Cumulative risk judgments and choice: an application to flood risks

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Introduction

Catastrophic events, such as floods, earthquakes, hurricanes, and tsunamis are rare, yet the cumulative risk of an event occurring at least once over an extended time period can be quite substantial [1].

In the present work we assess the perception of cumulative flood risks, how those perceptions affect insurance decisions, and whether those risk perceptions can be improved by providing simple cumulative risk information.

Materials & Methods

Cumulative risks for a base rate p over t years of exposure is $1-(1-p)^t$. We expect individuals will use one of two heuristics to compute it: i) mean heuristic or constant rule p and ii) additive heuristic or multiplicative rule p x t.

We recruited 997 M-Turk subjects to test our hypothesis. The survey comprised two sections a direct risk **Judgment task** [3,4] and **Choice task** between two options, full insurance and no insurance.

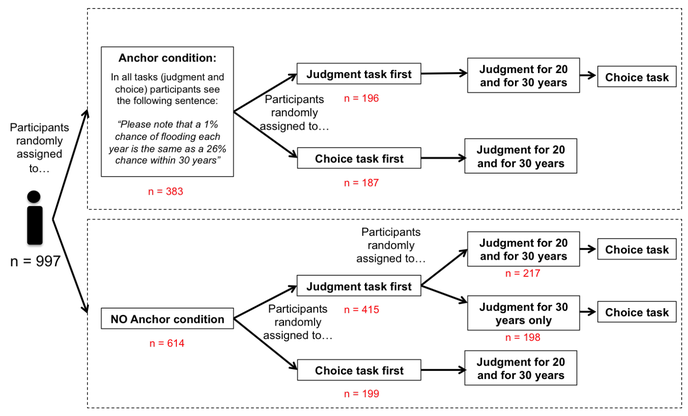

Figure 1. Experimental design

Results

Heuristics

- The mean heuristic was the most prevalent strategy in the no-anchor condition ($\chi 2_{1,0.95} \geq 140$, $p < 0.01$).
- The proportion of accurate judgments increased with the anchor ($\chi^2_{1,0.95} \geq 88$, $p < 0.01$).

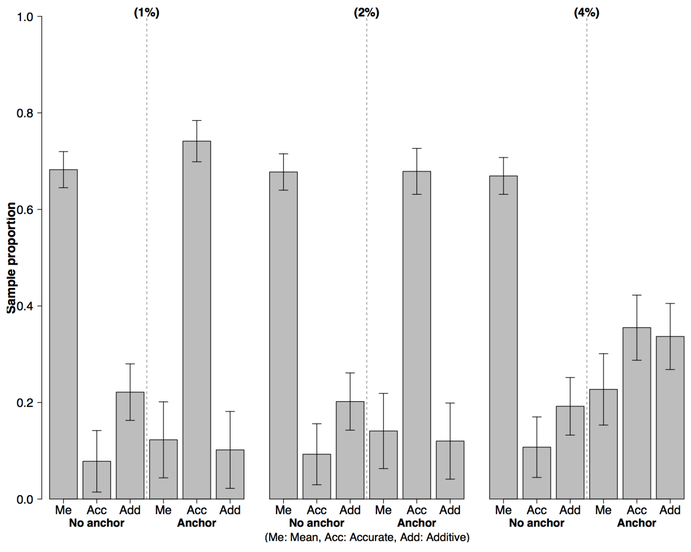

Figure 2. Proportion of heuristics per condition with 90% Wald CI**.**

Anchoring and Accuracy

Judgments can be represented by a bimodal distribution, with a group that severely underestimate the risk and a group that moderately overestimate it. Anchor displaced judgments closer to correct response.

