

Becoming Wikipedian: Transformation of Participation in a Collaborative Online Encyclopedia

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ABSTRACT

Traditional activities change in surprising ways when computer-mediated communication becomes a component of the activity system. In this descriptive study, we leverage two perspectives on social activity to understand the experiences of individuals who became active collaborators in Wikipedia, a prolific, cooperatively-authored online encyclopedia. Legitimate peripheral participation provides a lens for understanding participation in a community as an adaptable process that evolves over time. We use ideas from activity theory as a framework to describe our results. Finally, we describe how activity on the Wikipedia stands in striking contrast to traditional publishing and suggests a new paradigm for collaborative systems.

Categories and Subject Descriptors

J.7 [Computer Applications]: Computers in Other Systems – publishing.

General Terms

Design, Human Factors

Keywords

Wiki, Wikipedia, Community, Legitimate Peripheral Participation, Activity Theory

1. INTRODUCTION

Shocking things happen online. Consider the scope of extreme activities that can and do emerge in the comparatively unregulated landscape of online environments, where inhibitions are reduced [11], social norms are emergent [22, 26], and regulating behavior is still difficult at best [15]. One unexpected scenario is that of individuals around the globe coming together, unsolicited, to contribute their knowledge and provide volunteer editorial services to create a high-quality, freely-accessible information resource. It is at best counterintuitive that such a resource, written by committee, where anonymous contributions are acceptable, and anyone anywhere can edit any content at any time, could be accurate by any standards. Yet that is precisely what has happened at wikipedia.org.

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New forms of computer-supported cooperative work have sprung from the World Wide Web faster than researchers can hope to document, let alone understand. In fact, the organic, emergent nature of Web-based community projects suggests that people are leveraging Web technologies in ways that largely satisfy the social demands of working with geographically distant collaborators. In order to better understand this phenomenon, we examine how several active collaborators became members of the extraordinarily productive and astonishingly successful community of Wikipedia.

In this introductory section, we describe the Wikipedia and related research, as well as two perspectives on social activity: activity theory (AT) and legitimate peripheral participation (LPP). Next, we describe our study and how ideas borrowed from activity theory helped us investigate the ways that participation in the Wikipedia community is transformed along multiple dimensions of activity as newcomers enter and become established in the community. Finally, we summarize our conclusions and the implications of this study for designing systems that support online collaboration.

1.1 What is Wikipedia?

Wikipedia is an open-content encyclopedia, built on wiki technology. The first wiki was launched in 1995 by Ward Cunningham on the premise that publicly editable webspaces are a promising way to achieve fast, productive online collaboration [16]. Established in 2001, Wikipedia is among the most prolific collaborative authoring projects ever sustained in an online environment. As of July 2005, the English-language version contains over 650,000 articles [32] and smaller but active Wikipedias also exist in German, Japanese, French, Swedish, Polish and over 100 other languages.

The fact that Wikipedia content is publicly editable is essential to its rapid growth. Anyone with an Internet connection can edit the content at any time without registering or otherwise applying for editorial privilege. Beneath the veneer of encyclopedic authority, constant editing renders the Wikipedia perpetually incomplete and in flux. Articles are likely to have been touched by a variety of editorial hands and are likely to be touched again. It may seem surprising that the daily frenzy of editing has resulted in a resource that many individuals regard as well-written and factually accurate. In fact, many of the individuals involved in the site's genesis initially had little confidence that an openly-editable website could ever come to resemble an encyclopedic information resource [19]; however, citation of Wikipedia articles in news and other media is now common [17, 31]. An important factor in Wikipedia's success may also be the guiding editorial policy of

neutral point of view [29], to which most Wikipedia authors subscribe and endeavor to uphold.

Questions of authority and reliability in Wikipedia have attracted the attention of academics. In a comparative study, researchers applied discourse analysis methods to better understand genre differences between Wikipedia articles and other information sources. They found that, unlike the online encyclopedia Everything2, Wikipedia entries are stylistically indistinguishable from those found in a traditional, print source [7]. They attribute this surprising result to the fact that, because it is a wiki, multiple authors and revision cycles are common on Wikipedia. On Everything2, entries are owned and edited by individual users; if the content needs to be revised, the author receives comments from peers and can revise the entry. Here we find that the traditional model of publishing print resources does not yield comparable results in the collaborative, voluntary, online environment. In this case, a new publishing model better supports a seemingly conventional goal—writing in an encyclopedic style. This study is an effort to understand the activity system associated with the emergent publishing model on Wikipedia.

Attempts have also been made to establish quantitative metrics to measure site growth and complexity [24], and to identify article characteristics such as rigor (the total number of edits) and diversity (the number of individual editors) for evaluating the quality of Wikipedia content based on editing trends [17]. Although no definitive claims have been made concerning the overall accuracy of information in Wikipedia, Lih observes that both rigor and diversity improve following the appearance of a Wikipedia article in the popular media.

The *history flow* visualization method was developed as a collaborative effort between MIT and IBM researchers to examine editing trends on wikis [23]. Application of the *history flow* method to Wikipedia allowed the researchers to recognize and describe four patterns of cooperation and conflict on the site: vandalism and repair; anonymity versus named authorship; negotiation; and content stability. They conclude that the Wikipedia interface is designed to encourage surveillance of others' contributions. For example, watch lists help community members find and repair vandalism. In addition, the discussion pages provide a space for reaching consensus that is separate from the article space. Finally, the emphasis on neutral point of view provides an underlying principle that guides dispute resolution. These design elements and the culture of Wikipedia contribute to the knowledge building enterprise of creating a collaborative encyclopedia by separating conflict from the articles themselves and emphasizing the importance of consensus.

