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# Preference Reversals in Equal-probability Gambles: A Case for Anchoring and Adjustment

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ABSTRACT

The paper examines preference reversal in equal-probability gambles, gambles in which all payoffs have the same probability. The results indicate that for attractive gambles (gambles whose payoffs are positive) there is a higher preference for high-variance gambles when preference is inferred from pricing and rating than when it is inferred from choice, while for unattractive gambles (gambles whose payoffs are negative) there is a higher preference for high-variance gambles when preference is inferred from choice than when it is inferred from pricing. The results also indicate that in pricing, but not in choice, there is a lower preference for high-variance gambles when the subject possesses the gamble than when he or she does not possess it. The implications of these effects for various explanations of preference reversal are discussed, and it is concluded that the effects can be explained by anchoring and adjustment, but not by compatibility, prominence, expression theory, or change of process theory.

KEY WORDS risk; gambles; preference reversal; anchoring and adjustment

The concept of preference reversal refers to the phenomenon that the (inferred) preference for gambles depends on the context from which preference is inferred. The best-known example for preference reversal is the dependence of preference on whether the response mode was pricing or choice. For example, it is possible to construct pairs of gambles in which people choose gamble A over gamble B, but assign a higher minimum selling price to gamble B than gamble A in a pricing task.

Previously, studies of preference reversal examined reversals between particular types of gambles, called P-bets and $-bets. A P-bet offers a high probability of winning a small amount (for example, a probability of 0.97 to win $16) and a $-bet offers a low probability of winning a large amount (for example, a probability of 0.31 to win $40). The results of these studies have shown that people assign a larger cash equivalent for the $-bet in pricing, but choose the P-bet when offered a direct choice between the gambles.

There are five major explanations for preference reversal between pricing and choice. The earliest, *the anchoring and adjustment explanation*, was proposed by Lichtenstein and Slovic (1971, 1973). According to this explanation, an anchoring and adjustment process influences evaluation in pricing, but not in choice. In pricing attractive gambles, people determine an initial price on the basis of the greater payoff, and subsequently adjust this price on the basis of the rest of the information (e.g. the lower amount and the two probabilities). Since adjustment is insufficient, the $-bet, with its large gain,

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is overpriced. Similarly, in pricing unattractive gambles — gambles whose payoffs are negative — people use the lower (most negative) payoff as an anchor, which results in underpricing of the $-bet.

The second explanation, *the compatibility explanation*, suggests that attributes which are compatible with the response scale receive higher weight than those not compatible with this scale. In the pricing task, payoffs are compatible with the response scale, and therefore receive higher weight. As a result, the $-bet which is characterized by a large payoff, is priced higher than the P-bet (Tversky, Sattath, and Slovic, 1988). Note that in the context of preference reversal between P- and $-bets, the compatibility explanation is not unrelated to the anchoring and adjustment explanation (the larger weight of the payoff dimension may be associated with the fact that, because it is compatible with the response scale, the payoff is a natural anchor). However, since in the context of the experimental paradigm used in the current paper anchoring and adjustment and compatibility can be viewed as two different explanations, we postpone the discussion about the relationship between the two to the General Discussion section.

The third explanation, *the prominence explanation*, suggests that (1) probability is the more prominent dimension and (2) the more prominent dimension looms larger in choice than in pricing (or for that matter, it looms larger in choice than in any response requiring the expression of preference on a cardinal scale) (Tversky *et al.*, 1988; Schkade and Johnson, 1989).

The fourth explanation, *the expression theory explanation*, suggests that preference reversal occurs as a result of the expression of preference. Choice reflects basic evaluations, or utilities. On the other hand, in expressing preference on a cardinal scale (e.g. pricing or rating a gamble) subjects choose a response located between the top of the response scale (e.g. 9 on a 1–9 rating scale or the larger payoff in a pricing scale) and the bottom of the scale (e.g. 1 on the rating scale or the lower payoff on the pricing scale) by matching the proportional distance from the utility of the greatest payoff relative to the utility of the smallest payoff with the distance from the top of the response scale to the bottom of the response scale (see Goldstein and Einhorn, 1987, pp. 241–243).

The fifth explanation, *change of process theory* (Mellers *et al.*, 1992) suggests that in pricing people use a multiplicative combination of probabilities and payoffs, and in the judgment of the strength of preference the comparison between gambles is done through subtraction in which utilities and subjective probabilities are weighted according to the difference between the gambles on each dimension. This theory is relevant to preference reversal between pricing and choice if the processes underlying strength of preference judgment are similar to the processes underlying direct choice.

This paper examines preference reversals for gambles which are somewhat different from the gambles previously used in the preference reversal literature. These gambles, labelled equal-probability gambles, are characterized by all payoffs having the same probability. Such gambles may facilitate our understanding of monetary decisions in general and preference reversal in particular because only one dimension — the payoff dimension — varies between gambles. Thus any observed effects can be attributed only to the impact of this dimension.

## EXPERIMENT 1: CHOICE VERSUS PRICING

Consider a pair of equal-probability gambles, each consisting of five possible payoffs with probabilities of 0.2. The payoffs of one gamble are 10, 22, 40, 70, 90, while the payoffs of the other are 27, 36, 46, 56, 67. The expected value of the two is about the same, but the first, the high-variance gamble, has very high payoff(s) as well as very low payoff(s), while in the second, the low-variance gamble, all payoffs are moderate.

Consider the task of pricing these two gambles, and assume that people are indifferent between the two in a choice task. Compatibility, prominence, and change of process theory do not address the

question of which gamble would be priced higher. For example, the compatibility explanation attributes preference reversal to increased weight for the payoff dimension in pricing, which leads to a higher price for a $-bet than for the P-bet. However, for our equal-probability gambles, such increased weight does not imply a difference in price, since probabilities are equal within and between gambles (and sum up to 1).

