You Get Who You Pay for: The Impact of Incentives on Participation Bias

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ABSTRACT
Designing effective incentives is a challenge across many social computing contexts, from attracting crowdworkers to sustaining online contributions. However, one aspect of incentivizing that has been understudied is its impact on participation bias, as different incentives may attract different subsets of the population to participate. In this paper, we present two empirical studies in the crowdworking context that show that the incentive offered influence who participates in the task. Using the Basic Human Values, we found that a lottery reward attracted participants who held stronger openness-to-change values while a charity reward attracted those with stronger self-transcendence orientation. Further, we found that participation self-selection resulted in differences in the task outcomes. Through attracting more self-directed individuals, the lottery reward resulted in more ideas generated in a brainstorming task. Design implications include utilizing rewards to target desired participants and using diverse incentives to improve participation diversity.

Author Keywords
Incentives; participation bias; values; tailoring; nonresponse bias; study participation; crowdsourcing.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Whether it is encouraging crowd generated content in social systems, increasing compliance in behavior change technologies, or attracting participants in studies and surveys, getting people to participate is a critical problem that is prevalent in many human-computer interaction (HCI) domains. This problem is perhaps even more pronounced in the CSCW, Social Computing context, as the value of the technology depends on a critical mass of users [18]. Various strategies have been researched to encourage participation and quality contributions. Many have explored the use of theories from psychology, economics, and communication to help solve this problem [*e.g.*, 29]. Commercial sites also use a variety of technology-mediated motivators that offer badges, points, votes, awards, gifts, lotteries or money to motivate its users.

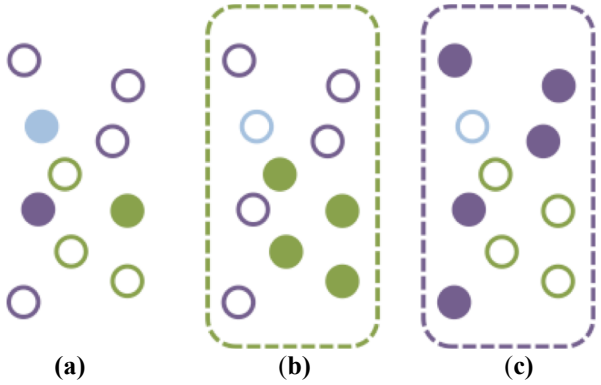

Figure 1. (a) Without incentives, a small percentage of the population may voluntarily participate (as denoted by solid dots). (b) & (c) Specific incentives may increase participation but only appeal to certain types of people.

Existing research has focused on the question of whether or not these incentives do work, and which reward is better. For practitioners, these studies help them focus on which reward to use to maximize participation and task effort. [*e.g.*, 1,11,15,23,29]. However, what is critically missing is the study on how the variety of incentives influence *who* participates. People are heterogeneously motivated; they hold different values and have different needs. At the individual level, this means that the effects of the different rewards or strategies are not uniform across all possible users. For example, some people may find the act of participation itself sufficiently rewarding, while others may be more motivated to participate when financially compensated, and yet another group may find it most rewarding when their participation is recognized by others. Further, offering a reward could act as disincentives to others who prefer not to be associated with the reward (*e.g.*, getting paid when the participants rather help pro bono).

Thus, any given reward may motivate only a subgroup of participants who value that reward, but may have little or

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negative impact on others who are not interested in said reward (Figure 1). This raises an important and critical issue at the system level when the use of incentives may influence more people to participate, but attract only a specific type of participants. This could be a problem for tasks that desire specific types of participants, or systems trying to attract a diverse set of users.

In this work, we provide empirical evidence that people are drawn to different incentives and their preferences can lead to systematic differences in participant composition and participation results. We present two experiments on how individuals' personal values influences self-selection into a brainstorming task that offered fixed financial rewards, lottery rewards or charity rewards (when a charitable contribution is made on behalf of the participants). We then examine how the task efforts of the different groups of participants differed. We found that the lottery reward attracted users who value openness-to-change (self-direction and stimulation), while the charity reward attracted users who value self-transcendence (benevolence and universalism). In the brainstorming task, the reward that attracted more participants valuing self-direction resulted in more ideas generated.

These results hold numerous design and theoretical implications. They demonstrate that incentives offered affect participation decisions, and highlight the need to consider participation bias when using different rewards, aside from the prevalent focus on maximizing response rate or task performance. It also suggests the potential of using diverse rewards as a way to improve the often desired participation diversity [34]. In addition, our findings uncover a number of nuanced links between individual's values and reward preferences. These findings may help future research in tailoring rewards to attract more participants or for maximizing different tasks-goals (*e.g.*, lottery reward for creative tasks).

BACKGROUND AND HYPOTHESES

The primary research questions are whether and how people's participation decisions are impacted by the offered incentives. And if so, could task outcomes be affected by the resulting participants? For scope, our research focus on three types of postpaid rewards that are often used in both research and commercial applications: fixed, lottery, and charity rewards [47]. The fixed reward represents the standard (fixed-amount) financial reward offered to participants. The lottery incentive enters participants into a drawing for one or more prizes. Often, and in our work, participants are told what the prizes are (*e.g.*, $25) and the odds of winning (*e.g.*, 1 out of 10). Finally, the charity reward differs from the fixed reward in that instead of being paid, that money is instead donated to a charity.

RQ1. Does offering fixed, lottery or charity rewards influence who chooses to participate?

RQ2. Can the participation bias due to incentives influence task outcomes?

An area where researchers have directly compared these rewards to each other is in research on survey design, studying how these premiums or rewards influence response rates. In general, offering money seem to be the most effective in increasing survey responses [27]. Lottery rewards also do generally increase responses [30,16,33]. However, for charity rewards, studies have found that the charity-related rewards tend to offer little or no improvement over not offering an incentive for response rates, and often perform worse than offering direct pay [14]. In defense of the charity reward, some have suggested that an altruistic appeal can be more effective than an egoistic appeal [7,22], and that it could be more cost effective as "fewer checks had to be written" [36].

