Visitor Oriented Design
–Three Studies of Visitor Accommodation and a Call for Action

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This article proposes and describes a visitor-oriented perspective emphasizing the unique needs of visitors of digital environments in contrast to the user-oriented perspective that emphasizes the needs of users. To do so the term accommodation is introduced in a technical sense and given a brief explanation. Results are also reported from three explorative studies of desktop virtual reality environments. In these studies the visitor-oriented perspective was adopted and allowed for analyzing how subjects perceived the environments as places rather than artifacts for use. In comparison to a web site, it was found that even a rudimentary virtual reality environment can have a positive impact on visitor regard for information content. Implementing teleports increased the efficiency of one test environment but it was not found to have a positive effect on user attitudes to the environment. Many subjects felt that first the environment was sterile. Another common complaint was about the amount of walking required in the first environment. Five suggestions are given for building desktop virtual reality environments that are better received by visitors. In closing, the visitor-oriented perspective presented here is briefly discussed in relation to Terry Winograd's writings on software inhabitants.

1 PLACE AND ACCOMMODATION

The starting point for this article is a description of a proposed design approach that centers on visitors of digital environments rather than users of digital environments. In order to explain this approach and to have a working terminology, the term accommodation is introduced in a technical sense. The term digital environment is also used, and for the purposes of this article it should be understood as referring to any digital artifact that can be experienced as a place. This article, however, centers on user studies conducted within a particular kind of digital environment: the desktop virtual reality system. This kind of system runs on an ordinary personal computer. With desktop virtual reality systems, environments are rendered on a standard CRT monitor producing convincing representations of 3D space. The subject interacting with a desktop virtual environment can move about within the environment, typically by using the arrow keys of a standard keyboard or by moving a mouse. Kaur's usability thesis (Kaur, 1998) is largely about usability issues pertaining to such systems. While Kaur's work focuses on the design for users of virtual environments the focus here is on the design of environments for visitors. The unique needs visitors have are here characterized as accommodative needs.

Accommodation occurs with digital artifacts capable of being experienced as places (Hedman, 1999; Hedman, 1999-2). In places (electronic or not) subjects as visitors reveal feelings, attitudes and dispositions that indicate how well accommodated they are. Arguably the needs of visitors are different from the needs of users. The subject as user has needs in order to work easily and efficiently with her/his digital tools such as the accountant adding a new formula to a spreadsheet, the writer tinkering with a word processor or the correspondent rearranging the folders of an e-mail application, i.e., usability needs. Similarly, the subject as visitor has needs in order to feel accommodated in her/his digital environment, i.e., accommodative needs. For example, a visitor of a desktop virtual reality environment may

find it uninviting unless some elements are included that make it appear less sterile. Adding elements such as trees and walkways may serve the needs of the visitor, but it may not do anything to make the environment easier to use or more efficient. In fact, adding such elements may have a detrimental effect on usability. The environment could become less responsive because the machine on which it is displayed must work harder to render those trees and walkways on the visual display unit. In terms of sheer usability, the environment has become less usable, although it may at the same time be more accommodating to the visitors needs.

So far, it may seem that accommodative issues are actually about form. Form, however is purposeless in itself. To give something a form does not say much about how it will be received. We need to know more about the relation between what the form is supposed to communicate and what the subjects are like that will perceive the form. Moreover, form is always given to something. Without knowing what that something is, it is difficult to get started to work on form. Also to have a complete environment (in terms of elements, whatever they may be) with an unappealing form could be more suitable to a visitor than an incomplete environment with appealing form. Appealing form is not the goal of accommodative design, although it is likely to emerge through the design process. The goal of the design process is to make adjustments so that the visitors feel pleased with the environment. This does not mean that the visitor is always right. Some suggestions that they give may prove unsuccessful when implemented. It is i.e., reported later in this article from one study in which teleports were implemented because visitors wanted them, but they proved to be problematic. However, through testing with visitors, the accommodative designer will be able to adjust the environment for the better, what does not work is simply deleted from the environment or modified. This process of design becomes both organic and

evolutionary. The design emerges through interplay between designers and visitors, yet neither the designers nor the visitors are in full control.

