Analyzing the Impact of Choice Complexity on Risk Choices

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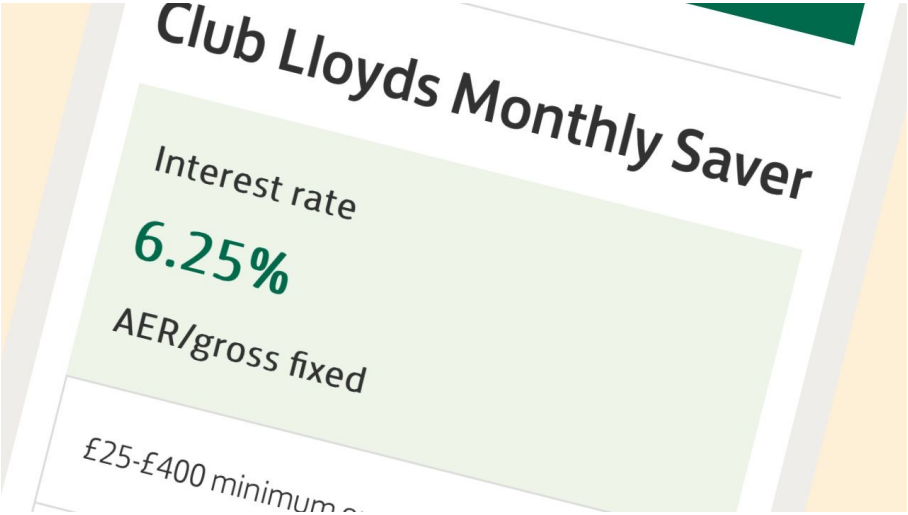
Overview

- Introduction
- Literature
- Hypotheses
- Design and Procedure
- General results and modelling
- Discussion

Introduction

Decision-making tasks of varying complexity

Investing in a High-Yield Savings Account



Investing in Stock Options

Literature review

complexity aversion:

people prefer simple options because they are easier to understand

- Oberholzer et al., 2021: complexity **decreased** the choice probability of an option

However, almost no study testing the cognitive mechanism of complexity aversion

Zhao et al., (2020) found the pre-valuation bias are crucial for explaining loss aversion.

Literature review

Compound lotte

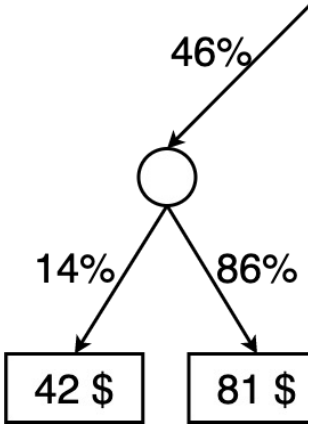
Harrison et al., 2

l., 2019;

Which of the following two alternatives do you prefer?

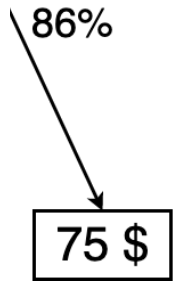
Alternative A

Probability	Payment 1	Payment 2
100%	0	100



Alternative B

Probability	Payment 1	Payment 2	Payment 3
50%	30	30	30
12.5%	0	0	0
0.5%	50	100	60
37%	60	60	40

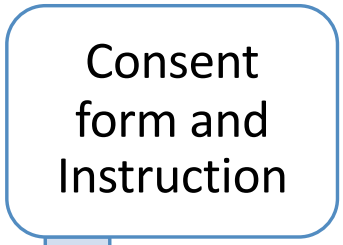


Mark your choice with a √

I prefer Alternative *A* to Alternative *B*

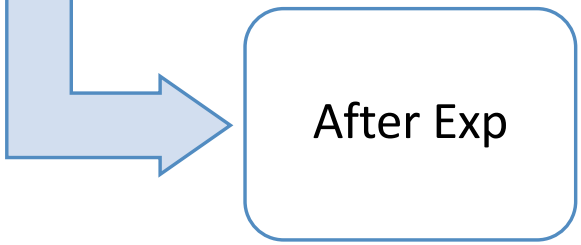
I prefer Alternative *B* to Alternative *A*

Procedure



- **Description** of two types of lotteries (complex and simple lotteries)
- **3 multiple choice question** to ensure the data quality (easy probability calculation tasks)
- **6 Practice trials** to make participants familiar with real trials

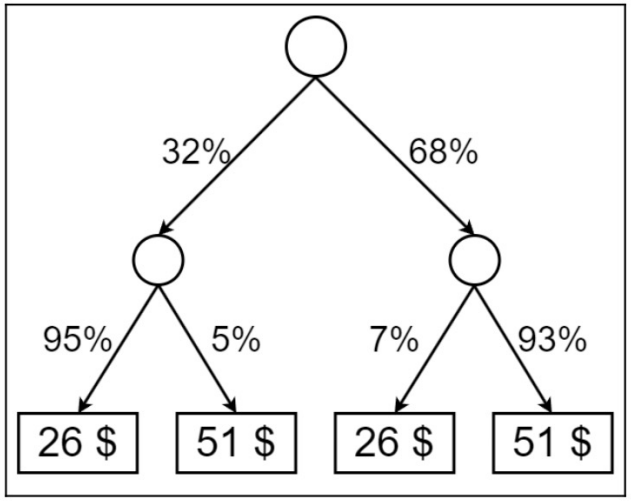
- **2 randomised blocks**
  simple vs. simple and complex vs. complex
  complex vs. simple

