SELF-ORGANIZATION OF VIRTUAL COMMUNITIES
Need and Members' Participation

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Keywords: Virtual community, Self-organization, Participation, Members.

Abstract: In a self-organizing virtual community, the members are responsible for defining the norms that govern the community. A model for self-organizing virtual communities is proposed. The model is useful to study a self-organizing community and understand how it is structured in order to improve its self-organization feature. The model is used in two investigations. We investigate the need of self-organization feature by virtual communities. We also investigate the participation of members in the self-organization process, by identifying the categories of members that contribute significantly during the elaboration of norms.

1 INTRODUCTION

Virtual community is a group of people, who come together for a purpose online, and who are governed by norms (Preece, 2000). Norms are specific to a social context, and they are generally established in order to regulate the people relationships (Palaia, 2005). Virtual communities are not fixed over time; they evolve due to the members' interests and demands. Communities that promote their own evolution, are called self-organizing communities.

Self-organizing virtual communities are dialectical systems in which technological networks and social networks are interconnected and produce each other in a self-referential loop (Fuchs, 2006). In this article, self-organization is understood as meaningful changes in community norms performed by the members themselves. Meaningful changes are those that require formal acceptance of members. Self-organized virtual communities are more flexible, which stimulates participation and involvement of members. It may result in more motivation and commitment to the members, contributing to the persistence of the community over time (Moe et al., 2008, Crowston et al., 2007).

The term self-organization is related to changes in distinct social structures and it is used in the descriptions of the dynamic creation of content (or knowledge) in communities (Bieber et al, 2002). The term is also used when describing the changes in interaction among members (social networks) over time in a community (Crowston, 2006, Lin et al.,

2007; Moor and Weigand, 2007, Baek et al., 2009, Xianjin and Minghong, 2009). We are particularly interested on the basis of the structures' changes, which are the changes in the norms that govern the community.

In this article we investigate which types of virtual communities are more prone to be self-organizing. We use the typology proposed by Fuchs (2006), which includes three levels of virtual communities: cognition, communication and cooperation. Our hypothesis is that the need of the self-organization feature depends on both the community objective and the members' involvement to meet effectively the community objective. Another open issue is the self-organization process, which is the process used by members to propose, discuss, and approve norms. Our objective is to understand which classes of members actively participate in the process. Our hypothesis is that the members that have already developed the sense of ownership of the community contribute to norms' elaboration.

In order to investigate the underlined hypotheses, we first propose a model of self-organizing virtual communities relating the components identified by Preece (2002) and the concept of self-organization provided by Fuchs (2006). Aiming to reason about our first hypothesis, we use the model to identify if a virtual community has the self-organization feature. The second hypothesis is validated by analysing some discussions about norms reported in Wikipedia community.

The article is organized as follows. Section 2 presents the model for self-organizing virtual communities. In Section 3, we investigate the need of self-organization in virtual communities. In Section 4, we reason about the participation of members during the self-organization process in Wikipedia. Section 5 concludes our work.

2 SELF-ORGANIZING VIRTUAL COMMUNITY MODEL

There is no agreed definition about virtual community. We use the definition by Preece (2000), who identifies the following elements of virtual communities: shared purpose, people, norms and computer technologies. Self-organization theory describes reality as permanently moving and producing novelty. The process of the appearance of order in a self-organizing system is termed emergence or evolution (Ashby, 1947, Fuchs, 2006). In the self-organization of a virtual community, a structural component (the virtual part) and the actor component (the social or community part) permanently create each other. So, actors agency structures, while structures constrain and enable actors. Social action produces and reproduces knowledge, rules, and resources that enable the existence of the overall community (Fuchs, 2006).

