When Things Don’t Add Up:
The Role of Perceived Fungibility in Repeated-Play Decisions

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ABSTRACT—Previous research on repeated-play decisions has focused on choices with fungible outcomes. In two studies, we investigated the perceived fungibility of outcomes over repeated plays of risky prospects in a variety of situations, as well as the relationship between perceived fungibility and preferences for taking risks in those situations. Perceived fungibility varied substantially across participants and situations, with outcomes experienced by different people (e.g., medical outcomes for different patients) receiving lower scores. Higher perceived fungibility was associated with more favorable evaluations of repeated plays of risky prospects with positive expectations. Additionally, perceived fungibility moderated the effect of repetition, such that the increased attractiveness of repeated plays relative to a single play was diminished when perceived fungibility was low. Although evaluating the overall distribution of outcomes is arguably rational when monetary outcomes accrue to one person, treating each play as a separate event may be rational when aggregation is considered inappropriate.

Oil, wheat, and lumber are fungible commodities.
—Merriam-Webster

People are fungible.
—U.S. Secretary of Defense Donald Rumsfeld, 2004

Samuelson (1963) sparked interest in single-play and repeated-play decisions with a compelling anecdote about a colleague who would reject a single gamble with an even chance of winning $200 or losing $100, but who would accept 100 plays of the same gamble. Although the rationality of making different choices for single- and repeated-play gambles has been debated (Lopes, 1981, 1996; Samuelson, 1963; Schoemaker & Hershey, 1996; Tversky & Bar-Hillel, 1983), empirical results indicate that people are usually more likely to accept risky gambles with positive expected values (EVs) when the gambles will be played more than once (Keren, 1991; Langer & Weber, 2001; Montgomery & Adelbratt, 1982; Redelmeier & Tversky, 1992; Wedell & Böckenholt, 1994). Multiple plays of such gambles are particularly attractive when participants are shown the distribution of possible outcomes resulting from repeated plays (Benartzi & Thaler, 1999; Langer & Weber, 2001; Redelmeier & Tversky, 1992). These results are attributed to the fact that the probability of losing money usually decreases with repeated
plays of positive-EV gambles (although the specifics depend on the characteristics of the gamble and the number of repetitions) and to people’s greater sensitivity to losses than to gains (Kahneman & Tversky, 1984; Tversky & Kahneman, 1992).

The difference between single- and repeated-play decisions is often coupled with a tendency to view decisions in isolation (i.e., as single-play decisions). This tendency, which has been called choice by segregation (Redelmeier & Tversky, 1992), narrow bracketing (Read, Loewenstein, & Rabin, 1999), narrow framing (Kahneman & Lovallo, 1993), and myopia (Benartzi & Thaler, 1999), is usually viewed as nonnormative because it leads to choices that do not maximize the decision maker’s long-run (i.e., aggregate) utility.

Of course, aggregating outcomes over repeated plays assumes that outcomes are fungible. Money won on some plays offsets money lost on other plays. In other situations, however, the outcomes of repeated plays may not be viewed as fungible. For example, patients who are given the same medical treatment may respond differently. Increases in health status or years of life for some patients do not offset decreases for other patients in any real sense (Asch & Hershey, 1995). Perhaps this is why the distinction between medical decisions for individual patients and for groups of similar patients does not mirror the distinction between single and repeated plays of monetary gambles. Instead, the attractiveness of positive-EV treatments appears to be similar for individuals and groups (DeKay, Hershey, Spranca, Ubel, & Asch, 2004; DeKay, Nickerson, Ubel, Hershey, Spranca, & Asch, 2000; Hux, Levinton, & Naylor, 1994) or greater for individuals than for groups (Kogut & Ritov, 2003a, 2003b; Redelmeier & Tversky, 1990).

Although it may be argued that monetary outcomes that accrue to one person are fungible by definition, and that medical outcomes for different patients are not, researchers have also attempted to measure people’s perceptions of fungibility. For example, Tetlock, Kristel, Elson, Green, and Lerner (2000) and McGraw, Tetlock, and Kristel (2003) explored the limits of fungibility by assessing people’s willingness to monetize various services (e.g., surrogate motherhood) or objects from different sources (e.g., from a family member). In this article, however, we focus on the fungibility of ostensibly similar outcomes with each other (e.g., meal tickets won or lost) rather than the fungibility of such outcomes with money.