Consider now the task of choosing between the two gambles and assume that people assign them the same price in a pricing task. Again, compatibility, prominence, and change of process theories do not address the question of which gamble would be chosen in a direct choice. For example, while according to the prominence explanation increased weight for the probability dimension in choice implies the choice of the P-bet over the $-bet, for our equal-probability gambles, such increased weight does not imply a higher tendency to choose one of the two gambles, since probabilities are equal.

Anchoring and adjustment, on the other hand, has a clear prediction regarding preference reversal between these two equal-probability gambles. If people anchor at the higher payoff, and insufficiently adjust on the basis of the other payoffs, the high-variance gamble will be priced higher than the low-variance gamble when people are indifferent between the two in a choice task. Alternatively, the low-variance gamble will be chosen over the high-variance gamble when people are indifferent between the two in a pricing task (because anchoring and adjustment, which increases preference towards the high-variance gamble in the pricing task, does not influence the choice task). Thus, anchoring and adjustment predicts preference reversals in which high-variance gambles are given higher monetary value in a pricing task, but low-variance gambles are preferred in a choice task.

## Method

### *Subjects*

Twenty-seven undergraduate business students participated in the experiment to fulfill a class requirement. The experiment was conducted in groups numbering two to four.

### *Stimuli*

The stimuli were 18 pairs of equal-probability gambles. Each gamble included five possible payoffs, ranging from 1 to 99 Israeli shekels ($0.3 to $33). The probability of receiving each of the payoffs was 0.2. The gambles were organized in pairs of high-variance gamble and a low-variance gamble. The expected value of the two gambles in each pair was about the same (in fact, out of the 18 pairs, in nine pairs the high-variance gamble had a slightly higher expected return, in six pairs the expected return was equal, and in three pairs the low-variance gamble had a slightly higher return). The 18 pairs are shown in Exhibit 1. The gambles were presented graphically (see top of Exhibit 2 for an example), and the position of each of the payoffs was randomly determined.

### *Procedure*

Each subject participated in both the choice task and the pricing task. Half of the subjects received the choice task first, while the other half received the pricing task first. In the choice task, subjects were presented with the 18 pairs described above and an additional four filler pairs distributed randomly among the 18 experimental pairs. The pairs were presented in a booklet, one pair per page. The order of the pairs was randomized across subjects and the position of the high- and low-variance gambles was determined randomly. For each pair, subjects were asked to choose the gamble in which they would prefer to participate. In the pricing task, subjects were presented with the 36 gambles, the same

Exhibit 1. Payoffs and expected values of the gambles

| Pair | Payoffs | | | | | | | | | | Expected value | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | High-variance gamble | | | | | Low-variance gamble | | | | | High var. | Low var. |
| 1 | 5 | 9 | 27 | 40 | 45 | 14 | 22 | 26 | 28 | 36 | 25.2 | 25.2 |
| 2 | 8 | 13 | 23 | 44 | 55 | 18 | 25 | 29 | 31 | 40 | 28.6 | 28.6 |
| 3 | 4 | 21 | 33 | 47 | 59 | 15 | 22 | 28 | 31 | 38 | 32.8 | 26.8 |
| 4 | 13 | 19 | 26 | 57 | 66 | 25 | 29 | 37 | 41 | 49 | 36.2 | 36.2 |
| 5 | 6 | 17 | 33 | 64 | 89 | 18 | 27 | 37 | 50 | 63 | 41.8 | 39.0 |
| 6 | 13 | 17 | 31 | 59 | 77 | 29 | 34 | 37 | 43 | 67 | 39.8 | 42.0 |
| 7 | 8 | 25 | 29 | 77 | 89 | 18 | 33 | 40 | 56 | 61 | 45.6 | 41.6 |
| 8 | 10 | 22 | 40 | 70 | 90 | 27 | 36 | 46 | 56 | 67 | 46.4 | 46.4 |
| 9 | 10 | 25 | 47 | 73 | 81 | 27 | 33 | 45 | 54 | 71 | 47.2 | 46.0 |
| 10 | 7 | 19 | 37 | 70 | 93 | 31 | 35 | 45 | 54 | 80 | 45.2 | 49.0 |
| 11 | 5 | 33 | 59 | 70 | 93 | 27 | 36 | 57 | 61 | 67 | 52.0 | 49.6 |
| 12 | 15 | 31 | 53 | 80 | 91 | 27 | 33 | 50 | 61 | 79 | 54.0 | 50.0 |
| 13 | 13 | 43 | 57 | 83 | 93 | 34 | 44 | 61 | 73 | 77 | 57.8 | 57.8 |
| 14 | 23 | 37 | 74 | 81 | 91 | 39 | 51 | 60 | 67 | 82 | 61.2 | 59.8 |
| 15 | 20 | 41 | 76 | 89 | 95 | 39 | 55 | 63 | 67 | 87 | 64.2 | 62.2 |
| 16 | 31 | 59 | 71 | 89 | 97 | 55 | 60 | 72 | 81 | 88 | 69.4 | 71.2 |
| 17 | 44 | 66 | 74 | 89 | 95 | 60 | 69 | 71 | 79 | 82 | 73.6 | 72.2 |
| 18 | 55 | 66 | 78 | 95 | 99 | 70 | 75 | 78 | 82 | 88 | 78.6 | 78.6 |

*Note*: Each of the potential payoffs has the same probability (0.2) of being received.

gambles that appeared in the 18 experimental pairs. The gambles were presented in a booklet, one gamble per page, and the order of the pairs was randomized across subjects. For each gamble, subjects were asked to state the minimum price they would require in order to give up participation in the gamble.

