A Differentiating between competing formulations of fairness preferences

A strict preference for interior allocations in split-the-tickets tasks can arise when utility is nonlinear in probabilities. In Section 2.1, we discussed one possibility: preferences may be defined over the distribution of expected utility, $W(EU_A, EU_B)$. In Section 7, we mentioned an alternative formulation involving probability weighting: preferences may take the form $\pi(p_A) W(U_A^W, U_B^L) + \pi(1 - p_A) W(U_A^L, U_B^W)$. Symmetric versions of both formulations can account for the tendency to equalize overall ticket shares in ex ante divide-the-ticket tasks, as well as for choice reversals (the tendency for subjects to divide their own tickets equally in ex post divide-the-tickets tasks). Here we discuss other implications of these competing formulations and test between them.

A.1 Theoretical considerations

We examine a new class of allocation tasks, in which we specify an arbitrary allocation of a fixed dollar prize between the two parties, and the decision maker selects an alternate allocation. A coin flip determines whether we implement the fixed or chosen allocation. Each subject chooses their allocation ex ante, but can revise it ex post upon learning that the coin flip has selected it.

Even though the implications of the two preference formulations mentioned above are indistinguishable for divide-the-tickets tasks, they differ sharply for these "divide-the-prize" tasks. It is easy to verify that, with probability weighting, ex ante and ex post choices must be identical: in each case, the subject should choose her allocation to maximize $W(U_A, U_B)$. Hence there are no choice reversals, and the chosen allocation is completely independent of the fixed allocation. In symmetric settings, the subject divides the prize equally in both frames. In contrast, preferences over the distribution of expected utility ordinarily give rise to partial offset of the fixed allocation in the ex ante frame, and hence to choice reversals when moving from the ex ante frame to the ex post frame.

Let x and y denote the fractions of the prize given to household A in the subject's allocation and the fixed allocation, respectively. Assuming the decision maker's preferences are defined over the distribution of expected utility, we can write her utility as follows:

$$V(L) = W\left(\frac{1}{2}u(y) + \frac{1}{2}u(x)\right) + W\left(\frac{1}{2}u(1-y) + \frac{1}{2}u(1-x)\right)$$

The first-order condition is:

$$W'\left(\frac{1}{2}u(y) + \frac{1}{2}u(x)\right)u'(x) = W'\left(\frac{1}{2}u(1-y) + \frac{1}{2}u(1-x)\right)u'(1-x)$$

Assuming concavity of w and u, this expression characterizes the optimum, $x^*(y)$, subject to corner constraints.

First consider the case of $y = 0.5$. It is immediate from the first-order condition that $x^*(0.5) = 0.5$.

Now suppose $y > 0.5$. Evaluating the derivative of the objective function at $x = 1 - y$, we have

$$\left.\frac{dV}{dx}\right|_{x=1-y} = \frac{1}{2}W'\left(\frac{1}{2}u(y) + \frac{1}{2}u(1-y)\right)\left[u'(1-y) - u'(y)\right] > 0$$

Thus, $x^*(y) > 1 - y$. Evaluating the derivate of the objective function at $x = 0.5$, we have

$$\left.\frac{dV}{dx}\right|_{x=0.5} = \left[W'\left(\frac{1}{2}u(y) + \frac{1}{2}u(0.5)\right) - W'\left(\frac{1}{2}u(1-y) + \frac{1}{2}u(0.5)\right)\right]u'(0.5) < 0$$

Thus, $x^*(y) < 0.5$. Plainly, $x^*(y) \in (1-y, 0.5)$ implies partial offset.

To understand the role of the curvature of W in determining the degree of offset, consider the isoelastic specification, $W(z) = \frac{z^{1-\alpha}}{1-\alpha}$. To ensure that the decision maker's objective is well-defined, assume also that $u : \mathbb{R}_+ \to \mathbb{R}_+$. For any given value of α, we will write the optimum as $x^*(y, \alpha)$. Consider two values of α, $\alpha' < \alpha''$. For α', we can write the derivative of utility, evaluated at $x^*(y, \alpha')$, as

$$\left.\frac{dV}{dx}\right|_{x=x^*(y,\alpha'),\alpha=\alpha'} = \left[\left(\frac{\frac{1}{2}u(y) + \frac{1}{2}u(x^*(y,\alpha'))}{\frac{1}{2}u(1-y) + \frac{1}{2}u(1-x^*(y,\alpha'))}\right)^{1-\alpha'} - \left(\frac{u'(1-x^*(y,\alpha'))}{u'(x^*(y,\alpha'))}\right)\right]$$

$$\times\left(\frac{1}{2}u(1-y) + \frac{1}{2}u(1-x^*(y,\alpha'))\right)^{1-\alpha'} u'(x^*(y,\alpha')) = 0$$

For the first-order condition to hold, the first term must be zero. Now consider the same derivative evaluated at $x = x^*(y, \alpha')$, but for α'' rather than α':

$$\left.\frac{dV}{dx}\right|_{x=x^*(y,\alpha'),\alpha=\alpha''} = \left[\left(\frac{\frac{1}{2}u(y) + \frac{1}{2}u(x^*(y,\alpha'))}{\frac{1}{2}u(1-y) + \frac{1}{2}u(1-x^*(y,\alpha'))}\right)^{1-\alpha''} - \left(\frac{u'(1-x^*(y,\alpha'))}{u'(x^*(y,\alpha'))}\right)\right]$$

$$\times\left(\frac{1}{2}u(1-y) + \frac{1}{2}u(1-x^*(y,\alpha'))\right)^{1-\alpha''} u'(x^*(y,\alpha'))$$

Notice that the expression after the bracketed term is strictly positive. Thus the sign of this derivative depends entirely on the bracketed term. Because we have already established that the decision maker partially offsets the fixed allocation, we know that

$$\frac{\frac{1}{2}u(y) + \frac{1}{2}u(x^*(y,\alpha'))}{\frac{1}{2}u(1-y) + \frac{1}{2}u(1-x^*(y,\alpha'))} > 1$$

Furthermore, with $K > 1$, we have

$$\frac{d}{d\alpha}K^{1-\alpha} = -K^{1-\alpha}\ln K < 0$$

Therefore,

$$\left(\frac{\frac{1}{2}u(y)+\frac{1}{2}u(x^*(y,\alpha'))}{\frac{1}{2}u(1-y)+\frac{1}{2}u(1-x^*(y,\alpha'))}\right)^{1-\alpha''} < \left(\frac{\frac{1}{2}u(y)+\frac{1}{2}u(x^*(y,\alpha'))}{\frac{1}{2}u(1-y)+\frac{1}{2}u(1-x^*(y,\alpha'))}\right)^{1-\alpha'},$$

which means that $\frac{dV}{dx}\big|_{x=x^*(y,\alpha'),\alpha=\alpha''} < 0$. From the concavity of the objective function, we then know that $x^*(y,\alpha'') < x^*(y,\alpha')$. It follows that the optimum involves a greater degree of offset with α'' than with α'.

In the case of lexicographic preferences, the decision maker's utility becomes

$$V(L) = \min\left\{\frac{1}{2}u(y)+\frac{1}{2}u(x), \frac{1}{2}u(1-y)+\frac{1}{2}u(1-x)\right\}$$

Trivially, $x^*(y) = 1-y$ is then the best choice because it equates the two arguments; hence we obtain full offset. For the isoelastic specification $w(z) = \frac{z^{1-\alpha}}{1-\alpha}$, we obtain the lexicographic case in the limit as $\alpha \to \infty$.

A.2 Experimental implementation

In our experimental split-the-prize tasks, the final division of a \$10 prize between households A and B is governed by one of two allocations. The first of these is fixed in advance and varies from task to task; we call this the "computer's" dollar allocation. The subject chooses the alternative allocation. We select one of these two allocations at random and implement it; each is equally likely.

We examine both ex ante and ex post versions of the split-the-prize task. The subject learns the computer's allocation at the outset of both versions. In the ex ante version, she chooses her allocation immediately thereafter. In the ex post version, she makes that choice only if she first learns that we will implement her allocation. Details are otherwise the same as for the split-the-tickets task. We implemented a $4\text{A\_}4\text{A}^R$ treatment involving split-the-prize allocation tasks with 61 subjects.

A.3 Results

Figure A.1 shows the distribution of choices for rounds 1-4 (panel A), as well as the marginal distributions of the original and final choices (panels B and C, respectively) for rounds 5-8. For the moment, we will focus on the ex ante choices (panels A and B), and return to the revisions (panel C) below. Notice that, when subjects choose ex ante, the most common type of allocation is ex ante fair. The tendency to make ex ante fair choices with ex ante framing is not quite as pronounced as with divide-the-tickets tasks, but it is still readily evident. Significantly, the somewhat lower frequency of ex ante fair choices with ex ante framing in divide-the-prize tasks (compared with divide-the-tickets tasks) goes hand-in-hand with a somewhat higher frequency of ex post equalizing allocations. This

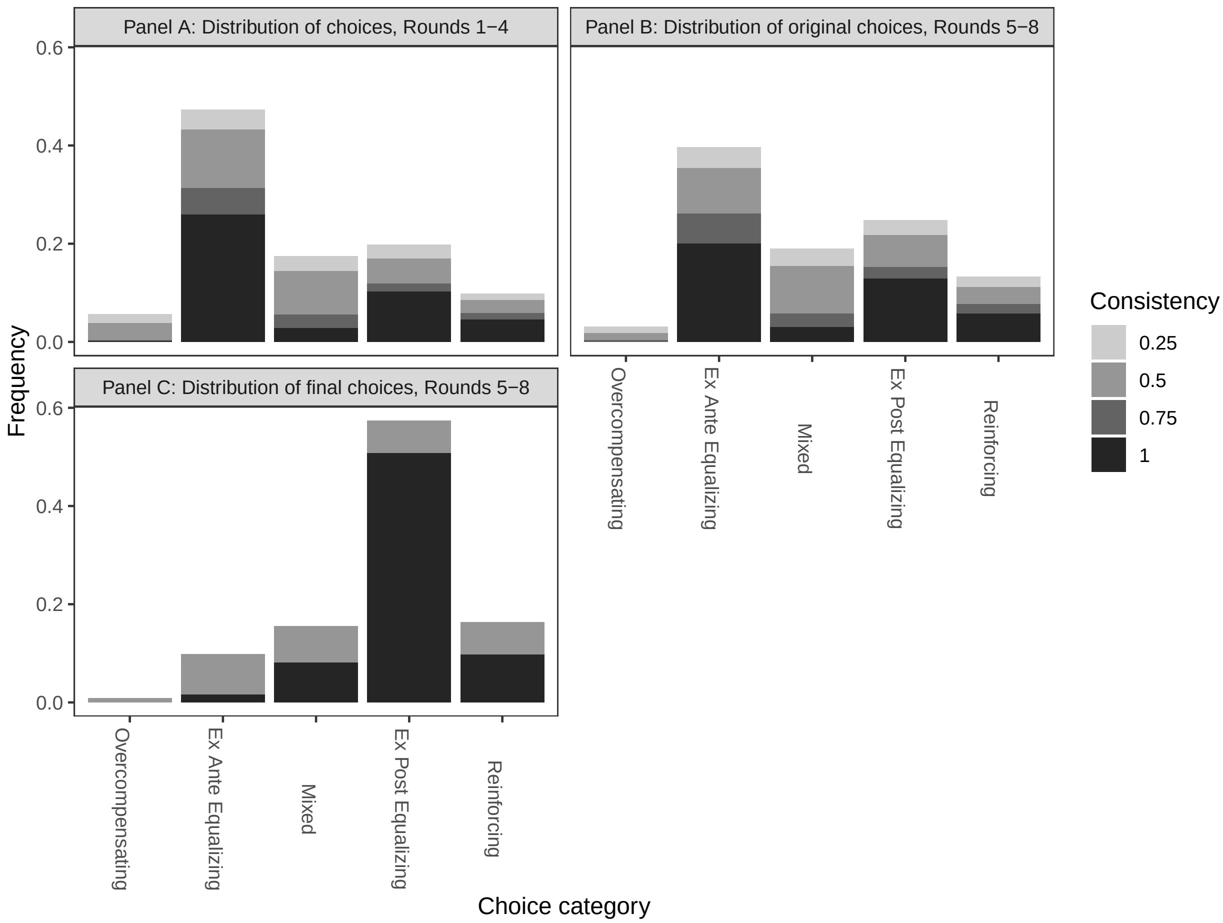


Figure A.1: Distributions of choices in divide-the-prize tasks

This figure is based on treatment 4A_4A^R with divide-the-prize tasks (61 participants).

