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Cookmark: Collaborative Cooking Interface

Abstract

Food brings people together. Cooking with friends and family is both a collaborative and social experience, but it comes with a host of challenges. The most experienced cook usually takes on the role of delegating tasks, which can be stressful. The distribution of tasks is uneven, leaving others feeling uninvolved and unsure of what the other cooks are doing. Recipes lack a way to bookmark the current and completed steps, making missed steps likely, which can jeopardize the meal.

We have iteratively designed a web interface and iPhone application to enhance the collaborative cooking experience, based on our findings from user interviews, surveys, heuristic evaluations, and user experience testing.

Cookmark is a digital head chef[1] that intelligently divides tasks for multiple recipes among multiple people. It takes into account their cooking preferences, so that everyone feels capable and involved, and nobody dominates the kitchen. Cooks have the choice to opt out of chopping onions, using knives, and handling meat, so that they are only given tasks they want to work on. They can choose either to help wherever they are needed or take responsibility for one of the recipes.

As multiple recipes are cooked in parallel, Cookmark can be trusted not to leave out any recipe steps. It shows a colorful trail of finished tasks so that everyone can see who has done what. Cooks relax, feel capable about their cooking, and enjoy the time with their loved ones, knowing that everything will come together nicely in the end.

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[1] The head chef is in charge of menu creation, management, and scheduling of the kitchen staff.

User Research

Cookmark is the result of a year of user studies and user-centered design. We began by thinking very broadly about cooking, and food. We conducted 11 in-depth 1–2 hour interviews with people to understand their histories with food. Our interview subjects ranged in age from their early twenties to late fifties. We asked them questions about topics such as grocery shopping and cooking with family. Our interviews revealed that there are two types of cooks: fast lane cooks and scenic route cooks. We define fast lane cooks as people for whom the main goal of cooking is to get food in their stomachs and move on. They may like eating, and good food, but they favor efficiency and time savings. We define scenic route cooks as people who love the process as much as the end result. These cooks are interested in the chemistry behind the food, and in lingering over the stovetop, spending time relaxing with others as the food cooks. These cooks express their affection for others through sharing food with them. We decided to design an interface to enhance the cooking experience for both types of cooks.

We also distributed an online survey to reach a wider range of people. It received over 50 responses. Our survey included questions about what respondents like and dislike about cooking, and their eating and cooking habits. We heard over and over again that people dislike the time it takes to cook and clean up. Even people who enjoyed cooking complained about the time commitment and stress of properly timing multiple dishes. At the same time, we heard again that people enjoyed cooking for their friends and family.

Project Motivation

Since we heard repeatedly that people like to cook for their loved ones, we decided to focus on collaborative cooking. We wrote another online survey to drill deeper into people's experiences cooking together. It received 14 responses. We asked questions about what they cooked, with whom, the process, and why they enjoyed it or found it to be difficult.

Typical Collaborative Cooking Scenario

We found that typically in a scenario where multiple people are cooking together, the host assumes the role of the head chef. The other cooks trust the head chef to know what to do. He or she delegates dishes and tasks, and asks people to take up tasks on an as-needed basis. The head chef is familiar with the recipes and has a bird's eye view of the cooking plan in his or her head. Most likely he or she has read the recipes from beginning to end before starting, and the other cooks play supporting roles.

Another common scenario is for one person to own each recipe and delegate tasks from it as needed. As each person finishes his or her assigned task, he or she asks the owner of the recipe how they can help next. Sometimes cooks talk strategy at the start of the cooking process, and one person takes up the preparatory work (chopping, peeling, and dicing) while another takes up the cooking portion.

Motivations for Collaborative Cooking

In addition to the surveys and in-depth interviews, we asked user test subjects to fill out a written post-test survey. The user test subjects cooked real dishes using paper and digital prototypes of Cookmark. Survey respondents, interview subjects, and user

test subjects all cited multiple motivations for cooking collaboratively. One paper prototype user test subject commented,

> "Usually it is more enjoyable and fun itself. I felt like I'm having fun rather than pushing myself to produce something."

One online survey respondent called cooking with others "a great social activity, one of few regularly scheduled ones remaining." One heuristic evaluator enjoys the problem solving aspects of collaborative cooking. He said,

> "I like the feeling of working collectively towards a goal, brainstorming together when something goes wrong, or how to adapt a recipe based on the realities of the pantry."

An online survey respondent discussed the satisfaction that comes from cooking together. This respondent said that it is satisfying to work together on something a group of people can all enjoy. The positive feeling that results from working on a team, having company while cooking, and socializing encourages many respondents to cook collaboratively. One heuristic evaluator likes being able to socialize and cook at the same time. "There is a lot of talking and drinking wine." One user test subject elaborated:

> "I like spending time with people while I'm cooking -- it's something I love doing, and it is much more fun to do it with other people who also enjoy it."

Another user test subject revealed that she likes cooking with other people because it's not so lonely. She went on to say, "Plus it often takes the stress off having to cook an entire meal if we get to divide up tasks."

Clearly collaborative cooking comes with many rewards. It is a challenging task that requires problem solving from time to time. It takes the pressure off of having to cook an entire meal by oneself. It offers a rich environment for social interaction, and producing a meal at the end as the result of group effort is immensely satisfying.

Common Problems with Collaborative Cooking

However, we learned that there is room for improvement. A tactical problem surfaces when multiple cooks and multiple dishes are introduced. One user test respondent described that it "gets hard to manage things." Another user test respondent dislikes the "communication overhead of figuring out what to do." An online survey respondent complained about not knowing what to do next, where the ingredients are, and how to time the dishes so they all finish at the same time. The feeling of not knowing what to do and having to figure that out rang out through many of the responses. A user test respondent who is a prolific baker and cook confessed,

"I dislike how disorganized the tasks can get (leaving out steps, mistiming dishes), especially because I am kind of a cookzilla in my own kitchen . :)"

She also went on to say that usually she is "in a flurry, thinking about what step is next or finishing prep work right before ingredients go in the pot." A paper prototype test respondent echoed the previous sentiment that it is "easy to lose track of where you are in the recipe." This is a problem with recipes, which do not come with a way to bookmark which step is the current one. With the entire recipe laid out in front of a cook, it is easy to misread or skip a step. Also, when it is not clear what everyone is doing, cooks may accidentally step on one another's toes. Two online survey respondents pointed out that it is important to make sure two cooks do not do the same thing.

