

Summary

- I presented my new experiment design and my pilot data on sequential multi-option decision making. The underlying interest is during value comparison, people don't simply register the value of each option and calculate a choice probability honestly according to their initial rating, instead, they do a pairwise comparison of values of the current option and the best seen option, and the winning option get a boost bonus in value and enters into the next rounds of competition. The pilot data shows a trend as in the simulated data.
- Feedbacks from the lab meeting: I should incorporate the recency and primacy effect in my model. Try to run simulation under these models and formally compare whether we need the default bonus, recency bonus and the primacy bonus.
- Also, I need to check whether there is a session related drift in my data, to see whether subject experience fatigue/boredom in the 3-hour experiment.

Decision-making under a sequential multiple-option choice frame

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(lab meeting 11/10/2017)

Introduction

- Understand how options are compared during decision making process is crucial.
- Former studies have identified that:
 - People's prior preference can shift the value comparison frame. Choice are based on the value comparison between the default option vs the alternative (*Lopez-Persem, eLife, 2016*).
 - People's preference might be shifted by their actions (e.g. choice). (*Vinckier, submitted*)
 - People demonstrate a bias towards the most recent presented options in sequential presentation (*results reported by S. Ballesta in C. Padoa-Schioppa's lab ; results in P. Domenech's lab*)
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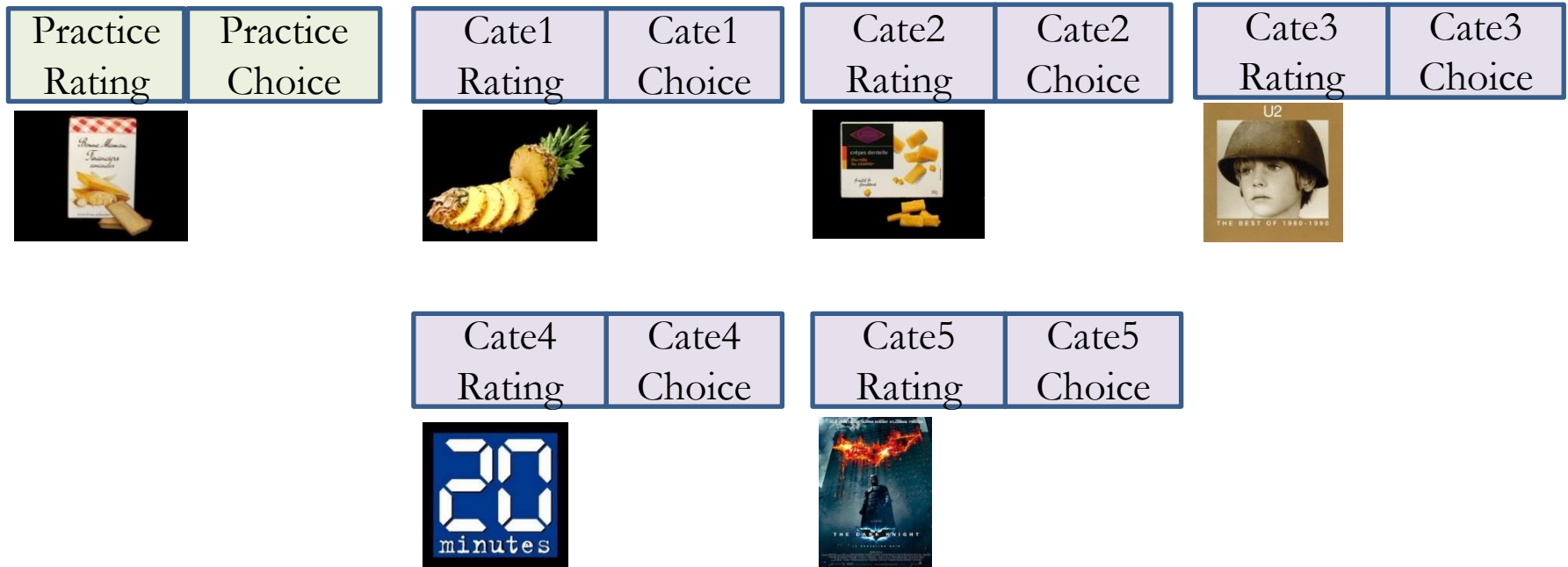
Questions of interest

- In sequential multiple-choice frame, is there a default option (temporary defined as *the best option the subject encounters so far*) serve as the reference option?
- Will there be interactions between option values and option sequences?
- How potential pre-commitment might modify people's preference and confidence report?

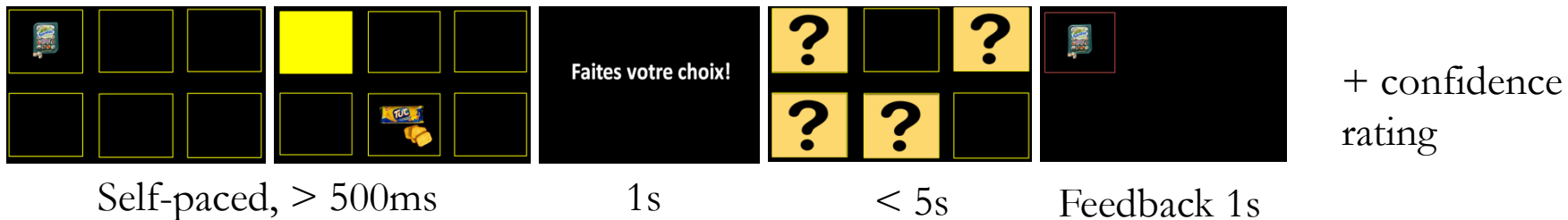
Hypothesis

- In sequential multiple option choice, instead of registering the value of each option and compare them at the end step base on Softmax rule, people will implement the value comparison in multiple steps (i.e. for n items, do $(n - 1)$ pairwise comparison).
- Each time a new option emerges, people will compare the new option with the current best option. Whichever option wins will get a bonus of pre-committed (implicit, compare to explicit choice action), and enters into the next round with augmented value.
- Therefore the final choice is based on the modified value after multiple pairwise comparisons instead of the initial reported ratings.
- The same advantages are predicted by response time and confidence report.