We proposed a model for self-organizing virtual communities and it is illustrated in Figure 1. The model is composed by three main elements identified by Preece (2002): *members* (people), *norms,* and *system* (computer technologies). Preece (2002) also identifies the element *shared purpose*, which is implicitly presented in the model through the community goal. *Members* belong to the community motivated by their personal goals, which should be aligned with the shared purpose of community. *Norms* impose discipline to members, because they regulate the community by establishing the appropriate and inappropriate values, beliefs, attitudes and behaviours (Palaia, 2005). The *system* encompasses the means for the members to work in their activities and interact with other members. The *system* is designed to meet functional requirements that follow the community *norms*. For example, if a norm states that content is editable by any member, the system shall provide the adequate functionality to it. So, the *norms* are implemented by the *system* and the *members* use the system. We understand member as a person associated to the community, while user is his/her logical representation in the system.
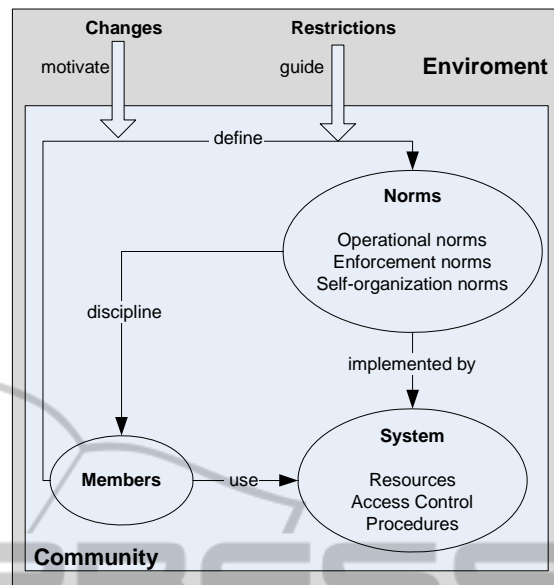

Figure 1: Self-organizing virtual community model.

We assume that the community exists inside an environment and can be influenced by it. Then, the definition of norms may be motivated by changes in the environment and also guided by restrictions. Examples of changes in the environment can be the best practices of other communities. Examples of restrictions imposed by the environment are of ethic and moral nature, social laws and rules. The norms of a community in general have to follow these restrictions, for example the user agreement of Linkedin community refers to United States Copyright Act, French Consumer Code, and German Civil Code.

We can identify the self-organization feature discussed by Fuchs (2006) in this model. The actors are the members of the self-organizing virtual community. The structures include the norms and the system. The relation "actors agency structures" can be explained as: members define the norms that governs the community, which are implemented by the system that supports the community. The relation "structures constrain and enable actors" can be understood as: members use system respecting the discipline imposed by norms.

In the next sections, we discuss about the elements of the proposed model.

2.1 The Norms

A norm is a type of principle, precept or rule that states obligation, permission, power attribution or competence attribution. In general a norm can be imperative (that imposes duties) and/or attributive

(that confers rights). A norm is general and abstract, because it does not regulate a specific situation, but establishes a principle that can be applied in many concrete cases (Palaia, 2005).

Norms may have associated procedures to be followed by the community. Procedures detail the operational participation of members in order to guide the accomplishment of norms. A norm defines "what" shall be followed by members, while a procedure explains "how" a norm (or a set of norms) can be put in practice, but the difference between them sometimes may be blurred. Changes in procedures are considered improvements in the system and not an evolution, because only the operational activities are affected. Changes in procedures can be made by an authorized member or group established by some norm. Changes in norms represent the evolution of the self-organizing community and shall be a result of a consensus among members.

The norms regulate distinct aspects of a community. They can be classified into three main groups: *operational norms*, *enforcement norms* and *self-organization norms*. *Operational norms* regulate the cooperation of members to develop their activities. The definition of norms is essential for the community organization and the enforcement of such norms shall be also addressed, because a norm shall contain a coercion element in order to force the members to follow it (Palaia, 2005). So, *enforcement norms* are important to regulate the entire enforcement process (Bezerra and Hirata, 2010). Finally, *self-organization norms* define how members propose new norms or improve the existent ones, and how the proposals are analyzed by members in order to assure the community acceptance.

