A FRAMEWORK FOR DESIGNING SOCIAL INTERACTIVE SYSTEMS

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Abstract: Digital natives are the potential users of many applications designed and built today. For this generation most of state of the art features related to social interactions and ubiquitous computing will be taken as granted. For this reason, we have to provide design frameworks and methodologies that integrate these features at early design stages. In this paper we propose a framework for designing Social Interactive Systems (SIS) based on four criteria: identity, space, persistence and action. In order to demonstrate the usefulness of the framework the paper will describe an experiment we held with a Social Virtual World developed using the above-mentioned framework.

1 INTRODUCTION

Our era is characterized by the convergence of social and ubiquitous computing. From one hand we have the emergence of the social web paradigm (with social sites such as Facebook and MySpace, and social 'worlds' such as Second Life). On the other we have the massive use of ubiquitous interfaces that allows computers to live out here in the world with people. It is our opinion that the mix between social and pervasive computing is an issue that prompts us to rethink Interactive Systems Design. In fact, the capacity to integrate social elements at early design stages will make the difference between successful or not applications. For this reason in this paper we propose a framework based on four elements: identity, space, persistence and actions that are the means for building Social Interactive Systems. In order to demonstrate the usefulness of the framework the paper will describe an experiment we held with a Social Virtual World developed using the above-mentioned framework.

2 A FRAMEWORK FOR SOCIAL INTERACTIVE SYSTEMS DESIGN

This section of the paper presents the core elements of the framework that can be used to design Social Interactive Systems (SIS). The framework is based on four elements: identity, space, persistence, and actions. These elements are motivated by an empirical analysis of current and past social software and supported by major findings from psychology and sociology. Actually, these elements represent core features of any Social Interactive Systems (SIS) targeted towards young generations (see Di Loreto, 2010). Hereafter, the semantics of each element of the framework is described more in details.

Identity

Our point of view about Identity is the same as social psychology's approaches (Hogg, 1987), which consider individual and social identity not as stable characteristics, but rather as a dynamic phenomenon (Harré et al., 1991). In these approaches, the choice about what possible self to show is driven by strategic moves (e.g., what features are more relevant and effective for self-presentation) which

participants can make within a particular situation. In describing everyday interactions, Goffman (Goffman, 1959) distinguished between two ways of expressing information: information that is given and information that is given off. Information that is given is the conscious content of communication, the voluntary symbolic actions that are mutually understood. For example, a person who describes their anger is giving information about their emotional state. In talking about their anger however, the person also gives off information, through para-verbal characteristics such as tone, volume, the choice of words, and non-verbal cues. While information that is given is considered to be within the actor's control, information that is given off is perceived by the audience to be unintentionally communicated. A classical example of 'identity announcement' that has intentionally and unintentionally elements is avatar personalization. While we will not enter in detail here on its implications the avatar is a visual claim for personal expression that is constantly worked on. This continuous work reinforces the concept of presence and thus social presence. As another example of collateral information, we can use the explicit specification of a social network of acquaintance. While it is true that social networks are built via a series of invitations, usually members also have some control over the visibility of their network for others. This means that, for impression management, a user will show only networks he/she wants to show. For instance, some members can decide to make their social networks visible only to their direct acquaintances. In this case, there is a 'given' information (the user chooses what to show about his/her identity), but also a 'given off' information (derived e.g., from the kind of groups a user showed/joined). From a design point of view, we can say that allowing both the kinds of identity representation becomes the starting point for a social evolving identity.

Space

If we look carefully, the language we use to describe our experience of the virtual environment is a reflection of an underlying conceptual metaphor: 'Cyberspace as Place' (Lakoff et al., 1988). This means that we are transferring certain spatial characteristics from our real world experience over the virtual environment. The metaphor 'Cyberspace as Place' leads to a series of other metaphorical inferences: cyberspace is like the physical world, it can be 'zoned', trespassed upon, interfered with, and divided up into a series of small landholdings that are just like real world property holdings.

