Competing or Aiming to be Average?
Normification as a Means of Engaging Digital Volunteers

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ABSTRACT

Engagement, motivation and active contribution by digital volunteers are key requirements for crowdsourcing and citizen science projects. Many systems use competitive elements, for example point scoring and leaderboards, to achieve these ends. However, while competition may motivate some people, it can have a neutral or demotivating effect on others. In this paper we explore theories of personal and social norms and investigate normification as an alternative approach to engagement, to be used alongside or instead of competitive strategies. We provide a systematic review of existing crowdsourcing and citizen science literature and categorise the ways that theories of norms have been incorporated to date. We then present qualitative interview data from a pro-environmental crowdsourcing study, Close the Door, which reveals normalising attitudes in certain participants. We assess how this links with competitive behaviour and participant performance. Based on our findings and analysis of norm theories, we consider the implications for designers wishing to use normification as an engagement strategy in crowdsourcing and citizen science systems.

Author Keywords

Citizen science; crowdsourcing; gamification; competition; social norms; personal norms; normification

ACM Classification Keywords

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

INTRODUCTION

Crowdsourcing and citizen science projects face key challenges in engaging contributors – namely how to recruit them, and how to get them to make an active ongoing contribution. In a review of crowdsourcing literature, Doan et al. [9] categorise common approaches, including (amongst others) coercion, payment, intrinsic enjoyment

and competition. In citizen science literature, Kim et al. [23] report the use of incentives, competition, entertainment and education to support ongoing engagement. Also within the realm of citizen science, Rotman et al. [40] report a complex network of factors at play, with initial scientific interest and curiosity moving towards a desire for attribution and acknowledgment over time. Within HCI and CSCW research more generally, gamification is an approach that has rapidly gained prominence as a motivational and engagement technique [8, 26, 52]. Deterding et al. define it as "using game design elements in non-gaming contexts" [8]. Elements can include point scoring, leaderboards, goal setting, questing, and artefact collecting. These gaming techniques have been applied in diverse domains including eco-feedback [13, 28], health and exercise [4, 7], image labelling [50], and service industries [20]. Gamification aims to increase the motivation of participants partly by engaging with competitive urges and partly by increasing intrinsic enjoyment in an activity. It has also been used to encourage paid crowdsourcing participants to perform tasks more rapidly and with greater accuracy, leading to higher quality data [11]. In this paper, we particularly consider those aspects of gamification focused around competition and achievement, which we refer to as *competitive gamification*.

Though competitive gamification may motivate some people, there is evidence to suggest that it can have a neutral or demotivating effect on others. Nicholson [30] has argued that competitive gamification can reduce peoples' intrinsic motivation to contribute to a given activity. More generally, Duffy and Kornienko [10] have found that encouraging competitive behaviour has the potential to reduce altruism. Our paper explores the possible negative effects of competitive gamification in greater detail, and considers an alternative approach, which we term *normification*. Normification focuses on ideas of collective engagement by a community, with individuals within the community each "playing their part". Rather than encouraging competition, it encourages normalising behaviour where community members aim to emulate others in the community and behave similarly to them.

Normification applies theories from psychological literature on social and personal norms [6, 39, 46]. Within CSCW research to date, norm theory has been applied to

understand and influence the development of online communities. It has also received some attention in the context of persuasive technologies. In this paper we focus on the potential of normification to support engagement amongst participants in crowdsourcing and citizen science systems. Normification is not seen as a direct replacement for competitive gamification. Instead the paper considers a range of situations in which gamification and normification strategies may prove more or less effective, and how the two approaches may interact with, and complement, each other.

Our discussion is grounded in a qualitative analysis of interview data from a pro-environmental crowdsourcing study called Close the Door (CTD) [28]. In CTD participants used mobile phone apps to collect data about whether shops in a city kept their doors open or closed in cold weather. The study was designed to explore the effects of competition on participants through the use of leaderboards, badges and pay-for-results financial incentives. Whereas high performing participants were clearly motivated by competition, analysis of semi-structured interviews with participants shows that may low performing participants were demotivated by competition. However, it also became clear that some participants, in particular those performing at a mid-level, were using the leaderboard in an unexpected way. For example, one participant stated the leaderboard *"was an indication obviously on how much other people were using it and I wanted to make sure I was sort of in the middle or top half rather than the bottom end."* The CTD study did not make explicit use of normification strategies, however attitudes such as this indicate the potential for motivational approaches based on normification to encourage those who are not motivated, or indeed demotivated, by competition.

This paper makes several contributions to CSCW research. It provides a review of three major psychological theories on the behavioural influences of norms. Following this we review the impact of normative theories on prior research in crowdsourcing and citizen science, and categorise the ways in which these theories have been used. We then provide a qualitative analysis of attitudes of participants in the CTD study. Three broad motivational/demotivational factors are identified: self-competition, other-competition and normalising attitudes. We consider relationships between performance, motivation and attitude and also assess our findings in terms of the theories of norms. Finally, based on findings from the study and our analysis of norm theories, we consider the implications and make recommendations for designers wishing to use normification in crowdsourcing and citizen science systems.

PROBLEMS ADDRESSED BY CROWDSOURCING

Depending on the key aims of a crowdsourcing or citizen science system, it may desirable to identify and maximise the contribution of key individuals. For example, Foldit [21] uses point scoring and leaderboards to motivate solving problems of protein structure prediction. The

scientists and designers behind Foldit are interested in identifying a small number of high quality solutions, which warrant further exploration. Given the nature of the problem addressed (protein folding), the system benefits most from regular participants with some basic skills, which participants may have inherently, or which may be developed through ongoing interaction with the system. Competition and high-ranking status may be an effective means of promoting excellence in such a community.

