The Perceived Diversity Heuristic: The Case of Pseudodiversity

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One of the normative ways to decrease the risk of a pool with uncertainty prospects is to diversify its resources. Thus, decision makers are advised not to put all their eggs in one basket. The authors suggest that decision makers use a perceived diversity heuristic (PDH) to evaluate the risk of a pool by intuitively assessing the diversity of its sources. This heuristic yields biased judgments in cases of pseudodiversity, in which the perceived diversity of a pool is enhanced, although this fact does not change the pool’s normative values. The first 3 studies introduce 2 independent sources of pseudodiversity—distinctiveness and multiplicity—showing that these two sources can lead to overdiversification under conditions of gain. In another set of 3 studies, the authors examine the effect of framing on diversification level. The results support the PDH predictions, according to which diversity seeking is obtained under conditions of gain, whereas diversity aversion is obtained under conditions of loss.

Keywords: diversification, risk perception, heuristics, biases, framing

It is the part of a wise man to keep himself today for tomorrow, and not venture all his eggs in one basket.
—Sancho Panza in Miguel de Cervantes, Don Quijote

Decision makers often have to evaluate and choose among pools of uncertain outcomes. For instance, people have to decide how many funds and what kind should be combined in their portfolio pool. Similar considerations apply to a choice among four different medical insurance plans that involve differential costs and benefits. In both examples, decision makers must compare distributions of prospective outcomes that can be represented by two measures: the expected value and the variance.

According to theories of traditional economics, the expected value of each pool represents its utility, and the variance of each pool represents its associated risk. When the variance increases, the degree of risk increases as well (Baron, 1978). One of the normative ways to reduce this risk is to diversify the sources of investment. For example, according to portfolio theory (Coombs, 1975; Markowitz, 1952), risk can be reduced by combining different stocks (e.g., technology, oil, and health care) in the same portfolio, such that poor performance in one field will be offset by better performance in others. Thus, as Cervantes and conventional wisdom have pointed out, a wise decision maker is advised not to put all his or her eggs in one basket but to distribute them in several baskets instead.

To determine whether people understand this idea intuitively, one must examine how people evaluate the risk involved in their decision. It appears that people exhibit a reasonable intuitive ability to identify fluctuations in the variance of stimuli (Kareev, Arnon, & Horwitz-Zeliger, 2002; March, 1996; Peterson & Beach, 1967; Pollard, 1984). Weber, Shafir, and Blais (2004) reported that the best predictor of the decision among pools of uncertain prospects was the coefficient of variation; that is, the ratio between the standard deviation and the expected value of the pool. According to this measure, the investment is better when this ratio is lower (Baron, 1978).

However, the attempt to reduce risk by increasing diversity among several sources leads to biases. A variety of studies have shown a strong tendency toward naı¨ve diversification under conditions of gains. This tendency has been labeled the variety seeking behavior (McAlister & Pessemer, 1982; McAlister & Pessemer, 1982; Simonson, 1990), the diversification bias (Read & Loewenstein, 1995), and the irrational diversification (Rubinstein, 2002). Benartzi and Thaler (2001) specifically examined how individuals deal with the complex problem of the selection of a portfolio for their retirement accounts. The results of this study demonstrated that most investors follow the In strategy: they divide their contributions evenly over the funds available in the plan (see also Hedesstrom, Svedsater, & Garling, 2006; Langer & Fox, 2005).

The aim of the present work is to propose and test a general theoretical framework for the conceptualization of the effect of perceived diversity on judgments and choice. Our basic assumption is that decision makers intuitively understand the portfolio theory logic described above and develop a rule of thumb with which to evaluate the risk of a pool by assessing the diversity of its sources. We label this intuitive strategy the perceived diversity heuristic (PDH), according to which the higher the perceived diversity, the lower the risk. Similar to other heuristics (Gilovich, Griffin, & Kahneman, 2002; Tversky & Kahneman, 1974), this proposed heuristic is useful and adaptive in certain situations, but leads to biases in other situations.

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Justified and Biased Activation of the PDH

A pool of uncertainty prospects consists of one or several sources; each of these sources is a unit that can generate potential gain or loss. The perceived diversity of a pool is determined by two independent factors: the perceived multiplicity, applying to the number of sources that constitute the pool, and the perceived distinctiveness of these sources. Perceived multiplicity of sources might be manipulated quantitatively. In contrast, a multitude of dimensions might affect perceived distinctiveness and thus change what Liberman, Trope and Stephan (2007) call the psychological distance between the sources (e.g., the degree of similarity among the sources, the time interval between the activation of each source, or the physical distance among the sources).

Both multiplicity and distinctiveness can produce normative paths and/or pseudopaths, as can be seen in Figure 1. Normative paths (i.e., the highest and the lowest paths) refer to cases in which the activation of the PDH is justified because the perceived diversity is based on the identification of real diversity. This actually reduces the variance in the distribution of outcomes and therefore reduces the risk of the specific pool. On the other hand, pseudopaths (i.e., the two middle paths) correspond to cases in which the perceived diversity is based on the identification of dimensions that do not affect the actual variance or the expected utility of the pool. In these cases, activating the PDH is likely to lead to biases.

The following examples illustrate each of the four paths depicted in Figure 1. The two lower paths describe situations in which people base their judgments on perceived multiplicity. The normative multiplicity in the lowest path is in line with the well known story of Samuelson and his colleague (Samuelson, 1963). Samuelson gave his colleague even odds to win $200 or lose $100 on a coin toss. Surprisingly, Samuelson’s colleague declined playing the single bet but was willing to play 100 trials of this bet. This situation was the starting point for a variety of experiments that showed that violations of utility theory obtained under unique conditions could not necessarily be generalized to repeated conditions. Specifically, people are less risk averse and better calibrated to normative principles of expected utility theory when they are required to bet on repeating rather than unique gambles (Fou & Shanteau, 1995; Keren, 1991; Keren & Wagenaar, 1987; Montgomery & Adelbratt, 1982; Redelmeier & Tversky, 1990, 1992). This line of results could be interpreted as a justified activation of the PDH. Thus, people correctly identify normative multiplicity as a source of diversity that leads to an adaptive judgment of risk reduction.

However, decision makers could also be affected by pseudomultiplicity (i.e., the lower-middle path); in other words, people identify multiplicity, but this multiplicity has no actual impact on the expected value or on the variance of the relevant outcomes. A good example of this path is the ratio bias (Denes-Raj & Epstein, 1994; Denes-Raj, Epstein, & Cole, 1995; Miller, Turnbull, & Mcfarland, 1989; Pacini & Epstein, 1999). This phenomenon illustrates the tendency to estimate an event as more likely when its probability is expressed as a ratio of large numbers (e.g., 10 out of 100) and as less likely when its probability is expressed as a ratio of small numbers (e.g., 1 out of 10). In the current framework, we posit that the intuitive mechanism that lies at the core of this phenomenon is perceived diversity: Participants mistakenly perceive the larger numerator as a source of greater multiplicity and ignore the fact that the ratio is similar in the two probabilities. The ratio bias could therefore be reinterpreted as an illusion of risk reduction that leads to a pseudodiversity bias (the lower middle path in Figure 1).