pattern is expected in light of the theoretical considerations discussed in Section A.1: subjects with probability-weighted preferences will prefer ex post equalizing allocations regardless of whether they make their decisions ex ante or ex post.

Significantly, revisions were common in rounds 5-8 of this treatment. Overall, 42.6% of choices were revised, and 55.7% of subjects revised at least one choice. Furthermore, the vast majority of revisions (73.1%) involved migration to ex post equalizing allocations, just as with divide-the-tickets tasks.

Figure A.2 displays the joint distribution of the original and final choices for rounds 5-8. Although migration from ex ante fair to ex post fair choices is not quite as common as for divide-the-tickets tasks, it remains the most common pattern (26.2% of tasks). Significantly, in this case it is tied with a time-consistent pattern: selecting and sticking with the ex post equalizing allocation.

The prevalence of time-consistent ex post fair choices is expected in light of our observations concerning the implications of preferences with probability weighting. The next three most common patterns are also time-consistent. In 13.9% of tasks, subjects made and resolutely stuck to mixed allocations. This pattern was relatively rare in divide-the-tickets tasks; apparently, the divide-the-prize setting is more conducive to reconciling the conflict between ex ante and ex post fairness by adopting and resolutely sticking to a compromise standard. In 13.1% of tasks, subjects made and stuck to choices that reinforced the computer's allocation, and in 9.0% of tasks, they selected and stuck to the ex ante equalizing allocation. The latter two frequencies are comparable to those observed in the context of divide-the-tickets tasks.

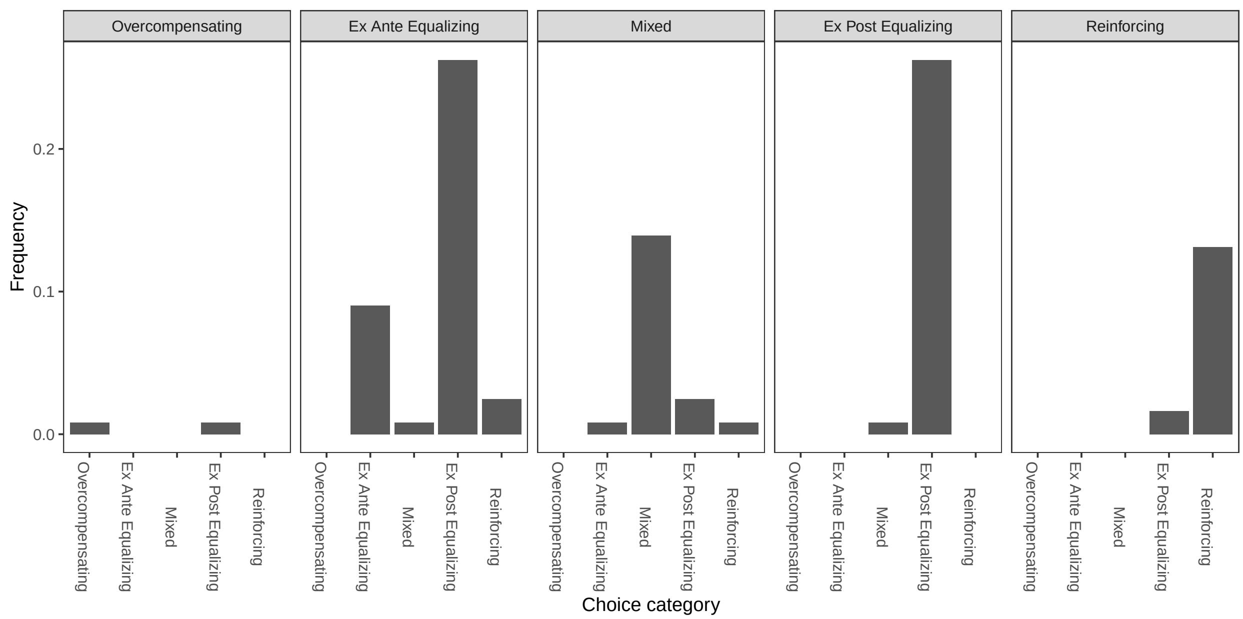


Figure A.2: Joint distribution of original and final (revised) choices during the final four rounds of treatment $4A\_4A^R$

Notes: This figure is based on the final four rounds of treatment $4A\_4A^R$ with divide-the-prize tasks (244 observations).

All of the results reported in this section are therefore qualitatively similar to their counterparts for split-the-tickets tasks. The patterns of interest are somewhat less striking, but this difference is expected given that, according to theory, choice reversals should emerge for a smaller class of preferences with split-the-prize tasks than with split-the-tickets tasks.

B Additional data analyses

B.1 Further analyses of basic framing effects

Stability of choices across rounds In general we found no evidence of systematic changes in behavior across rounds in which subjects encountered similar tasks. Figure B.1 shows the distributions over choice categories for the first four rounds of treatments 4A_4A^R and 4P_4A^R.

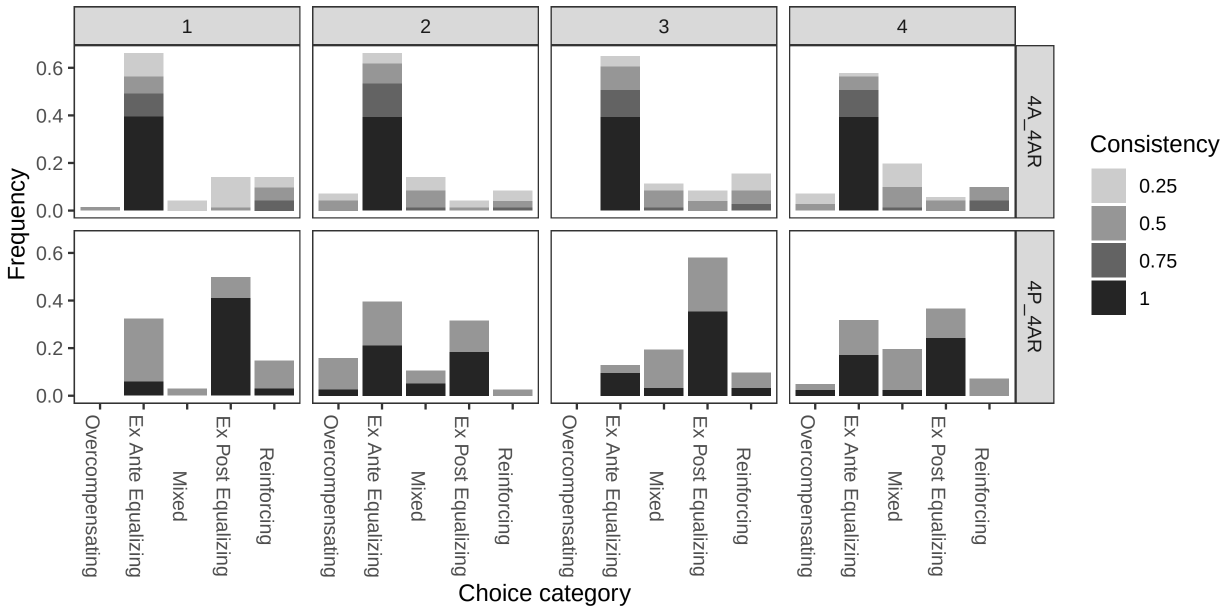


Figure B.1: Choice category frequencies in each of the first four rounds of treatments 4A_4A^R and 4P_4A^R.

Notes: This figure is based on treatment 4A_4A^R (71 participants) and 4P_4A^R (72 participants).

Formal tests involving figure 2 Formal statistical tests confirm the lessons that emerge from a visual inspection of Figure 2. First, the samples are comparable: we do not reject equality of the round 1-2 distributions of treatments 2A2P_4A^R and 4A_4A^R ($p = 0.21$); likewise, we do not reject equality of the round 1-2 distributions of treatments 2P2A_4A^R and 4P_4A^R ($p = 0.64$). Second, subjects do not simply adopt an initial perspective and adhere to it in all subsequent rounds, even when the decision frame changes: we reject the equality of the round 1-2 and round 3-4 distributions of treatment 2A2P_4A^R ($p < 0.001$), and similarly for treatment 2P2A_4A^R ($p < 0.001$). Third, initial exposure to the ex ante perspective does not systematically affect the subsequent proclivity to adopt the ex post perspective when the task involves ex post framing: we do not reject equality of the round 3-4 distributions for 2A2P_4A^R and 4P_4A^R ($p = 0.38$). Fourth, initial exposure to the ex post perspective does not systematically affect the subsequent proclivity to adopt the ex ante perspective when the task involves ex ante framing: we do not reject equality of the round 3-4 distributions for 2P2A_4A^R and 4A_4A^R ($p = 0.93$), nor do we reject equality of the round

5-8 distributions ($p = 0.42$). Finally, moving back and forth between multiple perspectives does not systematically affect the subsequent proclivity to adopt the ex ante perspective when the task involves ex ante framing: we do not reject equality of the round 5-8 distributions for 2A2P_4A^R and 4A_4A^R ($p = 0.80$). Each of these failures to reject a hypothesis results from the similarity of the distributions rather than the absence of statistical power.