## Results

The dependent variable in the analysis was Preference for High Variance Gambles (*PHVG*). In the choice condition, this preference was estimated for each subject by dividing the number of high-variance gambles chosen by the subject by the sum of the low- and high-variance gambles chosen. In the pricing condition, the prices were transformed to choices by treating the gamble with the higher price in each pair as the chosen gamble. Pairs in which the prices of the high- and low-variance gambles were equal were omitted from the analysis. Thus, if $H$ is the number of pairs in which the high-variance gambles were priced higher and $L$ the number of pairs in which the low-variance gambles were priced higher, then *PHVG* is defined as $H/(H+L)$.

The results indicate that *PHVG* is higher in the pricing condition than in the choice condition. *PHVG* in the pricing condition was 0.59 (SD = 0.24), while *PHVG* in the choice condition was 0.34 (SD = 0.30). The difference is significant at 0.0005 level, $t(26) = 4.0$. These results are explained by the anchoring and adjustment explanation, but not by compatibility, prominence, or change-of-process theory.

The results of the experiment can also be expressed by assessing the tendency for preference reversal. The average proportion of pairs in which a subject chose the low-variance gamble over the high-variance gamble but assigned the latter a higher price than the former was 31%. On the other hand, the average proportion of pairs in which a subject chose the high-variance gamble over the low-variance gamble but assigned the latter a higher price than the former was 9%. The difference between the two was significant, $t(27) = 3.8$, $p < 0.0007$.

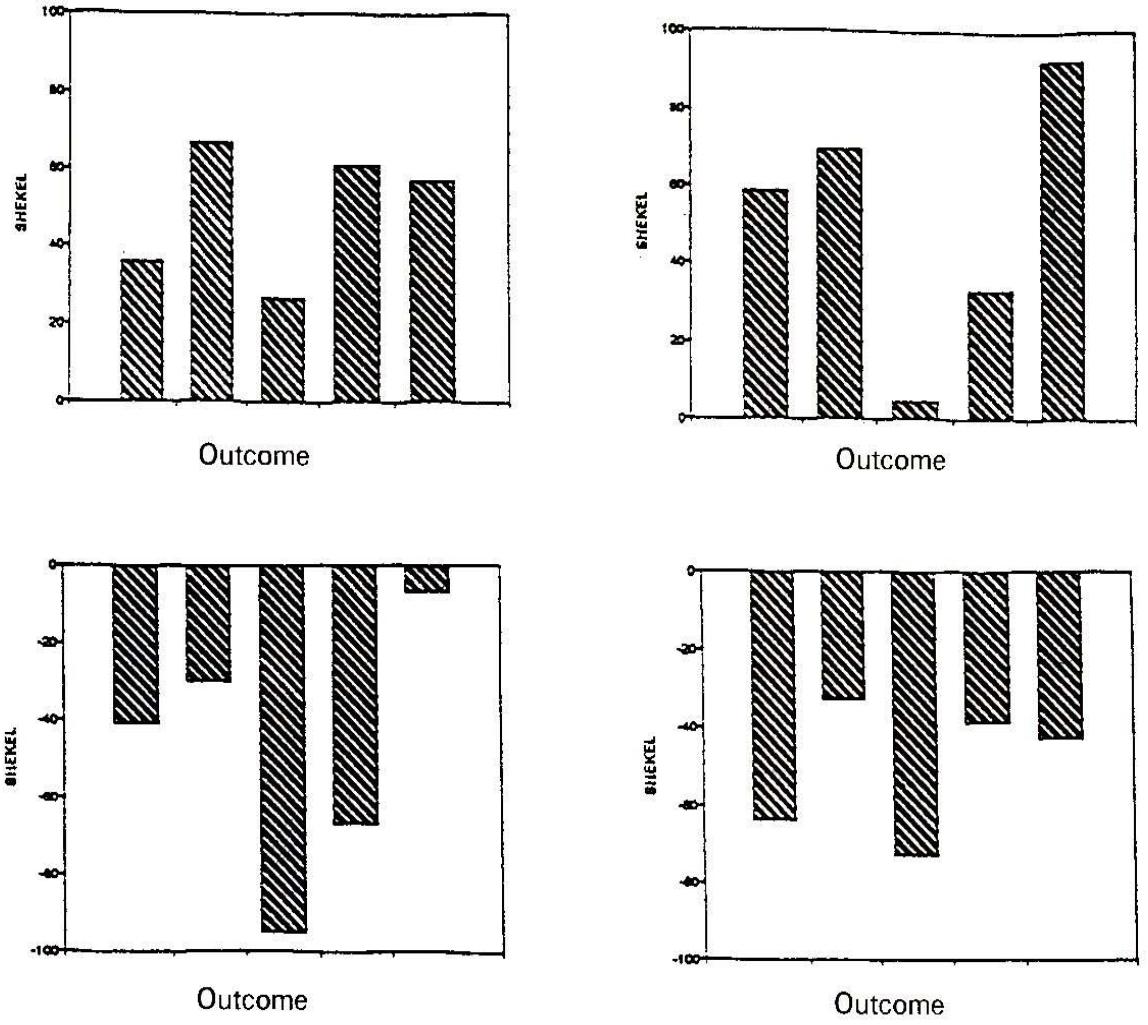


Exhibit 2. An example of an attractive gamble (top) and unattractive gamble (bottom). Payoffs are represented as bar-graphs, where the vertical axis is the amount of payoff. All payoffs are equally-probable

The rate of preference reversal in the current experiment (as well as its rate in Experiments 2 and 3) is lower in comparison to the rate of preference reversal between P-bets and $-bets reported in the literature (e.g. Lichtenstein and Slovic, 1971; Tversky, Slovic, and Kahneman, 1990). One reason for that may be that the gambles in our experiment are five-outcome gambles, while those used in previous research were two-outcome gambles. As Weber (1984) showed, an increase in the number of outcomes is associated with a decrease in the rate of preference reversal.

