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Task complexity moderates the influence of descriptions in decisions from experience☆

Leonardo Weiss-Cohen[a,*], Emmanouil Konstantinidis[b,c], Maarten Speekenbrink[a], Nigel Harvey[a]

[a] Department of Experimental Psychology, Division of Psychology and Language Sciences, University College London, London, UK
[b] Centre for Decision Research, University of Leeds, Leeds, UK
[c] School of Psychology, University of New South Wales, Sydney, Australia

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ABSTRACT

Decisions-makers often have access to a combination of descriptive and experiential information, but limited research so far has explored decisions made using both. Three experiments explore the relationship between task complexity and the influence of descriptions. We show that in simple experience-based decision-making tasks, providing congruent descriptions has little influence on task performance in comparison to experience alone without descriptions, since learning via experience is relatively easy. In more complex tasks, which are slower and more demanding to learn experientially, descriptions have stronger influence and help participants identify their preferred choices. However, when the task gets too complex to be concisely described, the influence of descriptions is reduced hence showing a non-monotonic pattern of influence of descriptions according to task complexity. We also propose a cognitive model that incorporates descriptive information into the traditional reinforcement learning framework, with the impact of descriptions moderated by task complexity. This model fits the observed behavior better than previous models and replicates the observed non-monotonic relationship between impact of descriptions and task complexity. This research has implications for the development of effective warning labels that rely on simple descriptive information to trigger safer behavior in complex environments.

1. Introduction

Decisions in everyday life are often made using a combination of descriptive and experiential information. For example, consumers use descriptive reviews and personal experiences of similar items bought in the past; doctors rely on written published literature and their own clinical experience; and drivers pass road signs warning them of traffic queues on a familiar stretch of road. The ongoing proliferation of warning signs and labels can be considered as descriptive information that is added to an individual's own experience, reminders of high-loss small-frequency risks that are rarely experienced. For example, passengers frequently run at stations in order to catch their trains, and the overwhelming majority never directly experiences any accidents. But warnings signs are common, reminding individuals that running can be dangerous and cause harm. Despite the ubiquitous presence of both sources of information concurrently, the vast majority of decision-making research has exposed participants either to "decisions from description" or "decisions from experience" separately, very rarely combining the two in the same task (Fantino & Navarro, 2012).

1.1. Decisions from description vs. experience

Decisions from description are those in which a complete, idealized, and abstract set of information about the values and frequencies of potential outcomes from each choice is provided, typically in writing, to participants before choices are made (e.g., "50% chance to win 1000; 50% chance to win nothing", from Kahneman & Tversky, 1979, p. 264). Decisions from experience, in contrast, do not provide any information before choices are made and, instead, require participants to form their own view of the potential outcomes from each choice via feedback provided after each selection is made (e.g., "You have won 100 dollars", from Bechara, Damasio, Damasio, & Lee, 1999, p. 5474). For the vast majority of the history of decision-making research, these two paradigms have been explored separately, each in their own individual domain.

One of the earliest attempts to empirically and systematically compare the two paradigms and study any differences in behavior was made by Barron and Erev (2003). They found that in decisions from experience, participants underweighted rare events, and were more risk

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* Corresponding author at: Department of Experimental Psychology, Division of Psychology and Language Sciences, University College London, Gower Street, London WC1E 6BT, UK.
E-mail address: leoweisscohen@gmail.com (L. Weiss-Cohen).

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seeking in the gain than in the loss domain. These are the reverse of well-established phenomena in the decision-making literature (Kahneman & Tversky, 1979), that is, overweighting of rare events and more risk seeking behavior in the loss domain, which had previously been explored exclusively in paradigms based in decisions from descriptions. This difference in behavior between decisions from descriptions and decisions from experience was later named the “description-experience gap” by Hertwig and Erev (2009). A substantial body of research has since been dedicated to studying the gap, by presenting different participants with the same choice scenarios, with either descriptions alone or experience alone (for a recent review, see Camilleri & Newell, 2013b). Camilleri and Newell suggested that the gap might be caused by differences in how information is presented, cognitively processed, stored, internally represented and compared. While the field has now extensively studied and compared the two paradigms side-by-side, limited research has been dedicated to tasks in which the two sources are combined and available simultaneously.

The limited previous research combining description and experience, “decisions from description-plus-experience”, has shown no difference in behavior when adding descriptions to decisions from experience, if the two provide the same underlying information (Lejarraga & Gonzalez, 2011; Weiss-Cohen, Konstantinidis, Speekenbrink, & Harvey, 2016). In other words, behavior was similar in decisions from experience and decisions from description-plus-experience.[1] Lejarraga and Gonzalez proposed that this lack of observable differences in behavior was due to descriptions being ignored when experience was also available. However, descriptions do not appear to be fully ignored, because they influence behavior when they provide novel information (Barron, Leider, & Stack, 2008). We showed in our previous research (Weiss-Cohen et al., 2016), using cognitive modeling, that descriptions are not completely ignored, but instead they are discounted. A similar effect of discounting of descriptions, when experience was also present, was found in probability judgments by Shlomi (2014). Empirical research so far has shown that descriptions are discounted, to the point of apparent neglect, when combined with experience provided in the form of feedback.