The effect of extended exposure to ex post framing on ex ante choices Having shown that exposure to one frame does not influence choices in the alternative frame, we next ask whether the same is true of extended exposure. To this end, we examine choices made in the 4P_4A^R treatment. Figure B.2 displays the unrevised choice distributions for rounds 5-8, during which subjects perform tasks with ex ante framing after experiencing four rounds with ex post framing. (Recall that Figure 1, panel B, exhibits the round 1-4 choice distribution for this treatment.) As in Figure 1, panel A, choices are predominantly ex ante fair. We reject equality of the round 1-4 and round 5-8 distributions ($p < 0.001$), which tells us that subjects do not simply adhere to their initial perspective once the decision frame changes, even after four rounds of reinforcement. We also fail to reject equality of the round 5-8 distributions for the 4P_4A^R and 4A_4A^R treatments ($p = 0.33$). The frequency of ex post fair choices is actually lower (5.9% vs. 8.1%), and that of ex ante fair choices higher (77.4% versus 63.7%), in figure B.2 than in panel A of figure 1. This pattern is precisely opposite what one would expect if initial perspectives on fairness were persistent. Thus, we find no support for the persistence hypothesis.

B.2 Further analyses of revisions

The distribution of revision types Focusing just on decisions that were revised, we can usefully classify them according to whether the subject switched to a 50-50 division of his or her own tickets (ex post fairness), moved part of the way toward 50-50, moved past 50-50, or moved away from 50-50. The first panel of Figure B.3 shows the distribution of revisions across these categories in the last four rounds of treatment 4A_4A^R.

The next three panels of B.3 are analogous to the first except they pertain to treatments 2A2P_4A^R, 2P2A_4A^R, and 4P_4A^R. All are qualitatively similar, in that revisions predominantly lead to ex post equalizing allocations. For the first and third of these treatments, we cannot reject the hypotheses that each of these distributions is the same as for 4A_4A^R ($p = 0.47$ and 0.43, respectively). In each case the failure to reject reflects the similarity of the distributions rather than low statistical power. For the treatment 2A2P_4A^R, we do reject the hypothesis that the distributions are the same ($p < 0.001$).

The final panel of Figure B.3 focuses on the decisions that were revised in the last four rounds of the split-the-prize sessions, and groups them into the same four categories used for this purpose

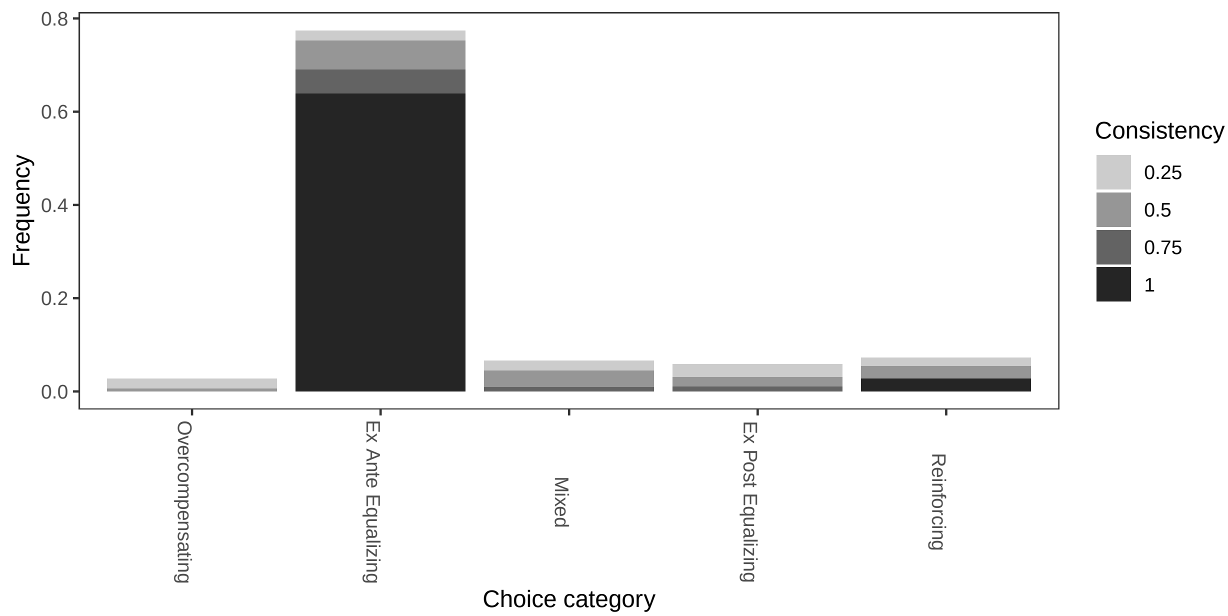


Figure B.2: Distributions of choices for tasks with ex ante framing after extended exposure to ex post framing

Notes: This figure is based on rounds 5-8 of treatment 4P_4A^R (72 subjects).

with respect to split-the-tickets tasks. Notice that the vast majority of those who revised (73.1%) migrated to ex post equalizing allocations, just as with divide-the-tickets tasks.

Marginal distributions of final (revised) choices for various treatments Figure B.4 exhibits the marginal distributions of final (revised) choices during the last four rounds of treatments 2A2P_4A^R, 2P2A_4A^R, or 4P_4A^R. The panels of this figure are analogous to the second panel of Figure 3, which pertains to treatment 4A_4A^R. We see that final allocations are predominantly ex post fair in all three treatments. Moreover, we cannot reject the hypotheses that the distributions for any of these treatments, 2A2P_4A^R, 2P2A_4A^R, or 4P_4A^R, are the same as for 4A_4A^R ($p = 0.50$, 0.15, and 0.46, respectively). The failure to reject reflects the similarity of the distributions rather than a lack of statistical power. Recall from Figures 2 and B.2 that the original (unrevised) choices for these same rounds were predominantly ex ante fair. Thus we see striking choice reversals from the ex ante to the ex post perspective in all of these settings, just as in treatment 4A_4A^R.

B.3 Further analyses of choices between commitment and flexibility

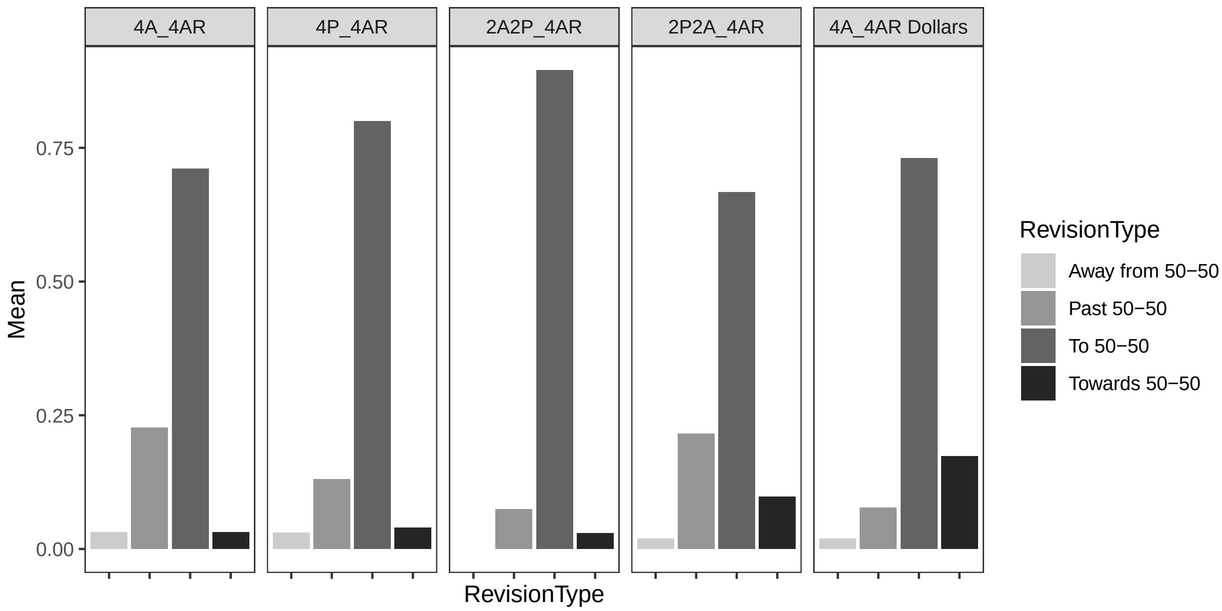


Figure B.3: Distribution of revision types during the final four rounds of various treatments

Notes: This figure is based on the final four rounds of the indicated treatments, in which there were (respectively) 97, 67, 51, 100, and 52 revisions.

Commitment choices by round As seen in Figure B.5, the frequencies with which subjects express preferences for commitment or flexibility in rounds 5-8 of treatment $4A^R\_4A^C$ do not vary systematically across rounds.

Commitment choices by category of initial allocation Figure B.6 divides the allocation tasks performed in rounds 5-8 of treatment $4A^R\_4A^C$ into five categories based on the type of the subject's original selection, and plots the distribution of commitment choices for each. As noted in the text, the propensity to commit is lower relative to the propensity to retain flexibility when subjects select initial allocations that are more vulnerable to revision.

Is naive time inconsistency a plausible explanation for decisions involving commitment and flexibility? The same patterns discussed above imply that those who committed themselves to ex ante equalizing allocations in the last four rounds likely observed few if any choice reversals in the first four rounds, while those who retained flexibility likely observed many such reversals. Altogether, during the last four rounds, we observed the "initial ex ante fair & commitment" pattern in 73 tasks involving 32 subjects, and the "initial ex ante fair & no commitment & revised ex post fair" pattern in 25 tasks involving 17 subjects. (Because subjects have the opportunity to

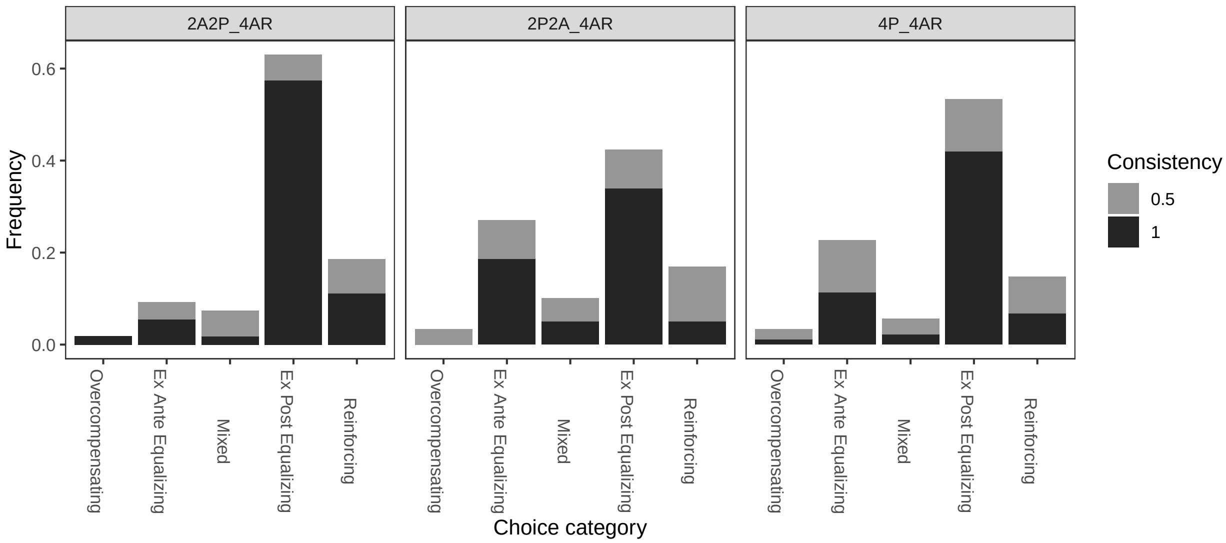


Figure B.4: Marginal distributions of final (revised) choices during the final four rounds of various treatments

Notes: This figure is based on the final four rounds of the indicated treatments, in which there were 48, 48, and 72 subjects, respectively.

revise only half the time when electing flexibility, the task counts – 73 and 25 – are not directly comparable.) Focusing on the first group of tasks (in which the subject opted for commitment), in 15.1% of those cases the same subject always migrated from ex ante fair to ex post equalizing allocations when given the opportunity during the first four rounds, and in 41.1% of those cases did so at least once. Focusing on the second group of tasks (in which the subject opted for flexibility and then switched), the corresponding figures are considerably higher: in 60% of those cases the same subject always migrated from ex ante fair to ex post equalizing allocations when given the opportunity during the first four rounds, and in 92% of cases did so at least once. Accordingly, those preserving the flexibility to migrate from ex ante fair to ex post fair allocations likely understood and anticipated their inclination to do so, and those choosing commitment likely understood their disinclination to make revisions.

