

Modeling Preference Formation of Risky Decisions via Eye Tracking

Orian Sharoni Moshe Glickman* Dino Levy & Marius Usher

*Equally contributed

Introduction

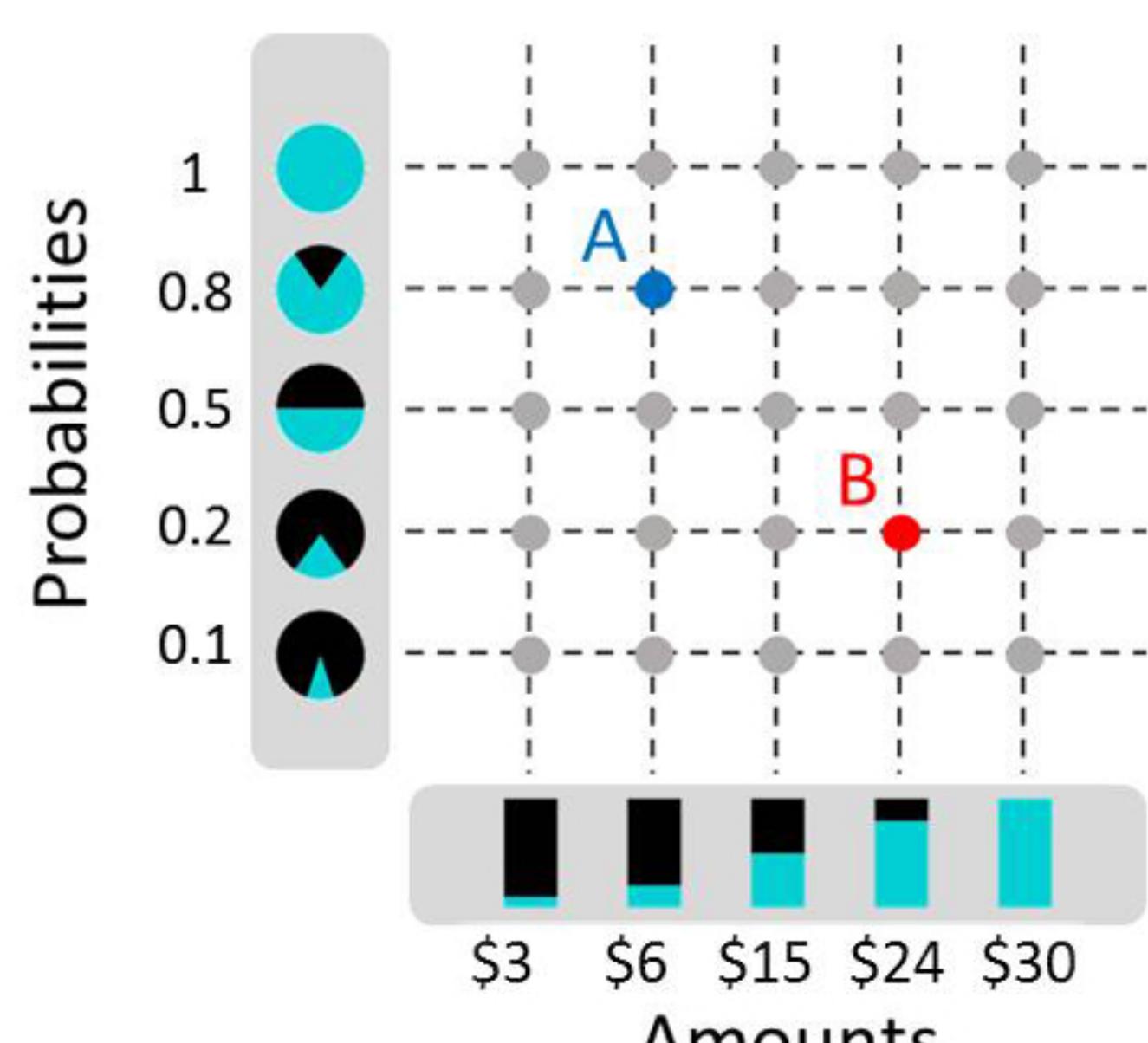
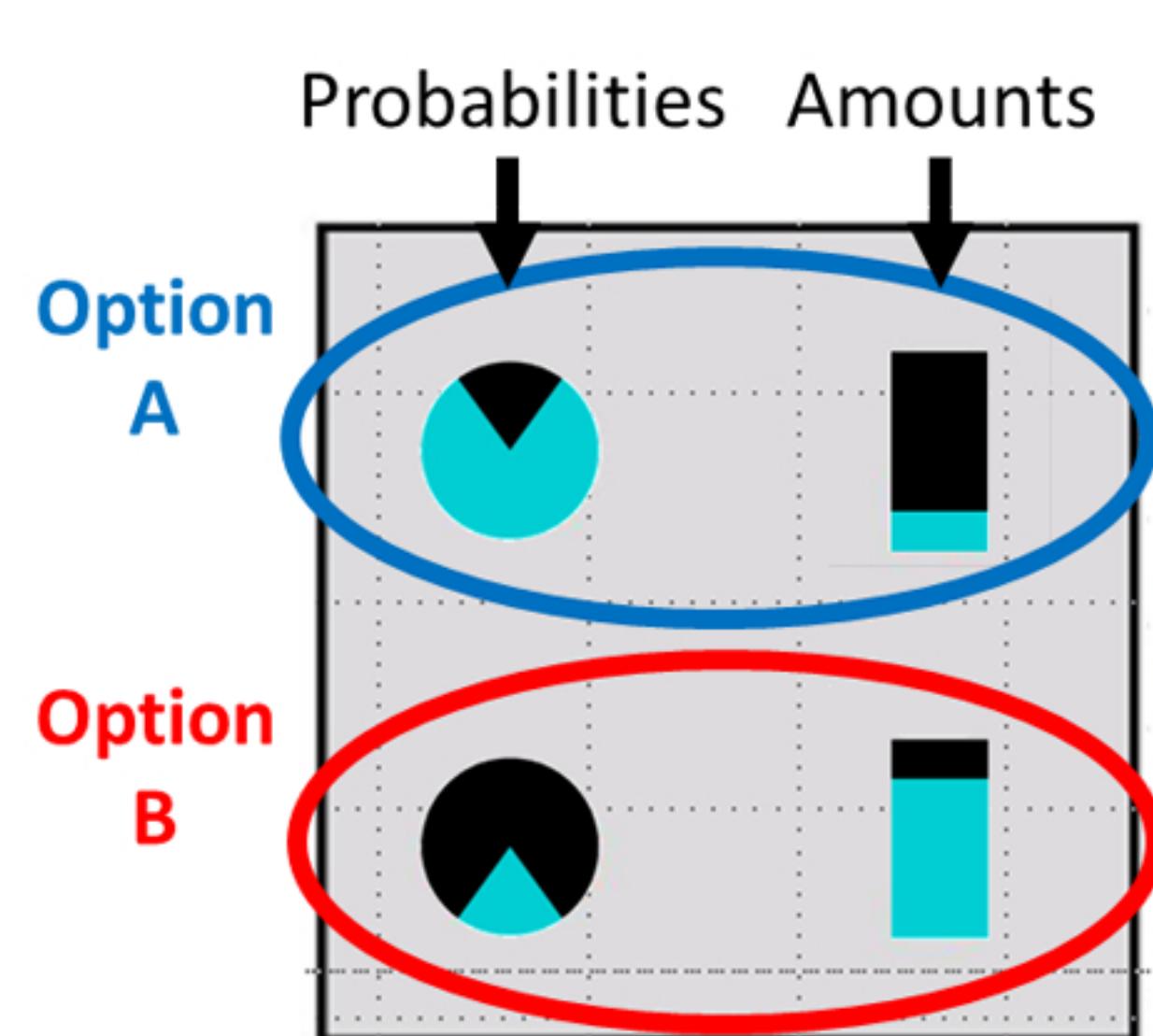