## EXPERIMENT 2: CHOICE VERSUS PRICING AND POSSESSION VERSUS NONPOSSESSION IN ATTRACTIVE AND UNATTRACTIVE GAMBLES

The current section describes an expanded replication of Experiment 1. The experiment includes a number of new features. First, it examines the difference between *PHVG* in pricing and *PHVG* in choice not only for attractive gambles but also for unattractive gambles, gambles whose payoffs are negative. If, as Lichtenstein and Slovic (1973) suggested, the pricing of unattractive gambles involves

anchoring at the lower (most negative) payoff and insufficient adjustment on the basis of the other features of the gamble, then the high-variance gambles, with their large losses, would be underpriced. That is, while in attractive gambles we observed higher *PHVG* in pricing than in choice, in unattractive gambles we expect higher *PHVG* in choice than in pricing. Furthermore, since for attractive gambles the anchor is the higher payoff while for unattractive gambles the anchor is the lower payoff, we expect that in pricing, *PHVG* would be higher for attractive than for unattractive gambles. Note that compatibility, prominence, expression theory, and change-of-process theory cannot readily explain these effects.

A second feature of this experiment is the inclusion of a 'point of view' manipulation. To illustrate this manipulation, consider the attractive gambles. In some conditions, subjects were told that they possess the gambles and were asked which of each pair of gambles they would prefer to give up (in the choice condition) or what is the minimum selling price (in the pricing conditions). In other conditions, subjects were told that they do not possess the gambles and were asked in which of each pair of gambles they would prefer to play (in the choice condition) or what is the maximum buying price (in the pricing conditions) (see below for the manipulation of point of view in the unattractive gambles). So far, most of the literature on preference reversal has used selling price and preference for participation as response modes in pricing and choice, respectively (but see Lichtenstein and Slovic, 1971; Casey, 1991; Mellers *et al.*, 1992), most likely under the assumption that (in preference reversal), the differences between buying prices and selling prices and the differences between preferring to participate and preferring to give up are negligible (e.g. Slovic and Lichtenstein, 1968). Recently, however, Birnbaum *et al.* (1992), drawing on configural weight theory, showed that in pricing, point of view has an impact on preference: Possessors assign heavier weight to the more desirable payoff than nonpossessors (see also Casey, 1991). This result is consistent with an anchoring and adjustment process, in which possessors have a stronger tendency than nonpossessors to anchor at the more desirable payoff and (insufficiently) adjust on the basis of the other elements of the gamble (as Lopes, 1981, showed, anchoring and insufficient adjustment is associated with increased weight to the dimension which serves as an anchor). One question raised by Birnbaum *et al.*'s (1992) results, which is relevant to the issue of the paper, is whether preference in choice is also affected by point of view. Our analysis of the difference between pricing and choice suggests that the point of view effect may not occur in choice, since while anchoring and adjustment is involved in the cognitive processes underlying pricing, it is not involved in the cognitive processes underlying choice.

## Method

### *Subjects*

Ninety-six undergraduate business students participated in the experiment to fulfill a class requirement. The experiment was conducted in groups numbering two to four.

### *Procedure*

The gambles of Experiment 1 were used in this current experiment as well. Subjects evaluated either attractive gambles or unattractive gambles, and participated in four tasks. In two of the tasks they were asked to assume that they possess the gambles, and in the other two tasks they were asked to assume that they do not possess the gambles. In addition to the possession factor, the experiment included another within-subjects pricing/choice factor. Thus, the design was a 2 (attractiveness: attractive versus unattractive gambles) $\times$ 2 (point of view: possession versus nonpossession) $\times$ 2 (response mode: pricing versus choice) mixed design with repeated measures on the second and third factors. The order of the four within-subjects conditions was counter-balanced across subjects.

The tasks of subjects who evaluated attractive gambles were as follows. In the price-possession task, subjects were asked to state the minimum price for which they would give up participation in the gamble, while in the price-nonpossession task they were asked to state the maximum price they are willing to pay in order to participate in the gamble. In the choice-possession task, subjects were asked which gamble of each pair they would prefer to give up, while in the choice-nonpossession task they were asked in which gamble of each pair they would prefer to participate.

The tasks of subjects who evaluated unattractive gambles were as follows. In the price-possession task subjects were asked to state the maximum price they would be willing to pay in order to avoid participation in the gamble, while in the price-nonpossession task they were asked to state the minimum price they would demand in order to participate in the gamble. In the choice-possession task subjects were told that they can avoid only one of the two gambles, and asked to indicate which of the two they would prefer to avoid. In the choice-nonpossession task subjects were told that they have to participate in one of the two gambles, and were asked to indicate in which of the two they would prefer to participate.

*Stimuli*

The attractive gambles were the same gambles used in Experiment 1. The unattractive gambles were constructed from the attractive gambles by subtracting 100 shekels from each payoff (an example is presented in the bottom of Exhibit 1). This method insured that the same relationships between the moments of the payoff distributions that existed in the original attractive pair also existed in the corresponding unattractive pair. The stimuli were presented in a booklet and randomized across subjects in the same way as in Experiment 1.

Exhibit 3. Mean *PHVG* by condition in Experiment 2

| | Attractive gambles | | Unattractive gambles | |
|---|---|---|---|---|
| | Possession | Nonpossession | Possession | Nonpossession |
| Pricing | 0.59 (0.19) | 0.43 (0.24) | 0.46 (0.22) | 0.26 (0.21) |
| Choice | 0.30 (0.25) | 0.32 (0.25) | 0.55 (0.20) | 0.54 0.19) |

*Note*: *PHVG* is the preference towards high-variance gambles, calculated by dividing the number of high-variance gambles preferred by the subject by the total number of pairs for which preference was available.