In many cases, however, the objective of crowdsourcing is to maximise the overall output of the crowd. Many such systems require less skill and involve rapid or widespread data collection and/or assessment. For example, GalaxyZoo [25] involves the rapid assessment and categorisation of photos of galaxies, while WhatsInvasive [15] involves the spotting and logging of invasive plant species. Competitive, highly engaged, high performing volunteers can provide a substantial contribution to such systems. However there is also significant benefit from engaging larger numbers of more casual or occasional volunteers. In such cases, if gains among high performers, induced by competition, are offset by a loss in performance or participation by the wider community, then competition may reduce the overall output of the system. As we will see in the CTD study, which aimed to maximise the overall contribution of unskilled volunteers, there is evidence that competition did demotivate lower-level contributors. The question therefore arises: what techniques can we apply to maximise the effectiveness of both high and low level contributors? The norm theories discussed in the next section have the potential to help in addressing this challenge.

THEORIES OF BEHAVIOURAL INFLUENCES OF NORMS
Theories of norms and norm activation have developed primarily within research on the psychology of behaviour change, often in the context of pro-environmental and pro-health behaviours. Three major theoretical models exist for the role that different norms play in influencing the action of an individual: the Focus Theory of Normative Conduct, the Theory of Normative Social Behavior, and the Norm Activation Model.

The Focus Theory of Normative Conduct
The Focus Theory of Normative Conduct [6] distinguishes between two kinds of normative beliefs that can affect behaviour. *Descriptive normative beliefs* are beliefs regarding what others tend to do in a particular situation. These can be used to guide behaviour as a heuristic and can affect the decision to adopt pro-social behaviour. For example, Nolan et al. [31] found a strong correlation between an individual's descriptive normative beliefs regarding the energy conservation behaviour of others and that individual's decision to conserve energy in their home. *Injunctive normative beliefs* are beliefs regarding what actions others approve or disapprove of, and again can influence choice as to whether to engage in pro-social behaviour. For example, a householder may believe that their friends or neighbours approve of energy efficiency and

disapprove of wasteful behaviour, and may thus be influenced to be more energy efficient in their own home.

A person's actions are affected by both descriptive and injunctive norms to varying extents, and research has been conducted to explore their relative strengths and interactions. Schultz and Khazian et al. [42] found that a message that linked both descriptive and injunctive norms was more effective in encouraging towel reuse at hotels than a purely information-based message. Schultz and Nolan et al. [41] found that descriptive information about average energy use in similar households encouraged a move towards the mean by both high and low energy users. However, when combined with an injunctive indicator – a smiley face for low energy use and a frowning face for high use – the increase in energy consumption by low energy users was reduced.

Descriptive and injunctive norms can operate in opposition to each other. For example, Cialdini et al. [6] demonstrated that people are more likely to litter in an area that already contains rubbish than in an area that is clear. Hence the descriptive norm that 'people tend to litter here' reduces the effect of the injunctive societal norm against littering. Interestingly, Reno et al. [38] compared the effect on littering in a litter-free environment of the observation of a single person discarding something, and found the reverse: viewing someone littering in a litter-free environment reduces the probability of an individual littering themselves. The Focus Theory argues that the norms that affect our behaviour at any given time depend on which norms are *salient* in any given situation. There is also evidence that norms operate subconsciously. Nolan et al. [31] found that, despite the strong correlation between descriptive normative belief regarding energy efficiency and an individual's decision, the behaviour of others was rated as the least important reason for their actions.

The Theory of Normative Social Behavior
With the Theory of Normative Social Behaviour Rimal and Real [39] built on concepts within Focus Theory. In particular they focused on injunctive norms and developed a model of how they operate. They argue that injunctive normative beliefs gain their weight either from threat of sanctions or from social approval – "because people important to them expect them to do so". They also argue that the effect of such norms on an individual's actions is influenced by two other categories of factors. Firstly, the individual's perceived *outcome expectations* of engaging or not in an action – namely what subjective benefits or disbenefits they believe they will experience. Secondly, the individual's *group identity* and the descriptive norms of that particular group: individuals aspire to a varying degree to behave like others within a given social group, and experience positive emotions when conforming to in-group norms. Hence an individual's course of action is influenced by a combination of injunctive norms operating on them, their subjective perception of 'outcome expectations' of

different courses of action, and a desire to conform to the descriptive norms of a certain social group.

The Norm Activation Model
The Norm Activation Model of Harland et al. [17] further extended norm theory by introducing the concept of *personal norms* – namely the individual's feelings of moral obligation to engage in or avoid particular behaviours. They argue that injunctive norms and other factors affecting the actions of an individual are significantly influenced by these personal norms. In a study of self-reported reasons for choosing to use unbleached paper or not, they found that personal norms were a stronger predictor than attitudes towards the product (a form of outcome expectation). They also found that personal norms were a stronger predictor of use than beliefs that others approved of such use (i.e. injunctive norms).

The Norm Activation Model aims to explain the way in which personal norms come into being over the longer term [46]. The model states that personal norms are activated by a combination of (1) Awareness of Consequences – namely an awareness of the benefits of success or cost of failure of the collective action; (2) Ascription of Responsibility – a sense that the individual is partly responsible for bringing about the collective action, and; (3) Outcome Efficiency – whether they believe that the actions individually and collectively taken will have some positive impact. The model was primarily developed and presented as a model for the development of pro-environmental personal norms. However, in a more general form it can be applied to arbitrary collective action problems – namely those problems where a set of individual choices can result in a collective benefit to the community, though each choice may have an immediate cost on the individual.