Emigh and Herring, Lih, and Viegas et al. all observe that the character of Wikipedia content is influenced as much by social norms within the Wikipedia community as by the technological substrate upon which the community is built. We are interested in the process by which individuals come to understand Wikipedia as a community of collaborative authorship and claim membership through participation and self-identification. How does an individual become a skilled, valued member of such an enormous cooperative enterprise?

1.2 Legitimate Peripheral Participation

Legitimate peripheral participation (LPP) is a theoretical description of how newcomers become members of communities of practice [14]. According to LPP, newcomers become members

of a community initially by participating in peripheral yet productive tasks that contribute to the overall goal of the community. These activities are typically simple and carry low risk to the community as a whole. For example, Lave and Wenger describe the activities of novice tailors as they learn their trade. Initially, tailor apprentices work on informal children's clothing and undergarments while they practice sewing [14]. They begin by attending to "finishing touches" on garments, and only later move on to sewing and, eventually, to cutting the cloth. Gradually, they accrue enough experience to create the garment in which their shop specializes—men's trousers. Through peripheral activities, novices become acquainted with the tasks, vocabulary, and organizing principles of the community. Gradually, as newcomers become oldtimers, their participation takes forms that are more and more central to the functioning of the community.

It is important to understand that LPP is not reserved for descriptions of membership in formal organizations or professions whose practices are highly defined. On the contrary, people participate in multiple, overlapping communities of practice (CoP) every day in their jobs, schools, at home and in other social contexts. It is *through* their practices that the structure and character of a community emerges [27, 2]. Researchers have used LPP to understand the nature of online communities as CoPs in the past [21]. Observations of members' behavior in Wikipedia reveals that the three characteristics of CoPs identified by Wenger [27] are strongly present on the site: community members are mutually engaged, they actively negotiate the nature of the encyclopedia-building enterprise, and they have collected a repertoire of shared, negotiable resources including the Wikipedia software and content itself.

LPP suggests that membership in a community of practice is mediated by the possible forms of participation to which newcomers have access, both physically and socially. If newcomers can directly observe the practices of experts, they understand the broader context into which their own efforts fit. Conversely, isolating newcomers can have negative effects. For example, Lave and Wenger describe a scenario in which apprentice butchers have little physical access to the tools and spaces in which advanced meat cutting is done by experts (Marshall, 1972, cited in [14]). This isolation from more advanced practices limits apprentices' possible forms of participation in the community. In the world of online collaborative spaces, the technological architecture of the community can be seen as analogous to the physical arrangement of community spaces such as the one in which the apprentice butchers practiced their trade.

Whether explicitly or implicitly, social organization also plays a large part in determining what forms of participation are available to newcomers in a community. Lave and Wenger use the example of recovering alcoholics in Alcoholics Anonymous to describe how the participation of newcomers in a group can be mediated by social rituals and overtly defined relationships between members of a community (Cain, in press, cited in [14]). Not all forms of social organization are reified as strongly as those of a 12-step recovery program; however, cooperation online is often highly structured according to ritual activities of members.

In our investigation of participation in Wikipedia, we will examine how users' motivations and their perceptions of their roles in Wikipedia change as they become more engaged in the community. In particular, how do technological and social structures mediate user activity in Wikipedia? What forms does

initial participation in Wikipedia take? How does the character of participation change over time as users become full participants in Wikipedia? Do barriers like the physical ones that isolated the apprentice butchers also isolate individuals in the online world of Wikipedia? In what ways does social organization in Wikipedia regulate the forms of participation that are available to newcomers?

1.3 Organizing the Data: Activity Theory

Activity theory suggests a structure for thinking through technology use and emergent social norms on Wikipedia and how they influence the transformation of members' participation over time. Activity theory (AT) is often described as proceeding from the work of Russian psychologists Vygotsky, Leontev and Luria, who sought to understand human activities as complex, socially-situated phenomena. For an in-depth discussion of its theoretical roots, see Engeström [8]. Today, activity theory is most often used to describe activity in a socio-technical system as a set of six interdependent elements:

- Object - the objective of the activity system as a whole
- Subject - a person or group engaged in the activities
- Community - social context; all people involved
- Division of Labor - the balance of activities among different people and artifacts in the system
- Tools - the artifacts (or concepts) used by subjects to accomplish tasks
- Rules - the code and guidelines for activities and behaviors in the system

These six elements and their mutual interdependencies are often depicted by the activity triangle diagram:

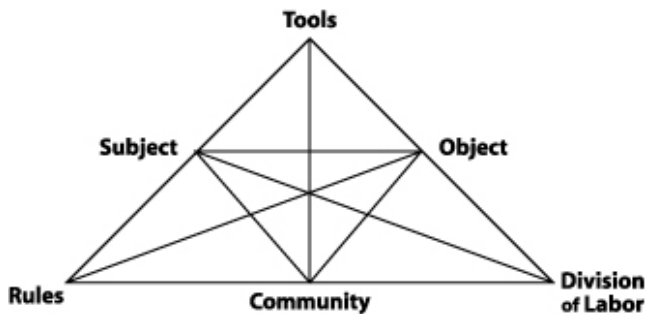


Figure 1. Model of an activity system [8].

