Human-Food Interaction Framework: A New Design Tool Used to Understand Amateur Home Cooks' Needs

Sohyeong Kim, Da Hyang Summer Jung, Anand Upender, Sahej Claire, and

Ion Esfandiari

Center for Design Research, Stanford University, Stanford, CA, USA
{sohkim,summerjung,anandx,saclaire,ionesfan}@stanford.edu

Abstract. Our present research focuses on gaining a better understanding of the relationships between food and different human stakeholders in order to develop our Human-Food Interaction framework. This paper focuses on the key stakeholders of people new to the kitchen called "amateur cooks." We noticed there is a gap in research on this group regarding how they transition between taking stored food and choosing how and what to cook. We discovered from initial interviews that more amateur home cooks initially strictly follow recipes and therefore create food waste on the niche ingredients they buy for each recipe. More advanced cooks see recipes as composed of an essential base (like pasta or salad) and extras which are added on to that base (like nuts, sauces or cheese). As a result, we sought to develop a tool to help amateur cooks unleash their creativity and gain confidence while cooking. Our research led us to develop a prototype called *Flavor Explorer*, a new algorithm and corresponding interface that allows amateur cooks to find the best ingredient pairings depending on what they have stored in their kitchens. With this tool and our research, we thus hope to highlight the importance of the needs of this user group while proposing a novel tool that could actually help amateur cooks around the world.

Keywords: food design, ingredients, confidence, home cooks, design thinking

1 Background

1.1 Human-Food Interaction (HFI)

Food is significant in every walk of human life from physical and mental health to social and cultural perspectives. There have been attempts to understand food-related behaviors based on Human-Computer Interaction (HCI), framed as Human-Food Interaction (HFI) [1, 2]. HFI is the study of the interface between food and people, whether at the level of food production, preparation, or consumption. To understand the interactions more systematically, we adopted a conceptual framework from existing literature on food systems. Food systems have been understood as a "set of activities ranging from production through to consumption" [3]. This framework operates with several

different stakeholders, defined as those who have an intentional interest or designated role in the food system. Examples of stakeholders are farmers, cooks, and consumers.

Table 1. Primary food-related activities in the food subsystems [2]

Subsystems	Examples of activities
Production	Farming, growing, harvesting
Storage	Packaging, labeling, freezing
Culinary Processing	Preparing, cooking
Foodservice	Serving, catering, transporting, wholesale/retailing
Food Data Management	Communicating, collecting, storing and accessing data (e.g., nutrition, culinary know-how, and knowledge, etc.)
Consumption	Eating, digesting
Waste	Composting, recycling

1.2 Amateur Home Cooks

In this qualitative study, we decided to focus on one main transition period people face with food: their move to a first apartment or home that requires them to learn to cook for themselves and possibly others (non-commercially). This group's development is crucial as we know that adolescent's confidence in their cooking ability in this stage can even have long-term impacts on diet and consumption of fast food [4]. We define amateur cooks as individuals or couples in their twenties who do not have a background in cooking from their childhood. These people are a large entry group to the funnel of people who cook in America and by studying them, we hope to display opportunities for changes in how we perceive culinary confidence, grocery shopping, and food waste.

2 Research Process

We adopted the design thinking process as a research process, which is heavily grounded user-centric [5]. The process, which is a novel user-centric approach to problem solving and innovating, is broken down in the steps of empathizing, defining, ideating, prototyping, and testing. We started our research by conducting extensive interviews with our target user group to learn more about their needs (empathize). From these interviews, we then identify research questions we can focus on based on patterns observed, before diving into more interviews (define). Finally, as we seek to develop a solution which would solve our target user's need, we engage in brainstorming (ideate) and then develop and iteratively test that solution (prototype and test). By the end of that process, we have thus identified an important user need and a solution that successfully responds to that need. As this research is still in the pilot study, research method was only qualitative, though we plan to include a quantitative method in the future.

3 Research Questions

Of the different stages of the HFI framework, we decided to focus on the transition from storage to culinary processing in this paper.

Fig. 1. Summary of interactions between consumers and their food. "X" indicates a gap in research and solutions.