Task Structure



Per choice trial:



In each blocks:

Ratings: $3*3 + 4*4 + 5*5 + 6*6 = 86$ items per block

Choice: $3 + 4 + 5 + 6 = 18$ trials * 4 repetition = 72 per block

Hypothesis testing

- H0 $P_i = e^{\left(\frac{V_i}{\beta}\right)} / \sum_k^n e^{\left(\frac{V_k}{\beta}\right)}$
 $V_i = R_i$

$$P_i = e^{\left(\frac{V_i}{\beta}\right)} / \sum_k^n e^{\left(\frac{V_k}{\beta}\right)}$$

- H1- default:

$$V_t = R_i + \alpha * (N_{win} - N_{def}),$$

$$N_{def} = 1 \text{ or } 0,$$

Only update the win option and the current option .

$$P_i = e^{\left(\frac{V_i}{\beta}\right)} / \sum_k^n e^{\left(\frac{V_k}{\beta}\right)}$$

- H2- recency and primacy effect :

$$V_t = R_i + \alpha_r * (Rec) + \alpha_p (Pri),$$

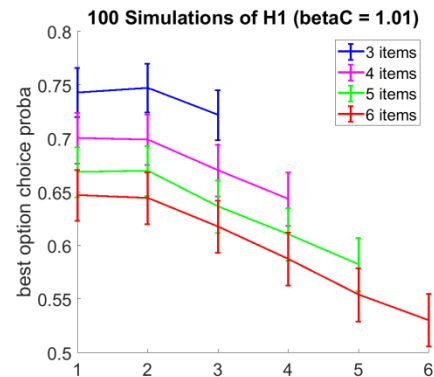
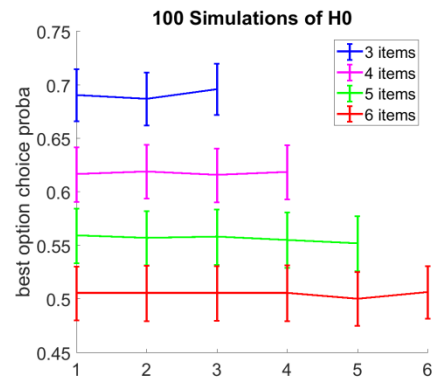
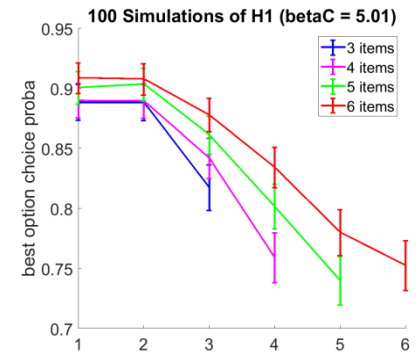
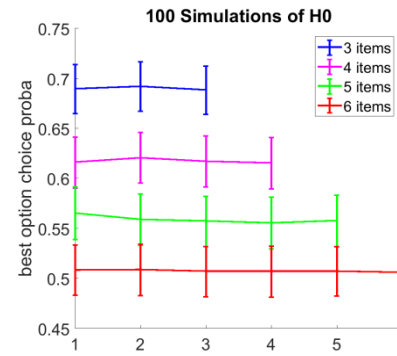
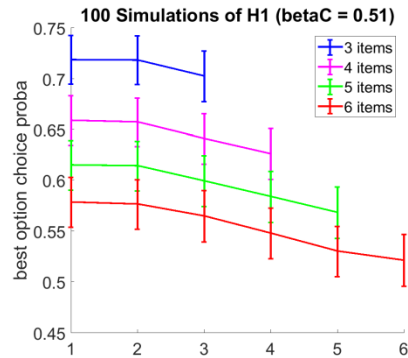
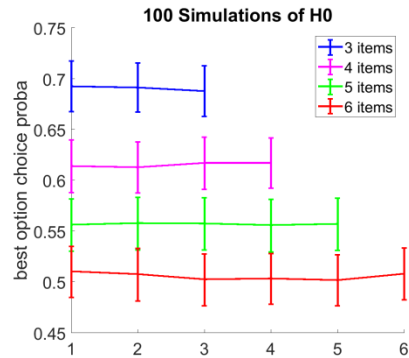
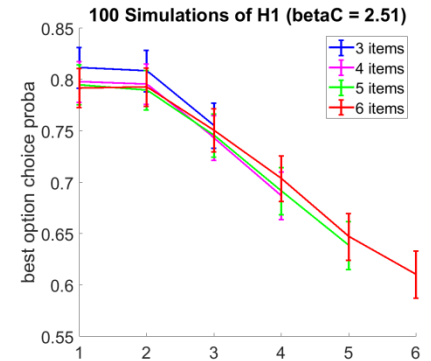
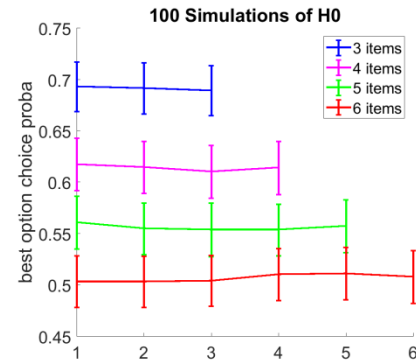
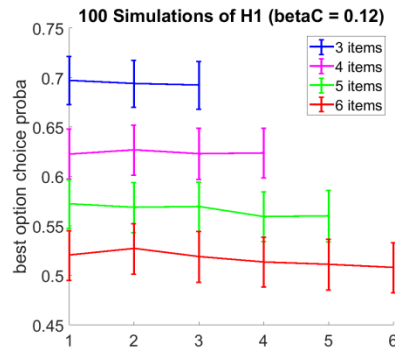
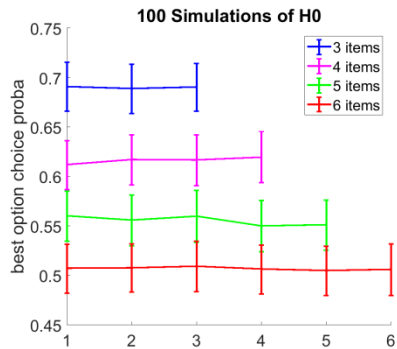
Rec: Recency effect, 1 if being the last one, otherwise 0.

