Judgment and Decision Making, Vol. 15, No. 2, March 2020, pp. 246–253

Preferences for rank in competition: Is first-place seeking stronger than last-place aversion?

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Abstract

The use of gamification to motivate engagement has greatly increased the number of ways in which people compete. Many of these competitions allow individuals to see how they rank as a competition progresses. Our work aims to provide a better understanding of how individuals feel about different rank outcomes in competitions. We do this by applying the principles of expected utility theory to elicit utility curves for over 3,000 people across three studies using hypothetical competition scenarios. We find consistent support for the following generalizations: 1) individuals are risk-seeking when in second place, 2) they are risk-averse when in second-to-last place, and 3) the utility decrease going from first to second place is greater than their decrease going from second-to-last to last place. Our results suggest individuals are both last-place averse and first-place seeking, with an even stronger inclination towards the latter.

Keywords: rank, competition, social comparisons, expected utility theory, prospect theory, winner effect

1 Introduction

The rise of gamification has increased the number and variety of ways in which people compete. In leisurely pursuits, people try outranking each other on leaderboards showing most visits to a restaurant, most steps taken in a week, or highest score in a video game. Professionally, individuals compete for prize money and jobs through innovation competitions, and charitable organizations compete for awards through fund-raising contests. However, there is scant literature that provides insight regarding how individuals feel about different rank outcomes in a competition. Using methodological tools from expected utility theory (EUT) (von Neumann & Morgenstern, 1947), we elicit rank utility curves of over 3,000 individuals, which reveal several interesting insights regarding rank preferences.

Our work relates to the social psychology literature on social comparisons and competitive behavior (Buunk & Gibbons, 2007; Festinger, 1954; Garcia, Tor & Schiff, 2013; Ku, Malhotra & Murnighan, 2005; Malhotra, 2010). Of particular relevance, Garcia, Tor & Gonzalez (2006) explored the effect of specific rank feedback as a modifier of competitive drive. Based on choices involving hypothetical outcomes (e.g., profits or grades) for oneself and one's rival, individuals exhibited substantially more competitive behavior against a rival when they both ranked consecutively near the top or bottom of a list, compared to when they ranked consecutively at an intermediate ranking. This suggests that individuals are both first-place seeking (FPS) and last-place averse (LPA).

As discussed more below, our analysis of individuals' utilities for different ranks in a hypothetical competition provides consistent support for the following generalizations: 1) individuals are risk-seeking when in second place, 2) they are risk-averse when in second-to-last place, and 3) their utility decrease going from first to second place is greater than the decrease going from second-to-last to last place. The first two findings also support FPS and LPA behavior, respectively. The third finding suggests that individuals exhibit an even stronger drive to be FPS compared to LPA.

Kuziemko et al. (2014) also studied individuals' risk preferences as a function of their rank in social comparisons. They randomly assigned individuals to groups of six, with each individual in a group randomly endowed with some amount of money. Everyone knew each other's amount, and therefore, rank. Participants were then asked to choose between a certain monetary gain, which would leave their wealth rank unchanged, or a gamble with the same expected monetary gain, but for which winning increased, and losing decreased, their rank. Their various analyses established robust statistical support for the hypothesis of LPA; individuals in last place chose the gamble a significantly higher proportion of the time than other ranks. Moreover, the authors found *no* evidence of FPS; individuals ranked 1 and 2

The authors would like to thank the Social Sciences and Humanities Research Council (SSHRC) of Canada, Insight Development Grant, for supporting this research. We would also like to thank research assistant Andrew Lai for his contributions to data collection and data analysis, Professor Stephen Spiller for his help with creating Figure 1, and Professor Dale Griffin for his helpful comments on our work. Finally, we thank the editorial team of Professors Andreas Glöckner, Marc Jekel, and one anonymous reviewer for their constructive feedback.

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chose the gamble at a similar rate as those ranked 3–5. A possible reason for the lack of FPS in their study is that rank outcomes were randomly endowed and not the result of an effort-based contest. As first suggested by Allport (1924) and explored further in Ku, Malhotra and Murnighan (2005) and Malhotra (2010), rivalry and features of a competition may enhance one's desire to win. Ranking near the top of a contest may engender a "competitive arousal" (Ku et al., 2005) not experienced when ranking near the top of other forms of social comparison (e.g., endowed wealth).

