Design for art and leisure

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ABSTRACT

The paper is a reflection about the compelling yet difficult nature of design and evaluation of entertainment or edutainment systems. Such systems are not designed to help users perform work tasks or save time. They should encourage users to spend time and enjoy the interaction, and their ultimate mission is to engage the user and stimulate learning. The nature of this kind of systems imposes the definition of a theoretical and methodological policy of design that mediates between design visions and user needs. In the paper we describe the framework adopted to design and develop a tourist guide that transforms the user experience from one of consultation, whether with an audio guide, a multimedia kiosk, a CD ROM or even a book, to one of immersion in a rich information environment. The technology used allows to overlay multiple information structures over the physical world in a non intrusive fashion, opening up new possibilities for creative design. We believe that the success of the "new generation" systems for tourist applications, especially those exploiting advanced technologies, strongly relies on a design philosophy that mediates between a deep and continuous focus on the users and innovative design visions.

KEYWORDS: tourist guide, immersive environment, situation aware contents, dynamic narrative generation.

INTRODUCTION

The successful introduction of new advanced technologies in everyday life settings critically depends on meeting user needs. Most development consists of improvements on existing products and is incremental in nature. Sometimes design visions address completely new human activities that are designed together with the artefacts that will enable them. In this contexts, collecting explicit demands and expectations from the users may be difficult since they are required to envision an activity they have never carried out. Therefore, grounding the initial analysis to current human practices and customs or previous works in the same area incurs the risk that more innovative ideas and solutions can be suppressed. To avoid the problem, designers are required to envision human activities together with the tool that will support them. They have to balance user needs and design visions; to go beyond the direct interaction with the artefact and to anticipate the cultural change that the introduction of the tool can imply: modification of the role of the users in the community, norms and cultural conventions.

In the following we describe our experience in designing an innovative tourist guide that transforms the user experience from one of consultation to one of immersion in a rich information environment. The particular technology used allows to overlay multiple information structures over the physical world in a non intrusive fashion,

opening up new possibilities for interaction design. The guide is the result of a design process that came up with new ideas balancing the knowledge of the existing practice and tools with an articulated theoretical and technological framework. In the description of the process we highlight also lessons learned and methodological issues.

THE DESIGN PROCESS

The design process of the HIPS tourist guide was driven by an ambitious vision: to minimise the boundary between the physical space and the related information using the movement of the visitor as mediator. From this vision we developed, within a three years project[1] funded by the European Commission in the I^3 Programme, a prototype system that was installed in the Museo Civico in Siena, Italy. The project finished in October 2000 and the system is currently maintained in laboratory at the University of Siena, Engineering Department.

The HIPS tourist guide has a number of innovative features including advanced technologies and interaction paradigms. From a technical point of view, a positioning technology continuously monitors the visitor's movements, thanks to a wireless connection between the portable guide (a PDA) and an infrared emitters infrastructure. An electronic encompass is integrated to detect the orientation of the gaze so that the system can provide information about what the visitor is looking at. The museum space is therefore the true interface of the system and the physical movement and orientation are the main interaction means. Deliberate control of the system behaviour is possible through simple buttons located on the PDA. These controls include cancel/confirm choices, stop/play audio comments, stop/more information, cancel/select... and their "look and feel" is inspired by the last generation of mobile phones and "game-boy like" video games. The movements of visitors and their visiting strategies are modelled with the aim to provide appropriate contents for the specific context of the visit. Contents are dynamically generated in form of audio commentaries and are delivered through earphones. They can vary on multiple dimensions: length, information contents, reading styles, ambient noises and 3D effects.

In the following we describe how design concepts were defined bridging the analysis of human activity in art settings to the theoretical and technological framework. The process is described in four iterative phases:

Collection and inspiration: we learned from previous works including field studies and surveys, and we defined the theoretical and technological framework ;

User involvement: we selected elements from the previous phase, observed and interviewed people, consulted experts, studied the environmental features of the museum (artistic, physical, social, economical, cultural), shared ideas and concerns in every stages of design;

Creation: we explored ideas, composed concepts, developed mock-ups, evaluated alternative solutions with users;

Sharing: we presented results and asked different stakeholders to try out and assess the final product. The outcomes of this phase were fed back into the design process to refine and consolidate

[1] HIPS Consortium: University of Siena (I) - Project Coordinator, University of Edinburgh (UK), University College of Dublin (IR); IRST-ITC (I), GMD (D), SINTEF (N); ALCATEL (I).

the system.

