Recruiting Messages Matter: Message Strategies to Attract Citizen Scientists

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Abstract
Although participation of citizen scientists is critical for a success of citizen science projects (a distinctive form of crowdsourcing), little attention has been paid to what types of messages can effectively recruit citizen scientists. Derived from previous studies on citizen scientists' motivations, we created and sent participants one of four recruiting messages for a new project, Gravity Spy, appealing to different motivations (i.e., learning about science, social proof, contribution to science, and altruism). Counter to earlier studies on motivation, our results showed that messages appealing to learning, contribution and social proof were more effective than a message appealing to altruism. We discuss the inconsistency between the present and prior study results and plans for future work.

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Introduction
Citizen science describes scientific projects that rely on contributions to scientific research from volunteers from the general public (i.e., citizens in the broadest sense of the term). Some citizen science projects have volunteers collect data, while others, including the Gravity Spy project examined in this paper, have volunteers analyze already-collected data, such as images of scientific phenomena. Most of the later are conducted via the Internet, making them examples of crowdsourcing and of interest to researchers of social computing.

The success of citizen science projects relies heavily on citizen scientists' participation. Thus, successful recruitment of participants is one of the keys to a project success. However, little attention has been paid to what types of messages successfully recruit citizen scientists to a project.

Motivations of Citizen Science Volunteers

With a growing number of citizen science projects, researchers have studied citizen scientists' motivations [1-5]. Past studies have suggested four different motivations: learning about science, social proof, contribution to science and altruism.

Learning about science

While participating in a science project, citizen scientists are exposed to contents of science and scientific processes. Studies documented that participation in citizen science actually increased knowledge related to the project [6, 7]. Learning was suggested to be especially important motivation when participants do not receive momentary rewards [8]. In one study, participants in ecological citizen science projects reported that they perceived participation in the projects to be a good opportunity to extend their knowledge [3].

Contribution to science

Citizen science projects are designed to contribute science. In one study, Zooniverse volunteers reported being more motivated by their contribution to science compared to by learning about science and altruism [4]. In a study of the citizen science game Foldit [1], citizen scientists reported that contributing to science is the most important motivation to participate.

Social proof

When people believe that an action is valued by other people and others engage in that action, they also tend to engage in the action, a phenomenon called social proof [9] or social norm [5]. Although social proof has been proposed as an effective way to attract participants [8], one experiment showed that a message emphasizing social proof was less effective than on emphasizing altruism in encouraging participants to make contributions to a crowdsourcing game [5].

Altruism

Finally, some previous studies adopted a model of helping behaviors to explain motivations underlying massive virtual collaborations [2]. Altruism was found to be effective in leading people to contribute to a crowdsourcing game [5] and has been found to be a prominent motivation for contribution in open source [10].

Although studies have suggested these four motives, it is not clear which should be appealed to in a message to recruit participants. Thus, we conducted an experiment to test the relative efficacy of messages appealing to each motive.

Method

A total of 36,513 registered Zooniverse (www.zooniverse.org) users randomly received one of the four email messages inviting them to participate in a new Zooniverse project, Gravity Spy. Zooniverse provides researchers a platform for citizen science projects and citizen scientists voluntarily participate in the projects.

Message	clicks in each condition n (%)
Learning	529 (5.80%)
Contribution	508 (5.56%)
Social proof	490 (5.37%)
Altruism	429 (4.70%)

Table 1: The number of users who clicked the link to Gravity Spy in the email message and % of total messages sent for each message condition.

Message Pairs	Z-score	P-Value
Learning - Contribution	0.682	0.495
Learning - Social Proof	1.270	0.204
Learning - Altruism	3.334	0.001
Contribution - Social proof	0.588	0.557
Contribution - Altruism	2.654	0.008
Social proof - Altruism	2.067	0.039

Table 2: Results of Z-tests comparing the number of click throughs between each pair of message conditions.

Email Messages

Four recruiting email messages were created. The four messages provided identical information about the Gravity Spy and provided a link to the project. However, the subject lines of the emails and the first and the last paragraph of the messages were designed to appeal to different motivations, as follows:

- Learning science: Extend your knowledge in astrophysics by participating in Gravity Spy!
- Social proof: Join your fellow citizen scientists in classifying problematic noise in the search for gravitational waves!... Many citizen scientists are already participating in the project…
- Contribution to science: You can contribute to science by classifying problematic noise in the search for gravitational waves!
- Altruism: Astrophysicists need your help to classify problematic noise in the search for gravitational waves!

Number of clicks as an outcome variable

Three weeks after sending out the emails, we used Google Analytics to count how many participants in each condition had clicked the unique link for the project provided in the email. This approach may underestimate interest, e.g., if a user forwards an email or types the project URL in a browser rather than clicking the provided link. However, there is no reason to expect such problems to occur more often in any particular condition, so they should not affect the comparison between conditions.

Results

The number and percentage of participants who clicked the link for Gravity Spy by condition is presented in Table 1. To test which conditions produced statistically different numbers of clicks, we conducted z-tests for each pair of conditions. The results are presented in Table 2. Volunteers who received the altruism message were less likely to click the link to Gravity Spy than those who received other messages at significance $p = .05$ level. No statistically significant difference was found among the other three message conditions.

Discussion and Future Study

The present results challenge the results of prior studies. Kaufman et al. [5] showed that a message appealing to altruism led to more contribution than a message appealing to social proof and Raddick et al. [4] documented Zooniverse volunteers' contribution to science as a more prominent motivation than learning. However, we tested citizen scientists' motivation to participate in a new project. Kaufman et al. [5] showed a message after recruitment to see which message leads to more contribution. Raddick et al. [4] asked Zooniverse volunteers about their motivation for citizen science projects in general, not necessarily about a new project.

Because peoples' motivation toward citizen science projects can change as they progress [2, 3], the strength of volunteers' motivation might differ depending on the stage of participation. For example, while this study indicated that a message appealing to learning was effective in recruiting participants, once participants learn enough, their

motives for learning may decrease, so a message appealing to learning might not continue to work.

To test volunteers' changes in motivation as they progress in Gravity Spy, we plan to monitor their participation in the project over time. For instance, does the message influence the total number of classifications volunteers complete, the number of visits to Gravity Spy and the time they spend contributing? Monitoring volunteers' activities in Gravity Spy by each message condition will help us understand what messages and motivations are associated with different types and levels of participation.

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