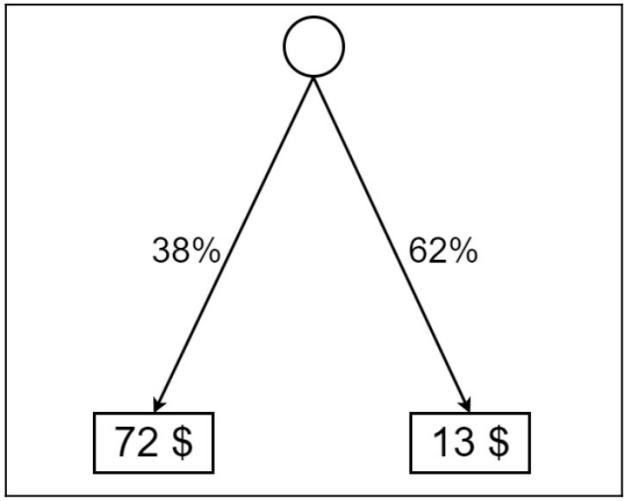


- **Cognitive ability test**
- Bonus payment decision
- Demographic questions(age, education, gender and feedbacks)

Trials

Please choose one option that you perfer.





Press F to choose the left option

Press J to choose the right option

Stimuli construction

- **EV Difference:** -20,-10,0,10,20
- **SD Difference:** 5,10, 15
- **Skewness diff:**

  left vs. right = left lottery probability of lower outcome is < .20 & right lottery probability of lower outcome is > .80

  right vs. left = left lottery probability of lower outcome is > .80 & right lottery probability of lower outcome is < .20

  no skew vs. no skew = left and right lottery probability of lower outcome is .30 < p < .70
- 8 control trials (EU Diff: 20 and -20, SD Diff 0 and no Skewness) in each condition

Hypotheses in the CC and SS condition

Behavioral Hypothesis:

- faster response times in simple versus simple compared to complex versus complex.
- choice consistency to be higher in simple versus simple than complex versus complex

Hypotheses in the CS condition

Behavioral Hypothesis:

People prefer simple options than complex options.

Cognitive Mechanism hypotheses to explain complexity aversion:

- **First hypothesis**: Complexity aversion is mainly driven by a pre-valuation bias.
- **Second hypothesis:** Complexity aversion is mainly driven by a discounting effect that occurs during information accumulation.
- **Third hypothesis:** Complexity aversion is mainly driven by the subjective representation of outcome probabilities.

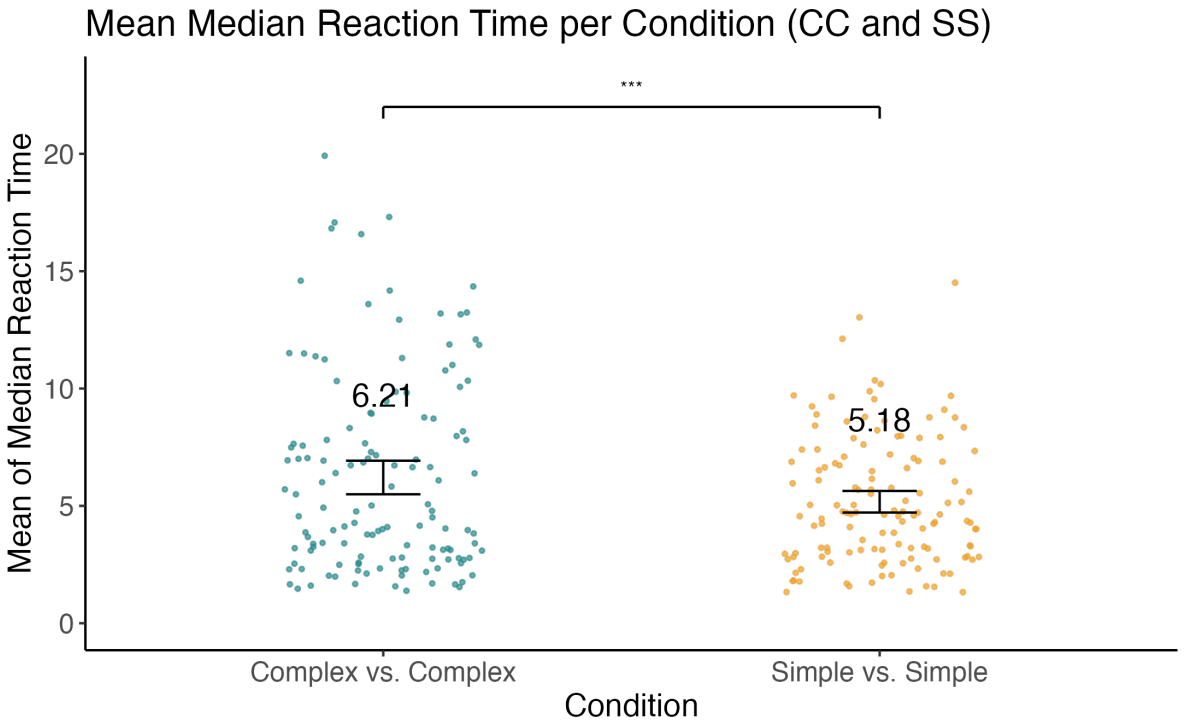
Additional Correlation Hypotheses

Behavioral Hypothesis:

Complexity aversion is positively correlated with cognitive ability.

