Organizational Behavior and Human Decision Processes 116 (2011) 286–295

Contents lists available at ScienceDirect

Organizational Behavior and Human Decision Processes

journal homepage: www.elsevier.com/locate/obhdp

Effects of feedback and complexity on repeated decisions from description

Tomás Lejarraga *, Cleotilde Gonzalez

Dynamic Decision Making Laboratory, Department of Social and Decision Sciences, Carnegie Mellon University, Pittsburgh, PA 15213, USA

ARTICLE INFO

Article history:
Received 3 September 2010
Accepted 2 May 2011
Available online 26 May 2011
Accepted by Madan Pillutla

Keywords:
Decisions from experience
Instance-based learning theory
Feedback
Binary choice
Foregone payoffs

ABSTRACT

Recent evidence from research in risky choice shows that decisions from experience differ significantly from decisions from description, particularly when problems include a small-probability event and when samples from experience are small. Little is known, however, about the cognitive processes behind repeated decisions where both descriptive and experiential information are available for the decision maker. While previous findings suggest that feedback makes choices "deviate" from the predictions of prospect theory (Jessup, Bishara, & Busemeyer, 2008), we find a stronger effect: Our results suggest that information from description is neglected in the presence of feedback. Moreover, we find that in the presence of feedback, descriptions are overlooked irrespective of the level of complexity of the decision scenario. We show that an instance-based learning model and a reinforcement learning model account for the observed decisions by solely relying on observed outcomes. We discuss our findings in the context of organizational behavior.

Introduction

The study of decision making under risk and uncertainty has traditionally focused on decisions that occur once, and where the characteristics of the alternatives are fully described to the decision makers. When studied in a laboratory, decision makers receive written descriptions of the alternatives that inform them of all possible outcomes and the probabilities associated. This paradigm has been referred to as decisions from description. Many real-world decisions, however, take place repeatedly and the outcomes of those decisions and the likelihoods of those outcomes commonly have to be inferred from experience, rather than read and interpreted from a description. Recent advances in behavioral decision making have investigated decisions from experience, drawing on early studies of repeated choice and learning (e.g., Edwards, 1961; Katz, 1964; Myers & Sadler, 1960). Interest in the study of decisions from experience grew rapidly with the observation that choices made from experience differ significantly from those made from description, particularly when alternatives involve small probability events (Barron & Erev, 2003; Erev & Barron, 2005; Erev et al., 2010; Hertwig, Barron, Weber, & Erev, 2004).

Although research on decisions from description and decisions from experience has produced consistent findings in recent years, most of the studies explore scenarios where description and experience are evaluated separately. Little is known about decisions that are made when both sources of information (description and experience) are provided together. In this article, we attempt to gain insight into decisions from experience by studying how people combine descriptive information with experience.

Decisions from description and experience

Decisions from description and from experience differ in at least two fundamental psychological aspects: the assessment of likelihoods and learning.

Assessment of likelihoods

In decisions from description, the likelihood of an outcome is typically expressed as single-event probabilities (e.g., a .8 probability of $4). These are symbolic abstractions that express the proportion of expected outcomes from a reference population. Most theories of decisions from description propose that decision makers weigh all possible outcomes by their likelihoods to assess an option's desirability. Different theories postulate different alternatives for these weighted averages: Expected value theory assumes linear values and probabilities (Bernoulli, 1954); expected utility theory assumes linear probabilities, but allows for non-linear value functions (von Neumann & Morgenstern, 1947); and prospect theory, the most prominent account of decisions from description, assumes a non-linear value function and a non-linear transformation of probabilities (Kahneman & Tversky, 1979). In essence, these theories suggest that decision makers are able to accurately understand the notion of probabilities and perform either a conscious or unconscious calculation.

When decisions are made based upon experience, likelihoods are inferred from repeated exposure or observation. Hasher and

* Corresponding author. Fax: +1 412 268 6938.
E-mail address: tleja@andrew.cmu.edu (T. Lejarraga).

0749-5978/$ - see front matter © 2011 Elsevier Inc. All rights reserved.
doi:10.1016/j.obhdp.2011.05.001

Zacks (1979, 1984) showed strong evidence of the human capacity to encode frequency information automatically and effortlessly. Theories of decisions from experience, however, assume different treatments of experienced frequencies. For example, instance-based learning, a theory that captures decisions from experience relatively accurately, assumes that old experiences decay in memory, making recent experiences more salient than less recent ones (Gonzalez, Lerch, & Lebiere, 2003; Lejarraga, Dutt, & Gonzalez, 2010). A similar approach is proposed by the explorative sampler model, which assumes that the pool of experiences from which the brain assesses likelihoods is limited and skewed toward recent experiences (Erev, Ert, & Yechiam, 2008; Erev et al., 2010).

