Kitchen Stories:
Sharing Recipes with the Living Cookbook

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Research on smart houses has mostly been focused on automation and invisible integration of technology, which may lead to a perceived loss of control and a sense of being observed. In our perspective users play an active and creative role, deliberately engaging with visible technology, not for reasons of efficiency, but rather for the fostering of social relations. In particular, we are looking at the kitchen environment, and we present the Living Cookbook. It enables people to share their cooking experiences, to educate others in the cooking practice, and to suggest a sense of presence and sociability. The cooking activity is reinterpreted as an experience, and the use of technology supports intimacy, communication, education, fun and creativity while cooking.

Keywords: ubiquitous computing, instrumented environments, domestic environments, collaborative cooking

Introduction

In post-war Sweden it was discovered that an average housewife walks the equivalent of the distance between Stockholm and the Congo per year while preparing her family's meals. The study inspired Norwegian director Bent Hamer's [6] "Kitchen Stories," a movie in which a Swedish research institute sends out 18 observers to map out the kitchen routines of single men in rural Norway. The researchers sit in high chairs placed in a corner of the kitchen and can't be addressed or included in the kitchen activities under any circumstances. A subtle paradox between observing and being observed is ironically presented and a sympathetic relationship between observer and observed eventually emerges: by movie's end, the researcher is collaborating in the kitchen with the subject and the subject is filling out the researcher's forms.

In the real world attempts have been made to bring technology into the domestic sphere invisibly, in order to increase efficiency of certain tasks or to completely

automate them. Technology is then hidden in the backstage, tracking users' performance on the stage.
The Kitchen Stories project explores the kitchen as a design space and cooking as a social activity. The project aims to cultivate communication and collaboration in the kitchen by making people's cooking experiences explicitly recordable and shareable in an interactive digital cookbook. This allows them to preserve cultural and social roots as well as stimulate cross-cultural and cross-generational fertilization.

Motivation

Design for everyday life and the investigation of how technology can enter our lives in a smooth and enjoyable way have been some of the main goals of recent HCI research. Starting from Weiser's vision of Ubiquitous Computing [14], the Disappearing Computer initiative [4] investigates "how information technology can be diffused into everyday objects and settings, and to see how this can lead to new ways of supporting and enhancing people's lives that go above and beyond what is possible with the computer today". Ambient Intelligence [3] is a vision of the future where we shall be surrounded by electronic environments sensitive and responsive to people. The physical reality will be thus overlaid by an additional virtual layer (Mixed Reality) and by naturally moving in the space and/or by manipulating physical objects in our surroundings we will act upon information in the virtual layer.
The actual experience of affecting a virtual layer of information while acting in the physical world is not new and it is not necessarily associated with technology. Rather, it is intrinsic in human nature. Every time we perform a creative activity, such as painting, writing, designing or playing an instrument, we create and deliver a virtual meaning. The same happens in many other ritualistic or symbolic acts, such as giving a present or preparing a meal for someone. In a reciprocal way the virtual layer made of imagination and emotions drives our activity and behavior in the physical world.
Pervasive computing and context sensitive systems allow us to design new stimuli, from which people can create their own meaningful experiences, and thereby facilitate new ways of communication, collaboration, personalization and

automation. With Kitchen Stories our main goals in the design of such interaction scenarios are:

- to investigate how the introduction of pervasive technology into everyday life environments can deliver positive experiences;
- to augment people's social, creative and cognitive skills;
- to deliver technology into humans' everyday life such that the meaning of creative and symbolic activities can be augmented and new symbolic activities can be created and shared.

We neither focus on automation and invisibility, nor on improving the efficiency of task performance. Instead, we aim to motivate the inhabitants of the instrumented environment to interact with the system because of an added value of a shareable experience and of a sense of accomplishment.

In the remainder of this article we explore the terrain for the design of new collaborative experiences and behaviors in the kitchen environment. The central part of the Kitchen Stories project is a new digital kitchen appliance called the Living Cookbook. It allows users to record, annotate and play back cooking sessions. Thus it becomes similar to a family photo album, composed of recorded and shareable "kitchen stories". It suggests a sense of presence and fosters social bindings.

