Organizing without Formal Organization: Group Identification, Goal Setting and Social Modeling in Directing Online Production

Haiyi Zhu, Robert Kraut, Aniket Kittur
Carnegie Mellon University
5000 Forbes Avenue, Pittsburgh, PA15213
{haiyiz, robert.kraut, nkittur}@cs.cmu.edu

ABSTRACT
A challenge for many online production communities is to direct their members to accomplish tasks that are important to the group, even when these tasks may not match individual members' interests. Here we investigate how combining group identification and direction setting can motivate volunteers in online communities to accomplish tasks important to the success of the group as a whole. We hypothesize that group identity, the perception of belonging to a group, triggers in-group favoritism; and direction setting (including explicit direction from group goals and implicit direction from role models) focuses people's group-oriented motivation towards the group's important tasks. We tested our hypotheses in the context of Wikipedia's Collaborations of the Week (COTW), a group goal setting mechanism and a social event within Wikiprojects. Results demonstrate that 1) publicizing important group goals via COTW can have a strong motivating influence on editors who have voluntarily identified themselves as group members compared to those who have not self-identified; 2) the effects of goals spill over to non-goal related tasks; and 3) editors exposed to group role models in COTW are more likely to perform similarly to the models on group-relevant citizenship behaviors. Finally, we discuss design and managerial implications based on our findings.

Author Keywords
Online Production Communities, Group Identification, Governance Mechanisms, Directing Behaviors, Group Goals.

ACM Classification Keywords
H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces – Collaborative computing, Computer-supported cooperative work, Web-based interaction; K.4.3 [Computers and Society]: Organizational Impacts – Computer supported collaborative work.

CSCW 2012, February 11–15, 2012, Seattle, Washington.

INTRODUCTION

Online production communities are becoming increasingly important in creating innovative products in the networked world. These organizations have successfully aggregated the efforts of millions of volunteers to produce complex artifacts such as GNU/Linux and Wikipedia. Currently most large online projects primarily rely on a paradigm of self-direction in which contributors work primarily on the tasks they are interested in. This paradigm provides a number of benefits. Contributors are motivated to work on the tasks in which they are intrinsically interested in and are likely to choose tasks in which they already have some expertise [4]. However, this approach breaks down when there are conflicts between the interests of the contributors and the interests of the project as a whole. Many people may want to work on the same popular areas (e.g., an article on "Barack Obama" in Wikipedia) while ignoring less popular areas that require work. Contributors may not want to perform maintenance and other unattractive tasks, even though these tasks are important to the continued functioning and health of the project.

Many techniques used in conventional employment organizations are not effective in managing online volunteers due to the fundamental characteristics of online communities, including lack of employment contracts, weak external incentives, weak interpersonal bonds, impoverished communication, large size, and high turnover [20]. For example, if a project tries to exert too much managerial control, volunteers can simply leave, with fewer economic or social consequences than if they had quit a job or left a real-life social group.

Instead, communities must turn to other means of motivating volunteers to accomplish tasks that are important for the welfare of the group. One technique is by leveraging group identification—the perception of belonging to a group. If volunteers feel that their identities are tied to the identity of the group, their goals may be more likely to reflect those that are important to the group [1,15,19,32]. However, group identification by itself does not specify *which* particular tasks to work on.

In contrast, direction setting—for example by specifying goals—can be an effective mechanism for accomplishing specific tasks [3,21,22]. However, direction setting by itself may not be enough. For example, Cosley and his colleagues found that task recommendations based only on the

community's needs are less likely to interest members than those that consider personal needs [9]. These challenges may become even more pronounced for tasks that are considered unpleasant or unrewarding.

We hypothesize that group identification and direction setting can complement each other in managing volunteers' efforts. Group identification can align the individual volunteer's goals with the group's goals, while direction setting can channel their effort toward specific group goals. Thus people who identify themselves as group members may voluntarily follow directions based on group needs and perform tasks valued by the group because they believe that investing effort in these tasks is important for the group and thus validates their own identity.

This paper describes a mechanism to motivate and manage volunteers when standard managerial mechanisms deployed in conventional organizations are not available. This mechanism combines group identification and direction setting. Particularly, two sources of direction setting are investigated – explicit direction based on publicized group goals and implicit direction based on role modeling. We test the effectiveness of the mechanism in the context of WikiProjects, subgroups within Wikipedia. After presenting the main findings we also discuss design implications for governance in online communities.

TRADITIONAL MANAGEMENT MECHANISMS

Markets

The market mechanism relies on individuals to make independent decisions about the tasks they want to undertake and how they will do them. In contrast to simple self-direction, market mechanisms use external incentives, such as price, to regulate participants' behaviors. Amazon's Mechanical Turk, a popular crowd sourcing website, uses price to encourage subscribers to undertake tasks that employers care most about. If Wikipedia applied a monetary market mechanism, it would pay editors more for editing important but unpopular articles or for engaging in important but tedious tasks such as maintenance work. However, volunteer peer production systems rarely have the resources to provide external incentives to get important work done. External incentives may undermine people's intrinsic motivation to contribute if they become focused on the extrinsic rewards [11]. Finally, they may be inconsistent with the ideology that drives some volunteer communities.

Bureaucratic Control

Three primary controlling strategies evolved in the history of modern organizations [2]. First was "simple control", which represents direct and personal supervision by factory owners. The second was "technological control", in which simple control was reinforced by physical technology such as the assembly line in traditional manufacturing. The most familiar is bureaucratic control, which derives control from hierarchical social relations between supervisor and supervisee and sets of systemic rules that reward compliance and punish noncompliance [2]. A supervisor can legitimately assign employees tasks and rewards and punish them based on their amount and quality of work.