## Results

As in Experiment 1, the dependent variable in the analysis was *PHVG*.[1] Exhibit 3 presents the mean *PHVG* by condition. A $2 \times 2 \times 2$ mixed ANOVA revealed two important significant interactions: The interaction between response-mode and attractiveness [$F(1,90) = 53.9$, $p < 0.0001$] and the interaction between point of view and response mode [$F(1,90) = 36.2$, $p < 0.0001$]. All the other interactions were nonsignificant. Of the three main effects, only the effect of point of view was significant.

[1] Note that choices in the choice/possession conditions (both for attractive and unattractive gambles) indicate less preference. In addition, in the two pricing conditions of the unattractive gambles, higher prices indicate less preference.

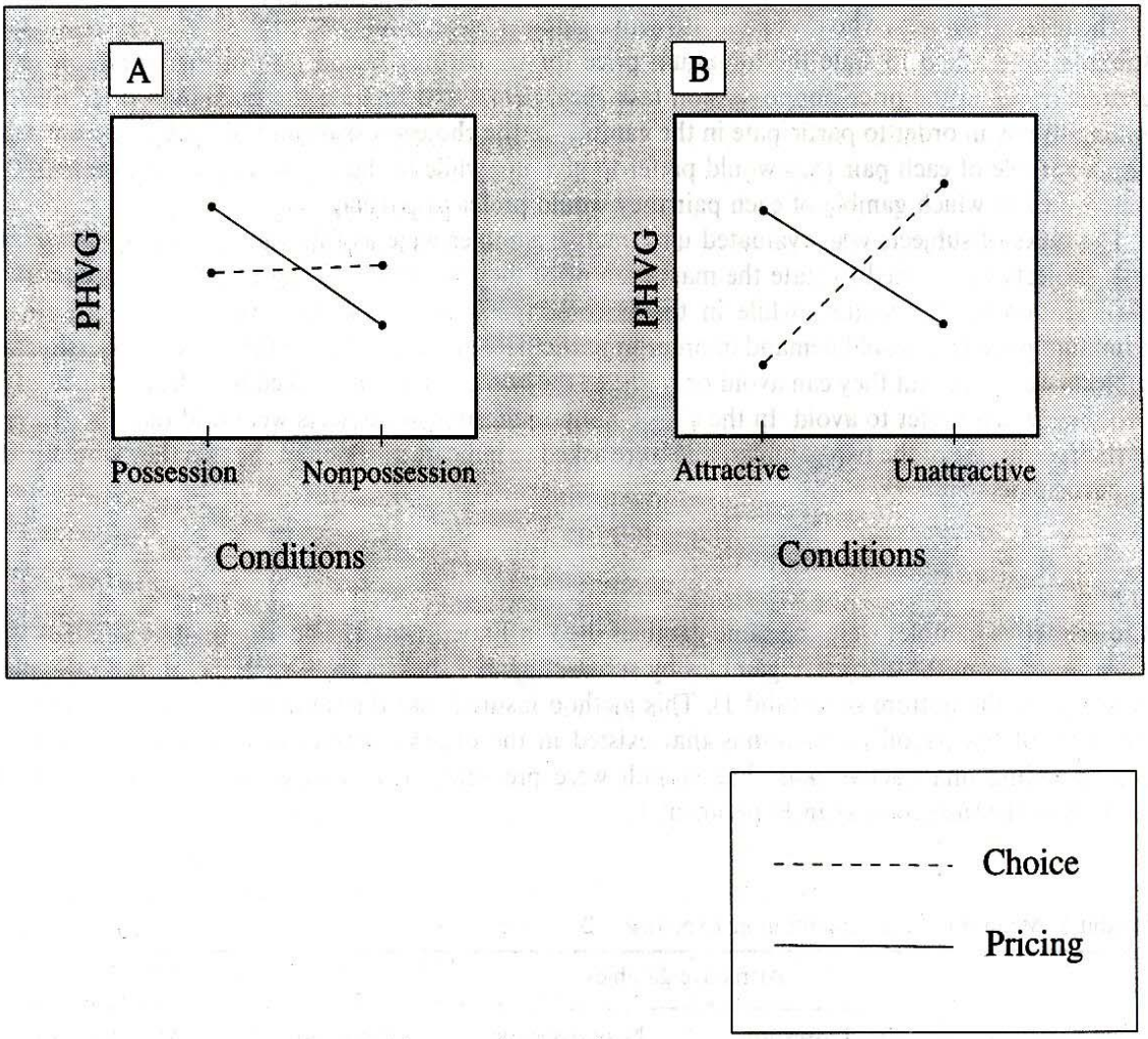


Exhibit 4. A graphical representation of the interaction between point of view and response mode (panel A) and the interaction between attractiveness and response model (panel B). In panel A, the data are collapsed over the two attractiveness conditions and, in panel B, the data are collapsed over the two point of view conditions. The ordinate represents Preference for High Variance Gambles

The interaction between point of view and response mode is graphed in panel A of Exhibit 4. This interaction is associated with the fact that, while in choice, point of view has a very small impact on preference for high variance gambles, in pricing it has a large impact on this preference: *PHVG* is higher when the subject possesses the gamble than when he or she does not possess it.