We hypothesize that the perceived fungibility of outcomes over repeated plays is lower when the outcomes are experienced by different people. More generally, perceived fungibility is likely to be low when there are physical, temporal, legal, ethical, cognitive, or other restrictions on the
aggregation of outcomes, or when outcomes are not sufficiently similar to be considered exchangeable. We emphasize perceptions because we anticipate that people will disagree about the fungibility of outcomes in any particular situation. This hypothesis is based on observations that people disagree about the appropriateness of monetization (McGraw et al., 2003; Tetlock et al., 2000); that authors disagree about whether the individual or aggregate perspective is more appropriate in medical settings (e.g., compare Asch and Hershey, 1995, to Nord, 1995); and that people often behave as though their own money were not fungible (Heath & Soll, 1996; Levin, 1998; Shefrin & Thaler, 1988; Thaler, 1990, 1999; Winnet & Lewis, 1995).

Perceived fungibility is interesting in its own right, but to a great extent, its importance depends on whether it affects decisions. We hypothesize that perceived fungibility is positively related to preferences for repeated plays of positive-EV prospects, both across situations and across individuals. In addition, we hypothesize that the increased attractiveness of repeated plays relative to a single play is moderated by perceived fungibility. When outcomes are not viewed as fungible, we expect little difference between single- and repeated-play decisions.

We investigated these issues in two experiments. Experiment 1 was an exploratory study involving repeated-play decisions in a variety of domains, with scenarios that differed in many ways. Experiment 2 involved a smaller number of single-play and repeated-play decisions that were matched in several important respects.

**EXPERIMENT 1**

This study was designed to explore the measurement of perceived fungibility, the variation in perceived fungibility over participants and situations, and the relationship between perceived fungibility and repeated-play decisions.

**Method**

**Participants**

One hundred sixty-three participants (70 undergraduates, 40 graduate students, and 53 nonstudents) from the Carnegie Mellon community were paid $25 for their participation.

**Materials and Procedures**

We created 32 scenarios involving a wide variety of topics (e.g., monetary gambles, corporate investments, gift certificates, frequent-flier miles, medical treatments, athletics, cellular phone
plans). For comparability and ease of exposition, four scenarios that involved more than one type of outcome (e.g., lower prices versus lost jobs) are excluded from the analyses below. The remaining 28 scenarios are described in Table 1. Each scenario entailed a hypothetical choice between a status-quo option and a risky option, with the choice applying to a number of equivalent repetitions (plays) with independent outcomes. In most cases, the status-quo option was a sure thing and the risky (or riskier) option had a higher EV. Usually, the chance of winning was greater with repeated plays than with a single play. Several pairs of scenarios were created to assess features that might be associated with perceived fungibility while holding other aspects of the scenarios constant. For example, monetary outcomes would be experienced by the same person in one scenario and by several different people in another scenario.

To shorten the task, we divided the 32 scenarios into four sets of eight, with members of paired scenarios appearing in different survey versions. In Section 1 of each booklet, participants read brief decision problems and indicated their strength of preference for one of the two alternatives on a –5 to 5 scale, with 5 meaning a strong preference for the risky option and –5 meaning a strong preference for the status quo. They also made a dichotomous choice between the two options. In Section 2, participants reread the scenarios and answered three questions regarding the fungibility of outcomes in each scenario on 0–10 scales. The first question asked the extent to which it was reasonable to consider the amounts won on some plays as offsetting the amounts lost on other plays; the second asked the extent to which it was appropriate to add the good and bad outcomes together over all plays; and the third asked the extent to which it was meaningful to consider the average outcome when deciding which option to choose. In addition, participants indicated how good it was to have the specified chance of obtaining the favorable outcome on each play, how bad it was to have the specified chance of obtaining the unfavorable outcome on each play, and how risky it was to choose the riskier option.

Complete stimulus materials for both experiments are available from the first author.
Results and Discussion

Reliability of Perceived Fungibility
We averaged each participant’s responses to the three perceived-fungibility questions for each scenario and used the resulting scale in subsequent analyses. Cronbach’s alpha for this three-item scale ranged from 0.508 to 0.913, depending on scenario, with a mean of 0.778. In all 28 scenarios, there was substantial disagreement among participants regarding the fungibility of outcomes. Across participants, perceived-fungibility scores spanned the full 0–10 range in 16 scenarios, and the range of scores was less than 8 in only two scenarios.