Bureaucratic control legitimizes the roles of managers, so that employees see themselves as having an obligation to adhere to the decisions made by their managers. External incentives, including monetary rewards such as raises and bonuses, and social ones including promotions and better assignments, supplement this legitimacy and are also important in causing employees to follow the direction of their managers.

Bureaucratic control has become the primary control strategy in conventional modern organizations. Some degree of bureaucratic control exists in online production communities, as well. For many years, Linus Torvalds had significant control in the community developing the Linux operating system. Although by definition managers cannot use wages as incentives to get volunteers to comply with their directives, they can motivate contributors through promotion from rank-and-file positions to more important ones, such as committer status in open source software development projects [29] or administrator status in Wikipedia [6].

However, the effectiveness of bureaucratic control is limited by other characteristics of online production communities. As with market mechanisms, online production communities cannot afford external incentives. Furthermore, tight managerial control of volunteers, including regular supervision and communication with them, is associated with higher turnover rates in offline volunteer organizations. According to Hager and Brudney, bureaucratic control may cause their "volunteer experiences to feel too much like the grind of their daily work rather than an enjoyable avocation," [14, p. 9] and thereby drive them away. In addition, impoverished communication and weak interpersonal bonds in online communities weaken the managers' ability to exert bureaucratic control [10].

INCORPORATING GROUP IDENTITY AND DIRECTION SETTING

Group identity

Tajfel and his colleagues conducted a series of laboratory studies in the early 1970s showing that the mere perception of belonging to a group – that is, social categorization per se – is sufficient to trigger intergroup discrimination favoring the in-group [32, 33, 34]. For example, when assigned to groups on the basis of trivial criteria, participants tend to award more rewards to in-group members than outgroup members. Tajfel and his colleagues introduced the concept of social identity and developed classic social identity theory. Social identity is "the individual's knowledge that he belongs to certain social groups together with some emotional and value significance to him of the group membership" [32]. Social identity rests on intergroup social comparisons, in which members attempt to establish or confirm ingroup-favoring evaluative distinctiveness between ingroup and outgroup. Social

identity is motivated by an underlying need for self-esteem [34]. That is, to the extent people have incorporated the group's identity into their personal identities, positive evaluation of the group results in enhanced self-esteem.

The relationship of social identity and in-group favoritism plays out in work environments. In offline organizations, social identity leads individuals to perform behaviors beneficial to the groups of which they are part (see [1] for a review). The outcomes associated with social identity involve cooperation, effort, participation, organizationally beneficial decision making, intrinsic motivation, task performance, information sharing, and coordinated action. Recently work has extended the analysis to online volunteer communities as well. Kittur and his colleagues [19] examined the effects of group identification in Wikipedia, finding that joining a WikiProject (a subgroup in Wikipedia) was associated with increased production work, coordination work and citizenship behaviors.

Direction setting: Goal setting & social modeling

The in-group favoritism that results from group identification alone is often too diffuse to effectively direct volunteers toward specific actions. Volunteers, who identify with a group and want to benefit it, have wide latitude in selecting behaviors that benefit the group. Therefore, we hypothesize that direction setting could complement group identification by focusing people's group-oriented motivation towards important and necessary tasks for the group.

Previous researchers interested in increasing contribution in online communities have often focused on getting volunteers to provide more of what they already contribute. For example, Beenen et al. examined the effects of goal setting in MovieLens [3]. They assigned performance goals (e.g., number of movies to rate), while allowing volunteers to self-select specific targets (e.g., which movies to rate). Cosley and his colleagues designed task recommendation systems in Wikipedia and MovieLens. However, these systems focused on matching individuals with tasks they are already interested in [8,9]. Below we discuss how two direction setting mechanisms—explicit goal setting and implicit social modeling—can motivate self-identified group members to work on tasks important for the group's interests, rather than their own interests.

Goal setting

A goal is the object or aim of an action, usually within a specified time limit [22]. Goal setting can be an effective technique to direct human attention and efforts toward goal-relevant activities and away from goal-irrelevant activities [22, 23]. For example, students with specific learning goals attend to and learn goal-relevant passages better than goal-irrelevant passages [30]; similarly, when people receive feedback, they only improve their performance on dimensions for which they have goals even when receiving feedback on multiple dimensions [21]. In addition to the directive function, goals can motivate high task performance. Goals have an energizing function – high goals lead to greater effort than low goals. Goals also affect persistence – they extend directed effort over time. Finally, goals also affect action indirectly by leading to strategy development and action plans for attaining ones' goal [22].

Group goals, which highlight important tasks for the group as a whole, can direct people's attention and efforts towards these tasks and improve their performance on these tasks. The effects are strongest when people perceive goals as desirable and important for them and thus are committed to the goal [22]. As we discussed previously, people who identify with the group align their own interest with the group's interest; therefore they are more likely to invest their efforts to achieve group goal than people who do not identify with the group because they believe the goals are important to the group and thus important for themselves.

> **Hypothesis 1** (Direct effects of goal setting)**.**
> **H1a.** Highlighting tasks important to the group through goal setting directs people' efforts towards these tasks and improves performance on these tasks. **H1b.** The effect is stronger for people who identify with the group than those who do not identify with the group.