There is little guidance from the human-computer interaction (HCI) literature with respect to how to design for visitors as opposed to users. When this article was written a title search among the over fifty thousand articles in the ACM (one of the largest organizations for computer related research) digital library for the word stem "visitor" yielded 0 records, while searching for the word "user" yielded well over 800 records. This may seem satisfactory or challenging depending on ones outlook. It is satisfactory to the one who holds that HCI should not bother with visitors, but challenging to the one who thinks that visitors have a place in HCI in their own right. The literature of HCI is largely about users as cognitive agents using tools (Baecker, 1995; Helander, 1997; Dix, 1998; Shneiderman, 1998). Indeed the tradition of user-orientation in HCI is strong, and builds on a vast amount of research. But, at the same time it is visitors that many organizations should be interested in understanding if they wish to construct pleasing or suitable digital environments, and not only usable environments.

Ease of use is the blinding light of HCI that obscures a truly visitor-oriented perspective. It is easy to forget about how subjects feel about being in an electronic environment and instead emphasize how they use its features. The issue here is about scope and general approach more than subject. While there are many broad studies of subjects as users each involving broad ranges of usability issues there is a lack of similarly broad studies of subjects as visitors. Nielsen takes on a broad usability perspective (Nielsen, 1993; Nielsen, 1999). In many cases he reports from studies were as many as possible of the usability "bugs" in a software artifact are to be found. Nielsen can be said to advocate user-oriented "debugging" by letting expert evaluators or regular users discover usability problems during experimental trials. There is no obvious reason for why it should not in a similar vein also be possible to do

visitor-oriented "debugging". Research on visitors in digital environments, however, generally focus on particular and often highly theoretical topics such as presence (Slater, 1998), navigation (Norman, 1999), embodiment (Benford, 1995), and realism (Carr, 1993).

The accommodative approach is broad and emphasizes the feelings, attitudes and general dispositions of visitors that might lead to the rejection or acceptance of an environment. By researching accommodative needs it should be possible to develop general design guidelines for the construction of accommodating environments. At the end of the article, five suggestions are offered as a starting point of such a guideline. Note that the term accommodation (as used here in the proposed technical sense) is derived only roughly from one everyday use of the term meaning a place to stay or work in. It should not be understood in the Piagetian sense, i.e., the modification of internal representations in order to mentally accommodate a changing knowledge of reality (Bringuier, 1980). Accommodative design does not concern changes that occur over periods of time in users as they adapt to an environment, but rather changes that can be made to an environment so as to please its visitors. Thus the designer struggles to change the environment so it better accommodates its visitors. Also, the term accommodation as used here should not be confused with the term referring to the automatic adjustment of the lens of the eye to obtain distinct vision.

Accommodative design is simply the design, which brings to the foreground the unique needs of subjects as visitors. What is unique about those needs is that they go beyond those of users working with tools. Such needs can for example be aesthetical, cultural or simply related to what it means be a visitor. Accommodative design is a form of visitor-oriented design meant to complement user-oriented design rather than replace it. The term accommodation allows for classifying environments by how well they are satisfying visitors needs. Thus the terms usability and accommodation stand in contrast. An environment can be

said to be more or less usable to its subjects as users, and more or less accommodating to the same subjects as visitors.

2 ACCOMMODATION STUDIES

In the spring of 1999 a series of studies was started at the Royal Institute of Technology in Sweden with the goal of exploring accommodative needs. The subjects were students with mixed backgrounds. The ages varied between late teenagers to middle aged, and the sexes were approximately evenly represented. Trial environments had to be designed and implemented. Although it would have been possible to start out with theoretical design ideas such as those inherent in Alexander's pattern language (Alexander, 1987) or Hillier and Hanson's social logic of space (Hillier, 1984) a less ambitious route was taken. A minimalist approach was adopted, and the first design was very simple. This approach allowed the visitors to strongly influence how the environments should evolve from rudimentary to more sophisticated.

ActiveWorlds (a desktop virtual reality system accessible over the Internet through PC compatibles) was used to construct the 3D environments. ActiveWorlds was chosen because the technology lends itself well to the designer who wishes to construct trial environments for empirical studies. Trial environments can be produced quickly and run well, with few problems such as software "crashes". Moreover, ActiveWorlds is also simple to navigate in, and allows inexperienced visitors to start exploring environments with minimal guidance. In the trials it was sufficient to provide the subjects with a simple map of the keyboard keys used for navigation along with a short verbal explanation. Lastly, as long as the trial environments built with ActiveWorlds are not overly complicated, navigation is swift and smooth. To render complicated environments (containing many objects per area unit, and/or with detailed surfaces) on the visual display unit takes more processor time, and generally makes interacting with the system sluggish. In the studies described here, such complicated

environments were avoided. The environments were also optimized in various ways for better performance.

