

A Study about Designing Reward for Gamified Crowdsourcing System

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Abstract. The goal of this study is to understand the mechanism of gamification in crowdsourcing by investigating the ways of giving rewards. Perceived reward diversity is proposed as a construct to induce fun experience from participants based on previous studies about gamified crowdsourcing. With respect to system manipulation, explicating the anticipated level of rewards before task phase is conducted. The effect of explication on task outcome and psychological outcome is compared with control group. As a result, both perceived reward diversity and explicating the anticipated level of rewards significantly affect both quality and quantity of submitted answers, as well as feeling of fun during the task phase. The limitation and implication of the study is stated in the end.

Keywords: gamification, crowdsourcing, reward, perceived diversity, fun experience.

1 Introduction

While both academia and industry have struggled to find ways to engage users, customers or participants, they pay considerable amounts of money and time voluntarily, playing games. This has led to the birth of a research area called "gamification", indicating a line of studies in which adapting "game-design elements in non-gaming contexts" (Deterding, Sicart, Nacke, O'Har, and Dixon, 2011) in order to encourage a greater sense of engagement and promote higher productivity among the targeted people. Incorporating game metaphors, social competitions and a reputation system, or designing an effective reward system are thought to be the most representative applications of gamification (Deterding, Dixon, Khaled, and Nacke, 2011). What distinguishes gamification from existing studies about human motivation is that gamification places emphasis on the fun to be engendered at the end of any task (Koster, 2004). Crowdsourcing is one of the major fields in which gamification has been applied thus far. Indeed, most gamification research has been conducted in the crowdsourcing context (Hamari, J. Koivisto, H. Sarsa, 2014). With the growing industrial impact of crowdsourcing, the use of gamification to motivate voluntary participants in crowdsourcing has also become more important.

Previous studies, however, have tended to adopt practical approaches rather than academic perspectives to gamification, thus lacking the associations between empirical results and theories. Given its rather short history, gamification research largely consists of case studies. Diverse applications and cases of gamification are accumulating, but whether the results can be applied in other contexts than those described in the pertinent literature needs to be questioned. In sum, further research on gamification is required to identify theoretical constructs by drawing on existing research findings. A theoretical construct allows general implications to be drawn at the level of theory, thereby increasing the possibility of being able to adapt the research results (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). Additionally, the concept of fun needs to be explained in gamification research. Drawing on the Stimulus-Organism-Response (SOR) framework (Mehrabian and Russell, 1974), more studies explicating the organism of gamification those results in fun (response in the SOR framework) should be conducted. Most of the studies undertaken thus far have used the stimulus (game-like features)-response (fun) framework.

In this study, the goal is to understand the mechanism of gamification in crowdsourcing by investigating rewards. The setting of our research is the crowdsourcing platform for application ideas about information and communication technologies. The principal research questions are as follows: 1) What constructs can be found from previous research that can be applied to gamified crowdsourcing? And through what organism do the constructs have resulted in generate feelings of fun as a response? 2) How can the system support produce an increase in feelings of fun in the process? This study is organized as follows. In the following section, the existing literature about crowdsourcing and gamification is reviewed in order to identify the theoretical constructs. Then, hypotheses are addressed based on the findings of the reviews. The descriptions of experimental settings to test the hypotheses are illustrated in the following, and the results of the experiments are also reported. In the last section, we discuss the implications and limitations of the study, and present future plans for follow-up research.

2 Related Works

2.1 Reward in Online Crowdsourcing

Crowdsourcing is currently positioning itself as a possible means of scouting for innovative solutions to companies' problems (Poetz and Schreier, 2012), or of shortening the work time required for simple cognitive tasks (Ross, Irani, Silberman, Zaldivar and Tomlinson, 2010). However, quality assurance of the work outcome has been a weakness of crowdsourcing methodology due to its open participation model (Oleson, Sorokin, Laughlin, Hester, Le and Biewald, 2011). Although no significant differences have been observed in the performance of participants between crowdsourcing and in-house offline experiments with regard to simple cognitive function tasks (Komarov, Reinecke and Gajos, 2013), the crowdsourcing method inherently relies on voluntary participation and bottom-up governance; thus it is unable to produce stable, quality outcomes over multiple instances.

