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# Preferences under risk: content-dependent behavior and psychological processing

Petko Kusev<sup>1\*</sup> and Paul van Schaik<sup>2</sup>

<sup>1</sup> Department of Psychology, Kingston University London, London, UK

<sup>2</sup> Department of Psychology, Teesside University, Middlesbrough, UK

\*Correspondence: p.kusev@kingston.ac.uk

A common view in economics and psychology is that decision agents achieve their choices and express their respective preferences by computing probabilistic properties (probabilities and money) from a decision-making context (e.g., von Neumann and Morgenstern, 1947; Tversky and Kahneman, 1992; Starmer, 2000). In this computational processing, the main psychological mechanism requires that decision agents are able to integrate economic (contextual) attributes such as money and probabilities into subjective values; in other words people are able to construct and employ psycho-economic scales. Subsequently, when making a choice, decision agents are supposed to perform tradeoffs between the computed outputs (psycho-economic variables such as expected values) and certain monetary alternatives (see Kahneman and Tversky, 1979; Tversky and Kahneman, 1992; Starmer, 2000). Despite the dominance of descriptive approach to the decision-making (e.g., Kahneman and Tversky, 1979; Tversky and Kahneman, 1992), theorists (Hertwig et al., 2004; Stewart et al., 2006) have recently argued for somewhat different psychological processing in decision-making, without computations (integration of attributes) and tradeoffs. In particular, a non-utilitarian structure of preferences for risk is proposed. In this approach, decision-making is accounted for by experience with sequential events, simple binary comparisons (based on context and memory), and a threshold mechanism (Hertwig et al., 2004; Stewart et al., 2006). However, recent research (Kusev et al., 2009, 2011; Jones and Oaksford, 2011), in an effort to map the nature of human preferences, explored the role of decision-making content (the influence of memory in precautionary decision-making – Kusev et al., 2009, and transactional content on temporal and probabilistic discounting of costs – Jones and Oaksford, 2011). Specifically, we distinguish the influence

of decision-making *content* from that of decision-making *context* (the description of risk); we see the content of decision-making as experiential (accumulative) cognitive storage system which represents (but not necessarily accurately) experienced events and their associate frequencies as these events occur over time. Accordingly, in this article we elaborate further on the interplay of decision-making context and content, as well as potential “decision” biases as a result of sequential experience in decision-making.

## THE IMPORTANCE OF DECISION CONTENT AND PSYCHOLOGICAL PROCESSING

People’s behavior in the face of risk implies that they judge and weight the probability of risky events in characteristic ways that deviate from normative theory. Nonetheless, both expected utility (EUT; von Neumann and Morgenstern, 1947) and prospect theory (PT; Tversky and Kahneman, 1992) share a common representational assumption: people’s risk preferences and decisions under risk and uncertainty are task-independent. In this opinion article we pursue an opposing idea that risky choices are affected by decision content, even when utilities and probabilities are known. In contrast with PT (Tversky and Kahneman, 1992) and experienced-based decision-making (e.g., Hertwig et al., 2004), we suggest that people do not have stable preferences (Kusev et al., 2009, manuscript in preparation); instead, context, accessibility to content of decision-making, task demand, and skills determine choices. Accordingly, we argue that any assumption about a particular behavioral pattern for risk as well as the assumption of a single type of processing (e.g., computational or non-computational processing in decision-making) is difficult to justify. Indeed, in decision-making, humans might be able to exhibit different patterns and use

different types of processing [e.g., computing the probabilistic information from the context or sampling from memory (content of decision-making) and context].

Our position is that the particular combination of contextual factors, accessibility to content, demands, and skills trigger a particular type of processing, which then results in preferences. For example, task relevance has been demonstrated to influence processing style in risky choice. Task with high relevance result in the application of an analytic processing style, but the opposite is true for tasks with low personal relevance, leading to the application of a holistic processing style (McElroy and Seta, 2003). We speculate that some of the differences between experience-based and description-based decision-making reflect differences in psychological processing (e.g., computational and non-computational processing; holistic and analytical psychological processing). Commonly, as in learning about decisions from experience, the risky events in the real world are experienced sequentially and separated from the context provided by subsequent events in a temporally extended sequence. However, some risky events are not experienced individually over time, but are reviewed retrospectively and can also immediately be viewed holistically such that any overall pattern will be immediately apparent – as with learning about decisions from descriptions. Nevertheless, in both situations decision-makers refer to exactly the same data points in order to make their choices (or express their risky preferences). In Kusev et al. (2009), the empirical results and probability-weighting fittings indicated a failure of the descriptive invariance axiom of EUT. For risky choices, people overweighted small, medium-sized, and moderately large probabilities: respondents exaggerated risks. It was concluded, that exaggerated risk is caused by the accessibility of events in memory (content of decision-making): the

weighting function varies as a function of the accessibility of events. This result suggests that people's experiences of events leak into decisions even when risk information is explicitly provided; variation in decision content produces variation in preferences for risk.