The interaction between attractiveness and response mode is graphed in panel B of Exhibit 4. There are two ways to view this interaction (later we refer to these two views as representing a 'multiple determination' of preference reversal). One view is that it results from the fact that for attractive gambles *PHVG* is higher in pricing than in choice ($t(47) = 6.23$, $p < 0.0001$, and $t(47) = 2.32$, $p < 0.03$, for the possession and nonpossession conditions, respectively), but for unattractive gambles *PHVG* is higher in choice than in payoffs ($t(47) = 2.4$, $p < 0.02$, and $t(47) = 7.0$, $p < 0.0001$, respectively). These effects cannot be explained by compatibility, prominence, expression theory, or change-of-process theory (since these explanations do not address the issue of preference reversal in equal probability gambles), but, according to our discussion above, can be explained by anchoring and adjustment.

The other view is that this interaction results from the fact that in pricing, *PHVG* is higher for attractive than for unattractive gambles ($t(46) = 3.0$, $p < 0.005$, and $t(46) = 3.8$, $p < 0.0005$, for the possession and nonpossession conditions, respectively), but in choice, *PHVG* is higher for unattractive than for attractive gambles ($t(46) = 5.3$, $p < 0.0001$, and $t(46) = 4.6$, $p < 0.0001$, respectively). The first effect is consistent with anchoring and adjustment (but cannot be explained by the other four explanations for preference reversal). The second effect is consistent with prospect theory's postulation about risk aversion in the domain of gains and risk seeking in the domain of losses (Kahneman and Tversky, 1979).

**Discussion**

In this section we discuss the implications of the results for various theoretical explanations for the evaluation of risky prospects. We first discuss the implications of the results for explanations of preference reversal, and then discuss their implications for a number of issues in utility theories.

- *Compatibility, prominence, and change-of-process theory*: These explanations cannot account either for the interaction between attractiveness and response mode or for the interaction between point of view and response mode.
- *Expression theory*: While it is not clear how expression theory should be applied to the type of gambles used in the experiment, the interaction between attractiveness and response mode is consistent with the spirit of the theory. However, expression theory cannot readily account for the interaction between point of view and response mode.
- *Anchoring and adjustment*: The pattern of the results obtained in the experiment is consistent with an anchoring and adjustment explanation. First, while the difference in *PHVG* between the attractive and unattractive pricing conditions is consistent with this explanation, the reverse difference in the choice conditions is *not* inconsistent with it. The process of anchoring to the salient payoff and insufficient adjustment on the basis of the other payoffs, which explains the differences between the pricing conditions, is irrelevant to the choice conditions. In these latter conditions, the difference in *PHVG* is associated with the well-documented difference in risk attitude between positively and negatively framed choices (Kahneman and Tversky, 1979). Second, while the effect of point of view on *PHVG* in the pricing conditions is also consistent with an anchoring and adjustment explanation, the lack of a point of view effect in the choice conditions is not inconsistent with it. Again, the process of anchoring to the higher (lower) payoff when the subject possesses (does not possess) the gamble, which explains the effect of point of view in the pricing conditions, is irrelevant to the choice conditions. Under these latter conditions, the evaluation of the gamble is not mediated by an anchoring and adjustment process.
- *Configural weighing*: Birnbaum *et al.* (1992) suggested that the effect of point of view on pricing is due to configural weighing, that is, it is due to the fact that possessors assign more weight to the higher payoff, while nonpossessors assign more weight to the lower payoff (perhaps as a result of an asymmetric loss function) (see Birnbaum *et al.*, 1992, p. 335). The current results are inconsistent with an explanation which suggests that point of view affects configural weighing in choice. However, they are consistent with the assumption that configural weighing is the result of an anchoring and adjustment process, and that anchoring and adjustment operates in judgment (pricing) but not in choice.
- *Prospect theory*: Some of the findings of this experiment are consistent with prospect theory's treatment of choice tasks, while none of the findings is inconsistent with it. In particular, the difference between the attractive and unattractive conditions in the choice task is consistent with the theory's assertion that people are risk averse in the domain of gains and risk prone in the domain of

losses. Note that previous tests of prospect theory did not completely separate the impact of the value function from the impact of the weighing function on attitude towards risk in choice tasks. The current experiment directly tests prospect theory's basic tenets concerning the shape of the value function, since probabilities (i.e. the weighing function) are irrelevant in comparing the attractiveness of the high- and low-variance gambles.

- *The endowment effect*: Many studies indicated that people demand more money to give up an object than they would be willing to pay to acquire it. While there are a number of theoretical explanations for this effect (see Kahneman, Knetsch, and Thaler, 1991, for a summary), one explanation suggested by the current results is that in generating a buying price people anchor at the less favorable aspects of the object, while when generating a selling price they anchor at its favorable aspects. This explanation suggests a testable hypothesis regarding the endowment effect: it should be stronger when the variability in the object's attributes is high than when it is low.

## EXPERIMENT 3: CHOICE VERSUS RATING

One possible method by which preference may be inferred is rating. Subjects may be asked to express their preferences on a numerical scale ranging from extremely attractive to not at all attractive (Goldstein and Einhorn, 1987; Mellers *et al.*, 1992). Goldstein and Einhorn (1987) examined P-bets and $-bets for preference reversals between rating and choice, and found higher preference for the high variance gambles (i.e. the $ gambles) in choice than in rating. Their explanation for this difference in preference is based on expression theory.

However, expression theory, as well as prominence, compatibility, and change-of-process theory, does not have clear predictions about differences in preference between rating and choice in equal-probability gambles. Prominence, compatibility, and change-of-process theory clearly cannot explain such differences, because only the payoff dimension varies among these gambles. As to expression theory, it is not entirely clear how predictions about differences in preference between rating and choice are to be derived from Goldstein and Einhorn's (1987) development for the case of equal-probability gambles.