The role of experimenter demand effects To illustrate the potential role of experimenter demand effects, imagine that, when faced with two consequential alternatives and an option to express indifference, subjects feel they are expected to choose one of the former. Suppose this causes them to make commitments in a significant fraction of allocation tasks – say 40% of them, selected at random. As ex ante choices are predominantly ex ante fair, and revisions predominantly lead to ex post fairness, the most visible impact of the hypothesized demand effect would be an

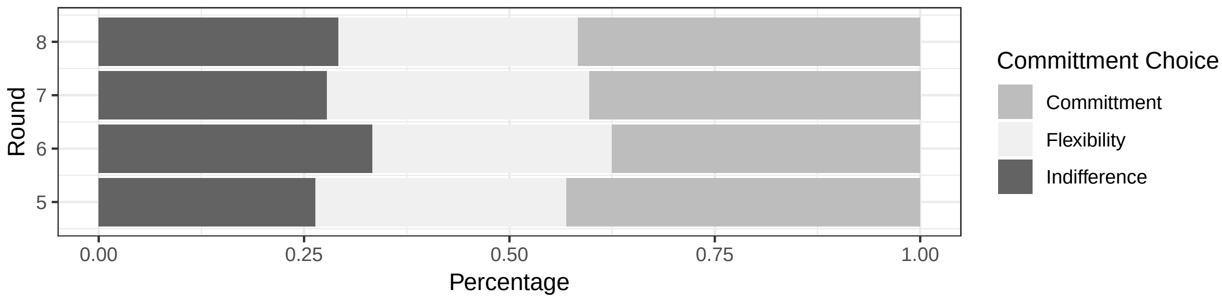


Figure B.5: Commitment choices by round

Note: This figure is based on the final four rounds of treatment $4A^R\_4A^C$ (72 subjects).

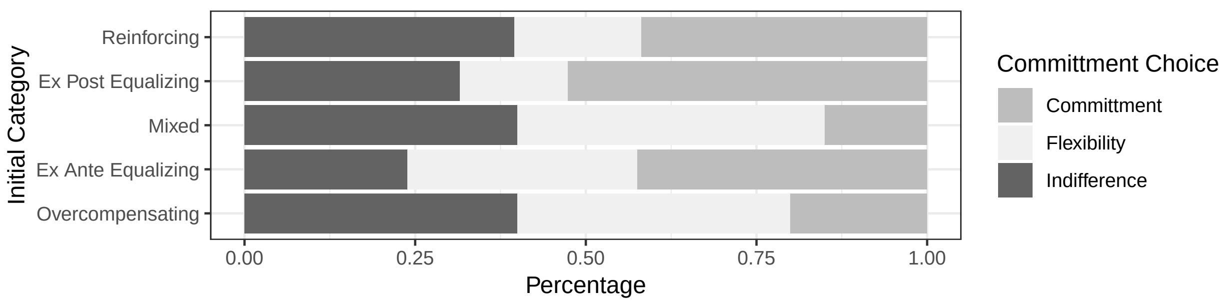


Figure B.6: Commitment choices by category of original choice

Note: This figure is based on the final four rounds of treatment $4A^R\_4A^C$ (72 subjects). The distributions are based on 172 ex ante fair choices, 20 partially offsetting choices, 15 overcompensating choices, 38 ex post fair choices, and 43 reinforcing choices.

increase in the fraction of ex ante equalizing allocations, and a decrease in the fraction of ex post equalizing allocations, among final outcomes. That is of course precisely what we documented in the text. A similar experimenter demand effect could likewise explain why other subjects retain flexibility, but this effect would not account for subsequent switching unless one posits a second demand effect (specifically, that offering people the opportunity to revise induces them to do so). We designed the revision protocol to minimize that possibility, but it still merits consideration. Moreover, even if experimenter demand effects establish baseline frequencies with which subjects opt for commitment and flexibility, our theories of fairness remain testable because they imply different patterns of deviations from the baseline.

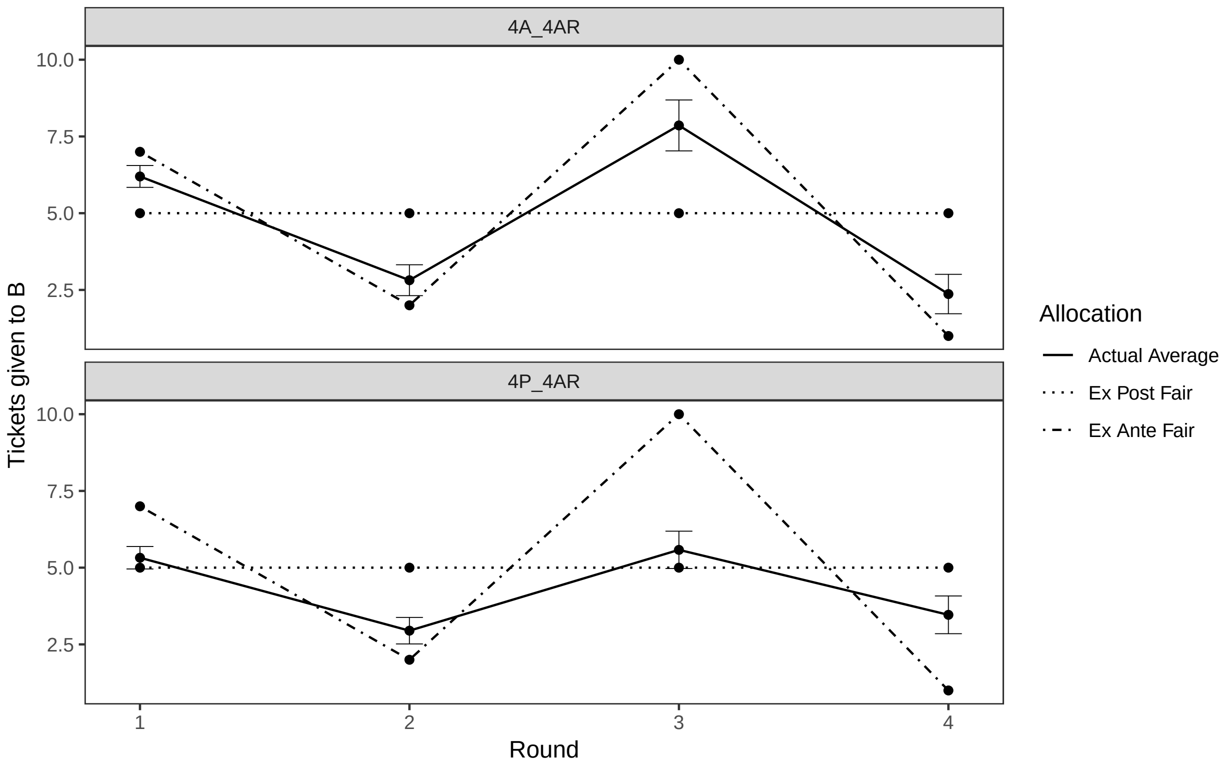


Figure B.7: Allocations for those performing initial tasks in a single frame

Notes: Panel A is based on the first four rounds of treatment 4A_4A^R (71 observations per round). Panel B is based on the first four rounds of treatment 4P_4A^R (36 observations per round).

B.4 Fingerprint Analyses

B.4.1 Fingerprints for initial choices in divide-the-tickets tasks

An important feature of our experimental design is that the allocation of the computer's tickets varies from one round to the next. Accordingly, the choices of an ex ante fair subject should vary in a recognizable and distinctive manner across rounds, while the choices of an ex post fair subject should remain fixed. We exhibit these patterns in the two panels of Figure B.7, which plot the number of the subject's tickets given to recipient B, by round. The dashed and dotted lines correspond, respectively, to the "fingerprints" of an ex ante fair subject, and of an ex post fair subject. Panel A superimposes a black line representing the average choices made with ex ante framing in the first four rounds of treatment 4A_4A^R; panel B does the same for choices made with ex post framing in the first four rounds of treatment 4P_4A^R.

Notice that the actual choices resemble the ex ante fingerprint much more closely when the initial tasks involve ex ante rather than ex post framing. In the latter case, the black line is much flatter. To quantify this difference, we estimated simple regressions of the chosen split on a constant and the computer's split, separately for the two treatments, clustering observations at the subject level. For an ex ante fair subject, the coefficient of the computer's split would be -1; for an ex post fair subject, it would be 0. In fact, we find that it is -0.63 (s.e. $= 0.06$) for choices made with ex ante framing, and -0.29 (s.e. $= 0.06$) for choices made with ex post framing. We decisively reject the hypothesis that these coefficients are the same ($p < 0.001$).

The absence of a persistent perspective on fairness that survives changes in the decision frame is also evident from comparisons between the pattern of average allocations across rounds and the "fingerprints" associated with ex ante and ex post fairness. The various panels of Figure B.8 display these fingerprints, along with average allocations in each of the last four rounds of the following treatments: 4A_4A^R (panel A), 4P_4A^R (panel B), 2A2P_4A^R (panel C), and 2P2A_4A^R (panel D). In every instance, actual choices resemble the ex ante fair fingerprint much more closely than the ex post fair fingerprint. As in section 4, we quantify this similarity by estimating simple regressions of the chosen split on a constant and the computer's split, clustering observations at the subject level. The coefficient of the computer's split is -0.61 (s.e. $= 0.08$) for treatment 4A_4A^R, -0.79 (s.e. $= 0.06$) for treatment 4P_4A^R, -0.69 (s.e. $= 0.08$) for treatment 2A2P_4A^R, and -0.60 (s.e. $= 0.09$) for treatment 2P2A_4A^R. We do not reject equality of these coefficients ($p = 0.14$), and there is certainly no indication that previous exposure to the ex post perspective pushes the coefficient away from -1 (the ex ante fair benchmark) and toward 0 (the ex post fair benchmark).

