



## Brief article

# Pricing decisions from experience: The roles of information-acquisition and response modes



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## ABSTRACT

While pricing decisions that are based on experience are quite common, e.g., setting a selling price for a used car, this type of decision has been surprisingly overlooked in psychology and decision research. Previous studies have focused on either choice decisions from experience, or pricing decisions from description. Those studies revealed that pricing involves cognitive mechanisms other than choice, while experience-based decisions involve mechanisms that differ from description-based ones. Thus, the mutual effect of pricing and experience on decision-making remains unclear. To test this effect, we experimentally compared real-money pricing decisions from experience with those from description, and with choices from experience. The results show that the mode of acquiring information affects pricing: the tendency to underprice high-probability prospects and overprice low-probability ones is diminished when pricing is based on experience rather than description. The findings further reveal attenuation of the tendency to underweight rare events, which underlies choices from experience, in pricing decisions from experience. The difference occurs because the response mode affects the search effort and decision strategy in decisions from experience.

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## 1. Introduction

The expression of preferences by means of decision-making is often perceived as the essence of purposeful behavior. Yet behavioral decision research consistently shows that decisions are heavily influenced by the context in which they are made. A classic example is the “preference reversal” phenomenon (Lichtenstein & Slovic, 1971): when people face a choice between prospect A that offers low value with high probability, and prospect B that offers high value with low probability, they choose A. However, when they are asked to assign a price to each prospect,

they assign a higher price to B. The finding that decisions might be altered by seemingly irrelevant factors, such as the decision-maker’s response mode (choice or pricing), suggests the value of studying the situational factors and cognitive processes that may underlie decisions across contexts and explain such discrepancies.

The preference reversal phenomenon, like all subsequent studies of pricing decisions, has been studied exclusively in the context of “decisions from description” (Hertwig & Erev, 2009), i.e., situations in which decision-makers receive a full description of all possible outcomes and their probabilities. The current paper explores a new decision context, that to our knowledge has never been studied systematically, which we refer to as “pricing decisions from experience”. These are situations in which people need to value (i.e., assign a price to) a prospect whose properties are unknown a priori, but can be learned through experience. Examples may include setting a

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selling price for a used car, or asking residents to state their value for conserving a local park.

The current body of knowledge in behavioral decision research seems insufficient to inform on how people make pricing decisions from experience. An attempt to rely on the conclusions of studies on pricing, which have focused on description-based tasks, is problematic given demonstrations of robust differences between decisions from description and those from experience (Hertwig, Barron, Weber, & Erev, 2004). Similarly, relying on the conclusions from studies on decisions from experience, which have focused on choice tasks, is problematic given previous demonstrations of robust differences between choice and pricing decisions in other domains (Tversky, Slovic, & Kahneman, 1990).

The current paper studies pricing decisions from experience directly by conducting an experiment that systematically compares this context with each of the well-known paradigms outlined above (pricing from description, and choice from experience). The comparison between pricing from description and from experience enables us to assess whether pricing decisions are affected by the mode of information acquisition (described or experienced). The second comparison, between pricing and choice decisions from experience, enables us to evaluate whether and how the response mode (choice or pricing) affects the way in which decision-makers experience their environment.

## 2. Information acquisition and the description–experience gap

It seems that the focus on description-based tasks is not unique to pricing studies. As Lejarraga, Hertwig, and Gonzalez (2012) noted: “Decision researchers, using choice between monetary gambles as a canonical model for risky choice, have grown accustomed to presenting their respondents with a complete description of the problem, spelling out all outcomes and their probabilities” (Lejarraga et al., 2012, p. 335). Yet in real life, people rarely receive descriptions of probability distribution over outcomes. Instead they can learn about them by trying them out, making “decisions from experience”. It turns out that people respond quite differently to the same quantitative information, depending on whether it is described or experienced (Hertwig et al., 2004). This “description–experience” gap is most prominent when people face outcomes with low probability: they overweight low probabilities when they make decisions from description but underweight them when they make decisions from experience (Erev et al., 2010; Hertwig & Erev, 2009). These tendencies imply that when people receive a description of a low-probability prospect, e.g. one that pays 41 with a probability of 0.05 and 1 otherwise, they tend to overweight the probability of getting the desirable outcome (41), and this prospect therefore appears better than its expected value (EV). If this prospect is not described, but people experience it by drawing random samples from its payoff distribution, they tend to underweight the probability of receiving the desirable outcome (41) and the prospect