Perceived Fungibility in Different Scenarios
In general, perceived fungibility was highest in scenarios involving money or business ventures ($M = 6.48$), followed by those involving market goods ($M = 6.27$), time ($M = 5.97$), medical care ($M = 5.48$), and other outcomes ($M = 5.26$) (Fig. 1). This ordering is consistent with Leclerc, Schmitt, and Dubé’s (1995) suggestion that time is less fungible than money and with Asch and Hershey’s (1995) argument that aggregating outcomes over patients is inappropriate, although the differences between category means are not particularly large. Perceived fungibility was also higher when multiple outcomes were experienced by one person, couple, or firm ($M = 6.26$ for 18 scenarios, with 17 in the first three categories) rather than by different people ($M = 5.32$ for 10 scenarios, with nine in the last two categories).

Several planned comparisons involved paired scenarios. Outcomes of repeated plays of a monetary gamble were viewed as more fungible when experienced by one person ($M = 7.39$) than when experienced by different people ($M = 4.44$), $t(80) = 4.97$, $p < 0.0001$; gift certificates to similar stores ($M = 7.59$) were viewed as marginally more fungible than gift certificates to dissimilar stores ($M = 6.68$), $t(80) = 1.87$, $p = 0.0647$; frequent-flier miles on the same airline ($M = 6.95$) were viewed as more fungible than miles on different airlines ($M = 5.73$), $t(79) = 2.39$, $p = 0.0193$; and undated meal tickets ($M = 6.55$) were viewed as more fungible than dated meal tickets ($M = 5.18$), $t(80) = 2.46$, $p = 0.0162$. All four differences were in the expected directions.
In scenarios involving medical treatment for a fatal blood disease (Redelmeier & Tversky, 1990; DeKay et al., 2000), we thought that perceived fungibility might be lower for one’s own patients than for patients in general, in accord with the distinction between identified and statistical lives (Jenni & Loewenstein, 1997; Schelling, 1968; Small & Loewenstein, 2003). However, perceived fungibility was not significantly different when participants were placed in the role of a physician making recommendations for his or her own patients ($M = 4.76$) than when they were recommending a practice guideline to be followed by other physicians ($M = 5.41$), $t(80) = 0.99, p = 0.3246$.

Finally, performances of track athletes were viewed as more fungible when the emphasis was on the individual athletes ($M = 6.35$) rather than on the team ($M = 4.67$), $t(80) = 2.85, p = 0.0056$. We had expected the opposite result. Perhaps participants reasoned that decreases in the performance of the best athletes on the team could not be compensated by increases in the performance of other athletes.

**Perceived Fungibility, Strength of Preference, and Choice**

Previous studies have found that people are more likely to accept risky gambles with positive expectations and fungible outcomes when the gambles will be played repeatedly. We hypothesized that participants’ preferences for repeated plays of risky options with positive EVs would be positively related to the perceived fungibility of outcomes. In this study, the EV of the risky option was unambiguously positive in 19 of 28 scenarios (Table 1).

We regressed participants’ strength of preference ($SoP$) for the risky option onto the three-item perceived-fungibility scale ($Fungibility$) and ratings of other characteristics of the risky option ($Good$, $Bad$, and $Risky$), with fixed effects for participants and scenarios:

\[
SoP_{ij} = b_0 + \sum_{j=1}^{19} b_{ij} Fungibility_{ij} \times S_j + \sum_{j=1}^{19} b_{2j} Good_{ij} \times S_j + \sum_{j=1}^{19} b_{3j} Bad_{ij} \times S_j \\
+ \sum_{j=1}^{19} b_{4j} Risky_{ij} \times S_j + \sum_{j=1}^{18} b_{5j} S_j + \sum_{i=1}^{159} b_{6i} P_i + e_{ij},
\]

where $i$ indicates the participant, $j$ indicates the scenario, and $P_i$ and $S_j$ are dummy codes for participants and scenarios, respectively. $P_i$ was omitted for one participant in each of the four survey versions.

The adjusted $R^2$ for this regression was 0.484. The coefficients $b_{ij}$ indicated that the relationship between Fungibility and SoP was positive in 16 of 19 scenarios ($M = 0.292$), $F(19,$
514) = 2.00, p = 0.0072. Coefficients for the other predictors also had the expected signs (positive for Good, negative for Bad and Risky). Separate regressions for each scenario, separate regressions for each participant, and logistic regressions for predicting participants’ choices yielded similar results.

The results of this study indicate that perceived fungibility can be measured reliably, that it varies greatly among people considering the same situation, that it varies over situations in mostly sensible ways, and that it is positively associated with preferences for repeated plays of risky options with positive expectations.