Not all norms are formally codified in self-organizing virtual communities. There are informal norms that can be inferred by members, for example, a norm that states that a person shall be aligned to the community goal in order to become a member. Therefore only the essential norms should be explicit. This parsimony keeps the trade-off between freedom and discipline, as explained by Pascale et al. (2001): "*Neither too many rules nor too few rules. The key to self-organizing resides in a field of tension between discipline and freedom... In organization, rules provide discipline.*".

2.2 The System

A virtual community is supported by an information system based on Internet technology (web-based system). The system, sometimes named as community system, teamware, and groupware, is used as a means for the members to achieve the community goal.

Although there is no perfect technology configuration for a system as it changes from community to community over time (Wenger, 2007), it is possible to identify three main components in a system: *resources*, *access control policy model*, and *procedures*. *Resources* encompasses all the goods developed in the community, such as messages in forums, articles in Wikipedia, and documents and codes in open source communities. The permissions over the *resources* are handled by an *access control* policy model according to the social roles presented in community. *Procedures*, introduced in Section 2.1, are driven by the norms and detail the operational interaction of the members.

The platform of the system can take advantage of distinct technologies (Michaelides et al., 2008, Geib et al., 2004)., for example: asynchronous technologies (which involve a time difference, e.g. email, and discussion boards), synchronous technologies (e.g. instant messaging, synchronous cooperative editing systems, and video conferencing), and functions for content management and the exchange of knowledge (e.g. blogs, wikis, and document repositories).

The creation, elimination or modification of system components may require some implementation made by an authorized system developer. The changes in system related to correctness (to correct bugs), adaptation (new versions of software or platform) and prevention (to increase performance or to ease future maintenance) are seen as operational tasks of the system developer. The changes in system concerned to the improvement of its functionalities are directly related to the changes of norms approved by community. In this case, we observe the relation "norms are implemented by system" shown in Figure 1 as part of the self-organization of virtual communities.

2.3 The Members

Members are responsible to create, increment, and adapt the norms that govern its relations and processes. The active participation of member is essential for the community evolution, because the members have the detailed knowledge about the problems and expectations (Moor et al., 2007). Any member can be an agent of change who influences

what emerges from individual interactions (Olson and Quade, 2006).

Some researchers (Michaelides et al., 2008; Geib et al., 2004) state that the productivity of a virtual community depends heavily on the fact that its members accept the community system that supports it. However, in self-organizing virtual communities, the members have the possibility to change norms and consequently the system according to their goals. The members are responsible for the community evolution. They are not seen as mere users of a system controlled by an individual or a selected group. As explained by Fuchs (2006), the self-organizing virtual community is not controlled by an elite group take takes decisions, but by self-managed networks of activists.

Members in virtual communities are in general volunteers because they show interest with the community goal. The self-organization characteristic is attractive for the members because it stimulates involvement, resulting in more commitment, motivation, sense of ownership, and desire for responsibility (Moe et al., 2008).

2.4 The Self-organization Process

In order to coordinate the self-organization, some process shall be defined. This process is regulated by the *self-organization norms* mentioned in Section 2.1. The self-organization process is a group decision making process, whereby members have to debate the issues and reach a decision. Based on the phases of the group decision making process identified by Simon (1960), we argue that the self-organization process may include the following activities: *problem definition*, *identification of alternatives*, *analyses of alternatives*, and *solution implementation*.

In the *problem definition* activity, a member indentifies a problem regarding a norm or a set of norms. The problem may include ambiguous or very specific norms, and even the missing of norms to regulate some issues. The problem is then discussed by other members during the *identification of alternatives* activity in order to identify possible alternatives for solution. In the *analyses of alternatives* activity, members discuss the identified alternatives and choose the more appropriate one. In the *solution implementation* activity the solution is applied to community. The solution can be a change of norms or a creation of new norms, and may require some technical implementation in the system.