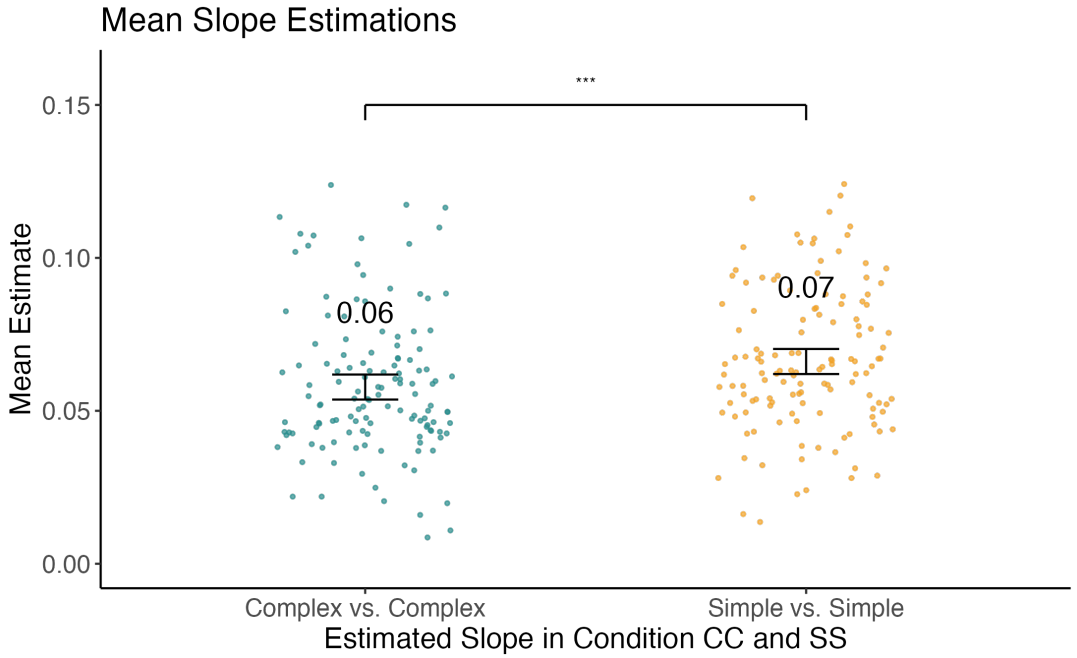
Results: Complex vs. Complex and Simple vs. Simple: **Reaction time**

- faster RT in the CC condition ($t(131) = 5.8352$, $p < .005$)



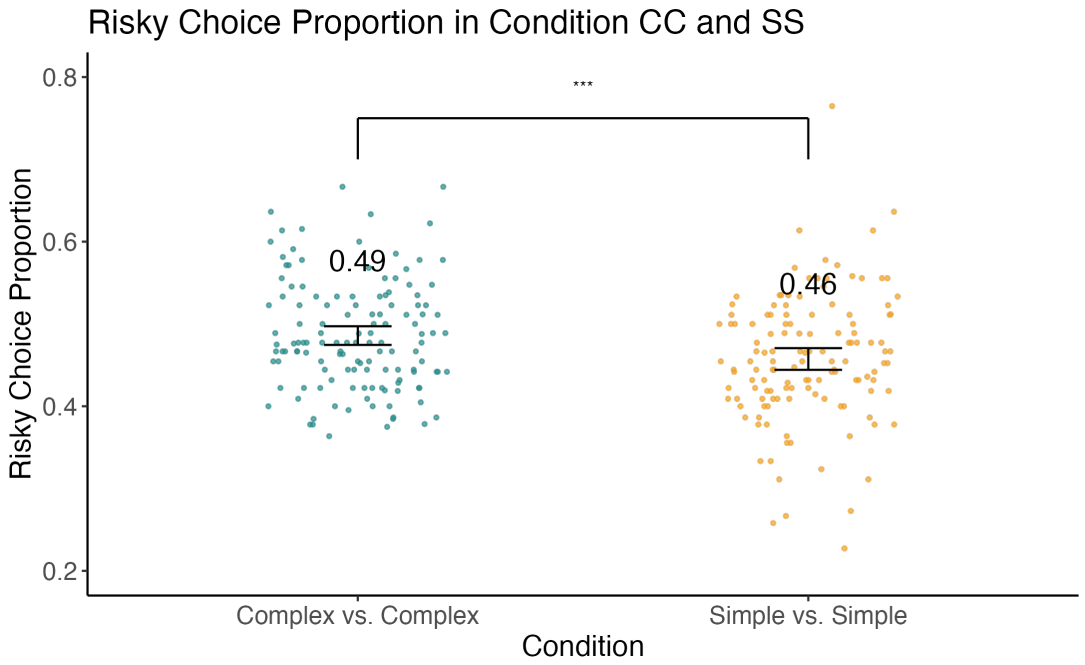
Results: Complex vs. Complex and Simple vs. Simple: **EV Coefficient**