Pri: Primacy effect, 1 if being the first one, otherwise 0.

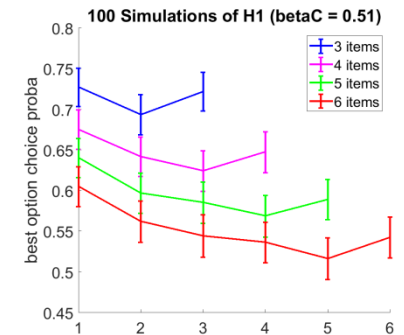
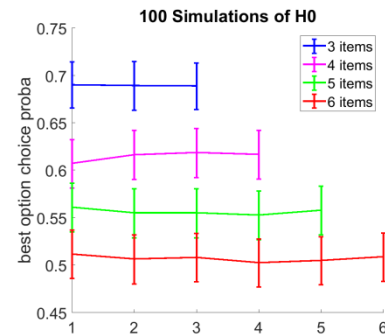
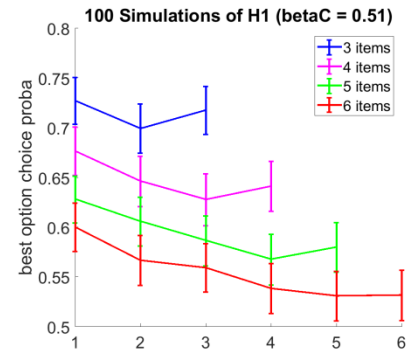
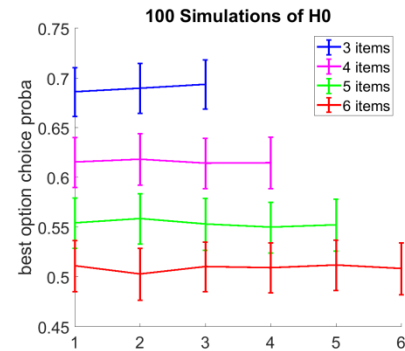
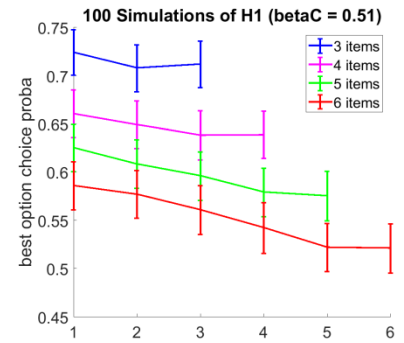
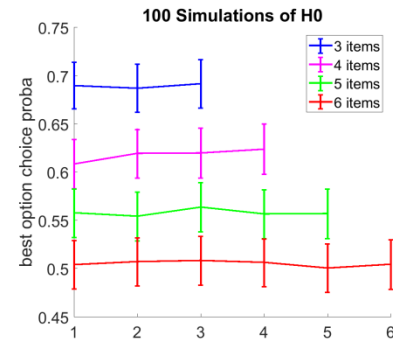
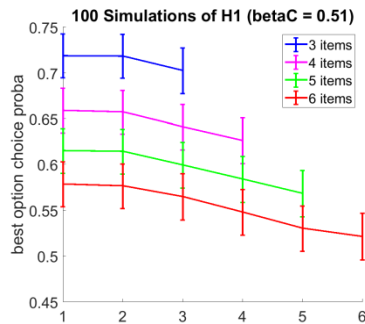
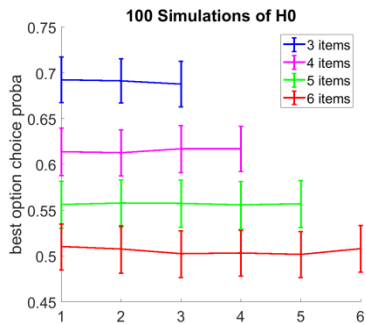
Task simulation

- Based on previous tasks using similar items, the ratings are simulated as uniformly distributed random integers from 0 to 100, with 10% attracted to the 0 point.
- Result set: 86 ratings *10 categories, 18 trials* 10 categories (24 subjects)
- Simulate the choice:
 - Using the **inverse temperature** from the previous study of DV on choice
 - Simulate a range of possible ‘**bonus for winning a comparison**’, ranging from 0.51 to 10,02), to verify the extent to which the predicted effects sustain.