However, the focus on general response rates overlooks the more intricate question on how these incentives affect who responds. Survey researchers are interested in sample composition, often through the focus on non-response bias, where they sought to know if the answers from respondents may differ from the potential answers of non-respondents [38]. Much work has studied the non-response bias of general survey (*e.g.*, mail vs. online) [*e.g.*, 38], but in comparison, the research linking incentives to response bias is sparse. One reason is that the goal of studying response bias is to help surveys achieve a representative sample, but that "most commonly recommended protection against nonresponse bias has been the reduction of nonresponse itself." [2]. Therefore, the studies of incentives on surveys often focus on participation rate as the outcome of interest and not on understanding who chooses into participation due to the incentives [28].

Of the survey research that has looked at how different people may be attracted to different rewards, the results are not conclusive. For example, one experiment suggests that monetary incentives may diminish responses from those who are interested in the survey topic, as the incentives attracts respondents who are not just intrinsically interested in the survey topic [17]. Some recent web-based research also included basic demographic variables in their regression models and found that lottery has a stronger effect on women than men [33], but that a charity reward does not bias towards the sex, marital status, education or household income of participants [36]. Part of the challenge here is it is hard knowing a-priori what to compare, hence most studies resort back to comparing the more "known" statistics of the population (*e.g.*, age, income) [2].

Thus, one of our goals is to identify what are some individual characteristics that can be used to predict reward preferences. The first factor we study is individual's risk attitude. Prospect theory suggests that risk-preference could lead people to prefer the lottery option over a fixed-pay option, when the expected payouts are the same (*e.g.*, $0.50 or a lottery of $50 with 1/100 chance of winning) [26].

Thus, we hypothesize that those who are more risk-seeking would be more likely to choose to participate a task offering the non-guaranteed, lottery reward.

H1. Risk-seeking attitude predict a preference towards lottery reward.

Values and Incentives

Another potential factor influencing reward preferences is individuals' personal values. Values are defined as "desirable, trans-situational goals, varying in importance that serve as guiding principles in people's lives" [40]. Research has shown that values can influence a number of aspects of our lives [39]. Though it has not been used to study incentives, we believe it may also influence participation decisions when incentives are offered.

Several general personal values dimensions have been proposed [21,37]. We focus on Schwartz's Basic Human Values for a number of reasons. First, Schwartz's values discriminate among individual people instead of national cultures. Second, Schwartz's values are not limited to work but also include values from different life domains. Third, they have been well studied and tested. They have also been included in the European Social Survey [39]. According to the Basic Human Values developed by Schwartz, there are 10 basic human values, which then map onto 5 higher-level values (Figure 2). The closer any two values are to one another, the more similar their underlying motivations.

In this work, we focus on two higher-level values: openness-to-change and self-transcendence. Openness-to-change encompasses two basic human values related to the desire for independence and new experience (self-direction and stimulation). Self-transcendence encompasses two basic human values involving concern for the welfare and interests of others (universalism and benevolence). While hedonism is sometimes coded as an openness-to-change value, because it shares both elements of openness and self-enhancement [39], we treat it as a separate higher-level value in our work.

Using Schwartz's value, we first hypothesize that there is a link between a lottery reward and the openness-to-change values of self-direction and stimulation. These are individuals who value stimulation and novelty. They are willing to explore, interested in taking on challenges, and are also less likely to need security and certainty. Hence their valuation for a lottery reward may be higher than others who are less inclined towards risk.

H2. Openness-to-change values predict a preference towards lottery reward.

What is interesting about the openness-to-change values is that they also have been associated with creativity and innovation [3]. The more an individual attaches to openness to change over conservative values (on the opposite end of the value structure), the higher their innovativeness [44]. Specifically, self-direction values have the largest

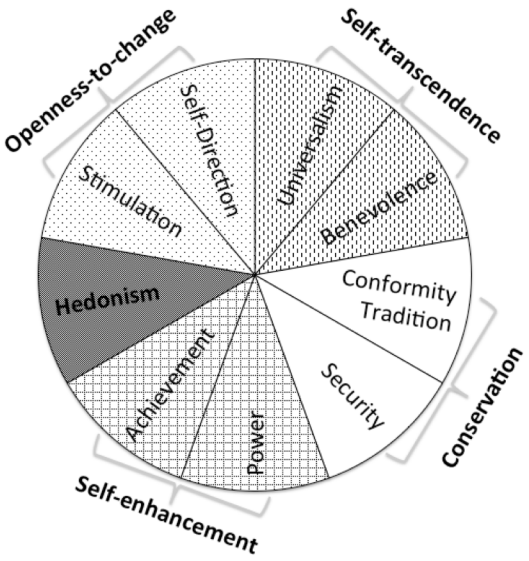


Figure 2. Schwartz' Basic Human Values

correlation with creative accomplishments [12]. This suggests that if given a creative, brainstorming task [32], those who hold strong openness-to-change values may enjoy and be more intrinsically motivated to work on the task. Prior research often assessed this motivation through a free-choice measure, or how much they worked on the task when they were no longer paid to [11]. In a brainstorming context, we thus examined the number of ideas generated beyond what was asked. We also studied performance on task through the creativity of ideas generated.

H2a. People who choose lottery reward generate more ideas in a brainstorming task.

H2b. People who choose lottery reward generate more creative ideas in a brainstorming task.

Schwartz's value may also predict another link between people and incentives: those individuals who value self-transcendence, or "enhancement of others and transcendence of self interests" [39], may be more likely to value and participate in a task offering the charity reward. Much prior research has shown the relationship between these values and helping and prosocial behaviors [41].