- t test comparing Coefficient of EV in a logistic regression on choice in CC and SS condition(higher in the SS condition, $t(131) = -4.534$, $p < .005$)



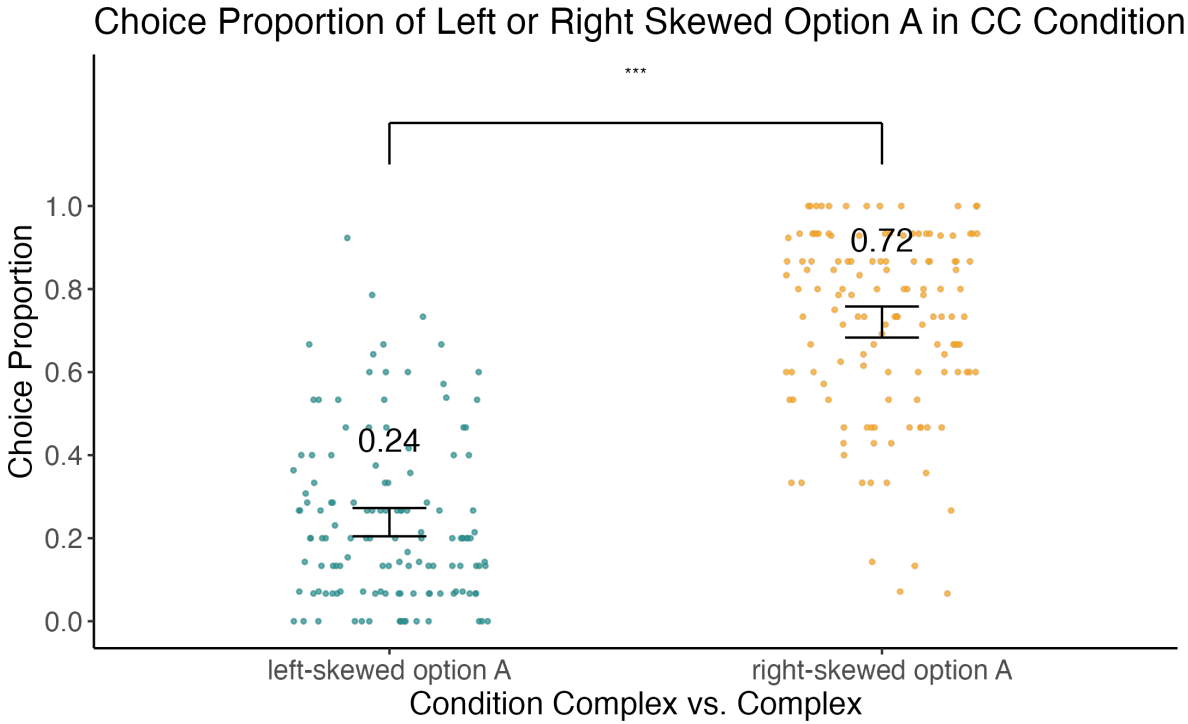
Results: Complex vs. Complex and Simple vs. Simple: **Risky choices proportion**

- Two-sample t test comparing percentage of risky choices
- More risky choices in the CC condition, $t(131) = -3.50$, $p < .005$