While collaborative cooking is a social activity, interactions between cooks can become tricky. An online survey respondent said that sometimes people don't know how to cook, but they work it out. One of our fast lane user test respondents who bills himself as someone who enjoys good food but is not good at cooking, lamented,

"I usually feel unhappy about being the most incompetent cook of the group. :("

He lives with three other men. They have a system in place whereby each person cooks once a week.

Personality clashes also frustrate cooks that are attempting to cook collaboratively. Aggressive cooks tend to dominate the kitchen. One of the fast lane user test respondents describes,

"Sometimes, one person can take over (in fact, this is usually what happens); this can be challenging in cases where there are multiple strong personalities in a group. Or if there is one person just trying to do everything."

Three online survey respondents commented that aggressive cooks act as head chefs, leaving the others to become *sous-chefs*. The scenic route user test respondent who told us it is more fun to cook with other people who also enjoy cooking divulged,

"I dislike cooking with people who don't have the same feelings about cooking as I do, or the same style, because it starts to make me think more about not stepping on someone's toes than about just enjoying the experience."

She elaborated by telling us that it is sometimes tricky cooking with her mother because they do not have the same style. Her mother prefers to stick rigidly to the recipe, and chastises her when she adjusts a recipe.

Respondents talked at length about task distribution. The heuristic evaluator who enjoys the problem solving aspects of collaborative cooking reported disliking "the diffusion of responsibility that can result in no one taking responsibility for a dish not getting burned or overcooked." He also said it was hard to decide "who gets stuck with unsavory tasks" such as chopping garlic and washing dishes. Indeed, online survey respondents revealed that some people are only interested in chopping. One of our in-depth interview respondents expressed his wrath for chopping herbs and his preference not to get stuck with such tasks.

Evidently, the field of collaborative cooking is ripe for potential improvements, both by way of offloading the responsibility for task delegation, and smoothing interactions between cooks. Some amount of choice is also useful, so that cooks can take on only tasks they enjoy. Our inspiration for Cookmark came partially from global navigation systems (GPS) in cars, which simplify route finding by figuring out a route automatically and showing only one instruction at a time.

Related Work

In our review of related work, we identify a few domestic technologies for the kitchen. While some of them embody notions of efficiency and are designed to improve time and resource management in the kitchen, others strive to improve the collaborative and social aspects of cooking. Efficiency-oriented cooking tools view cooking as a transaction and belie the notion of cooking as an expression of love and attachment (Bell and Kaye, 2002). Social cooking tools, on the other hand, pay attention to the multiplicity of users, their skills, and the importance of collaboration and discussion in

creating a more enriching and rewarding cooking experience. In this section, we describe both types of these cooking technologies and highlight their similarities and differences with Cookmark.

CounterActive
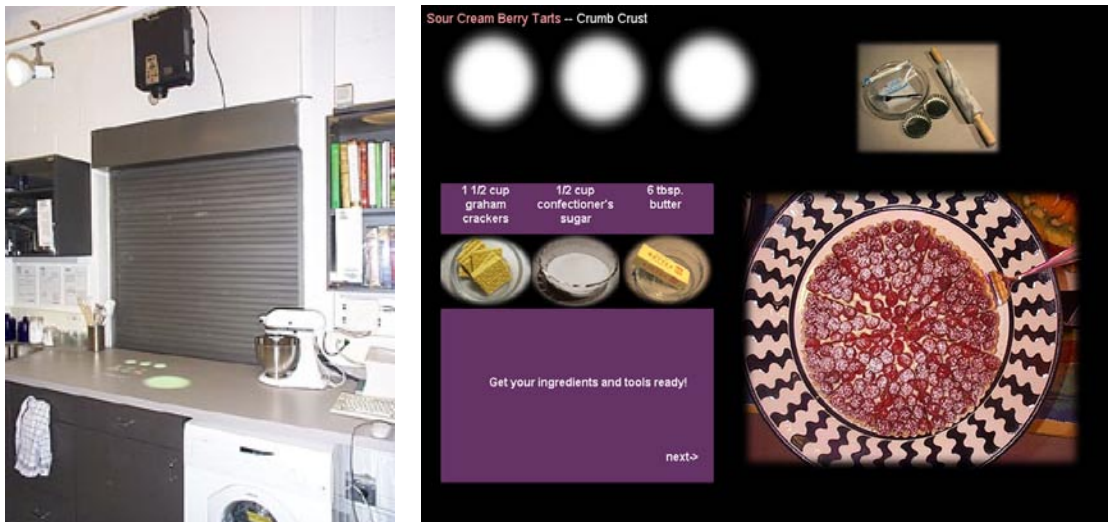
[Figure 1] CounterActive in Action

CounterActive is an interactive kitchen cookbook that teaches people how to cook. It projects the recipes onto the kitchen countertop, blending in with the environment and architectural space of the kitchen. Its focus is not to make meal production more efficient, but to enhance the experience of cooking. CounterActive provides instructions and pictures showing the cooks how to cook various recipes, and has the capability to provide cooking tips and demonstration videos, music and help on-demand (Ju et al., 2001). Its touchscreen interface allows the cook to navigate the display by pressing on words or highlighted "hotspots". The cooks receive the cooking instructions and supporting multimedia content at their own pace and put together their dish within the same interaction space.

