Berlin 2013

XXXV Annual Meeting of the Cognitive Science Society

Emotion and Decision-Making: Modeling Strategy Selection

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Probabilistic inference

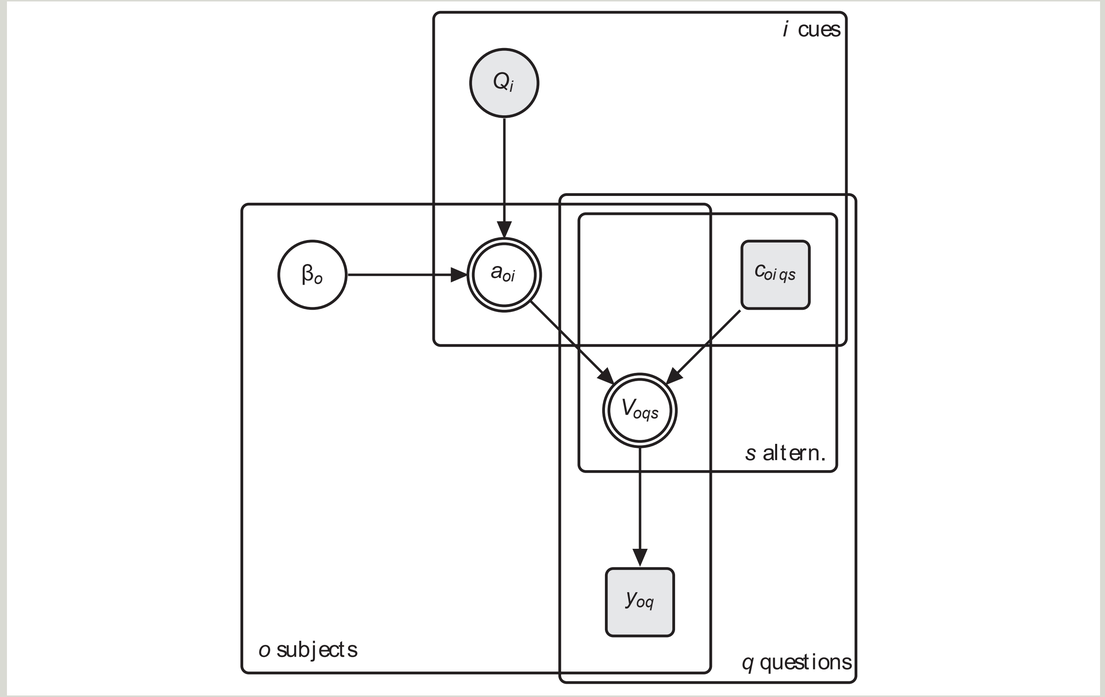
Emotions influence our decisions on a daily basis. However, most models of decision making neglect the impact of emotions on predecisional information processing and choice.

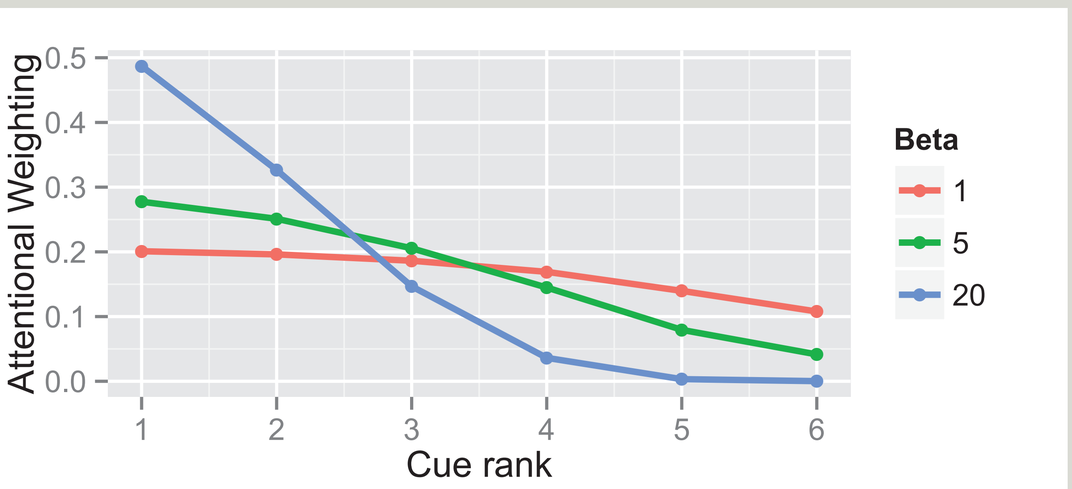
In a **probabilistic inference task**, individuals make an inference about a criterion on the basis of several probabilistic cues (Rieskamp & Hoffrage, 1999, 2008).