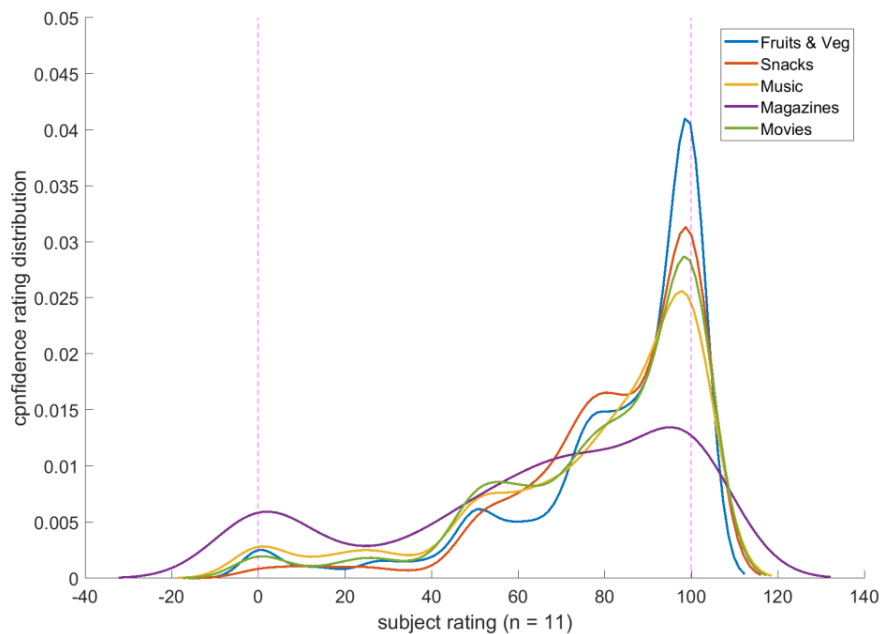
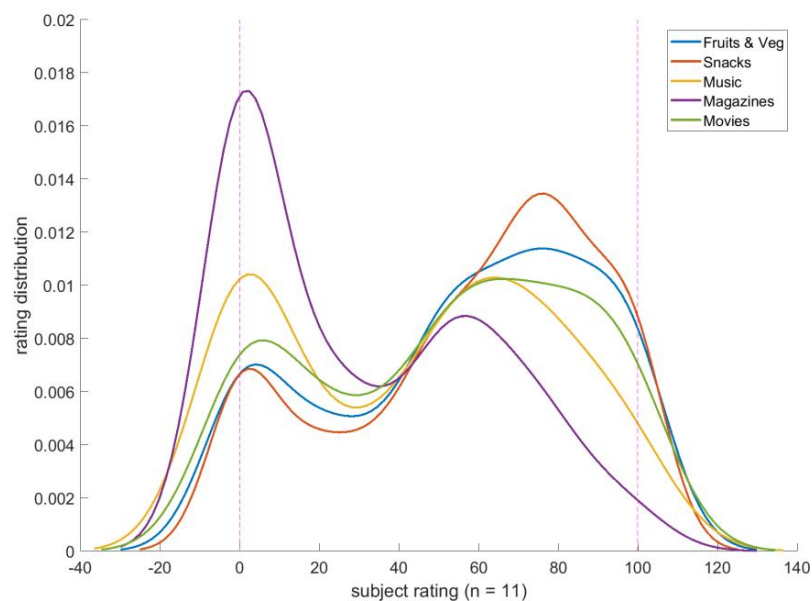
Simulations choice under H0 and H1



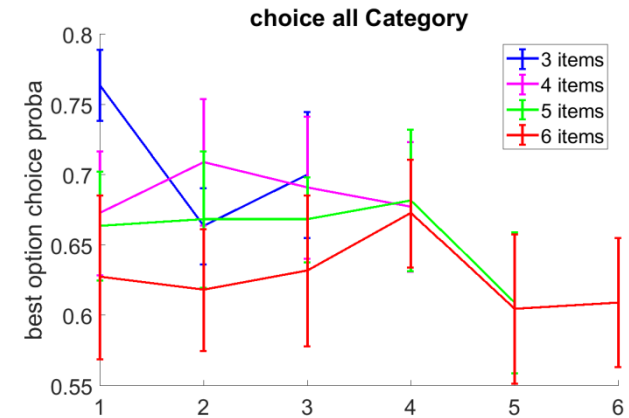
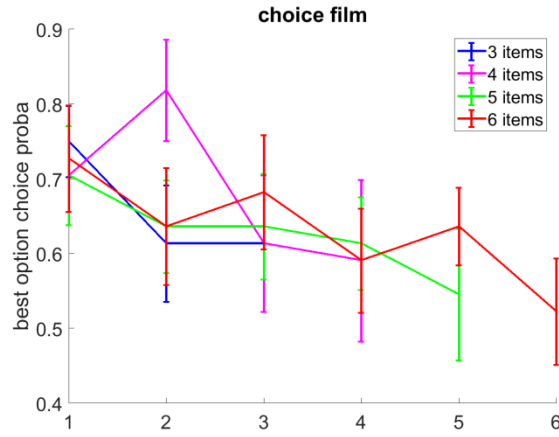
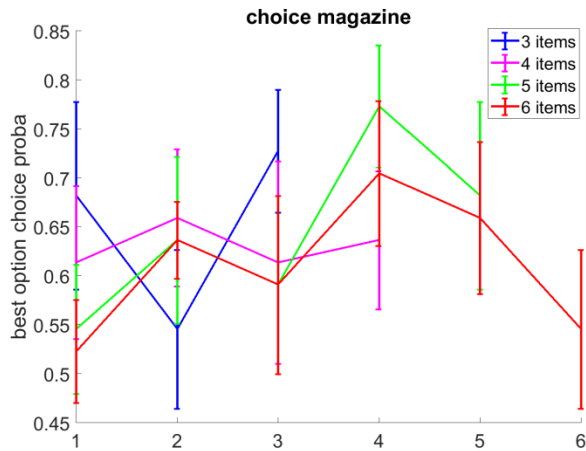
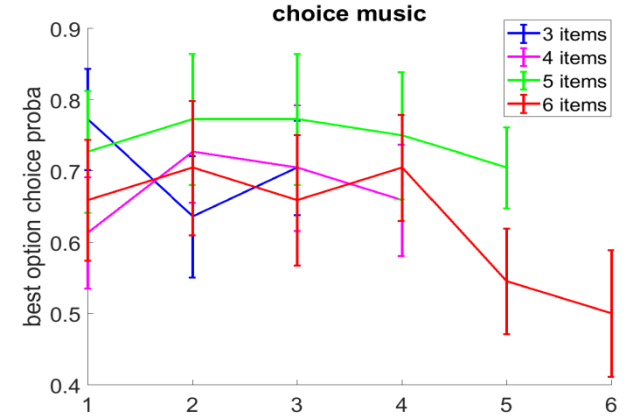
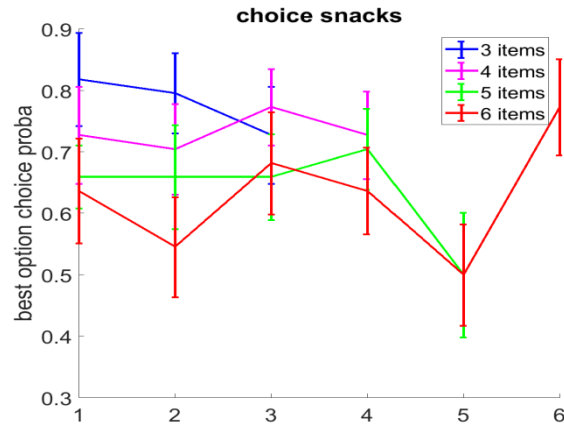
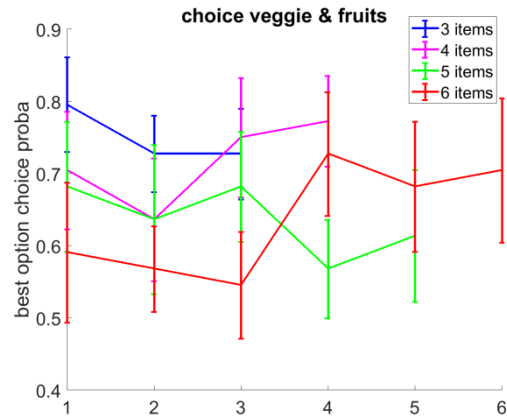
H1 with primacy and recency bonus ($\beta = 0.51$)



