Knowledge creation in virtual communities
-
a communicative perspective

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ABSTRACT

The modern information technique has made it possible to introduce virtual communities. These can appear in different shapes and with widely different purposes. It is a common interest that inspires members to form a virtual community. Some communities are most successful and their members experience an added value through the interaction in the community, whereas other communities are less successful. The purpose of this paper is to discuss the process of knowledge creation in virtual communities. This process is analyzed seeing the virtual community as a human activity system. One important aspect found in the analysis is that Customers, Actors and Owners consist of the same group of participants in virtual communities, that is their members. The process of creating knowledge is illuminated from different perspectives. The information processing of the *individuals* in the community that results in knowledge of the individual members is described (intrapersonal communication). The interaction in the community is also analyzed using social constructivist theories that look at the community using a holistic perspective (interpersonal and group communication). Knowledge creation in a virtual community is illustrated using a model. The paper also includes a short discussion of the forces that keep the community together and fosters its development. The role of the computer system in the virtual community is also discussed.

Keywords: Virtual community, knowledge creation, learning, social constructivism, computer mediated communication, human information processing

INTRODUCTION

The modern information technique has made it possible to introduce virtual communities. These can appear in different shapes and with widely different purposes. The most characteristic property for virtual communities is that the members share some kind of mutual interest. The community could consist of members who want to share information about for example computer games or members who want to exchange information about software applications.

One important characteristic of virtual communities is that the result of the interaction of the individuals can create knowledge that is not directly connected to one specific member. The whole is greater than the sum of its parts. Therefore a systemic perspective can be very useful when analyzing the activities in the community and Checkland's CATWOE categories may be used as the base for the discussion.

Some communities are most successful in sharing information and their members experience an added value through the interaction in the community whereas other communities are less successful. To be able to influence the process of knowledge creation and to find factors that may obstruct or facilitate the process it is important to reach an understanding of the different activities in the human activity system that creates the added value.

The purpose of this paper is to discuss the process of knowledge creation in virtual communities. The process of creating knowledge will be illuminated from different perspectives. The information processing of the *individuals* in the community that results in knowledge of the individual members will be described (intrapersonal communication). By using Vygotskijs [20] theories it is also possible to look at the community using a holistic perspective (interpersonal and group communication). The paper also includes a short discussion of what forces that keep the community together and fosters its development.

The members of a virtual community communicate through an interactive computer system. The design of a computer system is based on a perception of what a computer really is. But what is the role of a computer system in a virtual community? What perspective on the computer system should the system developer adapt to be able to design a system that facilitates knowledge creation in the community? Different perspectives on the system in use will be discussed briefly.

VIRTUAL COMMUNITIES

The word *community* is used to characterize many different groups. The group could be seen as a place for people to share their ideas and experiences [9]. There are communities where their members meet personally in the real world whereas in other communities the members meet only in cyberspace. The latter kind of community is called a *virtual community*.

The concept *virtual community* may be defined as a social cluster of interconnected computer networks where a sufficient number of people can publicly exchange ideas long enough and with a sufficient level of human emotions involved to allow

personal relationships to emerge in cyberspace [15]. When the term virtual community is used, focus is on communication through an electronic network between the members in the community [13]. One important reason to establish a virtual community is thus the creation and maintaining of interpersonal relationships [5].

A great advantage with a virtual community is that the interaction between the participants with a common interest will contribute to an environment where creativity and innovation flourish [3].

One reason to form a virtual community is thus to exchange and take advantage of each others knowledge. But there could also be other reasons such as for example to prevent the ineffectivity that occurs when many people work with the same inventions. Sometimes it is also important to assure that information is distributed to the appropriate recipients. This will also at the same time retain the information within the community even if one participant decides to leave it. [3]

There are two possibilities to organize the activities in the community. In the top-down approach a center is first established which will influence the information sharing in the community. In the bottom up approach individual collaboration between different members are supported to form a knowledge sharing virtual community. [8]

In a virtual community it is also important that the individual members experience an added value from their participation in the activities and interaction with the other members. They must thus be encouraged and realize the benefits for themselves as well as for the community as a whole. [16]

There is also a need to create creability and therefore it is necessary to promote good solutions. At the same time the community must also encourage diversity for alternative solutions and innovations to occur. Once a solution is found the work should always continue trying to find a better solution or improvements. [16]

HUMAN ACTIVITY SYSTEMS

By applying a systems perspective it is possible to focus on the process of knowledge creation in virtual communities from a holistic perspective that also makes it possible to illuminate certain details. Systems thinking has been developed in several widely disparate disciplines such as biology, astronomy and engineering [6].