MS Smart Kitchen Countertop

MS Smart Kitchen Countertop is a kitchen counter interface similar to CounterActive.[2] It allows the user to choose from a series of recipes to cook. It is voice activated, providing cooking instructions on demand. In addition, it uses image recognition algorithms to understand what is placed on the counter to predict cooks' activities and offer help proactively.

America's Test Kitchen: Let's Get Cooking
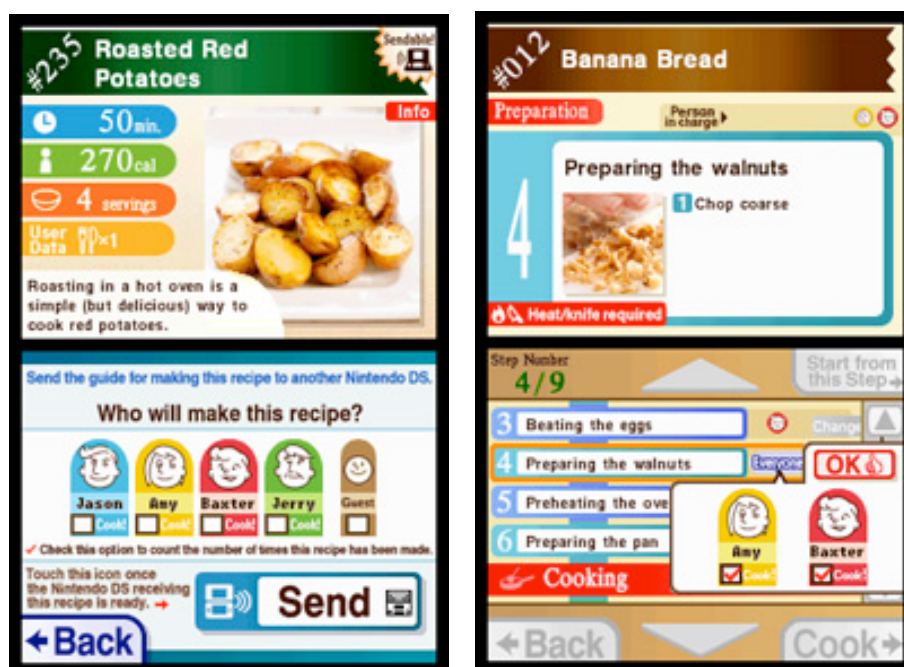
[Figure 2] America's Test Kitchen: Let's Get Cooking

Let's Get Cooking is a touch-based and voice-activated Nintendo DS game that allows multiple cooks to collaborate together on dishes.[3] Each cook can create a profile with his or her cooking preferences. The software allows the user to set his or her preferences for using a knife or stovetop. Before a cooking session, the cooks check off

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[2] http://www.smartergadgets.com/2006/04/11/smart-kitchen-countertop/ (accessed May 4, 2010)

[3] http://www.nintendo.com/games/detail/fIeyCqi4iFZwJXW395q2KhDE0wyfId_q (accessed May 4, 2010)

the specific tasks they want to work on. If the tasks align with the set preferences for a particular cook, the game assigns the task to that cook. Cooks can also determine the head chef for a cooking session. By default, the head chef performs most of the cooking tasks and the other cooks are involved with the preparation. Let's Get Cooking also provides cooking tips, photos while cooking, but the how-to videos are accessible separately. It also supports annotations, grocery shopping lists and a calendar tool to track the recently cooked dishes.

[Table 1] Summary of Existing Technologies and their Similarities to/Differences from Cookmark

Related work	Similarities	Differences
CounterActive	• Provides instructions, cooking tips, and demonstration videos on demand for a chosen recipe • Emphasis on cooking experience, rather than making meal production more efficient • Natural and unobtrusive interface that blends with the kitchen environment	• Functions more as a teaching tool than a social and collaborative cooking tool • Target users appear primarily to be children • Tested on one user at a time • Allows physically tracking ingredients and detecting user actions
MS Smart Kitchen Countertop	• Allows users to choose a recipe to cook and provides instructions on demand • Natural and unobtrusive interface that blends with the kitchen environment	• Functions more as a personal smart kitchen guide than a social and collaborative cooking tool • Focuses on efficiency and time management • Uses image recognition technology to understand the ingredients on the counter to predict user's activity and offer help proactively
America's Test Kitchen: Let's get cooking	• Allows multiple users to cook together on one dish • Allows cooks to set up their preferences—only for using a knife or stovetop • Provides cooking tips while cooking • Displays tasks on demand	• Cooks manually choose the tasks they want to work on in advance, and also who plays the role of the head chef • Supports annotations and grocery shopping lists and is voice activated • Cooks share one small screen • Task allocations are serial, rather than in parallel • Cooking multiple dishes requires multiple DS devices • Does not show the overall picture of the cooking process at any given time (only shown when users wish to see the task flow)

**Interface Design**

Core Design

[Figure 3] Cookmark Main Screen and iPhone Preference Screen

We set out to design and build a fully functional prototype that would successfully help multiple people cook multiple dishes. Our prototype is a main interface screen for recipe selection and provides one panel for each cook that contains the assigned task and a "Done" button. As a supplement, cooks with iPhones create a profile with their name and photo, choose their cooking preferences, access their individually assigned tasks, take pictures throughout the cooking process, and save them to be viewed later as a visual history. The iPhones are synchronized with the main Cookmark interface. The cooking preferences target vegetarians who prefer not to handle meat, allergic people who dislike chopping onions, and people who are uncomfortable or too young to handle knives. Cookmark honors cooks' preferences when it delegates tasks. The iPhones give cooks the option of referring back to their assigned tasks without having to always crowd around the main screen. At the same time, we hoped the main screen would foster an environment of collaboration and discussion.

We tested the idea out as an experience prototype, on ourselves, to see firsthand what the experience would be like. We used a rough paper prototype based on initial sketches and cooked a full meal with it. Then we made a more extensive paper prototype based on new sketches created from the findings from the experience prototype, and tested it on our first set of users. All users cooked the same set of two dishes: an entree and a salad.

