Stages of Motivation for Virtual Voluntary Teams Online Engagement

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ABSTRACT

Members of Virtual Voluntary Teams engage in massive virtual collaborations (MVC), in which large numbers of mostly unpaid contributors collectively collaborate to create new content. Motivation for such contributions has been an active area of research. We argue that what was previously considered a single, static and individual phenomenon, namely motivation for contribution to MVC, is in fact at least three separate but interrelated phenomena, with varying organizational and dynamic aspects. Using the theory of helping behavior as a framework and integrating stage models, work motivation and social movement theory, we propose a conceptual framework that distinguishes three separate models of motivations of participants in Virtual Voluntary Teams. The models distinguish motivations for three stages of participation (initial, sustained and meta) and include as well propositions concerning the effects of contributions on individual states and emergent states of the project as a whole and vice versa. The models provide implications for both researchers and practitioners who manage MVC projects.

Keywords: virtual teams, massive virtual collaboration, motivations, free/libre open source software, Wikipedia, helping behavior
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“I’ve always been only a Wikipedia reader, never a Wikipedia editor. Over the years, Wikipedia has greatly benefitted me with scads of information about every topic under the sun. However, the prospect of editing the thing seemed scary and mysterious—I mean, who are these people anyway? How does one become an encyclopedia editor?—but there it was, a big honkin’ typo staring at me. I was suddenly seized by the responsibility—obligation, really—to fix it. So I took the plunge and hit that edit button.

So began my love affair with editing Wikipedia. It turns out editing an article isn’t scary at all. It’s easy, surprisingly satisfying and can become obsessively addictive.”

– Gina Trapani, editor of Lifehacker

INTRODUCTION

Advances in technology that enable team members to work together in novel ways lead to novel kinds of teams. In particular, extensive research has been conducted in the past two decades on virtual teams (e.g., Martins, Gilson, & Maynard, 2004; Maynard & Gilson, 2014), defined as “groups of geographically, organizationally and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational tasks” (Powell, Piccoli, & Ives, 2004). More recently, a new kind of virtual team has achieved prominence. Internet-based information and communication technologies supporting online community spaces and shared information resources have made possible a new mode of coordinated effort, Virtual Voluntary Teams, which support what we call “massive virtual collaboration” (MVC), a term that highlights the following signal features of these phenomena:

1. large numbers of distributed contributors, commensurate with the popularity of the activity but ranging from dozens to tens of thousands or more;

1 From http://lifehacker.com/software/wikipedia/geek-to-live-how-to-contribute-to-wikipedia-133747.php. Included with permission from the author
2. mostly unpaid contribution by contributors, for reasons subject to much speculation but
   less data; and
3. jointly-focused activity, in which contributors collectively innovate new content (e.g.,
   text, images or software) of value to a larger audience.

Wikipedia is the most dramatic though not unique example of MVC. This online encyclopedia
has expanded rapidly to nearly 35 million articles in more than 280 languages, with a huge
number of text contributions from voluntary contributors who develop and edit content for the
site: more than 21 million edits from over 1.8 million active contributors in December 2014
alone\(^2\). However, MVC also includes a wide variety of smaller-scale collaborations, such as
blogs and discussion groups on a wide variety of topics, evaluations of products or posts on sites
like Amazon or Slashdot, citizen science projects that involve members of the general public in
scientific research (Bonney, 2008; Raddick et al., 2009) and the free/libre open source software
(FLOSS) projects that bring together teams of programmers and users who contribute software
and documentation.

Such collaborations have many features that set them apart from the virtual teams studied in
prior research. Still, Virtual Voluntary Teams are of interest to group and organization
researchers for at least two reasons. First, many managers, witnessing the success of systems like
Wikipedia and understanding that people can be highly motivated to share knowledge with the
right organizational and technology support, are seeking to implement similar systems for
knowledge sharing within their organizations (e.g., Huysman & Wulf, 2006). But for these
systems to be successful requires understanding what made MVC successful in the first place.

\(^2\) From http://stats.wikimedia.org/EN/TablesDatabaseEdits.htm and
http://stats.wikimedia.org/EN/TablesWikipediansContributors.htm
Second, MVC represents a novel form of interaction, one that includes contributions from numerous diverse individuals. Such technology-supported team forms are of increasing interest for their own sake (Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007).

The purpose of this paper is to propose a framework for studying the motivation of members of Virtual Voluntary Teams to contribute, reviewing literature and integrating various theoretical perspectives to develop a novel theoretical model. By contribution, we mean the effort that is given by individual volunteers to create the collective good produced by the MVC, such as articles or text for Wikis and blogs; software, documentation, bug reports or tests results for free/libre open source software (FLOSS) development; or videos or photos on sites such as YouTube or Flickr. By motives, we mean factors that increase the probability that an individual will make a contribution. Because the success of MVC depends on contributions from participants, motives for contribution have been a consistent topic of research in various settings and researchers have identified a variety of motives that lead to increased membership and quantity of output, as we review below. The paper makes three novel contributions to this extensive and growing literature.