Applying a systems paradigm means looking at *wholes* and their hierarchical arrangement (ibid). Instead of observing parts and fragments, a holistic perspective can create an understanding far beyond the sum of the parts. This thus means that the result of the interaction of the individuals will create knowledge that not can be described only by looking at the parts of the community (the individuals).

There are many kinds of systems with different nature and different purposes. Checkland [6] identifies four different kinds of systems:

- natural systems
- designed physical systems
- designed abstract systems
- human activity systems

Natural systems are physical systems that build the universe. They could be anything from the systems of atomic nuclei through living systems to galactic systems. They are systems that could not be other than they are. (ibid) Human beings are a kind of living systems. They are a good example of the advantage of systems thinking since they possess qualities beyond the meaning of the sum of their parts. [2]

Designed physical systems are man made and a result of conscious design for some human purpose. Sometimes the purpose may be difficult to define as for example an artist's painting. The physical systems encompass many different items from hammers via tram cars to space rockets. [6]

There is however another class of designed systems whose members are not physical but abstract. *Designed abstract systems* represent the ordered conscious product of the human mind and even if they are abstract systems in themselves they may be captured in physical systems such as books. Examples of designed abstract systems are mathematics, poems or philosophies. (ibid)

Human activity systems are less tangible systems than the previous mentioned system types. They are nevertheless possible to observe in the world since a great number of human activities, more or less consciously ordered for some purpose, occur everywhere around us. The human act of design of physical or abstract systems is one example of this system class. One extreme example is a system consisting of one man using a hammer and on the other extreme we can find international systems needed for life to be tolerable on earth. (ibid)

A virtual community can thus be regarded as a human activity system (the whole) and may consist of different subsystems (parts). Human systems are a kind of natural system that may communicate through a computer system that is a kind of designed physical system as well as a designed abstract system.

Human activity systems are social systems where people perform actions. Information systems are communication systems and as such a part of a human activity system. An information system is a socio-technical system involving human activities as well as information technology. (Benyon-Davies, 2002) A computer information system belongs to the technical part of an information system
Checkland [6] presents a way to describe a human activity system which can be summarized by the acronym CATWOE, where

- C= Customer, who is the person who will benefit from the activity.

  The Customers are the members of the community as well as the community itself since the purpose of the activity is to develop the knowledge within the community.

- A = Actors, who are the actors involved in the activity.

  The actors in this activity also be will be the members of the community. The interpersonal communication between

the participants is described in the section *knowledge creation in virtual communities* below.

- T = Transformation, which defines input, output and main processes necessary to describe the system.

  It is the transformation that creates the added value in the system, that is the process of interaction between the members that creates the output, increased knowledge within the community. The processes taking part in the activity depend on the different roles that the participants will possess.

- W = Weltanschauung (= world perception, the perception of critical concepts related to the activity).

  The perspective on knowledge creation in the virtual community as a whole and as well as the information processing of the individuals will have an impact on other concepts in the acronym.

- O = Ownership, that is the organizational body that has the ultimate power and ambition to continue the activity.

  The owners are the members in the virtual community. It is the members who can decide what information should be available in the system as well as who may have access to the material.

- E = Environment, the factors in the surrounding world (context) that could influence the activity.

  Environmental factors are related to the perception of the concept *context*. One important aspect of the environment is that the interaction takes place in a virtual world. Communication on the Internet have special characteristics that can influence knowledge creation. One example of this is when a few members communicating via e-mail (asynchronous communication). It is then not possible for the members to observe non-verbal feedback which is a great part of the message. The computer as a mediating tool is discussed in the section *The computer*.

In virtual communities the owners, actors and the customers are thus the same group of people. It is possible that this can have an influence on the motivation of the individual members in the virtual community. If the actors feel that they have a power to influence the situation and benefit from the added value created by the transformation in the human activity system, they will have an inner motivation that will serve as a driving force to continue the interaction and develop the virtual community.

KNOWLEDGE CREATION IN INDIVIDUALS

The process in which a person thinks, acts and modifies subsequent behavior may be seen as information processing. The self-corrective unit extends far beyond the human body. [6]

For a long time people have been interested in how thoughts are constructed and how they are represented in our minds. It has also been assumed that it is thinking that makes the difference between human beings and animals. Thoughts have also been regarded as proof of consciousness and existence. The French philosopher and mathematician Descartes formulated the phrase "Cogito, ergo sum" (I think, therefore I exist).