Compared to others stages of HFI framework, such as logistics and food waste, there is less research on the transition between storing (fridge and pantry) and cooking food. We adopted the approach of observing user groups with extreme needs because this research style has been shown to fluidly lead to new insights on future high-technology products [6]. We explored various extreme groups and decided to focus on a precise segment of consumers: amateur home cooks, as described in the Background. We had a general understanding of how amateur cooks store and prepare ingredients, but we identified opportunities in the interactions between these two processes, such as deciding what to make or handling leftover ingredients after cooking. This gap led to one main research question: what barriers do amateur cooks face in transforming a set of raw ingredients into complete dishes given their diverse cultural, societal, and personal preference constraints [7]?

4 Results

4.1 Preliminary Findings

We interviewed five individuals and couples in the Bay Area, 20-30 years old, who had recently gone through a transition in which they began to cook more. Through deep interviews with this group, we identified a few key findings.

People who are new to cooking often express a deep fear of "messing up," saying things like "I would burn a pot of boiling water" or "I just know how to make toast." One mom said of her daughter, "My daughter is...afraid to cook something and it not coming out the same, also afraid that her new husband will judge her cooking, so she doesn't feel comfortable moving away from a recipe." Many interviewees spoke about this desire for consistency and fear of letting others down with a failed attempt. They would stick to a recipe in order to deflect blame in case of a poor meal. There seems to be no incentive to experiment or time set aside from busy weekday eating hours to learn about cooking. Therefore, people who do not grow up in a household of cooking end up passively learning while cooking day-to-day meals often with the stress of a full-time job.

Furthermore, there is a desire in these new cooks to differentiate what is essential and what is extra. Essential ingredients are objective ingredients at the core of a dish like a chicken breast or pasta and extra ingredients are subjective ingredients that could be substituted like thyme or sesame oil. Traditional recipes tend to be inflexible, not informing users which ingredients can be exchanged or even left out entirely with a similar result. These amateur cooks hold a shared belief that they must follow recipes exactly as written, buying specific, niche ingredients to do so. These ingredients are often specific to a single recipe, making it difficult to use the leftover ingredients without a deeper knowledge of them. This leads to increased food waste from unused ingredients and also perpetuates a feeling of intimidation. Recipes are designed for one meal, but ingredients are packaged for many.

In addition, we found that amateur cooks' discomfort with modifying recipes may be due to gaps in knowledge around simpler cooking techniques and dishes. For example, they would find it difficult to cook a chicken piccata if they had never mastered the simple act of grilling chicken. We began to define a recipe framework centered around this finding called "bases," in which standard dishes, such as a quiche, omelet, or grilled chicken, should be taught first so amateur cooks feel comfortable preparing a wide array of more sophisticated variants of these bases. We even saw with two more culinarily advanced interviewees that they had organically developed this mental framework in which they would cook a base dish routinely but then experiment with new additions as their pantry changed. In talking about omitting an extra ingredient, one said, "But then I just made it without it, and it was fine. It just wasn't as deep flavor and that was fine." This sense of play and improvisation is a key trait that is common around more culinary confident individuals even if they are early in their learning and experience.

Finally, along with this notion of "base" ingredients, we uncovered that certain ingredients may seem simple and foolproof to most amateur cooks. We heard that eggs are one of these "because you can like, even if you're a bad cook... always make something with it. You can always put it in... anything." Recipes with these staple ingredients could be used to build confidence in those new to cooking.

4.2 Guiding Questions

After analysis of the interviews, we formulated guiding "How Might We" (HMW) questions to base our research on as part of the design thinking process [8]. These included: HMW help new cooks reuse leftover raw ingredients in creative ways? HMW help new cooks learn "base" skills and dishes? and HMW encourage new cooks to modify and personalize these "base" recipes? The relationships between these varied questions guided us in understanding how beginner cooks can gain the efficiency and creativity that more experienced cooks have. The main question simplified down to "How can we help new home cooks make use of seemingly-disparate leftover ingredients in their storage?"