appears inferior to its EV. Notice that the description–experience gap also applies to cases in which people face high-probability prospects, since the probability of the complementary event is low. To illustrate, consider a prospect that pays 21 with a probability of 0.95 and 0 otherwise. The complementary event of not receiving the desirable outcome occurs with a low probability (0.05). Overweighting this low probability implies that the prospect looks worse than its EV while underweighting the low probability implies the exact opposite.

Studies of the description–experience gap demonstrate the role of information-acquisition mode in decision-making, but its boundaries remain unclear. Recent studies have explored whether the gap reflects different cognitive processes in each information mode (Erev et al., 2010). They found that while decisions from description involve weighting and summing of outcomes and probabilities, decisions from experience are best predicted by models of reliance on small samples of past experiences. These models assume that the decision-maker recalls the realization of  $N$  outcomes of his/her past experiences with each alternative. When the sample  $N$  is small, this cognitive process implies underweighting because low-probability events are underrepresented in small samples. Therefore, if people rely on small samples in pricing decisions as they do in their choices, then we expect consistent differences between prices from experience and description. This is an open question, however, given that studies of decisions from experience have focused almost exclusively on choice tasks (Fantino & Navarro, 2012).<sup>1</sup>

## 3. Response mode and the choice–pricing gap

While studies of decisions under risk tend to focus on choice tasks, individuals can express their valuations of prospects in other ways, e.g., a common way of valuing an option in economics is assigning a price to it. The normative perspective assumes procedural invariance, according to which the exact response mode should not affect preferences. That is, a rational individual who chooses prospect A over B should assign a higher price to prospect A. However, as noted in the introduction, experimental studies consistently show preference reversal: people choose high-probability-low-payoff prospects over low-probability-high-payoff ones, but assign higher prices to the latter prospects (Lichtenstein & Slovic, 1971; Slovic, 1995).

A common explanation for the discrepancy between pricing and choice is the “compatibility principle”, which entails that pricing tasks facilitates focusing on the payoff outcomes, as these are more compatible with thinking of values/prices (Tversky et al., 1990). Notice that higher focus on outcomes than probabilities implies the same behavioral pattern as overweighting low probabilities: both imply overvaluing low-probability-high-payoff prospects and undervaluing high-probability-low-payoff

<sup>1</sup> We know of only one study (Pachur & Scheibehenne, 2012) that elicited prices from experience. That study was designed to explore the role of information search on the endowment effect, a question that differs from that posed in the current study.

**Table 1**  
Stated prices in the “pricing from description” and “pricing from experience” conditions.

Problem	High	P(high)	Low	EV	Median price		Average price		
					Description	Experience	Description	Experience	Difference ( <i>p</i> -value)
L05	41	0.05	1	3	7.5	1	10	4.6	+7.4 ( <i>p</i> = 0.02)
L10	60	0.10	0	6	17.5	6	17	10.3	+6.7 ( <i>p</i> = 0.07)
L15	55	0.15	2	9.95	16.5	7	19.9	12	+7.9 ( <i>p</i> = 0.04)
H85	29	0.85	2	24.95	20	25	19.5	21.1	−1.6 ( <i>p</i> = 0.43)
H90	30	0.90	0	27	25	25	22.9	23.4	−0.5 ( <i>p</i> = 0.76)
H95	21	0.95	0	19.95	18	20	17.6	20.9	−3.3 ( <i>p</i> = 0.04)

prospects. Recent research confirms that pricing facilitates overweighting low probabilities, resulting with the four-fold pattern of risk attitudes (Harbaugh, Krause, & Vesterlund, 2010). The implication of these findings to pricing decisions from experience suggests that this context might involve two opposing forces: pricing facilitates the overweighting of low probabilities, while experience facilitates their underweighting. The current experiment evaluates the mutual effect of these factors on decision-making.