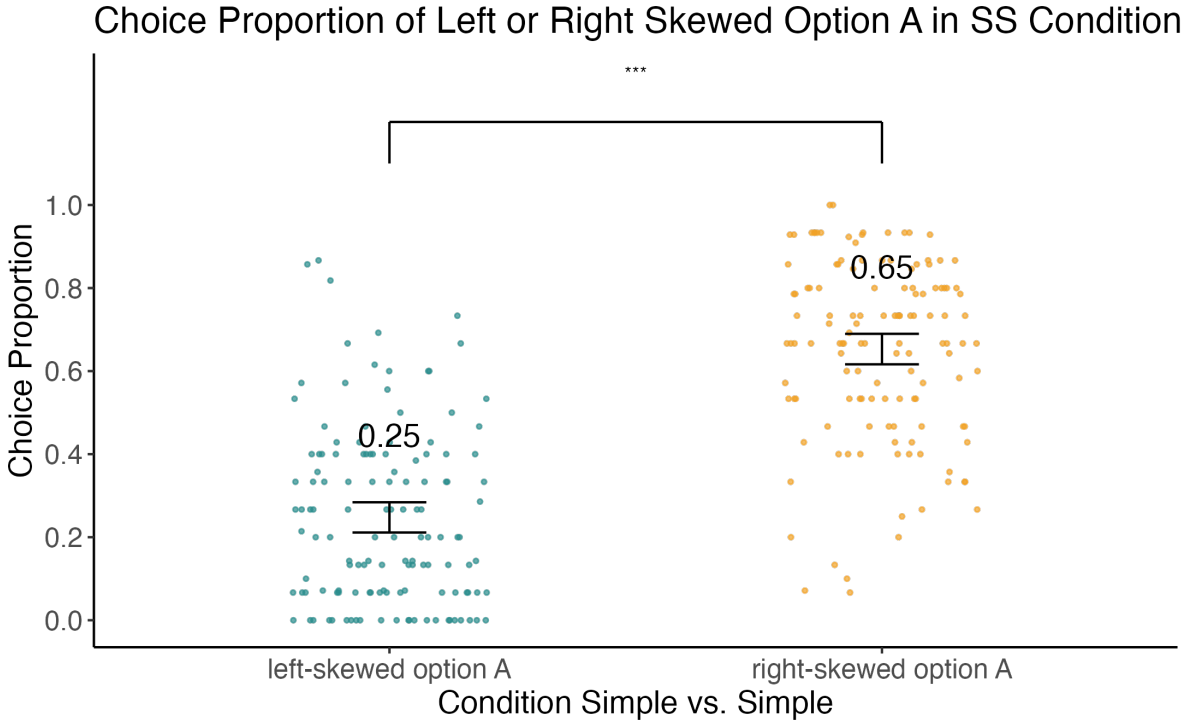
Results: Complex vs. Complex and Simple vs. Simple: **Skewness in CC**

- In CC condition: right skewed option A was prefered. $t(131) = 13.93$, $p < .005$



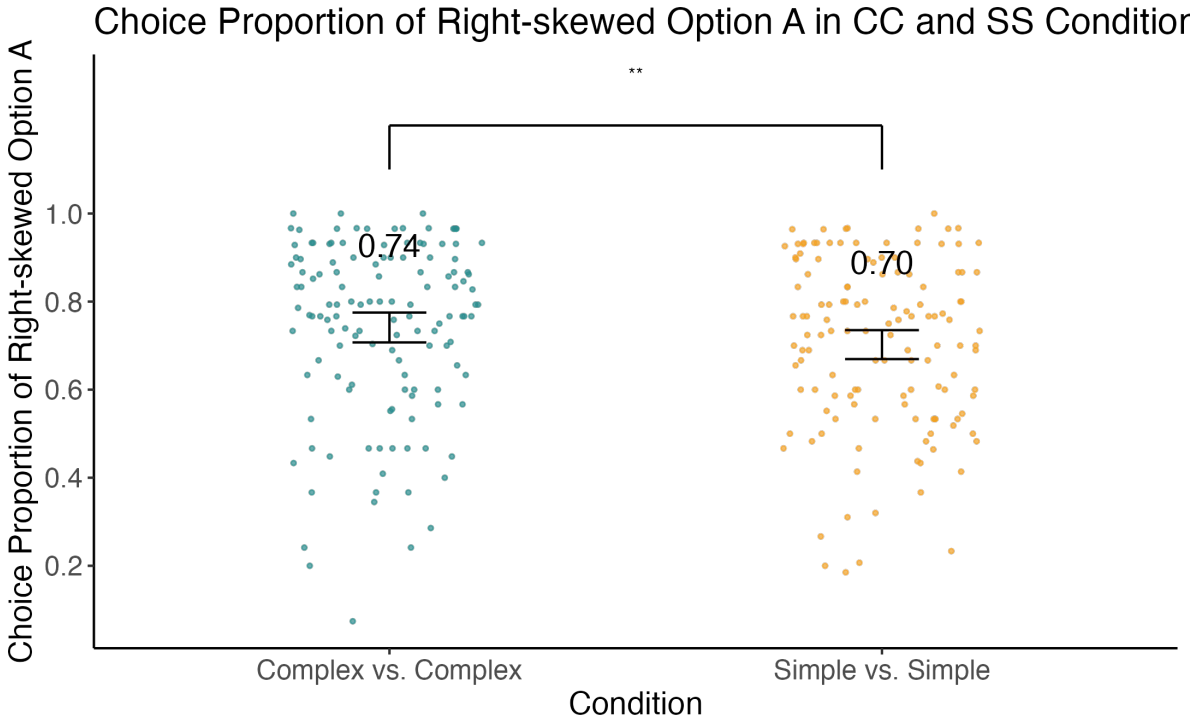
Results: Complex vs. Complex and Simple vs. Simple: **Skewness in SS**

- In SS condition: right skewed option A was prefered. $t(131) = 12.09$, $p < .005$

