Open Sampling: A critical investigation of information acquisition predictions

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A classic finding of risky choice research is that the integration of small probabilities is biased, and, in particular, that small probabilities seem to be overweighted when gambles are displayed in a tabular form (e.g. Tversky & Kahneman, 1992). However, in recent years, a host of research has shown that this effect is not universal, but rather that decisions are dependent on the mode of presentation – with sequential sampling formats leading to the reverse trend, an apparent *under*weighting of small probabilities (e.g. Hertwig, Barron, Weber, & Erev, 2004; Camilleri and Newell, 2011). In addition, Hilbig and Glöckner (2011) demonstrated that it is possible to reduce and almost eliminate biased processing of probabilities using the "Open Sampling" format, in which the outcomes of a gamble (as monetary values) are displayed in a 10x10 grid, with their relative frequency corresponding to the probability of their actualization. Hilbig and Glöckner hypothesize that this format enables decision-makers to employ "(automatic) processes of sampling and accumulation" and "fast scanning processes", which they assume allow for "drawing a more exhaustive and representative sample" (p. 395). However, they do not provide any evidence for their claim in terms of information acquisition data. In the current study, we trace the information acquisition processes through eye-tracking, in order to shed light on the actual samples drawn by participants, testing the assumptions made by the original authors. We observe these processes in a risky choice task, using incentivized decisions between gambles presented in the Open Sampling format.

Our first hypothesis concerns the type of information acquisition, which is assumed to consist of scanning rather than attentive information search. In line with this assumption, we observe predominantly short to medium length fixations (md=196ms) rather than extended ones, which would be expected given attentive processing.

Second, we confirmed the prediction that the information samples gathered by participants using Open Sampling were larger than those typically observed when information is obstructed and sampling is sequential and thus more effortful (e.g. Hertwig, Barron, Weber, & Erev, 2004). Participants directly sampled (fixated on), on average, around 50% more distinct outcomes presented in the matrix (and possibly assessed more through peripheral vision, which would not be reflected in fixations), indicating that decision-makers make use of additional information that is openly presented to them. Also, we observed that sampling is adaptive, in that the samples drawn become larger as the options become more similar.

Third, we observed that the samples drawn by participants were representative in that they reflect the underlying distribution of outcomes very well. Participants' attention to the outcomes was distributed almost perfectly in line with their actual probabilities, so that a valuation of the gambles based on the samples drawn reflected the underlying values very well. Sampling was also unaffected by the magnitude of the individual outcomes, which might have been a plausible and potentially strong source of bias.

Finally, although participants' samples were representative, our data reveal that they are far from random (in a special sense), and far from exhaustive. In particular, even though their sample is larger than samples typically observed in alternative presentation formats, it is fairly small relative to the amount of data potentially available. We observe that participants sample only a subset of the information presented, and that this sample is systematic, initially focussing on the upper left corner of the matrix (akin to reading a paragraph), and concentrated on the center of the matrix for the remainder of the information acquisition. This implies that unbiased decision-making in the Open Sampling format is critically dependent on the random distribution of outcomes across the matrix, and that biased decisions may arise if any bias is introduced in the construction of the matrix.

Our findings corroborate the view that decision-makers can, if given the opportunity, quickly and accurately assess risky prospects without inherent bias (c.f. Hilbig & Glöckner, 2011). In addition, we shed some light on the processes which enable this feat: They appear to draw upon fairly large and representative samples of outcomes, which are then integrated in an unbiased manner.

References

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