EXPERIMENT 2

The scenarios in Study 1 involved repeated-play decisions, but not single-play decisions. The scenarios also differed in many respects, including the number of plays and the probabilities and magnitudes of the possible outcomes. Study 2 was designed to assess the difference between single- and repeated-play decisions while holding these features constant. We also assessed whether explicitly considering fungibility and outcome distributions affected participants’ preferences in repeated-play decisions and whether the effect of repetition and the effect of considering fungibility and outcome distributions were moderated by perceived fungibility.

Method

Participants

Three hundred fifty-five participants (285 undergraduates, 38 graduate students, and 33 nonstudents) from the Carnegie Mellon community were paid $10 for their participation.

Materials and Procedures

We created eight scenarios involving hypothetical decisions about monetary gambles, frequent-flier miles, meal tickets, and medical treatments. Each scenario involved a choice between a status-quo option and a risky higher-EV option. In the risky option, there was a 1/3 chance of gaining an amount \( x \) of a good ($30; 3,000 frequent-flier miles; three meal tickets; or six years of life expectancy) and a 2/3 chance of losing \( x/3 \) of the same good. The repeated-play versions of these scenarios involved ten repetitions, with a 70.1% chance of obtaining a net gain.

In Scenario A, participants made monetary decisions for themselves. We expected relatively high fungibility ratings in this scenario. Similar monetary outcomes would be experienced by
one other person in Scenario B (also higher fungibility) and by ten other people in Scenario C (lower fungibility). Frequent-flier miles would be credited to a single account in Scenario D (higher fungibility) and to ten different accounts corresponding to ten different airlines in Scenario E (lower fungibility). Meal tickets could be used on any date in Scenario F (higher fungibility), but only on specific dates in Scenario G (lower fungibility). In scenario H, different patients would experience either increases or decreases in life expectancy (lower fungibility). Members of scenario pairs (B and C, D and E, and F and G) were matched in all other respects.

In Section 1 of each booklet, participants considered a single-play decision (e.g., a medical decision for one patient), indicated their strength of preference for one of the two options, chose one of the options, and made other judgments regarding the risky option (Good, Bad, and Risky, as in Experiment 1). In Section 2, they considered a repeated-play decision (e.g., a medical decision for ten patients) and answered the same questions. In Section 3, participants answered three fungibility questions, as in Experiment 1. In Section 4, they considered three different graphs that summarized the possible results of repeated plays of the risky option. Graph A was a binomial distribution of the number of successes out of ten plays. Graph B was a binomial distribution of the number of failures and was simply the reverse of Graph A. In Graph C, good and bad outcomes were aggregated over the ten plays, as in previous research on repeated-play decisions. For example, five successes out of ten plays yielded a net gain of $100 in the monetary scenarios and 20 years of life expectancy in the medical scenario. Graph C was identical to Graph A except for the labeling of the horizontal axis and values. Participants evaluated the appropriateness and usefulness of each graph on 0–10 scales. We expected that ratings of Graph C would behave like ratings of fungibility, whereas ratings of Graphs A and B would not. In Section 5, participants reconsidered the repeated-play decision and again indicated their preference between the two alternatives. In the final section, participants provided additional information, including ratings of their risk attitude.

Results and Discussion

Reliability of Perceived Fungibility

The three-item perceived-fungibility scale used in Experiment 1 was augmented with the appropriateness and usefulness ratings of Graph C, which correlated highly with judgments of
fungibility within and across scenarios. Cronbach’s alpha for the resulting five-item scale ranged from 0.727 to 0.943, depending on scenario, with a mean of 0.874.

*Perceived Fungibility in Different Scenarios*

Figure 2 shows mean perceived-fungibility scores in the eight scenarios. As expected, outcomes were viewed as more fungible in Scenarios A, B, D, and F \((M = 8.32)\) than in Scenarios C, E, G, and H \((M = 4.99)\), \(t(353) = 12.57, p < 0.0001\).

Consistent with the results of Experiment 1, monetary outcomes were viewed as more fungible when experienced by one person \((M = 8.56)\) than when experienced by ten people \((M = 5.09)\), \(t(80) = 6.52, p < 0.0001;\) frequent-flier miles were viewed as more fungible when credited to one account \((M = 8.44)\) than when credited to ten accounts \((M = 5.15)\), \(t(114) = 5.38, p < 0.0001;\) and meal tickets were viewed as more fungible when undated \((M = 7.19)\) than when dated \((M = 5.71)\), \(t(74) = 2.56, p = 0.0124\).