Our first and primary contribution is to distinguish motives that operate at different individual stages of contribution to MVC projects. Distinguishing different stages of individual contribution acknowledges the common observation that the distribution of contributions to MVC is quite skewed, with a few people doing the majority of work, and the majority doing little or none at all. For example, Mockus, Fielding, and Herbsleb (2000), in their study of the development of the Apache web server, observed that the top 15 contributors (out of 388 total) contributed over 83% of modification requests and 66% of problem reports. Similarly skewed distributions of
contribution characterize other forms of MVC and indeed, most other kinds of voluntary organizations. On Wikipedia, only 25% of registered users have edited 10 times or more, and 2.4% of users have contributed 80% of the edits. Skewed distributions are not restricted to online settings: Reed and Selbee (2001) state that “in Canada in 2000, 18% of adults were responsible for 80% of all money donated to organized charities, 9% accounted for 80% of hours volunteered and 21% accounted for 65% of civic participation.” However, despite its ubiquity, this skewed pattern of contribution seems not to have been considered in prior work on motivations in virtual collaborations, which generally tacitly assume that all contributors are alike, either in theorizing about motivations or in empirical study. (An exception is Preece and Shneiderman (2009), who noted a possible progression of participation in online groups from “reader to leader” characterized by different activities and motives at each stage.)

In light of these skewed distributions, our model distinguishes three stages of contributions, which we label initial, sustained and meta-contribution (i.e., contributions that structure and enable further contributions (Bryant, Forte, & Bruckman, 2005)). We propose an overall framework for synthesizing diverse motives for contribution, but then differentiate motives that are relevant for the individual at the different stages, drawing on different theories to explain motives for contribution at each stage, resulting in three distinct models of motivations. Of course, the volume of contribution varies continuously across the members of a project, so any grouping into distinct categories is a theoretical abstraction. However, we argue that the three proposed stages of contribution do exhibit distinct patterns of involvement with different motivations, making the theoretical abstraction meaningful. That is, we explicitly argue that the

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3 http://stats.wikimedia.org/EN/TablesWikipediaEN.htm
motivations to make a first contribution are not the same as the motivations to make additional contributions: it is not simply the case that sustained contributors have higher levels of the motivations that impel an initial contribution. Similarly, the motivations for making meta-contributions are not just more of the motivations to contribute in other ways.

Second, we note that prior attempts to theorize motivation of contributors to MVC have generally considered the problem at only an individual level of analysis, taking the overall organizational structure as a given context. In contrast, our models include propositions concerning the effects of project states on individual motivations for contributions. That is, we postulate a multi-level model of motivations, individuals nested within projects.

Finally, most prior models have been static, taking the state of the contributor and the organization as fixed. (One exception is Ye and Kishida (2003), who analyzed the “co-evolution” of FLOSS projects and communities.) This approach is problematic because contributors and projects evolve as the result of contributions, changing the context for future contributions. Therefore, our models include propositions concerning the dynamic and recursive effects of contributions on individual states and on project states, and the effects of these emergent states on motivations to further contribute. The overall model also addresses the evolution of contributors from one stage to the next, in what we call the motivational arc of contribution.

In summary then, the novel contribution of this paper is a set of related but distinct theoretical models of motives for contributions of virtual teams to MVC that makes three distinctions from prior work:
1. what is usually considered a single phenomenon, namely motivation for contribution to MVC, is in fact at least three separate but interrelated phenomena;

2. what is usually seen as an individual-level phenomenon, namely individual motives for contribution, is in part also a project-level phenomenon, as the structure of the project affects motives, and contributions affect the project; and

3. what is usually seen as a static phenomenon, namely the overall structure of motives, is actually a dynamic phenomenon, as participants and projects evolve with contributions changing the structure of motives.

CONCEPTUALIZING MVC CONTRIBUTION

In this section we present our overall framework for identifying and organizing motivations for contribution to massive virtual collaborations. In line with our basic argument, that motivation for contribution to MVC is actually a set of interrelated phenomena, we draw on different theories to explain different kinds of contributions: specifically, prior research on helping behavior (Schwartz & Howard, 1982), work motivations (Hackman & Oldham, 1980) and social movements theory (Klandermans, 1997). In line with our argument that motivation is actually a multi-level phenomenon, we identify factors at both the individual and project-levels of analysis.

We are interested in phenomenon of voluntary participation from virtual team members in MVC and view MVCs as a form of voluntary organization, that is to say, “an activity that produces goods and services at below market rate” (Wilson, 2000, p. 216). Wilson (2000) describes volunteering as “part of a cluster of helping behaviors, entailing more commitment than spontaneous assistance but narrower in scope than the care provided to family and friends” (p. 215). Given this view, we use the theory of helping behaviors to structure our analysis of
motives for contribution. In broad overview, the literature on helping behaviors suggests that such behavior results from the satisfaction of four precursor conditions (Schwartz & Howard, 1982):

1. First, an individual must recognize a need in the others to be helped. This condition, called *attention*, focuses on recognizing situational cues that suggest the need for a helping response. These situational cues vary in salience and seriousness.

2. Second, an individual must have *an impetus* to respond, often arising from a combination of feelings of social obligation and/or responsibility together with a self-perceived capability to respond. The capability to respond arises from the volunteer’s resources (Uslaner, 2003) and skills and knowledge relevant to the voluntary role (Wilson, 2000, p. 221).

3. Third, individuals weigh the obligation and capability of helping against the social and tangible costs of doing so in a phase called *evaluation* (Schwartz & Howard, 1982). Helping has some costs (if only the time taken) but may also have benefits to the volunteer. Unlike much of the literature on helping behaviors that has examined crises situations requiring quick decisions, evaluation of volunteering can be done deliberately over time.