A between-groups design was used for the studies and no subject participated in more than one condition. In the first study a rudimentary 3D environment was constructed and compared to a web site with the same content. The 3D environment was built out of a concern for design minimalism and allowed for incremental design adjustments in study two and study three. In study two, comparisons were also made with a complex navigational environment that was designed and implemented by Rod McCall from Napier University, Scotland.

3   STUDY ONE

In this study, a rudimentary web site containing content for a course on conceptual modeling was constructed. Conceptual modeling is an abstract subject that centers around the use of diagramming techniques for modeling relations between objects, and the way those objects can be part of processes (figure 1). An object can be physical or abstract, and there is no predetermined domain for it. In the course, a variety of organizational settings and processes were modeled. Access was given to the course materials, and the teaching assistants were filmed as they explained key issues of the course. The finished web site contained course texts, images of conceptual modeling examples, photos and video clips.

Twelve subjects participated in the study. Six subjects were assigned to a learning task using the materials within this web site. Another six subjects were assigned to an analogue learning task, within the 3D environment constructed using ActiveWorlds (figure 2). The ActiveWorlds environment contained the web pages of the web site, hyperlinked through images within the environment.

The exhibition was organized around stations with three components each: a section heading, a sketch of a conceptual model and a link to a page within the web site. The subjects

walked (using arrow keys) through the exhibition and stopped at the stations to examine each concept discussed. At these stations they could click on hyperlinked images using a standard mouse. Although some subjects had not explored 3D worlds prior to their participation in the study, they revealed little difficulty in getting around in the environment.

After each subject had completed the task, s/he was handed a questionnaire consisting of three main sections:

1. Propositions on a Lickert-style scale to reject or agree with by placing an x on a line ranging between the alternatives "agree" to "not agree"

2. A section where the subjects were asked to diagram the exhibition from memory

3. Open-ended questions

It took the subjects roughly 45 minutes to finish their assigned task and to complete the questionnaire in both conditions.

3.1 Results From Study One

The subjects preferred the ActiveWorlds environment (despite its rudimentary nature) to the web site. From an information retrieval viewpoint, the web site is far more efficient. It is a simpler and faster process to go through the content of the exhibition using the web site directly, than to access the content through the ActiveWorlds environment. The way in which the subjects accessed the materials differed markedly between the groups. Subjects in the 3D environment relied on the spatial properties of the exhibition and did not (with one exception) attempt to go through the content using only the web browser.

All in all, the ActiveWorlds environment was received with greater positive regard and held as more engaging (figure 3). The results also indicate that the content was easier to understand in the ActiveWorlds condition (figure 4) although the content was the same in both conditions. Not all subjects thought of the environment as aesthetically pleasing however.

This is how one of them characterized the environment:

Boring - A big open courtyard with a fence of steel. It feels like a prison.

Altogether, the verbal reports on the aesthetics of the ActiveWorlds environment were mildly positive and not markedly more positive than those gathered from the web site only condition. Reflections from subjects were collected to serve as a foundation for improvements in study two. From a pedagogical standpoint, it is notable that the subjects in the ActiveWorlds condition reported positive attitudes to the difficult content of the exhibition. What is more, few had any prior experience with conceptual modeling, and those who did had worked with other notational schemas.

Since it was a faster and simpler process to access the materials directly from the web site, than from within ActiveWorlds, it is difficult to see any clear usability reasons for why the subjects in the ActiveWorlds condition should find the content easier to understand. The two groups used the same web pages to access information. Why should walking around in the rudimentary 3D environment before accessing the web pages have any effect on attitudes to the content? Nonetheless, being visitors in this environment appeared to have a positive effect on their regard for the content. When the subjects were e-mailed questions regarding the content about a month after the trials had been done, no knowledge retention differences between the groups were found. Both groups revealed little retention.