*Perceived Fungibility, Strength of Preference, and Choice*

Figure 3 shows mean ratings for strength of preference for the risky option in Sections 1, 2, and 5 of the survey for each scenario. We analyzed these ratings using a 2 \((\text{Scenario}) \times 3 \,(\text{Section})\) repeated-measures ANOVA, with the between-participants Scenario variable comparing higher-fungibility scenarios (A, B, D, and F) to lower-fungibility scenarios (C, E, G, and H). The two main effects and the interaction were significant and in the expected directions. *SoP* ratings were higher in higher-fungibility scenarios \((M = 3.63)\) than in lower-fungibility scenarios \((M = –0.87)\), \(F(1, 351) = 28.63, p < 0.0001\). Ratings were also higher in later sections of the survey \((M = –0.42, 0.65, \text{and } 1.41 \text{ in Sections } 1, 2, \text{ and } 5, \text{ respectively})\), \(F(2, 702) = 60.84, p < 0.0001\). Finally, *SoP* ratings increased more steeply in higher-fungibility scenarios \((M = –0.20, 1.24 \text{ and } 2.58 \text{ in the three sections})\) than in lower-fungibility scenarios \((M = –0.71, –0.09 \text{ and } –0.07 \text{ in the three sections})\), \(F(2, 702) = 24.24, p < 0.0001\), indicating that the effect of repetition and the effect of explicitly considering fungibility and outcome distributions were moderated by perceived fungibility. Separate analyses for matched pairs of scenarios and repeated-measures procedures for modeling participants’ dichotomous choices yielded similar results.
We investigated these issues further by using participants’ fungibility ratings rather than a dichotomous variable for fungibility differences between scenarios. Specifically, we conducted the following three regressions to predict participants’ strength of preference for the risky option in Sections 1, 2, and 5 of the survey:

\[
SoP_1 = b_0 + b_1 Good_1 + b_2 Bad_1 + b_3 Risky_1 + b_4 RiskAttitude + e, \\
SoP_2 = b_0 + b_1 \hat{SoP}_1 + b_2 Fungibility + e, \text{ and} \\
SoP_5 = b_0 + b_1 \hat{SoP}_2 + b_2 Fungibility + e,
\]

where the subscripts on \(SoP, Good, Bad,\) and \(Risky\) indicate survey sections and \(\hat{SoP}_1\) and \(\hat{SoP}_2\) are the predicted values from the preceding regressions (to ensure that errors are not correlated with these predictors).

In the first regression, all four predictors had the expected signs, and three of the four were significant (Table 2). Adding dummy codes for scenarios increased \(R^2\) by only 0.007, \(F < 1\), and had no effect on the coefficients of interest.

In the second regression, strength of preference for the risky option with repeated plays \((SoP_2)\) was positively related to \(Fungibility\), even when strength of preference for the risky option with a single play \((\hat{SoP}_1)\) was controlled. As in Experiment 1, the fact that strength-of-preference ratings were associated with fungibility ratings that were obtained only later suggests that participants spontaneously considered fungibility in their repeated-play decisions.

In the third regression, strength of preference for the risky option after explicit consideration of fungibility and outcome distributions \((SoP_5)\) was positively related to \(Fungibility\), even when strength of preference for the risky option before such consideration \((\hat{SoP}_2)\) was controlled. Focusing on fungibility apparently heightened its relevance for repeated-play decisions, although whether this attention increased or decreased participants’ preference for the risky option depended on whether they viewed the outcomes as fungible.
Separate regressions for each scenario and logistic regressions for predicting participants’ choices in the three survey sections yielded similar results. In addition to replicating the positive relationship between perceived fungibility and the attractiveness of repeated plays of risky prospects with positive expectations, the results of this study indicate that the attractiveness difference between single and repeated plays of such prospects is moderated by perceived fungibility.

**GENERAL DISCUSSION**

These studies highlight the importance of perceived fungibility in repeated-play decision making. Perceived fungibility varies greatly over situations and over people evaluating the same situation. It is positively associated with preferences for repeated plays of risky options with positive expectations, and it moderates the effect of repetition in such circumstances.

Perceived fungibility is likely to be relevant to the effects of repeated plays on other expected-utility violations, such as common-ratio effects (Keren, 1991; Keren & Wagenaar, 1987) and preference reversals (Wedell & Böckenholt, 1990). It may also inform research on mental accounting (Heath & Soll, 1996; Shefrin & Thaler, 1988; Thaler, 1990, 1999), protected values and taboo tradeoffs (Baron & Spranca, 1997; Tetlock et al., 2000), and the distinction between identified and statistical lives (Jenni & Loewenstein, 1997; Schelling, 1968; Small & Loewenstein, 2003).