Activity theory addresses complex features of human action and has been adopted by theorists in a variety of forms. None of the six dimensions is unproblematic; each is a multifaceted concept and characterizing them in great detail is beyond the scope of this paper. Activity theory helps explain how artifacts and social organization mediate action [13]. It is useful to imagine that the dimensions of AT provide a silhouette that needs to be filled in, rather than a detailed map of human activity. These dimensions have been used in the past as a framework for systematically investigating socio-technical systems that emerge with the use of computer-supported collaborative learning tools [10]. In this paper, using the AT framework provides a common language and

a structure for thinking about LPP and transformation of participation. If the activity triangle above represents the context of activity when a user first encounters Wikipedia, we can imagine the triangle twisting and bending over time as transformations in one dimension and then another stretch and pull the rest of the triangle. Because each segment of the triangle is connected to the others, changes in one dimension affect the eventual character of the other dimensions as well.

To understand how users become part of the community, we “take activity as the term for the process through which a person creates meaning in her practice, a process we can neither see or fully recall but a process that is ongoing as part of the participation in a community of practice” [3].

2. METHOD

A purposeful sample of active community members was collected by using communication channels frequented by active members. Communication within Wikipedia happens largely through something called talk pages. Individuals who have registered for a Wikipedia account each have a personal user page and a talk page where it is customary to post personal messages. We identified several active Wikipedia users by looking at pages that list site-wide editing activity and placed recruiting messages on their personal talk pages. One of those users then posted a message about the study on a discussion area where it is appropriate for community members to make announcements. Several Wikipedians responded to the general announcement. We conducted interviews with nine Wikipedians. Five interviews were conducted by telephone, four by email. (A second set of data from thirteen later telephone interviews is currently being analyzed to extend and confirm these results.)

Table 1. Study Participant Demographics

| Participant | Time Active | Number of Edits (in Nov. 2004) |
|-------------|--------------|--------------------------------|
| 1 | 6 mos | 399 |
| 2 | 1 yr, 9 mos | 5,381 |
| 3 | 2 yrs, 6 mos | 14,615 |
| 4 | 8 mos | 2,106 |
| 5 | 7 mos | 1,312 |
| 6 | 1 yr, 6 mos | 13,377 |
| 7 | 1 yr, 3 mos | 15,072 |
| 8 | 1 yr, 11 mos | 2,190 |
| 9 | 2 mos | 3,664 |

Each telephone interview lasted approximately one hour and was designed to provide qualitative data about why the participants contributed to Wikipedia, how they had gotten started, how they perceived their role and, most importantly, how their perception of Wikipedia and their participation in it had changed over the course of their engagement with the site. On average, participants had been active in Wikipedia for 14 months at the time of the interviews, the duration of participants' activity ranged from two months to two-and-a-half years (See Table 1). All interviewees reported daily or nearly daily activity on the site. Wikipedia had been established for over three and a half years at the time interviews took place.

3. FINDINGS

As users move from peripheral to full participation in Wikipedia, we found that their activity is transformed in many dimensions. The following sections use the language and structure of activity theory to organize and present the different ways that interviewees' participation changed as they became full-fledged members of the Wikipedia community.

3.1 Transformation of Subject: Goals and Identity

Whereas the object of the whole Wikipedia activity system remains essentially unchanged over time—the object is to build and share knowledge in encyclopedic form—the subjects themselves change. The notion of subject in the activity system is complex; in this paper, subjects are defined as the participants in the Wikipedia community, each of whom has numerous characteristics that may change over time, including individual motivations, goals, and perceptions of self. Transformation of goals (which are different from the object of the activity *system*) and of users' self-perceived identities within the system are fundamentally linked to transformation of participation. Interviewees described a move from encyclopedia consumer to encyclopedia creator.

3.1.1 Novices: *Editing what they know*

At the periphery of Wikipedia, novice users contribute by reading articles out of interest, noting mistakes or omissions, and correcting them. For the novice, the goal of participating in Wikipedia is often information gathering (using the site as an Encyclopedia). In passing, they identify problems and mistakes and fix them. Initial contributions seem to spring fortuitously from users' personal knowledge, frequently related to domains with which they feel comfortable and competent such as hobbies and personal interests:

I saw a relatively weak article on [a South American writer]. I knew a lot about him, so I put together a stronger article on the topic. (Participant 6)

I think the first thing I contributed was a page on [a musician] who was a post-punk rock group...for some reason it occurred to me that they didn't seem to have a page on it so I should write one. (Participant 5)

I noticed how slim the railroad-related content was, so I started adding to it...My first contributions were just providing links to railroad historical societies' websites...It snowballed from there to writing new content myself. (Participant 9)

I just looked up the article they had on bands that I'm a fan of, added a few sentences there, corrected a mistake, and pretty soon I was branching out into different areas that interested me. (Participant 2)

I stumbled upon Wikipedia when searching for something else. I kept rechecking Wikipedia until I decided that it was definitely missing certain things and since I had an opportunity to contribute, why not do it? (Participant 8)

One of the first things I looked up was Wales, and I found that what was already there about Wales, where I live...I thought, "Well that's wrong. I'll change that." And I thought, "What can I put to make it a bit longer, because

it's short. And then it just sort of...I just got into the habit really." (Participant 3)