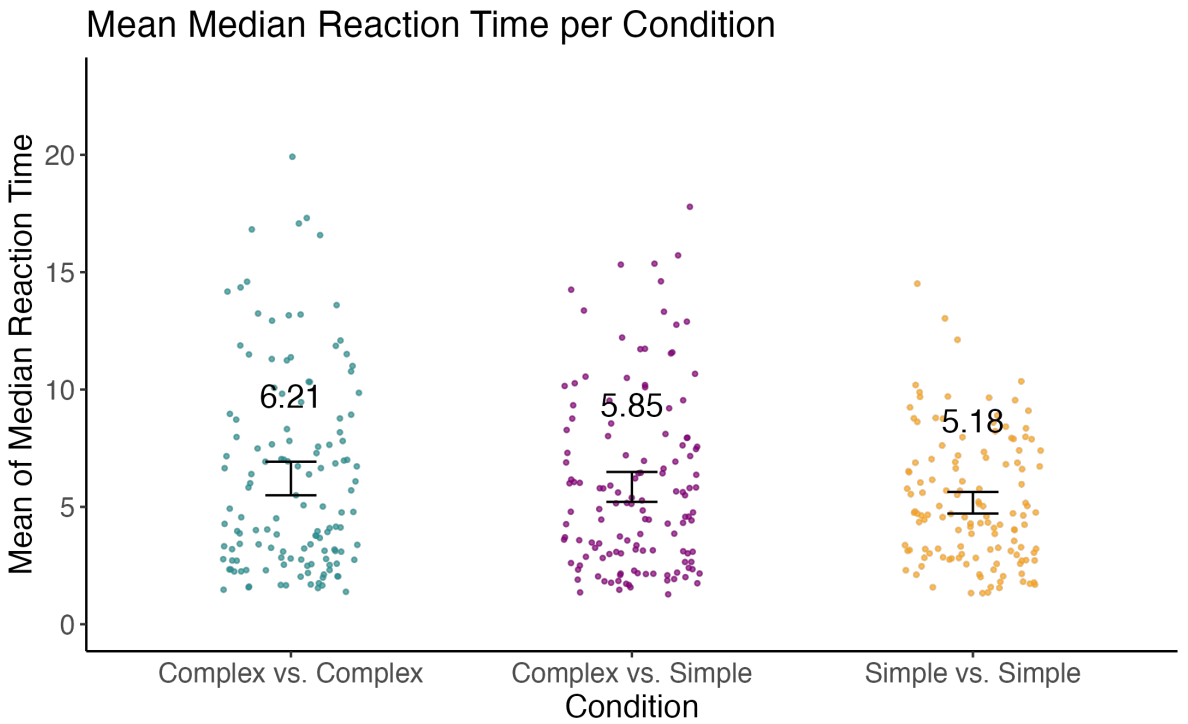


Results: Complex vs. Complex and Simple vs. Simple: **Skewness in CC and SS**

- Right-Skewed Option A was more prefered in CC condition, $t(131) = 2.38$, $p < .05$