Our study also has connections to the work of Medvec, Madey, and Gilovich (1995), which demonstrated that bronze medalists in Olympic events were generally happier than silver medalists. The authors explained this through counterfactual thinking, in which silver medalists were disappointed that they missed out on a gold medal, while bronze medalists were happy that they finished in the top three and received any medal. Counterfactual thinking may also help explain some of our findings, which we discuss further in the final section. However, Medvec and colleagues (1995) did not examine last-place aversion and did not compare first place seeking with last place aversion, which is the focus of our investigation.

We note that our consideration of rank-dependent utility is distinct from the formal body of work on "Rank-Dependent Utility" (RDU; see, for example, Diecidue and Wakker, 2001; Quiggin, 1982; Schmeidler, 1989; Tversky and Kahneman, 1992; Yaari, 1987). Our motivation is to explore whether rank-ordered outcomes in competitive settings are in and of themselves carriers of utility and if so, what insights come from the shape of the utility curves. The motivation for RDU was to fix stochastic dominance violations arising from nonlinear probability weighting functions, in which the weights of the set of outcomes did not sum to 1 (e.g., the overweighting of small probabilities and underweighting of large probabilities from original Prospect Theory [Kahneman and Tversky, 1979]). Quiggin (1982) resolved this issue by requiring that the sum of probability weights equal 1, from which he showed that the weighting function depends on both the probabilities of the individual outcomes as well as their ranked order. This, in turn, led to the updated version of Prospect Theory, known as Cumulative Prospect Theory (Tversky and Kahneman, 1992). The lotteries examined in RDU typically involved uncertainty in financial rewards or costs, and did not have any aspect of social comparison. Therefore, there was no reason to consider the ranks of outcomes as directly affecting utilities in those settings. In our study, there are no financial outcomes; one's rank in a contest is the only outcome that may provide satisfaction or lack thereof. As such, our topic of study is essentially orthogonal to previous work on Rank Dependent Utility.

2 Hypothesis Development

The Methods section describes how we constructed individuals' utilities for different rank outcomes in a competition. With utility curves in place, we examined their implications for rank preferences. As described below, we told participants that their identity would remain anonymous and that the competition would not award prizes. One might posit that someone will not care about such a competition. However, millions of people engage in competitive online video games using anonymous user names, with their scores shown on leaderboards, and only pride at stake. The literature on the psychology of competition (noted above) suggests that many individuals in these types of competitions would still have a clear preference to rank higher than lower. This forms our first hypothesis below. Before stating the hypothesis, we make a few comments. Because we anchored the utility of first and last place to 1 and 0, respectively, Hypothesis 1 focuses on individuals' utility values between second and second-to-last place (inclusive). These utilities can, in principle, take on any values between 0 and 1, and nothing in our elicitation method forces any pattern to hold.

Hypothesis 1: Individuals' utilities increase as rank increases from second-to-last place to second place.

The shape of utility curves also tells us how individuals feel about risk. A concave utility curve over monetary outcomes is associated with risk-aversion, while a convex utility curve is associated with risk-seeking. For example, someone with a concave utility function would prefer \$5 for sure over a 50–50 chance of winning \$0 or \$10; conversely, someone with a convex utility function would prefer the 50-50 gamble. However, care is needed when discussing risk preferences, concavity, and convexity for categorical data (e.g., rank outcomes). Although rank is categorical, it is also ordinal, and therefore one can apply the axioms and conclusions of EUT. In particular, one can define a real-valued, utility function over the discrete ranks. While continuous derivatives do not apply in this case, we shall say that the utility function is discretely concave at rank m if $U(m+1) - U(m) < U(m) - U(m-1)$ (and is discretely convex at rank m if the inequality $>$ holds instead). If discrete concavity holds at rank m, one can say that the individual prefers to finish in rank m for certain rather than take a 50–50 chance of finishing in rank $m - 1$ or rank $m + 1$. However, the usual notion of a risk-averse individual preferring the expected value of a lottery for certain, rather than receiving the lottery itself, no longer makes sense for this setting (i.e., we would not say that rank m is the expected value of the 50–50 chance of finishing in rank $m - 1$ or rank $m + 1$). A transformation is first required to map the ranks to real-valued numbers (i.e., associate random variables with the ranks), and the utility curve over this transformed variable may or

https://doi.org/10.1017/S1930297500007385 Published online by Cambridge University Press

Table 1: Summary of different studies. The "number of contestants per group" indicates the group sizes in which treatment participants were to imagine they were participating. "Avg comp" (male and female) indicates a self-rated competitiveness level, on a scale of 1 (not at all competitive) to 7 (very competitive).