H3. Self-transcendence values predict a preference towards charity reward.

EXPERIMENT 1

The goal of this first experiment is to demonstrate that these aforementioned individual differences can influence people's preference for rewards. To do so, we presented participants with two rewards – choosing between a lottery reward and a fixed payment (lottery condition), or between a charity reward and a fixed payment (charity condition).

Participants from Mechanical Turk, an online marketplace for work, were invited to participate in a $1 survey that

assessed their values and personality. In this first stage, they were asked to fill out questionnaires about their value-orientation, personality, and general demographics of age, gender, education level and income (Figure 3, top).

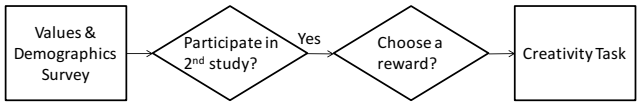
They were then invited to participate in an optional paid study on brainstorming and creativity. If they chose to participate, they were then told which reward options they had (randomly assigned). Half of the participants chose between a lottery reward and a fixed payment, and the other half between a charity reward and a fixed payment. The financial cost for all the rewards was $0.25. For the lottery condition, they would be entered into a drawing for $25 (1/100 chance of winning). And in the donation condition, they would donate that $0.25 to a charity out of the ten possible charity choices (*e.g.*, American Red Cross, NPR).

Similar to a recent study of creativity on an online marketplace for work, participants were asked to complete the Guilford's Alternative Uses Task [32]. The task required them to generate as many unusual uses as possible for a common object (in this study, a quarter), using the same instruction as [32]. Our participants were required to enter in 5 responses, but had the option of entering up to 10.

Finally, participants were asked to report their reasons for choosing the reward, their reasons for participating in an online marketplace for work, and their attitudes toward risk.

To be on par with US minimum wage, we priced the survey portion of the study to be $1 (the survey took on average 8 minutes). The challenge with selecting the second study price is to pick one that would lead to some variation in decision; we do not want to offer too much so that all or none of the workers participate. Thus we chose it to be one-fourth of the $1 offered, $0.25 (the second part also took less time). The choice of the lottery odds (1:100) is two folds. One, to make it a large enough contrast with the fixed award ($25 vs. $0.25). Two, to make it easy for people to compute the expected value and see that it is the same as the fixed reward (we also told them this explicitly).

Experiment 1 Design



Experiment 2 Design

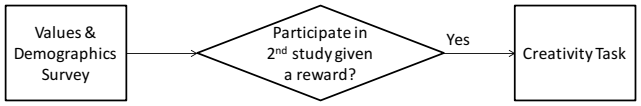


Figure 3. Experiment flow. (1) Experiment 1: after deciding to participate, participants chose between lottery and fixed or charity and fixed. (2) Experiment 2: participants were offered 1 of 7 rewards to participate in the second task; no incentive baseline and 6 incentive conditions (3 types x 2 levels).

There are a few things to note in this experimental design. First, having the participants choose the incentive after an initial survey (as opposed to doing that immediately for the study) allowed us to collect data on those who did not opt into the second task. This gave us a better baseline comparison of non-response bias to the second task. Second, this design is different from prior survey-incentive studies where participants were offered a single reward and decided whether or not to participate. Our "baseline" is the fixed reward and the participants decided between two rewards. We chose our design as it separated the decisions of "whether or not to participate" with "which reward to participate with," which enabled us to focus directly on incentive preferences. But we do test the true no incentives baseline in Experiment 2. Third, we chose to conduct our study on Mechanical Turk as how to effectively incentivize crowdwork is an active area of research [*e.g.*,1]. Our findings would allow us to directly contribute to current practices in this context. Further, research has shown that Mechanical Turk is as diverse as other stand subject pools and is being used as subject pools for many experiments [4,10], hence we also believe that our findings on incentive decision processes can be extended to other contexts. We will revisit this issue in the limitations section of this paper.

Participants

Participation was restricted to Mechanical Turk workers based in the US with an approval rate higher than 90% and have completed more than 50 tasks on MTurk. This was to ensure English proficiency and task compliance.

For our final analyses, we had 190 participants. 228 people started the study, 10 dropped out of the first task. Of the 218 who completed the first task, 28 failed consistency checks that we had incorporated into the survey (e.g., "If you are reading this question, please select 6 as the response"). Of the 190 left, 12 chose not to participate in the optional second task (before seeing the award options) and 10 chose not to participate after seeing the award options (without selecting a reward). Of those who chose to participate in the second task, 3 did not complete the task (1 in the lottery condition, and 2 in the donation condition). Data from the remaining 165 who completed the brainstorming task was used for our analyses.

62% of our participants were female. Participants' mean age is 37. The majority of them had an annual income less than $35,000 (61%), was Caucasian (71.6%), and had a college or advanced degree (55%). These demographics are comparable to prior study samples of experiments conducted on Mechanical Turk [1].

Measures

For the first hypothesis on risks, we used a risk-aversion measure (the domain-specific risk-attitude scale [48]) in the post-study survey. We used two items from the gambling and one item from the investment subscales (α=0.74). The reported α, or the Cronbach's alpha, is a standard measure of internal consistency reliability.

To assess values, we use the Portrait Value Questionnaire (PVQ) developed by Schwartz [39]. Participants were asked to fill out all 10 value dimensions with 21 questions, but for our analyses, we focus on the values of self-direction (2 items: α=0.48), stimulation (2 items: α=0.81), and the higher level values of openness-to-change (4 items: α=0.69), self-transcendence (5 items: α=0.77), self-enhancement (4 items: α=0.83), conservatism (6 items: α=0.71). Note that while the individual values' alpha reliability are not very high, Schwartz does argue that this is reasonable due to the different aspects of the values the sub-items are intended to represent different conceptual components [39]. As recommended by Schwartz, for analyses, we normalized the ratings by individuals' average across the 21 items. In other words, we took the difference between each rating and the 21-item average, we then calculated the value scores from these normalized scores.

