

Maximizing the Usefulness of Data Gathered Through Crowdsourcing Methods Using Gamification

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ABSTRACT

This literature review describes gamification and how it can be used in a crowdsourcing context. It relates motivations for participating in such activity as more intrinsic than conventional methods, and as such provides numerous benefits. Such benefits include more accurate work, better retention rates, and a more cost effective solution.

Elements of gamification are examined, as well as how it can be applied to existing applications.

Author Keywords

Gamification; crowdsourcing; research; data.

INTRODUCTION

Since the term was published by Jeff Howe in 2006 [8], crowdsourcing has been the interest of researchers and commercial enterprises. It provides a method of gathering a large spread of data at a relatively low cost, compared with more traditional methods [3].

This method of data gathering has been used in many different contexts such as biomedical research [9], search queries [6, 7], and context aggregation.

Using crowdsourcing methods to gather large amounts of useful data presents many challenges. These include, but are not limited to, getting a participant interested in the work provided, ensuring that the data gained is what was intended and preventing malicious behaviour.

One successful method of mitigating these problems has been to use gamification [3] defined as “the use of game design elements in a non-game context” [2].

This work will analyze the term gamification and its definition in the context of crowdsourcing. It will then provide motivation for the importance of this research by discussing related work in the area. The elements of gamification and a gamification framework will then be examined. The results from conventional methods of crowdsourcing will then be compared with the gamified approach. Finally, some weaknesses of this approach will be addressed.

DEFINITIONS

There are several definitions of gamification, since it started gaining popularity in 2010 [2]. The definition that has

become somewhat of a standard was the one proposed by Deterding et. al. [2] “the use of game design elements in a non-game context”.

Before discussing the usefulness of gamifying crowdsourcing methods, a precise definition of what is and isn't gamification must be sought. Deterding et al. [2] and Groh [4] both break down the definition into four parts; game, element, design and non-game context.

Gamification

Game

Deterding et. al. [2] and Groh [4] both stress the difference between the difference between ‘play’ or ‘playfulness’ and ‘game’ or ‘gamefulness’. Both argue that ‘Play’ can be determined by free-form, expressional or improvisational behaviour. In contrast to this, ‘Game’ relates to a user having clear and discrete goals with explicit rule systems.

Elements

The authors of both papers above [2, 4] mention work done by Reeves and Red [11] which identifies some potential elements of games. However they conclude that the set of games that included all such element would be empty, where as the set of games that included any of those elements would be boundless. As such, in this context, a game element is one that *characteristic* to games, one which can be found in most games, or one that is readily identifiable as belonging to games.

Design

Deterding et. al. [2] emphasises the importance of separating game based technologies from game design, the latter of which is used for this definition. The important point stated that ‘serious games’ fulfil all requirements for being a proper game, whereas gamified applications only take elements from such games.

Non-game context

Deterding et. al. [2] stress that gamification should not be restricted to use cases, as there does not seem to be any significant advantage of doing so. Just as there can exist a health game, a health application can be gamified.

Crowdsourcing

The term crowdsourcing was first published by Howe in 2006 as a method of sending an open call to an undefined

(and usually large) group of people to perform a function once performed by employees [7]. Since then, there has been a lot of talk in the scientific community, with multiple alternative definitions proposed.

In 2012, an integrated definition was proposed by Estellés-Arolas [4]. In this definition, he stresses the requirement to provide something in return to the user, be that “economic, social recognition, self-esteem, or the development of individual skills”

MOTIVATION

Using crowdsourcing methods allows a company or researcher to gain a very large amount of data in a short time. Traditionally, these have taken the form of surveys sent out as an open call. However, since the success of Amazon’s Mechanical Turk, whereby people can complete micro-tasks for small monetary incentives, crowdsourcing methods have gained both popularity and diversity [9].

Crowdsourcing is not without its challenges. Eickhoff et. al. suggest that getting a 65% rate of ‘honest contributions’ is considered standard [3]. Theory suggests that this is due to extrinsic motivations, and people will try and game the system [3].

