pre-registration #26990), we showed that people, when given indirect evidence that an agent was in a certain position in space (shown as a small pile of cookie crumbs in a gridworld), can infer where the agent came from and where they were going. We explained those previous findings through a computational model that generates probable actions under an assumption that agents navigate efficiently in space. In this experiment, we seek direct evidence for this assumption and we test if people can generate the full trajectory that an agent took based on the same indirect evidence.

After completing a brief tutorial (see Q8 for tutorial), participants will be presented with two-dimensional grid-worlds with three potential goals, and up to three labeled doors (see Q8 for stimuli; stimuli used are the same as in the previous study). Participants will be asked to infer the path the agent took to get from a door to a goal (see Q3 for details on how this is collected). The experiment consists of 23 trials presented in random order (see Q4 for design).

3) Describe the key dependent variable(s) specifying how they will be measured.
Participants draw the path they think the agent took by selecting the squares on the gridworld they think the agent walked through in a specific order. Stimuli will be presented on a computer and participants select the squares by clicking on them one at a time until a path from a door to a goal is made.

4) How many and which conditions will participants be assigned to?
All participants will complete all 23 trials in a random order.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.
We will analyze our data by comparing it to a computational model that jointly infers where agents entered, what goal they pursued, and what paths they took, by assuming that the agent was acting efficiently in space. Specifically, we will use this model to evaluate participant paths by computing the posterior probability of each path according to our generative model's inferences based on the observed position of the pile of cookie crumbs.

To evaluate the effectiveness of our model, we will compute the Bayes factor between (1) the posterior probability from our model and (2) the posterior probability from an alternative model that does not assume agents navigate efficiently in space. Instead, this alternative model assumes agents take actions according to a random walk (with the added constraint that agents cannot travel to their most recently visited state as they traverse the gridworld). Specifically, we will compute a Bayes factor for the participant path on each trial (within participants), and then average these values across all trials (within participants). Finally, we will compute a t-test with this distribution of Bayes factors, where our null hypothesis is that our model does not outperform the alternative model (indicated by a Bayes factor less than one). If our model does provide a better explanation for the participant paths than the alternative model, we should expect a Bayes factor significantly greater than one. We will use a standard alpha level of 0.05 to determine significance.

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.
After reading the task instructions, participants will complete a brief, six-question quiz. Participants that fail the quiz once will be redirected to the beginning of the instructions and asked to read them again. Participants who fail the quiz twice will not be included in the study. The quiz questions are listed below, with the correct answers in parenthesis:
1. How many corners is each person walking to?
(1) 2 3 Not sure
2. Do people always drop their cookie crumbs on their path to/from a corner?
(Yes) No Not Sure
3. Do people get to choose which door they walk through?
Yes (No) Not sure
4. Do people leave the room out of the same door they entered or the door closest to them?
(Same door) Closest Door Not sure
5. Can people move diagonally?
Yes (No) Not sure
6. What color are the walls?
White (Gray) Red Not sure

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.

Our sample size consists of 40 participants, not counting participants who fail the quiz more than once and are thus not eligible to participate. This sample size was determined by the sample size in a previous study (see pre-registration #26990).

8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

See the model predictions, procedure, and stimuli at:
https://osf.io/uj9mr/?view_only=4b8e2c5e697445c58a3f32dc25e55cb6