Previous studies have looked at how to encourage participants in crowdsourcing not only to participate but also to endeavor to produce work of good quality by rewarding them after completing given tasks (Horton and Chilton, 2010; Oleson, Sorokin, Laughlin, Hester, Le and Biewald, 2011). Some studies have approached the problem with greater emphasis on the crowdsourcing platform and service design than on a way of rewarding few participations (Leimeister, Huber, Bretschneider and Krcmar, 2009; Zheng, Li and Hou, 2011).

In this study, the authors aimed to understand the gamified application of rewards in the crowdsourcing context. We targeted to crowdsource specifically applications ideas about information and communication technologies. Drawing on previous studies about similar types of crowdsourcing tasks (Leimeister, Huber, Bretschneider and Krcmar, 2009), the following measures were determined as our dependent variables: the creativity of a submitted idea as a measure of the quality of a crowdsourcing outcome, the number of letters used for each idea as a measure of the efforts invested, and, lastly, the feeling of fun during a given task.

2.2 Gamification

Gamification can be applied to many fields that basically require human labor (Deterding, Dixon, Khaled, and Nacke, 2011). It distinguishes itself from other motivational research by aiming to induce 'fun' as a target state (Koster, 2004). Thus far, gamification studies have identified numerous application or visual representation methods of reward (Amory, Naicker, Vincent and Adams, 1999; Röber, Huber, Hartmann, Feustel and Masuch, 2006; Zichermann and Cunningham, 2011). Yet, despite rocketing interest in the subject, many Gamification research especially about rewards are case studies that report the results of applying the gamification method to specific conditions, and consequently lack any practical impact in other contexts. Thus, theoretical discourse about the methodology is required to come up with generalizable findings.

Identifying different motivational effects by rewarding is one common means of approaching gamification from an academic perspective. Regardless of the application or visual representation of rewards, they induce intrinsic or extrinsic motivation (or both) in people (Boudreau and Lakhani, 2009). The term 'extrinsic rewards' largely refers to monetary compensations or other equivalent perks. Examples of 'intrinsic rewards' are self-satisfaction or social recognition, which are mostly psychological outcomes. The classification, however, is not very effective in predicting the exact outcome when applied in real world settings, since intrinsic and extrinsic motivations are sometimes mixed or change over time (Vallerand, 1997). Motivations also vary depending on how much effort given tasks require of the targeted people (Pearce, 1983).

Other than the above-mentioned aspect, the definition of 'fun' is still lacking in gamification research despite the fact that the goal is to engender a state of fun. The concept itself is broad and vague, but an operational definition of fun according to each individual research context is essential in order to further discussions deriving from the research. Several studies have taken the initiative in defining 'fun

experience' within their specific context (Federoff, 2002; Mueller, Agamanolis and Picard, 2003). While in economics, the strength of anticipatory feelings is known to affect the decision making process (Caplin and Leahy, 2001). Drawing on previous findings, the authors assumed that fun experience would accrue from the state of tension created by the perception of diversity about future outcomes in the context of a task and reward situation, but on the premise that no physical threat is posed. This suggested construct is not included in Hoonhout's identification for 7 constructs related to fun experience (2002).

In sum, the study suggests the perception of reward diversity as a major theoretical construct in order to incur feelings of fun. Additionally, we assumed that the expression of an anticipated reward level would have an interaction effect with the perception of reward diversity, based on cognitive dissonance theory (Festinger, 1962). Since the concept can be manipulated on the system side, it can provide practical implications from the perspective of human-computer interaction.

3 Hypothesis

Explicitly expressing feelings or certain states is found to strengthen the feelings or memory of those states (March, 1987). Also, several studies have found that people try to abide by what they have previously said so as to reduce cognitive dissonance (Festinger, 1962; Greenwald and Ronis, 1978). Drawing on the cognitive dissonance theory, it can be assumed that if the participants in crowdsourcing explicitly express the anticipated rewards before the task phase, they will put more effort into carrying out the tasks in order to reduce the gap between the anticipated reward as previously stated and the actual quality of their work. This will lead to an overall improvement in the quality of crowd-sourced works. At the same time, the perceived level of engagement will also increase compared to that of the control group as more effort will have been invested in a similarly limited time frame, resulting in fun experience. In sum, the authors advanced the following hypotheses:

H1-2. Expression of the expected reward prior to carrying out a given task will produce a higher level of fun experience than if no such expression occurs.