Collection and inspiration

The collection and inspiration phase was mainly devoted to learn from previous works in the application domain. This collection spanned from field studies and data on museum visitors, to a benchmark of current technologies in use in museums and similar settings (nomadic information systems). A preliminary usability evaluation of the tourist guides was also performed [1]. The study was completed by a detailed analysis of our experimental site, the Museo Civico in Siena, including information about artistic contents, physical layout, economical aspects (flow of visitors, investments on infrastructure), socio-cultural aspects (typology of visitors, attitude toward technology and change).

A fundament part of the inspiration was the adoption of a theoretical framework that guided the formulation of the main design concepts.

In his book, *Things that make us smart*, Don A. Norman [2] analyses the nature of experiential and reflective cognition. An experiential mode of interacting with the environment is achieved when people can assimilate information without apparent effort, just letting the external world to drive emotions and perception. Reflective thought can take place in the same "environmental" conditions but with a more conscious effort and initiative in assimilating information. If we apply the notion to the context of the visit to an art setting, we could say that the reflective modality of interaction is related to the deliberate intention of the user to consult information of interest, whilst the experiential modality relies on the capabilities of the environment to attract and stimulate the visitors without requiring an explicit initiative from them. Inspired by the approach, we aimed to support both modalities of interaction with our tourist guide. In particular for mediating the experiential modality, we adopted the concept of *optimal flow* [3]: the absolute absorption in the activity where the experience is guided by external events, which stimulate the visitor and facilitate the assimilation of information. Supporting the optimal flow means providing intensive embedding in the physical and virtual environment, to motivate the visitor through a sense of engagement, enhancing the experience. It results is an immersive experience where the mind is externally driven, captured by the "*constant arrival of a barrage of sensory information*" [2].

User involvement

Final users and stakeholders of the project were involved from the early stages of the design process. Other users were involved as *informants*, that is people who play a specific role like domain experts or representative of the institutions. Techniques for user involvement included interviews, focus groups and direct observation through ethnographic methods.

Focus groups and workshops

Two interesting experimental workshops were organised with the aim to collect concerns and expectations from a heterogeneous group of stakeholders. The first one met in the Museo Civico to take part in a focus group: the director of the Museo Civico, an expert of history of art, a foreign tourist, an Italian tourist, a museum custodian, the fine arts superintendent, the administrator of the bookstore (desk) at the museum entrance. As second group brought together academic and industrial specialists working in intelligent information

interfaces and related technology.
They resulted both in an interesting combination of new ideas about "human activities" and technological requirements.

Ethnographic observation
Direct observation of the human activity is one of our primary source of inspiration for design [4]. In HIPS we both exploited the results of ethnographic studies documented in literature and performed an intense period of observations in two museums in Siena: Museo Civico and Santa Maria della Scala.
Documented ethnographic studies showed that visitors tend to move in exhibition settings in homogeneous modes. In particular two French ethnographers, Veron and Levasseur [5], classified visitors in four categories defined on the basis of the following variables:

- geometry of pathways,
- time spent in front of each artwork,
- the global time of visit,
- the number of stops.

The patterns of behaviour derived by the combination of these variables resulted in the following (metaphoric) visitor categories:

The ant visitor: «ant» visitors are those who follow the path proposed by the curator, taking time to observe all (or almost all) artworks. They stop frequently and the entire visit is quite long. Ant visitors usually move close to walls and artworks, avoiding empty spaces. They need to be guided by a powerful rational and tend to follow the path proposed by the exhibition curator.

The fish visitor: the «fish» visitor moves preferably in the centre of the room, performing a «slipping» visit of the exhibition. Fish visitors usually cross empty spaces, and have a «peripheral» vision of the contents of the room. Fish visitors do not pay attention at details of artworks and prefer a «holistic» observation. Even if they stop rarely in front of a specific artwork, they have a rapid look at most of them, but only for a short time.