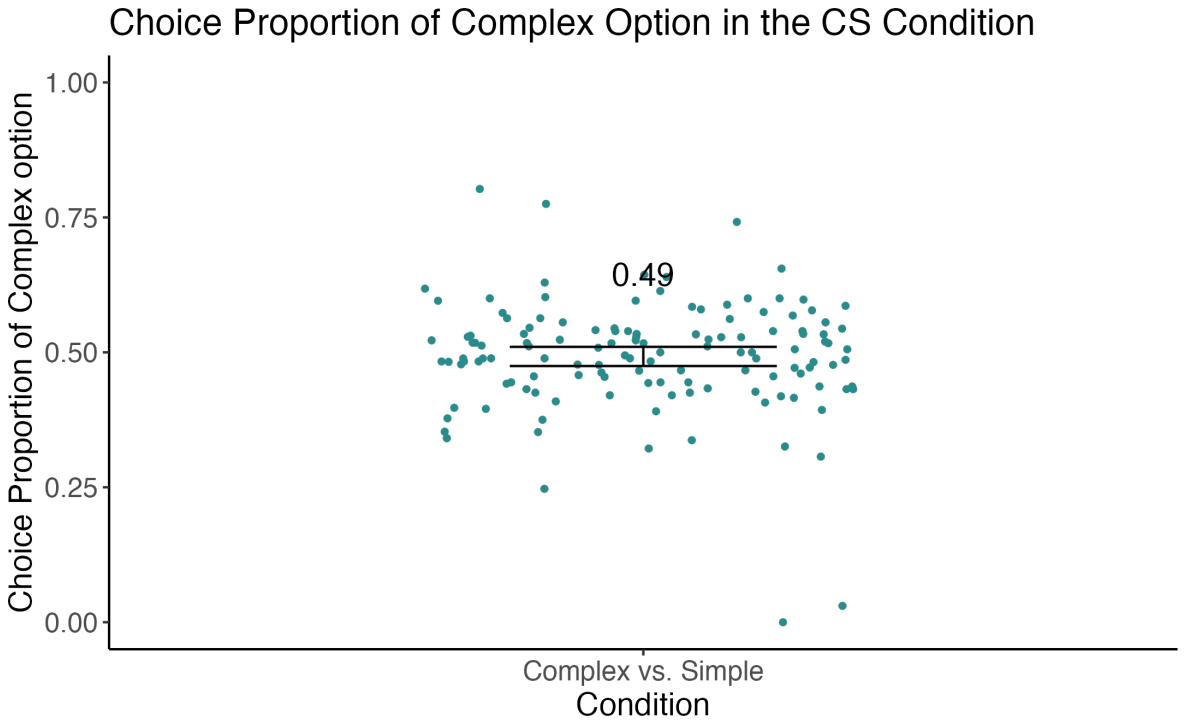


Complex vs. Simple: **Reaction time**



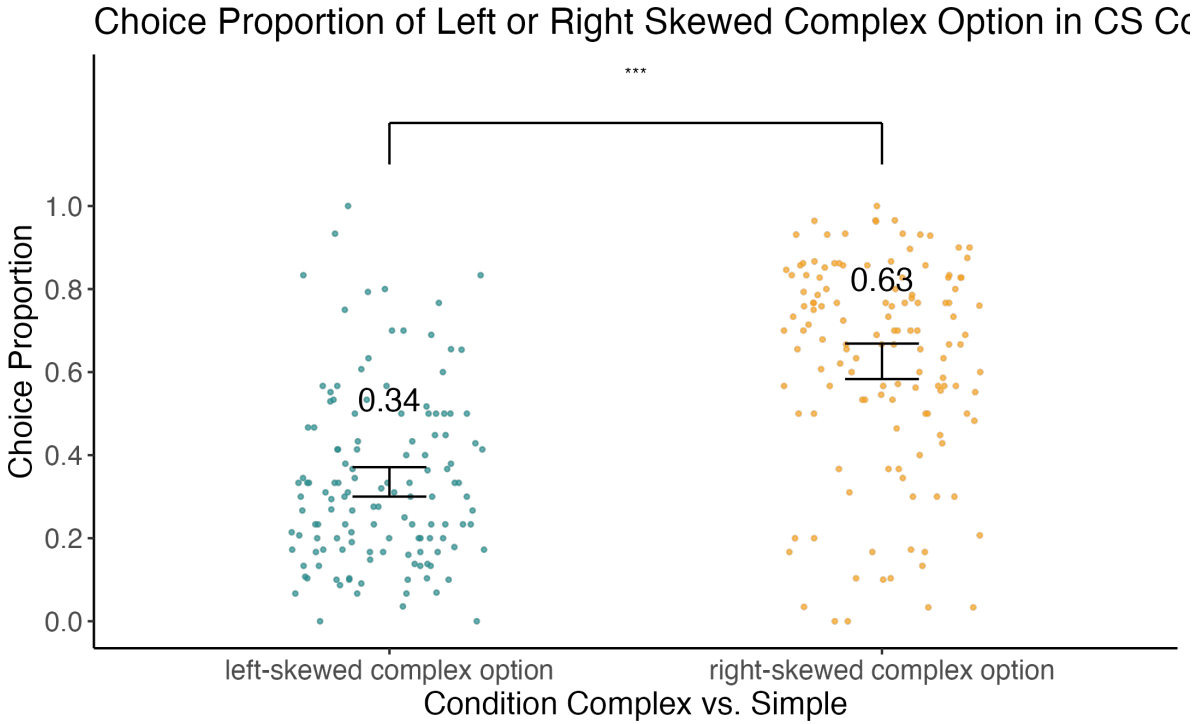
Complex vs. Simple: **Choice Proportion**

- Not significantly lower than 50%, t(131) = -0.839, p > .05



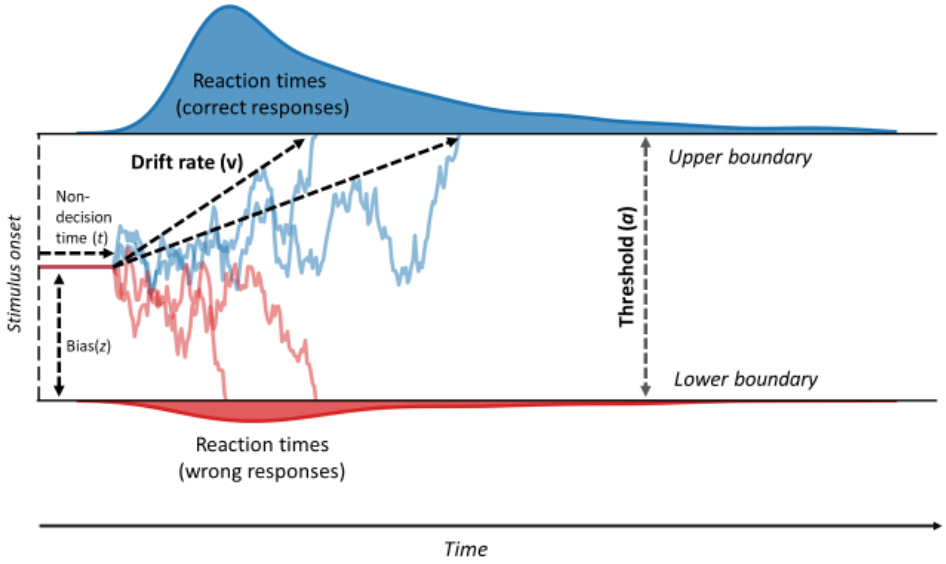
Complex vs. Simple: **Skewness**

- In CS condition: right skewed complex option was prefered. *t*(131) = 8.41, p < .005



Modelling

- Drift diffusion model



CC and SS condition

risky option

safe option

CS condition

complex option

simple option

Modelling: EU and MV models

- EU models: drift rate as the difference of subjective utility of the two gamble options
- mean-variance models: drift rate predicted by EVD and SDD.

