First-Person Cooking: A Dual-Perspective Interactive Kitchen Counter

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Abstract

Hobby chefs have various ways to learn cooking—paper recipes or cooking shows, for example. However, information in paper recipes may require prior experience to be understood and a television show cannot adapt to a viewer's individual speed. Based on our findings on cooking habits, we are developing PersonalChef to unravel the complexity of recipes in order to increase users' confidence and fun when preparing an unknown recipe. PersonalChef is a multi-display, dual-perspective, interactive kitchen counter to support users in-situ while cooking and to teach them about food preparation. In addition to an interactive "personal chef" on a screen behind the stove, the user can retrieve as much or as little information as needed/wanted using a display embedded in the kitchen counter.

Keywords

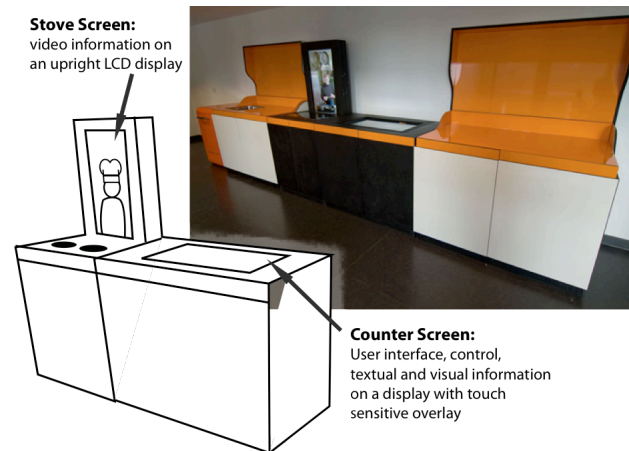Ubiquitous computing, domestic spaces, kitchen, computer-aided cooking, dual-perspective, interactive cooking show

ACM Classification Keywords

H.4.m Information Systems Applications: Miscellaneous—Kitchen Counter

Introduction and Motivation

Cooking advanced recipes can be complicated, and requires following detailed instructions to achieve the desired result. Textual instructions like paper recipes

Figure 1. PersonalChef consists of two modules: counter screen and stove screen.

Stove Screen: video information on an upright LCD display

Counter Screen: User interface, control, textual and visual information on a display with touch sensitive overlay

are often difficult to comprehend; they use technical terms or instructions that require prior experience to be understood ("How much is a handful of chopped basil?" or "How brown are caramelized onions?"). These types of information can be transferred more easily using images or videos, just as cooking shows do. However, cooking shows are not designed to be followed in real-time.

Although the increasing audience of cooking shows in European television [4] indicates that there is a growing interest in this format, no participant of our preliminary studies followed a recipe while watching a cooking show. They rather liked the inspiring aspect of the visual aesthetics. Typically, they would follow textual instructions when cooking, or not use any kind of instructions at all. The final outcome of a recipe depends on many factors and can fail at any point during the entire process. This can be demanding and stressful for beginners, perhaps discouraging them. We are developing PersonalChef, an interactive kitchen counter (see Fig.1), to avoid disappointing hobby chefs

when preparing unfamiliar recipes and to increase their confidence.

Related Work

Several systems have been developed to bring technical innovations into the domestic kitchen environment.

Cooking Navi [7] considers cooking as a time optimization problem when preparing a menu consisting of multiple recipes, and tries to optimize single cooking processes in order to have all dishes finished at the right time. Semantic Cookbook [10] and Kitchen of the Future [11] installed various electronic devices into the kitchen to record and share cooking sessions. Living Cookbook [12] offers these possibilities as well, but it further focuses on the social experience of cooking and collaboration. eyeCOOK [3] and Smart Kitchen [8] focus on the actual user input. They try to facilitate active user input or reduce it by tracking user's actions in the kitchen using eye-gaze, speech commands, and foot switches. CounterActive [9] integrates step-by-step cooking instructions using multimedia invisibly into the kitchen counter. Besides research prototypes, there are also commercial systems. Nintendo's personal cooking instructor (nintendo.com) on the small-screen NintendoDS device is an interactive cookbook and provides live cooking demonstrations.

While other work often focused on efficiency [1,5], our system aims to support the entertaining and social process of cooking. Our basic idea derives from the popularity of cooking shows, its aesthetics and inspiring character extending it with concepts from familiar methods, like cookbooks.