Our hypothesis is that, in equal-probability gambles, rating would be similar to pricing, and therefore *PHVG* in rating would be higher than *PHVG* in choice. If similar cognitive processes operate when people judge each gamble separately, rather than evaluating it via a comparative mode (Fishchoff, Slovic, and Lichtenstein, 1980), then anchoring and adjustment is likely to operate in rating. Indeed, there is experimental evidence both for the similarity between the processes of rating and pricing and for the operation of anchoring and adjustment in rating. Thus, Schkade and Johnson (1989) found that 'Pricing and rating share largely similar strategies of generating a starting point and then adjusting it to arrive at a response' (p. 224), and Ganzach's (1995) research in multiattribute evaluation suggests the operation of anchoring and adjustment process in rating.

In summary, the current experiment examined preference reversal between rating and choice. If anchoring and adjustment influences the rating of equal-probability gambles, it should be expected that *PHVG* will be higher in rating than in choice.

### Method

*Subjects*

Eighteen subjects participated in the experiment. Some were undergraduate business students who participated in the experiment to fulfill a class requirement, while others were paid subjects who

received 6 shekels ($2) for participation (most of them were undergraduate students). The experiment was conducted in groups numbering two to four.

*Procedure*

The experiment involved only attractive gambles. The choice condition was identical to the choice condition of Experiment 1 (i.e. subjects were asked to choose the gamble in which they would prefer to participate). The rating condition was similar to the pricing condition of Experiment 1, except that subjects were asked to state their preference for the gambles on a nine-point scale anchored by 'very little' (1) and 'very much' (9) (the question they were asked was, 'To what extent is the gamble attractive to you?').

**Results**

As in Experiments 1 and 2, the dependent variable in the analysis was preference for high-variance gambles. The results indicated that *PHVG* was higher in the rating condition than in the choice condition. For rating, *PHVG* was 0.54 (SD = 0.22), while for choice it was 0.37 (SD = 0.24). The difference is significant, $t(17) = 2.8$, $p < 0.01$.[2] Again, these results support an anchoring and adjustment explanation, but do not support compatibility, prominence, and change-of-process theory (since these explanations do not address preference reversal in equal probability gambles). They also do not support the explanation offered by expression theory.

Interestingly enough, the results of this experiment are very similar to the results of Experiment 1, and to the results of the two parallel conditions of Experiment 2. In particular, *PHVG* in the rating condition of the current experiment is similar to *PHVG* in the pricing condition of Experiment 1 and to *PHVG* in the pricing/possession/attractive-gambles condition of Experiment 2. These results are quite different from those of both Goldstein and Einhorn (1987) and Tversky *et al.* (1988), who found higher preferences for high-variance gambles in pricing than in rating. In our view, the source of the difference is that when both probability and payoff have to be integrated to arrive at an overall evaluation, the payoff dimension dominates pricing (e.g. by anchoring at the largest payoff), while the probability dimension dominates rating (e.g. by anchoring at the largest probability) (see Mullet, 1992; Schkade and Johnson, 1989, for empirical evidence for the dominance of the probability dimension in rating). On the other hand, when only payoffs have to be integrated, the processes of rating and pricing are similar, since they both involve the expression of evaluation on a cardinal scale.

## GENERAL DISCUSSION

**The case for anchoring and adjustment**

The dependence of preference on response mode in equal-probability gambles can be explained by an anchoring and adjustment process in which the outcome with the larger payoff (in absolute value) receives the heaviest weight in judgment (e.g. rating, pricing), but not in choice. These results cannot be explained by expression theory, change-of-process theory, compatibility, or prominence.

However, while the current findings give some support for anchoring and adjustment as an explanation for preference reversal, they fall short of ruling out other explanations. In my view, the

[2] In terms of preference reversals, the average proportion of pairs in which subjects chose the low-variance gamble over the high-variance gamble but assigned the latter a higher price than the former was 27%. On the other hand, the average-number of pairs in which subjects chose the high-variance gamble over the low-variance gamble but assigned the latter a higher price than the former was 9%.

state of the art in preference reversal research is that there are a number of competing explanations, each has some facets of preference reversal that it can uniquely explain, some facets that it can explain equally as well as other explanations, and some facets that it cannot explain. Below we review some findings in the preference reversal literature, discuss the status of various theoretical explanations *vis-à-vis* these findings, and examine to what extent do these findings support (or weaken) the anchoring and adjustment explanation in comparison to other explanations.

The anchoring and adjustment explanation is consistent with some of the effects observed in the literature. For example, it is consistent with many of Schkade and Johnson's (1989) observations in their study of search behavior in preference reversal. It is consistent with the finding that the primary cause for preference reversal between P-bets and $-bets is the overpricing of low-probability bets (Tversky *et al.*, 1990). And it is consistent, as Slovic and Lichtenstein (1968) note, with the finding that the amount to win has the larger weight in the pricing of attractive bets and the amount to lose has the largest weight in the pricing of unattractive bets. Note, however, that while the findings of Tversky *et al.* (1988) can be explained both by compatibility and anchoring and adjustment, Slovic and Lichtenstein's (1968) findings can be explained only by anchoring and adjustment.

Anchoring to the larger payoff and adjustment on the basis of the other elements of the gamble cannot explain some of the phenomena reported in the preference reversal literature. It cannot explain the pricing-rating reversal (higher price and lower rating for the P-bet) observed by both Goldstein and Einhorn (1987) and Tversky *et al.* (1988) and the rating-choice reversal (evaluating the P-bet as more attractive than the $-bet in rating while choosing the $-bet in direct choice) observed by Goldstein and Einhorn. Compatibility explains the former reversal while expression theory explains both the former and the latter reversals.