In this little presentation the term space was joined with the term place. In reality, for the good functioning of a SIS it is important to distinguish between the two terms. Actually, the literature about space and place is fairly massive and diverse. A converging definition of the difference between space and place does not exist, however in his book about urban spaces and places, Carmona (Carmona et al., 2002) distinguishes among dimensions of an urban space. While space is divisible, place is not. Place is complex, inextricably multi-dimensional, lived, experienced, meaningful (with of course multi - meanings).

This means that while space is a well-defined topographical entity, place is the result of human inhabitation, (social) interaction, and the like. We are located in spaces, but we act and develop individual and social experiences in places. We claim that in order to design a social application, it is essential to allow by design the creation of public (at different levels) places for aggregation but also the creation of private places (Wenger et al., 2002). Besides, the lever of personalization can be used in order to allow the shift from spaces to places. Only taking possession of the space, and manipulating it to turn it in something we like, we can transform it in a place.

Persistence

As we have seen, in order to create a social identity in an online environment several elements are required. An additional element is persistence (of personal identity in the system). In a non-persistent world, it is not possible to have a history of actions and thus allow, for example, the creation of a reputation like in real life. Moreover, Danet (Danet et al., 1997) argued that synchronicity is associated with 'flow experiences', a state of total absorption, and a lack of awareness of time passing. This idea of synchronicity is linked to the idea of temporality, a linear procession of past, present, future. This particular nuance (synchronicity as process) is very interesting if we think that interaction with media and media perception is changed. In fact, advances in technology and the speed of network connections are blurring distinctions between synchronous and asynchronous communications (Joison, 2003). Synchronous and asynchronous communications are thus processes that happen during time. The idea of communication as a process is very consistent with the idea of persistence and is another element supporting social awareness.

Actions

In this part, we discuss physical and psychological

mechanisms that regulate human actions in order to understand why the action element has to be considered as a pillar in the design of social software. The first theory we want to describe is the so-called 'thinking through doing'. This theory describes how thought (mind) and action (body) are deeply integrated and how they co-produce learning and reasoning (Klemmer et al., 2006). Jean Piaget (Piaget, 1952) postulated that cognitive structuring requires both physical and mental activity. In a very basic sense, humans learn about the world and its properties by interacting within it. As a second support, we can cite embodied cognition. Theories and research of embodied cognition regard bodily activity as being essential to understanding human cognition (Pecher et al., 2005). While these theories address cognition through action in physical environments, they also have important implications for designing interactive systems. In fact, body engagement with virtual environments constitutes an important aspect of cognitive work. For example, one might expect that the predominant task in Tetris is piece movement with the pragmatic effect of aligning the piece with the optimal available space. However, contrary to intuitions, the proportion of shape rotations later undone by backtracking increases (not decreases) with increasing Tetris-playing skill level. In fact, players manipulate pieces to understand how different options would work (Maglio et al., 1996).

To summarize, because an action is always an action-over- something, the kind of interaction spaces and objects we create in a Social System will influence which cognitive work the user will do over the system.

2.1 The Overall Framework

While we presented the four elements in a separate way, their usefulness in the construction and evaluation of social environments is mostly linked to the interaction between these elements.

In a way each element can be thought of as a line (an axis) that starts from the absence of the element to the fulfillment of its presence for a Social Interactive System. For example, for the concept of identity its total absence is anonymity while its fulfillment is social presence (with intermediate points such as personal identity construction).

For the concept of space its total absence is topographical space while its fulfillment is social places (with intermediate points such as third places and personal places). For the concept of persistence its total absence is system 'amnesia' while its
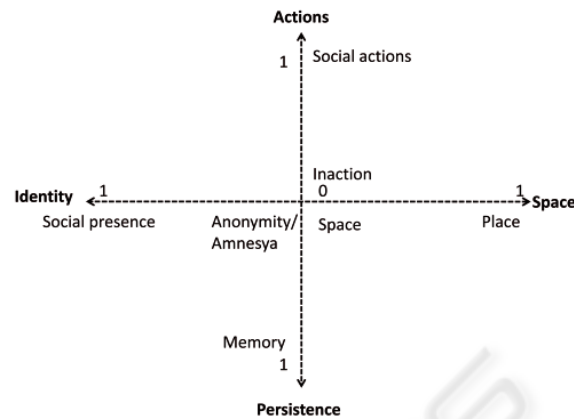

