

Decision Making in a Risk-Reward World

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1 Introduction

Theories of decision making treat **risks (probabilities)** and **rewards (payoffs)** as independent factors that determine the subjective value of an alternative, and ultimately choice.

BUT: Negative **risk-reward** relationships exist in many ecologies outside the lab (Pleskac & Hertwig, 2014).

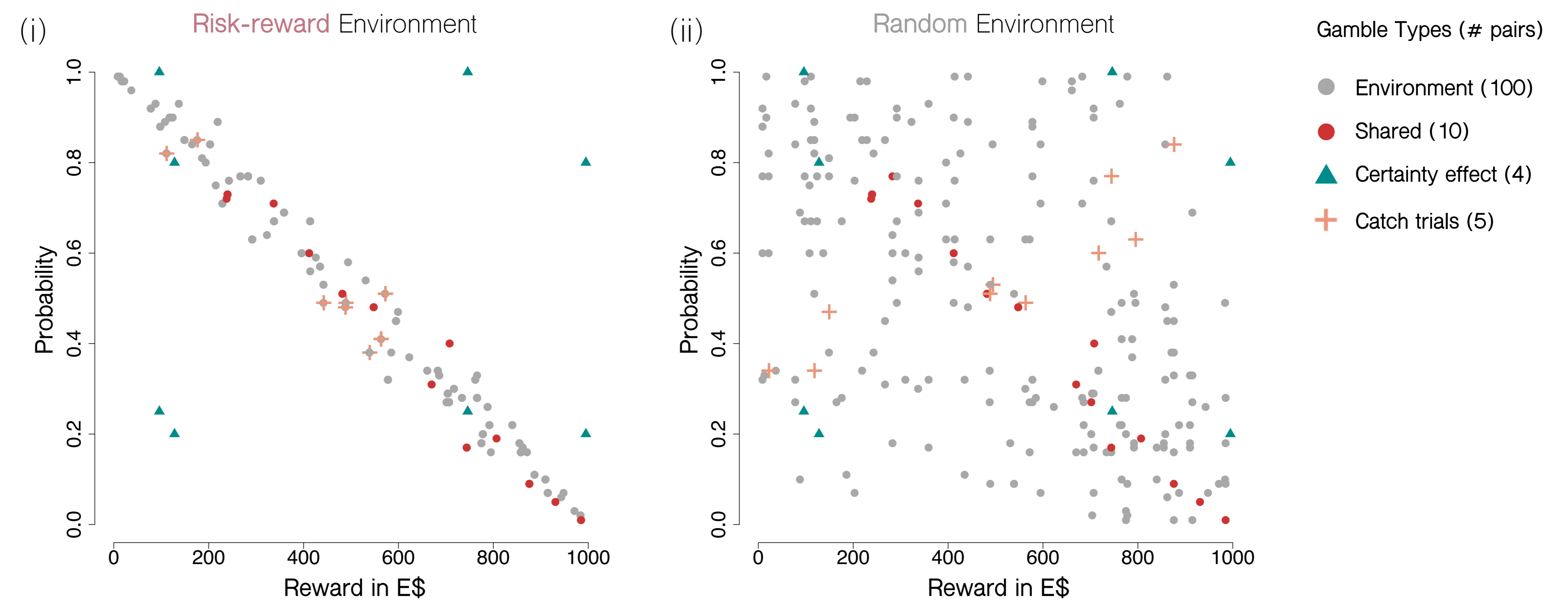
According to an adaptive view of cognition, people select decision strategies that match the **structure of the environment** (Brunswik, 1943; Payne, Bettman & Johnson, 1993; Simon, 1956).

How do people make decisions when finding themselves in ecological, **risk-reward** versus unstructured, **random environments**?