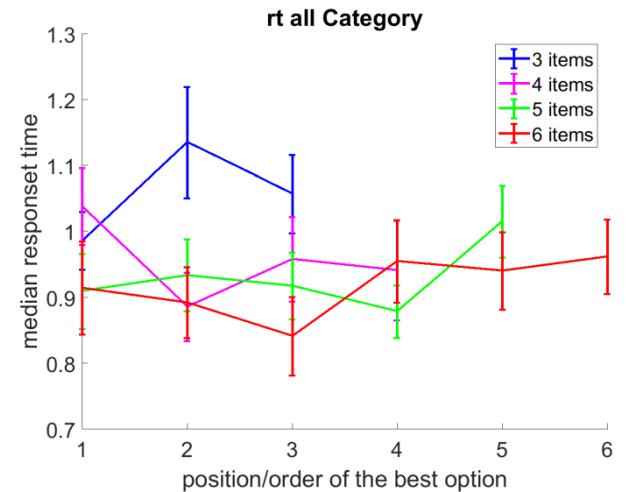
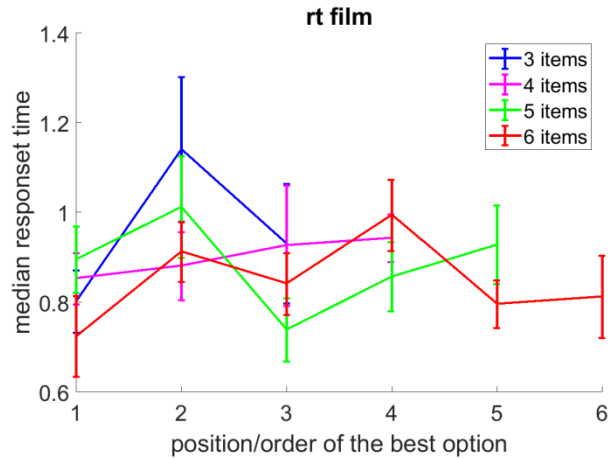
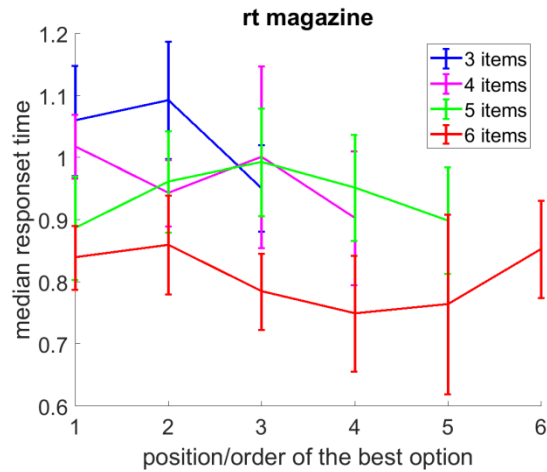
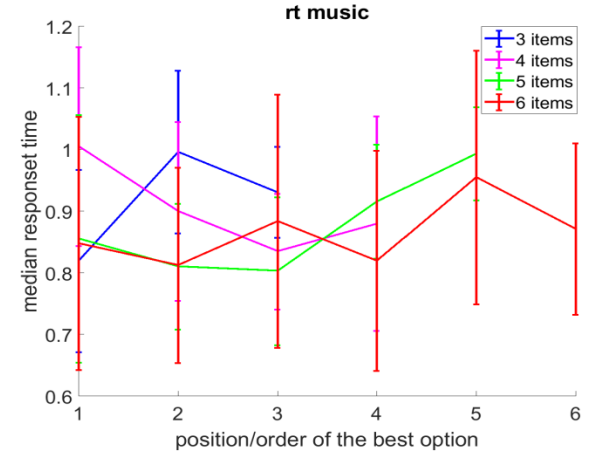
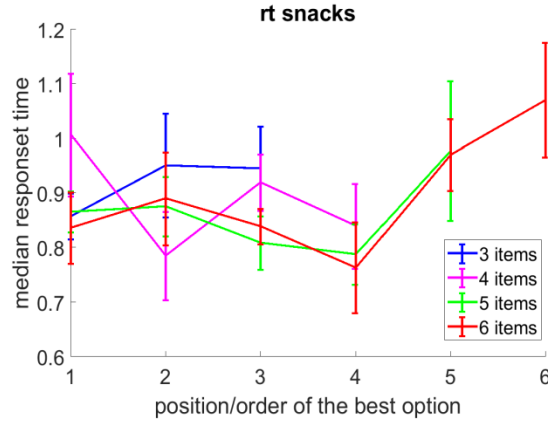
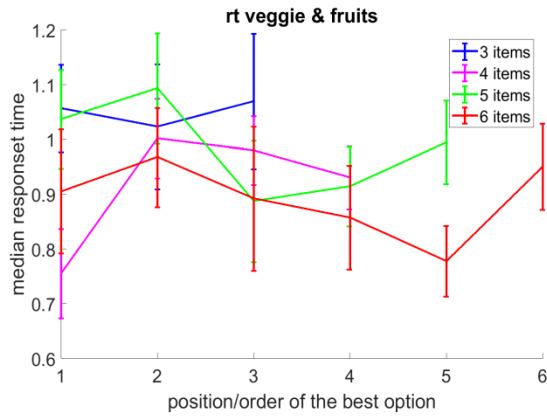
Pilot results: rating and confidence rating across categories