Related Work

Housing and highly interactive domestic environments have been investigated in numerous projects. Research institutes, companies and universities have set up so-called smart houses or smart homes, in which potential users can experience the interactive domestic environment. These house prototypes are known as living labs. Examples are the Home Lab by Philips [11], the Aware Home by the Georgia Institute of Technology [5], and the Place Lab/House_n by the Massachusetts Institute of Technology [10]. In these living labs, ambient intelligence and pervasive computing scenarios are set up in the architectural space of a normal house. The study subjects (either researchers themselves or strangers), are invited to live in these environments for a period of time, usually ranging from 1 to 10 days. During this time their behavior and interaction patterns are observed with cameras and various types of networked sensors, thus producing enormous amounts of data which is then analyzed. Researchers observe

and study users' patterns from a separated control room, without explicit interaction between users and observers. In the cited work the intelligence of the ambience has mostly been conceived as the capacity of sensing and automation. One of the main challenges of smart houses is the users' privacy and trust concerns, together with controllability and learnability of the user interface, if existent. Users are often skeptic though about being watched and tracked by Big Brother's eye.

In our approach, we therefore support the explicit and conscious engagement of users with technology. With the Living Cookbook, users choose to be observed by visible technology because it provides a means to capture their own experience and play back those of others, facilitating exchange and communication.

At MIT a smart kitchen space, named La Cantina, was set up to explore the cooking activity [1] as well. In its context, displays are embedded in the space for different augmentation purposes. Bonanni et al. [2] explore intuitive ambient interfaces requiring minimum attention effort and providing awareness of water temperature by projecting a colored light. The CounterActive [7] project is an interactive cookbook, projected down onto the kitchen counter; the cook touches the countertop to navigate through the recipe or to glean greater 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 multimedia presentation.

Computer Supported Collaborative Cooking

We use the term of Computer Supported Collaborative Cooking to denote computer technologies which support and promote collaborative methods of cooking and cooking instruction, based on shared experiences. The concept of CSCC not only incorporates the enabling technology (software, hardware, and network) but also includes psychological, social and organizational effects implied by such an environment.

The introduction of technology into everyday environments bears the potential of deeply affecting domestic, social and collaborative activities. The average western kitchen already contains a variety of domestic appliances ranging from the stove to the mixer and the microwave oven. While several domestic appliances have

focused on the maximization of efficiency for certain tasks, or even their complete automation, little work has been done on fostering collaboration and learning at home. The globalization and unification of food production and supply, together with technological developments enabling long-term food conservation and rapid cooking, are considered some of the reasons for the decreased amount of time spent with food preparation and with its consumption and enjoyment in households. The price for these developments is the vanishing of social and creative aspects of cooking and eating. The replacement of specific kitchen tools by multifunctional kitchen aids has been partly responsible for the reduction of the artifacts that embody collective knowledge and culture.

We propose a converse approach that aims specifically at promoting the social and communication aspects of cooking. In this sense cooking is not considered a mere working activity, but rather an edutainment experience. In the Kitchen Stories project we turn the domestic kitchen into a stage equipped with clearly visible technology to extend communication and collaboration across the boundaries of time and space by giving people a device to share their favorite recipes. 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. In doing that, they are supported by a live, rich multimedia cooking instruction provided by a fellow cook. Hence, the users are turned into actors of a participatory theater, who interact with their audience via technology. In addition to supporting communication we want to encourage people to participate, be creative and motivate social exchange both in food preparation and consumption.

Our approach to CSCC lives from and supports cultural inheritance and social knowledge. In particular, we expect that our system will support knowledge and culture transfer from one generation to another. If we enable parents to record their “special pasta” or “unique roast beef” for their children, customizing each recipe with personal tips and tricks, they can create a very personal experience. Content created by family members or intimate friends has an emotional quality which is very different from content which is broadcast for a large audience.

In education, constructivism theories tell us that knowledge is not transmitted unchanged from teacher to student, but instead that learning is an active process of recreating knowledge. In this sense we try to promote new forms of communities

of practice (CoP) [8], where learning is not considered a linear process with a beginning and an end, but rather a social process where beginners learn by participation and engagement in a group of people who share common interests and knowledge [13]. Mutual engagement of the group members also binds them together into a social entity.

Along with self-directed and situated learning approaches from empirical pedagogics and teaching, we hope that the creative and fun aspects of our approach increase the intrinsic motivation of the people involved. In order to bring out the best capabilities of each individual, we involve them in a creative group process [9, 12], thereby increasing their motivation to participate in the collaboration and contribute to the shared knowledge.