H1-2. Expression of the expected reward prior to carrying out a given task will lead to greater effort on the part of the participants in that task.

H1-3. Expression of the expected reward prior to carrying out a given task will lead to more creative outcomes from the participants.

People tend to experience fun in doing a task when the task is challenging and engenders curiosity (Malone, 1982), both suggest that the outcome of certain task is not decided. As to rewarding in closed organizations such as companies, it exhibits a greater effect on employees' motivation when the amount of incentive is determined in conjunction with their level of achievement (Banker, Lee, Potter and Srinivasan, 1996; Lavy, 2007). In a similar sense, the participants in crowdsourcing will be

engaged more when there is an open chance of greater reward dependent upon the quality of their work. Therefore, we hypothesized as follows:

H2-1. The higher the level of diversity perception, the higher the level of fun experience will the participants feel.

H2-2. The higher the level of diversity perception, the greater the participants' efforts in performing a given task will be.

H2-3. The higher the level of diversity perception, the more creative the outcomes produced by the participants will be.

Participants' expectations concerning the reward will be greater when the amount of reward is associated with the quality of the crowdsourced work. When the reward is fixed at a certain amount, participants can only imagine one situation, namely, that of oneself being rewarded. However, if the amount is variable, participants' diversity about the reward will be greater. Therefore, it may be assumed that expressing the anticipated level of reward and perceived diversity about the reward will produce an interaction effect towards dependent variables. The authors speculated that this interaction effect will have an impact on the psychological outcome in particular, i.e. the feeling of fun during the task phase. The pertinent hypotheses are as follows:

H3-1. The diversity perception and explication of anticipated reward will have interaction effect on the level of fun experience.

H3-2. The diversity perception and explication of anticipated reward will have interaction effect on the participants' efforts in performing a given task.

H3-3. The diversity perception and explication of anticipated reward will have interaction effect on the creativity of outcomes produced by the participants

4 Method

The 2 by 2 factorial experiment design was adapted for the purposes of this study. To eliminate the learning effect from the results of the experiment, we conducted a between-subject study.

4.1 Measurement Development

Measurement items for the construct, feeling of fun, are adapted from previous studies and operationally defined to fit our research context. In order to reduce the measurement error, at least 2 items for each construct were measured. Answer quality was measured by 2 IT experts based on Consensual Assessment Technique (Amabile, 1982). The number of letters used to answer the task was measured as answer quantity.

4.2 Participants

The participants were recruited from diverse online communities. To reduce the newness effect, only people who were already familiar with the concept of crowdsourcing were encouraged to participate. The authors paid particular attention to the distribution of the recruitment sources, in order that the results would not be biased towards a certain character from among the members of a certain community. Aside from the reward originally promised in the experiment, an additional reward of \$5 was given to each participant once they had completed the web experiment. A total of 70 people participated in the experiments after excluding 11 redundant participations from the 81 ideas submitted. The distribution of participants for each condition set is as given below. Redundant participations were removed from the analysis because the learning effect could have affected the participants and ruined the reliability of the results. The distribution of participants for each condition is as below.

Explic- it_cont*Fixed	Explic- it_cont*Diverse	Explic- it*Fixed	Explicit* Diverse	Total
17	18	18	17	70

4.3 Stimuli

The prototype pages of a crowdsourcing site, named “Imagine Tech”, was set up and provided to the participants. A total of 3 pages, i.e. the main page, reward policy page, and task page, were presented in the experiment to help the participants to imagine their using the actual website. Manipulation check between diversity and anticipatory feelings was conducted prior to the experiment.

4.4 Procedure

Web-based experiments were conducted to reproduce the same participation context as in online crowdsourcing websites.