The presented self-organization process is not unique; each community forges its own process. The chosen process may also evolve during the community life cycle, however in general such changes are more subtle to achieve consensus in community.

3 THE NEED OF SELF-ORGANIZATION

In this section, we investigate why some virtual communities are more prone to self-organization. The objective is to validate our hypothesis: "The need of the self-organization feature depends on both the community objective and the members' involvement to meet effectively the community objective". To achieve our objective, we identify some virtual communities according to the self-organization feature. We then discuss the results of the classification in order to validate our hypothesis.

We select some virtual communities of distinct typologies and identify the self-organizing ones, as shown in Table 1. The self-organizing virtual community model illustrated in Figure 1 is used to do such identification. The key is to verify if the relation "member define norms" proceeds. To verify it, we analyse what is stated in community norms, and also we observe the actual behavior of members, in order to know if they really contribute to the elaboration of norms.

The chosen typology is the one proposed by Fuchs (2006) that divides virtual communities in three levels: cognition, communication and cooperation. The first level represents the computer networks and application programs that enable a user to connect to a virtual world. The second level characterizes the computer-mediated communication between users that is regularized by general rules of interaction and shared interests. In the last level, jointly produced resources emerge through the cooperation among the users, which share feelings of togetherness and belonging.

Web-based discussion boards, blogs, group blogs, online dating and friendship services and online rating are examples of *communication* communities according to Fuchs (2006). In this category, we selected the following communities to study: Twitter, Linkedin, Orkut, LinuxQuestions, and PlanetMath Forum.

Twitter is a social networking and microblogging service, owned and operated by Twitter Inc., which enables its users to send and read other users' messages called *tweets*. Members interact using the

system. The norms of the community are responsibility of the owner company, so Twitter is not self-organizing. The same analysis can be inferred about Linkedin and Orkut communities.

Table 1: Virtual community classification.

Community	Business Model Type	Typology	Self-organizing
The Times of London	online journal	cognitive	no
UOL Radio	internet radio	cognitive	no
Twitter	social network and microblog	communication	no
Linkedin	social network	communication	no
Orkut	social network	communication	no
Linux Questions	forum	communication	yes
PlanetMath Forum	forum	communication	yes
BSCW	shared workspace	cooperative	no
PlanetMath Encyclopedia	wiki	cooperative	yes
Wikipedia	wiki	cooperative	yes
Netbeans	open source project	cooperative	yes
Apache	open source project	cooperative	yes

LinuxQuestions is a forum where members discuss topics related to Linux. It has a simple set of norms called "LQ Rules" that mainly regulates the conduct to be followed, for instance forbidding content with obscene, personal attacks and advertising. The norms were created by the community founder; however there is a specific thread of forum where the members can discuss the norms and propose some enhancements. Due to this possibility, the relation "members define norms" holds and the community is self-organizing. The same analysis can be inferred about PlanetMath Forum.

Fuchs (2006) exemplifies the *cooperation* communities with wikis, shared workspace systems, groupware and knowledge communities. In this category, we analyse the following communities: BSCW, PlanetMath Encyclopedia, Wikipedia, Netbeans, and Apache.

BSCW is a service for the international scientific community to share documents safely across the Web. Its norms are established by Fraunhofer FIT, the company that developed BSCW. As members cannot define the norms, the community is not self-organizing.

PlanetMath Encyclopedia is a free, collaborative, online Mathematics encyclopedia. The norms of this community are called "PlanetMath Collaborative Documentation" and are established by members, then classified as a self-organizing community.

Wikipedia norms are available for all members as content pages in wiki pages too, so members can access the norms and improve them (Goldspink et al., 2008; Beschastnikh et al., 2008; Forte and Bruckman, 2008). As the relation "members define norms" hold, Wikipedia is also a self-organizing community.