Even as they contribute to the articles, new users tend to make only minor changes. Several of the participants reported a reluctance to make drastic changes when they first began contributing to the Wikipedia:

When I first started I was hesitant about doing a lot of structural changes. You know, I could go fix a comma here and there but I wouldn't necessarily edit the whole text of an article or move a page or change the way a particular disambiguation was done. (Participant 2)

Early on, I was cautious about shaking up something I don't know much about. I was careful if an article seemed wrong, cautious about changing it. (Participant 6)

All the interviewees' first edits of the Wikipedia involved topics about which they had some personal expertise. Initially, the goal of their activity on Wikipedia was to find information about their own interests and sometimes they fixed omissions or weaknesses. They saw themselves as consumers of the information provided on the site. It is important to note that the consumer plays an important role in supporting the object of the system: without information consumers, creating an encyclopedia is a meaningless act. Like in many online forums, readers, or lurkers, play an important role in constructing meaningful practice [18]. As we will demonstrate in the next section, as they moved toward fuller participation, participants adopted a caretaker role with respect to some collection of articles. Over time, these collections grow. Eventually, Wikipedians identify with the community as a whole, adopt the goals of building a sound information resource, and see themselves as managers or creators.

3.1.2 Experts: *Building the Wikipedia*

For experts, or "Wikipedians," the Wikipedia as a whole becomes more important than any single article or set of articles. Whereas initial edits tend to be focused on correcting individual articles, once users become Wikipedians, their goals expand. Although they continue to improve the quality of the content in individual articles, their motivation seems to become rooted in a concern for the quality of the Wikipedia itself. They also become concerned with improving the community. In the move from novice to Wikipedian, goals broaden to include growing the community itself and improving the overall quality and character of the site.

It is important that the Wikipedia is public, and that Wikipedians' work is available to anyone. Many Wikipedians perceive their work as contributing to a greater good, offering knowledge to the world at large. When asked why they contribute to the Wikipedia, many Wikipedians recognized the project's overarching goals, the appeal of community, and perceived contributions to society:

I really got inspired by the idea [of the Wikipedia]. I'd say a lot of what hooked me was the community aspect and knowing that I was contributing something that was going to be around for a while...at the very least, I'll have done my part to make the whole package better and more accessible and more understandable, better links, more complete, whatever I happened to accomplish. (Participant 2)

I contribute, I suppose, because I have something to say which might be of interest to other people...On the web

generally, pages relating to the topics I know about are pretty dire in quality. Many are very inaccurate and there are entire topics missing completely. Wikipedia gives me the opportunity to fill some of the gap. I hope in a competent way and make a lasting contribution to knowledge. (Participant 1)

I think it's a worthwhile project. (Participant 4)

To a writer getting something "published" and reviewed in an environment that is more likely to correct your mistakes than reject your stuff might have a certain appeal. So when I do not write for a living, I write for Wikipedia. (Participant 8)

It's a challenge to see how well I can put an article together on a subject...how you can express something clearly for people who do use this as an encyclopedia. How something you know about, how you can express that for other people to read it and for it to actually be helpful to them if they don't know anything about the subject. (Participant 3)

I believe in the integrity of the project. I want to see it succeed, especially the articles people will look up. (Participant 6)

It has a dedicated task and it's producing a product...at least with the Wikipedia [versus Usenet and the like] you can convince yourself you're doing something to benefit mankind, you're moving the world ahead or something...I think, "What should I say here that will be of the maximum value to some guy who looks this up five years from now?" (Participant 5)

Wikipedians seem to contribute because they believe in the product that the community produces. Kollock observes that motivation to contribute to online communities can spring from a variety of sources—the expectation of reciprocity from the community in the future, a sense of efficacy, and sustaining one's reputation—and none of them depend on altruism [12]. Likewise, Donath remarks that altruism alone is unlikely to explain the millions of helpful interactions that happen online and proposes that establishing and sustaining one's identity is a far more likely motivator [6]. It is interesting to note that, on Wikipedia, receiving credit as an individual author is nearly impossible due to the radical nature of collaboration; yet, a sense of individual efficacy and ownership remains. Ciffolilli asserts that reputation is established through number of edits [4]; however, we observed that, despite the barriers to claiming credit, Wikipedians described feelings of personal responsibility for the *quality* of their contributions to the site and its contents. They also often refer to "my" articles or "my" work as will be seen in the following sections. Many also use personal pages to establish an identity on the site and describe their contributions qualitatively.

The potential audience for Wikipedia articles is important to Wikipedians and the way they feel about their contributions. One participant recounted a story about recognizing her work on a Wikipedia article about a particular musician in mainstream media reports when that musician died. Although the Wikipedia article was not quoted or cited, she believed that the journalist had used it as a source:

I've seen evidence that other newspapers and magazines who were writing their obituaries on him used what information that I put out there. Obviously nobody's quoting it verbatim but just things in the way that...turns of phrase or the order that I put the facts in or certain obscure details that I knew and put in the article that aren't readily available in other online sources. And I see them used in magazine articles and it just gave me a warm feeling to know that I took my knowledge and put it out there for free and people were actually using it. (Participant 2)

Because Wikipedians' goals are broader than assessing the quality of a particular article and fixing it, the scope of their activities extend beyond serendipitous editing. All participants reported that the first thing they do when logging into the Wikipedia is check their "watch list." Whenever a Wikipedia user is logged in and browsing articles, the option exists to "watch" that article. By clicking on the "watch" option, users add the article to their watch list, which is a page where recent editing activity is displayed for watched articles. With a watch list, Wikipedians can become caretakers of large sections of the Wikipedia by monitoring changes to selected articles. In many cases, Wikipedians watch articles to which they have contributed so that they can review any changes. Observing changes also enables Wikipedians to catch vandalism quickly [23]. Watch lists are discussed further in the next section.