Figure 1: The graphical representation of the 4 elements as axis

fulfillment is memory (with intermediate points linked more or less to the concept of persistence). Finally, for the concept of action its total absence is the obstruction of action (i.e., my user can only look at my application) while its fulfillment is social actions (with intermediate points such as public personal actions and the like). Figure1 shows the above-described axis graphically. This way to represent the four elements has an additional value. In fact a designer can create an 'Expected Profile' for an application using the four axis. For example, if he/she decides that his/her to be developed application has to have a high level of self-presentation elements (an avatar, a profile, and so on) he/she will give a high value for the identity axis. Same thing happens for the persistence axis. For example, a social network based on micro actions such as Facebook, does not require the same level of persistence as a virtual world such as Second Life. In the first case the persistence axis will have a medium value, in the second a high value. And so on.

Note that the total framework is not simply a list of elements (i.e., its application does not mean to put one after the other the four elements in your system) but it is created through the delicate balancing between them. Actually, it is up to the designer to choose which element of the framework to stress or not during the creation of a dynamic experience such as in a social application. In addition, only once the 'Expected Profile' of the application is decided, the designer chooses which features add to the system. This means that what is important is the balancing between the elements not which features the designer puts in his/her system.

3 THE SCHOOL SOCIETY WORLD

As mentioned in the introduction of this paper social elements really influence the use of an application in our era. In order to support the above-mentioned assertion we will describe a Serious Virtual World we developed using the framework: School Society.

From a practical point of view, the environment used in this experiment was able to support our students both in online learning, and in recreational experience. Note that due to the subject of this paper we will not analyze the virtual world as a learning environment, but as a social environment. Apart from studying, there is no final aim in School Society. Each Resident can find his own way to inhabit this word.

The Gameplay for the School Society World
When the user enters the world for the first time, an animated intro scene describes how the world was created. Sometime in the future mankind has managed to practically destroy the world via magnetic weapons. The world was knocked off its axis and continents have sunk into the ocean. Only small islets remain. Several decades later, the survivors have managed to remodel their lives. They have built homes on the islets, as well as shops and a school. The top, elite students of this school are recognized worldwide as the best people in the world: the Legendary Eagles.

4 THE FRAMEWORK IN ACTION

The first step in this experiment was to determine an 'Expected Profile' for the to be developed application. In this case the choice was a balanced 'Expected Profile' (see Figure 2. In order to understand how the profile was evaluated see Di Loreto, 2010). This means that the virtual world has to enable deep personalization, in both the space and the identity aspects. The world has to be a persistent one and it has to enable the creation of a community memory.

Hereafter the most interesting elements (both from the framework application and from gameplay point of view) are described in more detail.

Space in Action
First of all, as an element of identification, the Resident's home is indicated as 'My home'. In addition, when the Resident reaches a public place,
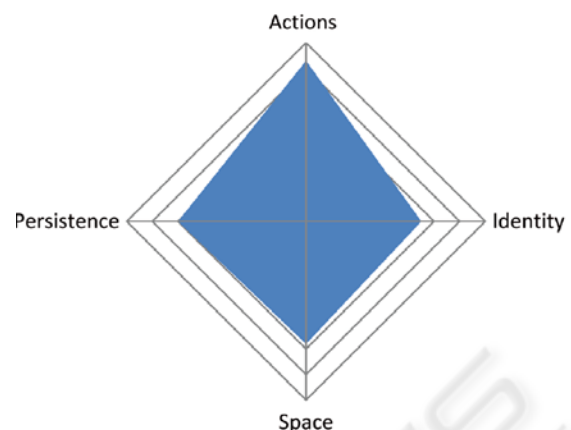

Figure 2: The Expected profile for the School Society virtual world.

an NPC (Non Playing Character) welcomes him (with 'special attention' if he is the winner of some world competition - an element also linked to identity construction).

At this moment the public buildings in the world are: the Pub, the Market, and the School.

The basic idea was to use the Pub as a potential 'third place' for the world. In fact the Pub is a place where the Resident can 'informally' meet people he does not know. On the contrary, the Market is only a space to buy items for competitions. The school is the more 'formal' space. In this 'space' there is a different section for each different quiz the students can take.