The cognitive psychologists focus on the human cognitive processes. In this perspective the structure and the functioning of the human brain is important. The brain is composed by cells, neurons that function through chemical reactions [18].

Cognitivism regards learning as a process. Learning occurs when the human being integrates new information with earlier mental representation of the concept in question. [17] Knowledge representation in the form of mental models and schemata is thus common in this perspective. According to the constructivist view, knowledge is achieved through an *active* cumulative process where knowledge is built by modifying or enhancing mental models. You thus learn something relative to something that you understand already [17]. Bruner [4] also means that knowledge is constructed from the individual's own earlier experiences and impressions from the outside world. The mental models are seen as the standards against which to make comparisons. He also pointed out that emotions have an important impact on human information processing. It thus also important to consider feelings when looking at the process of knowledge creation in virtual communities.

Human problem solving occurs when an individual uses a set of rules or previous skills to reach new conclusions [7]. This can be seen as an enhancement to or a reconstructuring of the individual's mental model. When learning, mental models are thus developed into more and more complex structures. If the information that is available for the individual is insufficient for solving the actual problem, the mental processes work in a way that they will fill the information gap using earlier experiences. That may lead to erroneous information.

KNOWLEDGE CREATION IN VIRTUAL COMMUNITIES

The cognitive perspective identifies learning essentially as a story of progressively enlarged capacity for internal processing of information [7].

Cognitive psychology as a science does thus study how individuals receive expressions, process the information that they create and how decisions are made and which actions that we choose to perform. This science is not primary interested in social relationships, group behavior or social actions.

There is however a problem with this approach that must be elaborated. Is it really possible for a structure to generate a new structure that is more complex than itself? A possible explanation may be found using Vygotskij's [20] theories. Even if more complex structures cannot be found inside the learner, they are present in his or her surrounding world. These are acquired through interaction with other people who help the learner to do things that he could not do alone. The activities that the learner in this way take part in will enhance the mental models in a way that makes it possible for the learner to continue independently – the social action is a prerequisite for the individual action. Vygotskij thus criticized the mentalistic tradition in that it tried to explain consciousness by the concept of consciousness itself. To be able to explain consciousness Vygotskij said that the explanatory principle must be based on other parts of the real world. He suggested that socially

meaningful activities could play such a role. [11] For virtual communities, some of these activities could be related to knowledge creation concerning the mutual interest that was the basis for forming the community in the first place.

Vygotskij's theories are highly concerned with the problems of interpersonal and intrapersonal communication. The startingpoint for his theories was that the congenital reflexes and psychological functions are developed through cultural tools. By adopting a cultural way of thinking and acting the human being changes his or her psychological functions such as memory, perception and thinking. [10] Those functions are called the lower mental functions that through psychological tools (that are internally oriented) are transformed into higher mental or cultural functions [11]. The constructive principle of the higher mental functions lies however outside the individual, in psychological tools and interpersonal relations. (ibid) In that way the human being learns to perform individual actions through performing actions together with other people (social activities). The psychological development proceeds like this from childhood when the child learns the communicative meaning of an action through others. Higher mental functions can thus be seen as products of *mediated* activity. [11] The difference between what the person can perform himself or herself and together with other people is called the proximal development zone [10] The ideas of virtual communities are built on this aspect, that it is possible to achieve more when cooperating with other people than when acting on your own.

Vygotskij also identified an important relationship between language and thinking since thinking is expressed and communicated through the language. The thought is thus objectivated in words and this creates a tension between thought and language. [10].

The activities in a virtual community can be regarded as social actions that are performed in what could be called an activity field, where different attributes could be added to the situation [12]. Such attributes could be *designed abstract systems* respectively *designed physical systems* or *another human being*. The human activity system is linked to a environment.

UNITING FORCES IN A VIRTUAL COMMUNITY

What reasons does a member of a virtual community have to stay in the community and develop the proximal development zone? It can not be the action in itself but rather the result of previous actions that have created knowledge stored in mental models that together with impressions from ongoing activities will produce expectations of added values. But what is the nature of these earlier experiences? Apart from a common interest, what could it be that inspires members to form and maintain a virtual community? Are there formal rules and agreements that constitute the "glue" that prevent the community from falling apart? Or are there more implicit affective characteristics that form the group? To understand what keeps the community together it is however not sufficient to just analyze the whole community. It is also important to look at the parts of the community.

Tönnies [19] introduces the concepts of gemeinschaft and gesellschaft. The concepts can be used when analyzing the forces that make the individual members to *create* a community as well as *keeping* the community *together* over time.