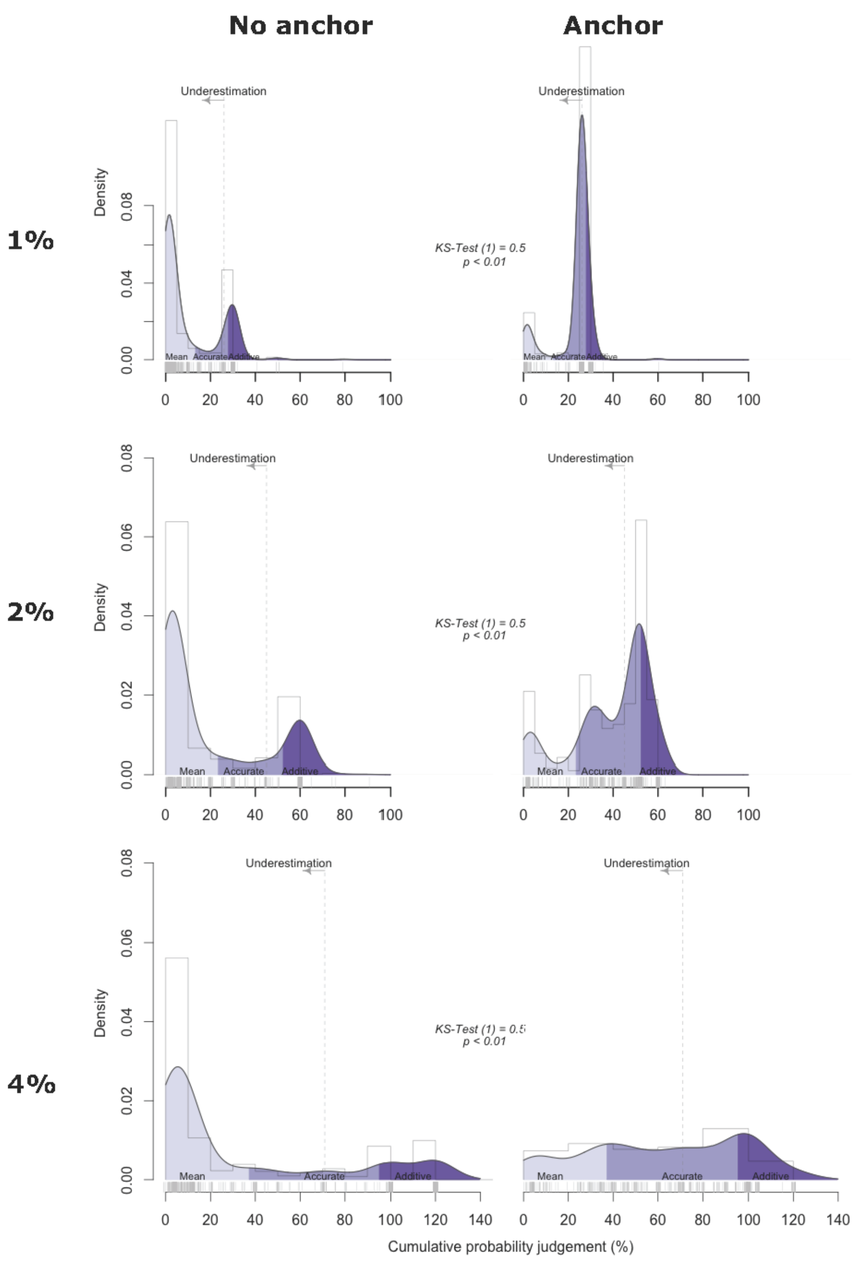

Figure 3. Kernel density cumulative risk judgments.

Effect of judgment heuristics in choices

Individuals that underestimate cumulative risk are more risk seeking than individuals that overestimate it ($\chi^2_{1,0.95} > 2.3$, $p < 0.05$).

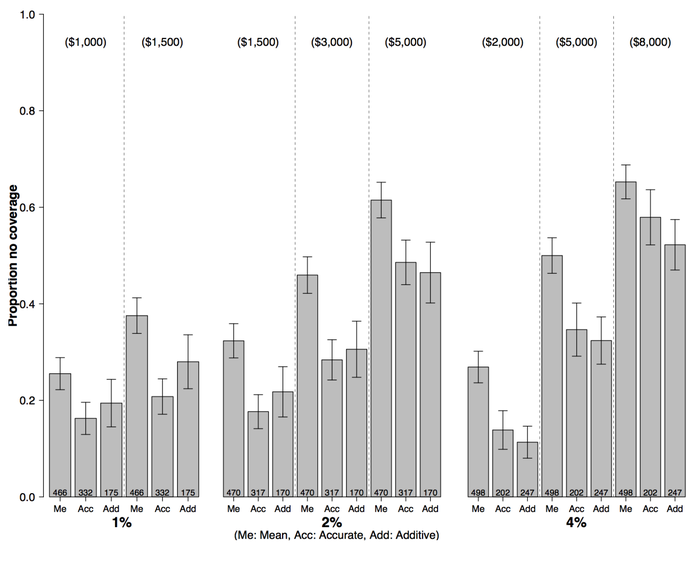

Figure 4. Proportion choosing option A-no-coverage with 90% Wald C.I.

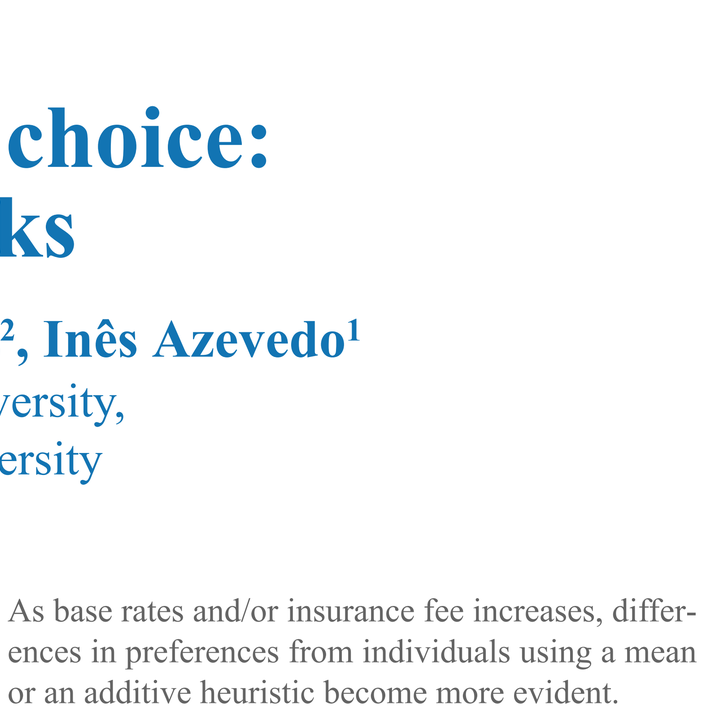

Figure 5. Probability of choosing no-coverage with: i) binary logit (MNL) and ii) latent class logit (LC).

As base rates and/or insurance fee increases, differences in preferences from individuals using a mean or an additive heuristic become more evident.

Conclusions

1. Respondents will first consider p as a plausible cumulative risk judgement leading to a mean heuristic. If bias is detected, respondents will search for a new heuristic. An additive heuristic will be the most likely available rule[4].
2. A large proportion of individuals chose the normative option. Judgment studies alone could prescribe more action than is required.
3. Nonetheless, providing information about the annual risk of an adverse event (rather than cumulative risk), could expose public to harm they would not accept when fully informed.
4. Instead, materials aimed at helping decision makers improve their choices should include cumulative risk information directly.

References

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