System Setup

PersonalChef is a multi-display, dual-perspective, interactive kitchen counter. Our system supports hobby chefs with textual, visual, and audio information while cooking. Aiming for one single system for beginners and advanced hobby chefs, we created a user interface design with user adjustable information depth.

We take advantage of the unused space behind the stove, and provide all information in-situ on two displays: (1) stove screen, an upright display behind the stove, (2) counter screen, a wide format display with a touch-sensitive overlay in the kitchen counter (see Fig.1). The stove screen offers help to the user by showing the chef in a first-person conversational perspective (see Fig.2), and a video showing a top down perspective onto the stove (see Fig.2 (a)). By showing the chef, users can see the handling of food in the kitchen. On the counter screen, the user gets textual and visual instructions, as well as videos in a top down perspective onto the kitchen counter (see Fig.2 (b)). Our layout keeps the distance between user and system minimal and displays information without requiring the user to change her view [11].

Our current prototype combines the interactive system and furniture, allowing us to observe users when actually cooking with the system. It was important to integrate technology invisibly because people consider the kitchen as a rather dangerous environment for technology [13], and also to allow people to focus on the actual task instead of being distracted by the apparent complexity of technology [2].

User Interface

The counter screen displays the user interface to control the information flow: there are textual descriptions of each recipe step similar to a traditional recipe on the left side (see Fig.3 (a)). This "instruction bar" helps the user to track her progress in the recipe and offers a familiar way to follow recipe instructions. Each recipe step works as a button: when the user taps on it, she gets images of the needed ingredients, tools, and the expected outcome (see Fig.3 (b)). If the recipe step describes actions on the stove, the personal chef will appear on the stove screen and demonstrate the user what she has to do. If it describes food processing on the kitchen counter, a video will appear in the movie area on the counter screen (see Fig.3(c)). Users can pause, rewind, or repeat any sequence by clicking on controls in the movie area.

The images of currently needed ingredients and items, the video, and an image of the expected outcome are displayed on the same background texture and represent a pipeline (see wooden line in Fig. 3 from (a) to (d)). A help button (see Fig. 3(e)) offers additional media, like a still image, an expanded textual description, another video, or an animation, for each specific step.

Figure 3. User interface on the kitchen counter: it consists of (a) an instruction bar listing the textual instructions of all recipe steps, (b) images of current ingredients and tools, (c) video showing the food processing on the kitchen counter in a top down perspective, (d) image of the expected outcome, (e) help button.

(a) **(b)** **(c)**

(e) **(d)**
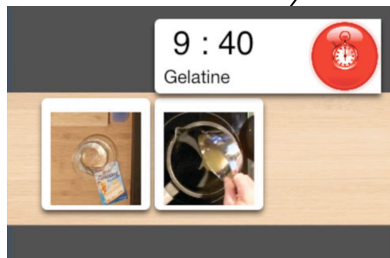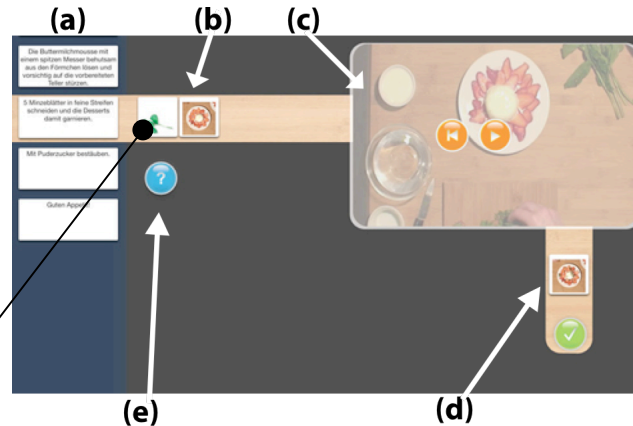
Figure 4. Time indicator above the corresponding ingredient.

Many recipes involve time dependent tasks. For this purpose we integrated a timer function next to the result representation of a recipe step. When tapped, the stopwatch symbol button turns red and the time begins counting down. When the result of an earlier step is needed, the user will see the remaining time above the ingredient representation to prevent premature use. By showing the time indicator above when the ingredient comes into her locus of attention (see Fig. 4). In a traditional kitchen, there is one clock or one timer in the kitchen; with PersonalChef the user has one virtual clock for every time-dependent task.

Preliminary Evaluation

In our early user studies we explored three possible effects of PersonalChef: (1) increase users confidence about the success of intermediate steps, (2) decrease perceived complexity of unfamiliar recipes, (3) reduce users' inhibitions of using technology in a kitchen for fear of damaging it. Further, we expected that users would not be annoyed with too much information independent of her cooking skills.