Study	Participant pool	Number of contestants per group	Sample size	% male	Avg age	Avg male comp	Avg female comp
1	MTurk	6	1960	52	35	5.0	4.4
2	MTurk	6	1001	49	36	5.0	4.5
3	Undergrad. students	10	423	36	21	5.7	5.2

may not retain a shape similar to a utility curve plotted over equally-spaced ranks. This caveat should be kept in mind when we take the latter approach to plotting utilities.

Given the salience of first and last place, we expected that individuals would be willing to take on risk to attain first place if they were close to first (i.e., they are first-place seeking), and that they would avoid risk that could land them in last place if they were near last (i.e., they are last-place averse). This conforms to what Prospect Theory (Kahneman & Tversky, 1979) would predict if individuals in second place view first place as their reference point; they would view their second-place rank as in the domain of losses and therefore be risk-seeking (Schoenberg & Haruvy, 2012). Conversely, individuals in second-to-last place may view last place as their reference point, feel like they are in the domain of gains, and therefore be risk-averse. We take this perspective and hypothesize the following:

Hypothesis 2: a) Individuals are risk-seeking when in second place, and b) risk-averse when in second-to-last place.

Our next set of hypotheses compare the relative strength of FPS and LPA preferences. While individuals may want to attain first place and avoid last place, does one of these drives appear more prominent than the other? As noted above, Prospect Theory predicts that individuals are risk-averse over gains and risk-seeking over losses. Another key aspect of Prospect Theory is "loss aversion," whereby the disutility of losing some amount is greater in magnitude than the positive utility one feels when gaining the same amount. Again, assuming that someone in second place thinks of first place as a reference point, and someone in second-to-last place thinks of last place as a reference point, we predict that FPS will be a stronger force than LPA. This forms the basis of the next two hypotheses, with the first one comparing Hypothesis 2, parts a and b.

Hypothesis 3: More individuals are risk-seeking in second place than risk-averse in second-to-last place.

In other words, while Hypothesis 2 suggests that a majority of people are both FPS and LPA, Hypothesis 3 predicts that even more people are FPS.

Our next hypothesis compares the magnitude of the utility change between first and second place, with the magnitude of the utility change between second-to-last and last place. Viewing second place as a loss of one rank from first place, and second-to-last place as a gain of one rank from last place, in accordance with loss aversion, we predict:

Hypothesis 4: Individuals experience a greater decrease in utility from first to second place, compared to the gain in utility from last to second-to-last place.

3 Methods

We ran multiple, independent, large-sample versions of our study to ensure robustness and replicability (Table 1). Studies 1 and 2 were run with MTurk participants, while Study 3 was run with a student population. As a rule-of-thumb, we wanted to have at least 50 observations per cell of our 2x2x2 full factorial design, which would mean having around 400 participants. For the MTurk studies, we could easily go well beyond this quantity, so we did that (Studies 1 and 2 had 1960 and 1001 participants, respectively). Study 3 was run with a student population, for which we obtained as many participants as we could, and this was close to 400. As demonstrated later in Figure 1, the confidence intervals around our point estimates are tight enough to separate out signals from noise. Data cleaning steps of the MTurk studies involved removing duplicates of any IP addresses (2% of Study 1, and 1% of Study 2, respondents were removed for this reason).

Each study involved a hypothetical contest in which the participant competed against other people to either 1) take the most steps (the "athletic" frame) or 2) solve the most puzzles (the "intelligence" frame) over a period of time. For example, participants in a hypothetical athletic contest among six people read[1]:

[1]Here we provide the wording from Study 2. The scenario wording in the other studies was slightly different, but the results were essentially identical. The complete text of all experimental materials can be found in Section 1 of the Supplement.

