



# USING ARTIFICIAL AGENTS TO STIMULATE PARTICIPATION IN VIRTUAL COMMUNITIES

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## ABSTRACT

Setting-up successful virtual communities represents an effective way for facilitating the circulation of knowledge in organizations and groups. However the design of such successful communities represents a main challenge that is principally related to the difficulty to engage people into a knowledge exchange process and to establish a sustainable level of participation. This short paper presents some research directions that consist in the design and the use of artificial cognitive agents, guided by user's behavioral profile and known principles of participation derived from social cognition theories, for stimulating participation.

## KEYWORDS

Social cognition, cognitive agents, participation, virtual communities, user behavioral profiling.

## 1. INTRODUCTION

Successful Virtual communities represent an effective way for facilitating the circulation of knowledge in organizations and groups. However the design of such successful communities represents a main challenge that is principally related to the difficulty to engage people into a knowledge exchange process and to establish a sustainable level of participation. If a certain number of theories in social sciences and in knowledge management exist to explain people participation, and a set of principles have been elaborated to help virtual community designers to stimulate the knowledge exchange in virtual communities, they are not without some limitations. Indeed, these principles are difficult to operationalize, do not guaranty a good level of success and often require an important level of expertise and effort from the community organizer.

In this paper, we propose the use of intelligent and active mechanisms to assist the community organizer in this task of stimulating people participation. Practically, this approach relies on using cognitive agents informed of social cognition theories that are able (1) to infer the individual participatory profile of the members from the observation of their online behaviors; (2) to use these profiles and the participatory principles to determine individual interventions that are the more likely to impact people participation; (3) to intervene proactively.

## 2. STIMULATING PARTICIPATION IN VIRTUAL COMMUNITIES

### 2.1 Virtual communities: the participation challenge

Howard Rheingold, the person who popularized the term "virtual communities", has defined the virtual communities concept as "social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace" (Rheingold, 1993). More generally, virtual communities are "electronically-supported" social structure holding together people sharing a common culture, set of interests, values, goals or norms. A variety of digital infrastructures & spaces are used to support the interactions of virtual communities such as electronic bulletin boards, chatrooms, elaborated virtual community systems, and more recently blogs (interactive journals) and Wikis (collaborative knowledge construction web sites). In the last few years, virtual communities have emerged as one of the most important actionable paradigms for supporting the circulation of tacit knowledge in our digital societies.

One of the main challenges facing designers and operators desiring to build successful virtual communities (see Cothrel and Williams (1999) for the main success factors) is the establishment of a sustainable dynamic of participation amongst its members. Indeed, the essential value of a virtual community resides in the activities of its members and in particular is strongly correlated to their willingness to spend time, to interact with others in conversations, or to provide knowledge assets. The participation of the members of a virtual community in this knowledge exchange process is indeed not spontaneous, but is motivated by a certain number of elements (Hall, 2001) such as: direct rewards, increased reputation, internal satisfaction (altruism and efficacy), or reciprocity.

Understanding the "mechanics" of the functioning of the participation in a knowledge exchange in virtual communities or in groups has been the subject of much research in different fields such as: knowledge management and organization (Cothrel and Williams, 1999); Computer Supported Collaborative Work (Majchrzak et al., 2003); complexity (Reed, 1999); social computing (Erickson et al., 2002); sociology and communication (Ridings and Gefen, 2004), or psycho-sociology (Beenen et al., 2004), to name a few.

## **2.2 Using social cognition for addressing the participation challenge**

From the social theories, we can derive a set of principles that can be used to address this participation challenge. Some of these principles consist in working on the establishment for the members of these communities of: a climate of trust (Tung et al., 2001), a sense of community (Blanchard and Markus, 2002; Koh and Kim, 2003), and a feeling of recognition for the actions of their members (Chan et al., 2004). Other principles can be derived from the application of the economic theories of rational choice. More concretely, the Social exchange theory (Thibaut & Kelly, 1959) suggests to us to intervene on the different factors that make people participate (Hall, 2001) such as: (1) anticipated reciprocity; (2) expected gain in reputation and influence on others; (3) altruism and perception of efficacy; (4) direct reward. Cognition and psycho-sociology also have some theories on influence that can be applied to "orient" people in their desire to contribute to a knowledge exchange process. For instance one can use means to stimulate participation in order to try and exploit some of the six principles of influence of Robert Cialdini (Cialdini and Sagarin, 2005): (1) reciprocity (feel obligation to "reimburse"); (2) social validation (social conformance); (3) commitment / consistency (tendency to act in a similar way as in the past); (4) friendship / liking; (5) scarcity; (6) authority. Finally, an interpretation of the laws of Metcalfe and of the laws of Reed (Reed, 1999) on the importance of critical mass effect suggests putting a maximum of effort in reaching a critical mass, and making more visible the perceived value of the virtual community for the user.

On the technical side, one of the most interesting approaches found to stimulate people's participation in digital community platforms consists in implementing mechanisms that contribute to make the activities of their members visible. This approach has attracted attention in the research community via the concept of *social translucence* (Erickson et al., 2002).