#### 4. Method

Eighty-two students participating in the experiment were randomly allocated to one of three conditions: “Pricing from Description”, “Pricing from Experience”, and “Choice from Experience”. Each condition included six decision problems that were played for real money. As the choice–pricing and description–experience discrepancies have been associated with low- and high-probability prospects, the six problems included three low-probability prospects (L05, L10, L15) and three high-probability prospects (H85, H90, H95; see leftmost column of Table 1). Participants received written instructions, followed by the main task in which the problems were presented in random order.<sup>2</sup> Participants in the two pricing conditions indicated selling prices for giving up the right to play each prospect (see Fig. 1), using the BDM (Becker, Degroot, & Marschak, 1964) procedure. They completed a quiz before starting the experiment to verify their understanding of this procedure. Participants in the choice condition chose between the prospect and its EV (presented as a sure payoff on the screen).

The two experience conditions (pricing and choice) were run using the sampling paradigm (Hertwig et al., 2004). In each decision problem, participants first sampled the prospect as long as they wished and then proceeded to the “decision-stage” in which they made one decision (i.e., assign a price to the prospect in the pricing condition, or choose between the prospect and its EV in the choice condition)<sup>3</sup> that determined the outcome of that problem. The outcome of the decision-stage was not realized until the session ended. Final payment was determined by the outcome of the decision-stage in one, randomly selected decision problem.

<sup>2</sup> The instructions are posted at [http://departments.agri.huji.ac.il/economics/teachers/ert\\_eyal/PCFInstructions.pdf](http://departments.agri.huji.ac.il/economics/teachers/ert_eyal/PCFInstructions.pdf).

<sup>3</sup> Participants were not informed that the sure payoff equals the prospect's EV.

#### 5. Results

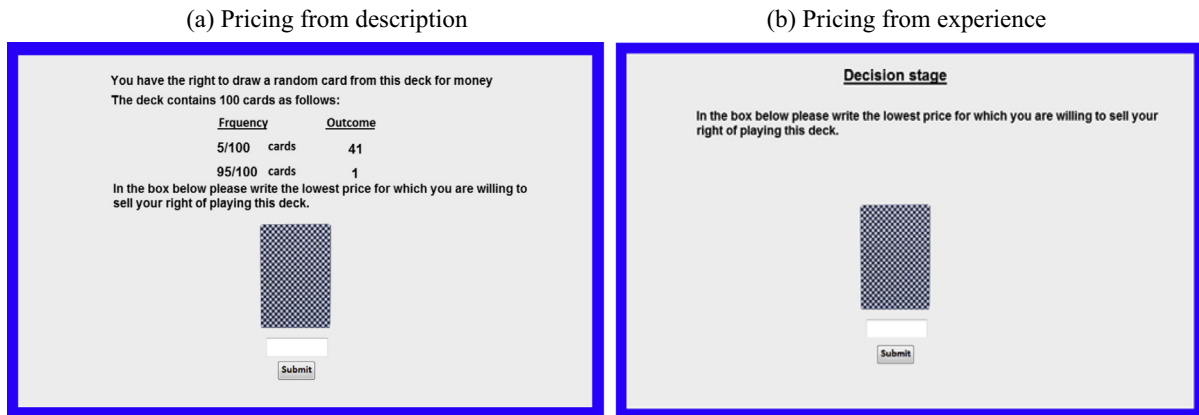
A comparison of the prospects' prices and EVs revealed that participants in the description condition overpriced the low-probability prospects, but underpriced the high-probability ones. This tendency reflects overweighting low probabilities in decisions from description. A comparison between the two pricing conditions revealed significant differences between the stated prices from description and from experience (rightmost column of Table 1). Specifically, prices in the experience condition were much closer to the prospects' EVs than prices in the description condition. These results indicate a description–experience gap in pricing decisions.