> Suppose you and five other people of similar fitness level (either gender) are matched up in a competition to see who takes the most steps over the next month (from a combination of walking, running, and stairs). Imagine that there are no prizes given out in this competition, and that rankings and performance would be displayed through an anonymized leaderboard (i.e., you will not know the identity of anyone else in your competition group, nor will anyone else in your group know your identity; however, you will know which rank is yours).
>
> The following questions are designed to assess your preference between using a strategy that would guarantee a certain outcome (e.g., third place out of 6) vs. using another strategy that gives you a chance of finishing in first place (out of 6) and a chance of finishing in last place (out of 6). Assume each of these two strategies involves the same amount of effort. Also, note that first place means the most steps taken and last place means the least. We will vary the chances approximately five times, to estimate the percentage chance that makes you indifferent between choosing the certain rank outcome and the uncertain rank outcome.

We told participants that the hypothetical contests did not award prizes and that their identity would be anonymous, because we wanted to assess their intrinsic utility for rank outcomes. Participants within each study were randomly assigned to one of 8 conditions of a 2x2x2 between-subjects full factorial design. The first factor was the athletic vs. intelligence frame. Participants randomized to the intelligence frame read that they were matched up in a competition to see who can correctly solve the most puzzles in 10 minutes. The second factor was a word vs. numerical formatting of rank information. The above example shows the word format; in the numerical format, participants decided between a guaranteed outcome of "rank #3 out of 6" vs. a chance of finishing in "rank #1 (out of 6)" vs. "rank #6 (out of 6)." The third factor counterbalanced the order in which we elicited the rank utilities for each participant. In the ascending version, we elicited utilities in the order of ranks 2,3,4,5, and in the descending version we started with rank 5 and finished with rank 2 (the utilities of last and first place were set to 0 and 1, respectively, as described next). We had no strong predictions or formal hypotheses about these three between-subject factors of the design (athletic vs intelligence competitions, rank wording, and rank order); we included these variations mainly as robustness checks to ensure that the utility curve results were not driven by arbitrary features of the experimental design.[2]

Under the axioms of EUT, individuals' preferences for different outcomes can be identified through a utility function (often referred to as "von Neumann-Morgenstern utilities"; von Neumann & Morgenstern, 1947). To elicit utilities for each participant, we applied the "probability equivalent" (PE) method (Hershey & Schoemaker, 1985). Because utility functions are unique up to a positive linear transformation, we arbitrarily anchored the utility of last place at 0 and the utility of first place at 1. Then, to elicit an individual's utility for finishing in third place (out of 6), for example, we began by asking her to choose between the following two options: A) "a strategy that guarantees you will finish in third place (out of 6)," or B) "a strategy in which you have a 50% chance of finishing in first place (out of 6) and a 50% chance of finishing in last place (out of 6)." If the individual selected A, then we asked her to choose between options A and B again, but this time option B was presented as a 75% and 25% chance of finishing in first and last place, respectively. We proceeded with this bisection approach until we identified the percentage p such that the individual was approximately indifferent between option A (finishing in third place for certain) or option B (p chance of finishing in first and 1-p chance of finishing in last).[3] By fixing the utility of first place at 1 and last place at 0, this final value of p (divided by 100) estimated the individual's utility for finishing the contest in third place. We then repeated the same process to assess that same individual's utility for other ranks, thereby creating within-subjects utility curves over ranks.

As discussed in the Results section, the PE elicited for some participants at second-to-last place involved low probabilities, and similarly, the PE elicited at second place for some involved high probabilities. Therefore, as a robustness check, we also estimated utilities assuming individuals apply a nonlinear probability weighting function that overweights low probabilities and underweights high probabilities (as introduced in Prospect Theory; Kahneman and Tversky, 1979). Specifically, we applied a widely-used and well-validated nonlinear weighting function (Prelec, 1998; Stott 2006), which weights probabilities using the function $w(p) = e^{-(-\ln \ln p)^{\beta}}$, where $0 < \beta < 1$ is a tuning parameter that affects the curvature of the function. Applying the eval-

[2] For example, individuals may have different competitive feelings about athletic vs. intellectual accomplishments. Regarding the second factor, it is possible that wording the ranks as "first" or "last" would produce stronger first-place seeking and last place aversion, as compared with wording the same ranks as "rank #1" and "rank #6". Finally, the order could influence reference points, and thus the utility results; for example, the descending order could make the top ranks stronger reference points and thus increase the convexity of the utility function near first (as anything lower would feel like a loss and thus induce more risk-seeking), or the ascending order could make the lower ranks stronger reference points and thus increase the concavity of the function near last-place (as anything higher would feel like a gain, and thus induce risk-aversion). Therefore, we experimentally varied these factors in an exploratory fashion, to ascertain if any of them were critical.