4.3 Prototype

Ideating and prototyping in cycles gave our team the opportunity to explore diverse solutions from new types of bento-box Tupperware to modular cookbooks. After receiving feedback from users, we concentrated our efforts on a single prototype addressing our key goals: instilling culinary confidence in amateur cooks, leveraging their leftover ingredients, and teaching them to master simple "base" recipes.

"The Flavor Explorer" is our vision of a tool that allows amateur cooks to explore relationships among the ingredients in their home as they plan a meal. A user can select anchor ingredients that they know they want in their meal, and the algorithm suggests appropriate pairings and how to bring them together into a dish.

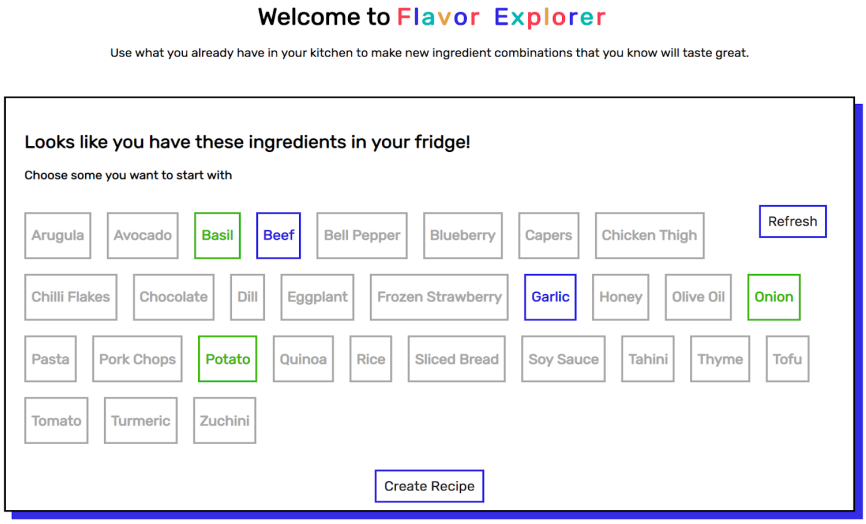

Fig. 2. Recommendation of pairings when garlic and beef are chosen as anchors. Blue ingredients are selected by the user and green are recommended.

For example, if one chooses the leftover garlic and beef from their fridge as anchors, the algorithm may recommend they use basil, potato, and onion from their pantry to make dinner. On the other hand, if they choose blueberries, the system recommends that the blueberries could go well with chocolate, frozen strawberries, or honey. Their personalized "recipe" is then generated—relieving the cook of the stressful task of finding their own—formatted for easy comprehension and flexible enough that the cook can add their own twist (still being built). In taking a closer look at a modern recipe's structure, we considered adjustable parameters such as time, difficulty level, and novelty. Our aim goes beyond a simple recipe generator; we wish to give beginner cooks the confidence to personalize basic recipes through tools that inspire such improvisation. We hope the output of our research can be the stepping stone that builds amateur cooks' intuition for flavors and ingredients.

5 Conclusion and Limitations

Our current iteration of the Flavor Explorer is limited to a small set of 30 ingredients that have manually labeled similarities. In future tests, we would like to use a large open-source dataset of ingredient similarities to create a more robust system. The system assumes that there exists adequate technology to know what ingredients a user has. We believed this to be a fair assumption given the rise in smart fridges as well as more simple receipt apps. We also determined unanswered questions that require new prototypes and tests. Much of it would revolve around the subjective quality of confidence and how an interactive product (rather than a human or a teacher) could instill confidence. Furthermore, if we are going to replace modern, static recipes with more dynamic ones, it is important to understand which aspects of current recipes are constraining and which are supportive and adequately prescriptive.

Through the presented research, we intend to create a welcoming platform for amateur cooks to feel more confident in their creative choices. Our future research, however, focuses more broadly on defining the human-food interaction framework by understanding its stakeholders and their experiences with food. In addition, the human-food interaction framework will elucidate the interconnected relationships between such stakeholders and the many other stakeholders they deal with. We aim to enhance this framework and provide it as a design tool for food design researchers, food entrepreneurs, and food corporations to identify and augment future ventures. Through doing so, we hope to create a network of both knowledge and interpersonal relations that can be leveraged as not only a design tool but as a means to effect change.

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