To compare the pricing and choice decisions from experience, we converted the stated prices to “implied choices”: prices that were lower than their prospect's EV were identified as “safe choices”, and prices higher than their prospect's EV were identified as “risky choices”. We found significant differences in the implied level of risk-taking between pricing from experience and from description (second rightmost column of Table 2), which are consistent with the aforementioned price analysis. Specifically, in the pricing from description condition, people exhibited risk seeking for low-probability prospects and risk aversion for high-probability prospects, a pattern that reflects “overweighting rare events”. In pricing from experience, however, the results suggested risk neutrality for both low-probability and high-probability prospects.

The comparison between pricing and choice from experience also revealed significant differences (Table 2, rightmost column). Participants who made choices from experience exhibited risk aversion for low-probability prospects and risk seeking for high-probability prospects, which seems consistent with underweighting low probabilities. However, participants who made pricing decisions from experience did not exhibit this behavioral pattern.

We next analyzed people's sample sizes in each condition, given its verified influence on decisions from experience (Hau, Pleskac, Kiefer, & Hertwig, 2008; Hertwig & Pleskac, 2010). The results revealed that people sampled significantly more in the pricing task ( $M = 28.3$ ,  $SD = 2.41$ ) than in the choice task ( $M = 15.35$ ,  $SD = 4.71$ ;  $t(58) = 2.91$ ,  $p = 0.005$  for the differences between conditions). This difference in sample size can explain, at least in part, the observed difference in choice patterns between the two response modes.

A recent study (Hills & Hertwig, 2010) differentiated between two decision strategies in decisions from experience: “round-wise” strategy that compares “rounds”



**Fig. 1.** Screen examples of the pricing conditions (description and experience). The experience decision stage (screen b.) was preceded by a sampling stage in which the deck was presented with text saying that the participant has the right to draw a random card for money, and that he/she can first sample the deck by clicking it. The choice-from-experience condition followed the same procedure only participants chose between the deck and a sure payoff, as in previous studies of experience-based choice (Hertwig & Erev, 2009).

**Table 2**  
Implied risk-taking in the description and experience conditions.

Problem	High	P(high)	Low	EV	P(risk) pricing description	P(risk) pricing experience	P(risk) choice experience	Price: description–experience	Experience: choice–price
L05	41	0.05	1	3	0.66	0.29*	0.16*	+37, $p = .01$	–13, $p = .22$
L10	60	0.1	0	6	0.80*	0.50	0.19*	+30, $p = .02$	–31, $p = .01$
L15	55	0.15	2	9.95	0.70*	0.41	0.26*	+29, $p = .03$	–15, $p = .19$
H85	29	0.85	2	24.95	0.20*	0.40	0.74*	–20, $p = .10$	+34, $p = .00$
H90	30	0.9	0	27	0.14*	0.43	0.74*	–19, $p = .02$	+41, $p = .01$
H95	21	0.95	0	19.95	0.30*	0.48	0.61	–18, $p = .14$	+13, $p = .30$

\* Significantly different from 0.50,  $p < 0.05$ .

of single samples of each option and prefers the option that “wins” the most rounds, and “summary” strategy that compares the mean outcomes of all samples from each option. To estimate the possible effect of response mode on these strategies we ran a logistic regression that analyzed the effect of each strategy on choosing the prospect over the sure outcome. The round-wise strategy was defined as the proportion of rounds in which the prospect yielded a higher outcome than its EV, and the summary strategy was defined as the gap between the mean outcome after sampling and the prospect’s EV. In the choice task, we found a significant effect of the round-wise strategy on preference for the prospect,  $\chi^2(1) = 2.70$ ,  $p = 0.0001$ , while the summary strategy had no effect ( $\chi^2 < 1$ ). However, in the pricing condition, the round-wise strategy had no effect on preference for the prospect ( $\chi^2 < 1$ ), while the effect of the summary strategy was significant,  $\chi^2 = 23.70$ ,  $p < 0.0001$ . At first glance, this finding may indicate contingent decision strategies. Nonetheless both strategies may be actually implied by the same cognitive process: reliance on past experiences with different sample sizes. We elaborate on this point in the discussion.