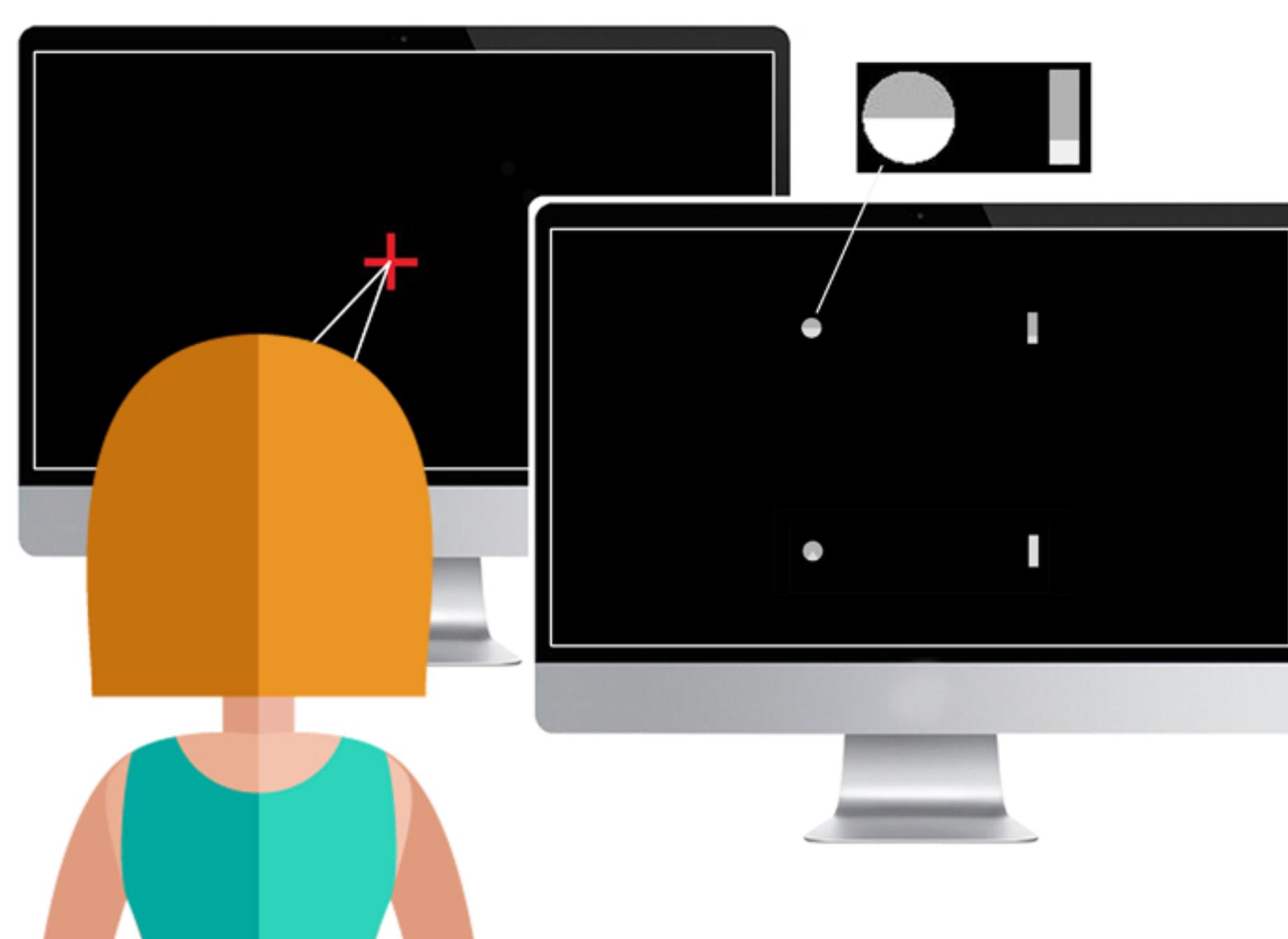
- Cognitive accumulation models assume that information (sensory input) is sampled rapidly in small portions until a threshold is reached and the competition is decided.
- We aspire to create integrated models that take into account both the perceptual process and the value of attributes in decisions.
- The eye-tracker is a significant research tool for this purpose as it allows monitoring the participant's visual attention at high temporal resolution (300 Hz).