4. Finally, in cases where individuals opt not to help the person in need, a series of psychological *defence mechanisms* occur in which the individual self-justifies why a helping response was not needed (Schwartz & Howard, 1980). Given our focus on motives that distinguish those who decide to contribute, we do not examine this stage further in our theorizing.
Stage models

We develop our theories as a stage model. Most commonly used theories in group research are continuum theories. Such theories are expressed as a set of factors that collectively predict an outcome, e.g., the probability that a person will act or intensity a specific behavior. Examples of such theories are the Theory of Reasoned Action (Fishbein & Ajzen, 1975) or the Theory of Planned Behavior (Ajzen & Madden, 1986). Continuum theories are useful in explaining behavior or in suggesting which interventions (changes in input factors) will be effective in achieving a desired outcome (e.g., a particular behavior). However, Weinstein, Rothman, and Sutton (1998) identify several limitations of continuum models: they do not account for the fact that variables have limits (i.e., once a threshold in some input is reached, further increases may have no further effect); they assume there is no need to match interventions to the specific situations of different people; and they assume there is no need to sequence interventions.

In contrast, stage models assume that people move through distinct phases, with different factors being important in different stages. For instance, Tuckman and Jensen (1977) stated that small group development goes through five distinct stages. In our model, MVC team members are seen as moving from one phase to another, changing their motivation as they change stages. According to Weinstein et al. (1998) the requirements for a stage model are as follows: A classification system to define the stages; an ordering of stages; identification of common barriers to change facing people in the same stage (i.e., barrier to making contributions); and identification of different barriers to change facing people in different stages.

Following the requirements for a stage model, when applied to this research on contribution to MVC, the first step in conceptualization was to define the stages. In this paper, we define the
stages by the amount of contributions contributors have made and use level of contribution as
evidence that participants have moved stages, from non-participant to initial contributor to
sustained contributor and then to meta-contributor, as further explained below.

Non-participant Becomes Initial Contributor

We now consider in turn motivations at different stages of contribution. The first stage we
consider is initial contributions. Contributors begin their contribution to a project with an initial
contribution (“clicking the edit button” in Wikipedia, as Gina Trapani put it). It is important to
consider motives for initial contributions for two reasons: first, all contributors must pass through
this stage, and second, in most MVC, only a small fraction of users of a system actually
contribute. For example, in the three month to June 2011, Wikipedia was reportedly the 7th most
popular site on the Web, according to Alexa™, visited by an estimated 81 million distinct users in
April 2011⁵, but with only about 14 million registered accounts⁶, most of which are dormant. (An
account is not required to edit, but anonymous edits are only a fraction of the total.)

Comparable ratios are reported for other MVC. Tancer (2007) reports that fewer than 1% of
visits to most user-contributed sites are contributions, with the exception of Wikipedia, where the
rate at the time was reported to be 4.6%. Dahlander and McKelvey (2005) found that only 7 of
50 users of Linux surveyed had ever sent comments to the author of an application, with even
lower ratios for operating system itself and for more substantive contributions; the rest were
passive users. In a study of Internet mailing lists, Stegbauer and Rausch (2001) reported that the
“proportion of lurkers… observed ranges between 56% and 81%”. As Aigrain (2003) points out,

⁵ http://siteanalytics.compete.com/wikipedia.org/?metric=uv
free riders are not really a problem in an information commons where the cost of reproduction is close to zero and where there may even be positive externalities of usage (Stegbauer & Rausch, 2001) as we discuss below, but projects do need visitors to become contributors to sustain and grow the collaboration, making it important to understand the motives leading to this initial step.

Attention

According to the helping model, the first stage in volunteering is becoming aware of the project’s need for help. The most basic factor for an initial contribution is simply having heard of the project at all and knowing that contribution is possible. Specifically, we propose:

**Proposition A.1.1.** The more aware someone is of the possibility of contributing to an MVC project, the more likely s/he is to initially contribute to the MVC project. (Note: For ease of reference, propositions are numbered according to the section in which they are introduced.)

Impetus to respond

Once the prospective contributors become aware of the possibility of contribution, the helping behavior model suggests that there must be some impetus for the response based on a perceived capacity to contribute, coupled with a perceived obligation to contribute.

Factors that would increase the perception of capability to contribute include particular knowledge about either the domain of the MVC or about online contribution in general (a construct known as technology self-efficacy, that is, one’s belief in one’s own capabilities to use the technology). For example, Bryant et al. (2005) suggest that new Wikipedia users start by correcting mistakes on topics they know (even fixing typos, as in Gina Trapani’s case) or adding topics that are not covered, rather than by making big additions or corrections. More generally, technology self-efficacy has been shown to be related to adjustment to new technologies such as telecommuting (Raghuram, Wiesenfeld, & Garud, 2003). Therefore, we propose:
**Proposition A.2.1.** The more domain expertise someone has, the more likely s/he is to initially contribute to the MVC project.

**Proposition A.2.2.** The more technology self-efficacy someone has, the more likely s/he is to initially contribute to the MVC project.

New contributors may feel some obligation to contribute to the project based on past use, but that this is likely to be a generalized feeling related to use rather than due to feeling like part of the project. Therefore, we propose:

**Proposition A.2.3.** The more someone has used an MVC project, the more likely s/he is to initially contribute to the project.