The butterfly visitor: the «butterflies» perform a sort of «pendulum visit». They frequently change the wall of the room, moving from the right to the left wall without following the proposed path. Empty spaces are usually avoided. The butterfly observes almost all the artworks, stopping frequently. The duration of the stops varies for each artwork. The visit is mostly guided by the «affordance» of the elements in the physical space.

The grasshopper visitor: the grasshoppers observe only artworks they are interested in, without following the proposed path. The visit is mostly guided by personal interests and pre-existing knowledge about the contents of the exhibition. The grasshopper crosses empty spaces, stops rarely, and the time spent to observe single selected artworks is quite long even if the entire visit is quite short.

The classification of Veron and Levasseur inspired our design and suggested how to isolate significant variables linked to physical movements

and how to relate the physical movements to the browsing of information spaces. This classification was confirmed by the observations we replied in two museums in Siena with the following elaborations:
The original classification was proposed for exhibitions, that is, physical spaces purposefully designed as exhibition spaces. Since the HIPS experimental site is a historical museum that was in origin the building of the Sienese municipality, it is neither an exhibition space nor a pure museum. This means that some variables considered extremely significant for the Veron and Levasseur study, such as the concept of «proposed path», acquire a different meaning in our scenario. For us a «path», is whatever uninterrupted sequence of artworks.
Visitors move in the space because they are driven both by intentional motivations (personal interests and preferences) but also by visiting strategies that are affected by the properties of the environment. In the latter sense, the movements of the visitor mostly depend on natural and contextual affordances of the space [6]. Some of these affordances can be used to model the physical movements of the visitors [7].
The results of this study were used in HIPS to develop a «Visiting Style Module» (VSM), a software module that supplies patterns of movements that can be coupled to information contents with the aim to provide the visitor with appropriate contents for the specific context of the visit.
The current and previous position and orientation of the visitor are obtained through a coherent use of infrared transmitters and electronic compass [8] and are modelled in the Physical Organisation Knowledge Base (POKB). The VSM estimates the degree of compatibility between the user's movement patterns and the four visiting categories [9]. Hence the *Presentation Composer* builds a new presentation selecting from an existing repository of audio files the one that corresponds to the visitor's area/orientation in the POKB. The data processed by the VSM are exploited to assemble the information that is delivered to the user [10]. This information is mainly provided in audio format even if a simple graphical user interface is available for a deliberate control of the system behaviour.

Creation

Creation was the phase where we produced design concepts. Intermediate prototypes were developed as a core means for exploring and expressing concepts.
The final system integrated a number of advanced features (see for details [11]):

Immersive environment

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, according to the Veron and Levasseur classification).

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).

Situation-aware contents

The audio descriptions in HIPS are segmented in Macronodes [10], 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.

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

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 physical dimensions 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 drive 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 while listening to the description, then the system continues to provide information, otherwise it only mentions the artwork without further elaboration.

Deliberate control

Deliberate control of the system behaviour is possible through simple and contextual buttons on the PDA (Figure 1). 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. 3D maps are also displayed on the PDA to help the visitors to recognise the surrounding environment and disambiguate what the system is describing.

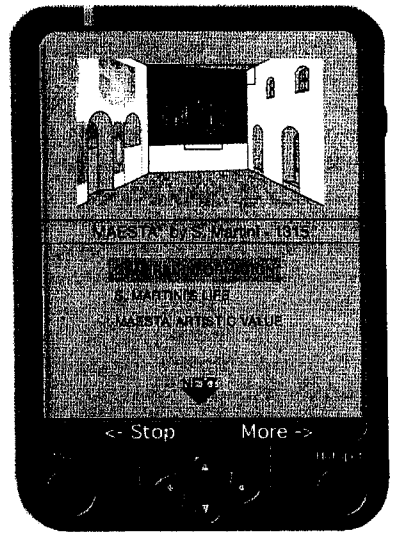

Figure 1: the PDA interface

An off-line browsing function supports the access to external information including search facilities, messaging among member of a group, tour proposition and different scale maps. These functions were designed and evaluated but not fully integrated in the final system.

Social navigation
HIPS provides some very basic supports to the development of a social memory in the community of visitors by "marking" a moment of the visit. Pressing the "hotspot" button on the PDA (bottom right in Figure 1) the visitor stores into the system the current position, an image of the artwork, the related description, personal comments. This knowledge is available for later use to suggest a friend to follow a tour, to elaborate on contents, to plan another tour etc.