Our results help to explain objections to the aggregate perspective in medical settings, where outcomes experienced by different patients may not be viewed as fungible (Asch & Hershey, 1995). More generally, perceived fungibility may be useful in understanding opposition to policies and practices that affect people differently. For example, free-trade policies result in lost jobs for some workers but lower prices for everyone; projects that benefit relatively few people are often funded through taxes on the general population; and products ranging from sport-utility vehicles to genetically modified crops result in unequal distributions of benefits and risks. In benefit-cost analysis, such outcomes are treated as fungible even though the winners are not required to compensate the losers (Farrow, 1998). Nonetheless, perceived fungibility may affect evaluations of the fairness of decision processes and outcomes as well as evaluations of the decision makers themselves (Tetlock et al., 2000).
Although our results are primarily descriptive, they present a challenge for normative theories of choice. Evaluating the overall distribution of outcomes (choice by aggregation) is arguably rational when monetary outcomes accrue to one person or firm, but treating each play as a separate event (choice by segregation) is arguably rational when aggregation is deemed inappropriate. This view is overly simplistic in two respects, however. First, the fungibility of outcomes is treated as dichotomous, even though people often view outcomes as somewhat fungible. It is not obvious whether aggregation should be prescribed in such instances. Second, the above statement does not address whether fungibility judgments should be accepted at face value (as expressed preferences often are) or subjected to further scrutiny. Although it would be useful to know whether fungibility judgments are well-reasoned, evaluating them with respect to normative economic or ethical models would be difficult and probably controversial. These observations suggest that future theory and research be focused on the determinants of perceived fungibility as well as its implications for decision making.

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REFERENCES


TABLE 1
Characteristics of 28 Scenarios Used in Experiment 1

<table>
<thead>
<tr>
<th>Category and scenario</th>
<th>Status-quo option</th>
<th>Risky option*</th>
<th>Net EV of risky option on each play</th>
<th>$P(\text{win})$ over all plays</th>
<th>$P(\text{lose})$ over all plays</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Money or business</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Money to self</td>
<td>$0</td>
<td>$9 \times (0.5, 12; 0.5, -10)$</td>
<td>$1$</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Money to one other person</td>
<td>$90</td>
<td>$90 + 9 \times (0.5, 12; 0.5, -10)$</td>
<td>$1$</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Money to nine other people</td>
<td>$9 \times 10$</td>
<td>$9 \times (10 + [0.5, 12; 0.5, -10])$</td>
<td>$1$</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Oil exploration</td>
<td>$0</td>
<td>$-2.8 \text{ million} + 5 \times (0.3, 2 \text{ million}; 0.7, 0)$</td>
<td>$40,000$</td>
<td>0.472</td>
<td>0.528</td>
</tr>
<tr>
<td>Small-business loans</td>
<td>$0</td>
<td>$-107,000 + 10 \times (0.9, 12,000; 0.1, 2,000)$</td>
<td>$300$</td>
<td>0.736</td>
<td>0.264</td>
</tr>
<tr>
<td><strong>Market goods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gift certificates to similar stores</td>
<td>$4 \times 20$</td>
<td>$4 \times (0.4, 60; 0.6, \text{ no certificate})$</td>
<td>$4$</td>
<td>0.525</td>
<td>0.475</td>
</tr>
<tr>
<td>Gift certificates to dissimilar stores</td>
<td>$4 \times 20$</td>
<td>$4 \times (0.4, 60; 0.6, \text{ no certificate})$</td>
<td>$4$</td>
<td>0.525</td>
<td>0.475</td>
</tr>
<tr>
<td>Frequent-flier miles on one airline</td>
<td>$4 \times 2200$</td>
<td>$4 \times (0.4, 4400; 0.6, 1100)$</td>
<td>220 miles</td>
<td>0.525</td>
<td>0.475</td>
</tr>
<tr>
<td>Frequent-flier miles on four airlines</td>
<td>$4 \times 2200$</td>
<td>$4 \times (0.4, 4400; 0.6, 1100)$</td>
<td>220 miles</td>
<td>0.525</td>
<td>0.475</td>
</tr>
<tr>
<td>Undated meal tickets</td>
<td>$15 \times$</td>
<td>$15 \times (0.5, \text{ lunch ticket worth }$5.50 and dinner ticket worth $7.00; 0.5, \text{ no ticket})</td>
<td>$1.25$</td>
<td>0.696</td>
<td>0.304</td>
</tr>
<tr>
<td>Dated meal tickets</td>
<td>$15 \times$</td>
<td>$15 \times (0.5, \text{ lunch ticket worth }$5.50 and dinner ticket worth $7.00; 0.5, \text{ no ticket})</td>
<td>$0.75$</td>
<td>0.696</td>
<td>0.304</td>
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<tr>
<td>Seating at football games</td>
<td>$11 \times$</td>
<td>$11 \times (0.5, \text{ best section; }0.5, \text{ worst section})$</td>
<td>ambiguous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seating at the symphony</td>
<td>$12 \times$</td>
<td>$12 \times (0.5, \text{ best section; }0.5, \text{ worst section})$</td>
<td>ambiguous</td>
<td></td>
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<td><strong>Time</strong></td>
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<tr>
<td>Commuting in carpool</td>
<td>Leave work at 5:20, get home at 5:35 each day for 1 mo.</td>
<td>Leave work at 5:00 + (0.8, get home at 5:15; 0.2, get home at 5:30) each day for 1 mo.</td>
<td>13 fewer min. (+)$^{b}$</td>
<td>0.9999</td>
<td>0.0001</td>
</tr>
<tr>
<td>Walking to/from parking lots</td>
<td>8-min. walk to/from building each day for 1 yr.</td>
<td>$12 \times (0.3, \text{ park right by building for }1 \text{ mo.; }0.7, \text{ walk to/from building for }1 \text{ mo.})$</td>
<td>0.4 more min. each day for 1 mo. ($^{c}$)</td>
<td>0.276</td>
<td>0.493</td>
</tr>
<tr>
<td>Overnight work shifts</td>
<td>$6 \times 1$</td>
<td>$6 \times (7/13, \text{ no overnight shift; }6/13, 2 \text{ overnight shifts})$</td>
<td>0.077 fewer overnight shifts (+)$^{b}$</td>
<td>0.418</td>
<td>0.275</td>
</tr>
<tr>
<td>Picking up litter</td>
<td>$7 \times 1$</td>
<td>$7 \times (0.5, 0 \text{ hr.; }0.5, 2.5 \text{ hr.})$</td>
<td>0.25 more hr. ($^{d}$)</td>
<td>0.227</td>
<td>0.773</td>
</tr>
<tr>
<td>Cellular phone minutes</td>
<td>$12 \times 100$</td>
<td>$12 \times (0.5, 200 \text{ min.; }0.5, 50 \text{ min.})$</td>
<td>25 more min. (+)$^{e}$</td>
<td>0.806</td>
<td>0.073</td>
</tr>
</tbody>
</table>