4 STUDY TWO

22 subjects participated in this study and were split into two groups with 11 subjects each. Two ActiveWorlds environments were constructed, one for each condition. Firstly, an enhanced version of the first test environment became the accommodationally enhanced environment (figure 5) for this study. According to suggestions made by subjects from study one, five adjustments were made:

1. The exhibition was geographically compacted

2. A semi-circular shape was used

3. Navigational paths were constructed

4. Start and end were clearly marked

5. A backdrop of trees was built around the exhibition and flowers were put inside

These adjustments were made because (1) subjects had complained about having to walk around excessively in the first environment. A more compact environment served to reduce the amount of walking required. (2) Subjects raised concerns about not being able to overlook the exhibition from a single vantage point. Standing in the middle of the circular shape in the new environment allowed them to survey the entire environment by simply turning around. (3) Paths that would guide visitors through the environment had also been suggested. (4) Some subjects complained about not being sure were the exhibition started and were it ended. (5) Many felt that the initial environment was sterile.

Secondly, Rod McCall from Napier University designed and implemented an environment for testing navigation (figure 6). This environment was compared with the accommodationally enhanced environment (figure 5).

4.1 Results From Study Two

The two environments (figures 5 and 6) were compared with respect to accommodation, as well as to navigation. From an accommodative perspective both environments were better received in comparison to the web site only condition from study one, but we also found differences between our two later environments. The accommodative environment appeared to be perceived as less sterile and as more engaging (figures 8 and 9). The differences between the groups here indicate that not just any 3D environment yields a positive experience. However, the standard deviations are so great that the results cannot be taken as anything more than indications.

It was also discovered that most subjects did not find the navigational paths useful in the accommodational environment. Yet, none of the subjects said they should be removed. This indicates that although the paths did have a role it was not obviously related to usability.

5   STUDY THREE

The information content was the same as in the previous two studies. No direct enhancements of the accommodative qualities of our environment from study two were made, but the efficiency of the environment was improved by providing teleports (figure 7).

The teleports served four functions:

1.   Go to a subject by clicking on its heading

2.   Go to the next subject by clicking '>>'

3.   Go to the previous subject by clicking '<<'

4.   Go to the first subject by clicking 'start'

Throughout all three studies suggestions that teleports should be used had been made. Subjects did not use the term teleport, but described how one could move through the environment by clicking on parts thereof. One subject from the second study, with no previous experience of 3D environments put it in the following way:

..it is difficult to navigate…it is the fact that I go into walls…one would just like to click on a place and get there.

To implement teleports appeared warranted. However, they proved to be problematic.

5.1   Results From Study Three

With teleports, the environment could be used more efficiently and the subjects revealed no difficulty in understanding how they worked. Teleports worked well enough that the subjects often did not understand what was meant when questioned if they were difficult to use. Overall, the subjects went through all materials and still finished faster than in the earlier

conditions. The teleports also helped visitors to get were they wanted within the exhibition (figure 10).

Did such increased efficiency allow for changes in accommodation? The subjects did not report any increased positive regard for the exhibition (figure 11). Could this have to do with an experienced loss of control? Though the subjects teleported to the different stations by themselves, they were still being teleported, i.e., transported. Thus the locus of control shifted by degree from internal to external. Moreover, it has been found that students with an internal locus of control are more likely to persist in distance education than those with external locus of control (Dille, 1991). Apart from the possible loss of autonomy, the subjects were also able to spend relatively more time with the content as opposed to walking in the environment than in the previous studies. This change implied that the subjects interacted less with the 3D environment and more with web pages, thus it could be expected that the purely accommodative effects of the 3D environment should be weakened.

As part of the experiment, subjects were also asked to go back into the environment and locate different information stations. In doing so they never used teleports. They walked slowly back into the environment as if they were "feeling their way back". In many cases they walked to the right information stations on the first try. It is difficult to characterize this situation correctly. If so many subjects knew were the stations were, then why did they not teleport to them? It would have been easier and faster to do so.

6 DISCUSSION

How we regard the "human" in human computer interaction gives us different perspectives on HCI since users are provided with artifacts to use, but visitors with places to reside in. The perspectives should not be held as mutually exclusive. As a rule, the processes of use and accommodation are mutually interdependent. Concerned use of artifacts is subject to breakdowns and mishaps that will force the user to shift her/his attention from the subjective

stance of being in an environment to that of using an artifact. Similarly as use becomes transparent, attention will shift back to the environment. As a user of an artifact or set of artifacts goes from being a novice to an expert this shift from focusing on artifacts of use to interacting gracefully with an environment becomes apparent. The philosopher John Searle gives an illustrative example of differently skilled skiers.