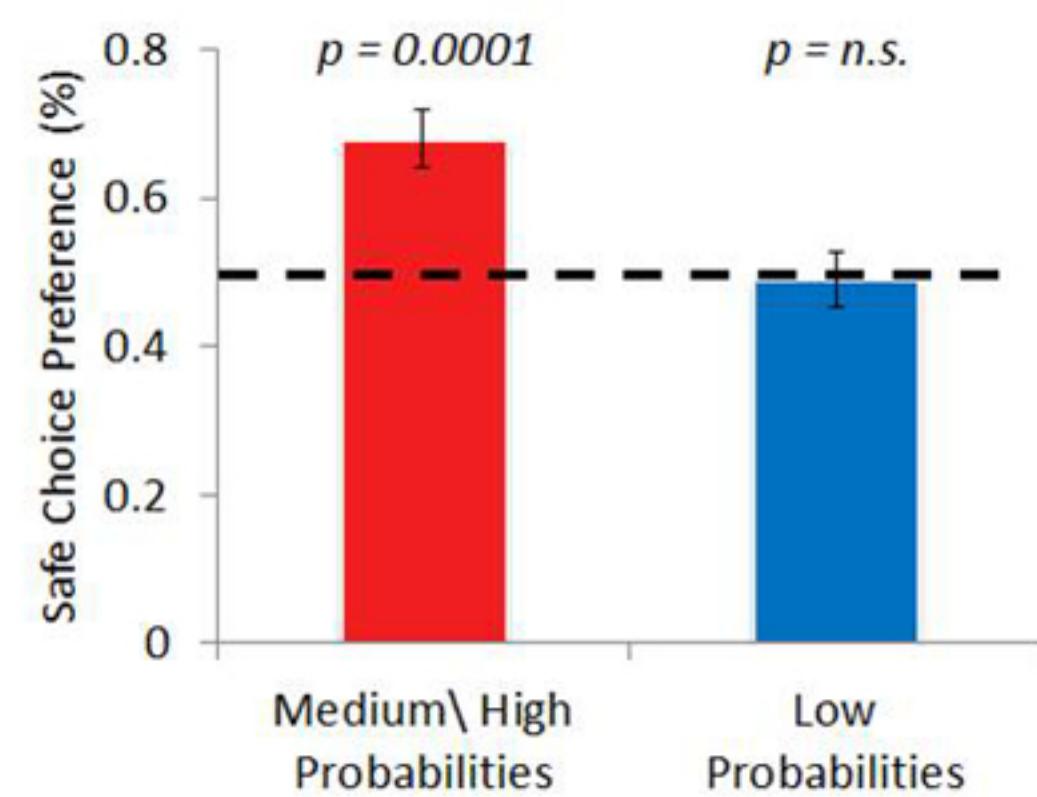
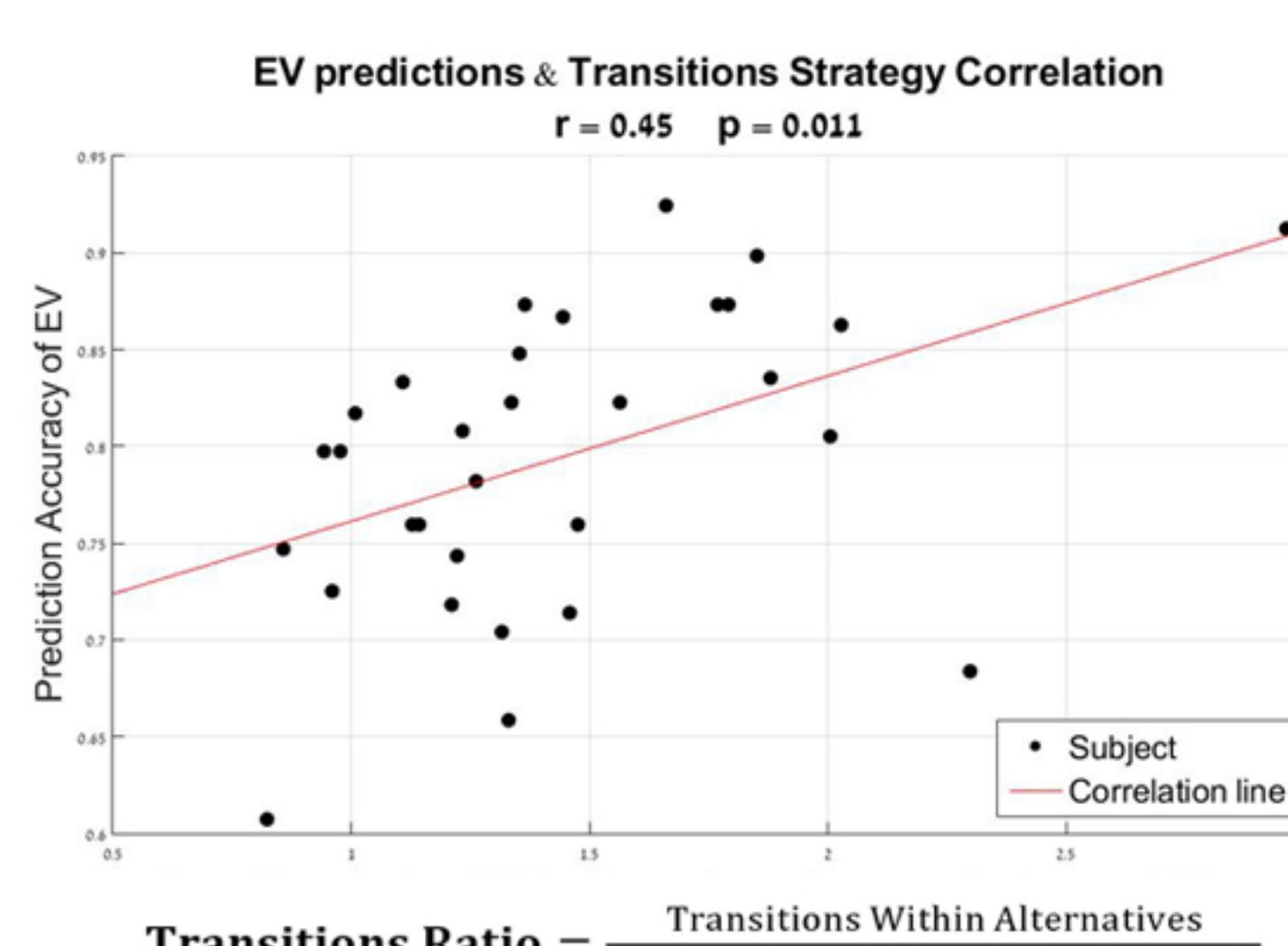
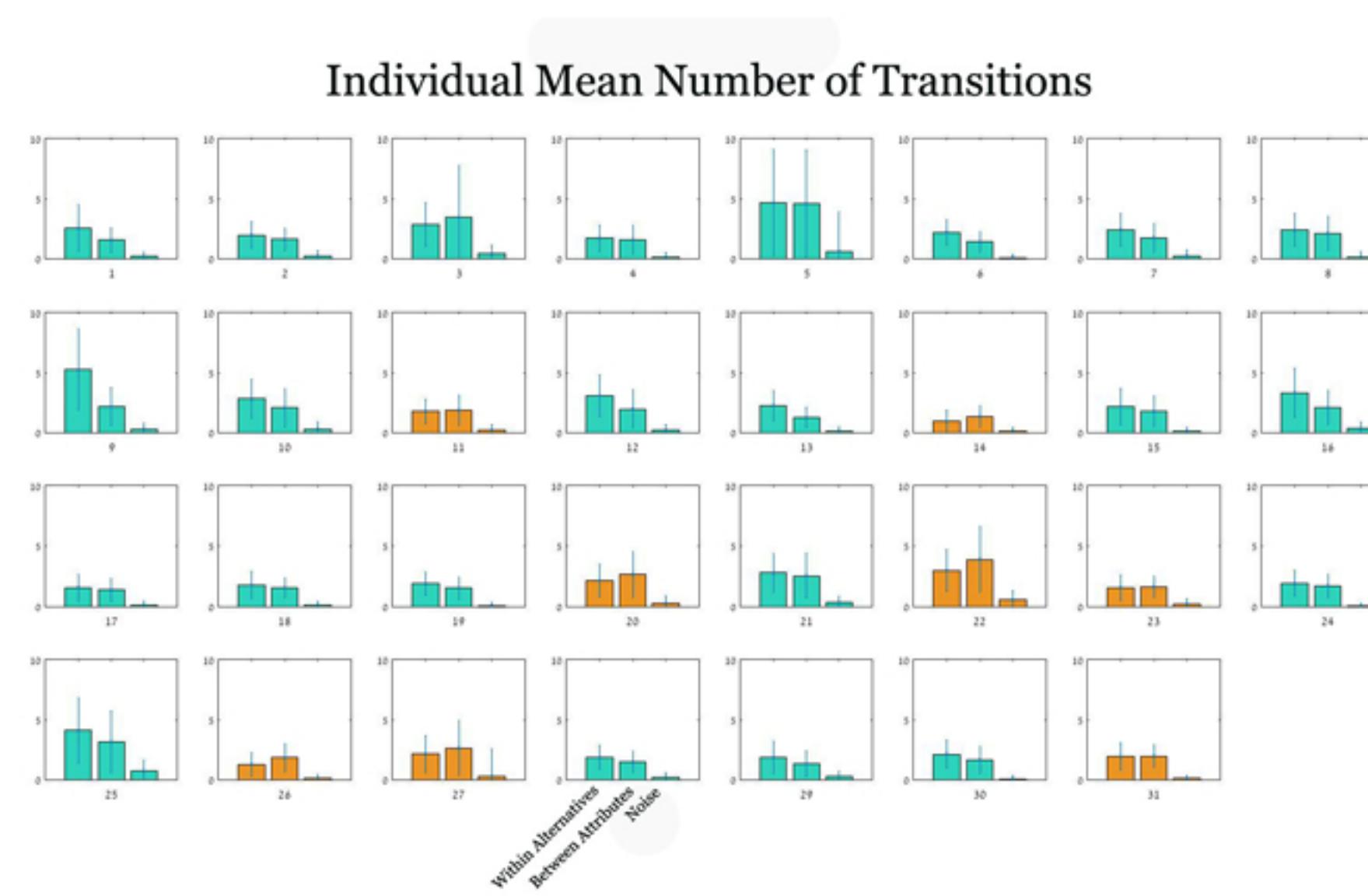
