Investigating the Motivational Paths of Peer Production Newcomers

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ABSTRACT
Maintaining participation beyond the initial period of engagement is critical for peer production systems. Theory suggests that an increase in motivation is expected with contributors' movement from the community periphery to the core. Less is known, however, about how specific motivations change over time. We fill this gap by focusing on individual motivational paths in the formative periods of engagement, exploring which motivations change and how. We collected data on various instrumental and non-instrumental motivations at two points in study participants' Wikipedia career: when they started editing and again after six months. We found that non-instrumental motivations (including collective and intrinsic motives) decreased significantly over time, in contrast with socially-driven motivations such as norm-oriented motivates which did not change and social motives which increased marginally. The findings offer new insights into newcomers' evolving motivations, with implications for designing and managing peer-production systems.

Author Keywords
Peer production; Wikipedia; newcomers; motivation.

ACM Classification Keywords
H.1.2. Models and Principles – User/Machine Systems

INTRODUCTION & RELATED WORK
Many peer production systems allow participants to define their own activities, but struggle to sustain participation beyond the initial period of engagement, potentially as a result of a decrease in motivation [18,21,33,35]. Research on the motivational determinants of knowledge contribution online is well documented and focused around both conventional and online peer-production systems [20,28,32]. Various relevant motivations have been identified, including extrinsic motivations, such as improvement of skills [20,26] and enhancement of status [17]. Intrinsic motivations in this context include altruism [34], fun [24], reciprocity [16], intellectual stimulation, and a sense of obligation to contribute [3]. Studies specifically on newcomers in peer-production systems tend to focus on key motivations that develop after editors begin to work, such as exposure to social learning [4], receiving different types of feedback [35], social barriers [29], and the platform's technical affordances [10].

Despite all that we have learned thus far, a key limitation of the extant body of research is that it tells us very little about newcomers' *initial* motivation, as data are often collected by surveying veteran users, who self-select when they continue participating, often long after they have been enculturated into a given online environment or system. Thus, prior research does not capture initial motivations and very early experiences. Such experiences are, however, formative [31], and individuals' perceptions and motivations are likely to develop and evolve during these critical first few months of activity.

Understanding participants' initial motivations and how they change over time may help explain the dynamics of sustained and limited participation in peer production efforts. In the present study, we make no assumption about editors' intentions or potential to be long-term editors, but share the view held by the Wikipedia community that sustained participation is desirable.

While the linkage between motivation and consequential behavior has been studied extensively, there is a scarcity of research on how motivations change in early peer-production. Prior research has suggested that individuals who move from the periphery to the core tend to experience an increase in motivation [27]. Research into social movements, however, suggests that people who *disengage* over time are likely lose motivation: they are not as well equipped to overcome barriers to participation [14,29]. To date, the literature in the area is not clear about how these two countervailing forces shape newcomers' motivations, and there is no empirical data to shed light on this puzzle. Existing studies largely use cross-sectional study designs (e.g., one-time surveys); and while these can help us understand the interactions of motivation and behavior at particular points in time, they cannot examine the temporal aspects of motivational dynamics and thus inadvertently assume that motivations persist over time [4,19].

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Our study aims to fill this gap by empirically investigating changes in particular forms of motivation at the earliest stages of participation, and across a variety of modes of engagement. Specifically, building on the research on motivational factors driving participation in social movements [11–15], we distinguish between instrumental (norm-oriented, social) and non-instrumental (intrinsic, collective) motives, and track their changes over the first six months of participation. Understanding how motivation changes may ultimately help us to identify ways in which people who make very few edits can be engaged to contribute more.

The contribution of this work is twofold: first, we provide empirical evidence on newcomers' motivational paths, which could be employed in developing a more nuanced theory of motivational dynamics in the context of peer production. Second, from a practical perspective, a better understanding of how different motivations change over time, and in particular, in the early stages of participation, can help us to design and manage peer production systems built to engage individuals at the community periphery in a more targeted manner.

METHODOLOGY

In order to analyze changes in motivation over time, we build on Klandermans' research on the motivational factors driving participation in social movements [13–15], which underpins many studies on motivations for contribution in peer production systems, such as open source software development, citizen science projects, and Wikipedia [9,25,28]. Klandermans' framework assumes that willingness to participate is a function of a cost-benefit tradeoff [11], where motivation is dependent on the expected outcome of an action and the perceived value of that outcome. Our notion of collective motives (the extent to which participants align with community values) and norm-oriented motives (the extent to which participants value their peers' perceptions of their participation) were drawn directly from Klanderman's work, and we extended his conceptualization of motives as a cost-benefit tradeoff to define a measure for social motives (the extent to which participants value social interaction with other editors) as well as for the intrinsic motivations fun and self-expression, following from [9,24,30].