A similar mechanism is involved in judgments of perceived distinctiveness, as depicted in the two higher paths of Figure 1. The highest path describes situations in which combining distinctive sources in the same pool leads to risk reduction. Hedestrom, Svedsater, and Garling (2004) found that most people tended to diversify their choices in the Swedish Premium Pension Scheme, in line with the recommendation to reduce risk. However, the chosen pension plans were suboptimal because people picked many different kinds of funds without sufficient knowledge of the right combination of funds or the correlation between the risky assets (see also Kroll & Levy, 1992; Kroll, Levy, & Rapaport, 1988). In such cases, people can also fall prey to pseudodistinctiveness that stems from the manner in which funds are grouped and presented. For example, Fox, Ratner, and Lieb (2005) showed

![Figure 1](image-url). Different paths characterize the effect of perceived diversity.
that individuals who allocate money or multiple discrete choices over a set of options tend to diversify their choices across the groups into which options are subjectively partitioned. Avramov (2004) reported a similar effect by simulating an actual college admission process. This study provided evidence of overdiversification caused by the arbitrary partition of college applicants according to irrelevant dimension (e.g., geographic origin). Thus, diversification that is based on the perceived distinctiveness among sources (e.g., stocks, college applicants) can be influenced by subtle variations in the presentation of options. This tendency to be biased by pseudodistinctiveness is depicted in the higher-middle path in Figure 1.

**Diversity Preference for Gains and Diversity Aversion for Losses**

The classic framing effect shows that people tend to avoid risk under conditions of gain but to seek risk under conditions of loss (Fishburn & Kochenberger, 1979; Kahneman & Tversky, 1979; Tversky & Kahneman, 1988, 1992). This effect is explained by the S-shape value function of prospect theory, which is concave for gains and convex for losses, and this effect was replicated under many different settings (e.g., Igou & Bless, 2007; Levin, Schneider, & Gaeth, 1998; McElroy & Seta, 2003; Simon, Fagley, & Halle-ran, 2004). Diversification is suggested as a mechanism by which one can control one's perceived level of risk. Thus, we posit that diversification operates in synchrony with the framing effect. Under conditions of gain, people tend to diversify because it reduces the risk of outcomes and ensures that at least some resources will be fruitful (i.e., increasing the probability of at least one gain, see also Kahn & Lehmann, 1991). On the other hand, under conditions of loss, people prefer to avoid diversification, believing that such a strategy will enable them to escape losing at all, even though diversification can actually protect from extreme losses (see also March, 1996; Thaler, 1999). Therefore, the PDH is likely to lead to diversity seeking under conditions of gain but to diversity aversion under conditions of loss.

Previous studies on diversification deal with outcomes that are framed as gains and support the first part of our prediction. For example, Simonson (1990) asked college students to select snacks from a group of six familiar snacks in one of two conditions: (a) sequential choice—picking one of the six snacks at each of three class meetings held a week apart; and (b) simultaneous choice—selecting all the three snacks at the first class meeting, one of which was to be eaten at each of the three consecutive class meetings. As predicted, participants in the simultaneous choice condition displayed much more variety seeking than did participants in the sequential choice condition. That is, when asked to make several choices at once, people tend to diversify. Read and Loewenstein (1995) labeled this behavior the diversification bias, emphasizing the fact that participants in the simultaneous choice condition were actually biased. These authors attributed the bias to choice bracketing, that is, the tendency to diversify when a set of choices are bracketed and viewed together in the simultaneous choice condition but to maximize utility when choices are unbracketed and viewed individually in the sequential choice condition (see also Fox et al., 2005; Read, Loewenstein, & Rabin, 1999). Note that the term diversification bias was deduced from a comparison between two conditions (i.e., simultaneous vs. sequential) rather than from a direct comparison of each of these conditions with a normative benchmark.

To determine in which cases the PDH leads to a real violation of normative principles, researchers should manipulate the perceived diversity of the pool while controlling any alteration of its normative measures (i.e., the variance and the expected utility of the pool). Rubinstein (2002) describes such irrational diversification under condition of gains. In this study, participants were required to guess the color outcomes of five independent spins of a roulette wheel whose slots were 60% red and 40% white. Although the guess of 5 red clearly dominated over any other strategy, most of the participants chose to diversify their choices, and the diversification was greater when the participants faced uncertainty without objective probabilities. The popular strategy among the participants who diversified their choices was probability matching (for review see Myers, 1976; Vulcan, 2000). Rubinstein explains this behavior by a misperception of randomness. Tversky and Kahneman (1974) called this phenomenon local representativeness, stating that "people expect that a sequence of events generated by a random process will represent the essential characteristics of that process even when the sequence is short" (p. 1126).

The first part of our prediction that diversity preferences will be obtained under gain conditions is thus firmly supported by previous research. However, there is no documented evidence for diversity aversion under loss conditions. The idea for this reversal is based on the corresponding reversal in prospect theory (Kahne-man & Tversky, 1979; Tversky & Kahneman, 1988, 1992). Additional indirect theoretical support for the loss prediction comes from mental accounting (Thaler, 1999). Given the traits of the value function, Thaler (1990) proposed four rules for hedonic framing that make the perceivers as happy as possible. Two of these rules are highly relevant to our case. The first rule is to segregate gains because the gain function is concave. The second rule is to integrate losses because the loss function is convex. Although this model characterizes postoutcome editing, these two principles can also be generated as preoutcomes of sources with an uncertainty prospect. Thus, when decision makers are asked to manage a large amount of money that they inherited, they will intuitively tend to diversify the resources of the investments. On the other hand, when they are asked to apply for a loan to buy a new house, they intuitively tend to take all loans in one bank and probably also concentrate on one specific loan within that bank. Although under some conditions this reversal behavior can be defended on normative grounds (e.g., when the investments involve more uncertainty than the loans), our framework aims to demonstrate that it is generalized to situations in which both gain and loss conditions involve the same level of uncertainty.

**The PDH predictions**

The hypotheses of the PDH stem from this theoretical rationale and include two central predictions:

**The gain hypothesis:** Increasing the number of sources that constitute the pool and/or making the sources more distinct will increase the perceived diversity and will decrease the perceived risk. This will lead to an increase in the attractiveness of the pool due to risk-aversion under conditions of gain.
The loss hypothesis: Increasing the number of sources that constitute the pool and/or making the sources more distinct will increase the perceived diversity and will decrease the perceived risk. However, this will lead to a decline in the attractiveness of the pool due to risk seeking under conditions of loss.

These hypotheses were tested in two sets of studies. In the first set (Studies 1A, 1B, and 1C), we tested only the gain hypothesis, manipulating the pseudodistinctiveness and/or the pseudomultiplicity of pools and examining the effects of these two factors on choices and judgments of betting pools. In the second set (Studies 2A, 2B, and 2C) we tested the predicted reversal between the gain hypothesis and the loss hypothesis by manipulating the framing of the choice (gain vs. loss) and examining its effect on the level of diversification.

The Effect of Pseudodiversity on Choices Among Betting Pools

In the first set of studies, we tested our PDH model by manipulating pseudodistinctiveness and/or pseudomultiplicity of betting pools. In Studies 1A and 1B participants were asked to choose among a range of betting pools that differed on the measure of pseudodistinctiveness, while the odds of winning in each of these basic bets and the reward for winning were held constant. On the basis of the PDH gain hypothesis we predicted that participants would prefer to bet on the higher perceived diversity pool and would rate this pool as more attractive.