Positive evaluation of contributing

Finally, the helping model suggests that potential contributors make an evaluation of the costs and benefits of contributing. For participation in an MVC, the major cost to participation is the opportunity cost of the time spent doing so. Dahlander and McKelvey (2005) found that the most commonly cited reason given by non-contributors was a lack of time. Hertel, Niedner, and Herrmann (2003) found that people more willing to tolerate the time cost of contributing made greater contributions. Therefore, we propose:

**Proposition A.3.1.** The greater someone’s perceived free time, the more likely s/he is to initially contribute to the MVC project.

Furthermore, we suggest that projects that reduce the needed effort or increase the likelihood of effort leading to a desired performance will increase motivation to contribution. For example, Bryant et al. (2005) note that the ease of editing a Wikipedia page is important in facilitating a reader’s transition to being an editor. No login or registration is required and additional features are available but do not get in the way of that first step (though the increased complexity of
Wikipedia has made editing more difficult). Similarly, many blogs and other sites that aggregate user contributions make it easy for individuals to post comments. Therefore, we propose:

**Proposition A.3.2.** The easier it is to contribute to an MVC project, the more likely someone is to initially contribute to the MVC project.

We now consider possible benefits to participation. In the case of MVC, outcomes rarely include direct monetary or material benefit, but prior research has suggested a number of non-monetary benefits. We review these below when we discuss sustained contribution, but note that few of these seem likely to apply to an initial contributor who is not familiar with the workings of a project or with other contributors.

Bryant et al. (2005) note that initial users were often curious about claim that they could just edit a page, so we suggest instead that the benefit to initial participation is simply satisfaction of curiosity about the project. Curiosity has been identified as an important part of intrinsic motivation to use computer system (Malone, 1980). Malone (1980) separated curiosity into two components: sensory curiosity (the attention-attracting value of changes) and cognitive curiosity (the prospect of modifying higher-level cognitive structures). He argued that cognitive curiosity can be incited by indicating discrepancies or paradoxes in a learner’s knowledge, which motivate the learner to learn more. In MVC projects, contributors’ curiosity might be aroused, e.g., when they notice a missing element in an article or a missing topic that deserves an article. Therefore, we propose:

**Proposition A.3.3.** The more curious someone is about contributing to an MVC project, the more likely s/he is to initially contribute to the MVC project.
In summary, we view the decision to make an initial contribution as largely curiosity-driven (“testing the waters”) driven by project visibility, and facilitated by the contributor’s having available time and some degree of expertise and technology self-efficacy, and the project’s being easy to use with low barriers to entry.

**Initial Contributor Continues Contributing**

We next consider factors that might cause an initial contributor to sustain their contribution, thus becoming *sustained contributors*, a second stage of motives for MVC contribution. Of course, there are differing degrees of sustained contribution. For example, Wikipedia authors range from occasional contributors to “high end” authors who explicitly try to improve “their” articles with the goal of having them appear as a featured article (Riehle, 2006) or those who take on responsibility for multiple articles. Nevertheless, it is striking that the majority of contributors to MVCs do not participate past an initial trial. For example, numerous studies of FLOSS teams have found large numbers of contributors, but most contributors provide only a single contribution, such as a single bug report or modification request (Howison, Inoue, & Crowston, 2006). Similarly, there were more than 1.3 million Wikipedia contributors in April 2011\(^7\), but the median number of edits was only 1, meaning that most members drop out of contributing at the moment they start. Of the millions of visitors to Wikipedia, only about 82,000 contributed more than 5 times in April 2011\(^8\), and only about 10,000, more than 100 times\(^9\). The large gap between initial and sustained contributors is hard to explain with a continuum model that assumes that sustained and initial contributors have the same motivations, just at different intensities. We

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7 [http://stats.wikimedia.org/EN/TablesWikipediansContributors.htm](http://stats.wikimedia.org/EN/TablesWikipediansContributors.htm)
8 [http://stats.wikimedia.org/EN/TablesWikipediansEditsGt5.htm](http://stats.wikimedia.org/EN/TablesWikipediansEditsGt5.htm)
9 [http://stats.wikimedia.org/EN/TablesWikipediansEditsGt100.htm](http://stats.wikimedia.org/EN/TablesWikipediansEditsGt100.htm)
argue rather that motivations for initial and sustained contribution need to be conceptualized separately.

Understanding the distinct motivations of sustained contributors is also practically important because of their importance to projects. There are many initial contributors, but since each makes at most a few contributions, the overall volume of their contributions is low. It is sustained contributors, those in the second stage of our model, who account for the bulk of contributions to most projects.

Attention

Again, the first stage in our model is attention. We can assume that sustained contributors are aware of the project from their initial encounter. However, we suggest that to continue contributing, a second factor is whether the contributor perceives that further contributions are needed by the project. Dahlander and McKelvey (2005) note that the second most cited reason for not contributing to a FLOSS project is that there did not seem to be a need, e.g., the software worked well enough. Therefore, we propose:

**Proposition B.1.1.** The more aware someone is of the project’s needs for contributions, the more likely s/he is to be a sustained contributor to the MVC project.