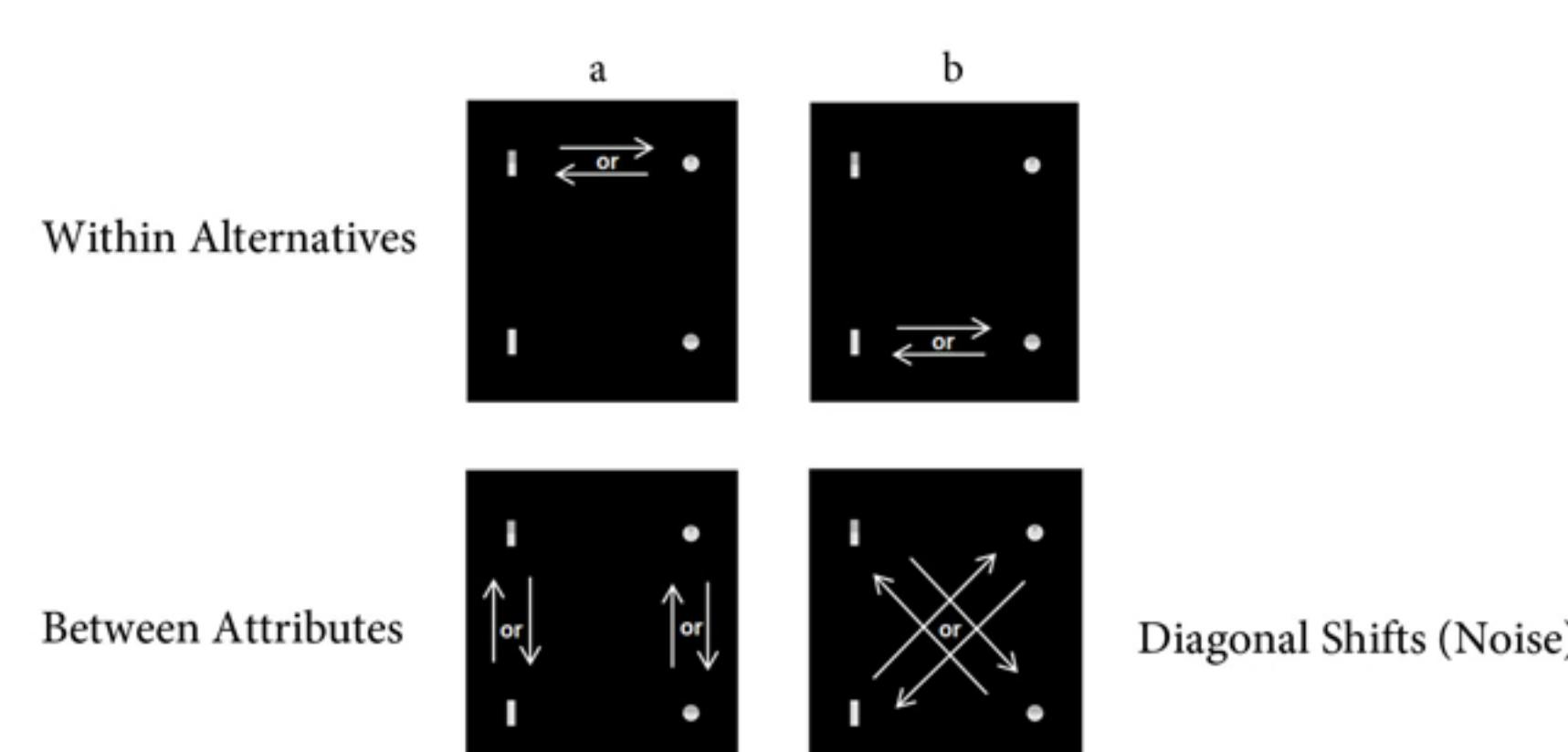
$$\begin{array}{lll} \text{Expected Value} & \text{Expected Utility} & \text{Prospect Theory} \\ \sum x_i \cdot p_i & \sum x_i^\alpha \cdot p_i & \sum \pi(p_i) \cdot v(x_i) \end{array}$$

