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# Investigating a theoretical model for supporting the design of locative media

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## **Abstract**

This paper investigates the social implications of using locative media and attempts to outline a theoretical framework that may support the design and implementation of such mediated communication systems. It stresses the significance of physical space and location awareness as parameters of computer-mediated communication and presents a specific implementation of location-based communication technologies, the LOCUNET project, the system's use scenario of which is briefly described. The main focus of the paper is on the theoretical framework that forms the basis of LOCUNET's design and which is mainly built around activity theory.

## **Keywords**

Location-based systems, spatial interfaces, situated communication, activity theory.

## **ACM Classification Keywords**

Human Factors, H.5.2 User Interfaces,  
H.5.3 Group and Organization Interfaces.

## **Introduction**

The convergence of new mobile telecommunication networks, geographical positioning systems and interactive graphical interfaces on mobile devices, as they

are already being utilised in a series of location-based activities (games, socialising services, commercial applications and artworks) leads to new forms of interpersonal communication. These forms may significantly alter the way that individuals conceive of, act and communicate within this convergence of physical and technologically mediated environments.

This paper documents the first phase of a research project, which aims at investigating the emergence of these forms of communication environments, supported by the integration of new mobile and locative media technologies and the impact that the implementation of these systems may have on mediated communication within urban public space. The paper focuses on systems accessed via interfaces that have a predominantly spatial character, and provide the context in which users engage in a process of computer – mediated communication.

LOCUNET<sup>1</sup> (LOcation-based Communication Urban NETwork) is a research project that focuses not only on the technical aspects of designing and implementing location-based systems, but mostly on the social implications of using such systems in the context of urban everyday life. Its main research objective is to study the way that users interact with other users (human-computer-human interaction aspect) and with the location-based system itself (human-computer interaction aspect), while focusing on the physical and social con-

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text in which this interaction takes place. To that end, LOCUNET adopts a methodological approach that favours in-depth, qualitative research.

In the following sections, firstly the implications of using locative media will be briefly discussed. Then, the theoretical approach that LOCUNET is based on will be outlined. Finally, a short description of the application that the project will develop for evaluating its theoretical approach will be presented.

### **Locative media: spatializing the Internet**

New types of wireless communication networks enable the detection of user's position at all times via GPS or related technologies. This information may be utilised by the system to constantly and dynamically update the output displayed to users, according to their location. The ability to track the location of users or other potentially mobile entities and the input of information, regarding the environmental situation captured by sensors, which are embedded in the physical environment, contributes towards creating context aware systems. *Locative Media* are communication media that make use of these technologies, thus making actual physical location a prominent feature of the interaction process and consequently triggering real social interactions. In order to understand the social ramifications of locative communication media, it is important to investigate the impact that the type of interpersonal communication they support has on the users' everyday experience within the urban environment.

Computer-mediated communication via the Internet has allowed physical meeting places to "immigrate" to a "virtual" spatial context, as in the case of MUDs or MOOs. The introduction of mobile location-based com-

munication networks relates again the concept of a “meeting place” to the physical space of an urban environment. The emergence of “locativeness” re-introduces the parameter of real location in the activity of computer-mediated communication, thus mapping the “virtual” mental space of communication to the physical space, inhabited by the real bodies of communicating participants. In location-based games (e.g. [14]), for example, the location of each player in the physical world is very important. Thus, the virtual spatial context of the game is mapped onto the physical world and the resulting hybrid spatial context becomes the arena of the game. Most importantly, such a communication system affords the possibility of face-to-face interaction and brings back the “compulsion of proximity” [2] into computer-mediated communication.

The significance of utilising actual physical location as a parameter of the communication interface [1] to an ICT system lies in its naturalness, as humans use location information all the time in everyday life. Of particular interest to this discussion is the manner in which the introduction of these technologies results in a transformation of the spatial context, where situated communication [13] takes place. Locative media may thus be called systems of situated, context-aware communication.

If we consider the Internet as a medium and a context, where information and symbolic content is communicated amongst its users, this information and content does not usually relate to its actual location or to the physical location of its users. Locative media on the other hand, afford the possibility of relating a part of this content to physical locations and in this way promise a sort of spatialization of the Internet [3], whereby

a part of its content, and the activities it relates to, are mapped onto physical space.

### **The theoretical framework of LOCUNET**

The theoretical approach adopted by LOCUNET is largely based on activity theory. In this section of the paper, activity theory will be briefly discussed in connection with the project and its relations to other theoretical approaches, often used in the study of computer-mediated communication, will be briefly examined.

Activity theory encourages a shift of focus from the computer to the context of purposeful human activity. Consciousness is viewed as the product of an individual’s interactions with people and artefacts in the context of everyday practical activity [10]. The context of human activity, in turn, emerges as the result of activities that occur in a given setting [7].