…the beginning skier may require an intention to put the weight on the downhill ski, and intermediate skier has the skill that enables him to have the intention "turn left", a really expert skier may simply have the intention "ski this slope". (Searle, 1992, p195)

Similarly, the novice visitor of a 3D environment may require the intention to "use the arrow key to move forward", the intermediate visitor has the skill enabling s/he to have the intention "move forward", and the expert may simply have the intention to "explore the environment".

When the use of artifacts is transparent because of well-designed artifacts, development of expertise or a combination of these factors, the human in HCI is enabled to engage more directly in the process of accommodation.

What makes the distinction between usability and accommodation difficult to accept is the "computer" in human-computer interaction. It suggests a stance that rightfully belongs to the history of computing, when humans were subjectively absorbed with physical machines. Computers need not be part of human everyday use of digital artifacts, they could become transparent to humans (Norman, 1998), letting them focus on their tasks instead of on technology. HCI must widen its scope to fit the experiential realm of humans and what they do in fact interact with

The focus should be on what is part of human experience within digital environments, i.e., the ontology (figure 12) within this suggested ontology, subjects engage in two primary roles: they are users and visitors. The digital artifacts they use can have a physical or abstract resemblance and the artifacts can be experienced as tools or places.

There is a potentially large set of features that determine how visitors accommodate to digital environments. Yet there is also a lack of guidelines that helps the designer to construct environments that work from a visitor-oriented perspective. The pilot studies conducted here indicate at least five such factors pertaining to the construction of 3D environments.

1. They should not force the users to walk long distances, because users do not like to walk excessively even if they expend little physical energy in doing so.

2. They should include elements that serve the purpose of making the environment non-sterile. In particular organic shapes and warm colors are sought.

3. They should be perspicuous so users easily can see what is in them. Note that this is not simply a question of informational perspicuity. The visitors simply like to see the 3D environment in its totality.

4. They should have paths indicating were subjects should walk. However, such paths may or may not fill a functional role. The subjects in the accommodationally enhanced environments were queried if they had used the provided paths, but generally responded that they had not. At the same time, none answered in the affirmative when asked if they should be removed.

5. Teleports appear to have a negative effect on visitor attitudes and should be used with caution. Efficiency of use appears to be in conflict with autonomy and/or the way visitors naturally cope with an environment.

For the educational organization, researching and taking accommodative factors into account could open up windows of learning opportunities. If a student reveals a more positive attitude to a subject much is won. The ramifications of a visitor-oriented design are not insignificant and should be taken seriously. If they are then we might come to speak of human or subject oriented design some day as an area encompassing both user-oriented design and visitor-oriented design.

Much of the work here is influenced by Terry Winograd and his book *Bringing Design To Software* (Winograd, 1997). Because of this influence, this article will end with a short discussion of Winograd's view on design. In this book he advocates a broad perspective on design and he claims to think of users as inhabitants of software.

"Software is not just a device with which the user interacts; it is also the generator of a space in which he lives. Software design is like architecture: When an architect designs a home or an office building, a structure is being specified. More significantly, though, the patterns of life for its inhabitants are being shaped. People are thought of as inhabitants rather than as users of buildings. In this book, we approach software users as inhabitants, focusing on how they live in the spaces designers create. Our goal is to situate the work of the designer in the world of the user." (p xvii)

There is a tension in the quote above. On the one hand Winograd argues that "people are thought of as inhabitants rather than users" and one the other hand he argues that the work of the designer should be situated in the world of the user. For Winograd the fundamental user ontology is still there. It is the user that is somehow primary. There is no obvious reason (other than following tradition) for why it would be wrong to take an extra step and dethrone the user from this position of primacy. Furthermore, the idea of being an inhabitant (though appealing to the metaphysician) seems to be going a bit overboard. Who can actually say that they are inhabitants of digital environments? Plenty are visitors (of web sites and virtual environments for instance), and in the future we might see more inhabitants, but people who actually live in cyberspace are still considered to be out of the ordinary. Especially the ones inhabiting their word processors or operating systems. The idea of viewing digital artifacts as places can be powerful, but if we carry it too far, it simply becomes misleading. Winograd's view of software inhabitants should at best be taken as a prediction of what may come. The

mass of humans interacting with software as places today, are still mostly visitors rather than inhabitants.