[3] We estimate the indifference probability to within 0.02, which happens after 5 choices.

Table 2: Summary of individuals' utility function behavior. Column 2 indicates the percentage of participants who had greater utilities with better ranks (H1). Column 3 indicates the percentage of participants whose utility function between first and third place was strictly convex (i.e., $U(\text{Rank 2}) - U(\text{Rank 3}) < U(\text{Rank 1}) - U(Rank2)$; H2a). Column 4 indicates the percentage of participants whose utility function between third-to-last and last place was strictly concave (i.e., $U(\text{Rank 5}) - U(\text{Rank 6}) > U(\text{Rank 4}) - U(\text{Rank 5})$; H2b). The last column indicates the percentage of participants who had a greater drop in utility from first to second place, compared to the drop in utility from second-to-last to last place (H3). 95% confidence intervals for the population percentage of each column are within ± 2% of the values shown.

Study	Utility Increasing from Second-to-Last Place to Second Place	Convex at Second	Concave at Second-to-Last	Drop from First > Drop to Last
1	72%	79%	72%	68%
2	86%	80%	68%	69%

uation of lotteries described in Cumulative Prospect Theory (Tversky and Kahneman, 1992) and using the probability equivalent, p_{PE}, obtained from our bisection search for an individual's utility of rank N, we set

$$U(\text{rank N}) = U(\text{last place}) \cdot [w(1)w(p_{PE})] + U(\text{first place}) \cdot w(p_{PE})$$

Letting $U(\text{last place}) = 0$ and $U(\text{first place}) = 1$ implies that $w(p_{PE})$ estimates the individual's utility for rank N (recall p_{PE} estimates their utility under EUT).

After participants made their competition choices, they answered some questions about how they thought they would actually rank in a contest, about their competitiveness, and about their feelings about finishing in first place or last place. Finally, participants indicated their gender, age, and ethnicity. The text for all of these individual difference measures are provided in Section 1 of the Supplement.

4 Results

First, we report on the percentage of participants that exhibited the behaviors hypothesized above, and then we discuss their magnitudes. We begin by using the utility elicitation procedure under EUT, and later discuss results under CPT. For ease of exposition, we report the results of Studies 1 and 2 in the main manuscript, since those both involved hypothetical contests among 6 people. Study 3 involved a hypothetical puzzle-solving contest among 10 people (rather than 6), and not all rank utilities were measured, so we report the results of Study 3 in the Supplement (Section 3). The overall results and insights were quite similar across studies.

Table 2 shows that 72% of all participants (pooled across factors) in Study 1 had utilities that increased monotonically from second-to-last to second place (supporting H1)[4], 79% had convex utility curves at second place (supporting H2a), 72% had concave curves at the second-to-last place (supporting H2b, H3), and 68% had a bigger decrease in utility from first place to second compared to their decrease from second-to-last to last place (supporting H4). The 95% confidence intervals around each of these percentages was ± 2% or less. The results of Study 2 also support Hypotheses 1-4. Visually, we see the predominant patterns of Table 2 in the plot of average utility vs. rank for Studies 1 and 2 (Figure 1).[5]

There were no statistically significant interaction effects among the three factors used for randomization, and the insights of Table 2 held for each level of the three factors. For example, a majority of individuals exhibited each of the four conditions (denoted by the columns of Table 2), regardless of whether their hypothetical scenario involved stepping or solving puzzles, whether ranks were expressed as numbers or words, or whether rank utilities were elicited in ascending or descending order.