As with our two other theories, the Norm Activation Model has been the subject of experimental investigation. For example, the interplay between personal norms and descriptive normative beliefs has been explored by Göckeritz et al. [14]. They observe that the impact of descriptive normative beliefs on the uptake of energy conservation behaviour is reduced when an individual is highly "involved" – namely they are consciously engaged with the issue and so have knowledge and strong personal norms around energy conservation. They propose that descriptive norms influence behaviour without conscious processing, while strong personal norms are associated with greater conscious engagement, which in turn weakens the influence of descriptive norms.

Overview
The theories described above, and the associated experimental work, explore the relative influence of different norm types in varying situations. Each theory prioritises different norm types and motivational triggers. The Focus Theory of Normative Conduct distinguishes between descriptive and injunctive norms, and emphasises how environmental factors can make certain norms more

"salient" at a given time. The Theory of Normative Social Behavior provides a more detailed model of the factors underlying the operation of injunctive norms in a given social situation. Finally, the Norm Activation Model adds the concept of personal norms, which when strong enough can override both descriptive and injunctive norms. It also provides a model for how personal norms become active.

Later in the paper we will return to these theories to see how they can be used to explain the results of the CTD study. Prior to this, we consider the extent to which norm theories have impacted on HCI and CSCW research to date, and the ways in which have been used to guide the design of crowdsourcing systems.

PRIOR USE OF NORMS IN CSCW AND HCI RESEARCH

Within CSCW literature, norm theories have featured in research aimed at understanding, influencing and developing online communities. Postmes et al. [36] explore how norms regarding the use of email are socially constructed over time by groups of collaborating students. In addition, Postmes et al. [35] have found that online communities with a strong social identity can reinforce the effect of pre-existing norms, despite participant anonymity. In a lab-based study, Sukumaran et al. [48] demonstrated that pre-existing contributions in an online news discussion site affect the thoughtfulness of contributions made by new arrivals. With regard to the use of social norms in influencing the behaviour of online communities, Chen et al. [5] explore how they can be used to increase contribution to MovieLens. They explored the effect of sending social comparison information regarding the performance of an individual and the mean performance of similar individuals. They found it resulted in an increase in contribution by those below the mean, and a decrease by those above – a similar phenomenon to that observed by Schultz and Nolan et al. [41]. However, the increase by those below the mean was significantly greater than the decrease by those above. Furthermore, they found that those who expressed a competitive preference in a questionnaire (defined as valuing achievement over social popularity) were more likely to increase their contribution if below the mean, and less likely to decrease it if above. This insight is of particular relevance to the focus of our paper on the interaction between competition and normification.

The design of an online environment can also influence the norms that develop or express themselves within it. Lea et al. [24] present a collaborative learning environment for use by students, which is designed in such a way to promote 'team player' behaviour – mutually supportive coordinated contributions. It does this through the use of "collectivised" activities, which encourage a common group identity. Sukumaran et al. [48] demonstrate the effect visual design has on a news discussion website, with a more serious and formal style promoting more thoughtfulness of contribution.

Research in persuasive technology, particularly in environmental contexts, has also begun to consider theories of norms. He et al. [18] include the use of norms in their set of recommendations for environmental persuasion, and several trials have incorporated consideration of norms into their design. Thieme et al. [49] consider how social monitoring can encourage injunctive norms around recycling, whilst Mankoff et al. [27] consider how social networking can develop community norms around environmental behaviour, e.g. greenhouse gas emissions reduction. Several projects [12, 34, 47] explore how social feedback can influence domestic electricity use. Finally [43] suggests that comparative social feedback can be used, not only as a means to influence behaviour directly, but also as an inquiry instrument to discover opportunities to save energy'.

In this paper we are specifically focused on the implications of norm theories for the design of crowdsourcing and citizen science systems. To determine the extent to which psychological theories of norms have been applied in this context we conducted a survey of prior literature. We extracted all papers from the ACM Guide to Computing Literature[1] that include either "crowdsourcing" or "citizen science" as an author keyword. This yielded a corpus of 538 papers. Within this, we identified all mentions of the substring "norm", and categorised the way in which different papers used it. We filtered out those papers which only used the substring in the word "normal" etc., and those which used it in a statistical sense, to leave only those which referred to social or personal norms. Of the original corpus, we found that 12 (2.2%) discussed norms in some way. The ways in which they discussed norms can be categorised as follows:

Emergence of social norms in crowdsourcing environments. Three of the papers [16, 33, 45] discuss how crowdsourcing environments result in the emergence of new social norms. For example, Starbird and Palen [45] observe the emergence of norms around retweeting behaviour of digital volunteers in the aftermath of the 2010 earthquake in Haiti.

The incorporation of social norms in design of crowdsourcing environments. Two of the papers touch on the relationship between the social norms of a community and the design of a crowdsourcing environment they use. Wiggins [51] discusses how existing community norms within the birding community were reflected subtly in the design of leaderboards as part of the eBird system. Reeves and Sherwood [37] observe that design choices when developing a crowdsourcing application can affect the norms that emerge in a user community – either unintentionally or intentionally.

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[1] Though this corpus contains over 2M publications both within and outside of the ACM, we recognize that this cannot be considered a complete literature survey due to the interdisciplinary nature of crowdsourcing research.

