Situated Interaction in Art Settings

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Abstract

This paper describes metaphors and design strategies applied to conceive and develop a hand-held location aware electronic guide for museums and cities that includes a number of situated and contextual aware interaction mechanisms. In particular we describe a design approach based on the situated visiting strategies and the contextual space *affordances* in order to support the user involvement in the activity and with the physical environment.

The work reports some of the results achieved within HIPS, a three-year project funded by the European Commission within the I-Cube (I[3]) Program. This paper offers a contribution to the design of cognitive artefacts aiming at mediating the emotional involvement with physical and information spaces starting from the understanding of how the situation of use does influence the interaction process.

1.   Introduction

The more sensing technology becomes emerging and offers new opportunities to include information about the situation and the context of use, the more the design of applications based on such systems needs new metaphors and interaction paradigms to fit user needs in new contexts of use. This is especially true for everyday leisure activities where the use of artefacts aims at mediating the emotional engagement with physical and information spaces.

A design contribution of the HIPS project[1] is based on understanding how the situation of use and the contextual variables influence the interaction process. This led us to design a cognitive artefact - a hand-held location aware tour guide (Benelli *et al*., 1999) - embedding the situated visiting strategies and the space *affordances* (Norman, 1988), in order to support the user involvement in the activity and with the physical environment.

The context of use for HIPS is a museum or a city. The addressed target of use is broad with heterogeneous needs and "*spaces for desiderata*", differently from structured workplaces. Therefore the situations of use can be various and idiosyncratic leading the visitors to adjust frequently their goals and objectives during the visiting experience.

2.   Situated, contextual and personalised interaction

In designing cognitive artefacts that mediate unstructured and emotionally-driven activities, it is fundamental to adopt a theoretical approach with the central focus on the real and potential activities situated in a specific context of use (Suchman, 1987, Norman, 1993). Indeed actions are always situated in particular social and physical circumstances, therefore the situation is crucial to action's interpretation (Suchman, 1987).

Considering the museum context it becomes clear that individuals generally do not anticipate alternative courses of action, or their consequences, until some courses of action are already under way. Moreover individuals often do not know ahead of time, or with any specificity, what future state they desire to bring about (Suchman, 1987). The visiting experience is a case in which individuals frequently have to "adjust" the way they interact with the environment, depending either on the action carried out or on the produced results. The shift in goal might be produced mainly by two modalities: i) the goal cannot be accomplished (lack of competence or physical constraints); ii) different states of the world are suggested on the basis of the performed activity (incoming information activate alternative patterns of knowledge) (Rizzo *et al*. 1997).

The ways in which individuals try to get control of interaction are contingent and derived from the situated action that they represent (Suchman, 1987).

Inspired by this theoretical approach, we focused our design activities on three main issues:

- **Context:** the context in which the activities occur is composed of natural, material, social and cultural components that affect the course of user' actions and interpretations during the interaction (Norman, 1988). By natural components we intend elements such as the lightening of the room. For instance, the Sala del Mappamondo, the experimental site for

HIPS contains two famous frescos: the Maestà and the Guidoriccio. During the morning people firstly notice the Maestà that is better lightened by the natural daylight; in the afternoon, the Guidoriccio is preferred since the artificial light brighten this fresco (Gabrielli *et al.* 1999).

- **Situation:** every course of action essentially depends upon its material and social circumstances (Suchman, 1987). For instance, two different situations like a free exploration of a museum or a search for a particular museum content, need to be supported by a flexible tool able to consider different objectives associated to the situations.

- **Personalisation:** "a cognitive artefact is an artificial device designed to maintain, display or operate upon information in order to serve a representational function" (Norman, 1991). Therefore an artefact that mediates the fulfilment of an objective, providing the individuals with the appropriate information at the right time (without pretending to know completely their interests and preferences that could change during a situation of use), can simplify the nature of the activity and, in this way, enhance the overall performance. For instance, a system able to personalise the length and duration of the presentation according to different visiting strategies decreases the need for direct requests of more or less information.

This approach led us to structure the interaction design of HIPS taking into account contextual and situated needs and visiting strategies. The results we reached can be described at two levels:

a) Situation and Context Aware Interaction Mechanisms
The context and its physical, material, social and cultural components orient the exploration of the environment and the meeting with its content: in HIPS we exploited this concept at individual and social level.