The concept that feedback overwhelms descriptive information had been proposed before (Jessup, Bishara, & Busemeyer, 2008; Yuviler-Gavish & Gopher, 2011). Lejarraga (2010) showed empirically that individuals prefer experiences over descriptions, by allowing participants to choose between the two types of information, which was then used to learn the probabilities associated with the options available and make their decisions. This preference for experiences can be explained by different cognitive processes being applied to descriptions and experiences, as suggested by Glöckner, Fiedler, Hochman, Ayal, and Hilbig (2012): when dealing with descriptions, individuals might engage in more complex computational processes, calculating the expected value of each option; conversely, personal experiences use simpler, more instinctive, and less demanding integration processes.

Research in other fields has shown similar findings arising from the additional cognitive burden consequent on processing descriptions and a resulting preference for experiences. For example, Gigerenzer and Hoffrage (1995) suggested that individuals are better at keeping track of sequentially acquired information, such as naturally presented frequencies experienced over time, and worse at processing percentages and probabilities presented descriptively. According to Hasher and Zacks (1984), individuals are able to learn from experience incidentally, automatically encoding frequencies with minimal effort and attention. On the other hand, Erev, Ert, Plonsky, Cohen, and Cohen (2017) have shown, using computational models, that decisions from descriptions can be explained by individuals mentally simulating outcomes from descriptions to arrive at expected values, a time consuming and costly process. Decision Field Theory, a model proposed by Busemeyer and Townsend (1993), is based around a similar concept that individuals mentally sample information over time until a decision threshold is reached. Overall, descriptions appear to be more cognitively demanding, whereas humans (and all other animals) are more naturally adapted to encode and process experiences.

The proposition that descriptions are more costly and effortful to process than experiences seems to support the evidence observed so far that descriptions are typically discounted in description-plus-experience paradigms, and that individuals prefer to rely on experiences rather than descriptions. However, we believe that the strength of this preference may not necessarily be static and that it is calibrated according to the situation. Some factors, such as plausibility and description complexity, have already been shown empirically to influence the strength of this preference. Less plausible descriptions, in comparison to the actual experienced feedback, received lower weights than more plausible ones (Weiss-Cohen et al., 2016). Lejarraga (2010) and Lejarraga and Gonzalez (2011) explored situations where descriptions were made less attractive to participants by increasing their perceived complexity, therefore making them even harder to process cognitively while keeping the underlying experiential task unchanged. By increasing the cognitive cost of processing descriptions, the authors showed an increase in preference for experiences. One limitation of these previous studies, however, was that the researchers did not change the complexity of the task itself, only the complexity of the descriptions by using simpler or more complex notation.

1.2. Task complexity

While complexity can be a subjective construct, and significantly dependent on individual differences, it is also related to certain underlying task characteristics that can be defined objectively (Campbell, 1988; Wood, 1986). Halford, Wilson, and Phillips (1998) have defined complexity as “the number of related dimensions or sources of variation” (p. 803), in terms of cognitive and computational processing loads and its influence on learning difficulty. The complexity of patterns of data can thus be quantified in relation to the ease of learning the simplest set of rules, with the minimum number of dimensions (or the most compressed set of information), which is required to represent all of the data’s potential sources of variability (Mathy & Feldman, 2012). More complex rules are the ones that require more information, are not as compressible, and therefore harder to learn (Feldman, 2000). For categorization tasks, for example, complexity increases, and learning deteriorates, in proportion to the minimum number of dimensions or components needed to identify items (Briscoe & Feldman, 2011; Mathy & Bradmetz, 2004). Comparably, memory tasks can be made more difficult by increasing the number of items that individuals are asked to recall (Miller, 1956), although if some of those items can be compressed together into fewer chunks of information, then empirical performance improves, and complexity is deemed to be lower (Cowan, 2001).

In the decision-making domain, Thorngate (1980) and Johnson and Payne (1985) defined task complexity in relation to the number of different alternatives from which participants can select, and the number of possible outcomes available from each alternative. Increasing the number of alternatives and outcomes increases the entropy of the task, which can be associated with higher task complexity (Fasolo, Hertwig, Huber, & Ludwig, 2009). Entropy is an objective measure that has been used to quantify task complexity, based on information theory, with higher entropy associated with higher complexity (Swait & Adamowicz, 2001). Despite some research dedicated to studying decision making with multiple alternatives and multiple outcomes (Ert & Erev, 2007; Hills, Noguchi, & Gibbert, 2013; Noguchi & Hills, 2016), most research has used relatively simple tasks,

[1] The reason for not comparing them to decisions from description (without experience) is because the two paradigms are inherently different. Decisions from description are typically single-choice, single-outcome, while decisions from experience are multiple-choice, multiple-outcomes (Camilleri & Newell, 2013a). By adding descriptions to the latter, it is possible to keep their repeated-choice nature constant.