Study 1A: Choice Among Pools of Coins

Method

Participants. One hundred undergraduate psychology students (61 female, 39 male) from The Open University of Israel (age: $M = 25.5$ years, $SD = 4$) participated in the study for the opportunity to win a prize of 200 new Israeli shekels (NIS; approximately U.S.$48) and a chocolate candy.

Procedure. In the simulation phase, each participant received a 1-shekel (approximately U.S.$0.25) coin with a green sticker on one side. Then, participants were instructed to toss the coin four times. To win, the side with the green sticker had to show in all four toss trials. Next, participants were invited to play the same game with three different coins by choosing one of two alternatives:

1. The diversified pool contains three different coins (a silver coin with a green sticker, a gold coin with a red sticker, and a copper coin with a blue sticker).
2. The nondiversified pool contains three identical coins from one of the types described in alternative 1. For example, three silver coins, all with green stickers.

In this phase, we used non-Israeli coins that differed in their size and color and obscured their value with colored stickers. Participants were randomly assigned to three conditions that differed by the type of coin in the nondiversified pool. Each participant had four trials on each of the three chosen coins. They were promised a chocolate candy for success on all four trials of the same coin (odds of winning = .5$^4$) and 200 NIS (approximately U.S.$48) for success on all 12 trials (odds of winning = .5$^{12}$). At the end of the experiment, each participant received a chocolate candy for his or her participation.

Results and Discussion

As can be seen in Figure 2, the pattern of results was similar in each of the three conditions, and no significant differences were found among the three distributions. Therefore, we combined the three conditions and analyzed the overall distribution. The results support the PDH prediction. We observed that 68% of the partic-
Participants preferred to bet on the more diversified pool that contained three different coins, whereas only 32% preferred to bet on the nondiversified pool that contained three identical coins. This distribution differs significantly from the expected random distribution of 50:50 (p < .001).

At this point, the tendency toward diversification seeking can be challenged on several methodological and theoretical grounds. First, Study 1A presents a dichotomy of choice between diversified and nondiversified pools, whereas one might prefer a middle level of diversification. Second, participants were forced to choose between the two options and did not have an opportunity to express indifference. Third, we assumed that participants based their choice on the perceived diversity, yet our method prevents direct measuring of this variable. In addition, in this setting it is not clear whether participants obtained the pseudodiversification due to their willingness to reduce the risk of the betting pool and enhance their chances of winning or whether they chose the pseudodiversification because it was more interesting.

Study 1B: Computerized Choice Among Betting Pools

To address some of the methodological limitations of Study 1A, Study 1B presented a computerized choice among three betting pools with three levels of diversification (none, moderate, high). Participants were asked to express their preference by dividing 100 tokens among these three pools, thus being allowed to express indifference. Finally, participants were asked to rate the perceived diversity of each pool as well as three other variables (i.e., risk, dependence, and interest). Analyzing the relation between perceived diversity and these three variables can help us distinguish between risk reduction and interest maximization as two potential explanations for diversification seeking.

Method

Participants. 160 undergraduate psychology students (131 female, 29 male) from Tel Aviv University and The Open University of Israel (age: M = 26.6 years, SD = 6.854) participated in the study as part of their course requirements.

Procedure. We conducted the study in three phases. In the first phase, participants familiarized themselves with the winning rule of three basic bets: rolling a die, spinning a roulette wheel, and drawing a card. The odds of winning in each of these basic bets, as well as the reward for winning, were held constant (1/6, 100 NIS). In the second phase, participants were asked to imagine that they were playing with real money and to choose among three betting pools that differed by the measure of perceived diversity. As can be seen in the example of Figure 3, betting pools consisted of (a) a nondiversified pool that included three repetitions of the same basic bet (such as rolling a die); (b) a moderately diversified pool that included a single game with three different bets of the same type (such as rolling three different dice); (c) a highly diversified pool that included a single game with three basic bets (rolling a die, spinning a roulette wheel, or drawing a card). The participants were randomly assigned to three conditions that differed by the basic bets that made up the non- and moderately diversified pools. Additionally, participants had to divide 100 tokens among these three pools, in a manner that reflected their preferences for these pools.

Finally, in the third phase, participants had to evaluate each of the three pools. In order to test the validity of our manipulation, participants were asked to evaluate the perceived diversity in each of the three pools on a scale ranging from 1–7, with 1 representing nondiversification and 7 representing high diversification. Next, so we could investigate the relations among perceived diversity and other variables, we asked participants to rate each pool according to three variables:

1. Risk measure: Participants rated the degree of risk that none of the bets constituting the pool would result in winning. The scale ranged from 1–7, with 1 representing no risk and 7 representing very high risk.

2. Dependence measure: Participants rated the correlation among the outcomes of the three bets constituting the pool. The scale ranged from 1–7, with 1 representing no correlation and 7 representing full correlation.

3. Interest measure: Participants rated the level of interest stimulated by the pool on a scale ranging from 1–7, with 1 representing not interesting at all and 7 representing highly interesting.

At the end of this stage, a short debriefing about the aims of the study was conducted.
Results and Discussion

Manipulation check. The results of the perceived diversity measure supported the PDH prediction and validated our manipulation and definition of pseudodiversity. For the sample as a whole, the means of this measure correctly reflected the level of pseudodiversity in each of the three pools. The mean score was highest in the highly diversified pool (M = 5.52, SD = 1.784), followed by the moderately diversified pool (M = 2.41, SD = 1.657), and the nondiversified pool (M = 2.06, SD = 1.551). An analysis of variance (ANOVA) revealed a highly significant difference between the pools, F(2, 158) = 173.684, p < .001. Paired-samples t tests showed that the score of the highly diversified pool was higher than the scores of both the moderately diversified pool, t(159) = 17.60, p < .001, and the nondiversified pool, t(159) = 18.52, p < .001, and the score of the moderately diversified pool was higher than the score of the nondiversified pool, t(159) = 3.983, p < .001. Further reference to this analysis is presented in this section.

Preferences analysis. From the PDH gain hypothesis, we can derive two predictions for participants’ preferences among the three pools. First, the highly diversified pool should be more attractive than the other two pools. Second, the moderately diversified pool should be more attractive than the nondiversified pool. The results confirm the first prediction, but there is no evidence to support the second.

As shown in Figure 4, there were no significant differences among the choice distributions in the three conditions. The highly diversified pool received the highest percentage choice in all conditions. Therefore, we combined the three conditions and analyzed the overall distribution. Overall, 70% of the participants chose to bet on the highly diversified pool, 9.4% chose to bet on the moderately diversified pool, and 20.6% chose the nondiversified pool, χ²(2, N = 160) = 99.838, p < .001.

Next, we analyzed the assignment of tokens to the three pools. Overall, the pattern of token distribution was similar to the choice results. The highly diversified pool had the highest average number of tokens (M = 51, SD = 29.60), followed by the nondiversified pool (M = 26.73, SD = 21.62). The moderately diversified pool had the lowest average (M = 22.19, SD = 16.59).

