Sticky, Smelly, Smoky Context: Experience Design in the Kitchen

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ABSTRACT
In this position paper I reflect on the challenges to design, set up and evaluate a user experience in hybrid contexts, i.e., physical and digital ones, of everyday life.

Categories and Subject Descriptors
H.5.2 [**Information Interfaces and Presentation (e.g., HCI)**]: User Interfaces – Theory and methods, User-centered design

General Terms
Design

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user experience, ubiquitous computing, human computer interaction, computer supported collaborative cooking, evaluation.

1. VISION
Our daily life environments are starting to contain an increasing number of displays in various formats and supporting different functionalities and interaction styles. In such interactive environments people can move around in a display continuum rather then sit at a desktop behind their screens, handle physical as well as digital objects at the same time, and interact on shared displays in co-located or remote collaboration. Thus, our contexts of interaction tend to get a more and more hybrid nature, where physical and digital artifacts blend together. This will most likely affect the way in which we interact with architectural space, with information and with each other in the near future. A holistic understanding of context, in this sense, requires looking at interaction as embodied [3], thus taking into account its social as well as physical aspects. Hybrid IT artifacts need to provide physical, cognitive, as well as social affordances in order to enable users to interact and communicate in such hybrid contexts.

My research focuses on the design of affordances for digital information in scenarios of ubiquitous computing. Here I present the Living Cookbook appliance: in this project we explore the introduction of digital display technology into the kitchen environment. In this paper I look at the complexity of the cooking context and I consider how the introduction of technology in the kitchen can affect the cooking experience. I provide a design perspective and point out the main challenges and potentials of bringing computing technology into contexts of everyday life.

2. TECHNOLOGY IN THE KITCHEN
In the kitchen we can traditionally find a diverse range of artifacts for food preparation. These include very specific as well as multi purpose tools, and they often embody and represent the material culture of a society and of a generation. Some of these artifacts still work mechanically; others are electric appliances supporting specific tasks. Electric appliances were mostly designed to ease their users' mechanical effort, to maximize the efficiency of certain tasks, or to even fully automate them [1]. While electric appliances have successfully entered many domestic kitchens, especially western ones, digital display technologies have had a very limited application so far. In most cases they are used as alternatives or supplements to dials and buttons in the interface of electric appliances.

More recently, several consumer electronics and communication companies have been working on interfaces for a centralized control of electric appliances in the house [7][8]. These are often controlled wirelessly from other locations and devices, both inside and outside of the house, such as mobile phones, or a PC over the web. Domestic appliance manufacturers seem to see the potential of digital displays and internet technology for augmenting the kitchen environment by providing information and entertainment. The GR-D267DTU Internet Refrigerator by LG [6] contains a server which controls the communication to the other connected appliances. Its display provides different functionalities, such as watching TV, listening to music or surfing the internet. A built-in microphone and camera enable multimedia communication.

Reviewing the examples above, we can notice that up to now technology has entered the kitchen mostly to optimize the food preparation process; to control appliances; or to provide additional entertainment and communication capabilities, which used to belong to other domestic or professional environments. Not so much has been done with respect to cooking as an experience. Only recently academic research has investigated ways to introduce computing technology in the kitchen and into its infrastructure. At MIT a smart kitchen space, named La Cantina, was set up, in which displays are embedded in the space for different augmentation purposes [2][5]. The system in this case makes inferences about users' intentions based on users' interaction with the different appliances (e.g. opening a freezer might imply the use of a microwave as follow-up activity). Still at MIT, the CounterActive project [4] is an interactive cookbook, projected down onto the kitchen counter. The cook touches the countertop to navigate through the recipe or to retrieve more details. Recipes incorporate pictures, audio and video.

Similar to the CounterActive project, we aim to augment the cooking experience and the traditional cookbook. Our focus, though, is on augmentation by social and family relationships and real life experiences, rather than on augmentation by mere multimedia presentation. Indeed, it is mostly neglected in the design of kitchen appliances, that cooking is a social process

involving rituals and symbolic aspects. Some people enjoy cooking together; several people enjoy cooking for others; friends and relatives often exchange recipes, which assume a cultural as well as communicative value. TV cooking shows, featuring popular cooks or showmen, frame cooking as a creative and cultural activity. In this sense cooking seems to provide a great potential for communication. Thus communication and display technologies can support the communication and sociability aspects of cooking, and bring new aspects to its social character.

3. THE LIVING COOKBOOK

The Living Cookbook aims to cultivate communication and collaboration in the kitchen by making people's cooking experiences recordable and shareable in an interactive digital cookbook. The goal is to preserve cultural and social roots on the one hand, and stimulate cultural and generational fertilization on the other. Instead of simply exchanging written instructions, we capture the whole cooking process with annotated audio and video and make it available for others so that they can asynchronously reproduce the dish. When users give instructions for a recipe, they author a multimedia cookbook. We therefore rely on people's interest in communication and story telling, as they are turned into actors of a participatory theater, who interact with their audience via technology.

