

# Allowing repeat winners

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## Abstract

Unbiased lotteries seem the least unfair and simplest procedures to allocate scarce indivisible resources to those with equal claims. But, when lotteries are repeated, it is not immediately obvious whether prior winners should be included or excluded. As in design questions surrounding single-shot lotteries, considerations of self-interest and distributive social preferences may interact. We investigate preferences for allowing participation of earlier winners in sequential lotteries. We found a strong preference for exclusion, both in settings where subjects were involved, and those where they were not. Subjects who answered questions about both settings did not differ in their tendency to prefer exclusion. Stated rationales significantly predicted choice but did not predict switching of choices between the two settings.

Keywords: fairness, social preferences, self-interest, lotteries, allocative procedures.

## 1 Introduction

When scarce, indivisible resources are to be distributed among equally deserving claimants, an unbiased lottery is commonly judged as the least unfair procedure (Stone, 2007).<sup>1</sup> But if lotteries are repeated, should earlier winners be included or excluded?

This decision may involve motives of self-interest and/or distributive social preferences.<sup>2</sup> On one side, self-interest might involve consideration of the variance of payoffs from including or excluding earlier winners, or the low probability event of winning twice. Since it is more likely that someone other than the subject will be the winner of the first lottery, it is also compatible with the subject's self-interest that the other be excluded. This should increase the subject's chances of winning once.

On the other side, distributive social preferences (Bolton & Ockenfels, 2005), might consider fairness with regard to those who hadn't won before, or with respect to those who had. On both sides, these motivations may interact (Karni & Safra, 2002; Dolan et al., 2003; Dolan et

al., 2004; Østerdal, 2005; Fehr et al., 2007). In particular, a "moral bias" due to self-interest might color social preferences (Croson & Konow, 2009).

In this note we report on subject preferences for allowing repeat winners in free sequential lotteries (i.e. raffles). Our study's focus on probabilistic allocations seeks to add to the large experimental literature on fairness in deterministic allocations (Karni et al., 2008). We follow and adapt an approach used by Konow (2008) and Croson and Konow (2009) and attempt to isolate self-interest from distributive social preferences. Questions are posed to subjects under a disinterested *spectator* framing, and under a partisan *stakeholder* framing.

We find that the majority of participants prefer exclusion of repeat winners. Subject preference were similar regardless of spectator-vs.-stakeholder framing. Stated rationales consistent with self-interest did not predict changes in preferences within-subject. In our subjects' judgment, repeated lotteries are as fair as simple lotteries, it appears, as long as prior winners are excluded.

## 2 Method

### 2.1 Designs

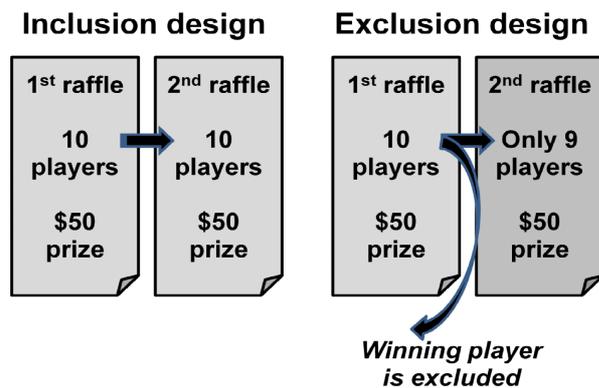
The preferences investigated here are over different designs of a back-to-back pair of raffles with 10 identical hypothetical participants (Figure 1). The only difference is that the winner of the first raffle does or does not participate in the second raffle. Under either design, each participant has a 1 in 10 chance of winning a \$50 prize in the first raffle. Allowing repeat participation of the win-

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<sup>1</sup>The operative word is "least". Keren and Teigen (2010) investigate preferences for the use of a randomizer in detail and find many conditions under which the actual use of a randomizer is strongly opposed even if the abstract idea of using a randomizer is not.

<sup>2</sup>In our set-up, reciprocal preferences (over player types) are not feasible as actions, intentions or identities of other players are all unknown in this game without strategic interactions (Bolton & Ockenfels, 2000).