Whereas Table 2 shows the percentage of respondents that satisfied each of the four properties (columns 2–5) separately, we also analyzed the percentage of respondents jointly falling into each of the 16 (=2^4) combinations of yes/no across the categories. For example, we found that 26.1% and 28.5% of respondents in Studies 1 and 2, respectively, satisfied all four conditions simultaneously (these proportions were significantly greater than the 6.25% that would be expected at chance level, $p < .001$ in both studies.) These were the modal outcomes by a significant margin; for both Study 1 and Study 2, the second most common combination was respondents who satisfied all conditions except for "concave at second-

[4]Individuals were included in this metric if their utilities from second-to-last place to second place were non-decreasing, with at least one of the inequalities being strict. For example, in the 6-person competition of Study 1, an individual was included if the following held for their utilities: $U[rank5] \leq U[rank4] \leq U[rank3] \leq U[rank2]$, *and* $U[\text{rank }5] < U[rank2]$. We use "non-decreasing" rather than "strictly increasing" between each rank because we limited the precision of our estimates (to avoid survey burden), which may result in the same estimated utility despite someone truly preferring the higher rank. However, we also want to avoid including anyone who elicits the same utility for every rank from second-to-last to second, which is why we check that $U[\text{rank }5] < U[\text{rank }2]$.

[5]Distributional information on utility responses at each rank are shown in box plots in Section 4 of the Supplement.

Table 3: Average within-subject utility differences, with 95% confidence intervals in parentheses. Column 2 shows the average of each individual's U(Rank 2) − U(Rank second-to-last). Column 3 shows the average of the individuals' [U(Rank 1) − U(Rank second-to-last 2)] − [U(Rank second-to-last 5) − U(Rank last)], where U(Rank 1) and U(Rank last) were set to 1 and 0, respectively.

Study	(Utility Second) - (Utility Second-to-Last)	(Drop from First) - (Drop to Last)
1	0.35 (0.34, 0.36)	0.21 (0.20, 0.23)
2	0.35 (0.33, 0.37)	0.22 (0.19, 0.24)

to-last" (Study 1: 18.1%; Study 2: 22.7%). The number of respondents satisfying at least three of the four conditions was 71.4% and 77.0% for Studies 1 and 2, respectively. The complete breakdown of all 16 combinations is shown in Section 2 of the Supplement.

In addition to the proportion of individuals exhibiting the various utility patterns, Table 3 measures the magnitudes of some relevant differences. For example, the participants of Study 1 had a utility of second place that was on average 0.35 utils higher than the utility of second-to-last place (t-statistic of paired t-test = 56.7; $p < .001$; Cohen's D = 1.281), supporting the hypothesis that individuals fundamentally prefer higher to lower ranks (supporting H1). Furthermore, the loss in utility from first to second was on average 0.21 utils higher than the gain in utility from last to second-to-last place (t-statistic of paired t-test = 23.9; $p < .001$; Cohen's D = 0.539), supporting H4.

In addition to the utility elicitation exercises, we also asked participants a direct question to assess the comparative strength of their own FPS vs. LPA tendencies: "Which would feel better during a competition: rising from second place to first, or rising from last place to second-to-last place?" On a scale of 1 to 7, with 1 meaning rising from second to first place would feel much better, 7 meaning rising from last to second-to-last place would feel much better, and 4 meaning they would feel equally good, the average response in Study 1 was 2.11 (± 0.07 95% CI), and in Study 2 it was also 2.11 (± 0.10) (this question was not asked in Study 3). This provides further support for the hypothesis that individuals are even more FPS than they are LPA.

Our utility estimates were based on the assumption that individuals are Expected Utility maximizers. Indeed, it is this assumption that allows one to equate an individuals' probability equivalent with their utility for that lottery. As a robustness check, we also estimated utilities assuming individuals instead use Cumulative Prospect Theory (CPT) to value lotteries. Recall that CPT was motivated by evidence that individuals overweight small probabilities and under-