Gamification is useful in this regard, as it focuses a more intrinsic motivation [5]. By introducing game elements, people are more likely to want to participate, without the need for extrinsic rewards. This reduces the desire for cheating, in some measure.

This link between gamification and crowdsourcing is not an entirely new concept. The content aggregation website, reddit.com, allows users to vote on submissions from other users. Points in the form of ‘Karma’ are awarded based on the ratio of positive and negative votes.

FoldIt is another success story in this area. By appealing to a large crowd, users were able to help determine the crystal structure of M-PMV, a task that scientists had been trying to work on for 15 years [3].

GAMIFICATION ELEMENTS

Intrinsic vs. Extrinsic Motivations

Groh recommends three principles to bring a greater focus to intrinsic motivations as opposed to extrinsic motivations [5]. These are relatedness, competence and autonomy.

Relatedness

Groh compares the location based application foursquare to the website StackOverflow [5]. In regards to the former, despite its huge popularity, it had recently had a large number of people leave the service. Compared with the latter, Groh hypothesises that this is due to the fact that if points and badges were removed from the system, StackOverflow would be a useful programming resource, whereas FourSquare would leave little motivation for people to continue using the service.

Groh also argues the need for a visible and likeminded community so share in these goals [5]. Liu et. al. however argue that this could lead to the phenomenon ‘social loafing’, whereby people who work in a group will individually put in less effort [9]. To counter this, Liu et. al. suggest that an individual’s contributions should be made explicit (such as their efforts being prominently displayed).

In order to be successful, goals must be clear and personal, and the gamified application should allow people to connect with similarly interested people [5].

Competence

Groh suggests the need for gamified applications to provide a challenge to the user [5]. Such applications should not be trivial or monotonous, as enjoyment from games is gained through mastery.

He suggests that gamified applications should become more difficult to play as they proceed, however if accuracy is important, this is in contradiction with the findings from Eickhoff et. al. [3] where a more difficult game led to less precise results.

Autonomy

Groh suggests that a user should have a sense of autonomy, and that the choice to play should be intrinsic [5].

A gamification framework

To be successful in applying these ideas, Aparicio et. al. have devised a framework [1]. This framework works to maintain an intrinsic motivation in the user.

They identify three social and psychological needs to fulfil this purpose; autonomy, competence, and relatedness. They then go on to propose four activities for the effective process of gamification.

Identification of the main objective

Aparicio et. al. state that normally any task has a main objective that can be identified.

Identification of the traversal objective

This objective should be interesting to the user and serves as a basis for the game mechanics.

Selection of game mechanics

The game mechanics chosen should support the needs of human motivation.

Analysis of the effectiveness

Effectiveness should be considered twofold. Firstly, the implementation of the gameplay should be tested based on fun and satisfaction. Secondly, the results gained through the gamified application should be compared to initial results for comparison.

Though Aparicio et. al. do not provide any results to test this framework, other gamified applications have followed similar methodologies.

METHODS

In their paper, Harris and Srinivasan break down the large and complex task of information retrieval into smaller problems [7]. These smaller problems are then analysed as to whether they could be completed using a crowdsourcing method and a gamified method. Harris and Srinivasan encountered a number of challenges using this method, including the continued complexity of each task, and the latency between a search and the gained result.

Liu et. al. produced an application with a similar purpose called UbiAsk [9]. They ran into similar challenges, but they considered their application to have been successful.

Quality Assurance

Eickhoff et. al. state that one of the major challenges in crowdsourcing methods is to overcome malicious or sloppy contributions [3]. In both the work provided by Eickhoff et. al. [3] and Luengo-Oroz et. al. [10] a series of gold standards (results previously compiled by a trusted party) were used. These could be compared to contributions by users, and help detect input that would not be useful.

The work by Luengo-Oroz et. al. also included a quorum algorithm [10]. By aggregating the contributions from many participants, a consensus could be reached, mitigating the effect of false submissions.