Figure 1: Design choices.



ner [the *inclusion* design] results in an identical second raffle and a set of possible final payoffs { $\$0$ ,  $\$50$ ,  $\$100$ } with probabilities {0.81, 0.18, 0.01} respectively. The expected payoff in this design is  $\$10$ , with variance 450 square  $\$$ .

Without the participation of the winner of the first raffle [the *exclusion* design], each participant in the second raffle now has a 1 in 9 chance to win a  $\$50$  prize. Under this design, the set of possible final payoffs is { $\$0$ ,  $\$50$ } with probabilities of {0.80, 0.20} respectively. The expected payoff in this design is also  $\$10$ ,<sup>3</sup> but the variance is lower at 400 square  $\$$ .<sup>4</sup>

## 2.2 Data and sampling

We administered an on-line survey to a pool of subjects maintained by the Duke Interdisciplinary Initiative in Social Psychology (DIISP) at Duke University. Of 1,469 members of the DIISP pool, 261 agreed to participate in the survey (response rate of 17.8%), of which 6 did not (fully) complete the survey.<sup>5</sup> Surveys were completed anonymously. Subjects were asked to explain their preferences in a free text response field. Subjects' stated rationales were classified by the second author as *Expected*

<sup>3</sup>The intuition for the same mean payoffs across the two designs can best be seen from the principal's perspective. Under each design the principal disburses a total of  $\$100$  randomly to a group of 10 identical participants yielding each an expected payout of  $\$10$ .

<sup>4</sup>The intuition for the different variances across the two designs can most easily be seen by supposing there were only two participants. Then under the exclusion design, each agent must win one and one only time, so the variance is zero. Under the inclusion' design, either agent may win once, twice or no times, so the variance is strictly positive. Loosely, sampling with replacement is riskier than sampling without.

<sup>5</sup>The members of the DIISP pool are 40% male; 51% Caucasian, 25% Asian or Asian-American, 16% African-American and 4% Latino. 74% are undergraduate, 13% graduate student and 13% are not students. Highest educational attainment was 5% high school, 2% associate degree, 8% bachelor's, 6% advanced (master's or higher), and 78% in process of obtaining bachelor's degree.

*value* for use of any of the following: {expected value, expected return, average return, better off, expected payout, expected winnings, expected payoff, expectation} or if the subject multiplied probabilities with dollar amounts in his or her reasoning.

Rationales were classified as *Distribution* if they referenced any of: {better odds, better chance to win, higher maximum payoff, better shot, more chances, better distribution, less people, better opportunity} and they did not combine any of these words with explicit calculation of an expected value amount. Non-statistical reasoning with rationales invoking fairness was coded as *Include for fairness* or *Exclude for fairness* depending on preference. Rationales were marked as *Unclear* if blank or illegible.

## 2.3 Spectator or stakeholder framings

We asked each subject to express a preference over the designs as a hypothetically implicated *stakeholder*. The subject was instructed to assume that the raffles involved him or her and nine other players (Appendix). This was intended to highlight the individual utility domain, although clearly some consideration of social utility is likely to remain.<sup>6</sup>

Subjects also expressed preferences as a hypothetically impartial *spectator*. The subject was informed that the raffles involve ten other players not including the subject. This was assumed to isolate the dimension of social welfare and suppress considerations of individual utility to some degree. The order of the two different questionnaire framings, and within each framing the order of designs, was presented randomly across subjects using a random number generator embedded in the web-based survey tool. We combine results and report pooled results across orderings as there were no significant order effects in our pilot surveys.

## 3 Results

### 3.1 Overall preferences

In the stakeholder framing where the subject was presumed to be involved in the design, 78% of the respondents preferred exclusion (Table 1). A  $\chi^2$  test of the distribution of exclusion and inclusion responses versus expected equal distributions revealed a significant difference between the two distributions ( $p < .001$ ). Similarly, 75% preferred exclusion under the spectator framing with

<sup>6</sup>We thank an anonymous reviewer for pointing out that, if a subject prefers to exclude the winner in a design in which the subject is participating, then we cannot readily distinguish between fairness (or a desire not to seem greedy) and the desire to reduce variance.