3.2 Transformation of Tools Use

3.2.1 Novices: *How the Interface Helps*

In the previous section, we identified novice goals on Wikipedia as locating information and fixing mistakes. The most obvious interface feature for novices is the search box, which allows users to locate articles by keyword. This enables users to find subjects that interest them. The Wikipedia also comes up in many Google searches. Many of the study participants' first encounter with the Wikipedia was while researching a particular topic. Their searches brought them to a Wikipedia article and they could then use the Wikipedia search feature to look up additional topics or click on links within that article to other, related Wikipedia articles.

I would be searching for information on the Internet and I kept getting the same site over and over again and I hadn't really paid attention but the information was really good. So I believe I was looking up information on [a book]. I read the article and I noticed it didn't talk about the sequel which had just come out a couple years before. So I made that edit, added the information... That was my very first edit. That was my first time I edited the Wikipedia. (Participant 7)

Every page on the Wikipedia (with the exception of the front page and a handful of other sensitive pages) includes an option to "Edit This Page." The ease of editing a page played an important part in allowing novices to make the initial transition from reader to editor.

I didn't really understand when I started what it was about but saw that it said you start editing straight away and didn't even have to log in. And I thought, "Well that's strange, surely they don't mean that. I must give it a try just to see if it's true." When I found I could edit it, I was quite surprised that it worked straight away. . . . So I

thought, “Let’s see if they’ve got articles on any of the things that I know about.” (Participant 3)

I looked at the web page and saw that it was lacking this information. And it said “edit this page.” And most people think that web pages are plastic, that they don’t change. It was just totally natural for me to click “edit this page” and change it. (Participant 7)

An important first step in drawing new users into editing and writing activities was effectively removing barriers to participation and allowing them to contribute their own knowledge to fill in a perceived gap or mistake in Wikipedia content. They felt that they had something to offer, something that would improve the quality of that particular article. The interface offered an easy way to make that contribution.

In addition to the “Edit This Page” function, users can also read a discussion page and the editing history of any article. None of the participants mentioned reading either the Discussion or page History before making their initial edits. It appears that these tools are not relevant to novice, peripheral participation but, as will be seen, become more relevant as users move toward full participation.

3.2.2 *Wikipedians: How the Interface Helps*

We identified Wikipedians’ goals as maintaining the Wikipedia—both as a community and as a reliable information resource. In general, the same set of tools is available to both novices and Wikipedians; however, Wikipedians’ different goals and more sophisticated understanding of the site render more tools visible and relevant.

Vygotsky, whose early work on social cognition underscores much of AT, also first described the *zone of proximal development* (ZPD) [25, 28]. The ZPD is a useful concept for understanding why tool use changes, even when access to tools remains more or less constant over time. Among learning scientists and educators, the ZPD has come to represent the set of activities that a person cannot quite undertake on her own [20]. To accomplish an activity in her ZPD, a person needs some form of support, which can take the form of a more knowledgeable person or of instructional mediating artifacts. One way to understand users’ piecemeal awareness of features in the Wikipedia is by imagining that as an individual’s ZPD extends to encompass new potential activities, the tools that mediate these activities become meaningful features of his environment. Although the site does not change, Wikipedia supports a more robust set of activities for Wikipedians than for novices.

An example of tools awareness can be seen in interviewees’ descriptions of their daily activities in Wikipedia compared to their descriptions of initial experiences. Although none of the interviewees described initial encounters with Wikipedia that involved discussion pages or page histories, these features became deeply integrated into their routine activities on the site.

Discussion pages allow community members to confer about certain aspects of articles, whether it be an issue about including certain information, working toward a neutral point of view, asking for clarification, or simply requesting that someone with more knowledge about a particular aspect of the subject to add it. As a tool for knowledge building, the discussion capability affords consensus building:

Well, for every article there’s a talk page. On there, people will write, “I don’t agree with what you’ve put about such and such, and I’m going to change it,” something like that. And then sometimes they’ll say, “You shouldn’t have changed that and I’m going to change it back.” And sometimes you get something that they call an edit war where people keep changing each other’s contributions to it, so then it can get a bit fraught. But usually people will say, “Well what if I put such and such instead?” And someone else says, “Well, what about this?” And a few people might join in the argument...Usually they come to agreement. (Participant 3)

[One discussion I’m in now is] mostly just trying to build consensus, deciding whether something should be in an article and if so, how it should be presented in a way that covered it factually and neutrally...it’s a very casual discussion without much animosity, just acknowledging that there’s controversy and we shouldn’t be the ones to decide what’s real and what’s not. Just say, “this is what some sources claim, this is what other sources claim.” (Participant 2)

The discussion pages, also referred to as “talk” pages, are the most frequently used communication channel on the Wikipedia. Although the study participants said that they had occasionally emailed other Wikipedians, they all stated that talk pages were their primary communication medium. Beyond discussion pages for articles, the Wikipedia offers discussion pages linked to individual user pages and the Village Pump, the community area where Wikipedians discuss policies, general Wikipedia issues, and user help.