B.4.2 Fingerprints for revisions in divide-the-tickets tasks

The dramatic effect of revisions is evident from comparisons between the pattern of average allocations across rounds (both before and after revisions) and the "fingerprints" associated with ex

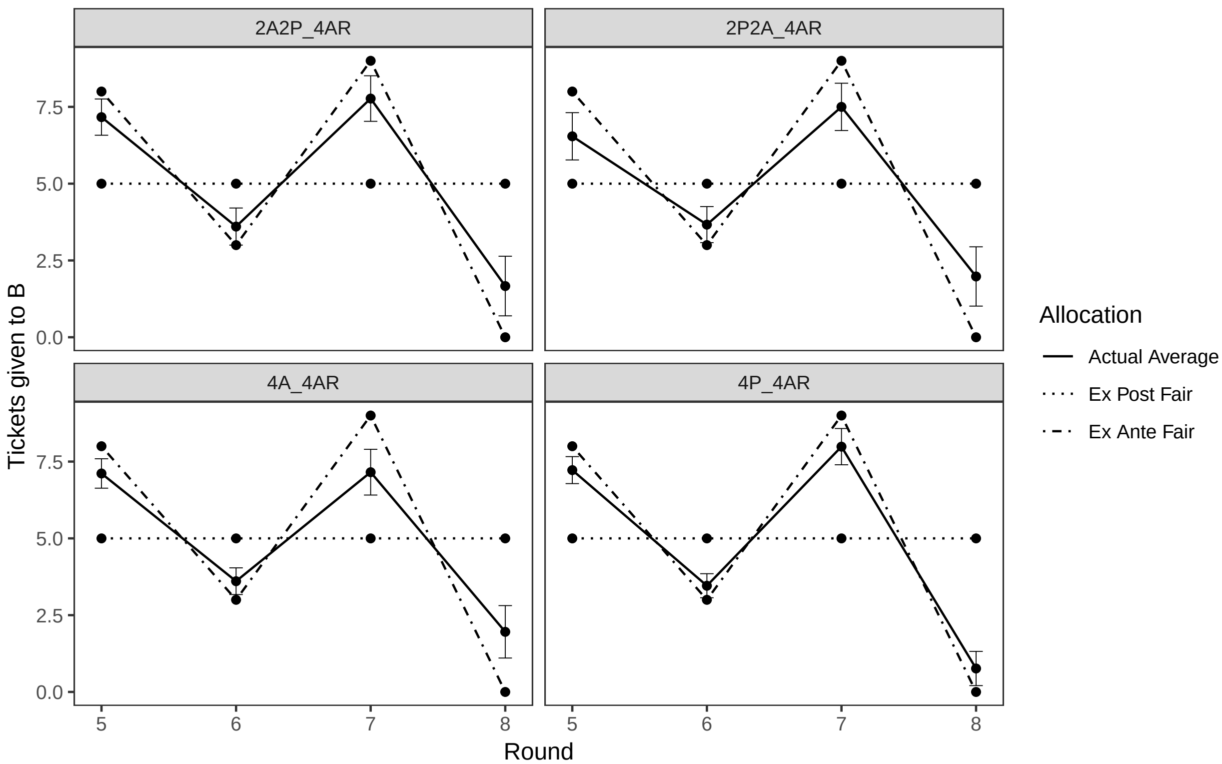


Figure B.8: Allocations for those performing tasks in the ex ante frame after varying degrees of exposure to the ex post frame

Notes: Panel A is based on 71 subjects, panel B on 72 subjects, panel C on 48 subjects, and panel D on 48 subjects.

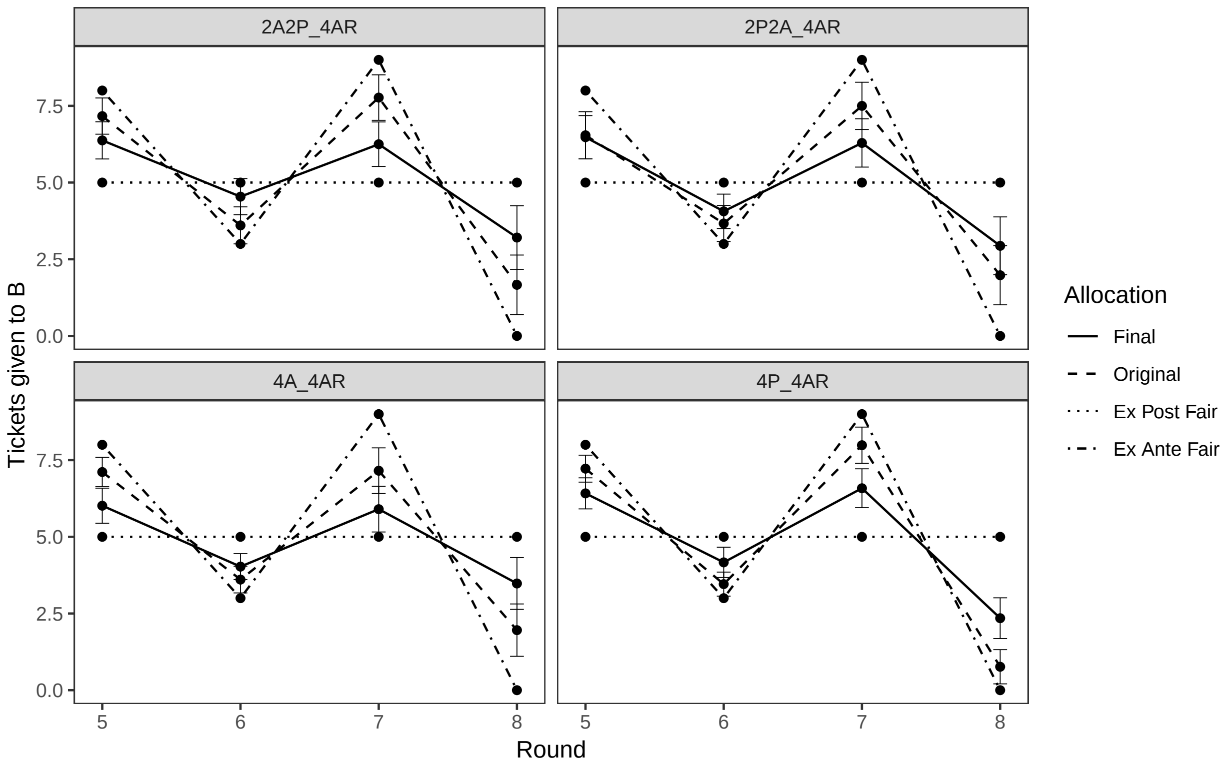


Figure B.9: Original and final allocations in rounds 5-8 of the indicated treatments.

Notes: This figure is based on the final four rounds of treatment 4A_4A^R (71 subjects), 4P_4A^R (72 subjects), 2A2P_4A^R (48 subjects), and 2P2A_4A^R (48 subjects).

ante and ex post fairness. Figure B.9 replicates B.8, except that we have added a line for the revised choices. We focus first on the bottom left panel, referring to treatment 4A_4A^R. The average revised choices closely resemble the benchmark for ex post fairness in rounds 5-7, and are nearly insensitive to the computer's initial distribution. In round 8, the final choice moves a bit in the direction of the ex ante equalizing allocation, but to a much smaller extent than the original (unrevised) choice. As above, we quantify the similarity to the benchmarks by estimating simple regressions of the chosen split on a constant and the computer's split, clustering observations at the subject level. The coefficient of the computer's split, -0.08 (s.e. $= 0.07$), is not significantly different from zero, again a reflection of the fact that the ex post perspective predominantly governs revisions.

The remaining panels compare the fingerprint patterns of average allocations across rounds 5-8 (both before and after revisions) for treatments 2A2P_4A^R, 2P2A_4A^R, and 4P_4A^R. We see qualitatively similar patterns: the initial choices track the ex ante fair fingerprint fairly closely, while the lines for the final (revised) allocations are flatter, more closely resembling the ex post fingerprint.

As before, we quantify the similarity to the benchmarks by estimating simple regressions of the chosen split on a constant and the computer's split, clustering observations at the subject level. Focusing on final choices, the coefficient of the computer's split is 0.02 (s.e. = 0.07) for treatment 2A2P_4A^R, −0.27 (s.e. = 0.08) for treatment 2P2A_4A^R, and −0.17 (s.e. = 0.06) for treatment 4P_4A^R. All of these coefficients are much further from the ex ante benchmark (-1) and closer to the ex post benchmark (0) than the corresponding coefficients for the original choices.

B.4.3 Fingerprints for split-the-prize tasks

Figure B.10 pertains to the split-the-prize treatment. It compares the patterns of the average allocations for rounds 1-4, as well as the original and final allocations for rounds 5-8, with the "fingerprints" associated with ex ante and ex post fairness; it is analogous to figures B.7 and B.9. The average ex ante choices resemble the ex ante fair benchmark, except that responses to the computer's allocation are dampened. Revisions in rounds 5-8 flatten the line further, moving it toward the ex post fair benchmark. As before, we quantify the similarity to the benchmarks by estimating simple regressions of the chosen split on a constant and the computer's split, clustering observations at the subject level. The coeffi:cient of the computer's split is −0.54 (s.e. = 0.06) for ex ante decisions in the first four rounds, −0.37 (s.e. = 0.07) for ex ante decisions in the last four rounds, and −0.06 (s.e. = 0.05) for revised decisions in the last four rounds.

B.5 Consistent choosers

A closer look at the data reveals that some subjects make the same type of choice in every round, while others move around between categories. As noted in the main text, consistency across rounds could be an indication of the seriousness and deliberateness with which subjects approached the tasks and acted on coherent decision principles. Accordingly, it is important to determine whether the documented patterns are attributable to subjects who choose consistently, or to those whose categorical choices vary across rounds. It is particularly important to ask this question with respect to our findings concerning revisions, because consistent choosers may be devoted to particular perspectives, and consequently less likely to change their minds as a result of changes in framing.