The influence of social norms on reporting of motivation in crowdsourcing. Antin and Shaw [1] report on how social norms in different cultures can affect self-reporting of motivational factors in crowdsourcing.

Social Norms as a motivational factor for participants in crowdsourcing and citizen science. Kim et al. [22] refers to social norms as one of several motivational factors for data collectors in citizen science, but does not explore it further. Nov et al. [32] conducted a survey on self-reported motivations of volunteers with stardust@home, and analysed the results to determine which factors were most salient. They found that collective and intrinsic factors were the most salient, with social identification and norm-related factors being secondary. Rotman et al. [40] explored the motivation of volunteers in projects making a scientific contribution and found a complex network of factors at play, with initial scientific interest and curiosity moving towards a desire for attribution and acknowledgment over time, but did not explore the role of social norms in this process. The only example in our corpus of work that attempts to actively use norm theory (along with other interventions) to affect behaviour is [44]. Shaw et al. explored the effect of a number of messages and questions on motivating qualitative coders in an online labour market. Among the messages, two were connected to social norm theory. For example, they attempted to activate an injunctive social norm encouraging good behaviour through the message "It is your job to provide accurate answers to these questions. It is important that you do your job well." This was found to have no significant effect on job performance. This is an interesting finding, and one that we return to in our Discussion and Analysis section when considering the results presented in the current paper.

Influencing of Social Norms through Crowdsourcing. Prior research with the CTD environmental campaign has considered two distinctive, but complementary perspectives on social norms and crowdsourcing. As previously stated, Massung et al. [28] investigated the use of different gamification strategies in supporting crowdsourcing of pro-environmental data. The current paper extends that work by considering normification as an additional engagement strategy for volunteers in crowdsourcing projects. They [28] also considered, but did not investigate, a longer-term possibility. Namely, if crowdsourcing can support large-scale environmental data collection, this data could then be brought to bear in influencing ingrained, negative social behaviour. The possibility of using crowdsourced data to influence third party social norms was discussed further in Massung and Preist. [29]. This is an interesting longer-term research goal, but beyond the scope of the current paper.

This literature review has shown that whilst norms have received attention in the CSCW community more generally, they have received only limited attention as an active design strategy in prior crowdsourcing research. We now consider the CTD study in more detail.

THE CLOSE THE DOORS STUDY

Close the Door (CTD) is a UK-based pro-environmental campaign that encourages shops to reduce energy waste by keeping their doors shut when running heating during the winter. A detailed study of typical 150m^2 UK high street shops found that keeping doors closed can reduce carbon emissions and the amount of heating energy used by 30-50% [3]. The campaign operates across several UK cities and is lead by a core group of dedicated and highly motivated members. The aim of the CTD study was to investigate how mobile crowdsourcing could be used to increase the scalability of campaign groups like CTD by engaging and enabling casual, digital volunteers to collect relevant data. This approach has the potential to allow small campaign groups to collect data on a much larger scale than previously possible and also free core members to focus on advocacy activities. In line with Massung and Preist. [29] we believe large-scale data collection, and focused advocacy, will ultimately support third party change.

Overall we developed three apps for the iPhone. As users went about their daily routines, the app allowed them to collect information about whether shop doors were opened or closed, with each app using a different strategy to try to engage and motivate the digital volunteers. The Virtual app used competitive gamification to encourage engagement through game mechanics including points, badges, and a leaderboard. The Financial app was similar to the Virtual app, incorporating the same competitive gamification techniques, but with the addition of financial incentives to encourage participants to carry out data collection tasks. The Control app did not use any explicit motivational strategies and so acted as a control. Control participants did not receive points or badges for rating shop doors, nor did they see the activity of other participants. Further details of the app design are available in [28].

Experimental procedure

The CTD study lasted two weeks. 48 participants were randomly assigned to three groups, each using one app – Control, Virtual or Financial – with 16 participants per group. In all cases, participants were asked to record data on as many shop doors as possible while going about their normal routine. Control and Virtual participants received a flat fee for taking part. Financial participants received a share of a fixed pot based on the number of badges and points they earned. The pot size was chosen to ensure that the average earned by the Financial group would be the same as the flat fee in the two other groups. Quantitative data on the number of shops rated was collected for all participants over the two weeks. Qualitative data was gathered through semi-structured interviews with 18 participants. These interviews explored participants' reactions on the different motivational strategies used in the CTD apps, e.g. leaderboards and badges. Six interviewees were selected from each app group: the two highest, two mid-range and two lowest performers in the data collection exercise.
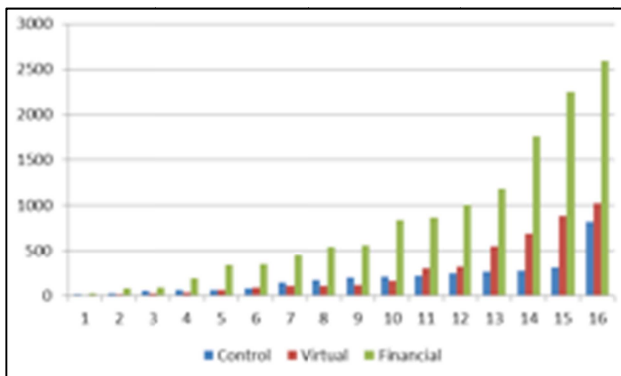
Figure 1: Points scored by the 16 participants in each group in the CTD study [28].