We classify these motivations based on whether their goals are instrumental or not. Heckhausen and Kuhl [8] define non-instrumental goals as those that are pursued for intrinsic interest and enjoyment (that is: collective, self-expression, and fun motives), whereas instrumental goals are defined as those that are pursued for the external consequences that they ensue (for example: norm-oriented and social motives in pursuit of prestige and interaction with others, respectively). The individual measure items for each type of motivation were based on [20,28] and comprised of two- and three-item scales (except for fun, which was a single item measure). Participants were asked to respond to each measure item using a 5-point Likert scale ranging between "strongly disagree" and "strongly agree", or to indicate that they had no opinion.

Our study uses a *short-term longitudinal design* [23] in which we collected participants' motivational survey responses at two points in time. Short-term longitudinal designs of 2-6 months have been used in the study of CSCW and HCI-related topics such as short-term motivation change among crowd sourced workers [22], online communication and well being [5], and the effects of cyber bullying [2]. An important and unique aspect of this study lies in the recruitment of participants when they first register as Wikipedia editors. Wikipedia suffers from a highly skewed distribution of participation such that the activity level of the majority of Wikipedia editors is minimal. To accommodate and account for this skewed participation distribution, we employed a stratified sampling technique to capture early users at different levels of engagement. We first examined the activity logs of tens of thousands of new editors to establish the participation level strata based around quintiles of participation. We then observed all newly created accounts for two weeks during two month-long recruitment intervals to determine which participation-level strata each editor belonged to. We sampled across two intervals to account for periodicity effects.

Potential participants with active email addresses were randomly identified from each sampling strata through the Wikipedia API, and emails containing links to the study were sent to these accounts after their first two weeks as Wikipedia editors. This recruitment technique was used to ensure that we had sufficient data from each of the participation-level strata. Though the survey was administered two weeks after account creation, we assumed that participants' responses at this early point in time were approximate representations of their motivations at the time of account creation. This point in time is referred to "Time 1" for each individual. 206 individuals responded to the first survey and were told that they would have the opportunity to participate in a future survey.

After approximately 6 months, a second survey was emailed to these individuals, of which 111 participated. The time at which the second survey was submitted is referred to as "Time 2". Polling participants at (roughly) six-month intervals allowed us to strike a balance between our assurances with the Wikipedia Research Community that we would not annoy new editors with too many surveys, and our need to apply a near-term longitudinal research design. Participants received a 10$ gift-card as compensation after submitting each survey. The data collection scheme is illustrated in Figure 1.

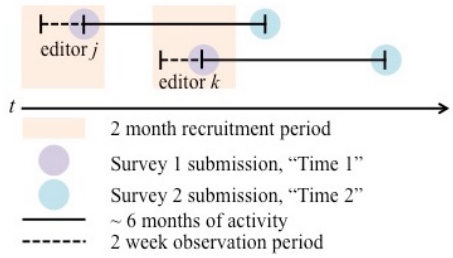

Figure 1: Illustration of study design.

After removing participants under the age of eighteen, 99 viable participants remained who had responded to both surveys. Table 1 summarizes the final sample's membership in the participation-level strata. These response rates clearly indicate why a stratified sampling technique was necessary: more active editors were more likely to respond to our survey, even though they made up a much smaller percentage of new editors. To moderate the influence of participants that were overrepresented, and strengthen the influence of those that were underrepresented, the data were adjusted using sample weights in each analysis.

Participation-level strata	Unweighted response rate (% sample)	Weights
0-1 edits	8 (8.08%)	5.59
2-4 edits	15 (15.15%)	1.94
5-8 edits	14 (14.14%)	0.51
9-14 edits	22 (22.22%)	0.19
15+ edits	40 (40.40%)	0.13

Table 1. Stratified sampling edit strata and weights.

Data Analysis

Bivariate correlation and confirmatory factor analysis were used to investigate the latent factor structure of the measures with varimax rotation [7], and reliability estimates were calculated for each of the resultant measures. Inter-construct correlations were below 0.5, factor loadings on relevant constructs were all above 0.6, and cross-loadings were below 0.35.

To compare participants' motivational measurements across the two time periods, we used linear mixed models with repeated measures, weighted to adjust for individuals' initial participation-level strata. Each motivation was modeled independently from the others.