If we assume volunteers' total efforts are fixed, group goals would only redistribute their efforts. However, there are reasons to expect that volunteers' total efforts will be increased by group goal setting. Specifically, group goals might lead to motivational spillover, in which people increase their efforts on behalf of the group beyond that demanded by the original goals. Because of expectancy effects, success and failure on one task may change motivations for subsequent tasks [18, 23, 28]. Accomplishing group goals can lead to rewards such as recognition and reputation, activating people to continue working after the initial task is accomplished. Furthermore, publicizing group goals may activate people's awareness of the group, which then leads to more group relevant activities and contributions.

> **Hypothesis 2** (Spillover effects of goal setting)**.**
> Group goals increases people's general contributions to group-related tasks.

Social modeling

There are often a set of prototypical members in groups who best embody the features that are valued by the group [15, 35]. In volunteer associations and online production groups, the prototypical members are often a small set of core members who perform large amounts of work, engage in coordination activities, and have significantly more knowledge of the group and the community than peripheral members [26, 27]. The prototypical group members serve as models, providing cues for what behavior is valued, and make salient the situational needs for certain actions.

According to social identity and self-categorization theories, individuals who identify themselves as group members tend to spontaneously change their behaviors to be more similar to these prototypical members [15, 35]. In contrast,

prototypical members should have less of an effect on those who does not consider themselves as group members [15, 35].

However, for social modeling to occur, the prototypical members should be visible, so that group members can perceive them as role models and to imitate their behaviors.

Hypothesis 3. (Effects of social modeling)
H3a Exposure to prototypical group members should lead people to perform more group-valued behaviors that prototypical members engage in. **H3b** The effect is stronger for people who identify with the group than those who do not identify with the group.

STUDY PLATFORM

Wikiprojects – groups in Wikipedia

We chose Wikiprojects, subgroups in Wikipedia, as the domain in which to investigate the effects of group identification and direction setting. Wikiprojects are collections of editors interested in specific topics such as military history, psychology, or even copyediting. As of March 2008, Wikipedia contained more than 2000 Wikiprojects.

Each Wikiproject has dedicated pages (known as project pages) on which editors can coordinate and organize the writing and the editing of project-related articles. Wikiprojects have a loose membership structure; any editor can participate in project activities and contribute to articles within projects as they see fit. Editors often express their identification with a project by adding their name to a member list or tagging their personal user pages with the project template. Some projects have explicit coordinators, who are responsible for coordinating maintenance tasks and keeping the project functioning.

Wikiprojects employ a variety of techniques to direct members' attention to project valued-tasks [19]. These techniques include: 1) *Open task lists or article alerts*. Many Wikiprojects list from dozens to hundreds of open tasks in their project pages. These lists identify articles that need to be expanded, assessed, copy-edited or reviewed and discussions that need more participation. 2) *Important article lists*. Some Wikiprojects list their most valued articles in their project pages, encouraging people to improve these. 3) *Contests*. Some Wikiprojects set goals and then reward people who contribute the most to them over a defined time period. 4) *Collaborations of the week (COTW)*. Projects set one or two articles need to improve during a defined time period (usually one week to one month).

Collaborations of the Week (COTW)

In this paper, we investigated a specific mechanism, collaborations of the week, which designate one or two articles to improve in a defined period. Collaborations of the Week (COTW) are a widely-applied mechanism in Wikiprojects. As of March 2008, 189 Wikiprojects had conducted COTWs for at least part of their history.

COTWs usually have two phases - selection and collaboration. In the selection phase the project chooses one or two articles on which members will collaborate. In some projects, the article is chosen through voting. Other projects rely on the judgment of coordinators for article selection. In other cases, the choice is made by an automated program. During the collaboration phase, the project tags the chosen article(s) with a special template in its talk page (as shown in Figure 1). This template is visible to all editors who read the article talk page, not just those who are members of the Wikiproject. In addition, the project typically announces the targets of the collaboration on its project pages (as shown in Figure 2). Some projects also send special reminders to project members (those editors with names on member list) on their personal talk pages.

Figure 1. An example template identifying an article as a collaboration of the week.

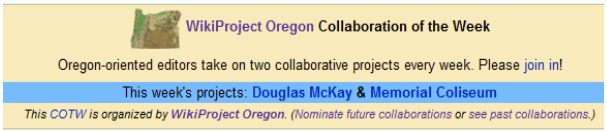

Figure 2. A collaboration of the week announcement in a project page

We chose to examine the Collaborations of the Week as group goal setting mechanism for a number of reasons:

- COTWs are a project goal setting mechanism that highlights tasks crucial for the Wikiproject. For example, some projects explicitly claim that the goal of collaborations is to "fill the gap" of the Wikiproject [38]; collaboration targets are typically articles rated as high importance but having low quality [40]. Furthermore, COTWs have many properties of effective goals, according to the goal setting theory [22]. Compared with a diffuse open task list, for example, COTWs set specific, concrete and time-limited requirements for editors. The limited number of articles and defined time period focus editors' attention on these articles, potentially leading to both production and social benefits.
- COTWs are also social events. COTWs focus volunteers towards specific targets during a defined period, providing opportunities for volunteers to discuss plans and progress with each other, and potentially to influence each other. According to a small survey we conducted with COTW participants, COTWs are "a chance to get to meet your collaborators and their interests". COTW participants are "virtually surrounded by peers who are into the topic and you all have the common goal of sharing knowledge together".