## **3. USING BEHAVIOURAL PROFILING AND INTELLIGENT AGENTS TO STIMULATE PEOPLE PARTICIPATION**

### **3.1 Using intelligent agents to stimulate people participation**

However, the operationalisation of the principles for stimulating participation is not without difficulties and requires an important level of expertise, effort and time from the community organizer. The approach we would like to present in this paper relies on the use of artificial agents aware of the social cognition theories of participation. Practically this approach relies on two components: (1) the automatic construction of a behavioral profile of each member related to his knowledge exchange activity. (2) The generation of agent interventions (based on the behavioral characteristics of the member) that are the most likely to stimulate the participation of this member.

Practically the construction of this profile results from the observation of the actions of the user and the application of a set of heuristics helping to determine the participatory profile. The different actions that are captured and intervene in the determination of the participation profile include events such as: entering digital spaces, posting files, posting messages in bulletin boards, answering to messages, etc. (see (Angehrn, 2004) for a more detailed description). The different behavioral patterns to which a particular user can be categorized include: the level of involvement (is he often present?) and the nature of his contributions (is he only a lurker? Is he a contributor of knowledge assets? Does he participate in the discussions? Does he initiate discussions? etc.). Example of heuristics rules include: a user that has not connected to the system in the last month can be considered as inactive. A user that posts in discussion at least one time a week is committed in exchanging his knowledge. A user that has posted in the last three months at least a document is an active knowledge contributor. Of course, other types of behavioral profile information that can also be used by agents to stimulate people's participation in knowledge exchange such as: the personality traits, the cognitive style, cognitive traits (Kinshuk and Lin, 2004) and the attention state.

### **3.2 The importance of the behavioral profile to direct agent intervention**

We would like now to illustrate with some examples how the effectiveness of the agent interventions described above depends greatly on the exploitation of the level and the nature of user's participation.

Amongst others, Everett Rogers' (1995) theory of innovation diffusion states that people do not adopt straightaway a new attitude but go through a series of phases of adoption (awareness, interest, trial, and adoption). The agent therefore needs to know about the current participatory level of the user (e.g. is the member already familiar with some of the knowledge exchange practices or is he totally unaware?) when selecting the most effective intervention, in order to avoid interventions that are too primitive, or on the contrary too far from the reach of a particular user. For instance it would be useless to invite a member of a community to share some knowledge assets with others if this member has shown in the past very little disposition to participate in an interaction. On the other hand, it may be useful to inform this member of the benefits people acquire when they interact more with others in order to make him familiar with the concept.

Similarly this theory of innovation diffusion distinguishes different categories of people (from the innovator to the laggards) with regard to their attitude towards innovation. For instance the innovators are principally driven in their action by their curiosity whereas the late adopters are very sensitive to social pressure and change their practices once they realize that they are isolated in their behaviors. An intervention that is likely to have the most effect on an innovator (identified as such by observing his behavior) will be one that emphasizes novelty, whereas the intervention that will have the most effect on a late adopter will be one that emphasizes the social conformance ("everybody does it that way").

The information about the level and nature of people participation also appears important to direct agent interventions based on the participation theories mentioned previously (knowledge management, psycho-sociology, etc.). For instance it can be used in interventions aimed at increasing the climate of trust, the sense belonging, the feeling of recognition, and at putting of social pressure and enforcing commitment.

## **4. CONCLUSION**

The approach that we have presented in this paper can be considered as relatively unexplored, and few designs or implementation have been proposed yet. Thaiupathump, Bourne, & Campbell (1999) have experimented with agents for online learning automating the work of human facilitators. These agents monitor the students' activities and stimulate the students to complete their work. Kinshuk and Lin (2004) propose to use agents in the context of learning communities to "support the cognitive processes of web-

based learners during the learning process". These agents are based on modeling the students according to their cognitive traits. Roda et al. (2003) describe the use of cognitive agents that embed change management abilities to stimulate manager's knowledge sharing management practices. All these approaches are however essentially centered on the user as an individual, whereas in our case the social dimension (social cognition) is a more central element. Beenen, G. et al. (2004) which on the other hand rely on psycho-sociological theories to stimulate the participation, remain however very basic (non-cognitive) in modeling the user.

The approach that we have presented in this paper looks very promising since it provides an outlook to radically new intelligent approaches aiming at transforming people behaviors based of the incorporation into these agents of socio-cognitive capabilities. Yet, although we have already elaborated a design of this system describing the different categories of events to be captured as well as the agent interventions (Angehrn, 2004), the implementation of this system is still at an early stage. We hope in the future to complete this implementation, and be able to start experimenting with this system, so as to get a confirmation about the soundness of our approach. Indeed we consider, that besides ethical questions about the collection, manipulation and exploitation of behavioral information in a social context, a certain number of questions remain open such as the reliability of personal behavioral profiling (heuristics and machine learning techniques have limitations), complexity of the operationalisation of the solution, and acceptance (how the users will integrate in their work the use of intelligent mechanisms).

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