To directly examine the relation between the choice of each participant and his or her token allocation, we divided the participants into three groups according to their initial choice: Participants who chose the highly diversified pool were labeled diversification seekers, participants who chose the nondiversified pool were labeled diversification averse, and participants who chose the moderately diversified pool were labeled moderate diversifiers. As can be seen from Table 1, the diversification seekers assigned a higher average number of tokens to their chosen pool than did the other two groups, and the moderate diversifiers assigned a higher average number of tokens to their chosen pool than did the participants who were diversification averse. A repeated measures ANOVA was conducted to test the effect of preference group on the number of tokens assigned to each pool, with group as a between-subjects variable and levels of diversification as a within-subject variable. This analysis revealed a significant interaction, F(4, 314) = 47.119, p < .01. The bold diagonal in Table 1 shows a good fit between the initial choice and the token assignment. It also implies that choice in this context reflects preference consistency and cannot be explained by demand characteristics.

The relations between the perceived diversity measure and other variables. In the last stage of the analysis, we tested the relations between the perceived diversity and other variables. First, we found a strong relation between the perceived diversity measure and the preference groups. As can be seen from Table 2, the gap between the perceived diversity of the highly diversified pool and the two other pools was higher in the group of diversification seekers than in the two other groups. A repeated measures ANOVA was conducted to test the effect of the preference group on the perceived diversity measure, with preference group as a between-subjects variable and level of diversification as a within-subject variable. This analysis yielded a significant main effect of preference group, F(2, 157) = 4.809, p < .01, a significant main effect of the level of diversification, F(2, 314 = 111.855, p < .001,
and a significant interaction between these two variables, $F(4, 314) = 9.309, p < .001$.

Second, we tested the correlations between the perceived diversity and the three other measures over the entire set of 480 pool evaluations (3 pools × 160 participants). We found a significant correlation between perceived diversity and interest ($r = .479, p < .001$), but there were no correlations between perceived diversity and risk or between perceived diversity and dependence.

Finally, these four measures (perceived diversity, risk, dependence, interest) were entered into a multiple regression model in order to predict the number of tokens assigned in each of the three pools. The results show a significant multiple correlation between the initial choice and the token assignment and implies that choice in this context reflects preference consistency and cannot be explained by demand characteristics.

<table>
<thead>
<tr>
<th>Pool preference group</th>
<th>Highly diversified</th>
<th>Moderately diversified</th>
<th>Nondiversified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversification averse</td>
<td>$M = 23.61$, $SD = 20.061$</td>
<td>$M = 27.09$, $SD = 15.98$</td>
<td>$49.30$, $SD = 23.570$</td>
</tr>
<tr>
<td>Moderate diversifiers</td>
<td>$17.20$, $SD = 12.126$</td>
<td>$42.47$, $SD = 26.495$</td>
<td>$40.33$, $SD = 28.657$</td>
</tr>
<tr>
<td>Diversification seekers</td>
<td>$63.72$, $SD = 24.090$</td>
<td>$18.03$, $SD = 12.330$</td>
<td>$18.25$, $SD = 12.518$</td>
</tr>
</tbody>
</table>

Note. The bold diagonal shows a good fit between the initial choice and the token assignment and implies that choice in this context reflects preference consistency and cannot be explained by demand characteristics.

Table 1

Mean Numbers of Tokens Assigned by the Three Preference Groups to Each of the Three Pools (Study 1B)

The previous two studies in this set (Studies 1A and 1B) illustrated the pseudodistinctiveness path and characterized situations in which people exhibit perceived diversity seeking, even if this diversification does not change the normative values of the pool. This behavior raises the issue of willingness to choose less preferred utility for the sake of pseudodiversity. In the current study, we manipulated both the pseudomultiplicity and the pseudodistinctiveness of the pools in order to test the effects of these two factors on perceived diversity. In addition, by contrasting pseudodiversity and utility, we explore whether diversification seeking under gain conditions can lead to substantial violations of normative rules.

Method

Participants. Three hundred and ninety-six students from Duke University (205 male, 191 female) with a mean age of 23.64 years ($SD = 4.4$) were paid $8 to participate in this study. Participants were randomly assigned to one of two conditions: 253 students (124 male, 129 female) were assigned to the within-subject condition, and 143 students (81 male, 62 female) were assigned to the between-subjects condition.

Procedure. The within-subject condition included a short questionnaire that presented a preference task between two of the three following lotteries:

- **Lottery A (highly diversified):** 10 prize cars (4 Volvo S-80s, 3 Toyota Corollas, 3 Honda Civics) will be raffled among 100,000 customers.
- **Lottery B (moderately diversified):** 10 prize cars (10 Volvo S-80s) will be raffled among 100,000 customers.
- **Lottery C (nondiversified):** 1 prize car (Volvo S-80s) will be raffled among 10,000 customers.

Participants were asked to imagine that they have purchased an expensive TV on a popular website and that the site offered them an opportunity to participate in one of two lotteries. After reading the description of the two lotteries, participants were required to express their preference by dividing 100 points between the two lotteries. Each of the participants in this within-subject condition

Table 2

Means of the Perceived Diversity Measure for Each of the Pools, According to Preference Groups (Study 1B)
read one of three descriptions that differed in terms of the lotteries presented and the dimensions by which these lotteries differed. In the multiplicity version, participants had to divide the points between the moderately diversified pool and the nondiversified pool (i.e., Lottery B vs. lottery C). In the distinctiveness version, participants had to divide the points between the highly diversified pool and the moderately diversified pool (i.e., Lottery A vs. Lottery B). Finally, in the multiplicity plus distinctiveness version, participants had to divide the points between the highly diversified pool and the nondiversified pool (i.e., Lottery A vs. Lottery C). On the second page of each version, participants rated the three cars of the highly diversified lottery (Volvo S-80, Toyota Corolla, Honda Civic) according to their cost, from the most expensive to the least expensive.

The between-subjects condition also included a short questionnaire, but in this condition each participant was faced with only one of the three aforementioned lotteries (i.e., Lottery A, B, or C). Participants were asked to evaluate the maximum amount of money that they would agree to pay as a registration fee for the given lottery. As in the within-subject condition, at the end of the task, participants rated the three different cars of the highly diversified lottery according to their price.

The normative solution versus the PDH prediction. When the study was conducted (December 2007) the market price of the Volvo S-80 was $42,045, more than twice the price of the Honda Civic ($17,760) and the price of the Toyota Corolla ($16,415). The probability of winning a car is equal on all three lotteries with winning odds of 1/10,000. However, only lotteries B and C promised winning a Volvo, the most valuable car. Therefore, according to the normative prediction, people should be indifferent in their choice between Lottery B and Lottery C (which are equal), preferring both of them over Lottery A (which is inferior). Participants who are aware of the fact that Volvo is more expensive than either Toyota or Honda should implement this normative rationale.

Note that Lottery A is highly diversified because it consists of both pseudomultiplicity and pseudodistinctiveness. Lottery B is moderately diversified because it consists of pseudomultiplicity only. Lottery C is nondiversified because it consists of neither multiplicity nor distinctiveness. Therefore, according to the PDH predictions, and in contrast to predictions made on the basis of the normative theory, Lottery A is expected to be the most attractive, Lottery B is expected to be the second most attractive, and Lottery C is expected to be the least attractive.