- COTWs are salient. Notices for COTWs are prominent on project pages, thereby attracting people who care about the project, and on the talk pages of the articles which are targets of the collaboration, thereby attracting editors interested in the specific article. Also, the effects of COTWs are amenable to analysis. Firstly, COTWs are widely-used so we can obtain sufficient data for analysis. Secondly they have clear-cut start times and end times. We can compare editors' behavior on the same articles when they are the subjects of collaborations and at other times.

METHOD

Data Collection

In the following analysis, we used a complete download provided by the MediaWiki Foundation from Wikipedia's inception to March 2008 (approximately 182 million revisions). To handle this data volume, we used the Yahoo! M45 computing cluster running Hadoop and Pig. Among the 189 projects that ever used COTW for goal setting, we chose projects with at least five collaborations that had explicit time periods and complete collaboration histories. We also excluded redirected projects and two collaboration-oriented projects which do not have their own topics. The remaining 26 projects carried out a total of 618 collaborations, which lasted 17.7 days on average.

The 26 projects were large and important ones in Wikipedia. They include eight of the ten largest projects in Wikipedia. On average, each project encompassed 26,553 articles (median = 4,632) and 471 members (median = 255.5). Overall, these 26 projects contained 68.5% of all articles associated with any project in Wikipedia.

ANALYSIS AND RESULTS

1. Direct Effects of Goal Setting (H1)

1.1 Analysis Strategy

H1 predicts that, although any editor can participate in the Collaborations of the Week, people who identify themselves as group members in particular will be especially likely to work more on goal-related articles.

We included in our sample editors who had edited the collaborated target articles either during the collaboration period (week or month) or the pre- and post-collaboration period (week or month). We assume that all of these editors were aware of the event, at least from the advertisement notice on the article talk page.

To test the direct effects of group goals, we examined whether these editors' contributions increased during the goal period (the period when the articles are selected as collaboration targets) compared to the non-goal period (the pre- and post-collaboration period). For the effects of group identification, we further investigated whether the contribution increase during the goal period was larger for editors who self-identified as group members than for those who did not.

1.2 Dependent Variable

Goal-relevant Contribution: We measured editors' contributions towards goal-related articles through their revision count on that article. Revisions are a measure of editors' effort, indicating the number of changes they make to articles during a period of time. Each revision comprises a set of editing actions, for example adding, changing, deleting or reverting text, references or illustrations, or communicating with other editors. In this analysis, the dependent measure was the number of revisions the editor made to the COTW articles or their associated discussion pages.

1.3 Independent Variables

Goal period: Collaborations of the Week are explicit group goals that designate one or two articles as targets of work during a defined time period. When editors revise and add to these articles during that period, we consider that they are following the group's goals. However, editing other articles or editing the COTW articles at other periods did not fulfill the group goals in this context. To assess the effectiveness of these goals, we compared contributions towards the same target articles in different time periods – pre-collaboration, during collaboration and post-collaboration. In the analysis, pre-, during and post-collaboration periods were of the same length. For example, if the collaboration lasted one week, pre-collaboration is the week before the start of collaboration; while post-collaboration includes the week after the end of the collaboration. In particular, the dummy variable "Goal period" in our analysis was defined as 0 during the pre-collaboration and post-collaboration periods, and 1 during the collaboration period.

Group identification: Originally, we operationalized people who identified with the group as those who edited the project member lists. However, we found edits to the project members list page were not always a good indicator of group identification, as members often added the names of others to the page (e.g., if the page was copied or repurposed from another source). Therefore, we determined self-identified group members to be all editors who have edited any project page, under the assumption that editors who are involved in the organization of project activities are more likely to consider themselves group members. We used a dummy variable to indicate group identification: 0 indicates the editor has not identified as a group member, while 1 indicates the editor has identified as a group member.

1.4 Control Variables.

Goal length: the number of weeks the collaboration lasts.

Project articles: the total number of articles in the scope of the project during the given period.

Project members: the total number of project members during the given period.

1.5 Statistical Model

We conducted an editor-level analysis, with revision count of contributors to the article as the dependent variable. Because revision counts are count data with a non-normal distribution truncated at zero, we used a negative binomial regression model. Because the analysis compared the contributions from the same editor in different time periods and one of the explanatory variables is constant for an individual, we used random effects methods to deal with the panel data set [16].

1.6 Analysis Results

Figure 3 shows the average number of revisions per editor on collaboration targets in different time periods. We found that people in general contributed more during collaboration periods, but the effect is dramatically larger for those who identified with the group: editors who identified with the group contribute approximately three times more during the collaboration period than they did before the collaboration period, and four times more than editors who did not identify with the group.

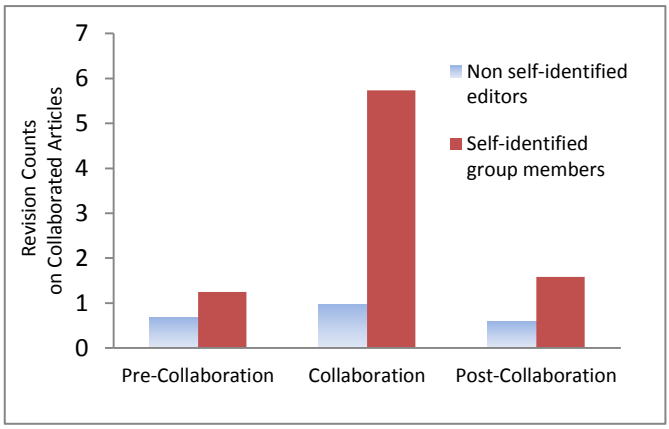

Figure 3. Average revision counts on collaboration target articles in different time periods from different types of editors.