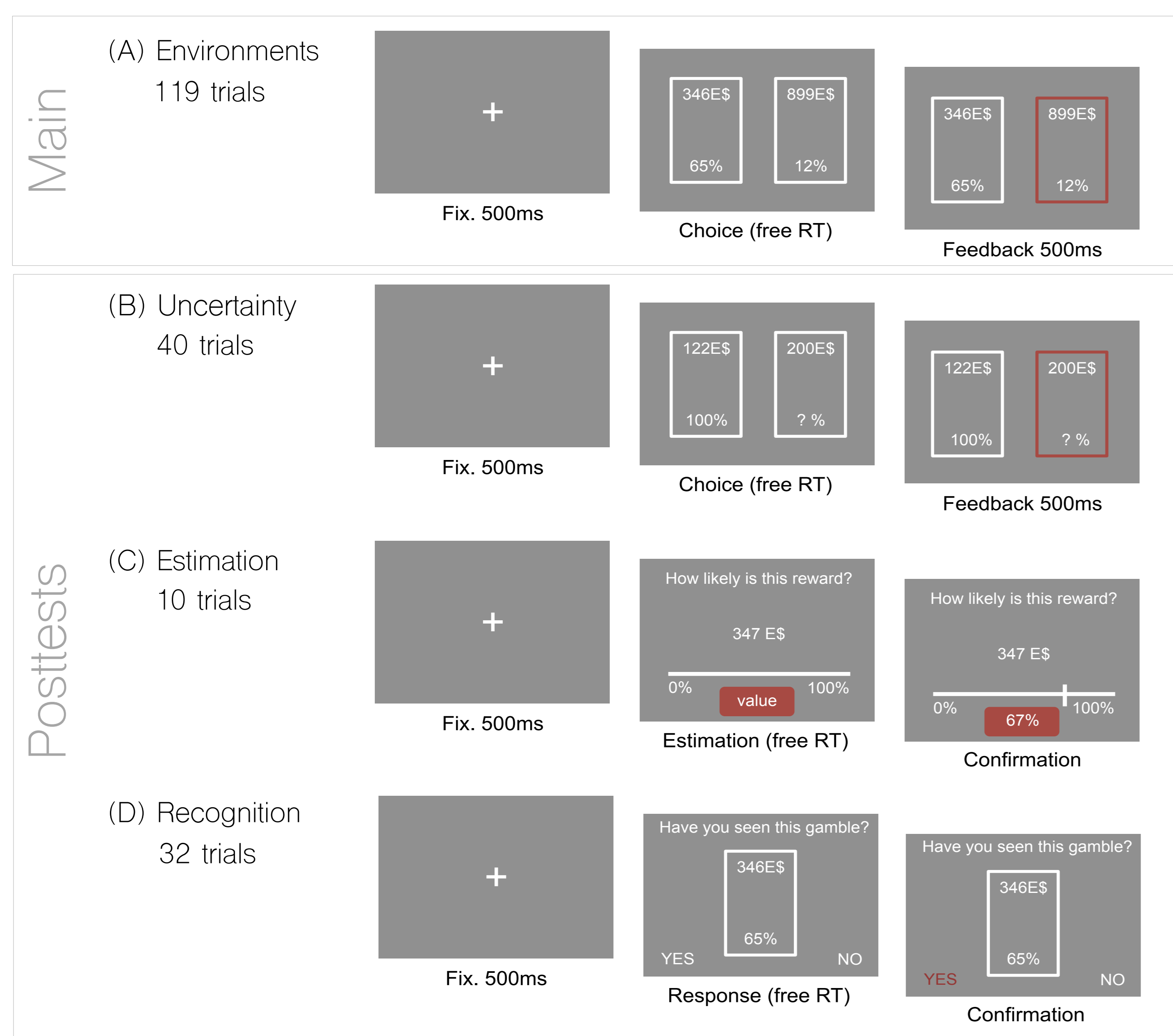
To test this, 62 participants (18–34yrs, 32 females) took part in a behavioral study (between-subjects).

2 Stimuli

Participants made 119 choices between two monetary gambles of the form ' p chance of winning x (otherwise 0)'. The gambles were drawn from either a **risk-reward** or a **random environment**.



3 Procedure



Task procedure. (A) Participants responded to 119 gamble pairs in the main experiment, with condition-dependent stimuli. **Shared gambles** and **Certainty effect gambles** were interspersed after 50 environment gambles. We played out 20 chosen gambles after the experiment (1000E\$ = 1EUR). (B, C, D) All participants completed the same set of post-tasks.

5 Discussion

People appear to use the **risk-reward** relationship in decisions under uncertainty (B). Their choices are consistent with them inferring probabilities from payoff magnitudes (C), via a previously learned **risk-reward** relationship. Although the **risk-reward** relationship seems to impact memory judgments about risky prospects (D), it did not affect choice behavior in decisions under risk as such (A).

Participants in the **random** condition showed similar tendencies (A, C, D). Why?

Gamble pairs: Removing dominated options from **random gamble pairs** creates a *local* 'risk-reward' structure

Ecology vs. lab: Prior knowledge of risk-reward associations (see Pleskac & Hertwig, 2014) hard to overcome in a laboratory task (**random condition**).

Future Directions

How do people pick up risk-reward associations? (Function learning?)

How do people perceive and use risk-reward associations in other domains?

What are lifespan implications? (e.g. stronger risk-reward sense at older ages?)

