# Encouraging Work in Citizen Science: Experiments in Goal Setting and Anchoring

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## Abstract
This paper describes the results of an online field experiment where we designed and analyzed the effects of a goal-setting tracker in an online citizen science project - Floating Forest. The design of our tracker was influenced by psychology theories of anchoring and goal-setting. Our results of our experiment revealed: (1) setting goals increases annotations in a session; (2) numeric anchors influence goals; and (3) participants in the treatment who saw a prompt but did not set a goal, contributed more annotations than the participants in the control group. Our research shows how goal-setting and anchoring combine to increase work in online communities.

## Author Keywords
citizen science; experiments; goal-setting

## ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Experimentation

## Introduction
One major struggle in online production communities like Wikipedia and FLOSS communities is attracting new members to maintain levels of production. To increase production, communities might focus on one of two strategies that focus on with increasing the pool of

workers or increasing the amount of work contributed by current members of the group. Kraut et al. [4] note that while no unified theory exists for online communities that address motivation, participation, and retention, established theories from social psychology (e.g., goal setting, interpersonal bond, group identity formation stating, etc.) might be useful in designing motivational experiences for participants to online communities. With this in mind, we designed a goal setting experiment that relies on goal-setting and anchoring to increase contribution to an online citizen science community.

*Goal-Setting*

Goal-setting has been used to motivate workers and engagement in the group. Goal-setting improves task performance through goal assignment. Setting goals can increase performance by motivating employees by directing attention to tasks and, as a result, increasing persistence [5]. In online communities, goal-setting has also shown to be a useful method to increase production. For example, Beenen et al. [1] found participants contributed more frequently when they had concrete and challenging goals. In a study of editors in Wikipedia's Collaborations of the Week (COTW), Zhu et al. [7] showed highlighting group goals has a positive impact on production for individuals who see themselves as part of the group.

*Anchoring*

Tversky [6], define anchoring as the heuristic through which decision are influenced by the presence of some numeric value - the anchor. For example, Kimmerle [3] studied information sharing in online gaming communities where gamers played the role of a detective and possessed information with which to solve cases and discovered a willingness to share information was influenced by anchors and led to more disclosures when higher anchor values were displayed. Although not described as anchoring, research in [7] showed when new editors are shown editing role models the editing behaviors resemble those of the role model.

Separately, the literature on goal-setting and anchoring are robust and when practiced support increased motivation and this production. We are unaware of existing research merging both goal-setting and anchoring to increase production. Since citizen science communities rely on a constant stream of volunteers, strategies to get current volunteers to contribute a little more will dramatically increase the rate at which tasks are completed. We expect both theories to be useful in increasing participation. Our hypothesis are shown in the sidebar.

**Research Hypothesis**

**H1:** Participants who set goals will contribute more annotations in a session than participants not setting goals.

**H2:** When shown a goal setting prompt with a numeric anchor, participants will set goals closer to the anchor value.

## Research Design

The setting for our field experiment is the Floating Forest (http://www.floatingforests.org) citizen science project. Volunteers in Floating Forest annotate images of coastal regions identify the location of kelp. Floating Forest assists oceanographers track long-term changes in the ecosystem. Figure 1 displays the annotation interface; volunteers identify kelp by drawing around the kelp areas. While annotating, users can track the number annotations they submitted, the coordinates of the satellite image, and after submitting an annotation, volunteers can see comments left by other volunteers.

*Experiment Design*

We designed a 2X2 factorial experiment with two levels for a numerical anchor (50 or 1), a message (Social or Personal). Participants were randomly assigned either the control or treatment. For participants in the treatment, after completing two annotations, a prompt appeared that displayed one level of message input (Figures 2 and