Experience Prototype
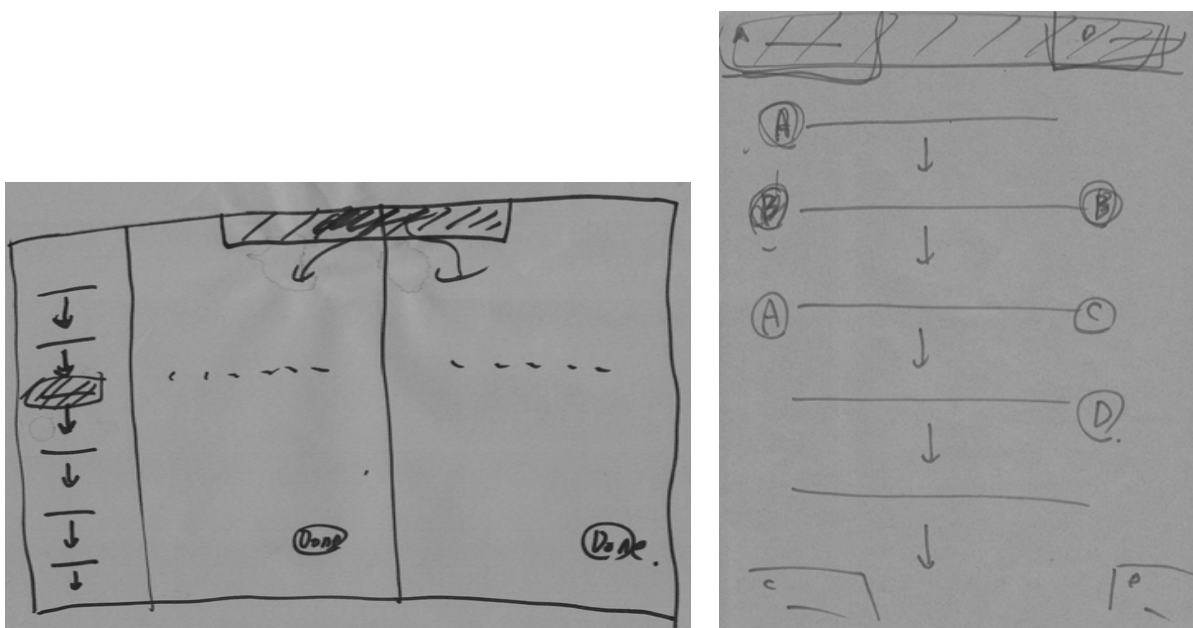
[Figure 4] Initial Sketches of Recipe Task Flow

At this point, we had fleshed out some of the major issues with our design. Between the experience prototype and the paper prototype, we discovered that receiving one task at a time without context was very discomfiting. We wanted to know why we were doing a particular task, and where it fit in the recipe. Because of this, we considered two options: 1) show the next task above each cook's panel, like a preview of the next Tetris block in the Tetris game, or 2) provide the recipe in its entirety. We opted for the second

option because it shows the entire context, including previous tasks, with a marker at each cook's current step. Also, since each task is assigned individually, context is especially important, so tasks needed to be rewritten to clarify how many of an ingredient was needed, or which of two onions for two different recipes needed to be sauteed.
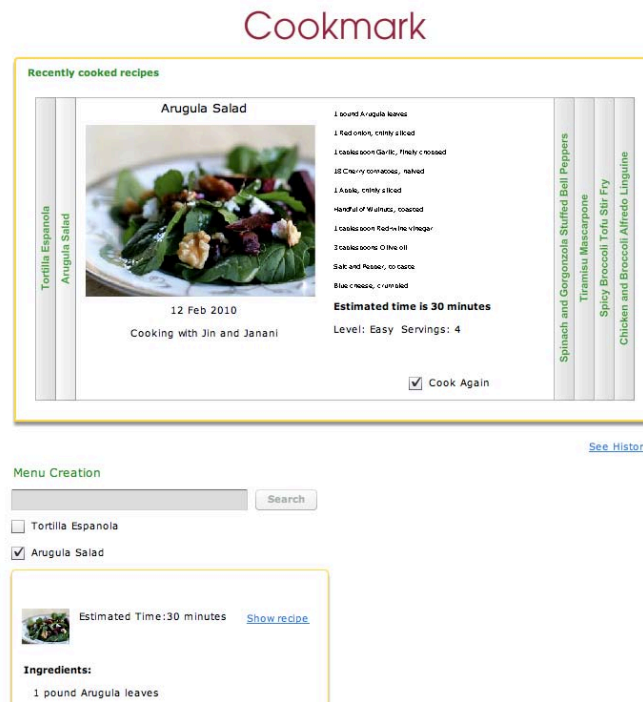
[Figure 5] 'Cook Again' and Accordion Widget

We brainstormed a few new features as well, such as including an accordion widget of recently cooked meals. A "Cook Again?" checkbox can be checked, and the dish is added to the menu. We noticed from our survey that sometimes people take responsibility for individual dishes. One person might say "I'll take care of the salad" and another person might say "Okay, I'll do the mashed potatoes." We worked into our paper prototype the ability to choose to 1) work on one particular recipe, 2) work anywhere you are needed, and 3) help out just a little.
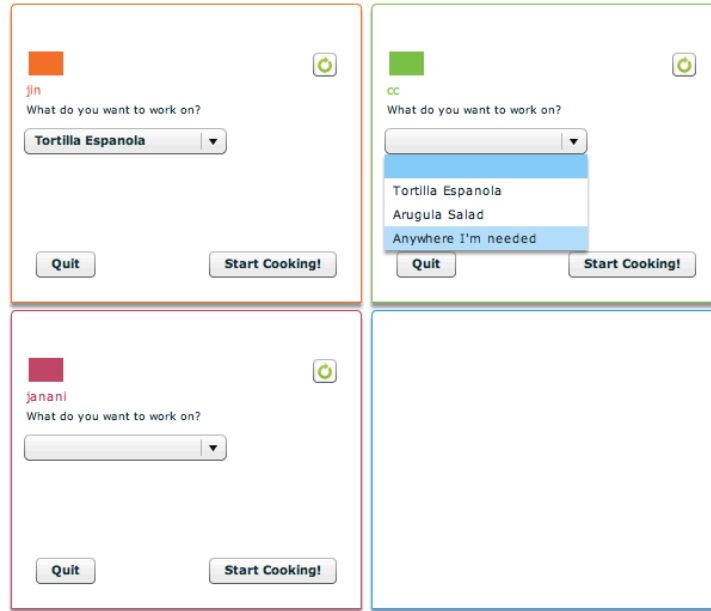
[Figure 6] Users' Cooking Scope Options