Sharing
Intermediate prototypes were continuously evaluated and refined with users both in the laboratory and in the museum (Figures 2-3). The final system was installed in the Museo Civico for two months. It used by visitors who accepted to try it and provide feedback. The subjects who took part to the evaluation were recruited in the museum the day of the test. All of them were English or English speaker tourists.

Figure 2: Trials in the Museo Civico

Figure 3: Trials in the Museo Civico

The user performance was assessed on four levels: phenomenological, cognitive, emotive and socio-cultural [12].
At the phenomenological level the performance measure concerned:

- user's perception of the adaptation to the visiting style (personalisation of the information, pauses, rhythm of narration) and the physical movement as a primary means for accessing information.
- effectiveness of auditory comments (deictics, pronouns, etc) in supporting the user's orientation and recognition of artworks.
- tool flexibility (tailoring to the user's changes of path or visiting style).

At the cognitive level the performance measure concerned the cognitive effort associated to the use of the tool, the comprehension of the contents and the user's conceptual model. At this level, scenarios were used to questioning the design of the system. Norman's cycle of cognition based on: goals, intentions, planning, execution, perception and evaluation, was used to generate questions such as "How does the artefact evoke goals in the user?" or "How does the artefact make it easy or difficult to carry out the activity?" or "How does the artefact support the user when a shift in the goal occurs?".

At the emotive level the performance measure mainly concerned aspects of experiential cognition including observation of frustration or confusion, expression of satisfaction and engagement.

At the socio-cultural level the performance measure concerned the social aspects of group activity mediated by the system (communication, knowledge sharing, collective memories); appraisal/dislike of contents and the impact of narrative styles (male/female voices, accents, music, reading styles).

The evaluation at the four levels was carried out on the basis of the direct

observation of the activity (video recorded) during free exploration and scenarios execution [13]. Scenarios were used as a means to create a context for the activity whilst a series of exceptional circumstances or constraints were artificially provoked in order to evaluate the system under specific conditions. At the end of each session, the visitors were involved in a debriefing where storytelling was encouraged to comment, analyse and interpret events occurred during the test. The subjects were asked to describe their experience commenting on the video recording of the test. This created a common base of discussion and knowledge, and provided concrete data to express impressions and points of view [14].

Most of the outcomes of the evaluation concerned emotional and socio-cultural aspects that visitors expressed in form of stories. Indeed stories, being concrete and immediate, do not require abstraction or introspection, and the users are free to tell and to compare their previous experiences, re-creating a context to share with the facilitators.

...this remembers me last year when we went to Avignone, to visit the Palais des Papes.

We had a local guide, a school teacher who explained in detail the artistic and historical features of the rooms. We were interested in her explanation, but the students (children of the primary school) got tired soon. During the visit we passed through a room with a different kind of exhibition: strange and funny animals dangled from the ceiling. Pupils were very curious to know about them, but the teacher was prepared only on the Palais des Papes, so she passed through the room without pay any attention to the animals of the exhibition with the complain of the students.

This is an example of the stories we collected. It contains a number of interesting elements. It highlights that visitors have heterogeneous needs, their behaviour is often "non-goal oriented", they may be pushed just by curiosity or pleasure, and their behaviour is not predictable. They often do not know ahead of time what future state they desire to bring about [15]. Therefore the situations of use can be various and idiosyncratic leading the visitors to adjust frequently their goals and objectives during the visit. The tourist guide should be able to provide information about any kind of exposed object and adapt contents to the context of the visit. It may damage the harmonic flux of the visit whenever it exceeds or does not meet the visitor's inclinations.

CONCLUSIONS

The design of entertainment or edutainment systems is compelling and difficult in nature. It requires the right balance between design visions, user needs and technological development. In HIPS we carried out an open concepts and content generation phase in parallel with the inspiration and user involvement phase. A set of design concepts was developed representing different ways by which enabling technologies can support the visit to a museum and promote engagement and learning. However concept generation is always a delicate phase. If it is grounded only on the user experience and current practices it may restrict imagination to a re-design of the existent. The design process we adopted allowed us to evolve the different phases of inspiration, user involvement and creation in parallel, while feeding the visions of the system. Afterwards, concepts were evolved in prototypes and filtered by the user experience.

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