The most prominent “new” tool that Wikipedians use is the watchlist. The watchlist formalizes the surveillance of others’ contributions. It alerts Wikipedians to changes on pages that interest them, and they can review the changes. Vandalism can be reverted, and controversial changes can be addressed. According to interviewees, the watchlist becomes an important part of ritual activity in Wikipedia. All of the participants interviewed said that checking their watchlist is one of their primary tasks whenever they log on.

I go look at the pages I’ve been editing through the watch list and see if anybody has sort of attacked them lately or done any modifications to them that ... I might want to modify myself. (Participant 5)

My watch list right now includes 373 pages, but not all of them are complete articles; all of the images I have uploaded (all but one are my own work) are on my watch list just to make sure that nothing happens to them. The great majority of edits that I see are ones that constructively add to the articles, but I have found a couple of pages that were vandalized. With these pages on my watch list, I can spot the changes and quickly find the difference and revert any changes that are not appropriate. (Participant 9)

I’ll keep an eye on what other community members have contributed to the page I’m watching, and sometimes I catch vandalism or just mistakes that people add, and in that case, I fix it. For the most part, I just see that they’ve added new and interesting facts and if it needs polishing

or copyediting to fit into the flow of what has come before, I'll do that. Usually I just look at, you know, just note what they've done, kind of think "Good job" and go on to whatever else. (Participant 2)

I'm a watch list junkie...I have my watch list bookmarked, so I just click the watch list and it brings me right there. Basically I skim down to where I last checked it. Basically I look for the interesting pages, see if any of them have been edited. If they have, I look at the page differences, just to see what changed. (Participant 7)

I've only got about 20 or 30 articles on my watch list, which would be mainly ones that, where I think other people might make controversial changes. And also my own user page in case somebody goes in and messes around with that...Just anywhere there's been a history of controversy. (Participant 3)

As they moved from the periphery into full community participation, these Wikipedians have assumed responsibility for maintaining the integrity of some set of articles. The watchlist is a tool they use to carry out this important task. Lists of recent changes and new pages also serve to alert Wikipedians to what other community members have contributed. These elements in the interface all provide Wikipedians tools for surveillance of the community. Rather than being faced with hundreds of thousands of articles to sift through in their efforts to maintain a quality resource, Wikipedians can focus on reviewing their personal watch list, recent changes and new articles. Several participants even noted that they use the random page function to pull up a random page and check it for errors or vandalism.

3.3 Transformed Perceptions of Community, Rules, and Division of Labor

Since perceptions of community, the rules that govern activity, and the division of labor overlap considerably, we present these three dimensions of activity in one section. In general, interviewees' novice experiences indicated little awareness of these three dimensions of activity on Wikipedia. It is only as individuals are drawn into the Wikipedia community that they begin to understand that Wikipedia *is* a community and begin to recognize the richness of community standards and roles.

3.3.1 Novices: Community? What Community?

In talking about their first experiences with the Wikipedia, none of our interviewees mentioned interactions with other users. In contrast, they spoke at length about other users when describing their later and current activities as Wikipedians. It appears that, to novice participants, the Wikipedia seems more like a *collection of articles* with random people adding information here and there than like a *collection of people* talking about, editing, and protecting their efforts to author good work.

Since they don't have an initially strong sense that a community exists on Wikipedia, novice users are likewise not aware of the roles associated with division of labor. Although most have already begun to move toward more central participation by shifting from the role of reader to editor, the possible roles they could play are still largely hidden. We can contrast this to the communities that Lave and Wenger observed while developing the idea of legitimate peripheral participation [14]. In case studies of communities of butchers, tailors, midwives, quartermasters, and recovering alcoholics, newcomers were aware of a

community that they wished to join. They knew that they initially played a novice role and, although their knowledge of more advanced roles was likely incomplete and flawed, they could identify more senior members of the community whose activities they would someday emulate. In Wikipedia, a part of moving from the periphery toward fuller participation is becoming aware of the community that you are joining.

Full community members recognize that there are a host of rules and guidelines for Wikipedia use. On the periphery, however, the most important rules are articulated on the edit page where novice users are likely to encounter them. The edit page contains brief instructions that explain the instantaneous nature of Wikipedia edits and reminds editors to respect copyrighted material. The statement also informs users that there are community members who review changes looking for bad edits. After users begin to contribute more regularly, they begin to learn of other rules and guidelines. For example, there are policies outlining proper formatting and syntax. New users who are making minor edits are usually not aware of these policies because they don't need to know them for the changes they are making. As the scope of their edits increases, they learn about formatting conventions. In true LPP form, some users simply learn formatting syntax through observation by exploring the site or the help pages:

And then after [starting to edit pages], the syntax for Wikipedia is very simple. At least for me. I have a degree in computer engineering...so picking up the syntax was very quick for me. (Participant 7)

Other users were coached by senior community members when they did not format their contributions according to convention:

I didn't understand the markup language that you use to get the contributions into the correct form. I didn't know the conventions...And then people started sending me messages telling me where I was going wrong and so on. So I just gradually picked up how to do it. (Participant 3)

As users continued participating in peripheral activities, they not only became aware of the community but also were exposed to and learned the rules that guide the growth of the Wikipedia.