<table>
<thead>
<tr>
<th>Version pools</th>
<th>Multiplicity %</th>
<th>Multiplicity Model</th>
<th>Distinctiveness %</th>
<th>Distinctiveness Model</th>
<th>Multiplicity + Distinctiveness %</th>
<th>Multiplicity + Distinctiveness Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lottery A (highly diversified)</td>
<td>36.5</td>
<td>PDH</td>
<td>51.4</td>
<td>Normative</td>
<td>31.3</td>
<td>PDH</td>
</tr>
<tr>
<td>Lottery B (moderately diversified)</td>
<td>9</td>
<td>PDH</td>
<td>12.1</td>
<td>Normative</td>
<td>45</td>
<td>Normative</td>
</tr>
<tr>
<td>Lottery C (nondiversified)</td>
<td>57.7</td>
<td>Normative</td>
<td>12.1</td>
<td>Normative</td>
<td>23.7</td>
<td>Normative</td>
</tr>
</tbody>
</table>

Note. For multiplicity (B vs. C), n = 78; for distinctiveness (A vs. B), n = 74; For multiplicity + distinctiveness (A vs. C), n = 80; PDH = perceived diversity heuristic.

Results and Discussion

To juxtapose normative predictions with those derived from the PDH, we focused the analysis only on those participants who rated Volvo as the most expensive car. Thirty-three participants (21 from the within-subject condition, 12 from the between-subjects condition) rated Toyota or Honda as the most expensive car and were thus excluded from the analysis.

The preference distributions of the three within-subject versions are shown in Table 3. The preference of each participant was defined according to his or her allocation of points. Allocation of 50 points for each of the two options was defined as indifference. In all other cases, the participant’s preference was defined by the option that received more than 50 points.

The left column of Table 3 presents the multiplicity version (Lottery B vs. Lottery C). More than half of the participants (57.7%) were indifferent regarding these two lotteries, as expected by traditional theory. Of the remaining participants, 33.3% preferred the moderately diversified Lottery B, as predicted by the PDH, and only 9% preferred the nondiversified lottery C. The difference between the two preference groups was significant in the PDH predicted direction, $x^2(1, N = 33) = 10.939, p < .01$.

The results of this version and the magnitude of the diversification preferences present direct replication of the ratio bias reported by Epstein and colleagues (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992), suggesting that pseudomultiplicity of the winners increases the attractiveness of the pool.

The two other versions are more critical for testing the PDH predictions because the highly diversified pool (Lottery A) has a lower expected utility, and therefore, according to normative considerations, Lottery A should be less attractive than Lotteries B and C. In addition, the ratio bias predicts no difference between Lottery A and Lottery B because they are both based on the same ratio presentation (10 out of 100). The middle column of Table 3 presents the distribution of the distinctiveness version (Lottery A vs. Lottery B). Here, 51.4% of the participants preferred the moderately diversified Lottery B, in line with normative predictions. But it is more important to note that 48.6% of the participants were biased. Of those 48.6%, 12.1% of the participants were indifferent, and 36.4% preferred the highly diversified Lottery A, as predicted by the PDH but not by the ratio bias.

Finally, the right column of Table 3 shows the multiplicity plus distinctiveness version (Lottery A vs. Lottery C). In this case, 45% of the participants preferred the nondiversified Lottery C, as pre-
dicted by the normative solution. The other 55% of the participants were biased. Of those 55%, 23.8% of the participants were indifferent, and 31.3% preferred the highly diversified Lottery A, as predicted by the PDH. As can be seen from Table 3, the percentage of biased participants was higher in the multiplicity plus distinctiveness version than in the distinctiveness version (55% versus 48.6%, respectively). However, this difference was not significant, \( \chi^2(1, N = 154) = 0.621, p = .431 \).

The results of the three versions of the within-subject condition show that around 50% of the participants followed normative considerations. The majority of the remaining 50% exhibited a clear preference for the more diversified pool. Both the multiplicity version and the distinctiveness version show a separate effect on perceived diversity, though the magnitude of this effect did not increase significantly in the multiplicity plus distinctiveness version. This lack of additive value might be explained by the nature of our within-subject method that included different options to compare in each of the three versions and, therefore, might have yielded different comparison processes (Hsee, 1998; Hsee, Loewenstein, Blount, & Bazerman, 1999).

To test this hypothesis, we analyzed the between-subjects condition data. Here, each participant judged only one of the lotteries by offering the maximum amount of money she or he was willing to pay to take part in this specific lottery. There was no limitation on the amount of money participants could offer. The results supported the predictions of the PDH: The highly diversified Lottery A received the highest price (\( M = 9.38, SD = 11.38 \)), the moderately diversified Lottery B received the second-best price (\( M = 5.91, SD = 5.64 \)), and the nondiversified Lottery C received the lowest price (\( M = 4.04, SD = 8.25 \)). A one-way ANOVA revealed a significant difference between these means, \( F(2, 128) = 4.168, p < .03 \), with a significant linear trend in the predicted direction (i.e., \( M \) Price A > \( M \) Price B > \( M \) Price C), \( F(1, 128) = 8.086, p < .01 \).

The overall results of the present study support our assumption that both multiplicity and distinctiveness contribute to the perceived diversity of the pool. The between-subjects version demonstrated that distinctiveness had an additive value to multiplicity, even though distinctiveness actually hampered the utility of the larger ratio. These results also offer an explanation for the intuitive mechanism that lies at the core of the ratio bias phenomenon. That is, participants seem to perceive the numerator of the larger ratio as a range of pseudodiverse sources. Thus, the incidence of the ratio bias can be raised not only by manipulating the perceived multiplicity of winning sources, but also by leveraging the putative distinction between these sources.

The Effect of Framing on Level of Diversification

What are the sources of the PDH? Could the intuition to diversify be generalized to any situation in which people have to choose between different pools? Our PDH model suggests that diversification stems from the attempt to reduce risk and ensure that at least some of the resources will result in gains. In Studies 1A, 1B, and 1C, we focused on distinctiveness and multiplicity under gain conditions. As a result, we were unable to distinguish unequivocally between the PDH and alternative models such as the interest maximization (McAlister & Pessemier, 1982; Venkatesan, 1973) or the tendency to rely on a decision heuristic to diversify when a set of choices are bracketed together (Read & Loewenstein, 1995; Read et al., 1999). Indeed, all three models predict overdiversification when facing a choice between pools (i.e., combined choice) under gain settings. However, based on the robust findings that people are risk-seeking in the domains of loss (Kahneman & Tversky, 1979; Tversky & Kahneman, 1988, 1992; March, 1996; Thaler, 1999), the PDH model predicts that diversification will be counterintuitive when the same choices are framed as losses. This reversal is unique to the PDH model and is not predicted by the two alternative explanations.

To test this predicted reversal, the second set of experiments includes three studies in which we manipulated the framing and invited participants to assemble a preferred pool of bets that would maximize their chances of winning under the gain condition and minimize their chances of losing under the loss condition. In line with the PDH hypotheses, we predicted that the distribution of perceived diversity scores in the gain groups will present a clear diversity preference, whereas the distribution of perceived diversity scores in the loss condition will show diversity aversion.

Study 2A: Choice of Lucky Numbers Under Gain and Loss Conditions

Method

Participants. The participants were 93 undergraduate psychology students (69 female, 24 male) from Tel Aviv University (age: \( M = 23.3 \) years, \( SD = 3.3 \)), who enrolled in the study as part of their course requirements. Participants were randomly assigned to one of the three framing conditions (gain, loss, control).