People posses a repertoire of strategies and use these strategies adaptively (Gigerenzer, Todd & ABC Research Group, 1999, see also Payne, Bettman & Johnson, 1993). The strategies differ in the amount of required information.

Take The Best (TTB; Gigerenzer & Goldstein, 1996) infers that the alternative with the highest cue value on the cue with the highest validity also has the highest criterion value.

Weighted Additive (WADD) integrates the available information; it computes the sum of all cue values multiplied by their cue validity for each alternative, and selects the alternative with the largest sum.





Modeling

BUMSS (Bottom-Up Model of Strategy Selection) was evaluated on the data from Wichary, Mata & Rieskamp (under review).

Hierarchical Bayesian Modeling

BUMSS was implemented as a hierarchical Bayesian model (Lee & Wagenmakers, forthcoming) in JAGS. Prior for β: exponential distribution with λ = .1.

	All trias		Discriminating trials	
	WADD	TTB	WADD	TTB
Beta	-0.35*	0.74**	-0.52**	0.66**

*p<0.05, **p<0.01

Attentional weighting and strategy selection

Use of the two seemingly opposite strategies, WADD and TTB, can be explained by one unifying mechanism, namely the attentional weighting of cues, controlled by the activity of the locus coeruleus norepinephrine system (LC-NE), a brainstem nucleus associated with physiological arousal and modulation of information processing (Aston-Jones & Cohen, 2005)

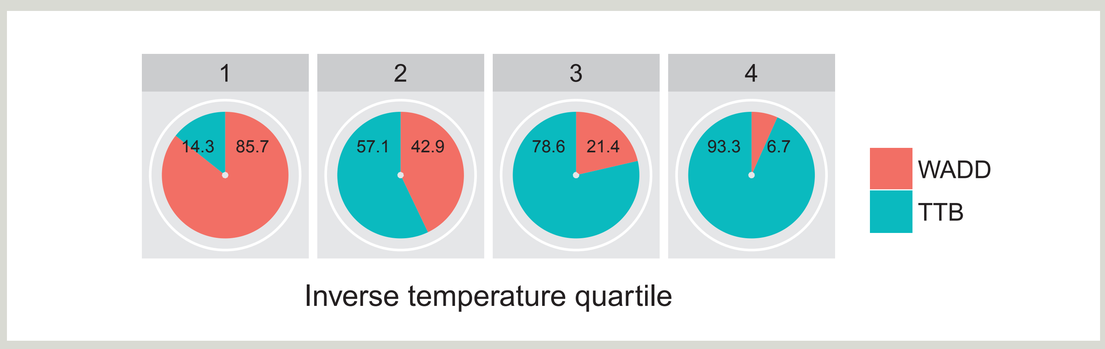
$$a_i = \frac{e^{\beta Q_i}}{\sum_{j=1}^{k} e^{\beta Q_j}},$$

where a_i is an attentional weight of ith cue, β is inverse temperature, the parameter that controls the attentional cue weighting, and Q_i is the cue validity of ith cue, defined as the conditional probability that a choice based on this cue is correct, given that the cue discriminates between the choice alternatives.

Cue integration according to the weighted additive rule

$$V = \sum_{i=1}^{k} a_i c_i,$$

where V is the value of a choice alternative and c_i is the value of ith cue for this alternative.



Emotional stress manipulation

Two independent main effects: the effect of Strategy Classification (F[1,50] = 15.6, p < .001) and Condition (F[1,50] = 3.8, p = .059) and no interaction effect (F[1,50] = 0.03, p = .86).

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