We also wished to accommodate our scenic route cooks by including music, videos, and tips about the food in the interface, to educate, entertain, and hopefully spark conversation.

Paper Prototype

[Figure 7] Paper Prototype

[Figure 8] Paper Prototype User Testing Session

From the paper prototype, we learned that additional context was needed. For example, using color to distinguish cooks was not clear enough. Each cook needs to have his or her name on his or her panel. Our users also suggested that we show the recipe to which each assigned task belonged. They wanted to know how many servings each dish would make. Since they had never cooked the dishes before, and had not seen some of the ingredients before, they mentioned that it would be beneficial to have a picture of what the dish looks like at each step, and a picture of unusual ingredients. They suggested using an automatic timer for tasks requiring a certain amount of time. Finally, they asked for a feature like "Depart by" and "Arrive by" on Google Transit that would ensure that all dishes are completed by a certain time.

As for their experience, the users told us the iPhone application was very useful for glancing over and seeing their next task. They liked having the choice not to chop onions, citing their own inexperience with chopping and slicing. They also commented

favorably about the history of recently cooked dishes. We discuss their experience

further in the Evaluation section of this paper.

Interactive Prototype Implementation

[Figure 9] Interactive Prototype in the Kitchen and Cookmark Main Screen

We decided to build our interactive prototype as a Flex website with an iPhone

application component. We wanted to choose a form factor that would be accessible to

the most people. With an Internet connection, browser, and Flash, anybody can use

Cookmark. We chose the iPhone platform over other mobile platforms because the

iPhone was very prevalent at the time of development, and our ownership of iPhones

made testing easier. We wrote PHP code to communicate between Flex and the iPhone

application and used comma-separated value (CSV) files to store the data: recipes,

task dependencies, cook names, preferences, and task assignments. Writing code to

automatically figure out task dependencies (for example, the task involving sauteing the

onions depends on the task where a cook chops the onions) would have required

natural language processing. Since we implemented this prototype solely for the

purpose of demonstrating and evaluating the experience of cooking with such an

interface, we chose to hard code the tasks, their dependencies, and their classification as onion, meat, or knife tasks inside the CSV files, for only two recipes. We decided early on that halving or doubling a recipe would be a good idea, or better yet, telling Cookmark how many people are eating and letting it figure out how to adjust the recipe, but did not implement this, partially because the tasks were hard coded. We procured a Toshiba Tecra M4-S435 touchscreen computer with stylus input to use for two of our three sets of tests.
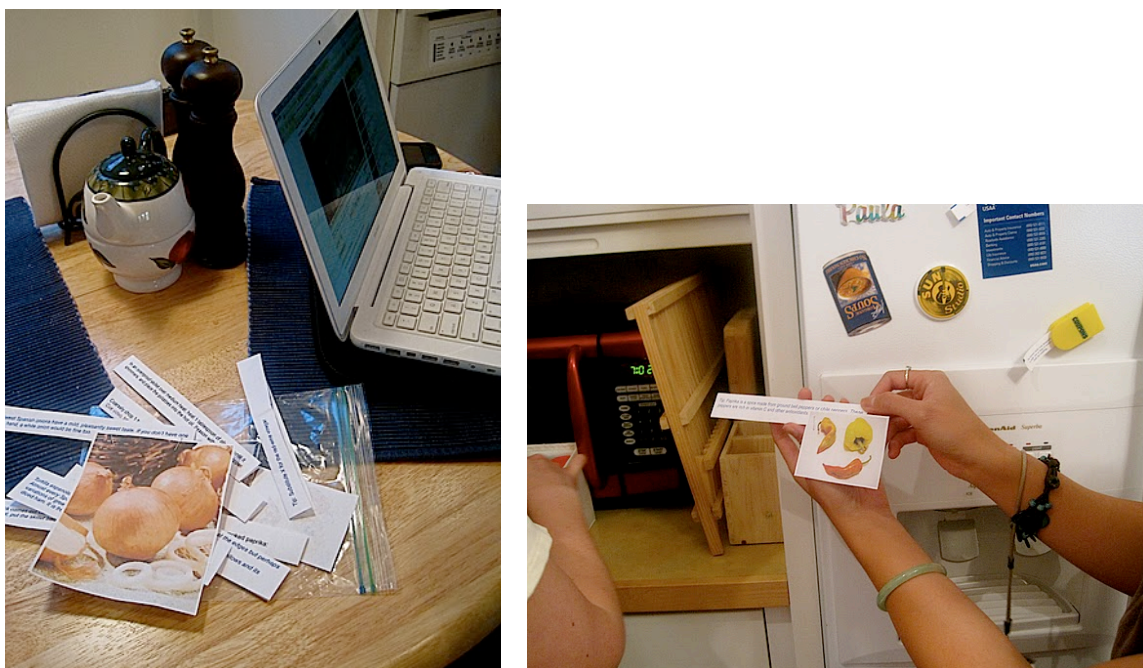
[Figure 10] Contextual Tips as Part of the Scenic Route

For the supplementary videos, pictures, and tips on the chemistry of food, or what we called the "scenic route option", we originally designed Cookmark to include a slider that cooks choose based on how much extra information they want to see. However, after speaking with users, we realized that this was an artificial construct that did not ring naturally with them. We also realized that we could include the information such that users make a conscious choice to access it. In other words, videos are played only

when a user clicks on the play icon, and tips are available as a sidebar if the user chooses to read them. Due to time constraints, we tested this "scenic route" aspect of Cookmark first as a paper addition to the digital testing and then on a computer to preserve the digital quality of the experience.