Procedure. The experiment was programmed in Microsoft Visual Basic 6 and was run on a desktop personal computer. Participants in the gain and loss conditions were told that the computer would randomly pick three numbers from 1 to 100. Next, each participant was asked to choose three numbers from 1 to 100. Those in the gain condition were told to imagine that any match between their choice and the computerized selection would result in winning a sum of money. In the loss group, participants were told to imagine that any match between their choice and the computerized selection would result in losing a sum of money. The detailed instructions for the gain and loss conditions were as follows:

1. Numbers ranging from 1 to 100 (1, 2, 3, . . . 100) will appear on the screen.
2. The computer will randomly draw three numbers from this range.
3. Place a bet on three numbers. You will win (lose) 150 NIS (approximately U.S.$36) for each hit.
4. The chosen numbers are _____, _____, _____.

The detailed instructions for the participants in the control condition were identical, except for the third sentence:

3. Write down three numbers between 1–100 that you believe will be picked by the computer.
Once the participant chose the three numbers, the experiment ended. A short debriefing about the aim of the study was conducted after that.

Results and Discussion

Each number between 1–100 was equally likely to be picked, and thus, the dispersing spans of obtained numbers can be viewed as pseudodiversity (i.e., pseudodistinctiveness). The perceived diversity score of each chosen sequence of three numbers was calculated by two measures of variability. The first measure was the range, defined as the difference between the highest number and the lowest number in the chosen sequence. The second measure was the standard deviation of each sequence. According to the PDH predictions, these two measures of variability should be highest for the gain condition, should be moderate for the control condition, and should be lowest for the loss condition.

As seen in Table 4, the results confirmed the PDH predictions for both range and standard deviation. The highest average range was found in the gain condition (\(M = 59.03, SD = 27.51\)), the middle average range was found in the control condition (\(M = 46.16, SD = 27.91\)), and the lowest average range was found in the loss condition (\(M = 36.41, SD = 29.97\)). A one-way ANOVA revealed a significant difference between these averages, \(F(2, 90) = 5.364, p < .01\), with a significant linear trend in the predicted direction (i.e., \(M\) range gain > \(M\) range control > \(M\) range loss), \(F(1, 90) = 10.673, p < .01\).

A similar pattern was obtained for the standard deviation. The highest average SD was found in the gain condition (\(M = 30.86, SD = 14.57\)), the middle average SD was found in the control condition (\(M = 23.86, SD = 14.83\)), and the lowest average SD was found in the loss condition (\(M = 19.02, SD = 15.90\)). A one-way ANOVA revealed a significant difference between these averages, \(F(2, 90) = 5.250, p < .01\), with a significant linear trend in the predicted direction (i.e., \(M\) SD gain > \(M\) SD control > \(M\) SD loss), \(F(1, 90) = 10.406, p < .01\).\(^1\)

It is important to note that the difference between the gain condition and the loss condition could be at least partially accounted for also by what has been termed local representativeness, (Falk, 1981, 1982; Tversky & Kahneman, 1974). According to this account, participants in the gain condition are trying to hit the same numbers as the computer and thus select the sequence that fits the prototypical representation of random choice. On the other hand, under the loss condition, participants are trying to avoid the numbers chosen by the computer and thus select a narrower and less representative sequence. Nevertheless, local representativeness alone cannot explain the observed disparity between the gain condition and the control condition. The high diversity of numbers selected under the gain condition implies that participants tended to diversify more than required by simply predicting the prototypical random sequence. Therefore, there is good reason to believe that both the local representativeness and the PDHs were activated to create this pattern of results. In keeping with the local representativeness assumption, participants in the control condition chose a wide range of numbers. Additionally, as predicted by the PDH, this tendency increased under the gain condition and decreased under the loss condition.

Study 2B: Assembling Betting Pools Under Gain and Loss Conditions

In this study, we further explore the hypotheses of overdiversification in conditions of gain and underdiversification in conditions of loss. The question here is whether these expected tendencies could be found within a context in which participants are given the opportunity to assemble the optimal pool of bets on their own.

Method

Participants. The participants were 72 undergraduate psychology students (48 female, 24 male) from The Open University of Israel (age \(M = 26.6\) years, \(SD = 5.37\)) who participated in this study as part of their course requirements. They were randomly assigned to one of the two framing conditions (gain, loss).

Procedure. The researcher presented each participant with nine different bets: three roulettes, three dice, and three stacks of six playing cards. The bets in each category differed in color and size. However, each bet had six potential outcomes of which only one was defined as the target outcome. Thus, the probability of winning or losing in each of the nine bets was 1/6.

After becoming familiar with all the bets, participants were asked to assemble a pool of three bets with which to play. They had the opportunity to repeat a gamble. In other words, participants could choose three trials of the same bet, two trials of one bet, and one trial of a different bet, or one trial of each of the three different bets. The level of diversification was based on the pseudodistinctiveness between the chosen bets. The number of different bets and the number of different categories determined this distinctiveness. For example, three different bets from the same category (e.g., three dice) were less distinctive than three different bets from a different category (e.g., one die, one stack of cards, and one roulette).

The manipulation involved a reward or a penalty for each hit (each time one of the bets ended in the target outcome). The study was advertised as an opportunity to participate in a random lottery

\(^1\) A similar pattern was obtained in a later study by Ayal (2006) in which 119 undergraduate psychology students chose three numbers under both gain and loss conditions in a within-subjects design. As predicted, higher measures of variability were observed in the gain condition than in the loss condition.

### Table 4

**Means of the Two Measures of Variability in Each of the Three Groups (Study 2A)**

<table>
<thead>
<tr>
<th>Framing condition</th>
<th>Range</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M)</td>
<td>59.03</td>
<td>30.86</td>
</tr>
<tr>
<td>(SD)</td>
<td>27.51</td>
<td>14.57</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M)</td>
<td>46.16</td>
<td>23.86</td>
</tr>
<tr>
<td>(SD)</td>
<td>27.91</td>
<td>14.83</td>
</tr>
<tr>
<td>Loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M)</td>
<td>36.41</td>
<td>19.02</td>
</tr>
<tr>
<td>(SD)</td>
<td>29.97</td>
<td>15.90</td>
</tr>
</tbody>
</table>

*Note.* For gain, \(n = 34\); for control, \(n = 25\); for loss, \(n = 34\).
with total prizes of 700 NIS (approximately U.S.$170). Half of the participants, those randomly assigned to the gain condition, won one lottery ticket for each hit. The other half, those assigned to the loss condition, received three lottery tickets in advance and were required to give one ticket back for each hit. Therefore, the hits in the gain condition, if picked, increased the participant’s chances of winning the prize, whereas the hits in the loss condition, if picked, decreased his or her chances of winning. Both the increase and the decrease were of the same magnitude.

The perceived diversity score. To describe the pseudodistinctiveness of the three bets constituting any individual chosen pool, we assigned each participant a Perceived Diversity score. Repetition of the same bet was scored 0, switching bets within a category was scored 1, switching bets across different categories was scored 3. This scoring method produced a Perceived Diversity scale ranging from 0 – 6, with 0 representing three trials of the same bet and 6 representing one trial of three bets belonging to three different categories. Table 5 illustrates the potential choices and their Perceived Diversity scores.