Individual Level: when individuals move in a space they are driven both by intentional motivations (personal interests and preferences) and situated strategies but also by the properties of the environment. In the former sense, after ethnographic studies concerning the visiting behaviours, we conceived a "visiting style module" (Marti *et al.,* 1999), that linking the physical movements to the browsing of information space, provides personalised presentations according to the situated visiting strategies. For details about how the module is used for selecting and presenting information to the visitor see Not et al. (1998). In the latter sense, we explored the concept that visitors pathways mostly depend on natural and contextual *affordances* of the space, those properties that are «intrinsically» connected to a particular setting or that depend on the context of use. Hence, we experimented a design solution to augment the physical *affordances* of artworks by means of an auditory information space (Marti *et al.*, 2000).

*Social Level***:** When a human being ties a knot in the handkerchief as a reminder, she constructs the process of memorising by forcing an external object to remembering her of something; *she transforms remembering into an external activity.* According to Vygotsky (1978), human memory is always generated by a social process. At the beginning the social memory is the product of knowledge distribution between the individual and the tools or the other individuals who are involved in a specific activity. Subsequently the social memory undergoes a process of internalisation by which external activities are reconstructed and the knowledge that is acquired through a social process is individualised and can be reused in different contexts.
HIPS is designed to support the process of embodying and transferring knowledge within a social group. A visitor can take a snapshot of a situation of interest (externalisation of knowledge) and then re-use it to suggest a friend to follow a tour, to elaborate on contents, etc. (embodiment and transfer of knowledge).

b) Language, Contents and Reading Styles
Contents are structured as small blocks of information dynamically combined in form of audio presentations (Not *et al*, 1997). This includes different types of contents and integrates contextual features (e.g.: deictics) in order to make more coherent the flow of narration with respect to the interaction of the user with the environment.

Moreover, we realised that the auditory output could be meaningful not only for the information delivery but also to support the physical navigation in the space: taking into account the existing indexical relationship between language and circumstances (Suchman, 1987), we conceived auditory contents that could provide cues about the surrounding physical space. Hence we are currently researching the effectiveness of different reading styles, integration of 3D sounds and music in order to design an auditory viscous space.

In the following, a scenario of use is provided in order to give a more concrete view of the whole system behaviour with respect to the design issues discussed above. Afterwards, we will go more into details describing the specific situated and contextual interaction modalities implemented in HIPS.

An actual scenario in the Museo Civico in Siena
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Berthe and Samuel are two Belgian tourists. They move in the centre of the room handling HIPS, a portable
guide. Berthe is attracted by the Maestà fresco.
HIPS: (with a male quite and polite voice) "In front of you there is the Maestà, one of the absolute
      masterpieces of the Sienese art, depicted by Simone Martini in 1315 ".
      (a small pause, then a new male voice, with a strong Italian accent):"The Virgin is depicted as
      Sienese people's protector, and as a symbol of municipal justice: this particular devotion to the
      Virgin derived from the famous Battle of Montaperti in 1260, when Siena defeated the army of
      Florence and preserved its freedom.".
Berthe laughs because the last voice had a strange Italian accent. Then she moves toward Santa Caterina:
HIPS: (with a female first person voice) "I'm Santa Caterina. I was born in Siena (…).".
      As she enjoys the comment, she takes a snapshot of the situation by pressing the hotspot button on
      their portable guide. The system continues to provide information about the S. Caterina's life, but
      Berthe skips this part.
HIPS: (with a male quite and polite voice) "The portrait of Caterina is set inside a Renaissance-styled
      shell; it looks like a real sculpture (…)".
Berthe and Samuel move to leave the room.
HIPS: (with a male voice and 3D sounds effects) "Behind you, there is another important fresco of Simone
      Martini: Guidoriccio da Fogliano".
So, curious of this artwork, she decides to go back and stops to admire the Guidoriccio. Samuel follows
Berthe and after few minutes they sit on a comfortable seat. They would like to visit the Pinacoteca but
they don't know where it is. So, Berthe presses the Menu Button: by Find/Museums functionality she queries
the system to know where the Pinacoteca is located and how to reach it. They go out the Museo Civico on
the way to the Pinacoteca with the HIPS guide in their pocket.
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The scenario exemplifies some basic concepts of situated interaction in HIPS.
1) The user is immersed in a rich audio environment. Different reading styles characterise the way in which artworks are described from different perspectives (historical, artistic, anecdotal descriptions).
2) The rhetorical styles are tailored to the context (use of deictic expressions) and to the iconographic contents (artworks representing people are described at the first person, as if the character presents himself/herself).
3) The rhythm of narration (length, duration) is tailored to the visitor's movement (long and detailed descriptions are provided to visitors who move slowly and stop in front of each artwork).
4) Experiential cognition is mediated by a natural input: the physical movement. Reflective cognition is allowed by intentional and context driven interaction (explicit queries to the system).