A Particular Space: The Gazette
School Society's world has its own newspaper called the 'Gazette'. The 'Gazette' is the 'voice' of the world. Every interesting event that has occurred in the world can be found in it. This journal is a kind of herald that publicizes 'public' activities (in-world events such as tournaments) but also 'private' activities (what your friends have done). The result is a dynamic public and private space that changes over time and is the 'memory' of the interactions within the world.

Identity in Action
Each student can personalize the avatar he chose when he entered the world whenever he wants.

Each avatar possesses the following attributes:
Name: When the student enters the world for the first time he is asked to choose a name for his avatar.
Body Attributes: When the student enters the world for the first time, he is asked to construct his avatar that will represent him during the interactions. However, he can change his appearance whenever he wants during the inhabitation of the world.

Finally, a student can use the gold he has earned through quizzes to buy objects in the market that he can use to add personal items on his avatar.

Activity in Action

As said the Pub is a particular space. In fact, in the pub the student can chat with people who are in it even if they are not on his buddy list (i.e., if they are not his friends).

In the School building students can take part in a set of social actions (apart from taking the quizzes the professors have created). In particular they can take part in two interesting social activities: participate in tournaments and challenge the professor.

For the first activity the student is alone against others students. If he can beat all the other participants his success is published on the world journal, the 'Gazette'. In this case the social aspect is driven through competition.

The other activity is literally a social one. If a professor is available, students can organize themselves in groups and challenge the teacher.

Practically, while the students will take quizzes created by the teacher, the teacher will answer to a quiz created by the students. For each answer the team gives, the time available to the teacher to solve the quiz increases or decreases (based on wrong or right answers). If the team is able to leave the teacher no time to solve the quiz, it will be the winner of the contest, rewarded with the Medal of Honor 'Where eagles dare'. In this case their bravery will also be publicized in the 'Gazette' (and so will be publicly visible).

Time in Action

First of all the game's world is a persistent one. This means that each time the player disconnects his account, the game will save his status: his modifications, his avatar's appearance, his experience, and so on. In addition, all old 'copies' of the Gazette are available for consultation. In this way all public events, all competition winners, and the like are stored creating a memory for the community.

5 EVALUATING THE FRAMEWORK THROUGH USE

In order to demonstrate the assertion stated at the beginning of this paper (i.e., that the presence of social aspect modulated through the framework influences the use of an application) the developed

School Society virtual world was given to a group of students to use. Hereafter more details on the experiment.

5.1 The General Method of the Experiment

Three (3) groups of students were asked to consistently use the system for about one week. Each group had different 'views' over the systems (i.e., the group could access a different set of features). The different views were created in order to block some aspect of the framework (e.g., identity representation) and then evaluate if this absence impacted on the user's experience in the way supposed while describing the framework.

Subjects

The participants in the experiments were 38 students of the University Institute of Technology (I.U.T.) of Montpellier. The gender distribution of participants was 34 (90%) male and 4 (10%) female, with an average age of 20.

Students were divided into three groups:
Group 1: Full vision over the system
Group 2: Vision of the system without Identity features
Group 3: Vision of the system without social features

Note that this means that all the groups were using the same system. They just had different views of it. This kind of division was done in order to demonstrate the effective importance of social features and of the identity factor.

The number of participants in each group (about 13 people) was coherent with the findings that 'with high complexity, a study with more than 15 cases or so can become unwieldy' (Miles el al., 1994, p.30).

5.2 Procedure and Materials

At the beginning of class, subjects in all groups were introduced to the virtual world of School Society. The students were asked to use the systems for 7 days.

The interactions were 'free' for the students. They just had to inhabit the world as they liked. The idea was that if the students did not feel the absence of a feature they would not ever look for it (i.e., if they did not feel the necessity to use a chat, they would never open a chat).

Materials

At the end of the week students were asked to

evaluate their experience in School Society. Data on the experiment were collected through two channels. In fact, the survey method was coupled with tracking methods based on technological features (log files, number of sessions, sessions' length, and the like).

The general idea was that by cross-referencing users' feedback and number of interactions (qualitative and quantitative data) it would be possible to understand if the designed social system really works or not from the social point of view.