Results and Discussion

In line with the PDH predictions, the average Perceived Diversity score was higher in the gain condition ($M = 4.95, SD = 1.224$) than in the loss condition ($M = 3.60, SD = 2.440$, $t(70) = 2.933$, $p < .003$). Figure 5 presents the difference between the Perceived Diversity score distributions in each of the two conditions, $\chi^2(4, N = 72) = 11.955$, $p < .02$. The main differences between the two conditions emerged in the extreme scores on the scale: More than half of the participants in the gain condition (54.1%) chose to maximize diversification, compared with only 40% of the participants in the loss condition. On the other hand, although none of the gain participants chose to minimize diversification, about one quarter of the participants (25.7%) in the loss condition chose to do so.

The presented difference in Perceived Diversity scores between the two groups can be explained neither by interest maximization (the alternative explanation in Studies 1A and 1B) nor by choice bracketing, as the factors relating to these explanations were held constant under the different framings. On the other hand, the PDH predicts precisely this pattern of results, especially the fact that one quarter of the participants in the loss condition decided to minimize their level of diversification.

Study 2C: Two Types of Pseudodiversity Biases

The two previous studies in this set (Studies 2A and 2B) characterized situations in which people exhibit perceived diversity seeking in gains and perceived diversity aversion in losses, even though this diversification was based on pseudodistinctiveness and did not change the normative values of the pool. Two questions remain unresolved: (a) Is the loss condition sensitive to multiplicity also? (b) Can the aversion to diversification also lead to violation of normative rules? These two questions are examined in Study 2C, in which we manipulate both pseudomultiplicity and pseudodistinctiveness and create choice situations in which the PDH predictions under gain and loss conditions contrast normative solutions (i.e., those calling for maximizing the probability to win and minimizing the probability to lose).

Method

Participants. One hundred and eighty four undergraduate psychology students (122 female, 62 male) from The Open University

Table 5
Potential Choices and Their PD Scores Study 2b

<table>
<thead>
<tr>
<th>Chosen pool</th>
<th>Within category switching (×1 point)</th>
<th>Across category switching (×3 points)</th>
<th>PD score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three trials of the same bet</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Two trials of the same bet and one trial of a different bet from the same category</td>
<td>$1 \times 1$</td>
<td>$0$</td>
<td>1</td>
</tr>
<tr>
<td>One trial of three different bets, all three bets from the same category</td>
<td>$2 \times 1$</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Two trials of the same bet and one trial of a different bet from different category</td>
<td>$0$</td>
<td>$1 \times 3$</td>
<td>3</td>
</tr>
<tr>
<td>One trial of three different bets, two bets from one category, and one bet from a different category</td>
<td>$1 \times 1$</td>
<td>$1 \times 3$</td>
<td>4</td>
</tr>
<tr>
<td>One trial of three different bets, each bet from a different category</td>
<td>$0$</td>
<td>$2 \times 3$</td>
<td>6</td>
</tr>
</tbody>
</table>

Note. PD = perceived diversity.
of Israel (age: $M = 25.3$ years, $SD = 3.8$) volunteered to participate in the study. They were randomly assigned to one of the two framing conditions (gain, loss).

Procedure. Upon entering the laboratory, each participant saw five stacks of lottery tickets. Each stack was in a different color, and every ticket had numbers from 1 to 49. The researcher explained that he was going to randomly choose five different numbers from this range. Under the gain condition, participants had the chance to win a prize of 200 NIS (approximately U.S.$50) for winning a bet. Under the loss condition participants received 10 NIS (U.S.$2.50) in advance and were told that they might lose it as a result of a failed bet. Each participant was asked to place a bet by selecting one of two methods:

Method A (highly diversified): Pick five tickets and mark five numbers on each of them. If you mark on at least one of your tickets the five numbers that are randomly selected in the lottery—you win (or lose, depending on condition assignment).

Method B (nondiversified): Pick one lottery ticket and mark six numbers from the entire range. If you mark the five numbers that are randomly selected in the lottery—you win (or lose, depending on condition assignment).

The normative solution versus the PDH prediction. Computing the probabilities to come up with the five lottery numbers shows that Method B is superior to Method A:

\[
P(A) = \frac{5}{49} \left( \frac{5}{5} \right) \quad \Rightarrow \quad P(A) < P(B)
\]

Therefore, to maximize the probability of winning under the gain condition, one should choose Method B. To minimize the probability of losing under the loss condition, one should prefer Method A.

On the other hand, Method A has higher perceived diversity than Method B. The perceived diversity of Method A is based both on pseudomultiplicity of the lottery tickets (i.e., five tickets) and on potential pseudodistinctiveness between different colors of these tickets, whereas Method B supplies only one ticket and one color. Contrary to normative predictions, the PDH predicts that participants will exhibit a preference for Method A under the gain condition and will exhibit aversion to this method under the loss condition.

Results and Discussion

Under the gain condition, 65.2% of the participants selected Method A; the pool that appeared to have higher pseudodiversity, in spite of the fact that this pool had lower normative gain utility. In contrast, under the loss condition, only 32.6% of the participants selected Method A, most probably because it appeared to have higher pseudodiversity and in spite of the fact that this pool had lower loss and was thus better in terms of its normative utility. The difference between the two distributions was highly significant, $\chi^2(1, N = 184) = 19.574, p < .001$. It is interesting to note that the percentage of participants who exhibited irrational preferences is very similar in the two conditions (65.2% and 67.4% in the gain and loss conditions, respectively).

Moreover, there was also a significant difference between the numbers of chosen colors under the two conditions. Only participants who selected five tickets in Method A and who thus had the opportunity to diversify the colors were included in this analysis. Under the gain condition, 93.3% of these participants (i.e., 56 out of 60) intuitively chose 5 colors, and the mean number of selected colors was 4.85 ($SD = 0.633$). In contrast, under the loss condition, only 36.7% of the participants who chose Alternative A (i.e., 11 out of 30) selected 5 different colors, and the mean number of selected colors was 2.96 ($SD = 1.75$). The difference between these two means was highly significant, $t(88) = 5.706, p < .001$.

These results provide the strongest support for the PDH hypotheses. The predicted pseudodiversity seeking under the gain condition and pseudodiversity aversion under the loss condition were confirmed both by the pseudomultiplicity and by the pseudodistinctiveness measures. Thus, pseudodiversity led our participants to exhibit a substantial violation of normative expectations. In fact, the majority of our participants minimized their probability of winning and maximized their probability of losing due to their tendency to seek the optimal level of pseudodiversity, that is, higher perceived diversity in gains and lower perceived diversity in losses.

General Discussion

The present work extends previous research on diversification in three ways. The first three studies (1A, 1B, and 1C) identified two independent sources of pseudodiversity—distinctiveness and multiplicity—each of which could lead to adoption of a normative path that reduces the risk and/or a pseudopath that leads to biases. The second set of studies (2A, 2B, and 2C) showed that the diversification seeking behavior observed under conditions of gain decreased and even reversed under conditions of loss. Finally, Studies 1C and 2C demonstrated a trade-off between utility and pseudodiversification. That is, the attempt to reach the optimal level of pseudodiversity led participants to prefer alternatives with lower positive expected utility under conditions of gain and higher negative expected utility under conditions of loss.