Because cooking quality is a highly subjective attribute, it was difficult to measure these qualities quantitatively, When we asked our users what they liked about cooking, they had quite different opinions: some people enjoy the process of cooking itself, independent of the time it takes, other people prefer to cook as fast as possible, and wanted to be successful with the recipe. Based on these subjective quality measurements, we adjusted our studies and asked people how they perceived information and how confident they felt about their results.

Experimental Setup
We recruited twelve users with varying background in education and cooking habits from 17 to 73 years (mean=35.75, SD=17.63) with a self-reported cooking experience of 3.18 (SD = .882) on a scale from 1(not experienced at all) and 5 (highly experienced).

Based on a prior survey about cooking and cooking show usage we chose the following counterbalanced conditions to compare our system to typical methods: (1) Prepare the recipe with the help of textual instructions only, (2) watch a cooking show one day before, and prepare the recipe with the help of textual instructions, or (3) prepare the recipe with the help of PersonalChef. The participants had to prepare a different recipe for each condition to prevent learning effects: one simple dish (salad) and two advanced (stuffed pasta, dessert). In the end users were given a questionnaire about their experience with the different test tasks.

Observations
We discovered that cooking with PersonalChef can increase the users' confidence about the success of their results For more advanced recipes the

representation of the information in our system seems to lower the perceived difficulty. Though the results of this explorative user study confirm the usefulness of PersonalChef a more extensive study should be conducted to verify a statistical relevance of our results.

In the results from the questionnaires, we could not find any relation between a subject's cooking skills and whether she had enough or too much information. The information density of PersonalChef did not bother advanced users, while beginners always had enough information.

In addition to the difference between beginners and advanced hobby chefs, we found three navigation strategies that people used in the recipes: (1) some people just tapped on recipe steps they felt insecure with, (2) some watched one video after the other without reading text and confirmed after each that a step was done, (3) some clicked on each recipe step watching the instructions and looked at the displayed icons. These observations suggest that it is possible to design a single kitchen system for people with varying cooking skills and different strategies.

The intended embodiment of the virtual cook on the screen had the desired effects: sometimes our users interacted with the chef on the screen as they would with a real person. They talked to him, or did not do what he demonstrated on purpose. Some people found the stove screen too close and intimidating. The screen, however, was not closer than an upper cabinet in a regular kitchen. But by showing something of interest in this position, the user had to look at this close object. The intimate space is considered to extend to a 50 cm (20") [6]. Entering that zone provokes rejection or even aggression. Based on this finding we will consider adjusting the distance of the screen.

When cooking with PersonalChef, a lot of users cross-checked their understanding of a recipe step against the video. "There [in the video] I could check up on how full a table spoon of butter has to be. Anyways, I took less." This quote of a participant expresses very well what she liked about the videos. Especially for vague units such as a pinch or a handful, people used the videos. The users did not just follow without reflection what the videos showed, but they applied it to their own task. Even when they decided not to follow the instructions given in the video, they felt more confident about their decision. When our participants did not have the chance to check their understanding of a certain instruction in a video, they became insecure and asked the experimenter for help.

After the tests, the participant was allowed to invite friends to eat the prepared meal with her and the experimenter. The resulting conversations became a kind of study method mixture of Constructive Interaction and Retrospective Testing concluding our test session. The users were proud of their achievements, and beginners were surprised that they were able to cook difficult recipes. They explained to their friends freely and without inhibitions what they did in the last hours and came up with ideas for the system and scenarios how they would use PersonalChef at home.

The most mentioned idea for future features was the possibility to annotate recipes with video, audio, or text. Some people would like to see videos or listen to

music while doing boring kitchen tasks, others would like to "telecook" with friends or relatives to profit from their cooking expertise.

Summary and Future Work

From the basic idea of providing a way to playback cooking shows adequately in the kitchen, we are iteratively developing a helpful and entertaining interactive kitchen counter. Our system offers a suitable way to help beginners as well as advanced hobby chefs to cook unfamiliar recipes. The user can adjust the depth of information for each step individually to her own experience and retrieve continuous feedback to check up on the success of her own results. We will need to conduct further experiments to verify the observations we made in our preliminary studies. Future prototypes of PersonalChef will aim for more workflow suitable automation, such as tracking the progress within a recipe by object recognition and connection to modern kitchen appliances.

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