2.1 NEW INTERACTION METAPHORS THAT INCLUDE SITUATION AND CONTEXT (INDIVIDUAL LEVEL)
Physical spaces are not neutral. They make sense from the very moment we use them. One of the objectives of HIPS is to fill the gap between visitor's navigational strategies and information needs. From a technical point of view, this is realised by continuously monitoring the visitor's movements, thanks to a wireless connection between the portable guide (a PDA) and infrared emitters infrastructure. The museum space is the interface of the system, the physical movement is the main interaction vehicle.

Adaptation of input and output to the situation
(1) The gap between the physical and the information space is bridged by the visitors' behaviours. From ethnographic field studies in artistic exhibitions, Veron and Levasseur (1983) identified four categories of visitors (ant, fish, grasshopper, butterfly) based on their pathways, movements, and time of visit. This classification suggests how to isolate significant variables linked to physical movements and how to relate the physical movements to the browsing of information spaces. Starting from these results, we developed a «visiting style module» that, using an incremental bayesian algorithm, classifies users within the four categories and tailors the delivered information accordingly. In this respect, information can vary for length, duration and details.

(2) Visiting strategies can vary not only with respect to physical paths. In order to access information that is not directly related to a certain position in the space, HIPS provides an off-line browsing function that supports the access to external information. Even if this can resemble an ordinary way to browse an information space, it can be still considered a situated strategy. A goal

shift generated by a new incoming need (e.g. visit another museum containing artworks of the same historical period) requires support for planning a future course of actions.

(3) Deliberate control of the system behaviour is possible through the handling of simple and contextual buttons located on the PDA. These controls change labels and function according to the current task (cancel/confirm choices, stop/play audio comments, stop/more of this kind of information, cancel/select...). The design of these control buttons were inspired by the last generation mobile phones and "game-boy like" video-games.

Environment sensitive UI
Visiting strategies are not sufficient to exploit the idea of the environment as interface. *Affordances* of cultural settings play a central role in shaping the interaction. These include: a) properties that are «intrinsically» connected to a particular setting like the width of the artworks, their position, their artistic importance; b) architectural elements like access points to a room, arches and steps; c) dynamic and contextual configurations of elements present in the space (crowd, lights).
The role of the affordances in attracting the visitor, can be hampered when combined in certain configurations (crowd and bad light conditions often oblige the visitor to skip important artworks). We envisioned the possibility to design audio triggers to attract the visitor's attention. If the user reacts positively moving to the mentioned artwork listening to the description, then the system continues to provide information, otherwise it will just mention the artwork without further elaboration.

2.2 NEW INTERACTION METAPHORS THAT INCLUDE SITUATION AND CONTEXT (SOCIAL LEVEL)
From Vygotsky, we adopt the assumption that the social memory is the product of knowledge distribution between the individual, the tools and the other individuals who are involved in a specific activity. The social memory develops from the externalisation of knowledge through its internalisation and recombination for later use in different activities.
HIPS provides some very basic supports to the development of a social memory in the community of visitors. The externalisation of knowledge is realised by bookmarking a moment of the visit (pressing the "hotspot" button on the PDA, the visitor stores into the system the current position, an image of the artwork, the related description, a personal comment). This knowledge is available for later use to suggest a friend to follow a tour, to elaborate on contents, to plan another tour etc. (embodiment and transfer of knowledge).

2.3 SITUATION-AWARE CONTENT
(1) The audio descriptions in HIPS are segmented in *Macronodes* (Not *et al*., 1999), small blocks of information that are dynamically combined to form an audio presentation. Each of them contains different kinds of contents with explicit deictic reference to the physical position. The flow of narration is made more fluid and harmonised to the context of visit.

(2) The use of different reading styles, the integration of 3D sounds and music are means to design rich audio environments. HIPS aims at creating a sort of "empathic effect" mediated by human voices and immersive information spaces to engage the user in an intense meeting with art.

3.   Conclusions
The research domain described in the paper raises challenging issues about the concepts of interaction. People mainly interact with a rich and stimulating environment like a museum for intellectual and aesthetic pleasure. This activity is not structured: visitors move in the physical space guided by their interests, stimulated by the context and adapting their choices to the contingent situations of use. In order to avoid breakdowns in the flow of the activity, the boundary between the physical space and the information space should be seamless. The tool that supports the visit should neither intrude the activity nor, and most critically, require a deliberate cognitive effort to be used. In this way the cognition can flow from the external environment to the interior world of interests and emotions in a transparent way. Such «efficiency» of action is reached when the artefact becomes part of the activity, a sort of invisible aspect of our experiential world.

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