To examine the quality difference in the creativity task, we coded the ideas for quarter use given by the participants into 132 distinct categories. Adapting the procedure used in [13], three independent reviewers evaluated the quality of each idea in terms of its originality and feasibility using a 5-point Likert scale. The coders were able to reach a high agreement for originality (α=0.80) and feasibility (α=0.73). We then calculated the average score for each idea for both dimensions, and then calculated the average originality and feasibility of ideas generated per individual participant.

In addition, we wanted to explore the diversity of ideas given by participants, such that multiple ideas for similar use from a single participant are discounted. To do this, we grouped the ideas into 13 distinct thematic areas covering ideas about different conceptual uses of the quarter (*e.g.,* as a jewelry piece or a music instrument). We then counted how many of these distinct thematic areas were covered by the ideas generated by each participant.

Finally, we analyzed participants' open-ended response for why they chose their reward over the other option available. Based on the similarity between the free text responses we devised a coding with 18 separate categories grouped into 6 thematic areas. Two reviewers independently assigned the categories to the comments. After this initial coding, any categorization discrepancies were discussed and subsequently resolved between the reviewers.

Analyses

For our analyses, we split our dataset into the lottery condition and the charity condition. To explore the research questions and to test our hypotheses H1-H3, we first conducted a series of t-tests, comparing the differences between the two groups of participants within each incentive pairs (lottery and fixed; donation and fixed). We also built two separate logistic regression models predicting the decision (choosing lottery over fixed payment and choosing donation over fixed payment), focusing on the values, openness-to-change value (H2), and self-transcendence value (H3), as the primary independent variables. We included general demographics as control variables: gender, age, education level, and income level.

While their results are similar, we report both the t-test and the regression results in this paper as they answer different questions. The t-tests show if there "are there differences between groups" whereas the logistic regressions show "what, and how strong are the influencers in the decision."

To examine difference in task outcomes, we analyzed the

Lottery or Fixed Payment			**Charity or Fixed Payment**		
	Lottery Mean (sd)	**Fixed Pay** Mean (sd)		**Charity** Mean (sd)	**Fixed Pay** Mean (sd)
Risk-Seeking (H1) ***	1.99 (0.71)	1.48 (0.41)	Risk-Seeking	1.61 (0.56)	1.71 (0.75)
Openness-to-change (H2) *	0.35 (0.79)	-0.05 (0.68)	Openness-to-change	0.18 (0.73)	0.14 (0.69)
Self-Trans	0.64 (0.49)	0.77 (0.73)	Self-Trans (H3) ***	1.06 (0.56)	0.44 (0.77)
Self-Enhancement	-0.80 (0.75)	-0.54 (0.73)	Self-Enhancement ***	-0.96 (0.78)	-0.27 (0.77)
Conservatism	-0.14 (0.79)	-0.10 (0.73)	Conservatism	0.01 (0.84)	-0.22 (0.73)
Hedonism	-0.26 (0.89)	-0.45 (1.12)	Hedonism ***	-1.10 (0.99)	-0.23 (1.08)
Age	37.1 (10.9)	38.8 (14.1)	Age *	42.2 (11.0)	34.4 (10.3)
Gender (Female)	0.68 (0.47)	0.68 (0.47)	Gender (Female) *	0.79 (0.41)	0.53 (0.50)
Income Level (1-8)	2.71 (1.88)	2.66 (1.90)	Income Level (1-8)	2.34 (1.31)	2.36 (1.68)
Ideas Generated (H2a) *	6.53 (1.94)	5.70 (1.44)	Ideas Generated	6.37 (2.06)	6.13 (1.68)
Categories of Ideas *	4.61 (1.23)	4.02 (1.10)	Categories of Ideas	4.00 (1.50)	4.35 (1.08)
Avg. Originality **	2.90 (0.37)	2.63 (0.43)	Avg. Originality	2.74 (0.49)	2.72 (0.42)
Avg. Feasibility	4.14 (0.38)	4.31 (0.43)	Avg. Feasibility	4.30 (0.40)	4.31 (0.43)

*** P<0.001, ** p<0.01, * p<0.05

Table 1. Mean and t-test results for sample and task performance between conditions (Experiment 1).

	Select Lottery			Select Donation
	Model 1 Exp(B)	Model 2 Exp(B)	Model 3 Exp(B)	Exp(B)
Risk-Seeking (H1)	8.26**			
Open.-to-chan (H2)	1.78	2.30*		1.16
Self-Direction			1.20	
Stimulation			1.75*	
Self-Trans. (H3)	1.09	0.78	0.80	2.99**
Age	0.98	1.00	1.00	1.06*
Gender (Female)	1.31	1.35	1.37	2.41

** P<0.01, * p<=0.05, † p<=0.10

Table 2. Factors predicting reward-selection decision.

free choice effort and quality. For the free choice effort, we used the number of ideas generated over the 5 required as the dependent variable. Since it is a count variable, a Poisson regression is used. The independent variables are the decision choice and the openness-to-change values of self-direction and stimulation. To evaluate the quality, we compared the average originality and feasibility ratings (as coded by the authors). We also compared the number of thematic categories of ideas generated.

Results

We separate our analyses into the two: on lottery/fixed and on charity/fixed. In the lottery condition, 36% (30 out of 83) chose the lottery reward over fixed pay. In the charity condition, 33% (27 out of 82) chose the charity reward.

Lottery

Comparing users through various measures between those who chose lottery instead of fixed pay, we noticed a couple of key differences (Table 1). First, participants who chose the lottery reported a higher risk-seeking rating (M=1.99 to M=1.48 in a 1-5 Likert scale, supporting H1). Furthermore, they were more strongly oriented towards the openness-to-change values (M=0.35 to M=-0.05), supporting H2. But there appeared not to be any demographic differences between the two groups.