Predictors	IRR.	Std. Err.	P>|z|
Group identification (1-self-identified; 0-not identified)	1.424	.301	<.001
Goal period (1- collaboration period; 0 – pre & post collaboration)	2.066	.036	<.001
Goal period * Group identification	2.975	.102	<.001
Goal length	.996	.001	0.002
Project members	1.000	2.16e-5	<.001
Project articles	1.000	1.07e-7	.105
Log likelihood	-42894.534		

Table 1. Negative binomial regression model predicting goal relevant contributions (revision counts on collaboration target articles). IRR: the ratio change of the dependent variable by increasing an independent variable by a unit.

The negative binomial regression model with random effects methods predicting revision counts on COTW articles tests the significance of these results we ran. The results of the analysis are shown in Table 1, with the effects reported as Incidence Rate Ratios (IRR), which can be interpreted as the ratio change of the dependent variable when increasing an independent variable by one unit. The model assumes that contributions from non-self-identified editors during non-collaboration periods are the baseline level. During collaboration periods, non-self-identified editors increased their contributions 107%, while self-identified editors increased 515% compared to non-collaboration period. The main effect ($P_{Goal\_period} < 0.001$) and interaction effect ($P_{Goal\_period*Group\_identification} < 0.001$) are both highly significant. These results support H1, suggesting that COTWs have a strong motivating effect on contribution, and the effect is especially strong for editors who identify with the project.

The results also suggest that the number of weeks a COTW lasts has a slight negative effect on contributions. Although statistically significant, the size of this effect is quite small, suggesting care must be taken in making too much of it. Factors such as the total number of project articles and project members do not have significant effects. Together, these results suggest that the group goal settings coupled with projects is robust and applies across variations in the length of goal period, and project characteristics.

2. Spillover Effects of Goal Setting (H2)

2.1 Analysis Strategy

The previous analysis demonstrated that group goals set via Collaborations of the Week energized editors, especially self-identified project members. We now examine whether accomplishing these COTW-set group goals influence these project members' editing contributions beyond the targets of the group goal.

We examined the 26 projects in different time periods. We investigated whether the projects received more contributions on goal-irrelevant articles when group goals were posted compared to the period when there were no group goal goals at all.

2.2 Dependent Variable

Non-related contributions: the average number of revisions done by each self-identified project member on all articles in the scope of a given project (including associated discussion pages) in a given month, *excluding the revisions on COTW target articles.*

2.3 Independent Variable

Goal period: a dummy variable indicating whether the project posted COTW goals in a given month. Even though all of the projects in the sample used COTWs at some time

in their histories, they used them in only 46% of the months in the dataset.

2.4 Control Variables

Project articles: number of articles in the project.

Project members: total number of project members signed up before the end of the given month.

Project coordination activity: number of revisions made to the project pages in the given month. Since these project pages are where editors organize and discuss project activities, this variable reflects the overall activity of the group during the time period. We used this variable to control for other project activities which might influence contribution towards the project.

Project age: number of months the project has been in existence, starting month one (the month when the project was created). We used this variable to control for the maturity of the project which might influence how much effort people will devote towards the project.

2.5 Statistical Model

For reasons similar to those for the previous analysis, we also applied a negative binomial regression model with random effects to fit the data.

2.6 Analysis Results

The results reveal that the presence of a Collaboration of the Week substantially increased the average number of edits done by project members (IRR = 2.14, P<0.001). The effect is substantial: the presence of COTW goals induced project members to approximately double their contributions on non-target articles. To put this in context, during the month the project posted COTW goals, self-identified group members on average made 9 edits to the collaboration target articles and 60 more edits to other articles in the scope of the project compared to non-COTW month. Thus it appears that employing shared group goal mechanisms such as COTWs can have large benefits to contributions to the project that go beyond the articles identified as collaboration targets.

	IRR	SE	P value
Setting goals	2.140	.097	<0.001
Project Activities	1.000	3.61e-05	<0.001
Project Members	1.000	9.13e-05	0.002
Project Articles	1.000	4.26e-07	<0.001
Project Age	1.043	0.002	<0.001
Log likelihood	-3121.773		

Table2. Negative binomial regression model with random effects predicting goal-irrelevant group-related contributions

3. Effects of Social Modeling (H3)

3.1 Analysis Strategy

Group goal presents explicit direction setting while social modeling is more implicit. When editors work together to accomplish group goals, they can be exposed to prototypical project members, who may serve as role models, and whose behavior provides implicit direction to others (especially self-identified group members).

According to prior research, social modeling may be a useful way to influence a particularly important kind of contribution: citizenship behavior [31]. Citizenship behavior has been defined by Organ [25] as the types of "extra-role" behaviors that are not explicitly recognized by the formal reward system, but are vital to the continued functioning of the organization. For example, the central and most valued work in Wikipedia is creating good quality articles. Adding content to articles is not sufficient. Established editor brag about the number of articles they have brought to "featured article" status. In contrast, maintenance tasks, such as copy-editing, formatting citations, welcoming newcomers, reverting vandalisms, and assessing articles, are actually important to wikipedia as a whole, but less explicitly value or rewarded. Wikipedians wrote of them as "tedious, often unrewarding, and usually unappreciated" tasks [39]. Many of the non-writing wikiwork identified by Kriplean et al [17], such as teaching rewarding welcoming others, finding sockpuppets, reverting vandalism, assessing articles and creating templates, comprise citizenship behavior in Wikipedia. In the analyses below, we treat reverting vandalism and article assessment as representative citizenship behaviors.