Survey and Qualitative Measurements

The survey was conceptually divided into three parts. Several questions directly addressed students' satisfaction with the social aspects (quality of the interaction). Another group of questions addressed graphic appeal and usage problem issues. A final group of questions provided an overall measure of satisfaction with the entire system (the overall reaction to the system). The different parts of the survey were designed in order to understand if the global satisfaction with the system was influenced by graphic appeal and usage issues, which are not directly linked to social satisfaction. The main idea was to distinguish between attitudes to the system itself and attitudes to using the system in a social way. Questions with Lykert type scales were avoided where possible in order to avoid different subjective approaches to these kinds of questions. In general, a scale of 0-4 was adopted in the process.

Log Files and Quantitative Measurements

In order to measure sociability from a quantitative point of view the system logged all the actions made by the students. In particular Preece's suggestions (see Preece, 2001) on determining sociability in online communities were taken into account.

Preece says that determinants of sociability include measures such as the number of participants in a community, the number of messages per unit of time, member satisfaction, and some less obvious measures such as amount of reciprocity, the number of on-topic messages, trustworthiness and the like (Preece, 2001). While in this case the number of participants in the community had no significance (the participants were only the students) a list of the other elements taken into account is described in detail hereafter.

5.3 Use of Sociability Determinants for the Evaluation

1-Number of Messages, Messages per Member indicate how engaged people are within the community. Number of private messages (i.e., in other friends' mailbox) and number of public messages (in the Pub) were regrouped under the label 'Number of messages' and measured during the experiment.

2-The Amount of on-Topic Discussion was evaluated only in public discussions and only to understand the relationship between learning topics and strictly social topics (i.e., the topic of the post as not evaluated by its profundity or its real impact on 'community life').

3-Reciprocity is concerned with giving to a community as well as taking from it. While this element is normally measured through the number of answered posts, in this case the measure of reciprocity was also determined through the challenge feature (number of reciprocated challenges).

4-Flaming and Uncivil Behavior, such as abusive language or harassment. In this experience this measurement was not relevant for two main reasons: the presence of teachers who acted as moderators, and the fact that the experience lasted only one week.

5.4 Results and Discussion

Before beginning analysis it is important to address a possible limitation of this study. Students of an I.U.T may not necessarily be the 'average user'. This could influence how fast they learn to use the system or its perceived usability, but not the sociability they put into it. In fact, because of their age they can be considered an 'average' Digital Native. In the case of this experiment the measurements were linked to the sociability of the system and not to its usability/ability to learn to use it. For this reason we believe that the composition of the sample did not influence the experiment.

System Usage

Figure 3 shows the general system usage (the number represented in the y-axis is the number of total general actions that impacted over the system, including posting, taking quizzes etc.) for each of the groups. As we can see the group with full features used the application noticeably more than the other two groups. In addition, the group with no identity features used the system more than the one with no social aspects but noticeably less than the one with full features.
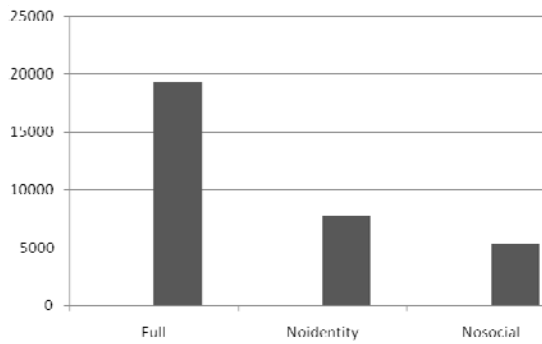
Figure 3: School Society: general system usage.

Global Satisfaction and Generic Issues

Parameters linked to system issues or graphic appeal (derived from the survey) are very similar for all the groups. On the contrary the global satisfaction of the system experience shows a difference for group one (Full features- see Figure 4). Interesting enough, the group that was not able to use identity elements rated it in a similar way as the group without social elements.
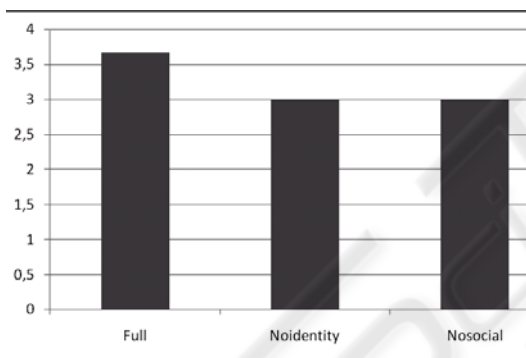

Figure 4: School Society global satisfaction.