The emotional quality of content created by family members or intimate friends is expected to be very different in comparison to the cooking sessions broadcasted on TV shows for a large audience. This aspect promises to affect motivation and engagement. People can customize each recipe with personal tips and tricks, make explicit reference to their well known target users, and thereby create a very personal experience.

The User Interface of the Living Cookbook is a client application running on a tablet PC mounted on a kitchen cabinet. It is implemented in Macromedia Flash and connected to a server implemented in Java, which in turn controls a camera for recording video, and a video projector for playing back the video. Via the client interface a user can insert new recipes, choose already inserted recipes and control video recording and playback. The video is projected onto a wall above the counter in order to provide a good view and still keep the counter clear of devices. The content of the cookbook is stored in an XML File on the server side. Video material is referenced externally from the server's file system. Another XML file stored on the server side defines all ingredients including appropriate ranges and units.

Considering that the cooking activity requires extensive manual work we tried to minimize users' gesture based input. Given that mouse and keyboard are obviously not suitable for kitchen environments, we chose a touch screen display which can be controlled by a pen or a finger. Since hands are often dirty while cooking, the interface design privileged the use of a pen. This means, for example, that the interactive elements of the GUI have a size which is more suitable for the tip of a pen, although interaction with a finger is still possible. Furthermore, this implies that the user interface provides affordances for direct manipulation with dragging whenever it makes sense (e.g., to set a value for the quantity of an ingredient). Our goal was to minimize the use of the virtual keyboard, which can be displayed and tipped on the screen of the tablet PC (for entering the name of the recipe, for example). Opening the virtual keyboard, entering text by tipping character, and then closing the keyboard pane is indeed a rather cumbersome activity: additionally, it implies that the real estate of the display is halved during the use of the keyboard.

4. TESTS IN THE KITCHEN

The technical setup and the user tests of the appliance took place in the small kitchen of our lab. The design of the interface underwent an iterative process. In an early stage of development 4 members of the design and development team tested the application with real cooking sessions. Two of them recorded recipes, and the other two played them back. Considering that the cooking activity was more or less familiar to everyone, it made sense to directly involve ourselves in the test, so as to have a first hand experience. Everyone, indeed, has her personal way to deal with household activities, which justifies the direct involvement of team members. These sessions were concluded by 4 meals in which the team dined and discussed the application, improvements to be done on the interface, changes in the setting of the camera and projector, and the experience delivered by the application.

In a second phase 4 people from outside of the team, 2 men and 2 women at the age of 22 to 45, were invited to test the application. In this phase a cognitive walkthrough method was adopted, so as to evaluate the user interface. Testers were given some tasks and were asked to report and talk aloud when they did not understand what to do, or encountered any difficulty. These tests also ended up in meals and discussions, jointly with the team members: in this setting the discussion addressed both the User Interface (e.g. whether it was clear how to interact), and the whole experience (e.g. how they felt about recording or playing a video of a personal cooking session). During the meal together with the team, testers were invited to present their impressions of the application, to think whether they would use it in their homes, and how it could be improved or done differently.

5. OBSERVATIONS AND LESSONS LEARNED

The discussions of the first phase were useful to identify the requirements that could improve the application and the user interface. We noticed that the playback of the video in playback mode is more entertaining when two people recorded a recipe together rather than a single one. When a single user is recording a recipe, it can happen that she forgets to mention a step. When two people cook together, the spontaneous conversation among the two of them, such as "Can you please pass me the cheese?" or "Can you turn down the fire?" helps to keep track of the process. It also creates a more fun experience for the users that are recording as they often end up in jokes or small talks about the recipe. The feeling of a natural social setting makes the whole cooking session more interesting for the user who plays the video back and the personalization of content is much stronger. For this reason, after the first test, we agreed on the protocol to cook with two people in all further tests.

Given that cooks are already managing a set of tools, we observed that the manipulation of an additional one, i.e., the pen, soon became inconvenient, especially when it was misplaced on the kitchen counter as it happens with cooking tools. After this observation in the first tests, the pen was hanged with a piece of string next to the display, so as to support more casual use.

We also noticed that more than one camera would better capture the whole event. A closer look at commercial TV cooking shows revealed that they use up to seven distinct

camera positions. Indeed it is important to have a close view at the location where the food is actually prepared (e.g. the fire and the counter), as well as on the face and movements of the person who is cooking, in order to keep the desired sense of presence.