The ability to process frequency information is a basic cognitive capacity that humans share with lower animals (Shafir, Reich, Tsur, Erev, & Lotem, 2008). Because the concept of probability is novel in an evolutionary time scale, the assessment of likelihoods is natural when derives from experienced frequencies. Perhaps the earliest reference to probability dates back 1654, in the correspondence between Blaise Pascal and Pierre de Fermat (Datson, 1988). Moreover, when probabilities are compared to naturally occurring frequencies, the first appear as an artificial indicator of likelihood that collapses the proportion of expected outcomes to a single number. It is therefore predictable that humans process frequencies naturally, and exert more cognitive effort to process probabilities (Gigerenzer & Hoffrage, 1995).

Learning

Another important difference between decisions from description and from experience is how information about the options is obtained. In decisions from description, complete information is provided to decision makers before the choice, and learning the characteristics of the options occurs when the information is being read and processed. According to the decision theories cited above, learning in decisions from description involves the combination of outcomes and probabilities to assess the attractiveness of the alternatives. Once evaluation is complete, the decision maker executes his or her choice according to the best preferred alternative. No additional information can be learned about the alternatives or the nature of the problem by observing the outcome of the choice made: Outcomes are just realizations of possible phenomena already described.[1]

In decisions from experience, learning derives from observing the outcomes of choices in the absence of any other information. Learning and choice are, therefore, parallel and interdependent processes. Early choices are executed without information, and the outcomes of those choices feed the learning process with valuable information. In this manner, the decision maker gradually learns to identify the best preferred option as outcomes accumulate in memory.

The differences between deciding from well described alternatives and deciding from information gathered from experience lead to distinct choice patterns, which suggest different cognitive processes. Evidence for this assertion comes from a recent brain-imaging study, which shows evidence that the neural networks recruited to evaluate risky prospects differ with respect to whether these prospects are learned from experience or read from descriptions (FitzGerald, Bach, Seymour, & Dolan, 2010).

Thus, the question we aim to answer in the current research is: how are choices made when both types of information are available to the decision maker? Situations with these characteristics are numerous. Investors face this information duality constantly, as they can rely on the recommendation of models that offer objective expected performances or they can rely on their own previous experience in the market. A similar puzzle is faced by managers, who count on accurate market studies, but they also count on their own managerial experience. Lay people are also subject to this information processing, as we learn about climate risk from objective accounts but also from our own experience (Dutt & Gonzalez, 2010; Weber, 2006). Another example is when we purchase insurance and after a collection of safe experiences we learn that it may not be necessary (Yechiam, Erev, & Barron, 2006).

Jessup et al. (2008) took a first step in exploring how feedback influences decisions from description in binary choice. They studied repeated decisions where alternatives were described to the decision makers and feedback about their decisions was provided immediately after the choice. Decisions made from description could be captured by prospect theory, but decisions deviated from prospect theory when outcome feedback was provided after each choice. The authors suggest that outcome feedback altered the weighting of probabilities toward objective values, and their results suggest that information from description and from experience were combined in the decision process. The authors show that these deviations are in accordance with the observation that choices from experience are as if rare events were underweighted. It remains unknown, however, how the observed deviations compare to decisions in a condition where only feedback is provided as a source of learning. Such comparison would shed light onto the relative importance of information from description and from experience.

Newell and Rakow (2007) studied the same problem with a different approach. The authors asked participants to fill in a questionnaire and to make predictions about the outcome of a die roll. Their findings revealed that outcome feedback had a significant negative effect on the adoption of the optimal strategy.

The interesting aspect of this research question is that experience does not add new objective information for decision makers who already read precise descriptions of the problems. While descriptions provide a complete picture of the decision problem, experiences are just realizations of outcomes that were described as possible and should therefore be disregarded. Yet, scattered evidence suggests that feedback alters the interpretation of descriptions. In a repeated choice task involving losses, Yechiam, Barron, and Erev (2005) found that experience limits the effect of description as people learn to underweight small probability events. Similarly, Barron, Leider, and Stack (2008) found that initial safe experiences reduce the effect of descriptions that warn decision makers of potential risks. Finally, the well-known gambler's fallacy is an example of how individuals who, despite being aware of the likelihood of the outcomes, reveal sequential dependencies in their bets (Barron & Leider, 2010).

In light of this evidence, Lejarraga (2010) studied individuals' preference for probabilities or experienced frequencies in decision making. Participants were asked to choose between either descriptive probabilities or the chance to sample the lotteries as many times as they wanted before making a decision between two options. Results showed that in a simple choice set-up (comparable to the set-up used in Jessup et al., 2008), one-quarter of the choices were made by experiencing the outcomes and without observing the probabilities. This preference, however, increased significantly as the decision scenario became more complex and the effort involved in assessing the likelihood of outcomes increased with more intricate descriptions. Similarly, participants in Lejarraga's (2010) study relied more heavily on experience in later than in earlier problems, a likely effect of accumulated cognitive effort across seven problems.

[1] The following example illustrates this argument. Imagine a gambler bets money on drawing an even number in a die toss. Before tossing, the gambler inspects the die and learns that the probability of getting an even number is 3/6. After the toss, the gambler observes that a 2 lands. The outcome does not provide new information to the gambler who knew that a 2 was a possible outcome.