Method

- 31 Participants
- 104 Trials
- Free response
- Incentive compatible



Individual Differences



Models

Model Types

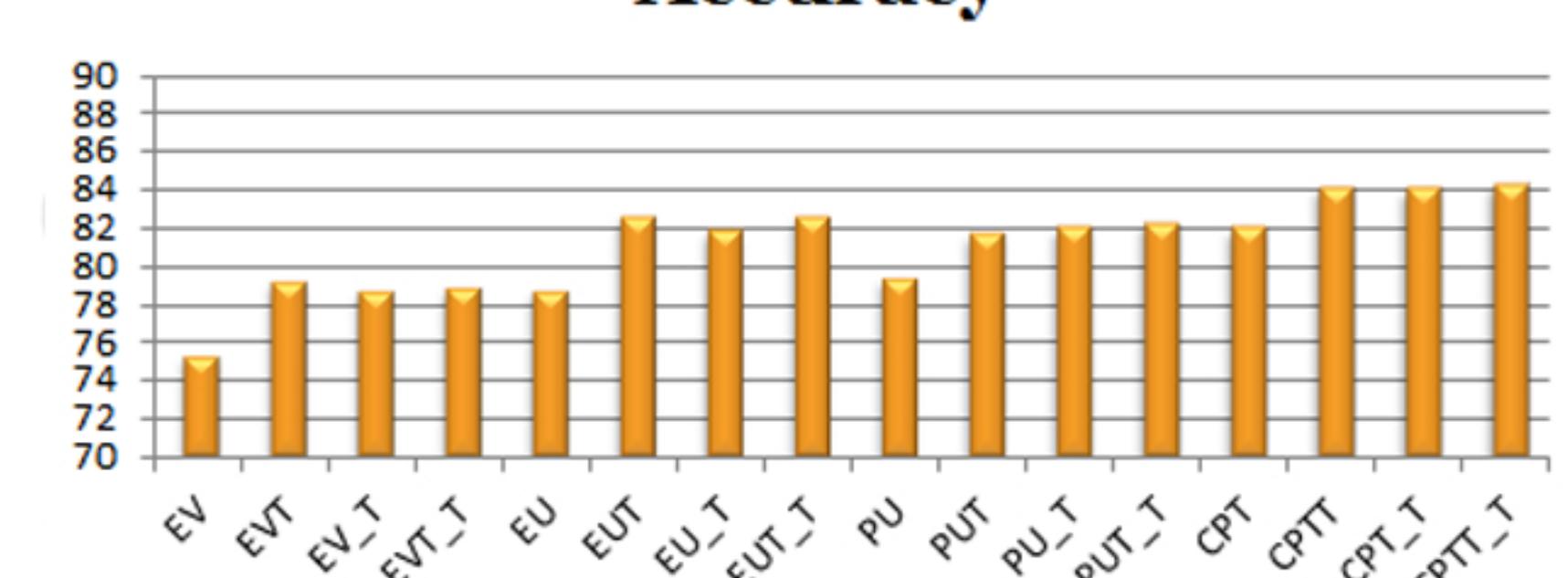
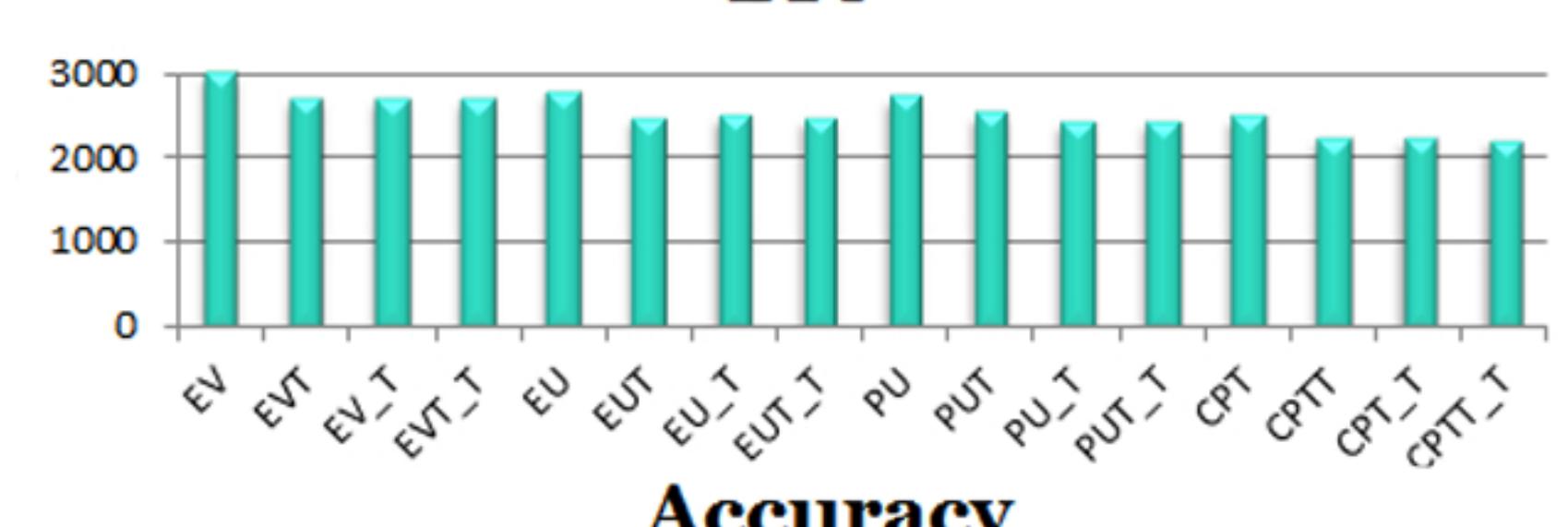
$$\text{Descriptive } f(EU_{regression}) = \frac{1}{1 + e^{-(\beta_1 x_1^\alpha p_1 - x_2^\alpha p_2)}}$$