To further examine these factors' predictive power on participants' decision, we focus on the logistic regression model (Table 2). Our analyses indicate that when risk-seeking attitude is used in the model, it is the primary predictor of the lottery selection decision (Model 1). For each unit increase in the risk-attitude rating, participants were 8.3 times more likely to choose the lottery reward. Once removed, openness-to-change becomes the significant predictor (Model 2). In post-hoc analyses, we used the two subscales of openness into the analyses (Model 3), showing that stimulation value is a significant predictor (p=0.02) while self-direction value is not (p=0.47). These results show that the openness-to-change values, specifically, stimulation, is related to risk-seeking (correlation: ρ=0.20). This is not too surprising as one of the PVQ questions for stimulation is specifically about risk: "She likes to take risks. She is always looking for adventures."

	Task Effort		
	Model 1 Exp(B)	Model 2 Exp(B)	Model 3 Exp(B)
Chose Lottery	2.06**		
Open.-to-change	1.23	1.49*	
Self-Direction			1.49**
Stimulation			1.08
Age	1.02†	1.01†	1.00
Gender (Female)	1.58	1.66†	1.59†

** P<0.01, * p<0.05, † p<0.10

Table 3. Factors predicting task effort for the Lottery/Fixed pay condition (H2a).

Related to our H2 about openness-to-change, we posit that because individuals who hold these values tend to be more creative and innovative, they would also be more interested in a creativity task (H2a). Testing their free choice efforts on tasks (how many ideas they generated over the 5 required), we found that compared to the fixed-pay, participants who chose the lottery generated more ideas. Specifically, those who chose the lottery rated ~2 times more additional ideas (M=1.53 to M=0.70, Table 3). These results support our hypothesis that those who chose the lottery reward put more effort into the creativity task (H1a). Further evaluation of the quality of the ideas revealed that the participants who chose lottery reward generated ideas that were more original (M=2.90 to M=2.63, p<0.01). They also generated a more diverse set of ideas in terms of thematic categories (M=4.61 to M=4.02, p=0.04). The feasibility difference was not significant, though in general it seems that the more unique ideas tend to be less feasible.

As an exploratory follow-up, we also tested separate models removing openness-to-change values and reward selection decision (Table 3). Results indicate that (1) self-direction but not stimulation more strongly predicts ideas generated and more importantly that (2) the reward selection mediates self-direction's effect on the numbers of ideas generated – that choosing the lottery mediates the effect of openness-to-change on the task effort (RQ2).

Our qualitative analyses of participants' explanations for their decisions also complement our quantitative analyses. 84% of the participants who preferred fixed payment gave reasons related to their general attitude towards gambling and low chances of winning. For example: *"rather cash than chance for nothing"* and *"Because I hate raffles"*. The participants who chose the lottery reward instead either discounted the smaller reward, and or thought their odds of winning were good. For example: *"I would rather take a chance on the $25 than .25 cents"* and *"the chances were good and it opens up another channel for money to come to*

me". 21% of those who chose lottery also mentioned specifically that they enjoyed gambling and taking risks.

Charity

The differences between those who chose the charity reward and the fixed payment are reported in Table 1. As hypothesized (H3), those who chose the charity reward held stronger self-transcendent values (M=1.06 to M=0.44).

Individuals who are older and female are also more likely to select the charity reward option. While we did not hypothesize it, there also appeared to be a difference in self-enhancement values across the two groups. Those who chose the fixed payment held stronger self-enhancement values. Perhaps the most direct explanation for this difference is that self-transcendence and self-enhancement are negatively correlated and conceptually reside on different ends of the dimension on self- versus other-oriented. Those who are other-oriented are more inclined towards donation, whereas those more self-oriented are not.

In the logistic regression model (Table 2), we found that, as hypothesized, self-transcendence does strongly predict charity reward selection. A unit increase in self-transcendence rating means 3 times more likely that an individual will choose the charity reward.

While we had not hypothesized any relationship between the charity reward selection and task performance, we did explore their relationships. Reward selection did not influence task performance. But like the lottery model, self-direction is a significant positive predictor of task performance. Again, signifying the link between this value and intrinsic interest in the task.

The participants who decided to donate the money to a charity gave reasons related to their attitude towards giving, charities or the cause in general (other-oriented). The most common single reason for donating was their willingness to help and be generous (38% of those donated). For example: "*It's good to give*." and "*Because the charity needs it*." On the other hand, those who selected fixed payment attributed it mostly to the importance of money to them and their immediate need for money (self-oriented). For example: "*Because I'm poor and would rather have the money!*" and "*Because I need every penny I can make right now*."

Discussion

In this experiment, we found that openness-to-change values and risk-seeking attitude predicted a preference towards the lottery reward over the fixed reward and that those who chose the lottery reward put more effort on the creativity task and gave more original ideas than those who chose the fixed reward. But more nuanced analyses showed that it is the stimulation value that influenced the reward choice, and that the self-direction value that predicted task effort. For the charity reward, the self-transcendent values predicted a preference towards it over the fixed reward.

One potential concern with our findings is that the task outcomes may be due to the different rewards having a differential effect on participation, and not the participation self-selection. For example, prior research has shown how offering money can undermine effort on task [11]. In our case, through additional analyses with values and the decision, we found that the openness-to-change values (specifically, self-direction) is a direct predictor of task effort, suggesting that at least part of the observed task effort differences can be attributed to the resulting difference in the participant composition.

EXPERIMENT 2

One of the main limitations of experiment 1 is that it pitched lottery or donation against the fixed payment. While this allowed us to show that people have a preference for certain rewards, it did not directly answer the research question: do people of certain types choose to participate because of the rewards offered.