Table 1: Number (%) preferring inclusion or exclusion of earlier winner.

	Inclusion	Exclusion	Missing	Total
Stakeholder	51 (19.5)	204 (78.2)	6 (2.3)	261
Spectator	63 (24.1)	195 (74.7)	3 (1.2)	261

Note:  $N = 261$  individuals, each asked twice under different framing, with order of presentation randomized.

Table 2: Within-subject number (%) preferring inclusion or exclusion of earlier winner.

		Spectator	
		Inclusion	Exclusion
Stakeholder	Inclusion	28 (11.0)	23 (9.0)
	Exclusion	35 (13.7)	169 (66.3)

Note:  $N = 255$  individuals excluding blank responses, each asked twice under different framing, with order of presentation randomized.

a similarly significant difference between the observed distributions and expected equal distributions ( $p < .001$ ).<sup>7</sup>

### 3.2 Within-subject comparison

Of the 255 subjects who completed the entire survey under both framings, 66% did not change their choice of exclusion while 11% did not change their choice of inclusion (Table 2). Of those who chose inclusion as a hypothetical stakeholder, 54.9% (28 of 51) also chose inclusion as a spectator. Conversely, of those who preferred exclusion as a hypothetical stakeholder, 82.8% (169 of 204) also chose exclusion as a spectator.

<sup>7</sup>A similar, smaller pilot survey was administered by the first author to 45 full-time MBA students at UCLA prior to the large-scale DIISP survey. However, participants in the pilot survey were given a choice of indifference rather than being forced to pick between the two raffle designs in each scenario. Results of this pilot survey were similar to those of the DIISP survey with 67% preferring exclusion ( $\chi^2 = 10$ ;  $p = .002$ ) under the individual perspective, 53% preferring exclusion under the social utility perspective ( $\chi^2 = 4$ ;  $p = .046$ ). In this pilot, across subjects, 3 of 45 chose “indifference” under the stakeholder perspective (7%), while 7 of 45 chose it under the spectator perspective (16%). Within subjects, we had 2 of 45 subjects stating “indifference” under both framings (4%), and 6 stating “indifference” under one of the framings (of which 4 chose “exclusion” under stakeholder framing (9%), 1 chose “inclusion” under stakeholder framing (2%) and 1 chose “inclusion” under the spectator framing (2%).

A McNemar test of symmetry did not find that the off-diagonal entries, representing subjects switching choices, differed significantly from each other ( $\chi^2 = 2.48$ , 1 d.o.f.;  $p = .12$ ). Arbitrarily assigning values of 1 to inclusion and 2 to exclusion and using a sign test similarly revealed no significant differences under the two framings ( $p > .14$ ).

### 3.3 Rationale-preference associations

We investigated whether the stated rationales (Table 3) predicted choice of inclusion under either framing. Probit regressions showed that stating a rationale of distribution reduced the probability of choosing inclusion by 18% (marginal effect,  $p = .016$ ) compared to not using this rationale. Stating a rationale of expected value increased the probability of choosing inclusion by 31% ( $p = 0.039$ ) compared to not using this rationale. However, stating a rationale of either distribution or expected value (i.e., claiming to use statistical reasoning) was not significantly associated with choosing inclusion (marginal effect reduction of 13% points,  $p > .12$ ).

We expected that subjects who prefer exclusion because they wished to reduce the variance of their own payoffs in the stakeholder frame might act differently in the two framings. Examination of whether the stated rationale predicted likelihood of switching choices under the two settings did not reveal significant associations. Probit regression marginal effects of stating a rationale of distribution reduced the probability of switching choices (from exclusion to inclusion, or vice versa, across the frames) by 12% ( $p = .073$ ) compared to not using this rationale. Stating a rationale of expected value increased the probability of this switch by 24% ( $p = 0.087$ ) compared to not using this rationale. Stating a rationale of either distribution or expected value (i.e. claiming to use statistical reasoning) was not significantly associated with switching choices (marginal effect reduction of 9% points,  $p > .24$ ).<sup>8</sup>

## 4 Discussion

While an apparently fair single lottery allows equal access to all participants (Stone, 2007), we find that a repeated lottery which excludes the prior winner is preferred to one that permits such participation. The study found strong preferences for such exclusion across two framings which attempted to isolate self-interest and distributive social preferences.