6 References

- Brunswik, E. (1943). Organismic achievement and environmental probability. *Psychological Review*, 47, 69–78.
 Payne, J. W., Bettman, J. R., & Johnson, E. J. (1993). *The Adaptive Decision Maker*. New York, NY: Cambridge University Press.
 Pleskac, T. J., & Hertwig, R. (2014). Ecologically Rational Choice and the Structure of the Environment. *Journal of Experimental Psychology: General*, 143(5), 2000–2019.
 Simon, H. A. (1956). Rational choice and the structure of the environment. *Psychological Review*, 63, 129–138.

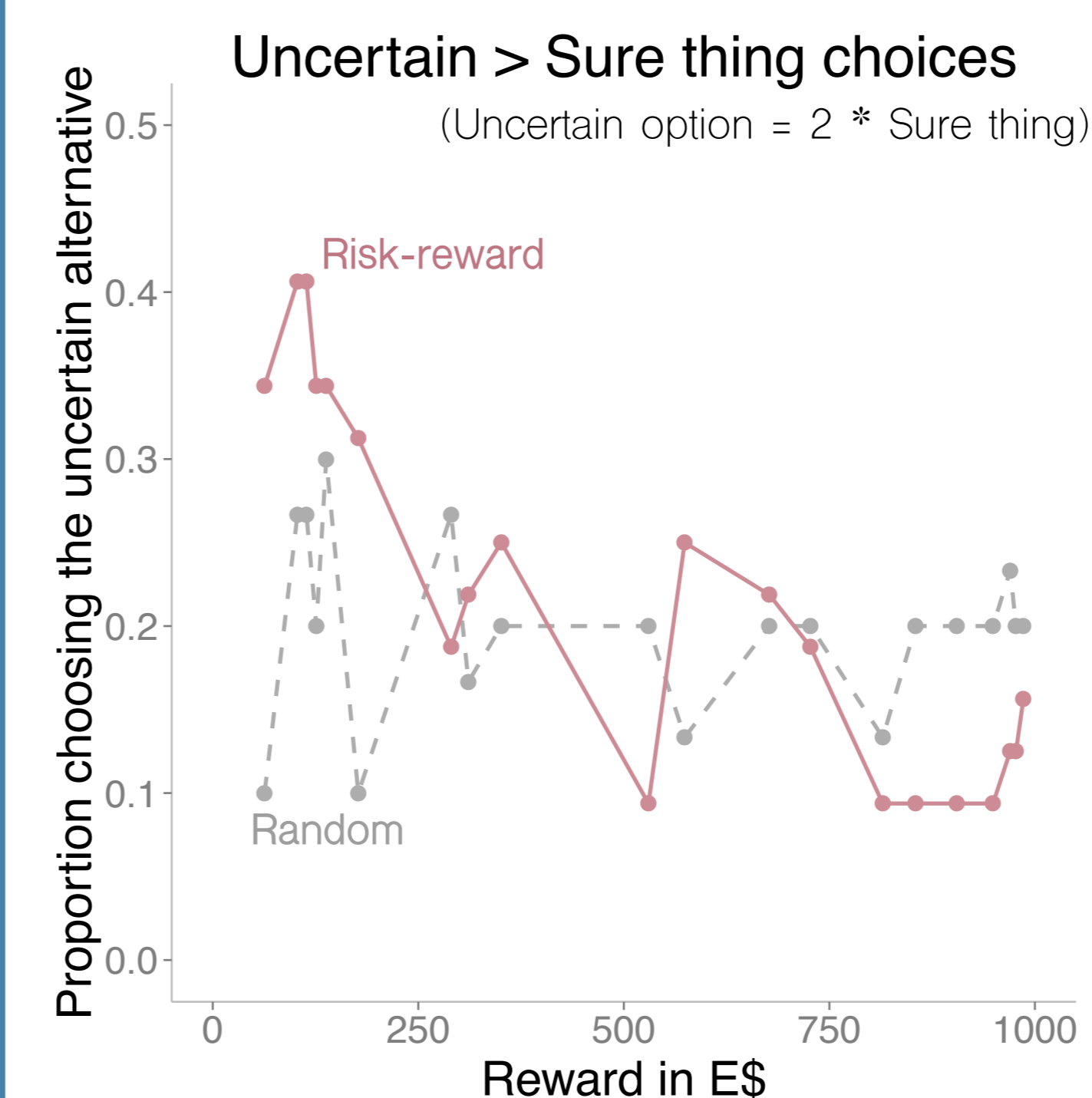
4 Results

(A) How does the **risk-reward** relationship affect decisions under risk?