Thus, for the second experiment, we use the similar setup as used in Experiment 1, but instead of asking participants to choose between two rewards, participants were offered one reward for the second task, and asked to decide whether or not to participate. Further, instead of just two conditions in Experiment 1, we had seven conditions: baseline no payment condition; \$0.05 fixed; \$0.25 fixed; \$5 lottery (1:100 chance of winning); \$25 lottery (1:100 chance of winning); \$0.05 donation; and \$0.25 donation. These conditions represented a true baseline of no rewards, and 6 reward conditions 3 types x 2 payment levels (Figure 3, bottom). The higher reward value (\$0.25) was chosen to match the incentive levels used in Experiment 1. The lower reward value was chosen to give a lower value comparison.

The same task is used, but instead of brainstorming creative ways to use a quarter, participants were asked to generate ideas for a brick (also used in [32]).

Participants

We used the same conditions to screen participants on Mechanical Turk. In addition, we also limited the experiment to those who have not participated in Experiment 1 (based on user id). In all, we had 927 who started our survey. 32 did not finish the first survey. Of those who finished, 48 failed our consistency checks. Of the 847 left, 30 failed our manipulation check (i.e., what reward they were offered for participating in the second task). Those that did not complete the first survey or failed our checks were removed from further analyses.

Of the 817 left and used for analyses, 385 opted not to participate in the second task with the randomly assigned incentive (47%). Those who opted out were asked to provide a reason. While their reasons varied, the majority of the comments were: "*I don't have time*" "*the pay is too low*", and "*I am not good at brainstorming*."

Of those who continued, 40 did not complete the brainstorming task after clicking on the continue button

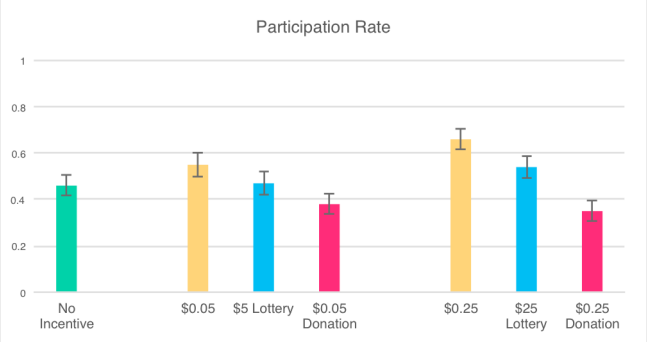


Figure 4. Experiment 2 participation rate across conditions.

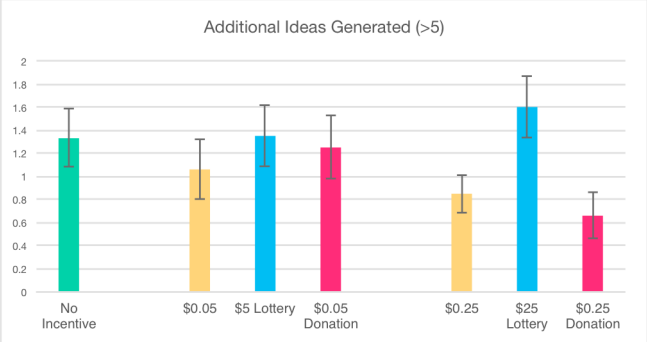


Figure 5. Experiment 2 additional ideas generated across conditions.

(9% of those who started). Consistent with Experiment 1, we coded these participants as *not* participating in the second task. In other words, our outcome measure used in the analyses was not whether participants said they would continue, but rather if they did.

60% of our participants were female; mean age was 35. About a third of them had an annual household income of less than $35,000 (35%)[1], was Caucasian (76.2%), and had a college or advanced degree (54%). These demographics closely resemble participants from Experiment 1.

Measures

The same measures used in Experiment 1 were used in Experiment 2. The reliability of these measures were comparable to Experiment 1: risk-aversion (α=0.68); self-direction (2 items: α=0.48), stimulation (2 items: α=0.79), openness-to-change (4 items: α=0.71), and self-transcendence (5 items: α=0.74). Our coding of ideas for brick use resulted in 329 distinct categories. The three independent reviewers evaluated the quality of each idea in terms of its originality (α=0.69) and feasibility (α=0.67).

Results

First, we examined the participation rate per condition (Figure 3). While our focus is not on the impact of incentives on attracting participants, the result supports prior findings: money is the most effective at attracting participants, then lottery, and then donation. Compared to the baseline no incentive condition, the donation conditions actually had a lower participation rate. Further, while the higher fixed and lottery incentives had the general effect increasing participation rate, the charity rewards did not.

Incentives and Participation Decision

In this section, we focus on RQ1 to see if the different incentives attract different participants. In other words, if there is a participation bias when the incentives are used.

Because we posed the risk-attitude question at the end of the creativity task, we were not able to include that measure in a logistic regression analysis comparing the group who participated in the creativity task against those who did not. As an alternative test, we compared the self-reported risk-seeking level across the incentive types through an ANOVA. There was no significance difference across conditions (H1 not supported). One possible explanation for the difference between our two experiments, as we will discuss later, is that the contrast between lottery and fixed in experiment 1 may have led to a stronger emphasis on the risk part of the incentive.

To test the relationships between values and participation decision (H2 and H3), we built 4 separate logistic regression models for each of the incentive types (combining the 2 price levels of incentives together). The decision to continue (yes/no) was the dependent variable. We used the same set of variables for the independent and control variables in Experiment 1. In addition, we included the reward level as an independent variable.

The results support both our hypotheses and replicates findings from Experiment 1 (H2 & H3). Openness-to-change values positively predicts participation in a task when the reward is a lottery, while self-transcendence values positively predicts participation when the reward is a charity reward (Table 4). Further, as visible in Figure 3, offering the higher valued reward was effective in Fixed, but not in the Charity condition.