The cognitive walkthrough tests with users from outside of the project team gave us some useful insight both on the usability of the interface as well as on the whole experience. To this respect it became clear the difficulty to evaluate experiences in a hybrid context, in an environment which is supposed to recreate an everyday life one, but is actually still far from the intimacy and acquaintance people have in their own real domestic environments. Even though some testers were employees of the lab and know the environment of this specific kitchen, the activities they normally perform there are different from proper cooking: e.g. coffee preparation, food warm-up, food storage. When both the employees and the external testers were asked to use the application and to cook there, we noticed that a certain stress was generated by the pure fact of cooking in an unfamiliar kitchen, using the interface, talking aloud or observing a video, and, in the cognitive walkthrough, being observed by a researcher. Some users, in particular, were most concerned about the result of their cooking, being aware that the team would taste it afterwards. Thus, the feedback they provided was mostly focused on this aspect rather than the whole experience of using the application and how this could affect their mundane activities.

In these tests we realized that for the assessment of the whole experience and of its social meaning it would be necessary to let users try the application in their own kitchens they feel familiar with. Furthermore, the expected increase in motivation due to social relationships needs to be validated in a more intimate social setting. One of the testers explicitly asked to have the video of his cooking session to show it to his girlfriend. Therefore we plan to connect different kitchens/cooks that have a real familiar relationship.

6. UNDERSTANDING CONTEXT: USERS' VS RESEARCHERS' PERSPECTIVES

In this discussion I aimed to highlight the idea that the introduction of technology into everyday life activities and domains implies hybrid contexts of interaction. In such contexts it is challenging to design and evaluate users' experiences.

During the design and evaluation of an application for collaborative cooking it became clear how the design of new experiences enhanced by available technology needs to cope both with the traditional constraints of the physical environment and of the mundane activity, and at the same time with the novel issues brought along by new appliances and new technology.

From a user's point of view, the two aspects blur and their combination affects the whole experience. For design research and evaluation this raises the challenge to distinguish the critical factors: i.e., whether these reside in the physical environment, e.g. on the screen placement in relationship to other artefacts and to the users; whether on the interface; whether on the cognitive effort required from the computer supported activity, etc.

So far, most of the research in domestic technology has focused on making the environment aware of the context: this requires definition and description of parameters, assessment of their relevance, interpretation of sensed data and design of relative system reactions. In a certain sense, environment and users have been "loaded" with sensors in order to make the system knowledgeable about the context. It remains an open issue though how to make users aware and knowledgeable of the hybrid context in which they interact. And, furthermore, how to make designers knowledgeable about the complexity of the hybrid contexts of interaction for which they design.

Interior and product designers, as well as ergonomists, have been working on the kitchen in terms of space and artefacts for some time; the design of affordances for digital information embedded in a real physical environment implies the consideration of new aspects which differ from the desktop PC environment. The users' possibility to move around in the space and to directly manipulate objects and information items needs to be supported by interfaces that are properly scaled to users' metrics, locations in the space, reciprocal distance among users and motor capabilities. Issues such as the height of the user, her visual angle, the reachability of displayed objects to the hands, the proportion between objects and hands sizes, environmental factors such as sound, smoke, heat, assume an important role. In order to face such issues, ergonomic considerations need to be included in the interface design, thus suggesting the emergence of a novel design approach. The traditional usability guidelines for visual displays will most likely need to be revised in order to address the novel aspects brought by ubiquitous computing. In these scenarios I expect that the design discipline will need to merge screen and product design competences, in order to merge virtual and physical worlds.

Furthermore, the design of experiences that build on social relationships and imply social contexts needs to find novel approaches to prototype, test and assess such experiences. In this sense the tight collaboration of design research with behavioural sciences promises to provide novel methods for experience simulation and assessment: such assessment should focus on a short, as well as on a longer time perspective.

7. TWO MAIN QUESTIONS

How can we learn about users' experiences in hybrid contexts of everyday life when technology is not yet mature enough to enter users' real everyday life environments?

How can we distinguish the critical factors affecting the whole experience (e.g. physical set up, social context, digital user interface, etc.) so as to guide design?

8. BIOGRAPHICAL SKETCH

I work as Human-Computer Interaction researcher and User Interface designer in the Media Informatics Department at the LMU University of Munich, Germany. In this context I work on my PhD within the FLUIDUM project (www.fluidum.org) investigating interaction techniques for instrumented environments that support collaboration. Besides, I have been working on tangible user interfaces for learning. Until November 2004 I worked at the Fraunhofer Institute for Applied Information Technology in Sankt Augustin, Germany. Here I was involved in the design and evaluation of applications for ubiquitous computing, e-learning and m-learning. Before, I worked in the Image and Communication Department of the Organizing Committee for the XX Olympic Winter Games – Torino 2006. I hold a master degree in Industrial Design, gained at the Politecnico of Milan, with a final project concerning the design of a mobile application for the visitors of the Olympic Games. More details about my research work are available at:
https://wiki.medien.ifi.lmu.de/Main/LuciaTerrenghi

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