Basic framing effects In the first four rounds of 4A_4A^R, 39.4% of the subjects (28 of 71) made the same type of choice in every round. In every case, the choices were ex ante fair. The degree of stability increased in rounds 5 through 8, perhaps because subjects arrived at coherent principles with experience. Specifically, 60.6% of the subjects (43 of 71) made the same type of choice in each of the last four rounds, and in 93.0% of those cases (40 of 43), the choices were ex ante fair. Turning next to the first four rounds of 4P_4A^R, it is important to bear in mind that each subject made two decisions rather than four. Overall, 48.6% of subjects (35 of 72) made the

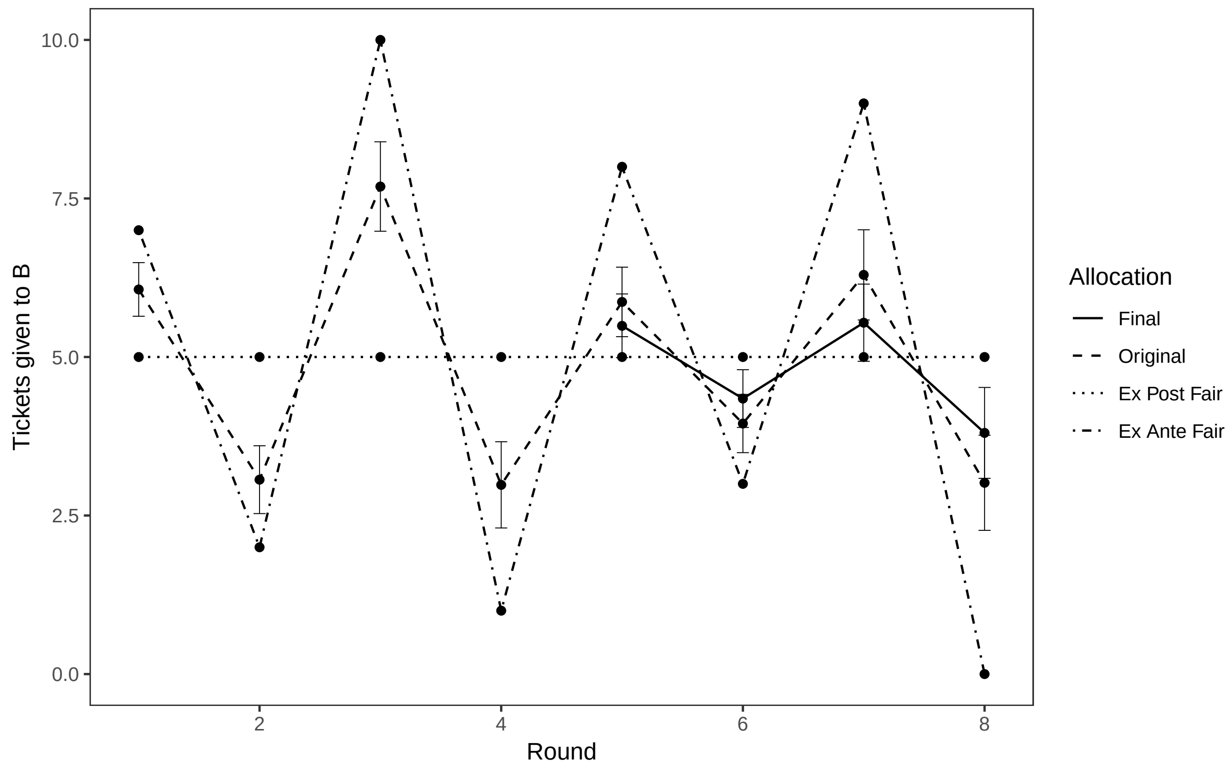


Figure B.10: Original and final allocations for all rounds of treatment 4A_4A^R with divide-the-prize tasks

Notes: This figure is based on treatment 4A_4A^R with divide-the-prize tasks (61 participants).

same type of choice in both of those rounds. Of those, 60.0% (21) chose the ex post fair option, which is considerably higher than the overall frequency for this treatment (shown in panel B of Figure 1), and only 28.6% (10) chose the ex ante fair option, which is noticeably lower than the overall frequency. Accordingly, we conclude that the differences between the distributions exhibited in Figure 1 are primarily attributable to consistent choosers.

The tendency for people to make ex ante fair choices even after being exposed to the ex post perspective is even more evident if one restricts attention to consistent decision makers. Two-thirds of subjects participating in the 4P_4A^R treatment displayed consistency in rounds 5-8, in the sense that they made the same type of choice in every round. We cannot reject the hypothesis that this fraction is the same as for rounds 5-8 of treatment 4A_4A^R ($p = 0.45$). Of the consistent choosers, all but two chose the ex ante fair alternative in every round. Analyses of consistent choosers in rounds 5-8 of treatments 2A2P_4A^R and 2P2A_4A^R yield similar conclusions.

Revisions We divided subjects from the 4A_4A^R treatment into two groups: consistent choosers (those whose original decision fell into the same category in at least 7 of the 8 rounds), and inconsistent choosers (all others). Notably, most of these subjects (52%) were consistent choosers. Several patterns merit emphasis. First, all but one (99.3%) of the original choices made by consistent choosers in rounds 5-8 were ex ante fair. Second, the frequency of revisions was actually higher for consistent choosers (77.0% of their choices) than for inconsistent choosers (58.8% of their choices). Thus, consistency across rounds does not translate into consistency across decision frames. Third, for this group, roughly two-thirds of choice pairs (64.9%) involved an original ex ante equalizing allocation, followed by a revision to an ex post equalizing allocation. Thus, consistent choosers manifest the pattern of interest to an even greater extent than the general subject population. Interestingly, nearly a quarter of choice pairs (23.0%) made by consistent choosers were time consistent: these subjects exhibited resolute non-EU preferences by making and sticking to ex ante equalizing allocations. Roughly one in ten choice pairs entailed revisions that compensated for bad luck, in that the subject switched from an ex ante equalizing allocation to a reinforcing one. In the remaining choice pair, the subject switched from an ex ante equalizing allocation to overcompensating. We conclude that choice reversals are especially prevalent for the 52% of our subjects who are consistent choosers.

Commitment versus flexibility For 36 of the 72 subjects in the 4A^R_4A^C treatment, original choices fell into the same category throughout rounds 5-8; in 30 of these cases, the initial allocations were ex ante fair. Two of these subjects consistently selected reinforcing allocations, and four consistently opted for ex post fairness. We will call these the “consistent” subjects, and we will call the remaining 36 subjects “inconsistent.” The preference for commitment is somewhat stronger for consistent subjects, who committed themselves in 52.1% of tasks and retained flexibility in 27.1%,

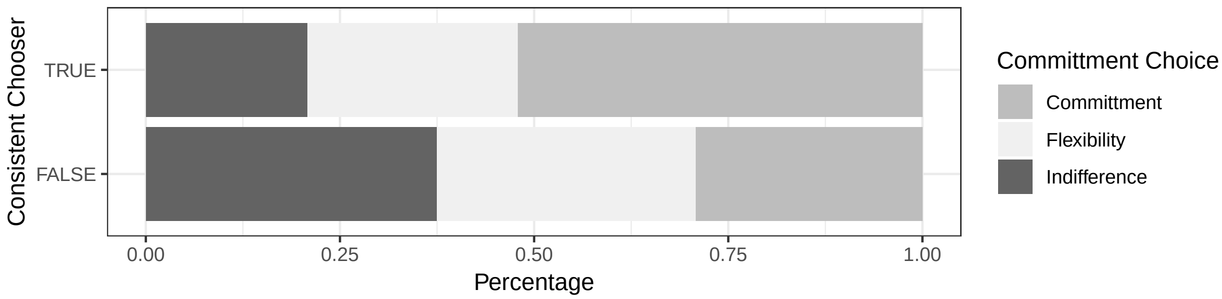


Figure B.11: Commitment choices for consistent and inconsistent subjects

Note: This figure is based on the final four rounds of treatment 4A^R_4A^C (72 subjects, 36 of whom were consistent, and 36 of whom were inconsistent).

while the inconsistent subjects committed themselves in 29.2% of tasks and retained flexibility in 33.3%; see figure B.11.

Figure B.12 exhibits distributions of final choices for consistent subjects who started out by choosing the ex ante fair allocation. (We do not display the rest of the joint distribution because consistent subjects started out by making other types of choices so infrequently.) Panel A pertains to rounds 1-4 of treatment 4A^R_4A^C, and panel B to rounds 5-8. In each case, we define a subject as consistent or inconsistent based on their behavior within the indicated rounds. There were 29 consistent subjects in rounds 1-4, and 36 in rounds 5-8. 21 of these were the same subjects. 25 consistent subjects always chose the ex ante equalizing allocation in rounds 1-4, and 30 did so in rounds 5-8. 20 of these were the same subjects. Here we see a nearly 30 percentage point increase in the frequency of final ex ante equalizing allocations, from 32.0% in the first four rounds (without commitment), to 61.7% in the last four rounds (with commitment), and a 27 percentage point decline in the frequency of final ex post equalizing allocations (62.0% versus 35.0%). Thus, among consistent subjects, offering commitment suppresses migration from ex ante equalizing allocations to ex post equalizing allocations.

C Experiment Details

C.1 Treatment Balance

Assignment to treatments was performed at the sessions level. The treatments were run at the following times:

- November 2013: 4A_4A^R (both split-the-tickets and split-the-prize)
- March 2014: 4P_4A^R, 2A2P_4A^R, 2P2A_4A^R, 4A^R_4A^C

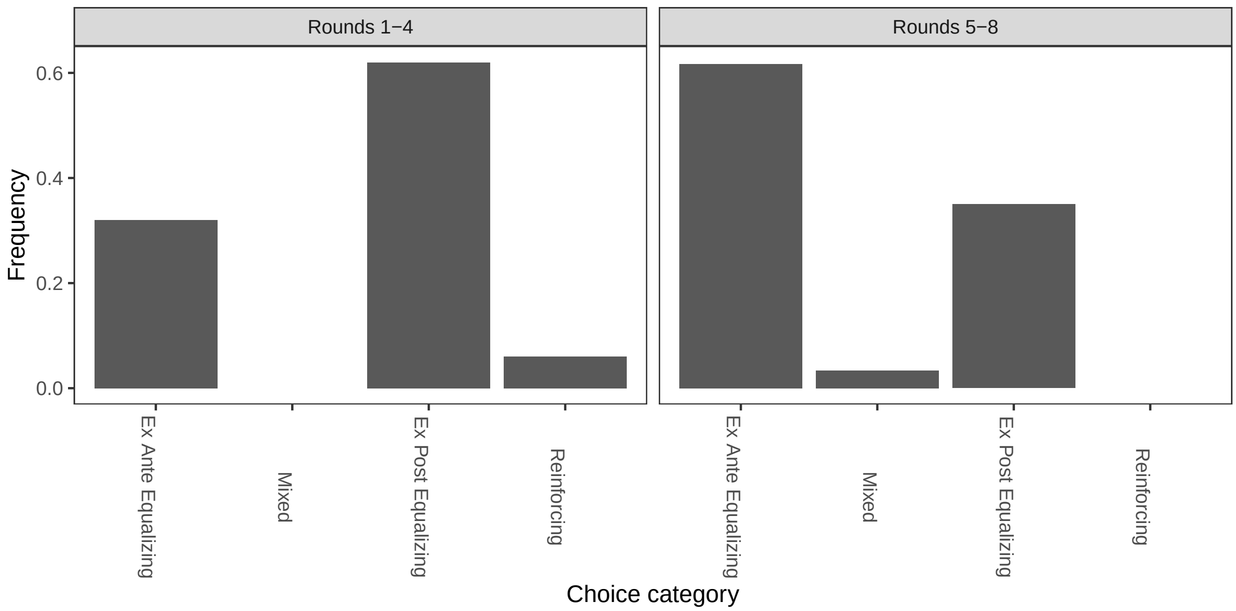


Figure B.12: Distribution of final choices of consistent subjects for treatment $4A^R\_4A^C$

Note: This figure is based on consistently initially fully offsetting subjects in treatment $4A^R\_4A^C$ (25 in rounds 1-4 and 30 in rounds 5-8).