A similar phenomenon can be observed in community-driven knowledge bases like the wikipedia project [16] where content and shared knowledge is created and maintained by the user community itself, rather than by a central content provider.

Setting the Stage in the Kitchen

Given Moore's law, we know that IT development cycles are counted in months rather than years in contrast to renovation cycles of houses and homes, which involve decades. It is therefore unlikely that houses will completely change their infrastructures and host invisible embedded technology and complex sensor networks in the near future. Taking that into account, we developed the Living Cookbook to be simply another kitchen appliance. It is a touch screen tablet PC with a simple user interface implemented in Macromedia Flash and mounted to the door of a kitchen cabinet (see figure 1, left, and right top). To this PC, a camera and a projector are attached.

The conceptual model of this device is that of a tape recorder, which has two primary functionalities, record and playback, as well as the secondary functions of fast forward, backward and pause. When recording, the camera actually writes a video stream to disk along with timing information, and the cook can indicate phases of activity and inactivity in the UI. In this teaching mode, the cook talks aloud, providing instructions and performing her/his "kitchen story". When playing back, i.e. in the learning mode, the device projects the recorded video of activities onto the kitchen wall, pauses during times of inactivity, and the cook can speed up or slow down playback of the recorded session by advancing to the

next section or pausing in order to catch up. The familiar conceptual model, together with a visible and touchable control device (instead of invisible technology) made the concept of recording and playing cooking sessions easily understandable and manageable. By creating not only a playback device, but also a cooking session recorder, we also tackled the authoring problem from which related projects suffer. Making recording just as easy as playback is essential in order to create a true communication medium. Pervasive technologies involving media in the household can only become a success on any larger scale if content is either freely available (cf. TV or Radio) or content creation is easy and driven by personal motivation, such as intimate communication with temporally or spatially distant but emotionally close people (cf. email, telephone).

Figure 1: Left: Overall setup of the kitchen. Right top: the control UI of the living cookbook. Right bottom: participants sharing a meal

Look and Feel … and Smell of the Living Cookbook

The cooks on our stage, playing the role of instructors and learners, are busy with different tools, dirty hands, noisy pans, smoky pots. They can have different ages and different familiarity with cooking and technology. When introducing an additional task demanding cognitive effort and manipulation, one needs to consider a number of issues to cope with the unusual setting of interaction.

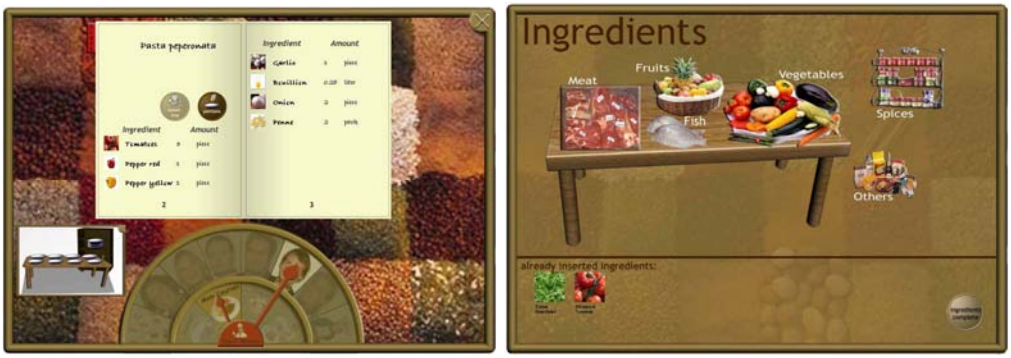

Figure 2: Left: Widgets for the Living cookbook.
Right: Screen for the selection of ingredients

In terms of interaction style we chose a touch screen display which can be controlled by a finger or a pen: we hung the pen to the display so that people could casually choose either way. We minimized text input, as it is tiring on a touch screen, especially when the display is mounted vertically (e.g. on a cupboard). Wherever possible we provided direct manipulation, such as tapping and dragging. Instead of writing ingredients' names and quantities, for example, cooking authors select them from categories (as shown in figure 2, right). We also opted for a strong use of pictures rather than mere text. In the ingredients menu this allows rapid visual scanning of the displayed information and recognition of the item to select, thus overcoming language barriers.