The interactive prototype and iPhone application both successfully assign tasks based on user preferences and task dependencies. When at least one user cooking the same dish consents to a preference (for example, handling knives), Cookmark does not assign tasks involving knives to those users opting out of that preference. Tasks are only assigned once all the tasks upon which they depend have been completed. When multiple dishes are being cooked, users' preferences for cooking only one, or both, dishes are honored. We removed the option to help "just a little" because the other two options were by far the more prevalent use cases. For cooking sessions where multiple dishes are being cooked, tasks are assigned from all recipes as tasks become available. Taking into account the task dependencies, and cooking and recipe preferences, inevitably means that there will be times that no task is currently available. In these cases, the user gets a "Take a break and relax" message and is notified with a 'ding' sound when a task has become available. The task appears in the user's panel. When a user's recipe is complete, he or she receives an "Enjoy your meal!" message notifying him or her that he or she is done.

[Figure 11] User Gets a "Take a break and relax" Message

Shortly after testing our interactive prototype on the first set of three users, we added

a colorful trail showing which tasks each cook has completed and is currently doing.

The tasks are highlighted with colors corresponding to the unique colors assigned to the

cooks. We decided to do this after observing the first set of users express confusion

over which tasks had been completed by others.
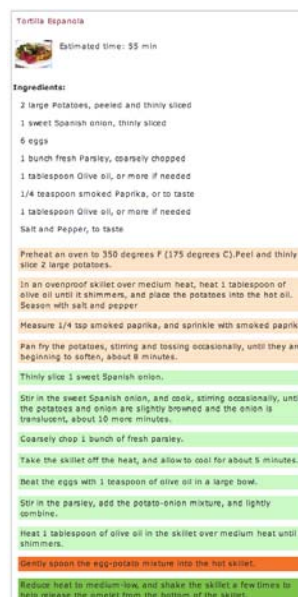
[Figure 12] Colorful Trails Showing Cooking Activity

We also recommended a certain number of cooks for each recipe and provided an estimated time to completion depending on how many cooks are involved.

Evaluation

We tested Cookmark on ten users: five males and five females. All were in their twenties and thirties. They fell roughly half and half in the scenic route and fast lane categories. Each test lasted an hour to an hour and a half, and involved cooking tortilla española and arugula, apple, and walnut salad. Additionally, we conducted a heuristic evaluation with two females and one male to pinpoint usability issues. These three subjects did not cook, but all thirteen subjects were asked to fill out a written post-test survey. We observed the subjects and took notes on their behaviors.

Emotional Affordances

The reaction to Cookmark was overwhelmingly positive. One female scenic route user deemed it a "really cool head chef." She went on to say,

> "I trusted Cookmark not to leave out any steps, and it was easier to focus on the
>
> task at hand instead of stressing about the larger picture."

Another user test subject said, "I feel much safe, knowing that I'm in right track." The "Take a break and relax" message had an unintended effect:

> "Cookmark made it possible to relax between steps! Usually I am in a flurry,
>
> trying to figure out what step is next or finishing prep work...The biggest benefit
>
> was not having to worry about any of that, because Cookmark did it for me."

[Figure 13] Users Relaxing Between Tasks

The male fast lane user who usually feels unhappy about being "the most incompetent cook of the group" reported "feel[ing] good about my cooking already". Since Cookmark assigns each cook one task at a time, this user did not realize he was cooking such a complicated dish. For him and his friend, cooking this way was much easier, and they were surprised when the dish came out that they had successfully cooked it themselves. For them, step-by-step cooking was a less intimidating way to cook. His friend told us that he "felt great, because it made things simpler and manageable."

[Figure 14] Fast Lane User Uses Cookmark

One heuristic evaluator divulged some of his discomfort with Cookmark. As a self proclaimed expert collaborative chef who cooks with others as part of his student co-op responsibilities, he saw Cookmark as requiring him to "relinquish alot [*sic*] of the control (and sticking more to the recipe), which [are] hard for [him]." Since he did not cook with Cookmark, we would like to recruit him to cook with the interface and observe his experience with it. While it may be possible that he would still feel the same way using the interface, our observations of other expert cooks using Cookmark suggest to us that Cookmark may be more flexible than he thinks.

Stress Relief

The user test subject who called Cookmark "a really cool head chef" reported feeling less pressure as the head chef in her own kitchen, because it "anticipated the timing issues and took the pressure off having to decided who has to do which task." She went on to say,

> "It was easier in that I only had to focus on one task at a time, and then had time
>
> to "hang out and relax"/clean up/work on other things until my next task."

A male fast lane user test subject remarked that with Cookmark it was "easier to know what to do." All users told us they had fun cooking with Cookmark.

Interaction between Cooks

A male fast lane user test subject found Cookmark to be most beneficial in that it "alleviates the effect of one cooker [*sic*] to some degree, since the leading of the cooking is done by the program." The female scenic route user test subject who told us it was tricky cooking with her mom said that she liked the fact that "tasks were assigned by the computer, so we didn't trip over each other so much." A heuristic evaluator who

did not cook surmised that Cookmark may "take away at least one piece of interaction, deciding who does what."