	Financial	**Virtual**
Low scorers	Other-competitive (-ive)	Normalising
	Other-competitive (-ive)	Other-competitive (+ive)
Medium scorers	Other-competitive (+ive)	Normalising
	Self-competitive & Normalising	Self-competitive & Normalising
High scorers	Other-competitive (+ive)	Other-competitive (+ive)
	Self-competitive & Other-competitive (+ive)	Other-competitive (+ive)

Table 1: The attitudes expressed by 12 interviewees, with respect to the leaderboard. Tags in brackets indicate the motivational impact (+ive or –ive) expressed in other-competitive statements. All self-competitive and normalising statements were associated with positive motivational impacts.

Competitive and normative attitudes in Close the Door

The initial purpose of the CTD study was to explore the effect of competition on participants, and the "leaderboard" was framed in this way. The quantitative results of the study are reported in [28]. Here we summarise those relevant to this paper. Figure 1 shows the points scored by the 16 participants in each group[2]. We found that virtual rewards (points and badges) increased performance over the control group, though not to a statistically significant level. Combining financial rewards with leaderboards led to a statistically significant increase in the amount of data collected. Z-score analysis of performance showed that in both the virtual and financial groups, those at the top of the leaderboard were relatively stronger while those in mid and low positions were relatively weaker than the control group. In the case of the virtual group, this difference could also be observed in absolute terms: though the top 4 participants notably outperformed the control group, this was offset by comparative underperformance by those at mid and low positions resulting in no statistically significant difference in performance between the two groups.

During our preliminary analysis of the qualitative interview data we also noted that some participants in the CTD study related to the leaderboard in an unexpected way. They used it more as a means to see how their performance compared with the community in general – i.e. a way more in line with theories of social norms rather than theories of competition. This observation raised interesting questions regarding the role of competition versus normification for our participants.

Building on this observation we now return to this qualitative data to assess/determine what attitudes people express towards the leaderboard, and present further analysis and results. Having presented our results we will begin our discussion and analysis by considering several inter-related research questions:

- How do participants describe the attitudes they hold as motivating or demotivating? How do the expressed attitudes and motivations link to actual performance on the leaderboard? How do these different attitudes interact with each other?

Following this we will step back and consider the broader question:

- What explanations do the three psychological theories of norms offer for the expressed attitudes?

Method

Of the 18 interviews conducted with participants of CTD, 6 were with the control group who had no access to the leaderboard. We analysed the transcripts of the remaining 12, tagging examples of language that reflected different attitudes to the leaderboard. We then sorted these statements into different categories of attitude, and used these to categorise attitudes expressed by the different interviewees. Next, we tabulated the results against participant group (virtual and financial) and score (low, medium, high). Then, based on this tabulation, we carried out a second pass of the qualitative data to identify other factors, which may explain 'anomalies' in the table. Finally, we returned to the six interviews with the control group and tagged any examples of statements that corresponded to the attitudes identified in other groups, to explore to what extent these attitudes emerged, even in the absence of a leaderboard.

Results

The analysis of language used by the 12 participants in the financial and virtual groups identified three broad categories of attitude towards the leaderboard: other-competitive, self-competitive, and normalising. Table 1 charts the attitudes observed in interviewee statements against participant group and scoring band. As can be seen some interviewees made statements expressing more than one attitude. In the case of other-competitive statements, we also record whether the participant described being motivated (+ive) or demotivated (-ive) by competition. All

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[2] The Control app maintained a log of the shops ranked by participants and through this their effective points total; however, this information was not revealed to control participants.

self-competitive and normalising statements were associated with positive motivational expressions.

Other-competitive: We define an other-competitive statement as one in which the interviewee compares their behaviour with that of others on the leaderboard, with an expressed wish to beat others and/or not be beaten by others. In some cases, particularly for high scoring participants, an other-competitive attitude was linked to engagement and positive motivation. For example, one interviewee [Virtual Group, High Scorer] stated: *"I would check [the leaderboard] … to see if people were coming up near me and if they were then I'd be like, 'Right, I've got to get on with it.'"* However, in other cases, it was demotivating and had a negative impact. One participant [Financial Group, Low Scorer] observed *"I think the score board put me off a little bit. ... after a few days I think people were on hundreds and I was trailing behind."* Interestingly, both of the low scoring participants in the financial group described how the competitive aspect was initially motivating prior to becoming demotivating. For example, one stating that "*to begin with* [the leaderboard] *spurred me on and then after getting so far behind it felt a bit oppressive really"*. This suggests that it may not have been competition per se, but rather poor performance in a competitive environment that was demotivating.

There is an anomaly in our data that that can be explained at this point. At first sight the low scorer in the virtual group who described other-competition as positively motivating appears inconsistent. However at interview this person stated that they found competition motivating, but also revealed that they had left Bristol for much of the trial period, thus limiting their ability to accumulate points.

Self-competitive: We define a self-competitive statement as one in which the interviewee used their score to monitor their own progress, but not in comparison with others or with regard to improving or maintaining a position on the leaderboard. For example, one participant [Financial Group, Mid Scorer] stated that they used the leaderboard *"kind of competitive with myself like today I'll do a few more than I did yesterday"* and that the leaderboard was motivating through *"seeing the numbers go up just for me more than seeing who was above or below me."* Another interviewee [Virtual Group, Mid Scorer] stated that they were motivated by getting badges and that scoring points *"helped me do more because I was like I want to get more."* Interestingly, unlike other-competitive statements, all self-competitive statements were associated with increased motivation.