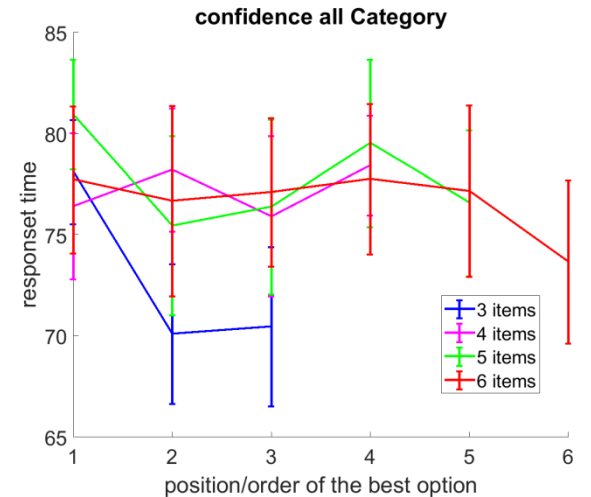
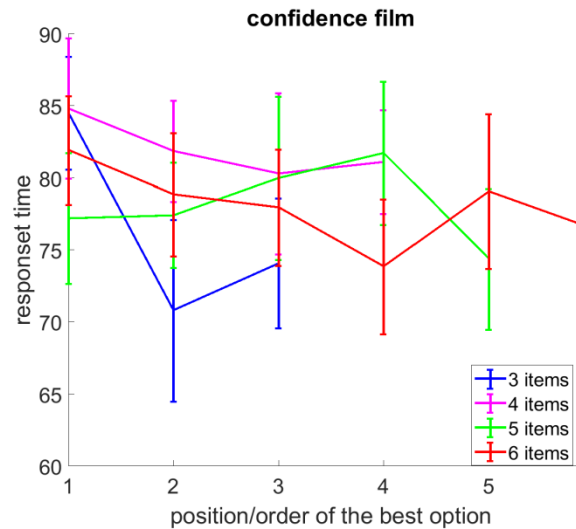
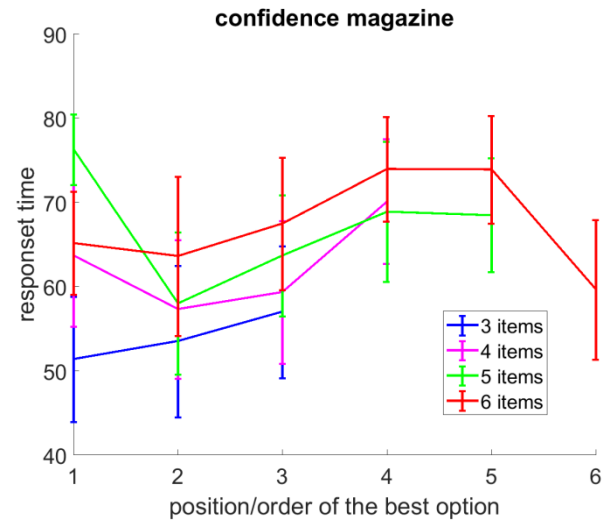
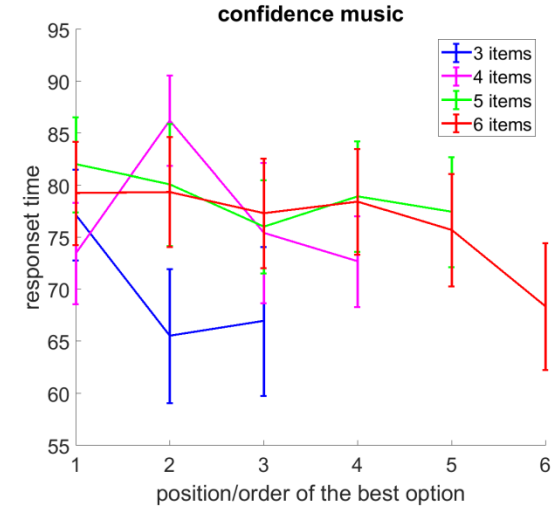
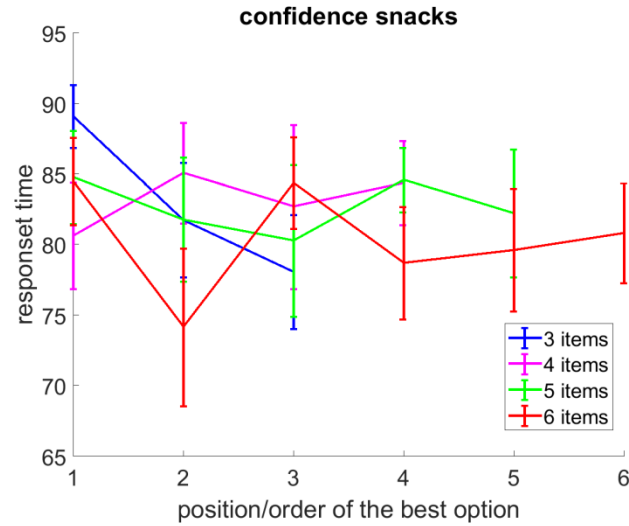
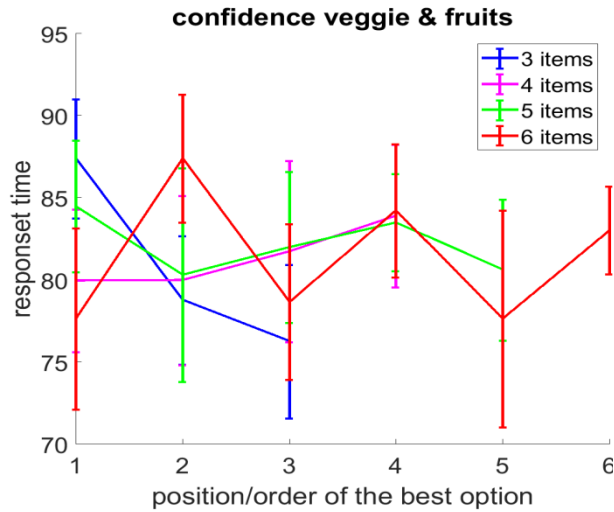
Pilot results: choice probability