Socializing

This was good food for thought, and most interesting because we heard two angles: Cookmark takes away the piece of interaction whereby users delegate tasks for each other, and Cookmark does the delegating, "leaving more time for enjoying others' company, drinking wine, etc." The male fast lane user test subject quoted above added, "This could be good or bad, depending on your style." For him, since Cookmark tells cooks directly what to do, they spend their time socializing rather than delegating. Multiple users commented on how much fun they had using the interface. The user above said it was fun to "be able to easily collaborate on cooking with several people." A female scenic route user said, "It was a very fun experience." The male fast lane user who feels like an incompetent cook among his roommates said it was "definitely more fun." The heuristic evaluator who thought Cookmark might require him to relinquish a lot of control also guessed,

"The constant task flow discourages some of the more collaborative efforts, like

jumping in to help when someone has fallen behind."

However, since he did not cook with Cookmark, we still feel it would be useful to have him cook with the interface. Also, we witnessed several occasions during user testing with subjects who did cook with Cookmark where participants helped each other out. For example, when one user did not know how to slice an apple, another user taught him how to do it properly. These users also discussed which spices to use as substitutes for the smoked paprika in the tortilla española dish. We also observed two

other test subjects collaborating over the stove. In both cases the person helping was the more experienced cook.

[Figure 15] An Expert Cook Helps Out a Novice Cook

In another user test, the subjects were two fast lane males who were more inexperienced with cooking. They asked us many questions that would normally be directed to a head chef, and should have been directed towards Cookmark. These experiences suggest to us that even with Cookmark, expert cooks naturally fill the role of head chef, and adjustments and substitutions can still be easily made, just as they are when cooks follow written recipes.

Intelligent Distribution of Work

Test users found Cookmark to be effective in at least three ways:

1. Intelligently distributing work so that everyone feels involved

2. Eliminating the problem of undesirable tasks by honoring cooks' preferences for certain types of tasks

3. Showing at a glance what others are working on

The first point refers to Cookmark's ability to take into account, in parallel for multiple cooks, which tasks are dependent on others, and only assign tasks whose dependencies are resolved. As one female scenic route user pointed out,

> "It's less likely for the "cooking together" to turn into one person cooking and the other just doing dishes...It was easier for everyone to have a clear role with Cookmark than it would have been without."

A male fast lane user commended Cookmark for doing the division of work optimally. The heuristic evaluator who cooks in his student co-op said Cookmark makes divvying up tasks easier and "provides a good baseline for what people should be doing when." The male fast lane user test subject who brought up the effect of one dominant cook said,

> "It's much easier to cook with groups in such a way that everyone is involved; this is fairly difficult without such a system."

The second point refers to the ability to tailor Cookmark to only assign tasks to cooks that they like to do, using preferences feature in the iPhone application under Profile. One of the male fast lane users pointed out that he and his friend got to do only things they like to do. The male heuristic evaluator said that Cookmark "eliminates some of the problem of undesirable tasks." An in-depth interview subject who was shown the prototype commented that he would choose not to chop herbs. One of the paper prototype test users liked the convenience of the iPhone itself, and not having to go back and forth between the main Cookmark interface and her work station.

The third point refers to the colorful task trails we added after the first interactive prototype user test. For both of the paper prototype test users, it was important to know

what others were working on. Since the paper prototype marked the current tasks (not the completed ones yet), these user test subjects found that Cookmark "allowed participants to help each other and to share the big picture of the entire cooking process in mind." For one of these users, the existence of the recipe and the markers added context to those who are not typically the head chef, so that everyone has a glimpse at what the head chef would know. After we added the task trails that included completed tasks, several users commented on them. The male heuristic evaluator said that the trails made keeping track of progress in a recipe easier. A female scenic route user test subject liked the built-in ease with which she could "switch back to the entire recipe."

The music, tips, and videos we included, which were targeted at scenic route users, received a warm reception. One of the two male fast lane cooks who cooked together said,

"I could see videos of things I don't know how to do & background music is awesome."

A female scenic route cook who loves baking and cooking raved about this aspect of the interface:

"I really liked the extra information that was available for making alterations and ingredients' origins...I felt like I had access to all the info I needed."

Finally, multiple users comments that the interface itself was visually pleasing and user friendly.

[Figure 16] The Finished Product from Cooking with Cookmark

Future Work

Based on our findings from user testing and feedback we received from our subjects, we identify a few areas of future work to improve the overall collaborative cooking experience with Cookmark.

Adding more context

- Show photos of every stage so users can compare what they have made with a benchmark on how the dish should look.

[Figure 17] Sketch of Showing Photos of Every Stage

- Add the task number to the current task. For example, showing that the cook is currently on task 2 of 4 informs him or her of how many tasks have been completed and the number that remains to be done.

- Every cook has burned something at one point or another. Not having a recovery plan causes them more stress and anxiety. It would be useful for Cookmark to support cooks with alternate 'rescue plans' that guide the user out of disastrous cooking situations, relieving stress particularly for novice cooks.

- Add a graphical bird's eye view of the entire process and the tasks involved gives more context to the individual steps by not only showing the dependencies between the various tasks in the recipe, but also highlighting each cook's contribution to the cooked dish.
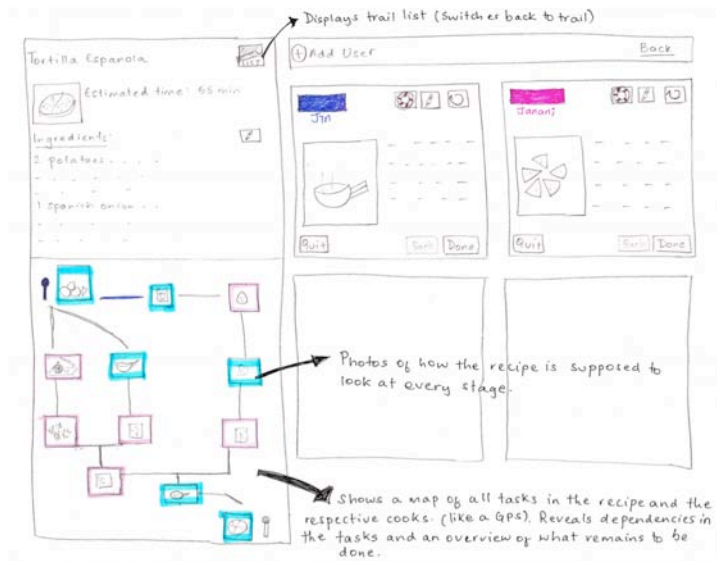
[Figure 18] Sketch of Graphical Bird's Eye View Option

Encouraging cooking as a social activity

- Support social networking in the Cookmark user community by encouraging people to share recipes, tips and photos of their process and the outcome.