Normalising: We define a normalising statement as one in which the interviewee used activity on the scoreboard as a guide to what other people were doing, with a view to following them or making a representative contribution. For example, one interviewee [Financial Group, Mid Scorer] stated that observing activity on the leaderboard *"did make me go oh okay [...] I should probably make sure that I make an effort to do it when I go out."* Another [Virtual

Group, Mid Scorer] stated that they viewed the leaderboard as *"an indication obviously of how much other people were using it and I wanted to make sure I was sort of in the middle or top half rather than the bottom end."*

Other normalising statements were more complex. One interviewee [Virtual Group, Low Scorer] stated that the sight of activity on the leaderboard before she had actually begun using the app meant *"I felt guilty that I hadn't started using it so then I used it."* This low performer is an interesting case. She expressed normalising attitudes not towards the score, but towards the use of the app. Overall it appears that she was spurred on by the activity of others to do something, but felt no need to compare her score with others, or to make an average or high level of contribution.

Our analysis of six interviews with the control group found, unsurprisingly, that these participants expressed no competitive or normalising attitudes. One of them did highlight the lack of feedback, in what appears to be a request for feedback to allow self-competition as a motivator: *"There should have been a guideline to how many shops we recorded [...] there was no incentive!"*

Discussion and Analysis

18 interviews, including 6 with control participants, is not sufficient to warrant strong conclusions. However, based on our results we can make a number of observations and give initial answers to our research questions. We will begin by considering our research questions around participants' stated attitudes. Following this we consider the insights on this provided by psychological theories of norms. We then consider our findings in light of prior CSCW research incorporating norm theories.

- *How do participants describe the attitudes they hold as motivating or demotivating? How do the expressed attitudes and motivations link to actual performance on the leaderboard? How do these different attitudes interact with each other?*

The results presented in Table 1 broadly show a pattern of low scorers having an other-competitive attitude linked to demotivation and high performers having an other-competitive attitude linked to motivation. Many people with an other-competitive attitude were initially motivated, but ultimately became demotivated by competition. Hence it appears that demotivation occurs when a participant is other-competitive but falls behind and feels they cannot catch up with others. Taken together other-competitive statements by our participants, and their contrasting performance, highlight both the benefits and possible negative effects of other-competitive gamification.

Mid performers in our study expressed a normalising and/or self-competitive attitude to the leaderboard, with three of the four mid-performing interviewees expressing a normalising attitude. Self-competitive and normalising attitudes were always associated in our dataset with positive motivation – though not always high performance or

positive emotion, as the quote referring to guilt above shows. We found no evidence that demotivation occurs in those adopting only self-competitive or normalising attitudes. Statements indicate that they remained motivated to act despite the emergence of significant high scorers.

While two interviewees expressed both self-competitive and normalising attitudes, and one expressed both self- and other-competitive attitudes, no interviewees expressed both other-competitive and normalising attitudes. This indicates an inconsistency between other-competitiveness and normalising attitudes, suggesting they are unlikely to be simultaneously held by the same person. The fact that all four high scorers expressed an other-competitive attitude, suggests that a competitive attitude is a necessary (but not sufficient) condition for high scoring, while a normalising attitude tends to encourage mid-range performance (corroborating the findings of Chen et al. [5]).

More broadly, it is interesting to consider how the behaviour of those holding one set of attitudes affects those holding another set. As Figure 1 shows, mid range performers in the virtual group (who typically expressed normalising attitudes in interviews) actually perform less well than the mid range performers in the control group. This is likely to be because of interaction, through the leaderboard, with low performers who were demotivated by other-competition. Consider again the words of a mid-performing virtual app user: *"I wanted to make sure I was sort of in the middle or top half rather than the bottom end."* This statement emphasises a leaderboard position rather than outright scores. Interestingly, the leaderboard in the CTD app was presented as a list. It therefore highlighted positions, and it is the low scorers on a leaderboard that determine the score needed to achieve a mid-level position. Hence if those low on the scoreboard are demotivated by other-competition, and therefore score less, the required score to achieve a mid-level position is also reduced. Hence, even though normalising attitudes acted as a positive motivator, they may have actually resulted in reduced performance of mid-range participants. This is analogous to the findings of Schultz and Nolan et al. [41] with regard to energy usage and Chen et al. [5] with regard to online community contribution. It is possible that a different feedback approach, which emphasised the size of individual contributions or the mean contribution, might have had a different effect on normalising participants.

- *What explanations do the three psychological theories offer for the expressed attitudes?*

The theory of Normative Social Behaviour [39] suggests that injunctive norms act through desire for social approval from specific individuals or groups. Participants in the CTD study did not know each other and the leaderboard used pseudonyms, which enforced anonymity. It is therefore unlikely that this theory provides a strong explanation for results in our study.

The Focus Theory and Norm Activation Model offer greater insight. One possible explanation for the expressed attitudes is as follows. Recall that *personal norms* [17] operate to encourage a behaviour that the individual believes is the "right" thing to do, based on their own self image rather than what they believe others will think of them. We hypothesise that two kinds of personal norms were at work in CTD. Some participants have a personal norm that encourages competition – "I must be one of the best in what I do" – while others have a personal norm around contribution – "I must contribute sufficiently and appropriately to this collective effort in line with what others do". In other words, a personal norm that follows a *descriptive norm* of what others contribute. Some, perhaps most, people have both contributory and competitive personal norms to a greater or lesser extent, yet which one is activated will depend on which is given salience in the specific environment [6].