3.3.2 Wikipedians: Members of the Tribe

Unlike novices, Wikipedians view their participation on the site as membership in a community. As we observed in the first part of this section, an important aspect of a community is the identity that individuals both establish within it and derive from it. The way that an individual presents himself is tied to his affiliations with particular communities, and, furthermore, with the roles he plays in them [9, 5]. In Wikipedia, one of the main ways that individuals can establish an identity within the community is through the userpage.

At some point, novices decide to create an account on Wikipedia, which allows them to create a watchlist, track their own contributions, and maintain a consistent identity on the site. One interviewee relates that he was encouraged by others to establish an account:

I started out as a "lurker," browsing articles, and then I made some anonymous contributions for about four months. After being encouraged by a couple other users, I created an account. (Participant 4)

When a user registers for a username, a userpage is automatically created. Wikipedians often use the userpage itself to provide some biographical information about themselves. Of the nine participants in the study, eight included biographical information on their user pages. Many also included links to articles they have worked on, to do lists, or lists of their interests. In addition, the discussion page that is associated with each userpage is called a “talk page,” and serves as a main channel of communication among Wikipedians. The ninth user, who did not include biographical information on his userpage, used his talk page extensively.

Some of the rules that govern activity in Wikipedia remain constant whether one is participating on the periphery of the community or as an established member. These include maintaining a neutral point of view in the articles, following proper procedures for editing and adding pages, and syntax and formatting. The expanded activities and responsibilities of full community members require additional rules, mainly connected to treatment of other community members. Whereas all users are subject to community punishment (from chastisement to banning) if they act inappropriately, Wikipedians are expected to give new users some leeway. As one participant noted, “We have a policy of don’t bite the newcomers and forgive and forget.”

Another convention that is understood by Wikipedians but not by novices is that anonymous contributions are inherently suspect, so new users are encouraged to register and get usernames and to always sign their contributions to discussions. On the Wikipedia Policies and Guidelines page of the Wikipedia, two of the Behavior Guidelines include “Sign your posts on all talk pages” and “Log in before making drastic changes to existing articles.” Although anyone can edit articles and post on discussion pages without registering, this is considered bad form. Whereas the rules on the periphery tend to focus primarily on the technicality of editing an article, full community members are expected to adhere to certain understood elements of etiquette, including assuming good faith on the part of others, avoiding deletions and reverts if possible, politeness, signing discussions but not articles, working toward agreement, and several other posted rules that encourage cooperative behavior [30].

In the previous section, we saw that novice users learn the rules and conventions for contributing both through observation and direct coaching from more knowledgeable others. Talk pages also provide one vehicle through which the community provides public recognition of good work on the Wikipedia that can serve as a model for new users. Wikipedians post messages on others’ user talk pages to commend individual contributions:

In some ways you get recognized, you get some respect, recognition from your fellow...here’s somebody who knows his stuff, who writes good articles and so on and so forth, and you feel happy when one of them puts a posting on your talk page. (Participant 5)

Wikipedians not only appreciate explicit accolades, but also the indirect attention they are paid when others edit and improve their contributions. Diverse authorship can be used as a measure of article quality; diversity increases after an article is cited in the media [17]. One participant observed a similar effect when an article that he had written become the center of an editing frenzy after a related topic caught the attention of international media. He

derived a great deal of satisfaction from others’ efforts to improve upon his work:

I got very lucky. I wrote an article on...prison experiments and after Abu Ghraib, that article exploded. It really exploded from what I had written, which consumed most of the article. Within a day, like 40 people had changed it. I’m like, ‘What’s going on?’ Then I saw on the news – Abu Ghraib. And I’m like, ‘Oh, that explains it.’

Interviewer: And so you really followed that one –

Yeah, the article improved pretty nicely. Everything that is in the news tends to improve pretty nicely. (Participant 7).

Another way that Wikipedians recognize exemplary work is the featured article. The review process for featured articles is more akin to traditional peer-review than the standard freeform editing and discussion that takes place as most articles are written. Wikipedians nominate candidates for featured articles, the article is posted on a list of nominations where community members review the candidates and vote on whether or not to feature each article. If a Wikipedian objects to an article, he must provide specific, fixable criteria to explain his objection. Although anyone can edit the article, generally, the person who nominated the article then makes the requested corrections, resolving the objections, and the article is promoted to a featured article if there is a consensus in favor. A label appears at the top of the article identifying it as a featured article and a link to it appears on the Wikipedia main page. Ordinarily, featured articles remain on the main page for a day, but they retain featured article status indefinitely.