- December 2015: $4A^S$, $4A^{RS}$
- May 2017: $4A^{RI}$, $4A^R\_4A^{CS}$, $4A\_4A^P$

One may naturally be concerned that the subjects differ systematically across treatments. To address this concern, we provide Table C.1, which gives several key demographics for each treatment. In addition to average age and fraction female, we provide the fraction of subjects who indicated their political stance as "somewhat liberal" or "strongly liberal." To test for balance, we regress each of these demographic variables on a full set of treatment dummies and examine the F-statistic for each regression. We find that gender and political stance do not vary significantly across treatments ($p = 0.61$ and $p = 0.15$, respectively). We find that age does vary across treatments ($p = 0.01$).

C.2 Screenshots of Instructions and Interfaces

Table C.1: Balance table showing average age and percent female in each treatment.

Treatment	Average Age	Fraction Female	Fraction Liberal
4A_4A^R	19.8	0.61	0.48
4A_4A^R Dollars	20.0	0.59	0.34
4P_4A^R	20.3	0.53	0.32
2A2P_4A^R	20.7	0.60	0.46
2P2A_4A^R	20.2	0.50	0.33
4A^R_4A^C	20.1	0.58	0.44
4A^P	20.1	0.72	0.35
4A^S	19.2	0.57	0.53
4A^{RS}	19.6	0.51	0.34
4A^{RI}	20.3	0.60	0.47
4A^R_4A^{CS} StrComm	20.5	0.63	0.46

Today's study

Today, you are cooperating with a charity called GiveDirectly. GiveDirectly was founded by economics professors at Harvard, Yale and UC San Diego with the purpose of giving money directly to households in impoverished villages in Kenya.

This charity takes advantage of the fact that, in developing countries, cell phones have become the equivalent of ATM machines and debit cards in the US—cell phones are used to make purchases and transfer cash, and the phone companies are the primary source of financial services. The innovation of this charity is that money you give will be transmitted directly to the individuals by being transferred electronically to the recipient's cell phone. The recipient household is free to use the money to pursue their own goals, such as repairing their homes, buying clothing for their children, or paying for medical services.

Importantly, an organization that watches and rates charities, GiveWell, has named GiveDirectly as one of the three top charities world-wide.

Below is a view of their webpage, GiveDirectly.org.

GiveDirectly

Like · Tweet · +1

introducing a radical new way to give: directly

Use GiveDirectly to send money directly to the poor

1. You donate through our webpage
2. We locate poor households in Kenya
3. We transfer your donation electronically to a recipient's cell phone
4. The recipient uses the transfer to pursue his or her own goals

latest news

GiveWell has named GiveDirectly one of three "top-rated" charities.

GiveDirectly has received a Global Impact Award from Google. Read more on our blog and from Google.

Figure C.13: Page 1 of instructions for treatment 4A_4A^R.

Your Chance to Give Directly

In this study, your task will be deciding how to allocate chances to win $10 prizes among actual household in Kenya.

There will be eight rounds of decisions divided into two sets of four rounds.

At the beginning of each of the first 4 rounds, you will see the photos of 16 households. The computer will randomly assign two of the 16 households to you. We will call these your "Household A" and your "Household B". You will not be told which pictures correspond to your households.

Next, you and the computer will each divide 10 lottery tickets between those two households. You will allocate tickets numbered 1 through 10, and the computer will allocate tickets numbered 11 through 20. You will see the computer's allocation before you make your choice.

One of the twenty tickets will be selected, and the household to which that ticket was assigned will be the winner for that round. You will be informed whether your ticket or the computer's ticket was chosen. Only one of the eight rounds will actually count, and we will select it at random after all eight rounds are complete. The outcome of that round will be carried out, and donations to GiveDirectly will be made.

Since all rounds are equally likely to be selected as the one that counts, you should treat each decision as if it is the one that is going to be implemented.

Figure C.14: Page 2 of instructions for treatment $4A\_4A^{R}$.

Things to Remember

- In each of the first four rounds, you will be randomly assigned 2 households from GiveDirectly, called Household A and Household B.
- You decide how to allocate your 10 lottery tickets between households A and B. The computer will also allocate 10 lottery tickets, and you will see the computer's allocation before you make your choice.
- You will repeat this decision four times, with four different pairs of households.
- One of the twenty tickets will be selected in each round, and the winner for that round will be the household to which that ticket was assigned. You will be informed whether one of your tickets or the computers tickets was chosen.
- At the end, one of the eight rounds will be chosen as the one that counts.
- We will then make the contribution to GiveDirectly, as determined by the outcome in the chosen round.

Figure C.15: Page 3 of instructions for treatment 4A_4A^R.

Round #1

Please view below the households from which your two households will be chosen.

Figure C.16: Typical display of households.

Round #1

You are assigned Household #6 as recipient A and Household #13 as recipient B. (Note: the pictures of the households are NOT in numerical order, so you cannot tell which pictures correspond to your households.)

As we explained, there are 20 lottery tickets in all, which are shown in the table below. Remember, each lottery ticket pays its holder $10 if it is the ticket drawn (and if this round is selected as the one that counts).

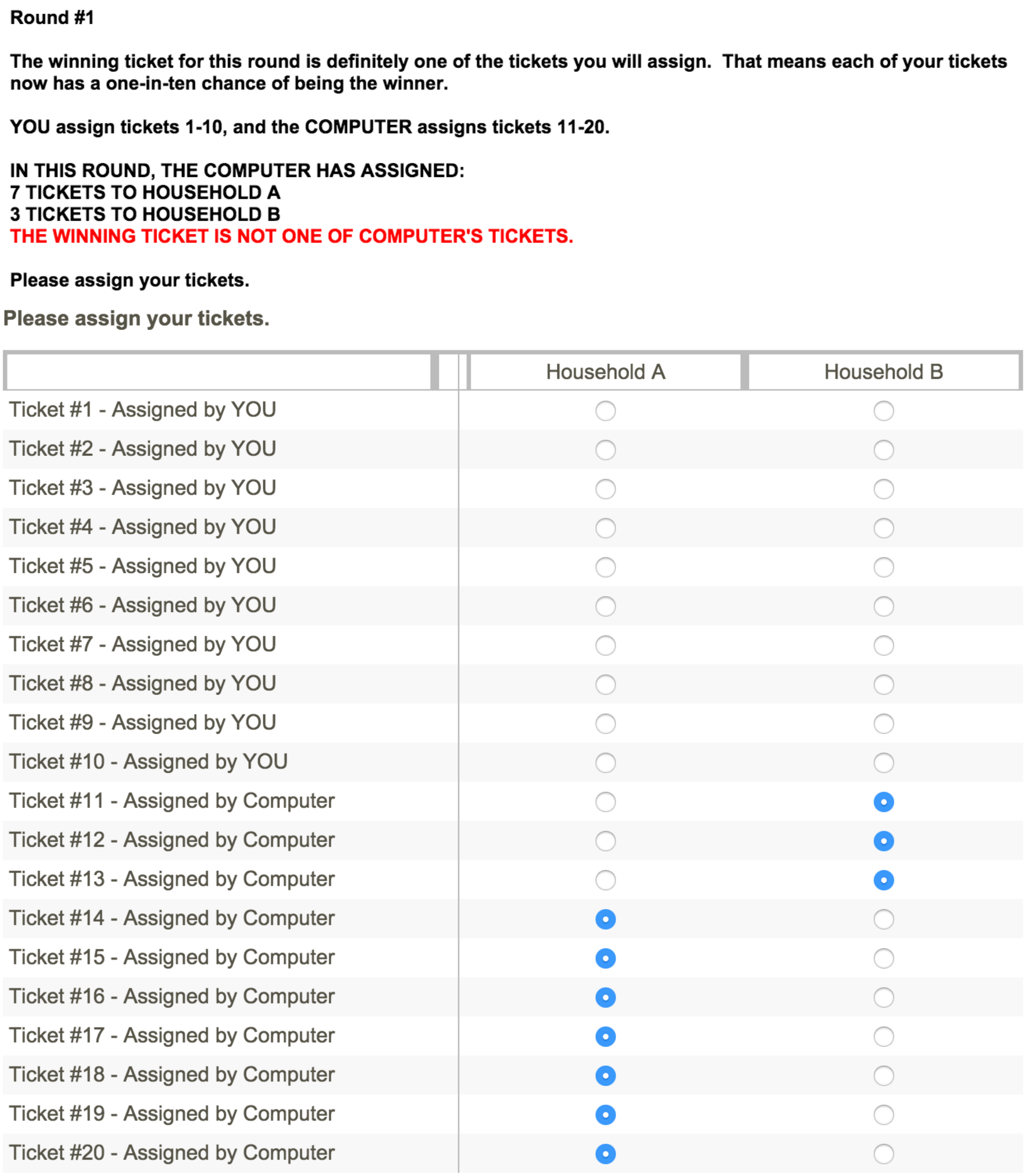
YOU assign tickets 1-10, and the COMPUTER assigns tickets 11-20.

IN THIS ROUND, THE COMPUTER HAS ASSIGNED:
7 TICKETS TO HOUSEHOLD A
3 TICKETS TO HOUSEHOLD B
YOU CANNOT CHANGE THE COMPUTER'S ALLOCATION.

Please assign your tickets.

	Household A	Household B
Ticket #1 - Assigned by YOU	○	○
Ticket #2 - Assigned by YOU	○	○
Ticket #3 - Assigned by YOU	○	○
Ticket #4 - Assigned by YOU	○	○
Ticket #5 - Assigned by YOU	○	○
Ticket #6 - Assigned by YOU	○	○
Ticket #7 - Assigned by YOU	○	○
Ticket #8 - Assigned by YOU	○	○
Ticket #9 - Assigned by YOU	○	○
Ticket #10 - Assigned by YOU	○	○
Ticket #11 - Assigned by Computer	○	●
Ticket #12 - Assigned by Computer	○	●
Ticket #13 - Assigned by Computer	○	●
Ticket #14 - Assigned by Computer	●	○
Ticket #15 - Assigned by Computer	●	○
Ticket #16 - Assigned by Computer	●	○
Ticket #17 - Assigned by Computer	●	○
Ticket #18 - Assigned by Computer	●	○
Ticket #19 - Assigned by Computer	●	○
Ticket #20 - Assigned by Computer	●	○

Figure C.17: Ex ante task interface.



Round #1

The winning ticket for this round is definitely one of the tickets you will assign. That means each of your tickets now has a one-in-ten chance of being the winner.

YOU assign tickets 1-10, and the COMPUTER assigns tickets 11-20.