The two types of risky gambles interspersed in both environments were unaffected.

- No difference in **shared gamble** choice proportions ($p = .821$) and RTs ($p = .901$).
- ▲ Standard **certainty effect** in both conditions ($p = .960$). Most participants prefer the certain (100% > 80%), but lower payoff option. These preferences switch when payoffs remain the same but probabilities are scaled down (25% < 20%).

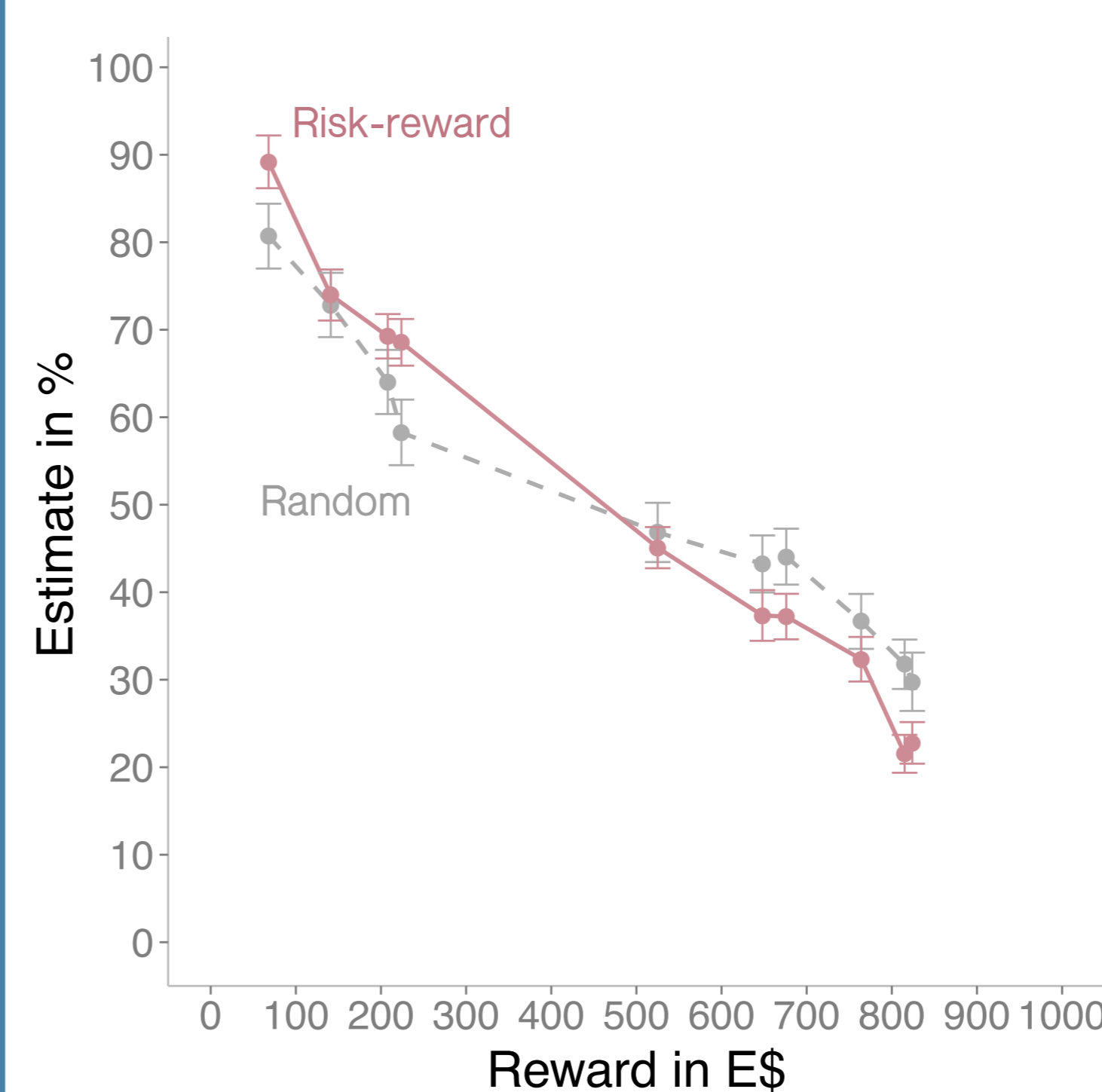
(B) How does the **risk-reward** relationship affect decisions under uncertainty?



Participants were informed that gambles in this task were structured like the gambles in the main experiment.

Participants in the **risk-reward** condition chose the uncertain option more when facing low-reward prospects, but slightly less when facing high reward prospects (*condition × reward interaction*, $p < .001$).