In a *gemeinschaft* the group is kept together by emotional relationships. Here affective components can be said to be more dominant than cognitive aspects. In a community that can be characterized as a *gesellschaft* the cognitive aspects are instead in focus. The glue that keeps the group together is thus based on a formalized structure. An example of such a community is a group of people that gets an assignment that must be solved in a limited time period.

It is thus a common interest that inspires members to form a virtual community. It is the individual interaction as well as information processing that create conditions for the community. We have seen that it is it is not only the cognitive aspects that are important for individual information processing. The affective aspects are equally important. A community that can be characterized as a gesellschaft will probably cease to exist when the assignment is solved. The reason for that is that cognitive information processing with a low degree of feelings involved can be connected to external motivation. Affective components with positive feelings involved can be linked to inner motivation. The motivation is also influenced by earlier experiences. It is therefore important that the earlier experiences of the individual members include a perception of added value.

In reality a specific community is probably based on a combination of formalized as well as emotional relationships. It is therefore the proportion of the forces that is of interest since that combination will influence how successful the community will be and also how long the community will exist over time.

THE COMPUTER

According to Vygotskij's [21] theories the interaction with other people is very important for learning. It is therefore reasonable to assume that the way the members of a virtual community use different tools for communication will affect knowledge creation within the community.

The members in a virtual community communicate through an interactive computer system that could be seen as a designed physical or designed abstract system (see above). The perspective that is used on the computer system in use will highlight some aspects but at the same time disclose other aspects. [1] From the systems theory approach follows that the perspective should be determined in relation to the purpose of the analysis.

The computer can be seen as an artefact, a designed abstract system or a designed physical system. It has been built by humans and the purpose of the system is to support our actions (Trefil, 1997). The design of a computer system is based on a perception of what a computer is. Also the users, that is the members in the community, will have an opinion of what a computer is and what it can do. That perspective will influence their behavior as well as their knowledge creation. Computer systems should be designed to facilitate learning.

Arvola [1] presents different perspectives that a researcher as well as a user or designer can adopt in relation to a computer system in use. The perspectives should not be seen as mutually incompatible in a specific context – instead different perspectives can be used to highlight different aspects. The perspectives are (ibid):

The tool perspective: This perspective illuminates the computer as a tool to perform a task. A typical situation when this perspective can be useful is when a worker perform a task and uses the computer to develop or apply his or her skills. To be able to use the computer as a tool there must be some kind of material to use it on. It could for example be some numerical data that must be calculated by the computer. (ibid)

An important aspect in this perspective is also that the user have the computer in total control (as opposed to the dialogue perspective and the machine perspective– se below).

The media perspective: Here the computer is viewed as a media for communication between people. [1] In this communication situation there are many people with different roles involved (ibid). There are for example designers and users. When Checkland's CATWOE acronym is applied on virtual communities the most important roles are the actors, the owners and the customers.

The communication can be synchronous or a asynchronous (ibid). An example of synchronous communication is when two people communicate via videoconferencing. Asynchronous communication occur instead when they use e-mail for information transmission.

The dialogue perspective: In this perspective we look at the computer as an agent that the human can communicate with using written or spoken language. In this perspective feedback is important. The user specifies actions that the application performs. The computer have some intelligence or autonomy and is thus also proactive and interactive. (ibid)

The systems perspective: In this perspective the computer and the human being are regarded as parts of a larger system for example an organization. In this paper the virtual community is seen as a human activity system. In the analysis it is important to establish what the outcome of the system ideally is going to be and study the flow of information and outcomes of the processes in the system.

The ideal outcome of the interaction in the virtual community is knowledge creation. The individual members should get enhanced knowledge or understanding but in the ideal case the community as a whole should also gain knowledge that is not directly connected to one specific member. The whole is greater than the sum of its parts.

The machine perspective: The computer is here viewed as a machine that has complexity and also some autonomy. If the human should be able to try to control the machine he or she must adapt to it. As opposed to the tool perspective it is not important to be in total control of the computer. The computer has been built by humans and therefore represents different values (ie the values are built into the computer). (ibid)

The task for the computer is to facilitate communication (the media perspective). At the same time the computer system is a sub system of a greater system, the virtual community (a human activity system) and therefore a systems perspective is also applied. The implication of the media perspective for virtual communities is that the situation must be regarded from a broad perspective that includes several aspects. It includes the sender with its earlier experiences as well as its information processing ability which will create the message. The message will be mediated through the computer to the receiver and will be interpreted according to its earlier experiences and information processing ability. The is thus a great challenge for the computer to serve as a mediator between the participants without distorting the message. If the computer also would possess some degree of autonomy that would give an additional complexity in the information exchange.