### DO EXPERIENCED SEQUENTIAL PATTERNS SHAPE PREFERENCES?

It is difficult to imagine that our experiences and associated memories do not shape our future choices. Indeed, the right question to ask is not whether this is plausible, but how and why preferences and judgments are shaped by experiences and their sequential pattern. Recent research on frequency judgments and memory (Kusev et al., 2011) demonstrates that participants do not make frequency judgments by sampling their memory for individual items; participants judged frequencies relative to experienced sequential patterns (sequentially encountered stimulus properties of the stimulus sequence configuration).

Traditionally, research in cognitive psychology has argued that decision-makers are constrained by limitations of information-processing and memory (Simon, 1956), and hence have a propensity to avoid cognitive load. We argue that this, in turn, will encourage them to respond to "appropriate processing" informed by simple patterns (Kusev et al., 2011), decision-making content, and memory (e.g., Kusev et al., 2009; Jones and Oaksford, 2011) – all psychological mechanisms that may account for people's risky decision-making. In Kusev et al. (2011) a series of experiments studied relative-frequency judgment of items drawn from two distinct categories. The experiments showed that judged frequencies of categories of sequentially encountered stimuli are affected by properties of the experienced sequences, through the first-run effect, whereby people overestimate the frequency of a given category when that category was the first *repeated* category to occur in the sequence. We also found dissociation between judgments and recall; given two types of event, respondents may judge one type more likely than the other and yet recall more instances of the latter. Specifically, the distribution of recalled items does not correspond to the fre-

quency estimates for the event categories, indicating that participants do not make frequency judgments by sampling their memory for individual items as implied by other accounts such as the availability heuristic (Tversky and Kahneman, 1973) and the availability process model (Hastie and Park, 1986).

The first-run effect could have particularly important implications for people's decision-making under risk in situations where experienced frequency of outcomes is the only basis for assessing likelihoods (e.g., experienced-based decision-making research; Hertwig et al., 2004). However, these studies did not require people to make explicit judgments of frequency – only to make decisions where experienced frequency of outcomes was an input to a risky decision. It is therefore worth considering also asking respondents in future decision-making studies to explicitly judge the experienced frequency of types of event experienced in sequences, or to make risky decisions where the judged likelihood of the experienced events is input for those decisions. Moreover, according to the foundation of economic theory, people have stable and coherent preferences that guide their choices between alternatives varying in risk and reward. In all their variations and formulations, UT (von Neumann and Morgenstern, 1947), and PT (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992) share this assumption. This view, for stable predictable patterns of preferences for risk, is shared by experience-based decision research, which reports (in contrast to PT) that probability of recently sampled information is overweighted (Hertwig et al., 2004). Nonetheless, it is possible that people simultaneously both overestimate experience-based likelihoods but also underweight their impact on risky decisions. The possibility of this sort of dissociation has yet to be systematically examined (cf. Kahneman and Lovallo, 1993).

### CONCLUSION

In conclusion, going beyond our research examples of the role of accessibility and decision-making and sequence-influenced frequency judgment, our position is as follows. Characteristics of (a) the decision-making context and (b) content (e.g., Kusev

et al., 2009; Jones and Oaksford, 2011), (c) the decision-maker (including cognitive resources and motivation; see Kruglanski et al., 2007) and (d) presentation format of task material (for example probability format or frequency format; see Gigerenzer, 2002) all influence people's psychological processing and subsequent risky choices. Many studies that limitations of space prevent us from reviewing here have demonstrated the effects of these components and their interaction on decision-making (e.g., Gigerenzer, 2002) and information-processing style (e.g., McElroy and Seta, 2003). Thus, risky choice is context- and content-dependent through the influence of specific characteristics of four components in decision-making behavior and processing.

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