However, an anchoring and adjustment process may explain the rating-pricing reversals and the rating-choice reversals between P-bets and $-bets under the assumption that in rating, people anchor at the probability of the (higher) payoff and adjust on the basis of the other elements of the gamble. This model is consistent not only with the preference reversals observed by Goldstein and Einhorn, but also with other findings such as that in rating, the probability dimension has a larger weight than the payoff dimension (Mullet, 1992; Mellers, Chang, Ordonez, and Birnbaum, 1992); the finding that the probability of winning has a larger impact on rating than other gamble elements (Slovic and Lichtenstein, 1968); and the finding that the probability of winning has a major influence on the rating's anchor (Schkade and Johnson, 1989).

While previous research found preference reversals between rating and pricing in the evaluation of P-bets and $-bets (Goldstein and Einhorn, 1987; Tversky *et al.*, 1990), the results presented in this paper (Experiments 1 and 3) suggest that in equal probability gambles, there will not be many preference reversals between rating and pricing. The reason for this is most likely that in the evaluation of P-bets and $-bets, the integration of probability and payoffs has a major impact on the output of the evaluation. In this integration process, payoffs loom larger than probabilities in pricing, but not in choice (because of compatibility). On the other hand, in the evaluation of equal-probability gambles, such an integration process is immaterial (e.g. the expected value is simply the average of the payoffs). In the absence of such an integration process, rating and pricing are similar since they both require a response on cardinal scales (i.e. they are both judgment tasks).

If anchoring and adjustment is indeed the process that underlies the difference between judgment and choice observed in the current experiments, a natural question to ask is why does anchoring and adjustment operate in judgment but not in choice. The reason for that is, in my view, that in order to generate a response on a cardinal scale, quantitative strategies must be used. Anchoring and adjustment provides people with a simple quantitative strategy, since it allows operations that involve only one piece of the input information at each stage of the evaluation. On the other hand, the process by which choice is made may be less sequential. Schkade and Johnson's (1989) work was a first

important attempt to obtain process information concerning the evaluation of gambles. Their results are consistent with our view about the difference between judgment and choice. For example, they find that subjects take much less time in making their choice between two gambles than when they judge (i.e. rate or price) a *single gamble.*

**Anchoring and adjustment, compatibility, contingent weighing, configural weighing and their roles in preference reversal**

Contingent weighing refers to the depe dence of decision weights on response mode. In particular, one determinant of the relationship between decision weight and response mode is the compatibility between outputs and inputs. Configural weighing refers to the dependence of decision weights on the rank of the input (i.e. outcome). In particular, the decision weight of an input may increase (decrease) the higher the rank of the input relative to the other inputs (e.g. the higher a particular payoff relative to the other payoff, or the higher an attribute's value relative to the other attributes).

Anchoring and adjustment can be viewed as the psychological process responsible both for contingent weighing (and the compatibility principle) and for configural weighing. According to this view, both compatibility and relative value (but also other features such as point of view) influence the selection of the anchor. On the one hand, people tend to anchor at features of the input information which are compatible with the response (for example, in pricing a one-payoff outcome, the payoff rather than the probability serves as an anchor because it is compatible with the response). Now, if adjustment is insufficient, the result of this anchoring and adjustment process is observed as contingent weighing. On the other hand, people tend to anchor at extreme values. Anchoring on these values may occur because they are more salient (Kahneman, cited in Weber, 1994, p. 237), and because they simplify the adjustment stage by making it unidirectional (anchoring at moderate values requires both upward and downward adjustment).[3] Now, if adjustment is insufficient, the result of this anchoring and adjustment process is observed as configural weighing (Lopes, 1981).

The robustness of the preference reversal phenomenon in the classical P- and $-bets (e.g. Grether and Plott, 1979) may be explained by the fact that it is determined by a number of independent factors. The choice-pricing reversals found in the two outcomes P-bets and $-bets (Lichtenstein and Slovic, 1971) are due not only to the compatibility of the response scale with the payoff dimension in pricing, but also to the prominence effect (i.e. to the increased weight of the probability dimension in choice) as well as to anchoring on the larger, rather than the smaller, payoff. The former two reasons apply also to the pricing-rating reversals between these two types of bets (Goldstein and Einhorn, 1987), and a third factor that may operate in rating is the compatibility between the response scale and the probability dimension in rating (Schkade and Johnson, 1989).

Experiment 2 supplies another example of the multiple determination of preference reversal. While attitudes towards risk play a major role in the evaluation of gambles in choice, they play a minor role in the evaluation of gambles in pricing. Therefore, preference reversal in attractive gambles is due not only to anchoring to the higher payoff in pricing, but also to risk aversion in choice, while preference reversal in unattractive gambles is due not only to anchoring to the lower payoff in pricing, but also to risk seeking in choice.

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[3] One question that is left open by this description is what extreme value serves as an anchor, the lowest value or the highest value. The answer to this question may depend on computability with the content (Tversky *et al.*, 1988). Thus, the most positive outcome serves as an anchor in positive gambles, and the most negative outcome serves as an anchor in negative gambles. Similar effects were obtained by Shafir (1994) and Ganzach and Schul (1995) who found that positive features loom larger than negative features in accept decisions, while negative features loom larger than positive features in reject decisions, and by Tversky (1977) who found that common features loom larger in similarity judgments while distinctive features loom larger in dissimilarity judgments.

Finally, the current experiments leave largely unanswered the question 'What determines the way by which anchoring and insufficient adjustment influence the outcome of decisions?'. However, as previous research indicates, it is likely that a variety of factors influence the role which anchoring and adjustment plays in decisions. Some examples are: motivational factors, such as the role of fear versus greed (Lopes, 1987), or leniency versus strictness (Amir and Ganzach, 1995); memory factors, such as primary effect versus recency effect (Anderson, 1991); and the availability of alternative heuristics, such as representativeness (Czaczkes and Ganzach , 1996).

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