## 6. Discussion

In this paper, we studied pricing decisions from experience to better understand the roles of information acquisition (description–experience) and response mode

(choice–pricing) on decision-making. The results show that information acquisition mode affects not only choice but also pricing decisions: experience reduces the tendency to overweight rare outcomes, which facilitates overpricing of low-probability prospects and underpricing of high-probability prospects in decisions from description.

The results also reveal that response mode (choice–pricing) affects decisions from experience in two related ways. First, it affects people’s search: the mean sample size under pricing decisions was almost twice as large as the sample size under choice decisions. This finding supports recent evidence suggesting that the search effort reflects people’s awareness of environmental stimuli, such as payoff valence (Lejarraga et al., 2012). It also seems consistent with evidence showing that people sample more when they estimate probabilities than when they choose among prospects (Ert & Trautmann, 2014). Together, these findings suggest that response mode may be an integral part of the decision ecology.

The second effect of response mode is on people’s decision strategy. We found that choice from experience was correlated with round-wise comparisons, while pricing from experience was correlated with the summary strategy. According to one interpretation these patterns reflect the compatibility principle: choices are more compatible with probability and piecemeal comparisons (counting “wins”), whereas pricing decisions are more compatible with computation of summary rewards and running

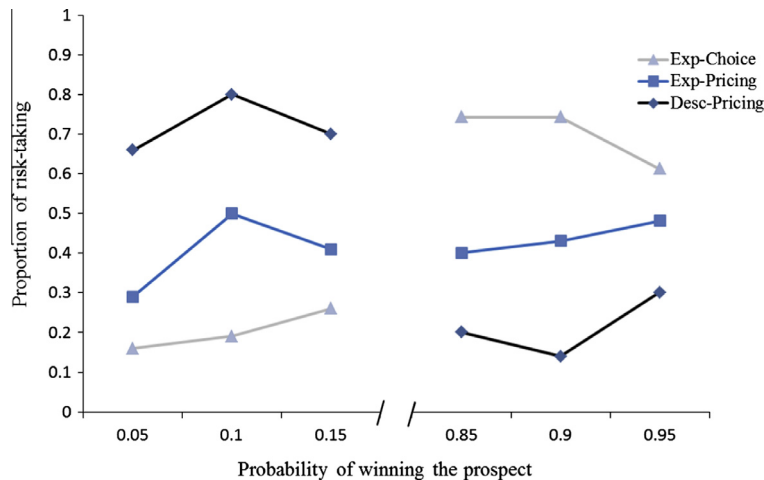


Fig. 2. Proportion of risk-taking as a function of the probability of winning the prospect in each experimental condition (Exp, experience; Desc, description).

averages. An alternative interpretation suggests that these seemingly different strategies may be the result of a single process: reliance on samples of past experiences. Recalling one sampled outcome from each option implies a round-wise comparison, while recalling all sampled outcomes implies the summary strategy. This assertion seems consistent with the observation that participants sampled significantly more in the pricing than in the choice condition.

The tendency to underweight low probabilities in decisions from experience is facilitated by smaller samples (Hau et al., 2008), and by round-wise comparisons (Hills & Hertwig, 2010). Thus, the finding that choice involves less sampling and more round-wise comparisons than pricing might explain why low probabilities are underweighted in choice, but not in pricing decisions from experience.