Our leaderboard and badges environment provided primarily competitive cues, and thus likely reduced activation of normalising motivations in users. However, it was (unintentionally) structured in such a way that those with strong personal norms towards contribution could use it in a normalising manner. In such cases, the leaderboard provided a representation of what others were doing, allowing individuals to form a descriptive norm of what a typical contribution was and therefore what they should aim for. So, for those with significantly stronger personal norm of contribution over competition, this descriptive norm of collective activity would activate their personal norm, resulting in the observed behaviour.

This finding is consistent with the observations of Sukurman et al. [48] that the environmental cues provided by an online system affect which behavioural norms are made salient to its users. Our findings are less consistent with Shaw et al.'s findings about the use of incentives with inexpert human raters [44]. They found that an injunctive norm statement, "It is your job to provide accurate answers to these questions. It is important that you do your job well." had no significant effect on job performance when sent to paid contributors in a crowdsourcing system, suggesting it did not motivate them. This approach is very different from ours – where individuals are able to discern norms from the leaderboard rather than being explicitly ordered to obey them – which may explain the difference in reported motivation.

As noted earlier, Nolan et al. [31] found that social norms were not explicitly stated as a motivator in interviews with householders, even though they were found to be a strong predictor of energy efficiency behaviour. Why our approach to interviewing did identify the role of normalising behaviour where theirs did not is a subject for further exploration. One possible explanation is the structure of our interview: the role of social norms emerged when participants were questioned about their feelings about the

leaderboard, not about their motivation for participation. Those expressing normalising attitudes when talking about the leaderboard would give other explanations of their motivations to use the app – for example *"I enjoyed doing it. When I went places I suddenly went 'Hey, I could use the open and closed app"* [Virtual, Mid] and *"It was just out of interest to see what you were up to really because I'd never done anything like that before so it was quite fun to have a go with it."* [Financial, Mid]. This may also explain why Rotman et al. [40] do not report social normalising behaviour as a motivator of participants in citizen science experiments.

DESIGN IMPLICATIONS

Building on our findings regarding norms and competition in the CTD study, we are now in a position to discuss implications for the design of crowdsourcing and citizen science systems. In presenting these implications we also draw on our review of norm theories and prior CSCW research. These implications should be viewed as tentative recommendations as this point. They can provide useful guidance for designers and are a worthwhile subject for further experimental validation.

1. *Designers should consider whether a crowdsourcing system requires cultivation of a set of exceptional performers to produce a small number of high quality results, or a broad community of "average" contributors. In the first case, competitive-gamification should be considered. In the latter case, normification may also provide an effective strategy for engagement.*

Some crowdsourcing systems (e.g. Foldit) aim to generate of a small number of high quality results, and require skill on the part of the participants, which may require time to develop. In this case it may be desirable to identify and maximise the contribution of key individuals. Here an explicitly competitive, indeed other-competitive, approach may be most appropriate, helping to filter out those who are less motivated or less able to contribute to the task, whilst motivating high performers to contribute further. Other crowdsourcing systems (e.g. CTD) involve relatively simple tasks, but require a large coverage. Here the objective of crowdsourcing is to maximise the overall output of the crowd, so a broad community, including a large number of average contributors, may be preferable. In such cases normification strategies should also be considered, as environments that emphasise competition may demotivate large parts of the overall crowd.

2. *Designers should consider the development of systems that combine gamification and normification to get the "best of both worlds" – but be aware that interactions between the two approaches can be negative.*

Building on our first point, there are many systems in which designers may want to combine gamification and normification. The aims in such a system may include:

- Allow high performers to compete with each other in such a way that other participants are not demotivated.

- Provide a mechanism that allows self-competition and normalising behaviour, without enforcing either.
- Encourage a sense of engagement in a collective, meaningful endeavour, and reduce environmental cues that specifically emphasise competition.

When combining competition and normification designers need to carefully consider how these strategies interact. Our results suggest that it may be fairly safe to mix self-competitive elements (badges, goal setting, personal scores) with normifying information. Chen et al. [5] have also provided evidence that achievement oriented individuals will largely ignore normalising cues, so normalising information should not overly demotivate high performing, self-competitive people. Combining normification and other-competition is more risky, for several reasons. Firstly, our results suggest this combination will demotivate those who are not performing well. If feedback mechanisms in the system are poorly designed, this in turn can have the effect of dragging down the performance of those with strong normalising tendencies. Finally, over emphasis on other-competition may make contributory norms less salient, and so reduce the impact of normification strategies. Finally, evidence from Sukumaran [48] (in line with the Focus Theory of Normative Conduct) indicates that the design of a virtual environment can affect the expression of norms, suggesting that over emphasis on other-competition may make contributory norms less salient, thus reducing the impact of normification strategies.

Overall, in a system combining competition and normification, competition should not be upfront in the system, should be easy to opt in and out of, and should be focused primarily on those who are already achieving strong results. Future version of the CTD system will reflect this advice. For example, by default the initial screen will display the total number of shops rated by the community, the average number of shops rated by each member over a given period, e.g. the last 7 days, and the number rated by the user in this time. A "contribution" screen will also be included. This will displays target numbers of ratings to be awarded a "bronze", "silver" or "gold" contributor award for a given 7 day period, together with the user's current score. To emphasise this is in recognition of contribution, not an achievement, the message accompanying successful completion would be phrased as a "Thank you" message, rather than "Congratulations!". This will cater for those motivated by personal achievement, but will do so in a way that promotes a sense of contribution to a collective endeavour rather than winning over others. Finally, the app will include a "star contributors" screen that lists the scores of the top 10% of contributors. This will be accessible through an "opt-in" function. Once selected, the user can then set it as their default view. This will allow other-competition between those at the top who "opt-in", while reducing the potential to demotivate others. We hypothesise that this combination of competitive and normalising strategies will result in an overall improvement in the

performance of the community. However, we acknowledge that further research is necessary to investigate this hypothesis.

