End-user Programming of Ambient Narratives

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1. INTRODUCTION

Ambient Intelligence is a vision on the future of consumer electronics, telecommunications and computing in which devices move into the background while at the same time placing the user experience in the foreground. Ambient intelligence is related to ubiquitous computing, pervasive computing but has a stronger connection to human computer interaction and design. Technically, Ambient Intelligence refers to the presence of a digital environment that is sensitive, adaptive, and responsive to the presence of people [1]. Producing Ambient Intelligent environments on a large scale is problematic however. First, it is technologically not possible in the foreseeable future to mass produce a product or service that generates Ambient Intelligence, given the current state-of-the-art in machine learning and artificial intelligence. Second, it is economically not feasible to manually design and produce Ambient Intelligence applications for each person individually. One of the main research questions in creating such environments is the design of a system capable of supporting mass customization of ambient experiences.

To address this research question an iterative top-down and bottom-up approach has been followed to gradually narrow down the solution space. The reason for adopting a top-down, analytical view was that it is easy to get lost in the wide variety of prototype systems, scenarios and examples that can be found in literature or gathered by doing empirical studies with end-users. The bottom-up, empirical view is necessary to ensure that any analytically derived concept is supported in practice, backed up by real world evidence. By repeatedly switching between these two perspectives, the concept is refined and eventually the design shaped.

2. BACKGROUND

The goal of Ambient Intelligence is to help people in performing their daily activities better, by making these activities more convenient and enjoyable: by introducing interactive media. Notice the word ‘performing’ in this description. In order to understand where and how Ambient Intelligence can be applied to support these performances, it is necessary to develop a better insight into what performances are and what it means to perform. Because performances vary so widely from medium to medium and culture to culture, it is hard to pin down an exact definition for performance. Schechner defines performance as “ritualized behavior conditioned/permeated by play” or “twice-behaved behavior” [9]. When people are performing, they show behavior that is at least practiced once before in a similar manner. In traditional performance arts this behavior can be detected easily: Actors in a theatre play, opera or movie rehearse their roles off-stage and repeat this behavior when they are on stage. But this twice-behaved behavior can also be seen in a priest conducting a wedding ceremony, a surgeon operating on a patient or a McDonald’s service employee behind the counter. Pine and Gillmore [8] argue how we live in an experience economy where work is theatre and every business a stage. In our own homes, we show signs of repeated behavior. This happens for example during everyday rituals, like brushing your teeth in front of a mirror in the morning, watching a soccer match with friends, or, coming home from work in the evening. Note that, here, the sending and receiving party in a ‘performance’ may be the same.

Viewing life as social theater is interesting for us for two reasons: First, if people behave according to social scripts, we can codify interactive media applications to support people in carrying out these scripts. Just as lighting and sound effects add to the overall drama of a theater play, Ambient Intelligence may thus be applied to enhance the performance described by these social scripts. Second, positioning Ambient Intelligence in performance theory gives us a well-studied and familiar frame of reference for the design of Ambient Intelligence environments and the underlying technology.

To model media-enhanced performances in the home and commercial service encounters in a machine understandable way, we choose to represent the structure and interrelationships of a set of related media-enhanced performances as an interactive or episodic narrative. Interactive narratives allow readers to affect, choose or otherwise change the plot of a story [7]. Most interactive narratives are situated either in the real world (e.g. live-action role playing games, improvisational theater) or in some virtual reality (e.g., hypertext novels, computer games). Another difference is that these media-enhanced performances are not really ‘read’ like a book or hypertext novel, but enacted like a theater play. We introduce the term *ambient narratives* to denote dramatic, interactive narratives that play in a mixed reality setting. We can look at ambient narratives from a consumer (reader) point of view or a producer (writer) perspective. From a reader point of view, interaction with the ambient narrative creates the perception of an intelligent surroundings. Interaction should be taken very broadly here as an ambient narrative can span both virtual and physical dimensions at the same time. Media-enhanced performances in

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different rooms may be linked to each other in one narrative structure, allowing people to influence the plot of the ambient narrative (the evolving Ambient Intelligence) by simply walking around for example. From a writer's perspective, the ambient narrative describes all possible media-enhanced performances and their interrelationships. Real-life environments are however highly complex and constantly changing so it is almost impossible for a producer to write ambient narratives for a given space in advance. Therefore end-users should be able to program their own ambient narratives.

The ambient narrative concept in itself is useful because it relates media, architecture and performance but in order to build a working system, we need to map the concept in a machine readable form. The underlying computer model and algorithms are inspired by interactive storytelling and hypertext systems such as [5, 10]. Essentially, implicit contextual information derived from sensors in the environment and explicit user feedback is fed into an interactive storytelling engine that will determine which media-enhanced performance scripts must be (de)activated given the database of scripts and the state of the ambient narrative engine. Each script consists of a preconditions part and an action part. If a script is selected and the preconditions are valid, the action is executed. Each action consists of three parts: an initialization, main and final part. The main part contains a description of a distributed hypermedia presentation in AmBX [2], a language and system used for enhancing game experiences with lighting and other ambient effects. The initialization section is used to set story values or triggers for other scripts before the amBX script is started. The final section gives the author the possibility to define story values or triggers that are executed right before the script is becoming inactive again. More information can be found in [4].

3. EVALUATION AND FUTURE RESEARCH

The ambient narrative concept and language model needs to be validated against the requirements placed by real world applications. To get a better notion of the type of language constructs needed, we performed a literature study where we analyzed existing scenarios, storyboards and prototype systems focused on the home and retail domain. The retail (and hospitality) domain is interesting in particular because no retail space is the same as each store wants to convey its own unique brand image. Furthermore, stores frequently change their collections. From this literature study we found that frequently appearing context paramaters are the location and identity of people, devices and objects, user roles and history.

To test the ambient narrative system we further made a prototype and refactored an intelligent shop window environment in ShopLab, the feasibility and usability laboratorium at the High Tech Campus in Eindhoven, to see if a typical ambient intelligent application would fit the model. The intelligent shop window reacts to the presence of users depending on their distance to the window and adapts its interaction style accordingly: When nobody is close, the transparent displays convey the style of the store by showing brand images. When a person stands directly in front, the transparent display switches to interaction mode. The person can then point or look at products in the shop and receive additional information about that product on the shop window, see Figure 1. We managed to map this application onto the ambient narrative model but found out we needed to filter out noise from the sensor data to make the system stable. Furthermore, some bypasses around the ambient narrative engine had to be made so that high frequency context data such as gaze input or pressure floor data could be fed directly to the devices if the device had gained focus by the narrative engine.

Figure 1: Touch interaction with the shop window display.

Currently, we are in the process of working out several different authoring strategies that allow end-users, in our case retail experience designers to quickly program environments such as the intelligent shop window. Several different programming strategies have been proposed in literature (e.g. desktop-based, in-situ, programming by example) e.g. [3, 11, 6] for ubiquitous computing environments. But in a series of workshops with designers of retail spaces we hope to collect qualitative feedback on which strategy they prefer when and see in how far they can think in the ambient narrative mental model. Finally, these end-user programming strategies need to be evaluated in ShopLab.

4. REFERENCES

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