Once they had decided to participate and clicked the given link, the participants were first introduced to the introduction of the experiment and then the prototype page of the crowdsourcing website, named “Imagine Tech”. By being encouraged to observe the prototype page for more than 5 minutes, the participants had an opportunity to fully understand the focus and aim of the website. After learning about the crowdsourcing service, the participants had time to read through the reward policy of the site. Both the main page and the reward policy page contained confirmation questions designed to make sure that the participants did not pass the page without understanding the given pages. Then the participants were given the task of suggesting an idea for a certain communication technology, without any time limit. There was no limitation on the maximum number of total letters, but a minimum limit of 300 letters was recommended. Next, the participants were asked to evaluate how much fun they experienced during the task phase. Demographic information was asked at the end of the experiment.

5 Result

PSAW statistics 18 is used to conduct the analysis for testing the hypothesis.

5.1 Hypothesis Testing

To examine hypotheses, we conducted two-way ANOVA test. The results are presented in Table 1.

Table 1. ANOVA results for hypothesis testing

	df	Answer Quality		Answer Quantity		Fun	
		F-value	p	F-value	p	F-value	p
EXP	1	60.95**	.000	18.71**	.000	52.24	.000**
DVST	1	25.38**	.000	26.70**	.000	18.57	.000**
EXP*DVST	1	2.59	.112	4.55*	.037	1.69	.198

EXP: Expression; DVST: Perceived Diversity (*p<=0.05 **p<0.01).

The result shows that hypotheses 1-1 through 2-3 are supported, but the interaction effect between independent variables is only significant to Answer Quantity (F=7.16, p<0.01). The average means for each condition is described in Table 2.

Table 2. Average Means for experiment conditions

	Explicit		Diversity	
	Control	Explicit	Control	Multiple
Answer Quality	2.86	4.51	3.15	4.21
Answer Quantity	342	446	332	456
Fun Experience	2.96	5.02	3.34	4.60

For hypothesis 3-2, the interaction effect between 2 independent variables is shown in Figure 1.

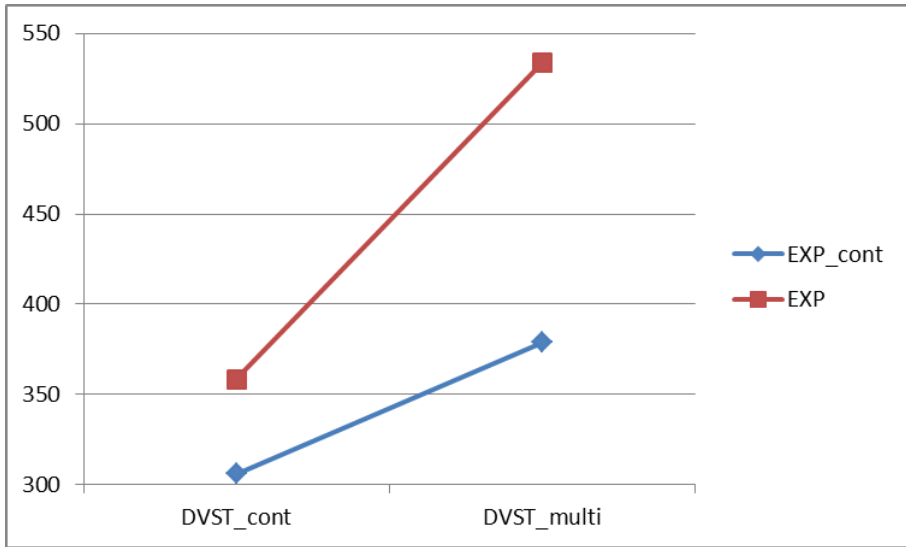


Fig. 1. Interaction effect between independent variables on answer quantity

6 Discussion

Drawing on the analysis of results from experiments, both research questions are answered. First, the authors suggest the construct of perceived reward diversity drawing on existing literature about human motivations. Also the tension that mediates between diversity perception and feeling of fun is proposed conceptually, though the direct link was not examined. As tension being a physiological state, future study can adopt physiological measures like heart rate and confirmed the proposed path between the construct and feeling of fun. We answered second research question by experimenting whether explicating the level of anticipation for reward has effects on the task outcome and also psychological feelings.

This study provides several theoretical and practical implications. First, we conducted explorative study to understand the concept of fun and understood a mechanism to engender the feeling, as well as system factors found to moderate the mechanism. Also, the construct suggested and tested in our study provides practical implications as to gamification design of various settings.

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