

On Fairness of Random Procedures

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Abstract

This is an experimental study of fairness perceptions of different procedures for collective decision-making. Procedures that are equivalent in a materialistic sense are viewed differently by subjects in terms of fairness. More than 60% of our subjects belong to one of two “types”: “rational” types who have a materialistic view of procedures, and “emotional” types who exhibit a systematic fairness ranking of the procedures.

KEYWORDS: Procedural Fairness, Random Procedures

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1. Introduction

Group decision-making procedures often include random elements. For example, when one group member needs to be assigned to a task, the identity of the person is often determined randomly. If we need to collect information from the individuals, the order by which the information is collected may be determined randomly. If we are limited in the number of people who could be consulted, we may select them at random. If the outcome must discriminate between agents, then randomization may be used. However, there could be intuitive reasons why procedures, which are seemingly equivalent in carrying out the randomization, are not perceived as being equally fair.

To illustrate this, consider a group of people who have to make a collective choice. Two procedures are considered. According to procedure A, all people will have to simultaneously write their choice, a random device will pick one of the individuals and the written choice of that person will be the collective choice. According to procedure B one of the people is randomly chosen and he makes the choice. The two procedures seem equivalent. In procedure B, as in procedure A, each agent "should" make the choice as if he is the decisive agent. However, there is a sense in which procedure A is fairer. First, it allows all individuals to "actively participate". Second, it makes it less salient that a single person will be perceived as bearing the sole responsibility for the outcome.

In this short paper we demonstrate that procedures involving randomization, which are equivalent in a materialistic sense, may be perceived as being different in terms of fairness. We report on the results of a survey in which subjects were presented with pairs of procedures, and in each pair they were asked to rank the procedures according to their relative fairness (indifferences were allowed). Each pair consisted of two alternative ways of randomizing in a particular scenario, of which one is hypothesized to be more fair. We argue that more than 60% of the subjects can be classified into one of two types: the "rational" type who considers pairs of procedures equally fair and the "emotional" type who finds the "intuitively" fairer procedure strictly fairer than another.

We do not hold a comprehensive theory of fairness that explains our findings. We conjecture that some procedures are considered fairer than others is due to several principles of fairness.

- (1) It is fair to treat all involved individuals equally.
- (2) It is fair to let all individuals voice their opinion or take an active role.
- (3) When necessary, it is fair to keep the symmetric treatment of participants as far as possible in the procedure.
- (4) It is more fair to use "conventional" means of randomizing than to randomize in a non-conventional way. This could stem from natural suspicion of manipulation that non-conventional means of randomization is a result of some hidden motive to bias the results.
- (5) A procedure is fair if it respects God's "will", where the realization of the random device in a procedure is interpreted as the "outcome that was meant to be".
- (6) It is unfair to allocate all responsibility or potential blame for a negative outcome to one

individual when the realization of the outcome is out of the person's control (philosophers refer to it as "agent's regret").

Our attempt to elicit intuitions about fairness of procedures follows the approach of Yaari and Bar-Hillel (1984). These authors investigated notions of distributive fairness by presenting subjects with different allocations of goods, asking them to pick the most fair allocation. The question of fairness of equivalent random choice procedures is also discussed in Keren and Teigen (2010). In Experiment 9, they asked subjects to rank four types of random procedures for selecting one of two patients to be treated. Their findings indicate some tendency of people to view a fair coin toss as more fair than procedures like pulling a piece of paper out of a hat, or randomly choosing a room number.

2. The Problems

Subjects were asked to respond to six problems presented in a random order. Each problem consisted of two procedures, which by standard materialistic terms would be considered equivalent. Then, they had to complete the sentence: "In your opinion, from the point of view of [an entity indicated in bold letters]": (1) Procedure A is fairer than B, (2) Procedure B is fairer than A, or, (3) Both procedures are equally fair.

The participants belonged to a subject pool that consisted of students of current or past undergraduate courses in game theory from around the world, who agreed to participate in extra curricular experiments. They were approached by an e-mail containing a link to the experiment (see <http://gametheory.tau.ac.il/kf12/>). 677 subjects completed all six problems. The subjects came from 58 countries. The vast majority (79%) were from 14 countries: USA (21%), Slovak Republic (8%), Columbia (7%), Argentine, Germany, Switzerland (5% each), Finland, Israel, Spain and UK (4% each) and China, Chile, Denmark and Italy (3% each). The male/female ratio was 68%:32%. Two subjects were drawn at random to receive \$50.

The following are the six problems.

P1 ("The doctor or the mother")

Suppose two twins need to receive a kidney transplant from their mother. The mother can donate only one kidney. Compare the fairness (from the point of view of the mother) of the following two procedures for determining who will receive the kidney.