In particular, even subjects who invoked statistical reasoning consistent with a self-interest motivation were not significantly more likely to change their preferences. We

<sup>8</sup>Computing tetrachoric correlations instead of probit regression coefficients yielded similar levels of significance ( $p > .05$  in both cases).

Table 3: Preferences and rationale(s) for inclusion or exclusion of earlier winner.

	Inclusion	Exclusion	Missing	Total
<b>Stakeholder rationale(s)</b>				
Expected value	4	7	0	11
Distribution	30	157	0	187
Exclude for fairness	0	25	0	25
Include for fairness	8	0	0	8
Unclear	9	18	6	33
<b>Total</b>	<b>51</b>	<b>204</b>	<b>6</b>	<b>261</b>
<b>Spectator rationale(s)</b>				
Expected value	3	2	0	5
Distribution	26	112	0	138
Exclude for fairness	0	71	0	71
Include for fairness	5	0	0	5
Unclear	30	23	3	56
<b>Total</b>	<b>63</b>	<b>195</b>	<b>3</b>	<b>261</b>

Note:  $N = 261$  individuals, each asked twice under the different framings. Sub-totals of counts of rationales exceed sub-totals of counts of choices since subjects appealing to both statistical reasoning (expected value, distribution) as well as fairness reasoning are counted in both rows.

interpret this as suggesting that subject preferences appeared to be driven by social welfare maximization as opposed to self-interest. An alternative explanation hinges on a subject’s realization that someone other than the subject is more likely to be the winner of the first raffle. Given this, it is entirely compatible with a subject’s perceived self-interest to wish to exclude the prior winner and thus increase the subject’s own chance of winning once. In this view, preference for exclusion are not necessarily motivated by social welfare maximization as much as self-interest.

Another alternative explanation is that any “moral bias” occasioned by self-interest was not strong enough to change preferences, or that our experimental design did not succeed in isolating the competing motivations of self-interest and distributive social preferences. In our setting, as has been found more generally elsewhere (Dolan & Cookson, 2000; Konow, 2008; Cappelen et al., 2010), subjects were fairly stable in their preferences. Finally, there was also a significant minority of subjects who chose inclusion on the basis of statistical reasoning, especially distribution (e.g., 30 subjects under the stakeholder framing). These preferences may be con-

sistent with subjects overweighting the low probability event of winning consecutively, in line with the cumulative prospect theory deviation from classic expected utility theory (Tversky & Kahneman, 1992; Wakker, 2000).

Our study suggests several avenues for further research.<sup>9</sup> It could be investigated whether other moderating or non-moderating factors (in addition to self involvement) determine elicited preferences. For example, how does our finding of strong preferences for exclusion based on a 10 player raffle hold up in a larger or smaller setting. We speculate that the presence of more players would attenuate the findings here, given the mathematical convergence of the parameters of the designs with increasing  $n$ , and the lower probability of winning under any design.

A complementary analysis could examine larger or small hypothetical rewards to understand the moderating effects of a larger expected payoff. Of particular interest is to change the experiment from one involving raffles for rewards to drawing lots for an unpleasant task or a financial penalty. The key question would then be, mirroring the current question, should someone who has “lost” once face the risk of being “punished” twice or should they obtain an exemption from further participation?

Finally, we see our results on preferences for repeated probabilistic allocation mechanisms as also relevant to other on-going research on preferences surrounding use of a single randomizer. While we have focused on how self-interest and social preferences might interact in repeated lotteries, they are presumably also implicated in single shot decisions. For example, the range of preferences that Keren and Teigen (2010) find surrounding the details of actual use of a randomizer (versus the abstract concept of “drawing lots”) suggest similar interesting interactions.

#### 4.1 Limitations

We see the most serious limitation of our study as lying in the hypothetical nature of the rewards. A previous (unreported) pilot study used incentive-compatible rewards and found similar strong preferences, this was unlikely to have represented truly salient rewards.<sup>10</sup> Other limitations include the lack of context to the questions posed, and the use of predominantly students experimental subjects. As Weber and Camerer (2006) point out, lab research with students may not concur with the citizenry in general which is relevant to possible applications of our study.