Impetus to respond

The second stage in the model is the impetus to respond, based on a perceived capacity to respond and a feeling of obligation. Considering the first, perceived capacity, we suggest that feelings of domain knowledge and self-efficacy remain important. However, as the contributor learns more about the particular MVC technology, this factor may shift from generalized self-efficacy to self-efficacy with the particular system. For example, Riehle (2006) notes that
Wikipedia provides features such as templates to support more sophisticated editors, suggesting a need to learn how to use this technology. Similarly, FLOSS developers need knowledge of the particular system and its development environment to be effective contributors to the project.

On the other hand, in contrast to initial contributors, we argue that feelings of social obligation are likely key in decisions to be a sustained contributor (Schroer & Hertel, 2009). To explore motivations for these feelings of obligation, we draw on the literature on social movements, defined by Marshall (1998) as an organized effort by a group of people to effect societal change (Eyerman & Jamison, 1991, p. 4). To the extent that MVC can develop the characteristics of a social movement, we suggest that they will be better able to retain and motivate participants.

Extending our overall helping behavior model, we draw in particular on theorizing suggesting that participation in a social movement happens when that individual weighs the costs and benefits of taking part in a social movement (Klandermans, 1984). Klandermans’s (1997) model of motivations (as augmented by Simon et al., 1998) suggests four distinct areas of motivation for participation in a social movement: collective motives, identification with the group or a subgroup, reward motives and social motives. We consider the first two of these motives in this section and the others later.

Collective motivations come from the individual’s evaluation of the group’s goals or ideology, relevant because many or most social movements coalesce around a shared ideology. Kavanagh (2004) notes that part of the motivation for some to contribute to FLOSS was identification with a narrative of resistance to proprietary software, which may explain the finding that license choice, often a reflection of ideology, seems to affect amount of output per developer (Fershtman & Gandal, 2007). More specifically, Xu, Jones, and Shao (2009) found that stated agreement
with a project’s values, norms and beliefs was a strong predictor of FLOSS developer involvement. In Wikipedia, sustained contributors express feelings of agreement with the project’s goals, contributing to the greater good (Bryant et al., 2005). Therefore, we propose:

**Proposition B.2.1.** The more strongly someone identifies with the ideology of an MVC project, the more likely s/he is to be a sustained contributor to the MVC project.

Group or community identification means that individuals join a movement because of their feelings of being part of or wanting to contribute to a valued group. The feeling of community identity is essential to the transformation of interests (group or individual) into collective action (Gotham, 1999, p. 19). Group identification differs from social motives in that the latter arise directly from interactions with other people—whether group members or not—while the former is a preferred state of mind based on a sense of belonging. This sense is part of the explanation for the feeling of obligation to the group that provides a motivation for sustained contribution. Ellemers, DeGilder, and Haslam (2004) stated that when individuals self-identify as part of a collective that they are more inclined to work towards improving the collective and its identity and Johnson, Chang, and Yang (2010) suggested that commitment to the group is an important motivation for work more generally. Such identification has been found across a range of MVC projects. Bryant et al. (2005) noted that active Wikipedia contributors develop an identity in the project, e.g., by having a Wikipedia home page and use a talk page to interact with others. Ren et al. (2010) claimed that online community members who identify with the group and/or to particular members of the group have a higher commitment and hence continued participation. Therefore, we propose:

**Proposition B.2.2.** The greater someone’s feeling of being part of the group of contributors, the more likely s/he is to be a sustained contributor to the MVC project.
Positive evaluation of contributing

The third stage of the model is the comparison of costs and benefits of contributing. We considered costs of contributing above, and those propositions hold for sustained contributors as well, though the time cost of contribution may be higher for a sustained contributor, as additional work is expected to meet the standards of the MVC, and these standards are likely higher for larger or more organized MVCs.

Turning to benefits, we expect that sustained contributors derive benefits beyond mere satisfaction of curiosity. Curiosity can be satisfied quickly, perhaps explaining why many initial participants drop out so quickly. To develop a specific set of propositions, we now consider in what ways the project might be rewarding. We start by considering individual rewards for contribution, which aligns with reward motivations identified by Klandermans's (1997) model of motivations for social movements.

An initial explanation for contributions to FLOSS projects was that performance signaled competence that would lead to better employment prospects (Lerner & Tirole, 2002), thus rewarding contribution. To achieve this benefit, it is more useful to signal in a prominent project, again emphasizing the importance of project visibility. To explain willingness to share contributions, many researchers have pointed to the importance of reciprocal giving in MVC, where a contribution is made with the expectation of benefiting from others’ contributions on other parts of the system (Raymond, 1999; Sauer, 2007). Consistent with these expectations, Ghosh (2005, p. 13) found that the majority of FLOSS developers report receiving as much as or more than they give to projects. Therefore, we propose:
**Proposition B.3.1.** The more someone expects to benefit from an MVC project as a whole, the more likely s/he is to become a sustained contributor to the MVC project.

A sometimes-overlooked motivation is the personal satisfaction of contribution. For example, researchers studying FLOSS projects have noted factor such as personal interest (Freeman, 2007) and the enjoyment of programming. Raddick et al. (2009) reported that contributors to the Galaxy Zoo project describe an interest in astronomy and in science. To better understand why making MVC contributions could be intrinsically rewarding for sustained contributors, we draw on Hackman and Oldham's (1980) model of work motivations (this model has also been applied to MVC by Chin & Cooke, 2004; Hertel, 2007; Schroer & Hertel, 2009). Hackman and Oldham identified five job dimensions—skill variety, task identity, task significance, autonomy and feedback—that they suggested create positive psychological states about the work and thus lead to work motivation. The first three dimensions lead to experienced meaningfulness of work, while autonomy leads to perceived responsibility for work and feedback to knowledge of work outcomes. Together, those three factors lead to making the work motivating.