Winograd's view of users as software inhabitants is also problematic because he fails to bring in a discussion of different degrees of what may be termed "place-likeness". In Winograd's view, it appears that all software is on equal footing with respect to their accommodative capacities. Thus a blank screen saver can accommodate inhabitants just as much as desktop virtual reality system.

Since Winograd makes a comparison with architectural design it is also odd that he chooses the terminology of inhabitants. There are many kinds of architectural works that are not constructed for inhabitants such as storage places, churches and libraries. In the previous quote he gives the example of office buildings as having inhabitants. In all these examples the word visitor would be more appropriate. People visit storage places, churches and libraries, and some work in them, but the ones who actually live in them are very rare.

To sum up, Winograd could be said to advocate an inhabitant-oriented view of design, but in our age it appears that a visitor-oriented perspective is more readily applicable. Moreover, the visitor should be put on equal footing with the user. Humans are users as well as visitors and in many cases these two modes of interacting occur in parallel and to different degrees. Whether the artifacts of interaction are physical or not does not change this change this fundamental relation. The human subject is primary, not the user and not the visitor; those are simply roles we play.

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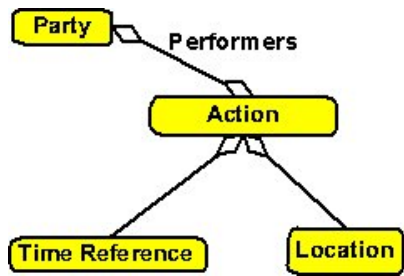
FIGURE 1 An example of a conceptual model

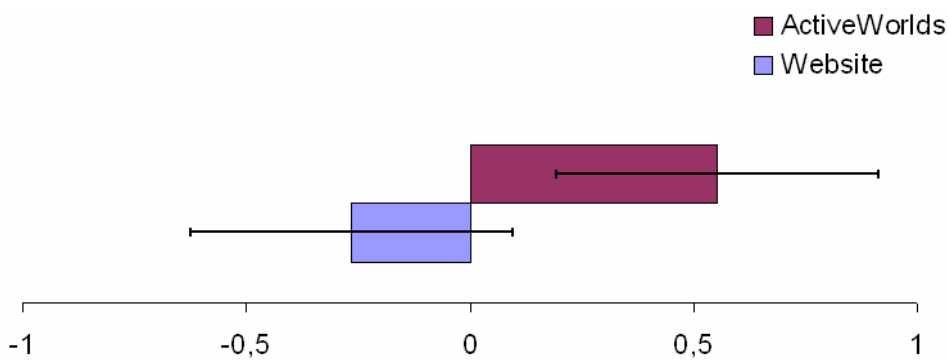**FIGURE 2** The minimalist initial environment