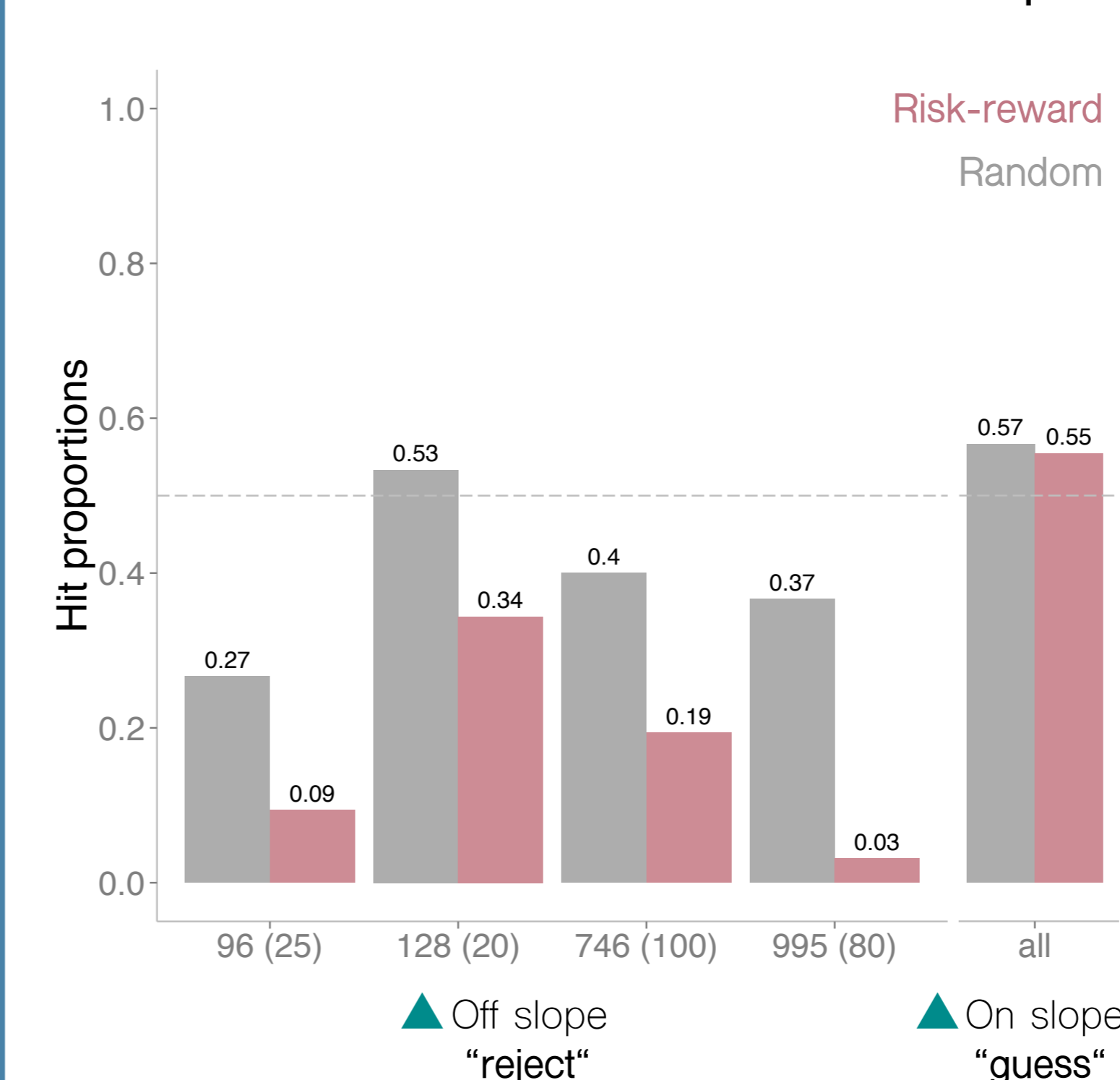
(C) How does the **risk-reward** relationship affect explicit probability estimates?



All participants estimated a negative risk-reward relationship when asked to infer probabilities from reward magnitudes alone ($p < .0001$).

Probability estimates were more regressive to 50% in the **random** condition (*condition × reward interaction*, $p < .0001$).

(D) How does the **risk-reward** relationship affect memory judgments of risky prospects?



Overall recognition was at chance level in both conditions ($d' < .01$), there were no response biases (criterion $< .01$, both SDT framework).

But: Participants in the **risk-reward** condition systematically **rejected** "non Risk-Reward" gambles (▲ off slope, see Risk-Reward stimuli).