Through additional post-hoc analyses, we found that when we using the lower-level values of self-direction and stimulation values directly, the stimulation value was not a significant predictor (while it was in Experiment 1). This, we believe, may further support the finding that the emphasis on risk was weaker in this experiment.

Also to note is that openness-to-change had about the same effect in the no pay condition as the lottery condition in attracting participation. This is likely due to the fact that the task is on creativity and brainstorming. Participants, when not offered rewards, may have self-selected into the task because they were intrinsically interested in the task.

[1] We changed this measure from *individual* to *household* income between Experiments, thus the "higher" value here.

	No Pay Exp(B)	Fixed Exp(B)	Lottery Exp(B)	Donate Exp(B)
Open-to-chan. (H2)	1.58*	1.32	1.40†	1.04
Self-trans. (H3)	1.34	1.32	1.12	1.68*
High Reward $0.25		1.88*	1.34	0.94
Age	1.00	1.04**	1.02	1.03*
Gender (Female)	1.73	1.81†	1.38	1.05

** P<0.01, * p<0.05, † p<0.10

Table 4. Factors predicting participation decision.

Incentives and Task Outcomes

Next, we focus on how participation bias may impact task outcomes (H2a & H2b). Figure 4 shows the mean ideas generated per condition beyond the initial 5 required.

For this analyses, we again used a Poisson regression for the count variable. Because we did not have a full factorial (the no incentive model only had one value, $0), we instead coded the incentive condition into 7 groups, comparing against the baseline no incentive.

The results support H2a at the high value level. For these higher value rewards ($0.25, $25 lottery and $0.25 donation), the fixed and donation were significantly lower than the baseline. The lottery condition generated 1.2 times more additional ideas than those in the baseline condition (but this relationship was not significant in our model, p=0.18), while participants in the fixed and donation generated 0.63 times (p<0.01) and 0.50 times (p<0.01) as many additional ideas than the baseline no incentive condition (Table 5). Again, self-direction seems to be a stronger predictor of ideas generated, although stimulation was also a positive predictor in this Experiment. Also, similar to Experiment 1, the older the participants were, the more ideas they generated.

Results for the low reward levels ($0.05, $5 lottery and $0.05 donation) were not significantly different from the no incentive condition. This suggests that when the value of the incentives were low, their impact were weak. Both the participation rate and the subsequent outcomes were not significantly different across these low reward conditions.

Contrary to experiment 1; however, neither the originality score nor the feasibility score were significantly different across conditions (H2b not supported). The lottery incentives conditions had the highest average originality (M=2.17) to the baseline no pay's (M=2.10), but the difference was small and non-significant. It is hard to speculate on the reason for the null result here, but it is important to note that the observed originality score difference in Experiment 1 was also not large (0.30 difference on a 5 pt. rating).

DISCUSSION

Existing research has largely focused on using incentives as a way to encourage *more* participation. But we hypothesized and found that offering incentives can also impact *who* participates. Specifically, we found that risk-seeking, and values of openness-to-change, are likely to encourage the participation decision under a lottery reward; and that values of self-transcendence are likely to influence participation decision under a charity reward (H1, H2, H3).

	Task Effort		
	Model 1 Exp(B)	Model 2 Exp(B)	Model 3 Exp(B)
$0.05	0.78		
Lottery $5	1.02		
Donate $0.05	0.98		
$0.25	0.63**		
Lottery $25	1.23		
Donate $0.25	0.50**		
Open.-to-change		1.27**	
Self-Direction			1.12*
Stimulation			1.29*
Age	1.01**	1.01**	1.01**
Gender (Female)	1.08	1.05	1.06

** P<0.01, * p<0.05, † p<0.10

Table 5. Factors predicting task effort (H2a) where baseline contrast is the no incentive condition.

Our results show that this participation bias due to incentives is critical to consider. The observed effects were not small. Participants holding certain values were 1.5 to 3 times more likely to participate in the task given the appropriate incentives. Further, those self-selected, self-directed participants generated 1.2-1.5 times more additional ideas in a brainstorming task. The overall task result quality was also higher in Experiment 1 (though not different in Experiment 2). While offering money was most effective in getting participation, our result show that different rewards could attract a larger group of individuals who are more intrinsically interested in the task. In a system or a large crowdsource context, they can have a big impact on the composition of participants and the task outcome (20+ additional ideas in a crowd of 100). The same point also goes to the use of the charity reward. While this type of reward was a lot less useful in getting more participants, it could still be very impactful in attracting a specific set of individuals who value benevolence and universalism. These individuals have been shown to serve particular roles in certain systems, such as helping out newcomers [25].

For the rest of this section, we will discuss more nuanced implications of our work.

Incentives and Participation Decisions

One way to discuss the findings regarding incentive and participation bias is through a formal model, such as one presented by Bénebou and Tirole for modeling the impact of incentives on (prosocial) behaviors [3].

$$(v_a)a + (v_y y)a - C(a)$$

In their model, a denotes participating level for an activity, which in our case is discreet (to participate or not). v_a represents an individuals' intrinsic valuation of the activity; v_y represents her valuation of the incentive amount, and y the amount. $C(a)$ is the cost for participating in the activity. The basic intuition is that the more an individual values the activity and/or the reward, the more likely she will participate because the activity will be more valuable than the cost of participating, $C(a)$.

Our empirical findings support this general model. In the baseline condition (y=0), we found that openness-to-change had a positive effect on participation decision. When no incentives are offered, people who decided to participate value the task (*e.g.*, high v_a, or those who are intrinsically motivated). This was also suggested in [17]. Then, when the incentive rate is low (y=$0.05), the incentives attracted some participants who value the rewards, but their effects were not strong and the differences were not significant. Then, at the high incentive level (y=$0.25), the incentives became a key force in driving the participation decision. This is where we observed the biggest differences across conditions.