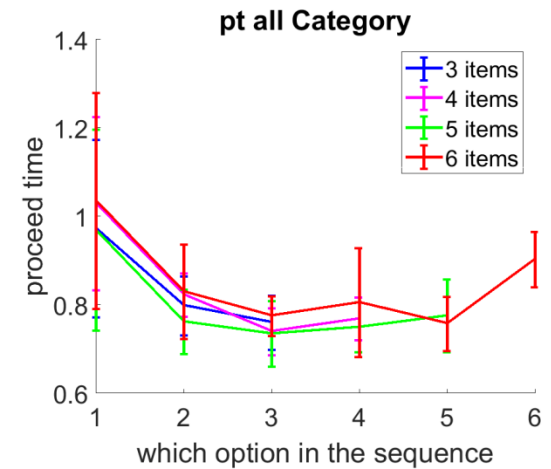
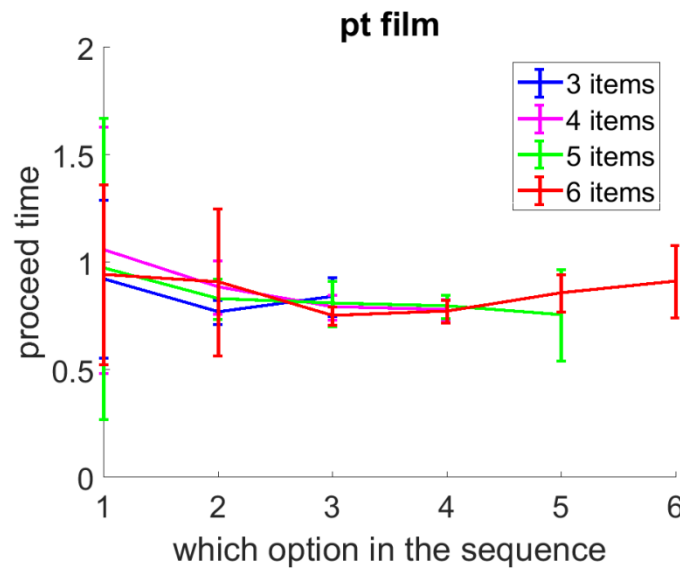
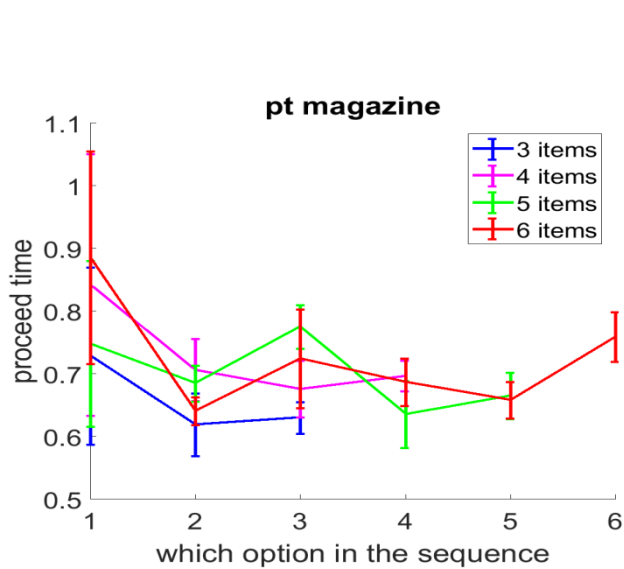
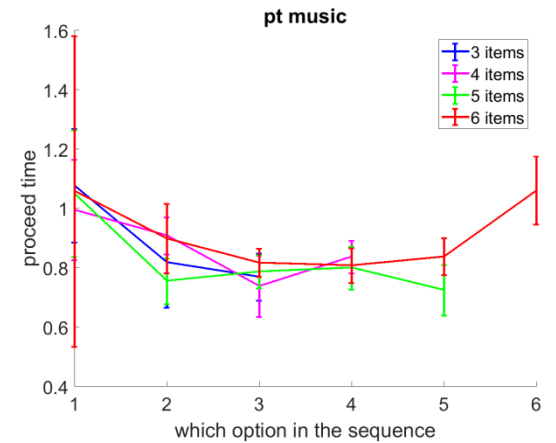
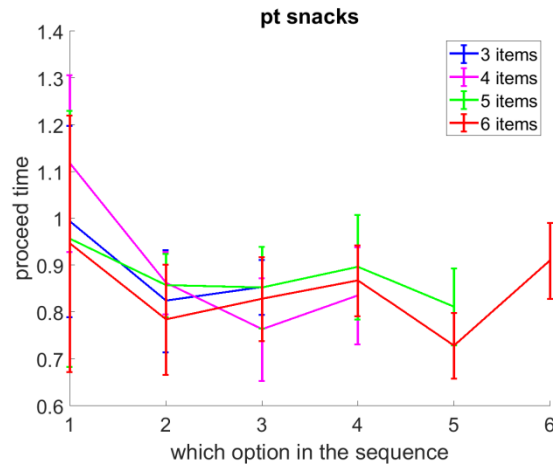
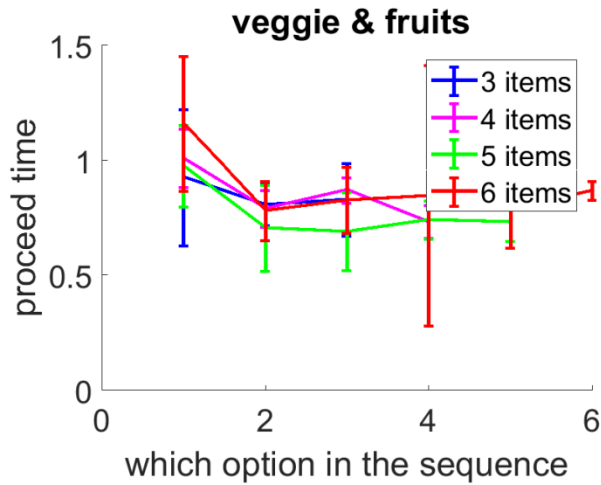
Pilot results: response time