There is some evidence that the variety of skills involved in MVC contribution motivates contributors. For example, a commonly cited personal benefit of contribution is learning (Ghosh, 2002, 2005). Working on an MVC project provides an opportunity for contributors to learn new skills (Ye & Kishida, 2003). As well, Lakhani and Wolf (2005) identified as a motive for contribution to FLOSS projects the chance to feel creative, i.e., using a set of skills that may not otherwise be regularly exercised. Finally, contribution may simply be viewed as fun, providing sufficient motivation for participation in a project (Bitzer, Schrettl, & Schröder, 2007; Freeman, 2007; Nov, 2007).
Above we noted that new Wikipedia users typically start by correcting mistakes on topics they know or contributing on areas that are not covered rather than by making big additions or corrections (Bryant et al., 2005). Similarly, initial contributors to FLOSS projects often start by contributing small bug fixes or taking part in technical discussions. However, we expect that sustained contributors will be more motivated by tasks with greater task identity, that is, those that include a complete work process with a clear beginning and end, such as overseeing an article or taking responsibility for a particular program module.

Finally, the visibility of the project seems important in making the contributions to the project seem significant. It is difficult to motivate people to spend time programming for a system no one uses or writing for a site that has few readers. In this respect the free rider problem identified by economists (e.g., von Hippel & von Krogh, 2003, p. 218) can be mitigated: free riders provide the audience for the work, thus providing a positive benefit for the project as a whole. Contrariwise, concern has been raised that Wikipedia policies that hide edits made by novice users may remove much of the impetus for contribution. In summary, we propose:

**Proposition B.3.2.** The more meaningful the available MVC tasks seem, e.g., in terms of skill variety, task identity and task significance, the more likely someone is to be a sustained contributor to the MVC project.

The second factor in Hackman and Oldham's (1980) model is autonomy leading to perceived responsibility for the task. A frequently cited benefit of working on FLOSS projects is chance to work on something entirely of one’s own choosing (Kuznetsov, 2006). von Hippel and von Krogh (2003) note the value of the sense of control programmers experience when working on FLOSS projects. Research has also pointed out that a work structure of autonomous tasks facilitates contribution by reducing the need to coordinate work with other contributors, a
significant advantage if work is done on a voluntary basis (Howison, 2009). Because MVC relies on voluntary contributions, we believe that they are generally high in autonomy (Chin & Cooke, 2004), but projects may adopt different practices. We therefore propose:

**Proposition B.3.3.** The more autonomy the available MVC tasks offer, the more likely someone is to be a sustained contributor to the MVC project.

The final factor in Hackman and Oldham's (1980) model is feedback leading to knowledge of actual work outcomes, a factor that has been consistently echoed in prior research. For instance, Bandura and Schunk (1981) claim that “consistent positive feedback should encourage high collective efficacy”. In turn, feedback is essential in developing efficacy perceptions that influence goal setting (Gist, 1987). Feedback can come from the task itself, such as the positive feedback of seeing a modified program run (Chin & Cooke, 2004) or a contribution to Wikipedia accepted. On the other hand, negative feedback, e.g., having a contribution rejected, is expected to be demotivating.

Of course, feedback can also come from other participants. Klandermans's (1997) social motives are based on the direct social reinforcement provided by others (e.g., praise). Feedback is typically sought by individuals (Klein, 1989); by contributors in the case of MVC projects who wish to be recognized by the user community (Jeppesen & Frederiksen, 2006). Forte and Bruckman (2005) suggest that Wikipedia authors are also rewarded by recognition in the group for their work, in informal responses or through explicit mechanisms such as a featured article or “barnstars” and other awards for contribution (Kriplean, Beschastnikh, & McDonald, 2008). We note the possibility of a virtuous cycle here: as an individual contributes, they become more
visible, which increases the likelihood of feedback and thus further contributions. Therefore, we propose:

**Proposition B.3.4.** The more positive feedback someone receives directly or from other contributors, the more likely s/he is to be a sustained contributor to the MVC project.

In summary, we view the decision to continue contributing as driven by the contributor’s feelings of obligation to the project, the intrinsic motivation of the task and feedback from the task and other participants.

**Sustained Contributor Becomes Meta-contributor**

Finally, we turn to consideration of motivations for meta-contributors, a third model, though many aspects of motivations for participants at this stage overlap the motives of active sustained contributors. We note that in successful MVC, a very few contributors, perhaps only 1% of sustained contributors, shift their focus from substantive contributions to what we label “meta-contributions,” those contributions that structure and enable further contributions (Bryant et al., 2005). For example, on Wikipedia, a few meta-contributors structure large sections of the encyclopaedia, check that the style of articles is consistent or administer the Wikipedia rules, rather than writing text for specific articles. Indeed, the presence of such structuring and the resulting coordination amongst contributors is what makes MVCs collaborations.