In terms of look and feel we chose to avoid the screen design typical of office applications and web pages, which can be suitable for working on the desktop PCs, but poorly supports touch screen interaction in a creative kitchen. Warm tones and organic textures were preferred to match the mood of a domestic room.

In our widget-based design different widgets are metaphorically referring to artifacts of a normal kitchen and semantically related to different functions: the dial (see figure 1, right top) embodies the cookbook selection, portions can be specified by dragging plates on a table (figure 2, left), and video control is operated on an egg-shaped widget (figure 1, right top). In the dial people can choose among a set of cooks/buddies, and among courses. This combined selection triggers the cover of the book displaying the picture of the selected cook, and of the desired course. The book metaphorically offers the affordances of paper, where people can both write and read, and flip pages: this comes at hand to display both the authoring and rendering environment using a consistent conceptual model. Furthermore the emotional aspect of authoring a book is

supported: users can go back to their personal cookbook, see the recipes they authored, thus enhancing a sense of paternity and memory.

Live Cooking

The design of the interface has undergone an iterative process, with real cooking performances. In an early stage of development 4 members of the design and development team tested the application with 4 real cooking sessions. 2 of them recorded recipes, and the other 2 played them back and cooked along. Such preliminary tests ended up in a meal each, which triggered open discussions about the set-up and the hands-on experience (see figure 1, right bottom). This first phase was useful to identify the requirements that could improve the application and the user interface. We noticed for example that the playback of the video in the learning mode is more entertaining when two people record a recipe together, rather than a single one. In that case, the spontaneous conversation among the two cooks keeps a better track of the process and creates a more fun experience as they often end up in jokes or small talk about the recipe. The feeling of a natural social setting also makes the whole cooking session more interesting for the learning user who plays the video back, and a stronger sense of presence is achieved.
We also noticed that more than one camera could better capture the whole event. In order to keep the desired sense of presence it is important to view the face and movements of the cook, and to have a close view at the location where the food is actually prepared at the same time.
In a second phase 4 people from outside of the team, 2 men and 2 women at the age of 22 to 45, with different degrees of computer literacy, were invited to test the application. They could choose in advance what recipe to cook so that the ingredients were provided. During the test, people were given tasks, such as “insert the name of your new recipe”, and were asked to report and talk aloud when they did not understand how to interact with the system, or encountered any difficulty in the preparation. 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). 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.

Considering the interface, testers had no major problems in fulfilling the tasks and in general they liked the look and feel. Sometimes, though, users were curious to go back in the process to check the effect of the actions that they had performed, for example the ingredients they had inserted in the page. From a design point of view, this suggests (not too surprisingly), that feedback, reversibility and error tolerance of the interface are important requirements. Another less obvious observation we made is that visual feedback of the personal performance is also important. In the teaching mode, users were expecting to view the captured image, to see themselves and what they looked like, and maybe send a greeting to their fellows. This feature is not provided so far, but it is a main requirement for the coming development iterations.

The technical setup and evaluation took place in the small kitchen of our lab. Even though the first testers were employees of the lab and knew the environment of this specific kitchen, a certain stress was generated by the pure fact of cooking in an unfamiliar kitchen. Location of tools and ingredients, limited room and limited equipment made some of the testers feel a bit uncomfortable. Some users, in particular, were most concerned about the culinary result of their cooking, and the feedback they provided was mostly focused on this aspect rather than the whole experience of using the application. This motivated us to conduct an explorative study with people in their homes: we interviewed six people, 3 men and 3 women, at the age of 29 to 56, who didn't have much acquaintance with computing technology. They were introduced to the concept of the Living Cookbook and shown the interface on a laptop, but they were not asked to cook. We suggested them to imagine the usage scenario and whether they could consider having this setup in their homes. At first it was hard for them to imagine having additional displays in the kitchen and expressed a concern with the impact of a projector and of an additional computer in the room. Considering the utility of the application, answers were rather different according to gender and age of the interviewees. The men interviewed mentioned it would be useful to have a visual feedback of how specific and more elaborate tasks of the food preparation need to be done. They expressed higher interest in the multimedia aspect of the application than in the social, emotional one. In contrast to this, women

mentioned that they like to cook spontaneously and saw the advantage of the application more as an emotional support, because they could see their relatives and friends, rather then as a cooking support. Young people were more curious and saw a higher potential in the application in comparison to older ones: several testers, especially the ones who recently moved out of their parents' place, reported that they often call their mothers to ask for recipes and exact instructions for food preparation. They saw a benefit in both the visual feedback and personalized content.

