Heuristic and discounting models of intertemporal choice: A quantitative test

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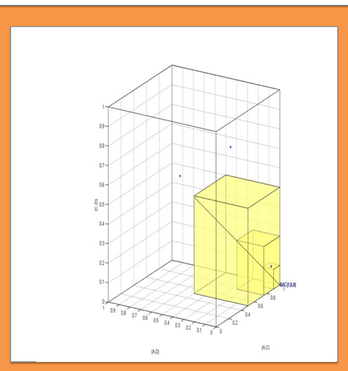
Abstract: Do you prefer a smaller sooner or a larger later reward? Intertemporal comparisons are ubiquitous, e.g., in consumer financial decision making. Choices among time delayed payments vary between and within person. There are two leading explanations for within person variability: Random errors or uncertainty about one's own preferences. We report on a large scale (67,000 p-values) quantitative test of several different probabilistic generalizations of several heuristic and/or discounting models. We report frequentist and Bayesian tests on individual subject data from U.S. and German participants. We compare model fitting with behavioral predictions. We illustrate the danger of overfitting as well the close agreement between frequentist and Bayesian analyses.

Intertemporal Choice

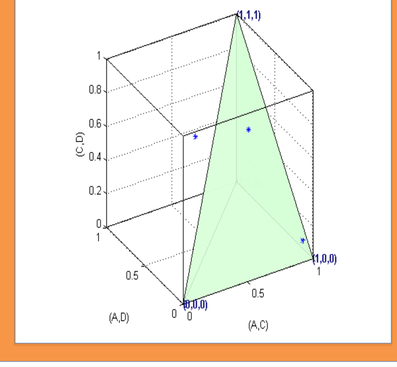
University of Illinois at Urbana-Champaign (US)		Max Planck Institute Berlin (D)	
$ 13 in 10 days	$ 15 in 24 days	13 € in 10 Tagen	15 € in 24 Tagen



Probabilistic specifications

Deterministic Preferences & Random Error

Random Preferences & No Error



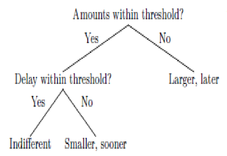
Exponential Discounting

$$Ae^{-kt}$$

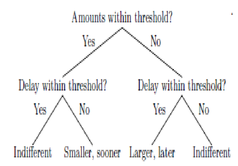
Hyperbolic Discounting

$$A/(1+kt)$$

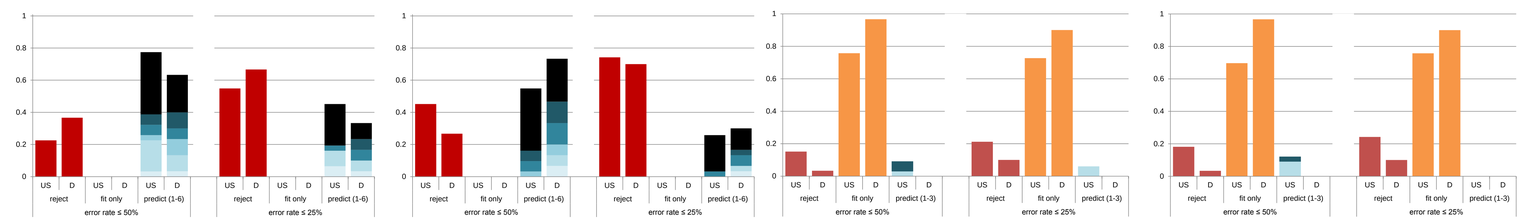
Lex. Semiorder



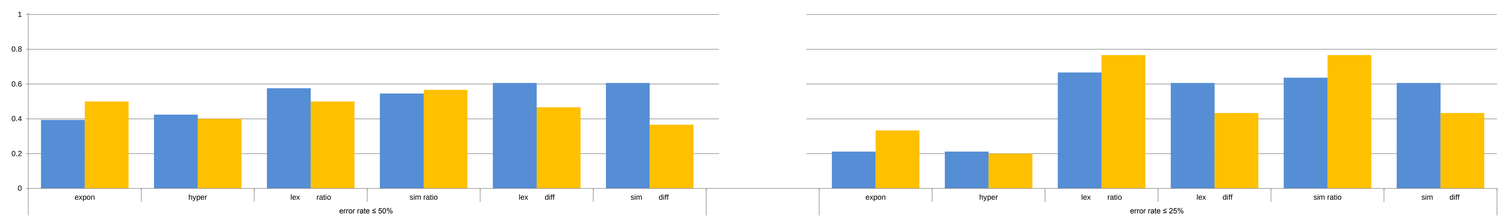
Similarity Heuristic



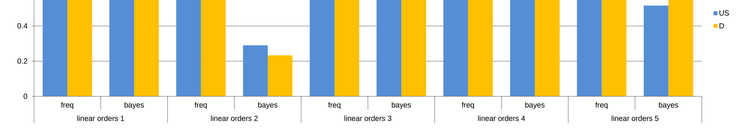
FREQUENTIST



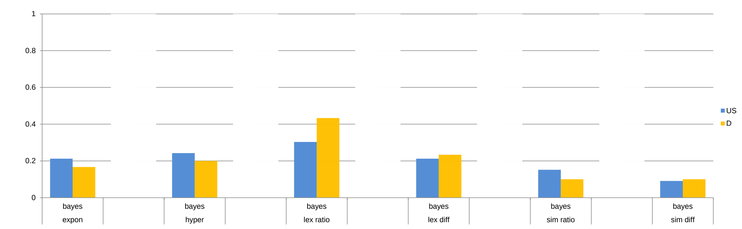
BAYES



General Random Utility Model (Linear Ordering Polytope)



Other Random Preference Models



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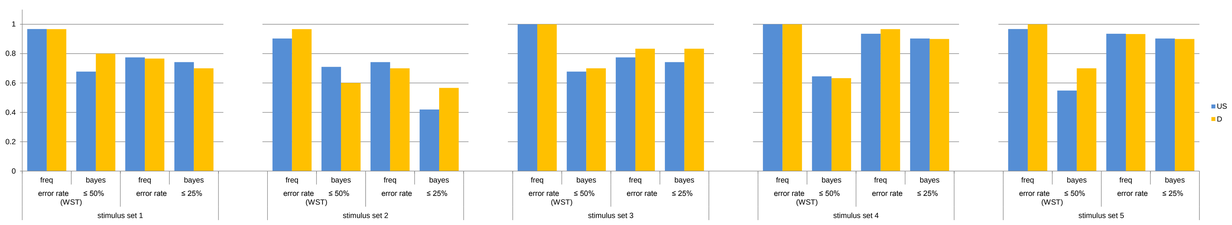
Poster QR Code

Linear Orders (General Utility)



Conclusions based on 67,134 frequentist and Bayesian p-values:

- Lex. Semiorders and Similarity Heuristics fit well (only w. high error rates), but predict poorly.
- Random Lex. Semiorder and Similarity Heuristic models fit poorly.
- Linear Orders (General Utility Theory) fit well using both specifications.
- Exponential & Hyperbolic Discounting fit well (only with high error rates), but predict poorly.
- Random Exponential & Hyperbolic Discounting models fit poorly.
- German and U.S. analyses match closely. (Germans paid same day, U.S. paid with stated delay).
- All analyses use advanced order-constrained inference.
- Bayesian (Bayes p & DIC) approach handles cases where frequentist methods are unknown.
- Frequentist methods allow for predictions from best-fitting parameters.
- When both methods apply, frequentist and Bayesian results line up very closely.