The six studies reported here attempt to test a new theoretical perspective. Although some of the data can be accounted for by alternative explanations, as we have acknowledged in our discussions of the specific studies above, our theory offers an integrative account that can explain the entire set of results. As predicted by the PDH model, our participants exhibited sensitivity to transformations in irrelevant dimensions of diversity. For example, under the gain conditions, they preferred to bet on pools with higher pseudodistinctiveness (e.g., preferring one trial with three different coins over three trials with the same coin), as well as on pools with higher pseudomultiplicity (e.g., preferring a pool comprising five lottery tickets to a better pool with one lottery ticket). It should, however, be noted that the effect of each irrelevant dimension on perceived diversity varied across tasks. For example, in the coin study (Study 1A), participants exhibited sensitivity to color and
size as cues of diversity and preferred to bet on three coins rather than choose three trials with the same coin. In contrast, participants in Study 1B did not prefer the moderately diversified pool (which contained size and color diversification) to the nondiversified pool. Avramov (2004) reported a similar inconsistency in simulating an actual college admission process. An overdiversification bias was obtained when college applicants were arbitrarily bracketed according to geographic origin, but this effect disappeared under an unbracketed condition, when candidates were not categorized according to geographic origin. In light of these results, it can be argued that the degree by which each dimension affects a decision depends on its perceived centrality and contribution to the categorization process. According to this explanation, the color and size dimensions in Study 1B lost their perceived relevance when a more prominent dimension was present.

The PDH model is highly relevant in many different social contexts. One example of its potential implications concerns decisions involving planning a sequence of activities associated with physical pleasure or pain. Imagine that for her 25th birthday Lisa is given two gift cards from her best friend: one card for three sessions of massage at a big spa and another card for piercing three different parts of her body, something she has long desired to do. Lisa must schedule her meetings in advance, according to the terms of each gift card. When attempting to choose between various massage methods (e.g., full body Swedish, deep tissue, or reflexology), Lisa focuses her attention on potential gains such as anticipating the relaxation, pleasant contact, and the aroma of the oils. She is not sure which method will be most pleasurable and is, therefore, likely to diversify by choosing different methods and providers. In contrast, when contemplating the body piercing methods (e.g., the needle method, dermal punching, piercing guns), she is suddenly alarmed by the potential losses that might accompany each procedure, such as pain, infection, or allergic reaction. In this case, although she does not know which will be the least aversive method, she would tend to narrow down the sources of potential losses and select one method and one provider. Moreover, for the same physical stimulus the level of diversification might change by switching one’s focus from gains to losses. One who focuses only on the potential gains of the massage sessions will diversify more than one who also considers their potential losses (e.g., side effects, the need to undress in front of a stranger).

The same rationale of the PDH holds when considering the perspective of providers who are evaluated by their clients. For example, consider a young lecturer who is teaching three courses as part of his 1-year probation period in an art school. The school looks for faculty members with excellent teaching skills. It is now the end of the semester, and the students are required to evaluate the course. If it were up to the young lecturer, he would prefer that a pool of praises about his teaching would come to the attention of the hiring committee from multiple students attending different classes. In contrast, when thinking about a pool of complaints, the lecturer would prefer all of them to come from one student or at least from few students within the same class. This example shows the preference to diversify sources of gains and reduce sources of losses.

As can be seen in the above examples, in many cases the PDH governs choices that seem rational, and at least some of them can be defended through normative predictions. Taking the young lecturer’s preferences as an example, it can be argued that when praises or complaints come from a more diversified sample (e.g., different classes, different students) they may serve as a more reliable predictor of the lecturer’s teaching ability. Thus, the lecturer has good reason to prefer the highly diversified pool of praises and the nondiversified pool of complaints. However, the findings of our studies along with previous research (e.g., Fox et al., 2005; Langer & Fox, 2005; Rubinstein, 2002; Thaler, 1999) demonstrate that people’s ability to distinguish between real and pseudodiversity is very weak. Consequently, in many situations the PDH is activated by irrelevant cues and subtle variations in the presentation of options.

These examples also imply that there is more than one motivation underlying the PDH. Kahneman and Frederick (2002) proposed the idea of attribute substitution to describe a general process that governs heuristics. According to this model, an individual assesses a specified target attribute of a judgment object by substituting another property of that attribute that comes more readily to mind (see also Kahneman, 2003). In the same spirit, our PDH framework emphasizes that to judge risk, people use the perceived diversity as a heuristic attribute. Support for this assertion comes from the second set of our studies in which only risk considerations can consistently explain the reversal between gain and loss conditions. Note, however, that Study 1B, which included only a gain condition, did not support this expected substitution because its perceived diversity measure was strongly correlated with interest but not with risk or dependence. These results might be explained more easily by interest maximization (McAlister & Pessemier, 1982; Venkatesan, 1973).

A possible model that refers to both interest maximization and risk reduction might suggest that perceived diversity serves as a heuristic attribute for more than one target. Under specific gain conditions, when the probabilities are transparent and people know how to compute the degree of risk, they use perceived diversity to measure the level of interest concerning a particular pool. Otherwise, when risk evaluations require more complicated computations, people use the perceived diversity to estimate the degree of risk of the alternative pools. Thus, people are more likely to engage the interest consideration in making judgments on diversification when they do not feel threatened (as in choosing between different massage methods). On the other hand, when the degree of risk is obscured and/or people face possible losses, consideration of interest becomes marginal (as in choosing between different methods of body piercing).

Summary and Conclusion

The unique contribution of the present study is the introduction of a new conceptual framework for the study of phenomena related to perceived diversity. Our theoretical distinctions between real and pseudodiversity and between the two sources of pseudodiversity (i.e., distinctiveness and multiplicity) enable us to examine the common cognitive mechanism that lies at the core of various decisions. For example, Study 1C showed that both the ratio bias (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992), defined as an error of probability judgment, and the diversification bias (Read & Loewenstein, 1995; Simonson, 1990), reported in the context of consumer research, can be viewed as a consequence of pseudodiversity perception. Moreover, in the spirit of Krueger and
Funder (2004), who call for a more balanced social psychology, our PDH framework reveals the advantages of diversification in explaining what prompts people to adopt this rule of thumb. Unfortunately, our results also point to the fact that people tend to overgeneralize this rule and often fail to distinguish between situations in which using the PDH is useful and situations in which this heuristic leads to biases. In a broader theoretical context, our research provides additional support for the assertion that pool judgments are not necessarily more natural and better calibrated than judgments of single events (Hsee, 1998; Kahneman & Tversky, 1992; Kahneman & Tversky, 1996). Rather, tasks involving pool judgments offer the decision maker additional bits of information to invoke different perspectives and heuristic tools. However, as Fischhoff and Bar Hillel (1984, p. 193) pointed out, “In life, information does not come tagged with guarantees of relevance.” Consequently, additional information draws decision makers closer to normative models under certain conditions (e.g., Cosmides & Tooby, 1996; Gigerenzer, 1991, 1996; Gigerenzer & Hoffrage, 1995), but in other circumstances, such as the pseudodiversity cases described in our studies, additional information may in fact move decision makers further away from any reasonable benchmark.

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