Conclusion

Until now, computing and display technology have mostly been used to improve efficiency of working activities in the office environment. This is a semi-public space, basically meant to be accessible and usable by everyone. But what happens when computing enters intimate spaces? How relevant is the users' familiarity with the environment to assess the experience? What is the potential of computing to affect our activities, communication and social relationships, and what are its limitations?

The design and assessment of new, technology-mediated experiences needs to cope with both the constraints of the physical environment, and with the novel issues raised by new appliances and new technology. From a user's point of view, the two aspects blur and their combination affects the whole experience. In design research and evaluation we now need to distinguish where the critical factors lie. They might be aspects of the physical environment (e.g., the small, unfamiliar kitchen), or the difficulty level of the activity (e.g., some testers chose to cook recipes more complicated then others). They might also be found in the interface itself or in the cognitive effort required for the computer supported activity.

In the evaluation, we realized that the expected increase in motivation due to enhanced 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. This suggests that for the assessment of the whole experience and of its social meaning it is necessary to let users try the application in their own kitchen in which they feel familiar and comfortable. Therefore we plan to connect different kitchens and cooks who have a real familiar relationship.

The group of people who tested the application so far is very heterogeneous with respect to the individuals' cooking skills. Therefore, some needed help with even the most basic steps in the food preparation process while others were only interested in special tips and tricks. We expect that augmentations and markups of the raw video material can help to deal with the problem of differing expertise levels (beginners/experts) in the user group. Psychology provides strong evidence that the amount of instruction has a very high impact on learning effects and motivation (challenge vs. excessive demands). This imposes the question: To what extent can we use technology to give additional information and help to those who need it, while not boring expert users? Some aspects of this problem can be solved by following a certain protocol (e.g. never do any steps off camera) while others need technical solutions. Symbols and images added to the video could, for example, highlight important steps or give additional insights into complicated steps. Experts may use the fast forward and pause functionality, and we expect that they will ignore or disable any low-level instructions and tips.

References

1. Bell, G., Kaye, J.: Designing technology for domestic spaces: A Kitchen Manifesto. Gastronomica 46-62, Spring 2002.
2. Bonanni, L. et Al.: Cooking With Elements: Intuitive Immersive Interfaces for Augmented Reality Environments. In Proc. INTERACT 2005.
3. Europe' s Information Society: http://europa.eu.int/information_society/policy/ambienti
4. The Disappearing Computer: http.//www.disappearing-computer.net
5. Georgia Tech Aware Home: http://www.awarehome.gatech.edu/.
6. Hamer, B.; Kitchen Stories, movie distributed by IFC Film, 2003.
7. Ju, W., Hurwitz, R., Judd, T., Lee, B. "counterActive: an interactive cookbook for the Kitchen counter," In Extended Abstracts CHI 2001.
8. Lave, J. and Wenger E. (1991) Situated Learning. Legitimate peripheral participation, Cambridge: University of Cambridge Press. 138 pages.
9. Mandl, H., Schnotz, W. & Friedrich, H. F. (1990). Research and development of teaching/learning models for guided self-instruction. In H. Mandl, E. De Corte, S. N. Bennett & H. F. Friedrich (Hrsg.), Learning and instruction. Social and cognitive aspects of learning and instruction (S. 633-644). Oxford: Pergamon.
10. Massachusetts Institute of Technology House_n: http://architecture.mit.edu/house_n
11. Philips Home Lab: http://www.philips.com/research/ami
12. Prenzel, M. & Mandl, H. (1991). Transfer of learning from a constructivist perspective. In T. M. Duffy, J. Lowyck & D. H. Jonassen (Hrsg.), Designing environments for constructive learning (S. 315-329). Berlin: Springer.
13. Smith, M. K. (2003) 'Communities of practice', the encyclopedia of informal education, www.infed.org/biblio/communities_of_pratice.htm
14. Weiser, M.: The Computer if the 21st Century. Scientific American, September 1991.
15. Wenger, E. (1998) 'Communities of Practice. Learning as a social system', Systems Thinker, http://www.co-i-l.com/coil/knowledge-garden/cop/lss.shtml.
16. Wikipedia, The Free Encyclopedia. http://www.wikipedia.org