COMPARISONS

The work done by Eickhoff et. al. compared their traditional crowdsourcing approach with a gamified crowdsourcing approach of associating words [3]. Their approach split the comparison into seven categories.

Quality

Using a comparison with both the gold standards (NIST) and the consensus data across their entire experiment (TREC-CS), their gamified version of their application performed remarkably well, compared with the conventional approach. Compared with the gold standards, the gamified version scored at 0.82, while conventional methods scored at 0.73. Compared with the consensus data, the gamified version scored at 0.93, while conventional methods scored at 0.74 [3].

Also of note, as the game in the research by Eickhoff et. al. became more difficult, the accuracy of the data submitted became much lower (compared to both the gold standard and the consensus data). This correlation would imply that by making the game too difficult, the data gained becomes less useful.

Efficiency

The rate at which tasks were completed in the gamified version was much greater than the conventional version

(352.1 votes per hour and 95.2 votes per hour respectively) [3].

In testing the effectiveness of the UbiAsk application where users could answer questions from other users for points, Liu et. al. found that half of all requests were answered in 10 minutes, 75% in 30 minutes [9].

Incentives

The definition of crowdsourcing provided by Estellés-Arolas required the need for some sort of incentive for the participant [4].

Often monetary incentives are used, and this is true for the research by Eickhoff et. al. [3]. In their conventional approach, workers were paid \$0.06 per task, and in the game-based approach, effectively \$0.0004.

The reason provided for the large difference in the area was the amount of work provided 'free of charge'. Workers were more likely to continue using the game-based version, even when there was no monetary incentive. This supports the idea of the value of intrinsic motivations (e.g. fun) rather than extrinsic motivations (e.g. money) [1, 9].

Consistency

Eickhoff et. al. also looked at consistency. When a worker was faced with the same problem multiple times, it was checked to see the proportion of times their input was consistent with a previous input [3]. The game-based version received a consistency score of 68.9% while the conventional method received a score of 61.3%.

Robustness

Traditional crowdsourcing methods are often plagued by low-quality submissions. Usually, these are driven by extrinsic motivation such as money, and users trying to game the system for maximum efficiency.

Eickhoff et. al. examined the proportion of 'cheaters' they encountered [3]. They defined a cheater as someone for whom 67% of submissions did not agree with the general consensus. They observed a rate of 13.5% of cheaters using the conventional method, and 2.3% of cheaters using the game-based method.

Population

High level participant demographics were recorded via a survey by Eickhoff et. al., so that the proportion of demographics could be measured [3]. Of note, the participant who preferred the game-based approach tended to be male, have higher salaries and hold a university degree.

Location

Eickhoff et. al. could not find any statistical difference between preference (conventional or game-based) or rate of cheaters based on location [3].

WEAKNESSES OF GAMIFICATION

After testing the application EcoIsland, an application designed to bring awareness of carbon emissions, Liu et. al. found that the application had no effect on peoples' power usage [9]. It was suggested that it is impossible to change a user's behaviour using gamification if the user is not interested in the service provided.

FUTURE WORK

Despite the fact a strong link exists comparing the quality of results from crowdsourcing methods and using gamification, very few studies have been performed to quantify the difference between the two models. With the extra effort it takes to gamify an application, one must question if it is worth it.

Further, much of the research has been done on applications that could be considered fully fledged applications in their

own right. More study into application with fewer game elements would be useful.

CONCLUSIONS

Crowdsourcing has provided an interesting and effective method of gathering large amounts of data in a cost effective manner. However, crowdsourcing is not without its weaknesses, such as the skewing of results from sloppy or malicious participants. Often it is extrinsic factors such as monetary incentives that are the cause of these problems.

Gamification provides an opportunity to counteract much of this. By focusing on intrinsic rewards, such as enjoyment, as opposed to extrinsic ones, results can be improved without the need for economic incentives. Further, if it is desirable for a person to have worked on many tasks (where a high level of competency is desirable), gamification has been shown to increase participant retention rate.

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