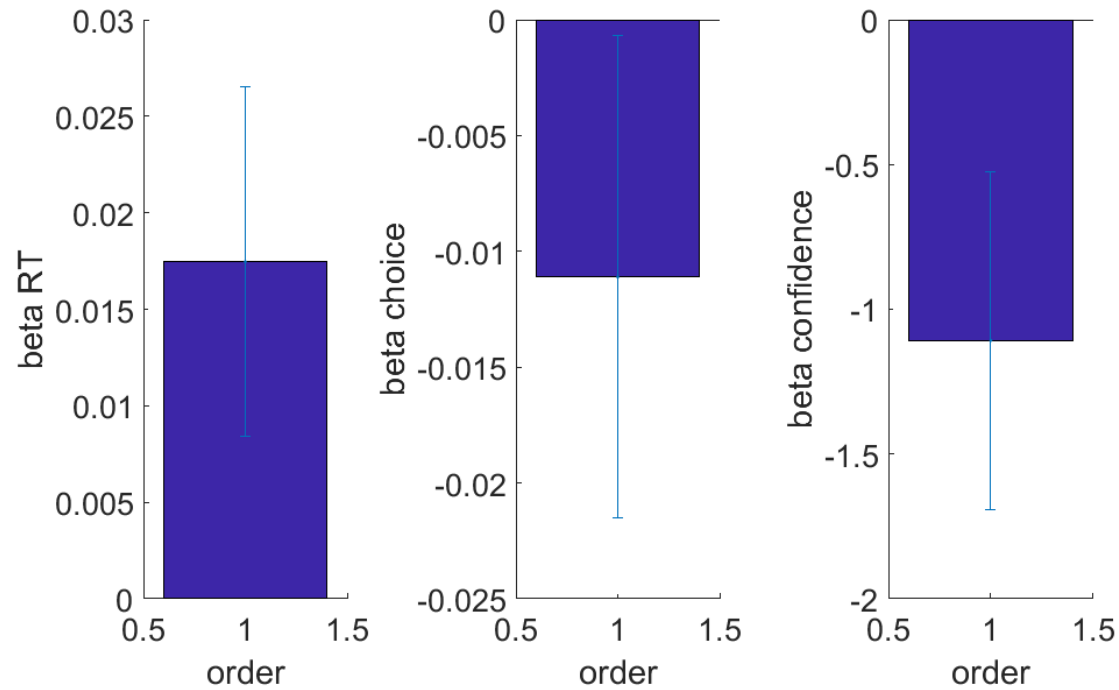
Pilot results: confidence



Pilot results: processing time



Regression coefficient



Discussion

- Regarding the design:
 - whether we should mask the options?
 - Whether we should constraint a time out if no mask?
- Alternative models proposal needed