Table continued on next page.
<table>
<thead>
<tr>
<th>Category and scenario</th>
<th>Status-quo option</th>
<th>Risky option(^a)</th>
<th>Net EV of risky option on each play</th>
<th>P(win) over all plays</th>
<th>P(lose) over all plays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical care</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency-room procedures for stroke</td>
<td>Unstated number of patients × (0.55, recover; 0.30, serious consequences; 0.15, die)</td>
<td>Unstated number of patients × (0.75, recover; 0.09, serious consequences; 0.16, die)</td>
<td>ambiguous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back surgery for own patients</td>
<td>Some patients × recurrent severe pain</td>
<td>Some patients × (0.70, significant reduction in pain; 0.02, paralysis from waist down; remainder, no change)</td>
<td>ambiguous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood disease practice guideline</td>
<td>Many women × 5–10 yr. of life</td>
<td>Many women × (0.85, gain 2 yr. of life; 0.15, lose 4 yr. of life)</td>
<td>1.1 yr. of life</td>
<td>0.950</td>
<td>0.050</td>
</tr>
<tr>
<td>Blood disease treatment for own patients</td>
<td>Many women patients × 5–10 yr. of life</td>
<td>Many women patients × (0.85, gain 2 yr. of life; 0.15, lose 4 yr. of life)</td>
<td>1.1 yr. of life</td>
<td>0.950</td>
<td>0.050</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rescuing prisoners of war</td>
<td>3 × (5–7 prisoners); 18 prisoners total</td>
<td>3 × (0.7, rescue a surprise, prisoners rescued, and small chance that rescuer or prisoner killed; 0.3, rescue not a surprise, prisoners not rescued, and almost certain that 1 prisoner executed)</td>
<td>ambiguous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance of track athletes</td>
<td>24 × normal performance of athlete</td>
<td>24 × (0.4, substantially increased performance; 0.4, no change; 0.2 substantially decreased performance)</td>
<td>0.2 if increase and decrease equal</td>
<td>0.879(^c)</td>
<td>0.076(^c)</td>
</tr>
<tr>
<td>Performance of track team</td>
<td>24 × normal performance of athlete</td>
<td>24 × (0.4, substantially increased performance; 0.4, no change; 0.20 substantially decreased performance)</td>
<td>0.2 if increase and decrease equal</td>
<td>0.879(^c)</td>
<td>0.076(^c)</td>
</tr>
<tr>
<td>Performance of tennis players</td>
<td>14 × normal performance of athlete</td>
<td>14 × (0.40–0.50, substantially increased performance; 0.25–0.30 substantially decreased performance; remainder, no change)</td>
<td>0.175 if increase and decrease equal(^d)</td>
<td>0.735(^c,d)</td>
<td>0.173(^c,d)</td>
</tr>
<tr>
<td>Performance of violin students</td>
<td>12 × normal performance of student</td>
<td>12 × (0.6 noticeable improvement; 0.4 totally lose interest)</td>
<td>ambiguous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovering computer files</td>
<td>9 × recover 90% of 1 file</td>
<td>9 × (0.9, recover perfect copy of file; 0.1, lose file completely)</td>
<td>0 files</td>
<td>0.387</td>
<td>0.613</td>
</tr>
</tbody>
</table>