We define prototypical members as those who were the heaviest contributors in project pages and at the same time participated in collaborations of the week in a given period. We selected regular editors as non-prototypical members who also participated in COTWs at least once. To measure the influence of role models, we calculated the correlation between their citizenship behaviors with the citizenship behaviors of regular editors, considering 1) whether the regular editors identified themselves as project members or not, and 2) whether the regular editors participated in COTWs in the given period or not. According to hypothesis 3, the correlation between prototypical members' behaviors and the behaviors of the regular editors will be higher when the regular editors participated in COTWs than during other periods. Furthermore, people who self-identified as group members and participated in COTWs should have the highest correlation with prototypical members.

3.2 Dependent variables: citizenship behaviors

Anti-vandalism correlation: Vandalism is defined as "any addition, removal, or change of content made in a deliberate attempt to compromise the integrity of Wikipedia" [36]. Anti-vandalism is the behavior of reverting the vandalized version to a previous state. Following previous research [19], we quantified anti-vandalism as edits annotated with common vandalism-fighting comments, such as "Reverting

vandalism" or variants such as "rvv". We measured this variable in two steps. First, we calculated the (log transformed) number of revisions with anti-vandalism comments on articles within the project done by each editor in the given month. We then used this data to calculate the correlation of regular members with prototypical members. To compute this correlation, we matched regular members with prototypical members whom they would meet if they participated in COTWs in that month (multiple editors can match the same prototypical member in a given month).

Assessment correlation: Each article within the scope of a Wikiproject can have a quality rating and an importance rating in its Wikiproject template. Assessing an article involves adding or changing the rating of an article. Assessing articles is an important task for Wikiproject in order to recognize excellent contribution and identify important topics in need of further work; there have been over 2.1 million assessments made over the history of Wikipedia, with most being driven by individual projects. Similar to the anti-vandalism correlation, we measured this variable by 1) calculating the (log transformed) number of revisions done by the editor which change the rating of any article within the project, and 2) calculating the correlation of regular members with prototypical members.

3.3 Analysis Results

The results are shown numerically in Table 3, and graphically in Figure 4 and Figure 5. For assessments, the results are consistent with the Hypothesis 3. Compared to editors who did not participate in collaborations of the week, editors who were exposed to prototypical members through the Collaborations of the Week performed more similarly to prototypical members in terms of helping assess articles. Editors who self-identified as group members and participated in the Collaborations of the Week acted most similar to prototypical members (r=0.36), compared to self-identified members in other months (r=0.24) or to non-self-identified editors, either in the month participating collaborations (r=0.08) or other months (r= 0.07).

For anti-vandalism, editors who participated in collaborations also behaved more similarly to prototypical members (average r=0.11) compared to editors who did not participate (average r=0.06). Surprisingly, however, the difference between participants and non-participants has higher among editors who did not identify as group members (non-self-identified editors: r=0.13 versus r=0.05) compared to those who did (self-identified members: r=0.09 versus r=0.06). Thus we have mixed results about the interaction effects of group identification and social modeling in the case of vandalism reversion. One possible explanation for the latter findings is that, reverting vandalism, although an important citizenship behavior, is not an activity that is strongly identified with any particular Wikiproject. This suggests that social modeling may not be effective for behaviors that are not specific to the group. Additional research is needed to further understand the mechanism of social modeling in these settings: why are models more likely to influence other community members on some citizenship behaviors but not others?

Correlation with prototypical group members	Regular editors			
	Editors who self-identified as group members		Editors who did not identify as group members	
	The month when participated in COTWs	The month when not participate in COTWs	The month when participated in COTWs	The month when not participate in COTWs
Assessment	0.3631	0.2378	0.0759	0.0697
Anti-vandalism	0.0852	0.0599	0.1292	0.0525

Table 3. The correlations of the behaviors of regular editors with the behaviors of prototypical project members.

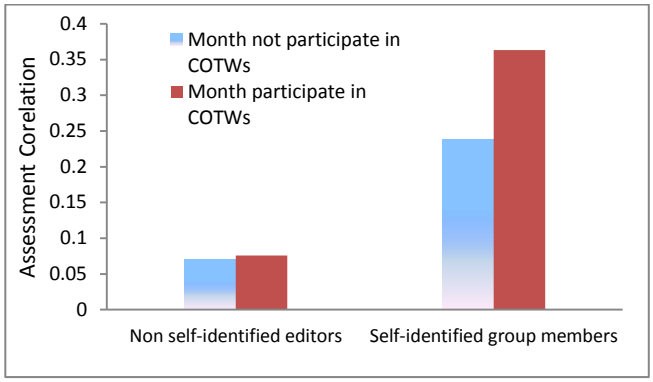

Figure 4. The correlation of regular editors' assessment with the prototypical project members' assessment

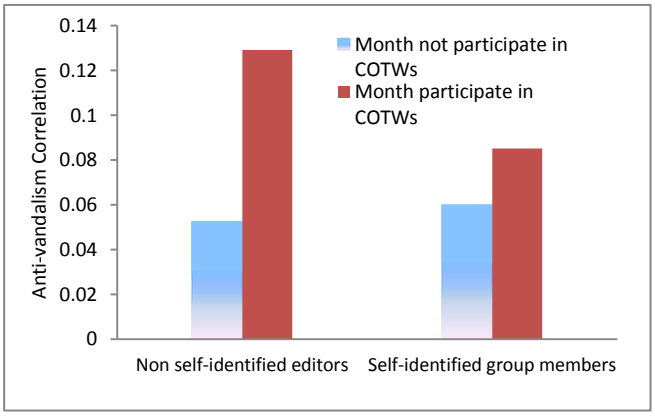

Figure 5. The correlation of regular editors' anti-vandalism with the prototypical project members' anti-vandalism