<sup>9</sup>We thank an anonymous reviewer for these and other suggestions for further work.

<sup>10</sup>The design that was majority-preferred was run on the class as a whole and cash rewards were given to the winners of the two raffles.

Subjects choosing between two simple lotteries and any convex combination of the two may prefer to choose mixtures of lotteries rather than the endpoints of a linear lottery set (Sopher & Narramore, 2000). It is thus possible that the exclusion design was favored, since it “creates” two different lotteries which are, in a sense, mixed equally over time. It has also been argued that the generosity to others that is often seen in experiments may be illusory (Dana et al., 2007). Apparent concern for others’ welfare may really represent a preference for not appearing selfish, at least in the stakeholder frame. The stakeholder results here could thus represent a desire by subjects not to seem greedy (by choosing a design which allows participating and winning twice) rather than true concern for fairness, although it is difficult to see how this would apply to the spectator frame. Taste for risk may be moderated by income levels (Bosch-Dome’necha & Silvestre, 1999), so it cannot be ruled out that wealth effects produced these results. Similar heterogeneity in preferences for fairness has been related to gender, monetary incentives and motivational context (Kennelly & Fantino, 2007).

## 4.2 Study implications

Our experiment contributes to a line of theoretical and applied research attempting to isolate self-interest and social preferences motivations (Karni et al., 2008; Croson & Conow, 2009; Cappelen et al., 2010). Our study investigated a similar trade-off in probabilistic allocations where strategic interactions were ruled out. Applications of such studies may have most relevance in resource-constrained systems such as healthcare, where rationing of access is routinely by lot, conditional on similar clinical need.

Consider, for example, access to public-subsidized in-vitro fertilization therapy. Should couples be allowed to have repeated access to the chance of receiving a child, if they have already “won” once? Our results add to those of some others (Walker & Siegel, 2002) who suggest that there might be strongly felt preferences for similar allocation design choices.

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## Appendix

Subjects chose their preferred design under stakeholder and spectator framings with framings and designs presented in random order across subjects.<sup>11</sup>

### Stakeholder framing

Suppose you and 9 others will take part in a pair of raffles. You prefer which design?

Design A: In one raffle you have a 1/10 chance to win \$50, followed by another raffle in which you again have a 1/10 chance to win \$50.

Design B: In one raffle you have a 1/10 chance to win \$50. If you didn’t win, you have another raffle in which you now have a 1/9 chance to win \$50.

Briefly, any reason why?

### Spectator framing

Suppose 10 other people — not including you — will take part in a pair of raffles. You prefer which design?

Design A: In one raffle everyone has a 1/10 chance to win \$50, followed by another raffle in which everyone again has a 1/10 chance to win \$50.

Design B: In one raffle everyone has a 1/10 chance to win \$50. For the nine who didn’t win, they have another raffle in which everyone has a 1/9 chance to win \$50.

Briefly, any reason why?

<sup>11</sup>In the pilot study we attempted to understand the intensity of the preferences. To do this, we asked subjects “if you could pay a small amount of money to switch the design to your preferred one, how much would you pay at most?” and made a free form field available to record their answer. We expected to find relatively small amounts since the difference in certainty equivalents (CE) for decision makers using cumulative prospect theory (CPT) or expected utility theory (EUT) are small in our experiment. For CPT, the values are 9.41 and 8.15 under the inclusion and exclusion designs respectively (Kobberling, 2009). We used the natural reference point of zero from not participating at all. The CE are then \$12.77 and \$10.86 respectively, implying around \$2 willingness to pay to switch designs. Under EUT, assuming exponential utility and a risk tolerance of \$1,000, Pratt’s guideline for CE is expected value less half of the ratio of variance and risk tolerance. The inclusion design thus yields a CE of \$9.77 and the exclusion design \$9.80 suggesting indifference under EUT. However, subjects recorded very large values, close to the expected value of the payoffs under the preferred choice. We assumed that subjects had failed to understand the question, so our main survey did not include this question.