RESULTS

Table 2 contains the weighted mean scores and standard deviations for motivations at Time 1 and Time 2. Our analysis shows that the non-instrumental motivations of collective (t= -2.45, p=0.01), self-expression (t= -2.67, p=0.009) and fun (t= -2.24, p=0.03) decrease significantly from Time 1 to Time 2. Instrumental motivations followed different trends. Specifically, social motives saw a marginally significant *increase* between Time 1 and Time 2 (t=1.71, p=0.09), and norm-oriented motivation did not change significantly between time periods.

	Mean @ Time 1 (SD)	Mean @ Time 2 (SD)	t
Collective	4.43 (0.73)	4.12 (0.97)	-2.45*
Intrinsic: Self-expression	4.25 (0.84)	3.96 (1.00)	-2.67**
Intrinsic: Fun	3.34 (1.24)	2.97 (1.36)	-2.24*
Social	2.01 (1.18)	2.21 (1.14)	1.71^{t}
Norm-oriented	3.90 (0.65)	3.84 (0.64)	NS

Significance codes: '***'= 0.001; '**'= 0.01; '*'= 0.05; ^{t}= 0.1.

Table 2. Descriptive statistics of motives at Time 1 & Time 2.

DISCUSSION AND CONCLUSION

This paper addresses a tension in the theoretical literature: motivations are described either as increasing when contributors move from the periphery to the core [27], or decreasing overall over time [14,21]. The present study provides the first empirical evidence of changes to newcomers' motivations over time during the formative period of engagement. Notably, we found that different motivations change in different ways in the early periods of engagement: non-instrumental motives (collective, self-expression, and fun) decreased significantly over time, whereas instrumental motives did not (e.g., social motives increasing marginally). Prior to this study, knowledge of how and when motivations change for newcomers in such platforms was limited by the use of cross-sectional (one-time) surveys of established editors, as well as retrospective measures of attitudes. In just the short 6-month period over which the data were collected, we observed several significant motivational changes among new editors.

There are a number of possible explanations for the observed decrease in motivation. It may be the case that participants initially experience higher motivations to participate because of a novelty effect. Antin et al. [1] refer to the initial, short period of high activity and output as the "honeymoon" period. It is possible that the decrease in activity after this period is correlated with the decrease in motivation. We suspect, however, that this type of motivational decay would be seen in both instrumental and non-instrumental motivations over time.

The decrease in non-instrumental motives (collective, fun, self-expression) suggests that newcomers' experiences contributing to Wikipedia are not altogether positive, which is interesting considering that prior studies found that intrinsic motivation to be positively correlated with activity on Wikipedia [24]. Drawing from self-determination theory [6] we assume that individuals' non-instrumental motives are autonomous and volitional: participants engage in a task because they enjoy it or it makes them feel good. Those motives are therefore bound to decrease if the experience of engagement – such as receiving negative feedback or edit reversions by other editors - is somehow unpleasant. Indeed, others have found that certain early experiences can be demotivating to new editors and that participants who eventually sustain participation may do so for reasons that are different than those that lead them to participate in the first place [21]. Given our results, it is possible that

participants are initially motivated around certain aspects of editing the encyclopedia pages themselves, but instead find themselves less motivated after a period of time as a result of some negative experience. Alternatively, a gap may form between participants' initial non-instrumental expectations and the reality of editing as they perceive it over the initial six months period. We recommend that future research investigate the dynamic relationship between different editing activities and experiences, and changes in motivation over time. This could be done using mixed-method approaches for a fuller understanding of how motivations change over time and as a function of editors' experiences and activities.

Our results suggest that participants' motivations increase when related to the *outcome* of the act of editing Wikipedia encyclopedia articles itself; namely, the increase in the instrumental social motivation. Though social motives may not initially influence the amount of participation [24], the social aspects of peer production systems and the satisfaction participants get from interacting with other editors (while not necessarily directly contributing to the main article) increase in importance over time, and may help to keep participants engaged on the platform.

The findings have practical implications: designing for instrumental rewards, such as building compelling social systems into knowledge productions platforms may be helpful in a number of ways: (1) helping to moderate some other negative experiences they may have, and (2) keeping individuals engaged at the periphery for longer (rather than leaving entirely), and therefore increasing the probability that they begin to take on more tasks related to the central encyclopedia product over time.

In this study we set out to examine how the motivations of newcomers to peer-production systems change in the earliest periods of engagement. We found that different motivations change differently. The contribution of the findings is two-fold: it informs more nuanced theory of motivational dynamics (in the context of peer production) than currently exists, and is helpful in understanding how to design and manage peer production systems built to engage individuals at the community periphery in a more targeted manner.

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