$$\text{Multiplicative models } f(EUT_{regression}) = \frac{1}{1 + e^{-(\beta_1 x_1^\alpha p_1 \cdot t_1^\alpha - x_2^\alpha p_2 \cdot t_2^\alpha)}}$$

$$\text{Additive models } f(EU-T_{regression}) = \frac{1}{1 + e^{-(\beta_1 (x_1^\alpha p_1 \cdot t_1^\alpha - x_2^\alpha p_2 \cdot t_2^\alpha) + \beta_2 (t_1 - t_2))}}$$

$$\text{Multiplicative \& Additive } (EUT-T_{regression}) = \frac{1}{1 + e^{-(\beta_1 (x_1^\alpha p_1 \cdot t_1^\alpha - x_2^\alpha p_2 \cdot t_2^\alpha) + \beta_2 (t_1 - t_2))}}$$

BIC



Cumulative Process Model

a	b
$A1 = \text{Leak} \cdot A1 + x_1^\alpha \cdot p_1 - \theta \cdot x_2^\alpha \cdot p_2$	$A2 = \text{Leak} \cdot A2 + x_2^\alpha \cdot p_2 - \theta \cdot x_1^\alpha \cdot p_1$
$A2 = \text{Leak} \cdot A2$	$A1 = \text{Leak} \cdot A1$
c	d
$A1 = \text{Leak} \cdot A1 + x_1^\alpha \cdot p_1 - \theta \cdot x_2^\alpha \cdot p_2$	$A1 = \text{Leak} \cdot A1$
$A2 = \text{Leak} \cdot A2 + x_2^\alpha \cdot p_2 - \theta \cdot x_1^\alpha \cdot p_1$	$A2 = \text{Leak} \cdot A2$

Model Comparison

Averaged Fit (and standard dev.)

Model	BIC*	Accuracy
EU	2623.74	76.4% (.06)
EUT	2440.27	80.3% (.06)
Cumulative EU-based transitions model	2266.07	83% (.06)

Conclusions

- Eye scanning patterns (proportion of within transitions) are associated with EV choice.
- Using dwell time/number of fixations can improve the accuracy of prediction.
- Processes models can further improve the accuracy of prediction, and elucidate the dynamics of preference formation