But this model also highlights our concern that prior work overlooks the differences across incentive types and treat them all as interchangeable tools to increase participation rate. This model does not account for differences in people's valuation of *different types* of incentives. In other words, there is no way to account for different v_y for different incentives. And as we have found, while increasing the financial incentive from $0.05 to $0.25 increased participation rate, the same $0.20 increase for charity reward did not affect participation. Related experiment has also shown that when using candies as incentives, offering more candies did not influence task performance [20]. A modification to their model to account for this is to change $v_y y$, to $v_i i$ to highlight differences in individuals' valuation of the rate, given there are different types of incentives, i.

$$(v_a)a + (v_i i)a - C(a)$$

Further, to accommodate the different kinds of positive incentives used concurrently, including the intrinsic reward from performing the action, a summation can be used where I denotes all the different incentives offered.

$$\sum_{i \in I} V_i(a, i) - C(a)$$

Another point to discuss about incentives and participation decision is the relationship between risk-attitude and participation when lottery reward is offered. It seems that risk-attitude, like values, can add to one's valuation of the lottery incentive. However, we found that while it was a factor in participation decision in Experiment 1, it was not in experiment 2. One explanation is that participants in the first experiment chose between a lottery or a fixed reward, whereas in the second experiment, they chose between participating with the lottery reward or not. Research has shown that offering alternatives does influence decision making; they focus on tradeoff contrasts [43]. Contrasting with a guaranteed pay, the potential for "loss" was made more salient in Experiment 1.

We should also briefly talk about incentives and participation bias in terms of general demographics. We did not find any consistent demographic differences across incentive conditions. We found that individuals who chose a charity reward over a fixed tended to be older in the first experiment, but that was not replicated in the second experiment. While prior work seems to agree that age does positively correlate with charitable giving, the relationship between general demographics and giving is complex [19]. Controlling for many other variables, some of these differences may no longer be discernible [6]. Further, we should point out with lottery, prior work actually suggest that it would have a stronger effect on women than men [15], but we did not find a significant difference.

Values, Incentives & Creativity

Another contribution of this work is the insights we add to our understanding of personal values and their relationships with incentives and creativity.

Despite the number of personality characteristics to explore, we chose to focus on a motivational construct, values, which has been shown to influence our behaviors in many different contexts [41]. We argue that to examine responses to different motivators, it makes sense to examine individuals' motivations – and values offer a way to categorize the different types of motivations. And indeed, our findings do demonstrate that these value dimensions can help us understand preference towards certain rewards.

But with the lottery reward, the effects of values may be more nuanced. Our analyses indicate that it is the stimulation sub-dimension of openness-to-change that predicts interests in the lottery (especially when risk is highlighted). This is the value that is associated with risks and seeking variety and challenges in life. But the main predictor between value and the creativity task performance is self-direction, the other half of openness-to-change. This is the value associated with individuals who care about independent thought, freedom of choice, and exploration. Our analyses also attempt to address the concern that it was the different incentives that (directly) caused the difference in task outcomes. In our model we see that these values predicted free choice effort, indicating that these values signal intrinsic interests in the creativity task.

Incentivizing for Diversity

From a practical side, our results also hold important implications for using incentives to improve diversity.

In many contexts, the goal of attracting more participants may be to maximize a certain output, and our results show that using the right incentives can help the designers to

target those goals more effectively (*e.g.*, lottery reward to get more ideas generated). But in some contexts, having diversity is more critical. For example, from a community design perspective, having a more diverse group of people may ensure more perspectives being presented while maximizing the different skills and resources that individuals bring. This would minimize problems such as filter bubble [35] and at the same time maximizing benefits such as fostering innovations [13].

While prior research has explored strategies to help attract more newcomers and participants, our finding suggests that offering *any single* reward may lead to a more homogenous sample. Money, lottery rewards, or donation incentives, when used individually, will attract a subset of participants who are drawn to those rewards, making the resulting participants more similar in some dimensions (as depicted in Figure 1). This suggests that there may not be any single incentive that can be used to ensure a diverse system. Simply not offering anything is also not a solution, as not offering any incentives may also only attract a certain type of individuals (*e.g.*, those who value the task intrinsically and/or incur low costs from participation). As Thaler and Sunstein points out, the default is also a design [45].

A potential solution is to design systems that allow participants the option to choose from different rewards to increase participation, which may help attract participants from different strata of the population. But another, potentially more effective approach, is to tailor the incentives to the individuals. Our research contributes to this idea of incentive tailoring by pointing out critical links between individuals and the reward they prefer (*e.g.*, lottery and openness-to-change, and charity and self-transcendence). With a better understanding of people's preference towards the different rewards, we may be able to attract different types of individuals through incentives.

LIMITATIONS AND FUTURE DIRECTIONS

Studying incentives and motivations on Mechanical Turk has its limitations. We did this because, one, testing their effects in this setting supports the ecological validity of our work as our results may be directly applied back to Mechanical Turk. Two, our focus is on basic human judgment and decision processes. Mechanical Turk offers us access to just as diverse, if not more, group of subjects than other subject pools [4,10]. It is certainly true that Mechanical Turk, by design, also attracts a certain types of users. However, that might further strengthen our general claims about incentives and selection bias since with a more diverse group of participants, there may be more pronounced differences between those who chose to participate versus those who do not. Nonetheless, more research is needed to examine these participation biases in different contexts, using types of tasks and types and levels of incentives.

CONCLUSION

In this paper we explore the influence of incentives on participation bias. While existing research has largely focused on using incentives as a way to encourage more participation, we demonstrate that the choice of incentives may also introduce a bias to the demographics of attracted participants. Furthermore, because the incentives can affect the composition of people who choose to participate, it can also result in differences in task outcomes.

Our results offer many important insights for incentivizing participation, but also highlights the critical need for a better understanding of incentives and participation. We hope that our findings will advance research in this area and lead to more informed and effective use of incentives.

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