Human activity may occur at multiple levels. Activity is hierarchically structured, consisting of three distinct but interconnected levels: *activities* (top), *actions* (middle), and *operations* (bottom). The actor (also called *subject*) identifies a need, and satisfying it becomes the subject’s motive (and the *objective* of the subject’s *activity*). *Actions* are subordinate to activities and are directed at specific conscious *goals* (steps toward fulfilling the objective). Actions are realised through *operations*, i.e. processes that are carried out automatically, without requiring conscious effort. Operations are influenced by *conditions*, which encompass all the characteristics of an artefact that may affect the outcome of the operation [9].

Activity theory successfully combines elements from cognitive approaches and situated action models (e.g. [13]) by balancing the relatively stable goals of an individual and the situated, ever-changing methods of accomplishing these goals [10, 11]. Cognitive approaches emphasise the role of planning and describe human activity as following pre-formulated plans [5]. Plans are formed beforehand with a goal in mind. The goal may be divided to subgoals, which may in turn have their own subgoals, and so on. In contrast, Situated Action Theory (SAT) and its derivatives postulate that plans are only an attempt to retroactively describe, explain, or justify an already committed action. This view underlines the importance of the ability to improvise and adapt to the context on-the-fly – a distinctly human characteristic [12]. Both thought and action are adapted to the environment: “what people *perceive*, how they *conceive of their activity*, and what they *physically do* develop together” [4, pp. 1-2].

While activity theory holds that action is situated, and thus actors must continuously adapt to the environmental circumstances they encounter, it also acknowledges human intentionality as an important factor that determines the structure of an activity prior to its unfolding [11]. This puts activity theory at odds with other theories, such as actor – network theory and distributed cognition (Kaptelinin and Nardi, 2006). Additionally, humans and artefacts are not given equal status. People act *with* technology, using artefacts (including tools and sign systems, such as language) to accomplish a series of objectives. The combination of human abilities and external components (in this case the mobile device and all implications carried with it) leads to the formation of “functional organs”. Essentially, tools mediate between their users and the world

[10]. Activity theory focuses on the way these “functional organs” are used. Location-sensitive handheld devices are a type of functional organ, and are expected to enhance the users’ capabilities of negotiating information pertinent to real space, allowing them to use and augment their spatial intelligence (e.g. [6]).

Activity theory is also consistent with ecological approaches to environmental behaviour, as for instance Gibson’s ecological approach to visual perception [10]. Ecological psychologists consider the relationship between an actor and the environment as dialectic and reciprocal [4]. Under activity theory, the subject’s relationship with the environment is implied. Environmental circumstances may manifest as conditions that dictate the course of operations, or even have a direct influence on the subject’s objectives and goals. Operations may be related to affordances (see [8]). Affordances refer to possibilities for action offered by the environment, and may be limited to operations if they are considered as particularly relevant to low-level manipulation of physical artefacts. However, this concept can be extended to the levels of actions and activities [10]. A digitally augmented environment will provide more possibilities for action to actors who are capable of perceiving them (i.e. appropriately equipped users). Handheld devices become functional organs that give the users access to digital information.

### **Designing an activity game using mobile locative media**

In order to evaluate the theoretical model that LOCUNET is based on, an application will be designed the implementation of which will attempt to study the use of mobile locative media for supporting communication amongst groups of citizens in a contemporary urban

setting. In this section, a preliminary scenario for this application will be briefly discussed.

The scenario refers to a location-based game activity that will take place in the city centre of Athens, Greece. It consists of a series of time-defined quests, which will be the basic elements of this activity. The game is also designed so as to help the users create their own quests, a feature which increases the game's replay value. Players are grouped into two different teams. Each team is competing against the other in order to successfully accomplish the objectives that will allow it to win the game. The members of one team use their mobile devices and are capable of physically moving around the city centre of Athens, while members of the other team are using desktop computers and navigate "virtually" in the same spatial representational context displayed to mobile users. Each "quest" has a specific duration or a specific goal that the winning team has to accomplish in a given time period. These quests can be location based, for example the members of each team must move a certain number of artefacts to a given place in the city centre, or object based, meaning that the members of the teams must find and acquire a certain number of artefacts within a specific time frame.

Regardless of the goal of each quest, every activity requires that each player has communicative skills; the ability to move strategically around the city, is a computer mediated activity and provides location proximity with an outmost value. All the artefacts and objects that users are searching for in this game relate to multimedia content, which may be used in various ways. It can be a means for someone to find instructions while moving in the city, or an audio cue, providing information about another artefact. While users are moving in

the city, the system displays on their screens a graphical representation of themselves and other participating players, whether they are using desktop computers or mobile devices. The system also allows users to communicate with each other in real time and to "attach" information to specific locations (geotagging) or alter the information they find attached on a location for the purposes of the game.

The hierarchy of activities described in the previous section [9] may also be applied to LOCUNET's game-like use scenario: the subjects (users) must accomplish an objective (the winning condition). To do so, they must formulate goals (steps closer to winning) and meet them by performing appropriate actions. In doing so, they will also perform operations (e.g. walking) while paying attention to any conditions that influence these conditions (e.g. weather, terrain, passers-by etc.). Thus, the paper suggests that activity theory is appropriate for providing a basis on which the theoretical framework of this project will be built.

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