- A) The doctor will toss a coin.*
- B) The mother will toss the coin.*

We hypothesized that the majority of participants would find it more fair to have the doctor toss the coin. Intuitively, it is not fair that the mother should bear the sole responsibility for denying a kidney to one of her children. Our findings suggest that this intuition is shared by

many of our participants.

<i>A</i>	<i>B</i>	<i>A ~ B</i>
31%	10%	58%

where *A* (respectively, *B*) means that *A* was chosen as fairer than *B*, and *A ~ B* means that both procedures are perceived as being equally fair.

P2 (“randomly pivotal”)

Consider a committee of 15 members that needs to decide by majority vote whether or not to fire some employee. Simultaneously, each committee member puts his name and his vote in a sealed envelope. The committee chair collects the envelopes and meets in private with the employee. Compare the fairness (from the point of view of the committee members) of the following two procedures for communicating the decision to the employee.

A) The committee chair opens the envelopes in private and counts the votes. He announces the outcome of the vote to the candidate and shows him the content of each envelope in some random order.

B) The committee chair opens the envelopes in some random order in front of the candidate. For each opened envelope he announces the name of the committee member and his vote. When at some point, a majority of votes is reached the chair announces the outcome and continues to open the remaining envelopes.

We hypothesized that the majority of participants would find *A* to be fairer than *B*. The reason being that *B* makes one of the committee members appear pivotal or decisive in the firing decision. Note that subjects were asked to evaluate fairness from the point of view of the *committee members* not from the point of view of the candidate. Thus, concerns for early versus late resolution of uncertainty (in the spirit of Kreps and Poretus (1978)) are immaterial for fairness ranking. The results support our intuition.

<i>A</i>	<i>B</i>	<i>A ~ B</i>
56%	18%	26%

P3 (“the first or random”)

Consider an employer who needs to fire at most one worker who failed some qualification exam. All workers have taken the exam, some passed some failed. Compare the fairness (from the point of view of the workers) of the following procedures for selecting the worker to be fired.

A) The employer reviews the list of exam results at a random order. The first worker to fail the exam is fired.

B) The employer selects a worker at random from among all the workers who failed the

exam.

This question touches on the principle that all individuals involved should be on equal footing as long as possible. Even though this is true ex-ante in both procedures, it ceases to be true in procedure A once the order is drawn. Thus, our hypothesis was that more participants would choose procedure B as the fairer of the two. Indeed, this is confirmed by our data:

A	B	A ~ B
6%	40%	54%

P4 (“random dictatorship”)

You are a student in a class that needs to select one of two exam dates. Compare the fairness (from the point of view of the students) of the following procedures for making the decision.

A) One of the students is selected at random and is asked to make the choice. His identity will be announced and his decision will determine the outcome.

B) Each student has to submit a note bearing his name and his choice. One of the notes will be randomly picked; the identity of the student will be announced and his choice will determine the outcome.

The two procedures are versions of the "random dictator". The appeal of a random dictator was emphasized by Gibbard (1977), who showed that it is the only social choice rule satisfying strategy-proofness, ex ante efficiency, neutrality and unanimity. Heyd (2000) argued that the merit of a random dictator is that it gives influence to members of the minority, who are "suppressed" by the majority rule system. Both papers do not relate to the differences between the procedures described here. As explained in the Introduction, we hypothesize that procedure B is more likely to be viewed as the fairer procedure. This is supported by our data.

A	B	A ~ B
5%	52%	43%

P5 (“the ‘drawn’ or the ‘not drawn’”)

Imagine there are two equally qualified candidates for a position, both of whom reached the final stage of the recruiting process. The name of each candidate is put in a sealed envelope. One of the envelopes will be randomly drawn. Compare the fairness (from the point of view of the candidates) of the following two procedures for selecting the candidate to be hired.

A) The candidate whose name is drawn is hired

B) The candidates whose name is not drawn is hired

There are two fairness principles that make A appear fairer. First, it is more conventional that a person who is drawn at random, is awarded the “prize”. Thus, procedure B is perceived as less fair. Furthermore, the first name drawn is perceived as “God’s will” (“it was destined that this person should win”), hence, *not* selecting that person may be viewed as “cheating God”. Our findings show that the conjectured effect exists but is very weak.

<i>A</i>	<i>B</i>	<i>A ~ B</i>
14%	2%	81%

P6 (“drawn twice”)

One prize is to be awarded to one person from among 20 candidates. Compare the fairness (from the point of view of the candidates) of the following procedures for selecting who will get the prize.

A) A computer program repeatedly draws a name at random, and the prize is awarded to the first person whose name is drawn twice.

B) A computer program draws one of the names at random and that person is awarded the prize.