- Give cooks the ability to make annotations such as notes to self, substitute or alternate ingredients used, and modify the recipe on the fly for future sessions.
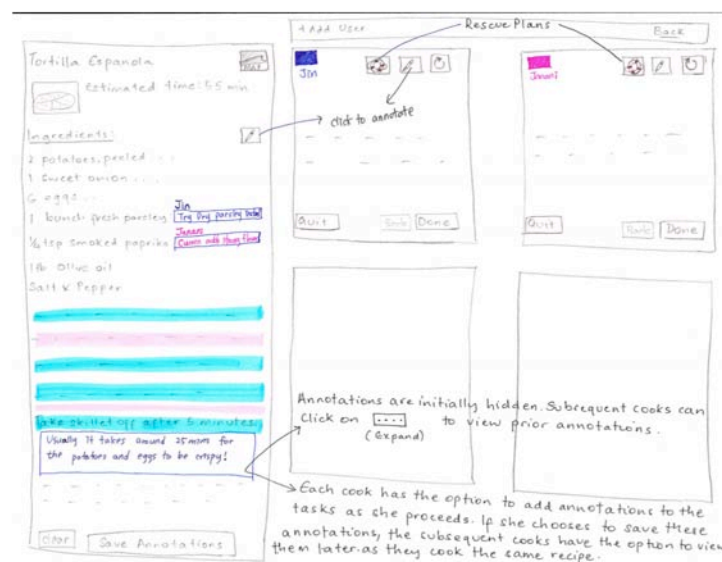
[Figure 19] Sketch of Annotation Functionality

- Provide a space within Cookmark where people can reflect on their cooking experience. This component will let the cook write about his or her overall experience, including things that went wrong, how he or she worked around the problems encountered, the lessons learned, and so on. In addition, allowing other people to comment creates a rich medium for social interactions on cooking. It encourages discussions on cooking and serves as a useful information tool that novices can use to learn from.

- Provide visualizations of users' collaborative cooking patterns every time a new cooking session. This has the potential to initiate discussions on their cooking styles and preferences. For instance, Cookmark currently shows a colorful trail that visualizes how a cooking session progressed. Because Cookmark assigns tasks based on each cook's preferences, this trail tells us something about the different styles of cooking that were involved in that session. At a deeper level, it also tells us something about the individuals who participated and the cooking relationships between them. Capturing these trails from a cook's session and displaying it as a part of his or her profile creates visibility of distinctive identities and relationships that exist within the Cookmark user community. It is also an indicator of how one's cooking styles and preferences change over a period of time.

[Figure 20] Sketches of Capturing Colorful Trails Functionality

Improve effectiveness

- Show alternate ingredients because a cook may not have a particular ingredient.

- Dynamically change the measurements of ingredients based on the number of servings.

- Give cooks the ability to create profiles and register from the main Cookmark screen.

- Some of our users indicated that they would like to do no more than cleaning up and washing dishes. Accommodating the needs of these users will mean expanding the list of user preferences to include even tasks such as "washing dishes."

- One user commented that Cookmark generates more dishes as cooks work in parallel. It would be useful if Cookmark advises cooks on the optimal use of dishes and utensils based on the task assignments.

- Add more recipes to the database and support searching by time, ingredient, and map region, and offer recipe suggestions based on upcoming holidays.

- Support timer functionality for timed tasks. During our user tests, cooks expressed a need to be given feedback on the 'time remaining' for timed tasks.

Conclusion

Food, cooking, and kitchens play a central role in our lives. People cook not merely for sustenance but to express their love for one another. As Bell and Kaye (2002) observe, cooking is an act of love, a ritual, a lesson. Foods are "memories of lovers, vacations, childhoods, family dinners gone wrong, family dinners gone right, first dates, last dates, and shared memories (Bell and Kaye, 2002:17)." In this culture, kitchens are a significant 'ecology' that brings together objects, people and most importantly, experiences. Even as we see an increase in computing technologies for the kitchen, their goals seem to "reduce cooking to a domestic science, the kitchen to a collection of labor-saving devices, and food to exercises in packaging (ibid)." By overly emphasizing on the maximization of the efficiency of tasks in the kitchen, they lose track of the joys of collaborative cooking and its social importance.

Cookmark is a technology whose focus is not on improving the efficiency of tasks, but rather on enhancing the overall experience of collaborative cooking. This is not to say that it does not improve efficiencies in the kitchen—it does minimize the time and stress in the kitchen—but this is not the primary driver of its design.

In this report, we have described the needs assessment and iterative design process of Cookmark. Through our design evaluations, we identified five main areas in which Cookmark enhances the collaborative cooking experience. Important areas of future work include adding more flexibility through recipe adjustments and encouraging more social networking in cooking. By prioritizing 'people' and the social practices common in cooking, we hope to turn the limelight in the realm of kitchen computing back to people-driven designs.

References

Bell, Genevieve and Joseph "Jofish" Kaye, 2002, Designing Technology for Domestic Spaces: A Kitchen Manifesto", Gastronomica—The Journal of Food and Culture, Volume 2, Issue 2, Pages 46–62

Ju, W., R. Hurwitz, T. Judd, B. Lee. 2001, "CounterActive: An Interactive Cookbook for the Kitchen Counter." Extended Abstracts of CHI 2001 (Seattle, April 2001) p.269-270