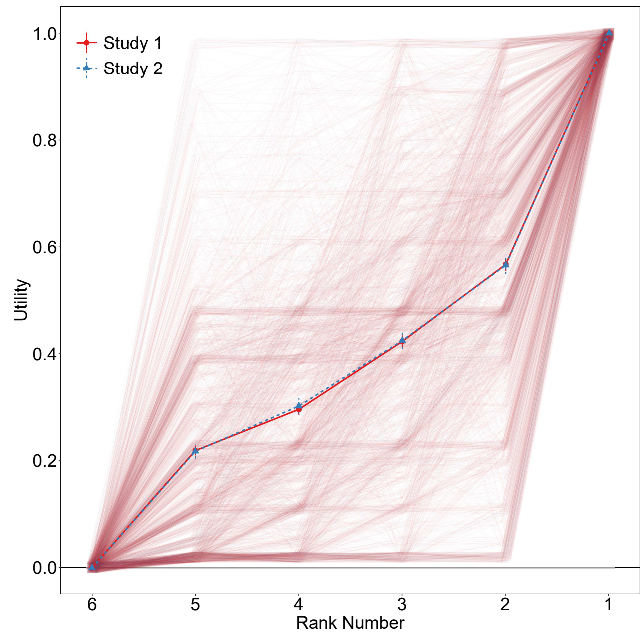

Figure 1: Utilities by rank, for Studies 1 and 2. The dark lines connected by dots show the average utilities across all participants for the two studies (the two curves nearly coincide with each other). The largest 95% confidence interval half-width for the averages was 0.02. The lines in lighter shading show the utility curves for every individual of each study.

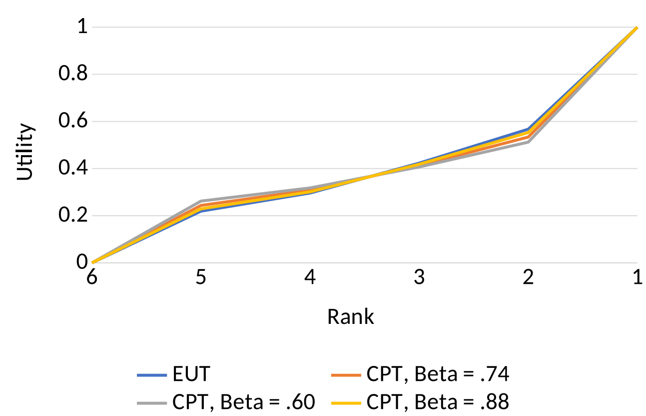

Figure 2: Average utility by rank, for Study 1, using both EUT and CPT valuation procedures.

weight large probabilities. In Study 1 (our largest sample size study), 7% of subjects indicated a probability equivalent for second place that was greater than 0.95 (where the effect of underweighting is most pronounced), and 27% of subjects indicated a probability equivalent for second-to-last place that was less than 0.05 (where the effect of overweighting is most pronounced). Therefore, we reanalyzed the results of Study 1 using the nonlinear weighting function $w(p) = e^{-(-\ln \ln p)^{\beta}}$, and we estimated the utility

https://doi.org/10.1017/S1930297500007385 Published online by Cambridge University Press

of a rank outcome N as U(rank N) = w(p_{PE}) (where p_{PE} is the individual's probability equivalent for the lottery; see Methods section). We used β values of 0.60, 0.74, and 0.88, which are based on the estimation work of Wu and Gonzalez (1996).

Figure 2 shows the utility curves for Study 1 under EUT (repeated from Figure 1) as well as the three variants of the CPT weighting function. Visually, we see that the general shape of the utility curve is robust to whether we use EUT or CPT to elicit utilities. Under the baseline value of β = .74, 86% of participants' utility curves were convex at second place, 82% were concave at second-to-last place, and 68% had a bigger decrease in utility from first place to second compared to their decrease from second-to-last to last place (under EUT, these percentages were 79%, 72%, and 68%, respectively). Therefore, our main hypotheses still hold under CPT.

5 Discussion

The results from three studies (two reported in main text and one reported in the supplement) were remarkably consistent in their overall findings and support of Hypotheses 1–4. That is, a large majority of individuals have utilities for competition-based rank outcomes in hypothetical scenarios that exhibit the following patterns: a greater preference for higher ranks, risk aversion at second-to-last place, more risk seeking at second place, and greater utility loss between first and second compared to second-to-last and last place. These findings held despite clear wording that the hypothetical contests involved anonymous participation and contained no prizes. In summary, individuals appear to be inherently both FPS and LPA, and exhibit an even stronger drive to attain first place than to avoid last place.