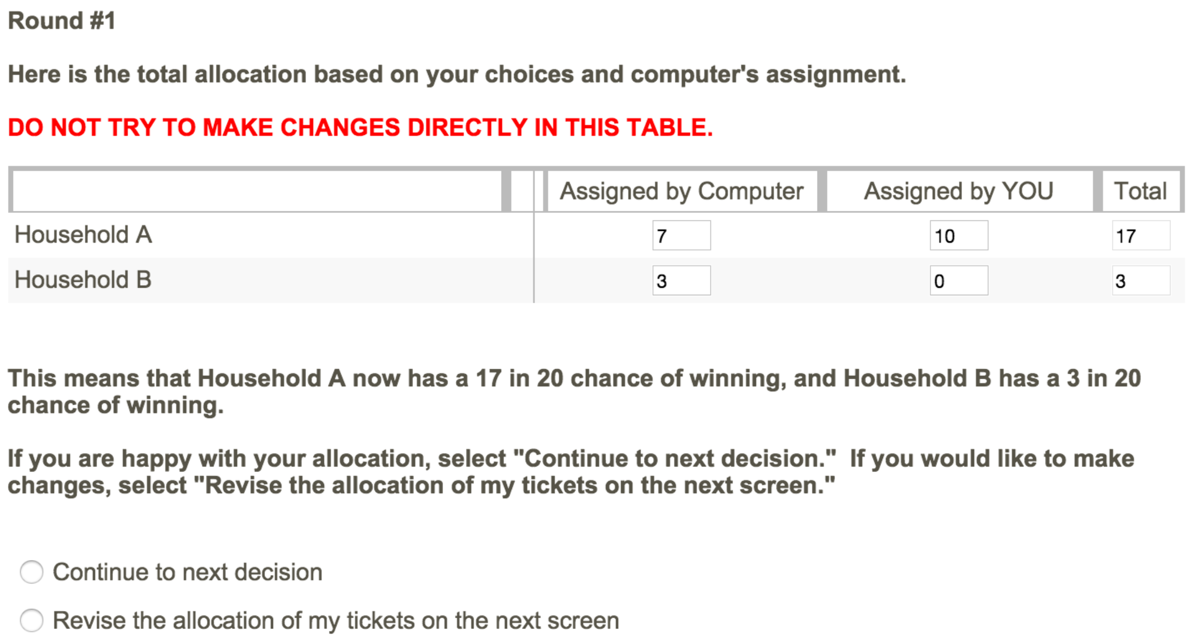
IN THIS ROUND, THE COMPUTER HAS ASSIGNED:
7 TICKETS TO HOUSEHOLD A
3 TICKETS TO HOUSEHOLD B
THE WINNING TICKET IS NOT ONE OF COMPUTER'S TICKETS.

Please assign your tickets.

Please assign your tickets.

	Household A	Household B
Ticket #1 - Assigned by YOU	○	○
Ticket #2 - Assigned by YOU	○	○
Ticket #3 - Assigned by YOU	○	○
Ticket #4 - Assigned by YOU	○	○
Ticket #5 - Assigned by YOU	○	○
Ticket #6 - Assigned by YOU	○	○
Ticket #7 - Assigned by YOU	○	○
Ticket #8 - Assigned by YOU	○	○
Ticket #9 - Assigned by YOU	○	○
Ticket #10 - Assigned by YOU	○	○
Ticket #11 - Assigned by Computer	○	●
Ticket #12 - Assigned by Computer	○	●
Ticket #13 - Assigned by Computer	○	●
Ticket #14 - Assigned by Computer	●	○
Ticket #15 - Assigned by Computer	●	○
Ticket #16 - Assigned by Computer	●	○
Ticket #17 - Assigned by Computer	●	○
Ticket #18 - Assigned by Computer	●	○
Ticket #19 - Assigned by Computer	●	○
Ticket #20 - Assigned by Computer	●	○

Figure C.18: Ex post task interface.



Round #1

Here is the total allocation based on your choices and computer's assignment.

DO NOT TRY TO MAKE CHANGES DIRECTLY IN THIS TABLE.

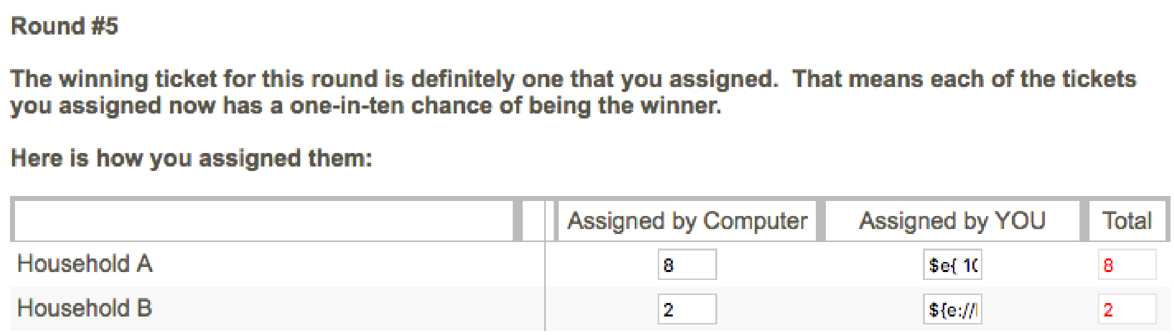
	Assigned by Computer	Assigned by YOU	Total
Household A	7	10	17
Household B	3	0	3

This means that Household A now has a 17 in 20 chance of winning, and Household B has a 3 in 20 chance of winning.

If you are happy with your allocation, select "Continue to next decision." If you would like to make changes, select "Revise the allocation of my tickets on the next screen."

- Continue to next decision
- Revise the allocation of my tickets on the next screen

Figure C.19: Confirmation screen shown after all tasks.



Round #5

The winning ticket for this round is definitely one that you assigned. That means each of the tickets you assigned now has a one-in-ten chance of being the winner.

Here is how you assigned them:

	Assigned by Computer	Assigned by YOU	Total
Household A	8	$e{ 1(	8
Household B	2	${e://l	2

Figure C.20: Surprise revision of an ex ante task.

Your Chance to Give Directly

Please read carefully as the instructions have changed.

There will be four more rounds of decisions.

As in the last four rounds, your task will be deciding how to allocate chances to win $10 prizes among actual household in Kenya.

At the beginning of each of the next four rounds, you will see the photos of 16 households. The computer will randomly assign two of the 16 households to you. We will call these your "Household A" and your "Household B". You will not be told which pictures correspond to your households.

You and the computer will each divide 10 lottery tickets between those two households. You will allocate tickets numbered 1 through 10, and the computer will allocate tickets numbered 11 through 20. You will see the computer's allocation before you make your choice.

After you make your choice, you will be asked whether you want to have an opportunity to revise your choice at a later point in the experiment, as described below. You may choose one of the following options:

- **I definitely want the opportunity to revise. If you chose this option, we will give you an opportunity to revise your choice at a later point in the experiment, as described below.**
- **I definitely do not want the opportunity to revise. If you chose this option, we will NOT give you an opportunity to revise your choice at any later point in the experiment.**
- **I do not care about having an opportunity to revise. If you chose this option, we will determine whether you will have an opportunity to revise later in the experiment randomly (with 50% probability).**

After you have chosen your initial allocation and indicated whether you want to have an opportunity to revise for each of the four rounds, we will select the winning tickets. We will then determine the outcome for each round as follows.

If you have chosen NOT to have an opportunity to revise (or we have randomly chosen that option for you), the household to which the selected ticket was assigned will be the winner for that round. We will tell you which household (A or B) was the winner, and whether the winning ticket was one of yours or one of the computer's.

If you have chosen to have an opportunity to revise (or we have randomly chosen that option for you) then:

- **We will tell you whether we have drawn one of your tickets or one of the computer's tickets, but we will not tell you which ticket it is.**
- **Then, if we have drawn one of your tickets, we will give you the opportunity to revise your allocation by redistributing your tickets between the two households. (You will have the option of confirming your original allocation at this stage if you don't want to make any changes.)**
- **Finally, we will tell you which Household (A or B) was assigned the winning ticket.**

Figure C.21: Commitment instructions.

Answer all Questions

We have completed the last 4 allocation rounds. It is now time to select the winning ticket for each round. How we determine the outcome for each round depends on whether you have an opportunity to revise.

If you DO NOT have an opportunity to revise (either because you chose not to have it or because you didn't care and we randomly chose that option for you), the household to which the selected ticket was assigned will be the winner for the round. We will tell you which household (A or B) was the winner, and whether the winning ticket was one of yours or one of the computer's.

If you DO have an opportunity to revise (either because you chose to have that option or because you didn't care and we randomly chose that option for you), then:
We will tell you whether we have drawn one of your tickets or one of the computer's tickets, but we will not tell you which ticket it is.
If we have drawn one of your tickets, we will give you the opportunity to revise your allocation by redistributing your tickets between the two households. We will remind you how you divided up your tickets earlier. You will have the option of confirming your original allocation at this stage if you don't want to make any changes. Any revisions you make at this stage will be final.
Finally, we will tell you which Household (A or B) was assigned the winning ticket.

Figure C.22: Commitment instructions continued.

Do you want to be able to confirm or revise your ticket allocation in the event that one of your tickets is chosen?

- ◯ I want to confirm or revise my allocation.
- ◯ I am indifferent
- ◯ I do not want to confirm or revise my allocation

Figure C.23: Commitment interface.

Round #5

After this, we will determine whether the winning ticket for this round is one of yours. At the moment, the allocations by you and the computer are shown below:

	Assigned by Computer	Assigned by YOU	Total
Household A	8	$e{	
Household B	2	${e:	

If the winning ticket is NOT one of yours, then the computer's allocation of tickets will determine the winner. This means Household A will have an 8 in 10 chance of winning and household B will have a 2 in 10 chance of winning. However, if the winning ticket IS of yours, then your allocation will determine the winner. Under your current allocation, Household A will have a $e{ 10 - ${e://Field/choice1} } in 10 chance of winning, and Household B will have a ${e://Field/choice1} in 10 chance of winning.

We now want to ask you to think ahead. Suppose we tell you that the computer has the winning ticket. Then nothing above will change. Suppose instead we tell you that you have the winning ticket. In this case you are SURE to determine which household is the winner - each of your tickets has a 1 in 10 chance of being the winning ticket. We are giving you a chance now to either keep your tickets as you have allocated them above, or to change your ticket allocation, BUT this will only happen in the the event that we find out you have the winning ticket.

- **If you would like to keep your tickets the same, assuming we find out you have the winning ticket, just reproduce your original choice below.**
- **If you would like to reallocate your tickets, assuming we find out you have the winning ticket, then put your new allocation below.**

Remember, we will only reallocate your tickets if we find out you have the winning ticket. Any choice you make now is final - you will not have another opportunity to revise your allocation.

Figure C.24: Planned revision task.

You have indicated that you do not want to have the option to **confirm or revise** your original allocation, in the event that one of your tickets is chosen.

On this page, we would like you to answer five questions about the choice you made in Round 1. Each question asks whether you would be willing to accept the option to confirm or revise your original allocation in exchange for changes in the prize. In each case you should indicate whether or not you are willing.

You should answer all of these questions truthfully, because we may act on one of them. Specifically, at the end of the experiment, we will roll a six-sided die. If this round is selected as the one that counts, and if the number we roll is between 1 and 5, then your answer to the question with that number will also count.

Remember that, if one of your tickets is chosen, in your original allocation Household A has a $e{ 10 - ${e://Field/choice1} } in 10 chance of winning, and Household B has a ${e://Field/choice1} in 10 chance of winning. If you give up your option to confirm or revise your original allocation, that is how we will allocate the tickets.

Figure C.25: Incentivized commitment task instructions.

1. Would you be willing to have the option to confirm or revise your original allocation, if we increased the prize to be allocated from $10 to $10.25?

○ Yes, I would be willing to have the option to confirm or revise my original allocation.

○ No, I would not be willing to have the option to confirm or revise my original allocation.

Figure C.26: Typical incentivized commitment task interface.