DISCUSSION

Lessons from Collaborations of the Week

Despite the success of Collaborations of the Week in Wikipedia, many Wikipedia projects that successfully used them ultimately abandoned them. In our data, only 13 of the 26 projects that started to use Collaborations of the Week continued to use them throughout the period of our research (as of March 2008). According to interviews with project leaders [37] the explanation is not related to their effectiveness but instead to the bureaucratic cost of running them. Like any recurrent event, they need an organizer responsible for managing the collaboration process, such as monitoring the nomination progress and maintaining the announcement. In addition, groups and organizers need appropriate strategies to choose collaboration targets. These problems suggest opportunities for computer support for coordinating the collaboration process, such as helping to choose collaboration targets and announcing and running the collaboration process.

Critics might suggest that computer supported coordinated goal setting is not as optimal as goals selected by group organizers or voted by members. However, goal-setting theory suggests that all these types of goal selection can be equally effective as long as group members become committed to the group goal [24] and furthermore some projects have already implemented an automated topic selection program which chooses targets from a collectively maintained list [40].

Although Collaborations of the Week are occasions for social interaction and modeling, their design could enhance these attributions. For example, some Wikiprojects has instituted temporally synchronous editing sessions for project members to get together to work on common tasks, with the explicit purpose of increasing social interaction.

Managerial implication

Although these results were obtained in the context of projects within Wikipedia, we believe that the basic idea of combining group identification and direction setting, as an unobtrusive management method, may generalize to other kinds of online communities and offline organizations. For example, these ideas may work well in organizations emphasizing creative work, such as art design or scientific research, where strong managerial control may harm creativity. Deadlines for major releases in many open source software projects serve similar functions.

There may be limits to the applicability of group goal setting, which simply highlight tasks important for the group. If these tasks involve high coordination costs, the benefits of adding more effort may be offset by the difficulties of coordinating that effort; or, as Brooks aptly states, “Adding manpower to a late software project makes it later” [5]. However, in the cases when group goal setting can be used, our results suggest it is remarkably powerful and leads to benefits not only to the targeted goals but also to other group-relevant tasks.

Compared to group goal setting, which focuses attention on a specific set of tasks, social models may be especially effective in drawing in peripheral members and training them in a wide range of subtle behaviors. Therefore, we recommend practitioners pay close attention to encouraging the desired behaviors from core members and then providing social opportunities (such as communication channels and collaboration tasks) for core members to interact with and potentially influence the others.

CONCLUSION

This paper investigated how combining group identification with direction, either explicit direction through group goals or implicit direction through social modeling, can motivate volunteers in online communities to accomplish tasks important to the success of the group. We tested our hypotheses in the context of subgroups within Wikipedia (Wikiprojects), examining a common group activity (Collaborations of the Week). Our results demonstrate that 1) highlighting important group goals can have a strong motivating influence on editors who have self-identified as group members compared to comparable others who have not self-identified; 2) the positive effects spill over to non-goal related tasks; and 3) editors exposed to prototypical group members are more likely to behave similarly to those members on group-relevant citizenship behaviors than editors not exposed to prototypical members.

ACKNOWLEDGEMENT

We thank the members of the Social Computing Group at Carnegie Mellon University for helpful feedback. We also thank Yarun Luon and Raechel Lee for editing help. This research was supported by NSF grants OCI-09-43148, IIS-0968484, IIS-1111124 and a grant from Carnegie Mellon's Center for the Future of the Work.

REFERENCES

1. Ashforth, B.E., Harrison,S.H., and Corley, K.G (2008) Identification in Organizations: An Examination of Four Fundamental Questions. Journal of Management.
2. Barker, J. (1993). Tightening the iron cage: Concertive control in self-managing teams. *Administrative Science Quarterly*, *38*(3), 408-437.
3. Beenen, G., Ling, K., Wang, X., Chang, K., Frankowski, D., Resnick, P., and Kraut, R. E. (2004). Using social psychology to motivate contributions to online communities. In *CSCW 2004*
4. Benkler, Y. (2002). Coase's Penguin, or Linux and the Nature of the Firm. *Yale Law Journal*, Vol. 112.
5. Brooks, F.P. (1975). The mythical man month. Addison-Wesley Longman Publishing Co., Inc. Boston, MA, USA
6. Burke, M., & Kraut, R. E. (2008). Mopping up: Modeling Wikipedia Promotion Processes. In *CSCW 2008*.
7. Cheney, G., & Tompkins, P. (1987). Coming to terms with organizational identification and commitment. *Communication Studies*, *38*(1), 1-15.
8. Cosley, D., Frankowski, D., Terveen, L., and Riedl, J., 2007. SuggestBot: using intelligent task routing to help people find work in wikipedia. In Proceedings of the 12th

international conference on Intelligent user interfaces (IUI '07).