**Attention**

As with sustained contributors, we note that becoming a meta-contributor starts with awareness of the project’s need for this kind of work. The distinguishing characteristic of meta-contributors is that they are concerned with structure of the whole project, not just a few pieces, and with the state of the community, not just its output (Bryant et al., 2005). For example, a meta-contributor
might focus on recruiting or encouraging members with necessary skills for a project, rather than on making those contributions personally. Projects can make these needs more visible to potential meta-contributors, e.g., by making these roles explicit and having those in them providing role models to others. We therefore propose:

**Proposition C.1.1.** The more visible the project’s needs for meta-contributions, the more likely someone is to be a meta-contributor for the MVC project.

**Impetus to respond**

Regarding the second stage in the helping process, we suggest that meta-contributors go through much the same evaluation as sustained contributors in determining their capacity to respond. However, rather than domain knowledge and media self-efficacy, meta-contributors must have a good knowledge of the community and its norms and rules. Therefore, we propose:

**Proposition C.2.1.** The greater someone’s knowledge of the MVC community and its contributors, the more likely s/he is to become a meta-contributor for the MVC project.

As with sustained contributors, we believe that meta-contributors feel a social obligation to respond based on their adoption of the project’s shared ideology, though in their role of meta-contributor, they also help shape this ideology. We suggest that for a contributor to be motivated at this stage of contribution, they must have feelings of trust towards the other community members (Lipnack & Stamps, 1999) that lead to a sense of obligation. Therefore, we propose:

**Proposition C.2.2.** The greater someone’s trust in other contributors, the more likely s/he is to become a meta-contributor for the MVC project.

**Positive evaluation of contributing**

The third stage of the model is the comparison of costs and benefits of contributing. We expect the same low evaluation of costs for meta-contributors as for sustained contributors. Considering
benefits, above we hypothesized a set of individual benefits that motivate sustained contribution. While meta-contribution may still be intrinsically motivating, we suggest that individuals receive little direct personal benefit from meta-contribution, relying instead on social rewards.

In summary then, we view the decision to continue contributing as driven by a sense of group membership, leading to feelings of obligation to the group, as well as by the intrinsic motivation of the task.

**Feedback**

Finally, we consider how the contributions discussed above change the state of the project, and thus the motivations for future contributions. Note that in discussing motives for contribution, we included both project-level and individual-level factors. We note that the project-level factors can be affected by contributions, thus affecting motives for further contributions. These linkages are important because they provide a dynamic aspect to the model and connect the three separate models we proposed above. Specifically, we propose linkages between the outputs of the models of motivation at each of the stages identified above. A higher volume of initial contributions (the output of the first model) leads to more sustained contributions (the output of the second model) by increasing the flow of new members into the MVC project. A higher volume of sustained contribution leads to more initial contributions by increasing the visibility of the MVC project. And finally, a higher volume of meta-contribution (the output of the third model) increases initial and sustained contribution by making contribution to the MVC project easier.

These positive feedback loops explain the observed exponential growth of successful projects: an initial set of contributions increases the visibility of the project, resulting in more visitors, some
of whom become sustained contributors, thus further increasing project visibility and so contributions in a virtuous circle. The feedback loops also emphasize the importance of steps taken by meta-contributors to ensure that the increasing contributions are fruitful for the contributors, ensuring that the feedback loop is indeed positive.

DISCUSSION

Our models have implications for both academic and practitioner communities. To the academic community, the models provide an agenda and guide for future studies of motivations for contributions to MVC, both in “the wild” and in organizational settings.

Implications for Future Research

First, future studies of MVC should consider different kinds of contribution separately rather than treating them as all the same. For example, surveys of motives for contribution should be careful to measure the stage of participation and to separate motives for different stages of contribution. Furthermore, studies of the process of contribution should develop samples that focus on sustained contributors, as a random sample of contributors will likely include many initial contributors who have not continued their participation.

Secondly, while the models are built on prior research, they still need to be empirically tested individually, and as a whole. The dependent variable of such studies is the level of contribution to the project and the independent variables, the various motives identified in the propositions and the respondent’s stage of contribution (initial, sustained or meta), based on the level and type of contributions. For many projects, contributions can be assessed from system data rather than relying on self-report. However, motives will likely be assessed by survey. Since our models are a synthesis of existing research, a survey instrument can use validated items for many of the
constructs (e.g., domain expertise, technology self-efficacy, ease of use and curiosity). However, we have not found items that fit the MVC context for six of the constructs, namely visibility of project needs, identification with project ideology, expectation to benefit from the project, MVC task autonomy, receipt of feedback and knowledge of other contributors; new survey items need to be developed for these constructs, though such development can draw on work done on these constructs in other settings.

The models include both individual-level variables (e.g., for individual domain expertise or perceived cost of participation) as well as contributor’s perceptions of project-level variables (e.g., visibility of project needs or task autonomy). To ensure variance on the project-level variables will require developing a sample of different projects. For example, one possible setting would be different WikiProjects within Wikipedia or different projects hosted by Wikia. Alternately, it may be that individuals differ in their perceptions of the projects, allowing researchers to reframe the models entirely at an individual level.

To fully test the models requires studying MVC projects that have a role for meta-contribution, such as Wikipedia. MVC projects that do not include a stage for meta-contributions would only allow a test of the first two models, for initial and sustained contribution. Finally, given the skewed distribution of contributions, it will likely be necessary to develop a stratified sample of participants in order to ensure a large enough sample of sustained and particularly meta-contributors.