\(^a\)Most expressions are of the following form: number of plays × (P[win], result if win; P[lose], result if lose).

\(^b\)For scenarios involving time, (+) and (−) indicate whether the EV is positive or negative, depending on whether additional time is desirable or undesirable.

\(^c\)P(win) over all plays and P(lose) over all plays sum to less than 1 because it is possible to come out even in these scenarios.

\(^d\)Values were computed using the midpoints of the probability ranges (0.45 and 0.275).
TABLE 2
Regression Results for Predicting Strength of Preference (SoP) for the Risky Option in Experiment 2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SoP$_1$</th>
<th>SoP$_2$</th>
<th>SoP$_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.555*</td>
<td>-1.634****</td>
<td>-1.455****</td>
</tr>
<tr>
<td></td>
<td>(0.637)</td>
<td>(0.349)</td>
<td>(0.383)</td>
</tr>
<tr>
<td>Good$_1$</td>
<td>0.421****</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.057)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bad$_1$</td>
<td>-0.112†</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risky$_1$</td>
<td>-0.487****</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.062)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RiskAttitude</td>
<td>0.355****</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SoP$_1$</td>
<td></td>
<td>0.638****</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.056)</td>
<td></td>
</tr>
<tr>
<td>SoP$_2$</td>
<td></td>
<td></td>
<td>0.681****</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.080)</td>
</tr>
<tr>
<td>Fungibility</td>
<td>0.374****</td>
<td>0.353****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
<td>(0.059)</td>
<td></td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.586</td>
<td>0.445</td>
<td>0.535</td>
</tr>
</tbody>
</table>

Note. Subscripts on SoP, Good, Bad, and Risky indicate survey sections. SoP$_1$ and SoP$_2$ are the predicted values from the preceding regressions. Standard errors are in parentheses. Fungibility and outcome-distribution ratings were made between Sections 2 and 5.

$^\dagger$p < 0.10. $^*$p < 0.05. $^{***}$p < 0.001. $^{****}$p < 0.0001.
**Fig. 1.** In Experiment 1, perceived fungibility varied across scenarios in mostly sensible ways (see text for specific comparisons). Bars indicate mean three-item perceived-fungibility scores, with standard errors. Possible scores ranged from 0 to 10.
Fig. 2. In Experiment 2, perceived fungibility varied across scenarios in the predicted manner: it was higher in Scenarios A, B, D, and F and lower in Scenarios C, E, G, and H (see text for specific comparisons). Bars indicate mean five-item perceived-fungibility scores, with standard errors. Paired scenarios (B and C, D and E, and F and G) were matched in all other respects.
Fig. 3. In Experiment 2, strength of preference (SoP) for the risky option was higher in repeated-play decisions (Section 2) than in single-play decisions (Section 1), and even higher after participants had made fungibility and outcome-distribution ratings (Section 5). As predicted, however, these differences were smaller in lower-fungibility scenarios (C, E, G, and H) than in higher-fungibility scenarios (A, B, D, and F). Bars indicate mean SoP ratings, with standard errors. Possible scores ranged from –5 to 5. Paired scenarios (B and C, D and E, and F and G) were matched in all other respects.