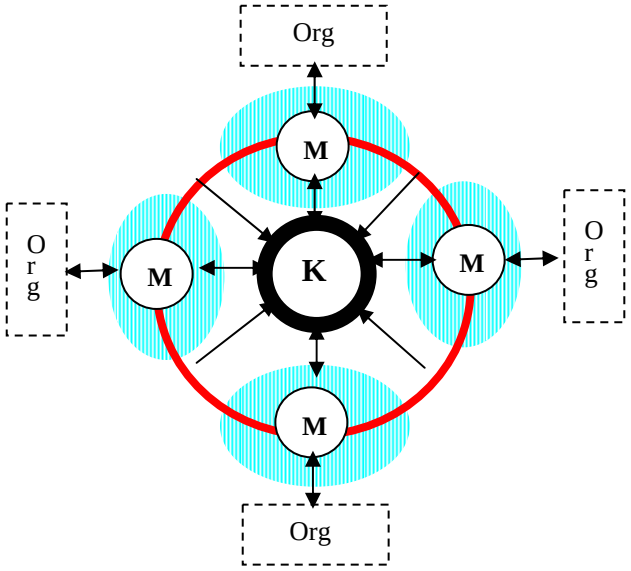
MEDIATED CO-DESIGN

The communication situation in a virtual community reaches a high degree of complexity. Interpersonal communication refers to information exchange between two individuals. In this case the sender must take the different perceptions of one person into consideration when conveying the message. In group communication there are several different perceptions to consider. Group communication via a media adds further complexity to the situation. Communication models illustrating interpersonal communication or traditional group communication are not sufficient. It is necessary to find a communication model that illustrates the influence of a media as a communication mediating tool. Maletzke [14] has presented such a model that was originally intended for media communication using radio as the mediating tool.

This model indicates that in mediated communication, there are aspects to consider that are not present in traditional communication situations. The following factors are directly connected to the fact that a media is used as a mediator: pressure and constraints caused by the public character of the media content, pressure of constraint from the medium and the receiver as a member of the audience.

In a virtual community, the members communicate and exchange information through a computer system. The factors mentioned above are important in this environment but also the ability of the computer system to mediate images of individual members to the participants in the communication situation. The properties of the computer system is thus critical for the success of knowledge creation in virtual communities.

The model presented below can be used to illuminate the interaction between members in a virtual community resulting in knowledge creation.



Legend:

M	a member of the virtual community
Org	the organizationational constraints of the communicator
	the environment of an individaul member including self-image, social aspects, individual knowledge, etc.
	member interaction mediated by a computer system
K	knowledge within the community as a whole
→	knowledge transfer
↔	

Figure x: Knowledge creation in virtual communities

The figure shows the computer mediated interaction between different members of the community. The members are interacting through the computer system. One member could for example add information to the common storage in the middle of the model. What information and in what form he stores it, will be determined by environmental influence as well as organizational constraints. Another member decides to get access to the specific piece of information. His choice and interpretation will be influenced by environmental factors as well as constraints within the organization. His own individual knowledge is thus enhanced. By interacting through the computer system with the member who stored the information and with other members, new information will be added to the community as a whole. Other members will also contribute to the information creation within the community. The information available in the community will in this way be created by the combined efforts of all members of the community, that is co-design.

CONCLUSIONS

There are many general learning theories based on different perspectives that can be used to create an understanding for knowledge creation in virtual communities. Cognitive theories are examples of theories that focus on the internal cognitive processes of the individual in the knowledge acquisition situations. These theories however leave out much of what happens outside the individual in form of for example social interaction (including interpersonal and group communication) and environmental influence. Virtual communities are most dependent on social interaction for knowledge creation. Therefore theories that include such aspects are more appropriate to describe knowledge creation in virtual communities. A model of knowledge creation through co-design based on theories illuminated in the paper has been presented.

The communication in virtual communities are of different types – interpersonal communication and group communication. These types of communication must however be seen in relation to intrapersonal communication because of the dialectical relationship between the communication types. In virtual communities it is the interaction between these types of communication that will lead to knowledge creation in the community as a whole as well as for the individuals as presented above.

The computer system has been regarded as a mediating system using the media perspective as well as a systems perspective. It is however necessary to realize that immediate feedback is important to avoid decisions made on erroneous information as discussed above. Computer system autonomy could complicate the interaction between the members in the virtual community and if such properties are implemented precautions should be made to prevent distortion of the message.

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