One interviewee described two important functions that the featured article plays in the community:

[The featured article] gives us a specific set of articles that we can say, “Look, here is our best work.” And so when people say, “How can this thing possibly work? How can it hope to rival an Encyclopedia Britannica?” And then we have this finite set of articles that we can say, “A-ha, look at this.” That’s very good in a PR respect. It also gives us a nice little something to put on the main page. It also works as kind of an incentive mechanism for people to write good articles. (Participant 7)

Another Wikipedian echoed the sentiment that the featured article serves as a public recognition of good work:

Recently I’ve been working on the article... as a featured article candidate. If my article is accepted as a featured article, it will appear on the main page with a multi-paragraph excerpt and photo. Featured articles stay on the front page for a day, and then they’re swapped for another, so I’m really just trying for bragging rights with this one. (Participant 9)

We have seen that the goal of the Wikipedian is maintaining the Wikipedia as a community and information resource. Although the division of labor in Wikipedia is always somewhat ambiguous, experienced Wikipedians support the community by adopting a variety of roles. In some cases, they simply check various help pages and answer questions when they can. Other Wikipedians help resolve disputes by serving on an arbitration

committee, which mediates extended conflicts that the community has been unable to resolve. Arbitrators are vested with the authority to ban individuals from certain sections of the site or for certain amounts of time. Some Wikipedians assume the role of system administrator. Administrators are not meant to hold privileged positions in the community. According to our interviewees and to the Wikipedia site, obtaining administrator status is not difficult. It is available to any established and therefore trusted member of the community and provides access to functions such as removing vandalism from page histories, blocking IP addresses or ranges from editing, and editing secure pages such as the top page of the site.

While most of the participants stated that they continued to write and edit new articles, even as they expanded their activities, one said that he did very little of that, instead concentrating on “meta” tasks related to keeping the Wikipedia community productive. The main role that Wikipedians adopt seems to be that of a watchdog—monitoring community activities looking for opportunities to help and correct mistakes:

Because I’m an administrator, I also keep any eye on the help desk and reference desk, which are places where people ask questions if they need help, and about one time in four I’ll be able to answer a question that someone has asked and I’ll pass that along. I’ll answer it as best I can, point them in the right direction. And if I have time and feel like getting into more depth, I’ll also look at the cleanup pages and see if there’s anything that I can do there. (Participant 2)

I act as a mediator for some controversial topics... trying to get extreme points of view and get an article out of it. It’s amazing that we get good articles written...I just do work where something is needed and it interests me. (Participant 6)

Starting in about January or February I kind of became, I like to call them “meta users.” They don’t touch the articles so much, because there’s a lot more there than articles...A lot of people look up to me, respect my opinion and what I do there. (Participant 7)

One user provided an example of a sub-community within Wikipedia, whose members fulfill a particular need in the broader community:

Then there are other people who’ve got different kinds of roles, who fall into different roles. For example, there’s something called the Welcome Committee, so they’re supposed to go in for people who have just signed on with an ID and to go to their Talk page and send them a message saying Welcome. (Participant 3)

4. CONCLUSIONS

When the creators of Wikipedia launched the site, they hoped to create a place where volunteer writers would find few barriers to contributing. They little imagined that the response would be as overwhelming as it was; nor did they anticipate that the quality of articles on a wiki would reach the current standards on Wikipedia [19]. They approached the project with a set of expectations based on traditional publishing models. In fact, the growth of their original collaborative encyclopedia, the Nupedia, was stymied by a cumbersome editing process that discouraged all but the most committed volunteers from contributing. In retrospect it is clear

that their initial vision of an online, volunteer-produced, free encyclopedia relied on editing and review procedures that were developed in print, expert-produced, for-profit publishing systems. The Wikipedia founders’ brilliance was in their ability to identify the shortcomings of the traditional model and adapt their project to new constraints.

This study does not investigate all the possible forms of participation in Wikipedia; the story is still incomplete. Participants in this study were strategically recruited in ways that ensured awareness of community norms and active participation in community spaces. These were active, committed members. Other methods of recruiting may reveal other, more casual, modes of participation or amplify the voices of those who began but ceased participating in the community. What are the social trajectories of contributors who choose to stop participating? What is the experience of the minority voice in a peer-edited project that traverses geo-political and cultural boundaries? We continue to pursue these questions in ongoing investigations of the site.

For the mean time, by describing the activity systems in which newcomers and established Wikipedians participate, we see concrete examples of how participation is transformed in an online collaborative project. As their participation becomes more central and frequent, participants in Wikipedia adopt new goals, new roles, and use different tools although they are doing so in the same “place.” Their perceptions of Wikipedia change. They identify the site, not as a random collection of articles, but as a community of co-authors who play distinct roles and have distinct talents as they build a resource. They move from a local focus on individual articles to a concern for the quality of the Wikipedia content as a whole and the health of the community. As Wikipedia users move from legitimate peripheral participation to full community involvement, the activities and structures that mediate them necessarily become more complex.

There is a disparity between the tremendous increase in the complexity of Wikipedian activity compared to novice activity and the relatively unchanged context of participation. Novices and Wikipedians are using the same site. For the most part, they have access to the same set of tools and are cooperating in the same virtual place that has the same set of affordances, with the same group of collaborators. Applying the AT framework over time helps reveal the many externally imperceptible ways that participation is transformed as newcomers establish themselves in this community.

We have described writing and editing activity on Wikipedia that is strikingly different from a traditional publishing model. Supported by computer-mediated tools and responsive project leadership, a new kind of activity system has emerged. The nature of that activity system is uncommonly opaque to the outsider—how the Wikipedia came to be and continues to grow was a mystery to us until we began to interview Wikipedians. In our field work, informants told surprisingly consistent stories of how they moved from the periphery to the center of Wiki-activity. These patterns suggest a new emerging genre, not only of information resource, but of collaborative activity [1]. As we come to better understand new patterns of computer-mediated cooperation, we can better leverage those models in our design of novel cooperative systems; however, understanding such new genres requires us to shed preconceptions about productive activity patterns and embrace the unfamiliar.

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