- Model parameters for all models include: t (non-decisional time), α (choice boundary), v (drift rate), θ (choice consistency parameter), β (risk sensitivity parameter).

Modelling: additional parameters

CC and SS condition

- Δβ (risk sensitivity difference between CC and SS)
- Probability weighting models: γ (curvature of probability weighting function; separate for CC and SS condition)
- Threshold models: λ

CS condition

- Starting point models: z (starting point, 0 if neutral)
- Discounting effect models: η (complexity discounting)
- Probability weighting models: γ (curvature of probability weighting function; separate for simple and complex)

Modelling: Results in CC and SS

CC and SS condition

risk sensitivity difference between CC and SS

- strictly negative 95% credible interval excluded 0 in both EU and MV models
- higher consistency for simple versus simple compared to complex versus complex.

- EU: mean: -0.32, 95% HPDI: (-0.48, -0.21)
- MV: mean: -0.003, 95% HPDI: (-0.0035, -0.002)

Modelling: Results in CC and SS

CC and SS condition

Threshold λ

- strictly positive 95% HPDI excluded 0 in both EU and MV models
- larger threshold of complex versus complex compared to simple versus simple.

- EU: mean: 0.20, 95% HPDI: (0.12, 0.27)
- MV: mean: 0.19, 95% HPDI: (0.12, 0.27)

Modelling: Results in CC and SS

CC and SS condition

Probability weighting models: γ (curvature of probability weighting function; separate for CC and SS condition)

- EU: mean: -0.25, 95% HPDI: (-0.39, -0.11)
- MV:

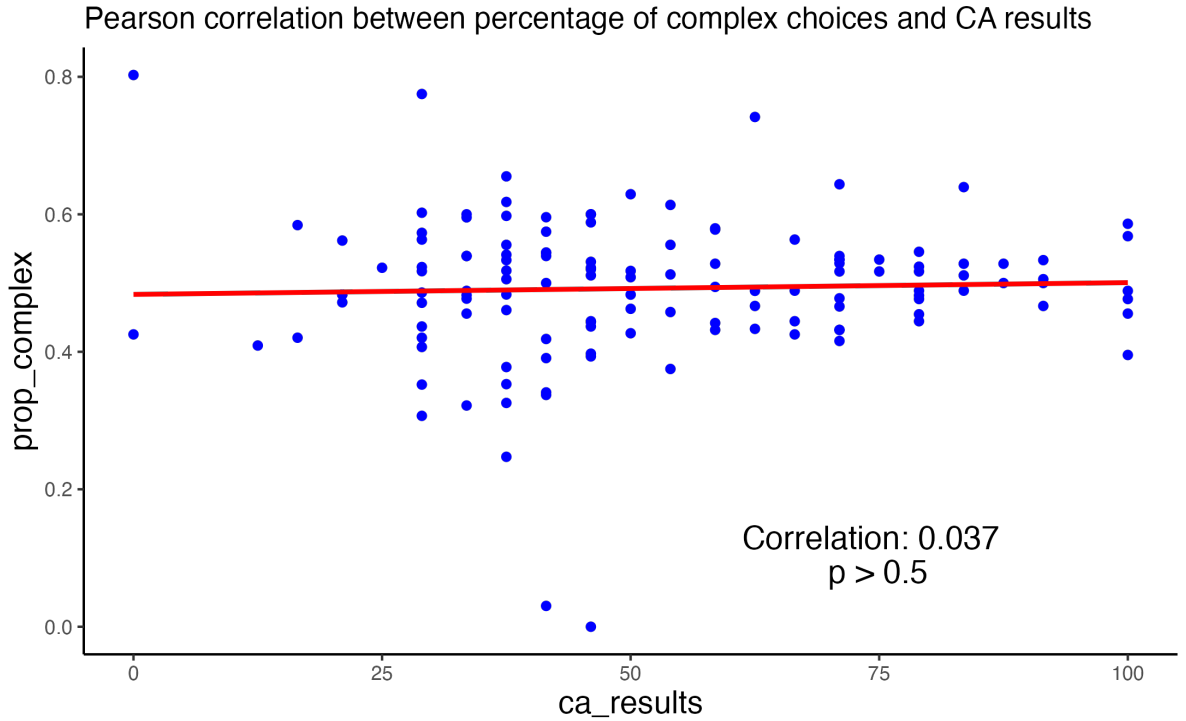
Modelling: Results in CS

CS condition

- Starting point models: 95% HPDI included 0.5 in both EU and MV models, no evidence support preliminary disposition against complex options
- Discounting effect models: 95% HPDI included 0 in both EU and MV models, no evidence support discounting effect against complex options
- Probability weighting models:

Correlation between cognitive ability and complexity aversion

- No significant correlation between cognitive ability scores and choice proportion of complex option in the CS condition.



Thanks for your attention!

Reference:

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