Sociability Determinants

Figure 5 shows the trends for exchanged messages. Public messages have greatest numbers than the private ones (we will return on this topic later in the paper). This is coherent with the perceived usefulness (derived from the survey) of the two features: while chats rated an average of 3.8, mail rated 2.8 (scale 0-4). It is interesting to note that while Gazette was used more for lurking activities its perceived usefulness is 3.6.

This is not a surprising finding. Lurking and contemplating activities are one of the most common actions in social environments (Wenger, 1999).

Perceived Sociality of the System

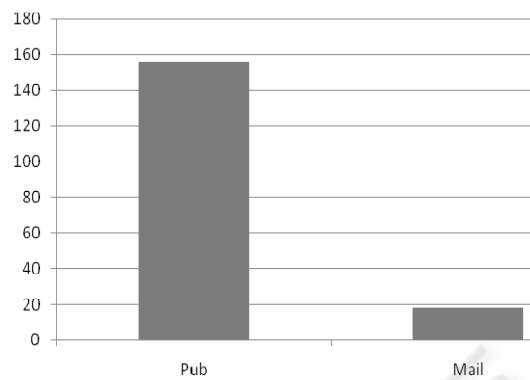The perception of the sociality of the system was obtained through the survey. To the question 'In

Figure 5: School Society: trends for exchanged messages.

general, about the fact that someone was playing the same game as you' 90% of participants answered they were encouraged to use the application and the main motivation (derived from another question) was because they play to beat their friends. Only four people answered that the presence/absence of others did not influence their use of the application. Nobody answered that the presence of others was an obstacle to the use of the application.

To the question 'Do you think that leaving messages for your friends in game is' 45% of participants answered they find it useful because they like to comment on what their friends do, 3 people answered they find it useless, and the majority (50%) answered they preferred the public chat (the Pub). This is more coherent with Digital Natives' use of social tools than with the use they did of the two media in the application.

In fact, the Pub had a flow of message very Twitter like (that in our opinion contributed on its success), while the note on mail was given based on the standard use of private messages and not on the ingame use of mail.

In addition, in the Pub participants with no identity features quickly added a nickname to each post. The result was something like: "Guest says: Guillaume: who is in the Guest group?".

6 CONCLUSIONS AND POSSIBLE IMPROVEMENTS

This paper started asserting that the mix between social and pervasive computing is an issue that prompts us to rethink Interactive Systems Design. In fact, the capacity to integrate social elements at early design stages will make the difference between successful or not applications.

Ending our discussion we can say that the

experiment described in this paper supported this assertion. Firstly, the absence of social features deeply influenced the use of the application (as the different usage of School Society demonstrated, see Fig 3).

In addition, the experiment demonstrated that also the identity aspect is very important in a Social Interactive Systems. In fact, not only it influence system usage, it generates a sort of 'need for identity' in the social context (as the Pub example demonstrated).

However, while trends are visible even in this short (in terms of time) experiment, we are aware that more interesting information could be obtained extending the time of the experiment. For this reason we are working on another experiment (on the same system) for a longer amount of time (the idea is to let the world 'live' for at least two months).

Another interesting experiment could be done 'playing' with the Action element. In fact, additional interesting information could be obtained doing a similar experiment that will use Identity, Space, and Time as reference points, and will play with different levels of social actions in order to answer questions such as: More or less to what degree do visible social actions affect social interactions? In addition, we want to demonstrate the importance of the space and the time aspect in the same way as we did for the identity aspect.

Finally, the idea of adapting complex software systems by creating different profiles based on the four dimensions of the framework in order to answer other questions could also be explored. For example, for a large democratic debate application is the right thing to do give all age ranges the same vision as the 'first vision' (i.e., the view they have over the system the first time they enter it)? Would a simplified vision in all aspects be better for older people or would they not need, for example, the space aspect for a good performance? And so on.

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