3. *Designers should carefully consider which of the norm types are most likely to encourage engagement in their user population and application context.*

The psychological theories of norm offer three different norm types – descriptive, injunctive, and personal – each of which has the potential to influence users positively or negatively. For example, Schultz and Nolan et al. [41] and Chen et al. [5] have found that *descriptive norms* can encourage low performing users to move towards the "typical" contribution level of a community. A potential disadvantage of descriptive norms, particularly in the early days of community development, is that the norm of contribution may not be high enough to sustain the community. If participants observe low levels of activity by other community members, it may have a demotivating effect.

Depending on the social characteristics of a system, *injunctive norms* may also be an option. Normative Social Behaviour suggests that individuals are influenced both by seeking social approval of people important to them, and by the expected behaviour of the groups they identify with. By sharing identities of participants in a community rather than remaining anonymous, individuals may experience a stronger motivation to contribute, particularly if they know others in the community. However this decision will involve trade-offs against other concerns, e.g. how important is privacy in a given system. If participants come to consider the community owners as people from whom they want social approval, then the theory would suggest that highlighting the visibility of performance to the owners, together with gentle encouragement and messages of thanks, would enhance motivation.

Finally, when *personal norms* are strongly held they can override the influence of other norms types, according to the Norm Activation Model. Those whose personal norms are aligned with the objectives of a crowdsourcing project are likely to be motivated to contribute beyond levels suggested by descriptive norm feedback. An environment can potentially be designed to appeal to those with a specific set of personal norms – perhaps leading to a reduced "pool" of recruits, but with higher levels of contributional commitment.

4. *Designers should consider alternate mechanisms to provide normifying feedback, both in terms of content and delivery modality.*

Research on the relative effectiveness of different approaches to providing norm feedback is at an early stage. Chen et al. [5] have used an email message stating an individual's contribution and comparing it with the average contribution of others who are similar. Our leaderboard allowed individuals to view the ranked performance of all participants, which some used in a normifying way. (This was not our original intention.) These two approaches involved different degrees of subtlety and had differing effects on the users. A wide range of other approaches could be applied, for example:

- Push messages of the form *"Together we can <do the task>. Most participants contribute at least X ratings a week"*. This wording draws on the findings of Schultz and Khazian et al. [42].

- Visualisations featuring contribution "bands" for a given period, including information on how many participants are in each band at a given time, and the participant's current band.

- Rather than focusing on individual comparison, a real-time visualisation of collective progress towards a group target, together with some form of notification whenever others have made a contribution.

Where injunctive norm feedback is used, important design decisions also are required regarding how explicitly this feedback is provided. For example, a participant's contribution could be displayed in red when well below average, and shading to green as it reaches the average. A more explicit message such as "We would like you to contribute at least X ratings a week" could also be used.

CONCLUSIONS AND FUTURE WORK

In many crowdsourcing and citizen science applications, the aim is to maximise the overall effectiveness of the crowd. In such situations, the motivating effect of competition on some may be outweighed by the demotivating effect it has on others. To that end, we have considered "normification" as an alternative design philosophy, aiming to encourage a sense of playing ones part in a collective effort. Whilst norm theories have influenced other areas of CSCW research, our review of crowdsourcing literature found little evidence of the use of norms as a design strategy.

Our analysis of qualitative data from the CTD study provides initial evidence that some participants in crowdsourcing systems relate to comparative performance data in a normalising way, even when it is framed competitively as a "leaderboard". These participants tend to be mid-range contributors. Such contributors can play a valuable role in increasing the overall effectiveness, and output, of crowdsourcing systems. In the case of the CTD study, we hypothesise that such people have a personal norm of sufficient contribution (as opposed to achieving more than others) and that the leaderboard allowed them to quantify what a sufficient contribution is, based on descriptive norms of others behaviour. However, with the leaderboard used in our system, we found evidence that normalising behaviour, interacting with the depressed scores from those demotivated by other-competition, lead to a reduction in the contribution of normalising participants. We believe more explicit norm strategies will increase the performance of normalising crowdsourcing participants.

In preparing this paper we are keenly aware of the ongoing debate within the HCI and CSCW communities regarding the role, and the gap between, theory and design-driven approaches [2, 19]. For example, Hekler et al. [19] have highlighted the role of differing experimental design strategies and the need for experimental validation of both theoretical predictions and new designs. We welcome this call. In the CTD study normification behaviour emerged somewhat accidentally. Research is now required to design and evaluate crowdsourcing systems that make more deliberate use of normification strategies. Two broad arguments presented in this paper are ripe for experimental examination: (1) that normification can improve the overall effectiveness of crowdsourcing systems, and (2) a combination of normification and competition will be most effective for systems requiring broad coverage, but not requiring high skill levels. These broad predictions, and the tentative design implications we have outlined, can also be examined at a more detailed level. For example, what are the most effective ways of combining normification and competition? Do opt-in strategies for competitive elements motivate people with strong competitive tendencies, whilst not demotivating others? Experiments can also be undertaken to investigate different types of norm feedback (e.g. text messages vs. visualisations, mean vs. individual scores), the effectiveness of subtle versus explicit injunctive feedback, and the impact of anonymity versus participant identification.

Subject to this ongoing research, we believe normalisation will provide a powerful additional strategy for designers of crowdsourcing and citizen science systems. This paper provides initial answers and a starting point for new research in this area.

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