FIGURE 3 "The exhibition is engaging" (bars represent mean scores with standard deviations plotted as lines, scale ranges between -1 to 1, n=6)
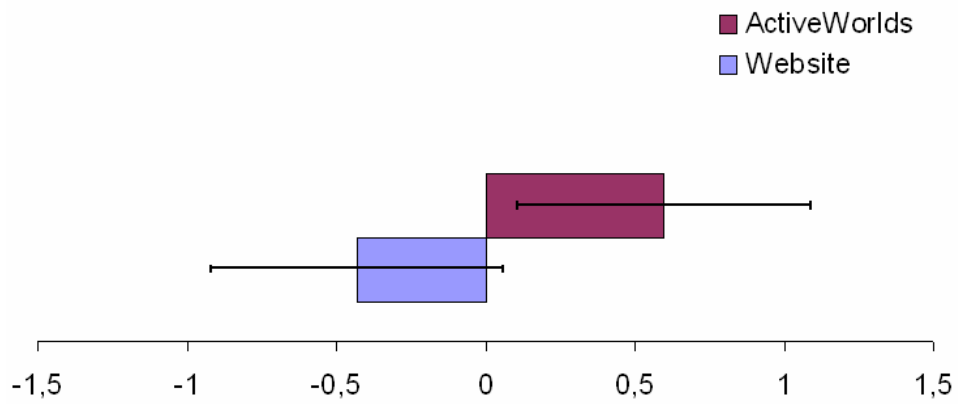
FIGURE 4 "The content of the exhibition is easy to understand" (bars represent mean scores with standard deviations plotted as lines, scale ranges between -1 to 1, n=6)
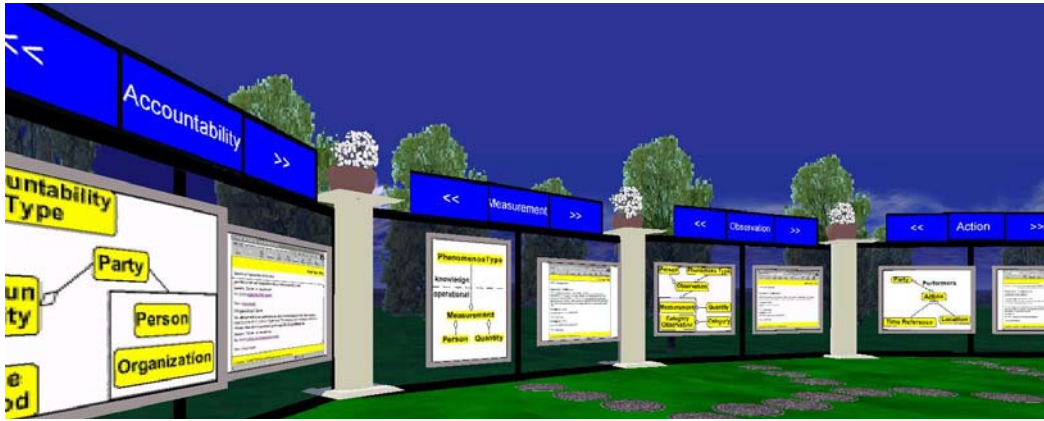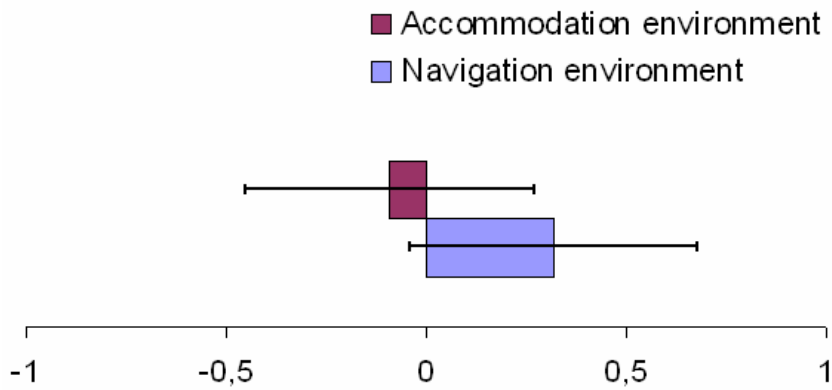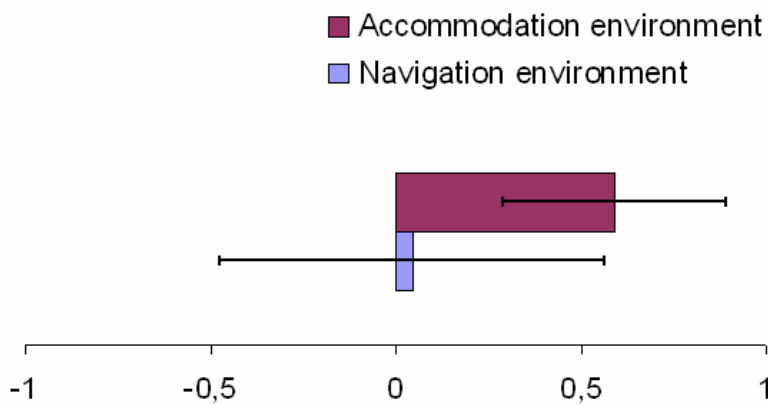

FIGURE 5 Accommodationally enhanced environment

FIGURE 6 Navigational environment

FIGURE 7 Accommodational environment with teleports ("clickable" signs on top)

FIGURE 8 "The exhibition is sterile" (bars represent mean scores with standard deviations plotted as lines, scale ranges between –1 to 1, n=11)