Another *cooperation* community is Netbeans. NetBeans.org is a community committed with the open source development of a Java IDE (integrated development environment). NetBeans provides some detailed norms to discipline the activities of members. The decisions regarding the norms are discussed in public main lists in order to assure a consensus (Jensen and Scacchi, 2005). So, the members define the norms and the community is self-organizing. The self-organizing characteristic is also found in Apache community.

Associating the typology of virtual communities (cognition, communication and cooperation) with the self-organization aspect leads to some findings. The self-organization aspect is absent in *cognition* communities, because the members are mostly interacting lonely with the system in order to retrieve some specific information. *Communication* communities tend to be not self-organizing. Members are mainly concerned to establish relations and to discuss about general content; and they are not involved in the definition of norms. Exceptions may occur, for instance, PlanetMath Forum and LinuxQuestions are self-organizing communities. Communities based on forum have a tendency to be self-organizing, because they require more involvement of members to effectively achieve the community's goal of sharing information and experiences. *Cooperation* communities are more prone to be self-organized, because the members work together in activities and therefore they are concerned to the norms that regulate these activities. The community objective is related to the community type, which in turn motivates the need for self-organization. It confirms our first hypothesis that states that the need of self-organization is related to the community objective and to the involvement of members.

4 PARTICIPATION IN THE SELF-ORGANIZATION PROCESS

In this section we investigate the participation of members in the self-organization process. The objective is to validate the hypothesis: "Members that participate of the self-organization process have already developed the sense of community by contributing actively of the operational activities in the community".

The participation investigation is performed for Wikipedia, a well succeed example of self-organizing community. The data availability is a positive aspect to research the community. Norms in Wikipedia are available as wiki pages. The discussion among the members about a norm is held in the talk page associated to the norm page. There is also a special page called "Village Pump (policy)" page, which is used to discuss existing and proposed norms. We have studied ten cases of "Village Pump (policy)" page in September, 2010. The cases are listed in Table 2. Based on the analyses of the discussions about norms in Wikipedia, we validate our hypothesis. We also comment some characteristics of the discussions and reason about the self-organization process.

Table 2 shows the selected cases and the type of the Wikipedia member that had initiated the discussion. We specified three categories of members based on the social roles that they perform in Wikipedia: *admin members*, *specialized members* and *regular members*. *Admin members* are members that hold roles related to Wikipedia administration. In this category we include the following roles found in Wikipedia: "administrators", "bureaucrats", and "stewards". *Specialized members* are general members that have access to some specialized administration function. In this category we include the following roles: "checkusers", "reviewers", "account creators", "oversighters", "rollbackers", "autopatrolled", and "edit filter managers". *Regular members* are the registered and anonymous members, both active (that contribute to the Wikipedia content) and inactive (that only read the Wikipedia content).

For each discussion in Table 2, we count the number of participants and contributions in each user category. It is shown Table 3. For instance, D1 had a total of 12 distinct participants that provided 35 contributions during the discussion. The 12 participants were 4 *admin members*, 7 *specialized members*, and 1 *regular members*. From the 35 contributions, 10 were provided by *admin members*,

18 by *specialized members*, and 7 by *regular members*.

Table 2: Analyzed discussions about norms.

Id	Discussion	Initiated by
D1	*Article cleanup templates*	Specialized member
D2	*Email from email provider*	Specialized member
D3	*I come to bury editors, not to praise them ...*	Specialized member
D4	*Need Button: "This Article Needs a Practical Example"*	Regular member
D5	*Notability of cities, towns, and neighborhoods*	Specialized member
D6	*Self-Identification versus Verifiable Fact.*	Regular member
D7	*The power of the Arbitration Committee*	Specialized member
D8	*The SCOTUS recently ruled that promotion of illegal material is not a guaranteed right; however, someone keeps adding links to illegal material to the Tor article.*	Regular member
D9	*University "reputation" sections*	Admin member
D10	*Wikipedia image policy?*	Specialized member

Table 3: Number of participants and contributions in discussions.