Our hypotheses were motivated by connections to Prospect Theory, with second place viewed as a loss if one views first place as a reference point, and second-to-last place viewed as a gain if last place is one's reference point. To elicit individuals' utilities for second place, we asked them to choose between a guaranteed finish of second place vs. some probabilities of finishing in first and last place. Given the close proximity of second place to the upper end of the rank spectrum (i.e., first place), it is plausible that individuals view the extreme point of first place as a reference point. Similarly, someone imagining they are in second-to-last place may view the other extreme point (last place) as their reference point. In a similar vein, the kind of counterfactual thinking that explains why silver medalists are less happy than bronze medalists (Medvec, Madey and Gilovich (1995)) may help explain why those in second place are risk seeking while those in second-to-last place are risk averse. That is, the dissatisfaction of just missing first place may induce the second place contestant to take more risk, while narrowly avoiding last place leads the second-to-last place contestant to be content with maintaining that position.

Two intriguing alternative explanations may explain risk-seeking preferences at second place and risk-aversion at second-to-last place. First: the biology and neuroscience literature discuss a phenomenon known as "the winner effect", in which winners of competitions become more aggressive in subsequent competitions, and conversely, losers become more submissive (Hsu & Wolf, 1999; Robertson, 2012; Zilioli & Watson, 2014). If individuals in our study view a middle rank as their reference point going into the competition, then they may instead view second place as a win (relative to their expectations) and second-to-last place as a loss. In this case, the winner effect could also explain risk-taking and risk-aversion near first and last place, respectively. We asked each study participant how they thought they would actually rank in a contest like the one described. The averaged rank out of the six possible ranks of Study 1 was 2.64 (± 0.05 95% CI), closer to the middle than either end of the rank spectrum. The implications of this perspective present an interesting contrast to the well-known shape of Prospect Theory utility curves (concave over gains to the right of a middle reference point, convex over losses to the left of middle). Referring to Figure 1, for example, and viewing the middle of ranks as the reference point, we observe a convex curve over gains (in rank) and a concave curve over losses. In other words, while the shape of Prospect Theory utility curves is well established when outcomes are dollars, the curvature may flip when the outcomes are ranks.

There is a second alternative explanation that could give rise to risk-seeking preferences at second place and risk-aversion at second-to-last place: mental models about competitions. Based on previous experience, participants may expect that achieving first place (versus second place) requires more skill and effort than avoiding last place (versus second-to-last place). If so, the utility curve we observed may reflect the perceived effort of achieving each position. Likewise, in real-life competitions, a risky strategy may often be required to achieve first (as one has to take a risk to stand out and beat the field), and a safe strategy may be prudent to avoid last place. In our scenarios, we gave explicit probabilities for each choice and outcome, and specified that the effort of each strategy was equivalent, but real-world mental models for risk and effort in competition may influence participants' preferences nonetheless. We leave this exploration of mental models about competition as a topic for future research.

We emphasize that our studies focused on eliciting von Neumann-Morgenstern utilities over ranks. In doing so, we asked participants to choose between certain rank outcomes vs. probabilistic outcomes (between first and last place), until we found their indifference probability. These scenarios were hypothetical. Indeed, every von Neumann-Morgenstern utility elicitation exercise or description we are aware of describes choices between hypothetical outcomes. As with all of these experiments, the question remains as to how individual utility curves map to real behavior. The decision of when to expend effort, and how much, in the course of an actual competition involves too many complexities (both physical and psychological) to be captured by a hypothetical scenario. Important factors may include time remaining in the contest, the distance ahead of/behind the next ranked individual, or the history of rank positions thus far in the competition. For example, runner A, who has led a 5 km race for the first 4.5 km before falling to second place with .5 km to go, may expend effort differently, compared to runner B, who has steadily moved up in rank throughout a different 5km race, until reaching second place with .5 km to go (controlling for the same distance behind the first place runner in both cases). Runner A may be deflated having lost the lead, whereas runner B may be inspired by her continued gains. On the other hand, runner A may push harder to regain the feeling of being first, whereas runner B may be content with her rise from a low rank to second place.

Finally, an interesting design question for real contests is whether to anonymize or reveal contestants' identities. If results and identities are publicized, it is possible that the shame of finishing in last place could hold more weight than the glory of finishing in first. Future lab and field experiments may help us better understand how competitors respond to rank information revealed publicly vs. privately during actual contests.

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