The main implications of the current findings for risk-taking behavior in pricing decisions from experience are summarized in Fig. 2. One is the description–experience gap found in pricing decisions (Exp-Pricing and Desc-Pricing curves), and the other is the choice–pricing gap found in experienced-based decisions (Exp-Choice and Exp-Pricing curves). In the current context, the two gaps operate in opposite directions and seem to cancel each other out, so that the risk level in pricing decisions from experience looks like it attenuates the biases in risk preferences in the other contexts.

The current findings suggest that experience may impact decision-making in various forms of preference expression, not only choice. This observation is consistent with Fantino and Navarro's (2012) recognition of the advantage of studying classic phenomena from an experience-based perspective, not simply descriptions. The present analysis also reveals that the process of experience may be affected by environmental features, e.g., the response-mode under which the decision-maker is required to operate. We believe that each of these observations may suggest a fruitful direction for future research.

## References

- Becker, G. M., Degroot, M. H., & Marschak, J. (1964). Measuring utility by a single-response sequential method. *Behavioral Science*, 9(3), 226–232. <http://dx.doi.org/10.1002/bs.3830090304>.
- Erev, I., Ert, E., Roth, A. E., Haruvy, E., Herzog, S. M., Hau, R., et al. (2010). A choice prediction competition: Choices from experience and from description. *Journal of Behavioral Decision Making*, 23(1), 15–47. <http://dx.doi.org/10.1002/bdm.683>.
- Ert, E., & Trautmann, S. T. (2014). Sampling experience reverses preferences for ambiguity. *Journal of Risk and Uncertainty*, 49(1), 31–42. <http://dx.doi.org/10.1007/s11166-014-9197-9>.
- Fantino, E., & Navarro, A. (2012). Description–experience gaps: Assessments in other choice paradigms. *Journal of Behavioral Decision Making*, 25(3), 303–314. <http://dx.doi.org/10.1002/bdm.737>.
- Harbaugh, W. T., Krause, K., & Vesterlund, L. (2010). The fourfold pattern of risk attitudes in choice and pricing tasks. *The Economic Journal*, 120(545), 595–611.
- Hau, R., Pleskac, T. J., Kiefer, J., & Hertwig, R. (2008). The description–experience gap in risky choice: The role of sample size and experienced probabilities. *Journal of Behavioral Decision Making*, 21(5), 493–518. <http://dx.doi.org/10.1002/bdm.598>.
- Hertwig, R., Barron, G., Weber, E. U., & Erev, I. (2004). Decisions from experience and the effect of rare events in risky choice. *Psychological Science*, 15(8), 534–539. <http://dx.doi.org/10.1111/j.0956-7976.2004.00715.x>.
- Hertwig, R., & Erev, I. (2009). The description–experience gap in risky choice. *Trends in Cognitive Sciences*, 13(12), 517–523. <http://dx.doi.org/10.1002/9781118130171.ch12>.
- Hertwig, R., & Pleskac, T. J. (2010). Decisions from experience: Why small samples? *Cognition*, 115(2), 225–237. <http://dx.doi.org/10.1016/j.cognition.2009.12.009>.
- Hills, T. T., & Hertwig, R. (2010). Information search in decisions from experience do our patterns of sampling foreshadow our decisions? *Psychological Science*, 21(12), 1787–1792.
- Lejarraga, T., Hertwig, R., & Gonzalez, C. (2012). How choice ecology influences search in decisions from experience. *Cognition*, 124(3), 334–342. <http://dx.doi.org/10.1016/j.cognition.2012.06.002>.
- Lichtenstein, S., & Slovic, P. (1971). Reversals of preference between bids and choices in gambling decisions. *Journal of Experimental Psychology*, 89(1), 46.
- Pachur, T., & Scheibehenne, B. (2012). Constructing preference from experience: The endowment effect reflected in external information search. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 38(4), 1108.
- Slovic, P. (1995). The construction of preference. *American Psychologist*, 50(5), 364–371. <http://dx.doi.org/10.1037/0003-066X.50.5.364>.
- Tversky, A., Slovic, P., & Kahneman, D. (1990). The causes of preference reversal. *The American Economic Review*, 204–217.