There are two arguments that are at conflict here. On the one hand, the fact that the same name appears twice is an indication that it is God’s will that this person should be selected. On the other hand, procedure B implies that candidates who were drawn might not be selected eventually, which may be viewed as “cheating God”. The conflict of intuitions is expressed in the results:

<i>A</i>	<i>B</i>	<i>A ~ B</i>
21%	23%	56%

3. Are there ‘types’?

A natural question that arises is whether the data points at intuitive “types”, i.e., systematic patterns of answers that are exhibited by significant proportions of participants. We looked for a typology based on the first four questions: in P5 more than 80% of subjects considered both procedures to be equally fair, and in P6 no procedure appeared to be perceived as fairer than the other. We identify two types:

Rational - Out of the 81 possible configurations, we labeled as “rational” the nine configurations of answers that included at least three indifferences. 31% of the subject fall into this category. Out of those 209 subjects, 40% displayed four indifferences, and 39% exhibited three indifferences with no indifference in P2.

Emotional - When a participant chose one procedure as the most fair, he was more likely to choose A in P1, A in P2, B in P3 and B in P4. A subject is labeled as “emotional” if in the first four questions he deviated from (A,A,B,B) by at most one answer. About 30% of all participants were emotional, and 25% of the emotional participants chose exactly (A,A,B,B).

While the other 63 configurations of answers consist of 78% of all configurations, they were chosen by only 39% of the subjects. None of these configurations attracted more than 6% of all subjects.

Because the definitions of the two types were based only on the first four questions, it allows us to test whether these types are a good predictor for the answers in the last two questions. We hypothesize that in these questions a rational participant is more likely to find the two procedures equally fair than an emotional participant. Our data confirms this hypothesis.

P5	Emotional	Rational
A	26%	3%
B	3%	0%
A ~ B	71%	97%

P5	Emotional	Rational
A	30%	9%
B	30%	12%
A ~ B	40%	79%

4. Discussion

Gender. The distribution of “rational” and “emotional” types among males is significantly different from the distribution among females:

type	Rational	Emotional
m	34%	26%
f	24%	37%

In all six problems more males than females declared the two procedures to be equally fair:

Question	1	2	3	4	5	6
m	60	30	57	45	85	60
f	56	21	44	39	81	46

This is consistent with a common wisdom that women are more sensitive than men to fairness considerations. Incidentally, the gender differences was smallest in the question involving the mother tossing the coin.

Order position. As mentioned above, the order of the problems was randomly drawn. Interestingly, the proportion of indifferences did not go up but even went slightly down: there were 56% indifferences in the first three positions, 52% in the fourth and fifth position, and 50% in the last position. The following table presents the distribution over the answers to each question when it appears first and on average.

	P1		P2		P3		P4		P5		P6	
	First	avg.	First	avg.	First	avg.	First	avg.	First	avg.	First	avg.
A	35%	32%	52%	56%	9%	6%	9%	5%	14%	14%	15%	21%
B	8%	10%	20%	18%	29%	40%	45%	52%	5%	2%	24%	23%
A~B	57%	58%	28%	27%	62%	53%	46%	43%	81%	84%	61%	56%

Though some quantitative differences appear, our conclusions remain the same whether we count only the answers which appear first in the sequence or all answers.

Geography. The wide distribution of countries does not allow us to make meaningful country based comparisons. Only six countries represented by more than 30 participants. We do not identify any striking differences in the distribution of answers across these six populations.

Response time. One could imagine that when comparing the response times of the different answers to a particular question, we will identify an answer which is more instinctive and one which stems from deeper cognitive thinking. In particular, there may be a difference between the response time of subjects who were indifferent between the two procedures and subjects who thought that one of the procedures was more fair. It turns out that within each problem, the median response times for the popular answers were not significantly different. That is, the response time results support the hypothesis that the two types capture different approaches to fairness and not differences in attention.

References

- Keren, Gideon and Karl H. Teigen, 2010. "Decisions by Coin Toss: Inappropriate but Fair," *Judgment and Decision Making* **5**, 83-101.
- Gibbard, Allan, 1977. "Manipulation of Voting Schemes that Mix Voting with Chance," *Econometrica* **45**, 665–681.
- Heyd, David, 2000. "When Practical Reason Plays Dice," in *Reasoning Practically*, Edna Ullmann-Margalit (Ed.), New York: Oxford University Press.
- Kreps, David M. and Evan L. Porteus, 1978. "Temporal Resolution of Uncertainty and Dynamic Choice Theory," *Econometrica* **46**, 185-200.
- Yaari, Menachem E. and Maya Bar-Hillel, 1984. "On Dividing Justly," *Social Choice and Welfare* **1**, 1-24.