9. Cosley, D., Frankowski, D., Terveen, L., and Riedl, J., 2006. Using intelligent task routing and contribution review to help communities build artifacts of lasting value. In Proceedings of the SIGCHI conference on Human Factors in computing systems (CHI '06)
10. Daft, R., & Lengel, R. (1984). Information richness: A new approach to managerial behavior and organizational design. *Research in Organizational Behavior, 6*, 191-233.
11. Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*(6), 627-668.
12. Feather N.T.; Rauter K.A., (2004) Organizational citizenship behaviours in relation to job status, job insecurity, organizational commitment and identification, job satisfaction and work values. *Journal of Occupational and Organizational Psychology*, 77(1), 81-94.
13. Forte, A., & Bruckman, A. (2008). Scaling Consensus: Increasing Decentralization in Wikipedia Governance. *Hawaii International Conference on System Sciences, Proceedings of the 41st Annual*, 157-157.
14. Hager, M., & Brudney, J. (2004). Volunteer management practices and retention of volunteers. *The Urban Institute*
15. Hogg, M. A., & Terry, D. J. (2000). Social identity and self-categorization processes in organizational contexts. *The Academy of Management Review, 25*(1), 121-14.
16. Kennedy, P. (2001). A guide to econometrics (4th ed.). Cambridge, MA: MIT Press.
17. Kriplean, T., Beschastnikh, I., and McDonald, D.W.(2008). Articulations of wikiwork: uncovering valued work in wikipedia through barnstars. In Proceedings of the 2008 ACM conference on Computer supported cooperative work (CSCW '08).
18. Kernis, M., Zuckerman, M., Cohen, A., & Spadafora, S. (1982). Persistence following failure: The interactive role of self-awareness and the attributional basis for negative expectancies. *Journal of Personality and Social Psychology, 43*(6), 1184-1191.
19. Kittur, A., Pendleton, B., & Kraut, R. (2009). Herding the cats: The influence of groups in coordinating peer production In *WikiSym 2009*.
20. Kraut, R. E. & Resnick, P. (Under contract). *Evidence-based social design: Mining the social sciences to build online communities.* Cambridge, MA: MIT Press.
21. Locke, E. A., & Bryan, J. (1969). The directing function of goals in task performance. Organizational Behavior and Human Performance, 4, 35– 42.
22. Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance*. Englewood Cliffes, NJ: Prentice-Hall.
23. Locke, E. A., & Latham, G. P. (2002) Building a Practically Useful Theory of Goal Setting and Task Motivation American Psychologist, Vol. 57, No. 9, 705–717
24. O'Leary-Kelly, A., Martocchio, J., & Frink, D. (1994). A review of the influence of group goals on group performance. Academy of Management Journal, 37(5), 1285-1301
25. Organ, D. W., & Ryan, K. (1995). A meta-analytic review of attitudinal and dispositional predictors of organizational citizenship behavior. *Personnel Psychology, 48*(4), 775-802.
26. Pearce, J.P., (1993) Volunteers: the organizational behavior of unpaid workers, Published by Routledge, 11 New Fetter Lane, London
27. Preece, J. and B. Shneiderman (2009) "The Reader-to-Leader Framework: Motivating Technology-Mediated Social Participation," AIS Transactions on Human-Computer Interaction, (1) 1, pp. 13-32
28. Quintela, Y., & Donovan, J. (2008). A model of motivational spillover. In K. H. Kiefer (Ed.), *Applied Psychology Research Trends*. New York: Nova Science, 141-160.
29. Roberts, J. A., Hann, I.-H., & Slaughter, S. A. (2006). Understanding the Motivations, Participation, and Performance of Open Source Software Developers: A Longitudinal Study of the Apache Projects. *Management Science, 52*(7), 984-999.
30. Rothkopf, E., & Billington, M. (1979). Goal-guided learning from text: Inferring a descriptive processing model from inspection times and eye movements. Journal of Educational Psychology, 71, 310 –327.
31. Smith, C. A., Organ, D. W., Near, J. P. (1983) Organizational citizenship behavior: Its nature and antecedents. Journal of Applied Psychology, Vol 68(4), Nov 1983
32. Tajfel, H. 1972. Social categorization (English translation of "La cat6gorisation sociale"). In S. Moscovici (Ed.), Introduction a la psychologie sociale, vol. 1: 272-302. Paris: Larousse.
33. Tajfel, H., Billig, M. G., Bundy, R. P., Flament,C., 1971 Social categorization and intergroup behaviour, European Journal of Social Psychology, Volume 1, Issue 2.
34. Tajfel, H., & Turner, J. C. 1979. An integrative theory of intergroup conflict. In W. G. Austin & S. Worchel (Eds.), The social psychology of intergroup relations: 33-47. Monterey, CA: Brooks-Cole.
35. Turner, J. C. 1985. Social categorization and the self-concept: A social cognitive theory of group behavior. In E. J. Lawler (Ed.), Advances in group processes: Theory and research, vol. 2: 77-122. Greenwich, CT: JAI Press.
36. Vandalism. http://en.wikipedia.org/wiki/Wikipedia:Vandalism
37. Wikipedia:Wikipedia Signpost/Archives/WikiProject report. http://en.wikipedia.org/wiki/Wikipedia:Wikipedia_Signpost/Archives/WikiProject_report
38. Wikipedia:WikiProject_Anime_and_manga/Collaboration_of_the_Week http://en.wikipedia.org/wiki/Wikipedia:WikiProject_Anime_and_manga/Collaboration_of_the_Week
39. Wikipedia:WikiProject_Council/Guide http://en.wikipedia.org/wiki/Wikipedia:Wikiproject_Council/Guide
40. Wikipedia:WikiProject_Video_games/Collaboration_of_the_week http://en.wikipedia.org/wiki/Wikipedia:WikiProject_Video_games/Collaboration_of_the_week