Thirdly, having distinguished different stages of contributions, research should examine empirically how contributors move from one stage to the other. Based on our model, we suggest that contributors are motivated to move from one stage to the other through sustained interaction
with the project. We argue that when a sustained contributor trusts and identifies with his/her community, that s/he is more likely to become a meta-contributor. For example, it seems plausible that the most frequent contributors are most motivated by identification with the project ideology, though this is an empirical question that needs further study (indeed, Nov (2007) found no correlation between the degree of ideological motivation and level of contribution in a survey of Wikipedians). However, future research should examine additional factors that explain the dynamics described above. We noted that only a small fraction of MVC users ever become even initial contributors and an even smaller fraction goes on to contribute regularly. It may be that the arc of motivations may be less a case of projects motivating contribution and more a case of self-selection of contributors who are already motivated for other reasons. Looking at teams in varying stages of progression can help us understand the phases of development, growth and maturity of a MVC effort.

Fourthly, future research should extend our models by tracing the antecedents of the various proposed motivational factors and examining the effects of the MVC setting on these links. For example, we hypothesized the importance of project visibility or of identification with the group, but did not examine antecedents for these factors, beyond proposing certain feedback loops (e.g., linking contribution and visibility). Future research might examine the process by which MVC projects become visible or by which project contributors form an identification with a project, drawing on and contrasting with work on other kinds of teams (e.g., Fiol & O'Connor, 2005; Wiesenfeld, Raghuram, & Garud, 1999, 2001).

Finally, research should consider the generalizability of the proposed model. As noted above, skewed levels of participation are found in many voluntary settings, not just MVC (Pearce,
1993). It may be that the proposed models are applicable also in those settings, though with modification to factors such as technology self-efficacy. More broadly, future research can examine the interaction between MVC and other organizations (e.g., contributions to company-sponsored projects, Jeppesen & Frederiksen, 2006). As well, the models should have implications for studies of contributions in other settings, such as to knowledge management systems in companies.

**Implications for Practice**

To the practitioner community, the framework provides an explanation of the motivations behind those who join MVC projects and their existing efforts. By looking at these efforts in a broader context and at two levels of analysis—individual and project levels—we can understand how to make these efforts more fruitful, which can be of use to organizations as they work through development and implementation of virtual teams or collaborative media such as wikis in their work practices. For example, our model suggests the importance of project visibility, ease of use, visibility of work that needs to be done and feedback to participants about their work. Increasing these factors is predicted to result in more satisfied contributors with a sustained ability to work together and enhance the work product. As well, project should state a clear ideology with which participants can identify as well as defined stages of involvement with guidance on how to progress from one to the other.

An initial motivation for this paper was to suggest how the MVC model might be applied in an organizational setting, e.g., for an in-house Wiki for knowledge sharing. A key here seems to be the conversion of initial visitors to sustained contributors (that is, it is not enough to just get potential users to try the system once). Organizations might emphasize the benefit to the
individual and to the organization for contribution, thus increasing the perceived obligation to contribute as well as the perceived benefit. An organization could provide information on who uses the contributed information (e.g., number of readers or positive benefits of use) to establish the first and provide positive feedback for contributions for the later.

Organizations (and indeed, any developer of an MVC system) should also consider the need for meta-contributions and meta-contributors, e.g., by providing opportunities for meta-contribution and explicitly recognizing and rewarding those who take on such roles. For example, the site Slashdot invites frequent contributors to rate the contributions of others. Individuals might be appointed to take on such a position, but the model suggests that making the role available to sustained contributors may help increase motivation for those individuals.

The feedback loops included in the model make clear the importance of having an initial body of contributions that is rich enough to motivate use and additional contributions, but still open enough to make it clear to potential participants where their contributions would be needed.

Finally, the models developed here suggest clear limits for the MVC model. For example, if the topic is of limited interest or if the potential contributors lack available time, there may not be a critical mass of potential participants. It may also be difficult in some settings to design tasks that are inherently motivating, e.g., if the overall project requires tasks that do not have high levels of skill variety or task significance. Indeed, some sponsored projects make a point of paying for the later contributions in order to facilitate volunteer participation.
CONCLUSIONS

The purpose of this paper was to develop a model of motives for contribution to MVC projects that distinguished different motives for different stages of contribution. Using helping behaviors as a framework and incorporating different theoretical perspectives, including stage models, work satisfaction and social movements, we can understand the phenomenon at multiple stages. Specifically, we suggest that MVC contributors may initially get involved to satisfy curiosity about the project, but that sustained contribution is driven by agreement with the project ideology and the intrinsic motivation of the task, and meta-contribution by feelings of group membership that lead to a sense of social obligation. Furthermore, contributions from participants at each stage change the project and thus affect the motives for further contributions.

Increasingly, many organizations with multiple locations use the Internet to facilitate communication and coordinate business operations. The potential appears to exist for MVC projects to uproot a variety of existing business models in the information sector (Carnevale, 1995; Castells, 1996; Pink, 2005). As organizations become more dependent on technology to facilitate collaborative efforts, it becomes important to understand the lifecycle of such collaborations. This paper proposes a set of models and a research agenda for understanding the motivations behind those who join and sustain such efforts. By looking at these efforts in a broader context, we can understand how to make these efforts more fruitful for contributors and for those who benefit from their voluntary efforts.

REFERENCES