FIGURE 9 "The exhibition is engaging" (bars represent mean scores with standard deviations plotted as lines, scale ranges between –1 to 1, n=11)
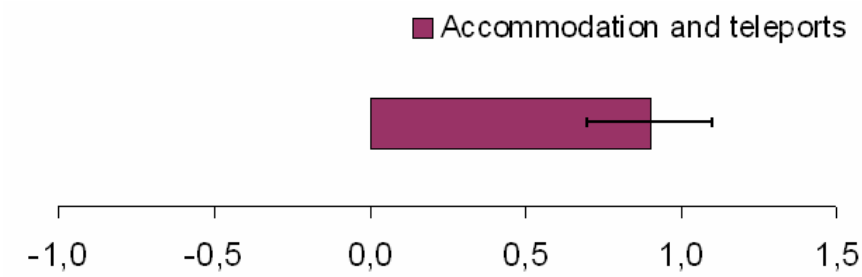
FIGURE 10 "The teleports reflected where I wanted to go" (bars represent mean scores with standard deviations plotted as lines, scale ranges between –1 to 1, n=6)
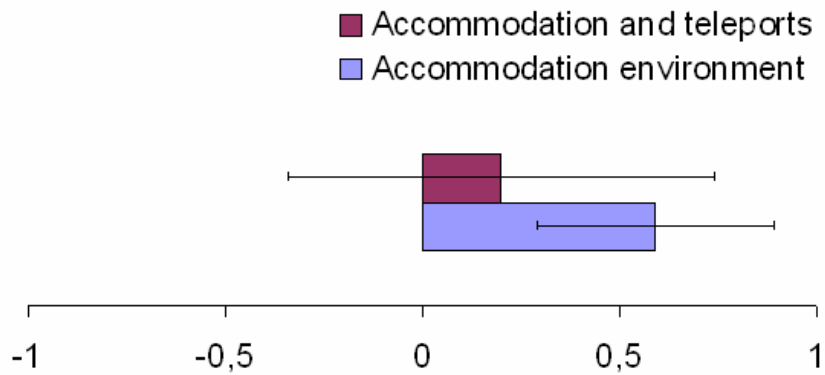

FIGURE 11 "The exhibition is engaging" (bars represent mean scores with standard deviations plotted as lines, scale ranges between –1 to 1, n=6)
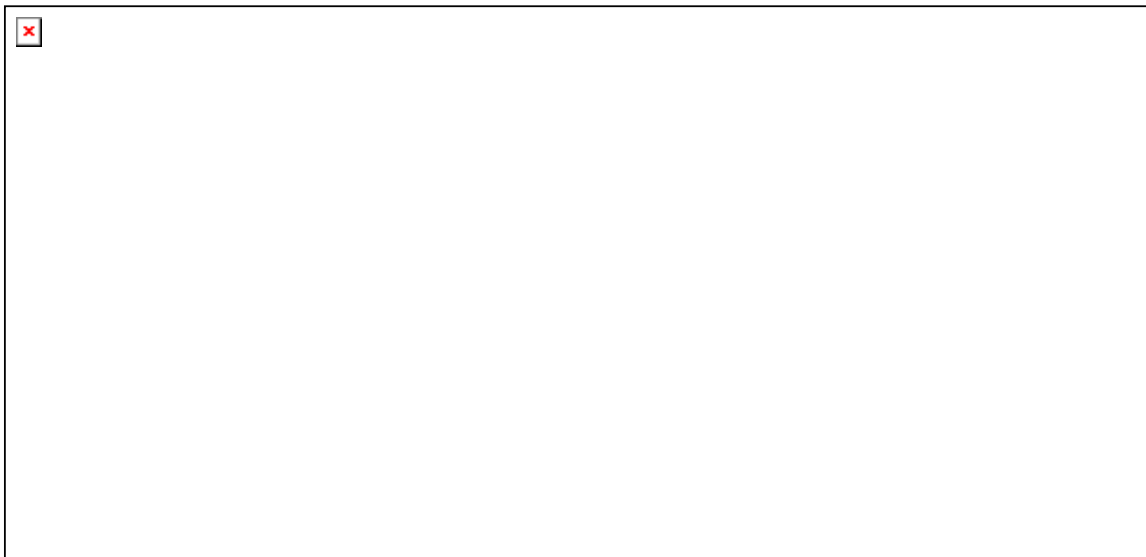

FIGURE 12 A proposed ontology for HCI