Id	Admin users		Specialized users		Regular users		Total	
	P	C	P	C	P	C	P	C
D1	4	10	7	18	1	7	12	35
D2	2	2	1	1	0	0	3	3
D3	3	17	11	40	2	16	16	73
D4	1	1	1	1	4	4	6	6
D5	5	9	5	12	5	9	15	30
D6	2	6	1	2	3	27	6	35
D7	5	6	5	12	0	0	10	18
D8	2	2	2	2	1	1	5	5
D9	1	2	1	1	1	1	3	4
D10	4	4	2	9	0	0	6	13

* P indicates the number of participants, and C, the number of contributions

Regarding the participation of members in the self-organization process, the figures presented in Table 3 show that distinct categories of members

can participate of norms' definition. As *admin users* are entirely involved in the definition of norms, their participation is verified in discussions. The participation of *specialized users* is also verified in discussions about norms. *Specialized users* participate of the community with special administrative tasks, so they may have doubts about how to proceed in some situations and their experience can help during some discussions.

In order to understand the participation of *regular members* in the studied cases, we investigate the degree of involvement of the member by retrieving his registration date, and the quantity of contributions he made in articles during 2010. We note that the *regular users* that participate of discussions about norms are mainly those involved in content edition. As they have their activities coordinated by norms, they are more interested on understanding the established norms and contributing to their evolution. One exception is identified: a regular user without contributions in articles that initiated discussion D3. This exception is explained by the fact that he is a new member in Wikipedia.

Although any member can contribute to the definition of norms in self-organizing virtual communities, not every member does. Members who developed the sense of ownership of the community are more likely to participate of the self-organization process. In Wikipedia we observe that the members that participate in the self-organization process are mainly administrators, members with some specialized administration function, and members that contribute with content in articles. It confirms our second hypothesis.

Based on the observations in Wikipedia discussions, we have other findings. The number of participants and interactions during a self-organization cycle varies according to the issue being debated. When the proposed evolution changes significantly the way the community operates or its basic organization, this kind of proposal is more difficult to be approved. We also identify some issues during the self-organization process that could be improved in Wikipedia and can be important to any community addressing self-organization. The initial proposal sometimes is not clear, which demands effort by the members to understand the issue being addressed. The initial proposal in general does not specify which norms are related. It is sometimes difficult to relate past and present discussions. The discussion among members can take too long, because there is no deadline to close the issue. The conclusion of a discussion is not clearly identified; it is sometimes necessary to read all the comments to infer the conclusion. Finally, when the group achieves a conclusion, there is no indication about how or when the changes (if any) shall be implemented in community.

5 CONCLUSIONS

The social relations in virtual communities develop themselves in space and time, and they cause the incidence of norms. When members contribute to the community evolution, through the definition of norms, the community is called self-organizing.

We propose a model for self-organizing virtual communities, taking into account members, system and norms. Although it is a simple model, the relations among the elements can be complex. The model is useful to study a self-organizing community and understand how it is structured in order to improve its self-organization feature.

We use the proposed model to identify self-organizing virtual communities of distinct types. This investigation allows us to understand that the need of the self-organization feature depends on both the community objective and the members' involvement to meet effectively the community objective. It is useful to identify virtual communities where the self-organization feature can be attractive.

Analysing discussions about norms in Wikipedia, we verify that the members involved with the self-organization process are in general members that actively contribute to the operational activities in the community and have already developed the sense of ownership of the community. It is important to be able to stimulate the correct members in community in order to improve the quality of the participation during the self-organization process. We also identify some issues in discussions that can be improved in order to benefit the overall self-organization process in virtual communities.

As future work, we intend to investigate how conflicts during discussions can be managed in virtual communities, i.e. how they emerge and can be detected, and how to address them contributing to their accommodation.

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