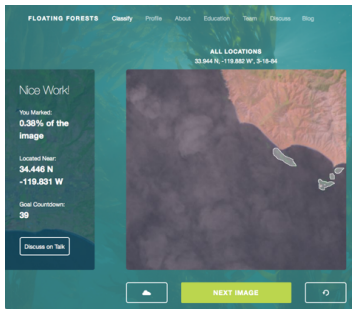


**Figure 1:** Annotation interface

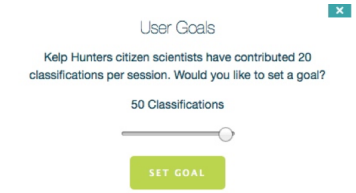


**Figure 2:** Social message with high anchor

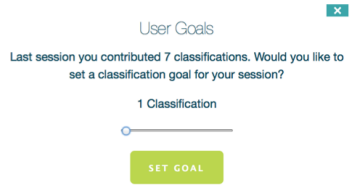


**Figure 3:** Personal message with low anchor

3). Participants either saw a social message that stated, "Kelp Hunters citizen scientists have contributed 20 classifications per session. Would you like to set a goal?" or a personal message that read, "You can set goals in Floating Forests to manage your contribution. Would you like to set a goal for this session?" For the input, the sliding bar was set to a low value (1) or high value (50). Participants selected a goal by adjusting the sliding bar to the desired numeric goal and clicking the "Set Goal" button. Once a participant set a goal, a countdown box was displayed in the interface and after completing the goal, a notification message was displayed. Participants in the treatment were not required to set a goal, making opting out an option.

*Data Analysis*

To test our hypothesis we analyzed our data using one-way ANOVA. The number of session annotation (log transformed) is the dependent variable for all statistical tests. We made transformations to our dataset that reflect the unique characteristics of the experiment design and the Floating Forest project. First, since some Zooniverse projects are shown as exhibits in museums or are part of school lessons, many annotations are regularly submitted from one user account, leading to potential outliers. Thus, we used the median absolute deviation (MAD) to remove outliers (2 detected). Second, the organizers of Floating Forest suggested displaying the messages only after volunteers had a chance to experience the project, so the prompt was shown after volunteers completed two annotations. Accordingly, we removed session where volunteers submitted less than two annotations.

## Results

More than 4,871 participants contributed to Floating Forest. Excluding volunteers whose sessions did not meet the criteria described in the previous section, 3,553 participants remained. Table 1 shows contribution statistics for the control (N= 2,492) and treatment groups (N=1,061). Since volunteers were allowed to opt-in to the experiment, not all volunteers set goals. Table 1 show the proportion of volunteers who compliant and non-compliant volunteers in the treatment. In total, 172 (16%) volunteers set goals.

| | | Annotations $\mu$ | N |
|---|---|---|---|
| Treatment | Compliant | 271(SD=753) | 172 |
| | Non-Compliant | 106.17(SD=316) | 889 |
| Control | | 73 (SD=133 | 2492 |

**Table 1:** Summary of annotation submitted by participants in experiment groups

*H1. Setting Goals Increases Production*

To determine whether goal-setting was a significant motivator to increase contribution in participants' sessions, we compared the sessions of participants in the control those in the treatment who complied. We found participants who set goals contributed more annotations ($\mu$=4.47) than participants not setting goals ($\mu$=3.34). The one-way ANOVA revealed a statistically significant difference at $F(1, 2662) = 95.56$, $p < .001$. Next, we compared the main effects of the message, anchor, and the interaction effect of the two factors. Our analysis revealed non-significant difference exists between the groups.

Lastly, we wanted to determine whether seeing a goal-setting prompt increased session annotations. We compared participants in the treatment (non-compliant) to the control and found participants in the treatment contribute more annotations ($\mu$=3.57) than participants who

were not shown a message ($\mu$=3.34). The results of the one-way ANOVA revealed this difference was statistically significant at F(1, 3379) = 5.52, p $=$ .01.

*H2. Anchors Influence Goals*
To determine whether anchors contributed to the goals participants selected, we compared the anchor and the goal participants selected when they were shown the prompt. The results of the ANOVA revealed the main effect input had a significant impact on the goals, where the higher anchor ($\mu$=40.23) caused participants to set goals higher than the lower anchor ($\mu$=19.32). The difference is significant at F(1,18808) = 55.92 p $<$ .001. The main effect message and interaction effect of message and anchor were not significant.

## Future Work

*Encouragement Designs*
One revelation from this experiment was the issue of self-selection. Our experiment design allowed participants to opt-out even though they were in the treatment. Clinical trials face a similar issue where patients assignment is randomized, but patients decide whether to comply with the treatment (i.e., set goals). To combat the issue of compliance, researchers use encouragement designs [2] which use a novel analysis strategy. In future work, we will explore how encouragement designs can be applied in online field experiments with self-selection. We suspect CSCW researchers engaged in experimental research might find a discussion of this method useful.

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