Stop Wasting, Start Tasting! Design Speculations for Reducing Food Waste in The Hospitality Sector

Hüseyin Uğur Genç
Koç University – Arçelik Research Center for Creative Industries
34450 Istanbul, Turkey
hgenc17@ku.edu.tr

Hakan Yılmazer
Koç University – Arçelik Research Center for Creative Industries
34450 Istanbul, Turkey
hyilmazer18@ku.edu.tr

Mert Yıldız
Koç University – Arçelik Research Center for Creative Industries
34450 Istanbul, Turkey
mertyildiz18@ku.edu.tr

Aykut Coşkun
Koç University – Arçelik Research Center for Creative Industries
34450 Istanbul, Turkey
aykutcoskun@ku.edu.tr

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Abstract
Food is an essential nutritional source for all humans, yet tons of food is wasted at an increasing rate each year. Although previous HCI studies examined this issue, most of this work focuses on the domestic context. To the best of our knowledge, no study explored the food waste in hospitality sector from a design perspective. Addressing this gap, we made observations and interviews in a high-end hotel restaurant kitchen to better understand the sources of food waste in restaurants. From our findings, we envisioned three design speculations which can inspire HCI researchers and practitioners explore this issue further.

Author Keywords
Food Waste; Hospitality Sector; Design Speculations; Design for Sustainability.

CSS Concepts
• Social and professional topics~Sustainability • Human-centered computing~Field studies

Introduction
Food waste is a global problem. Each year more than 30% of the produced food, approximately 1.3 billion



Figure 1: Food Waste in Hospitality Sector. Observations from our high-end hotel restaurant kitchen

tons, gets wasted. This equals roughly to 680 billion US$ in industrialized countries and 310 billion US$ in developing countries [11]. While the challenge of food waste is increasingly considered in the context of agriculture [8, 9] and grocery retail [6, 10, 12], the hospitality sector has largely been excluded from the analysis [15, 17]. Food waste in the hospitality sector is a growing challenge whose mitigation requires the commitment of multiple stakeholders. According to The Waste and Resources Action Programme (WRAP)'s 2011 report, the hospitality sector consumes 3.4 million tons of food annually throughout the UK [20]. In addition, as the hospitality sector grows, the amount of waste produced in this sector is increasing [5].

Food waste researchers Pirani and Arafat define hospitality food waste as unwanted and disposed of food such as leftovers from guest plates and waste produced during preparation [18]. Food that leaves the human food chain is also considered as waste, even if it is recycled (bioenergy) or reused (feeding animals) [11]. Research indicates that solutions for preventing food waste in the hospitality sector should focus on avoidable food waste [16] which includes all discarded food that has been edible prior to disposal (e.g., roots, bones, seeds etc.), whose share is estimated at 73–79% of the total amount [13]. This implies that the decisions of stakeholders in the food supply chain (producers, consumers, retailers, chefs, and so on) are influential in the amount of waste created. Thus, persuasive technologies aimed at influencing user behavior through design [4] has a potential to reduce food waste produced in hospitality sector. However, previous HCI work on food waste heavily focuses on domestic environments and consumers. For example, *Lyssna* is a design fiction that explores the qualities of the artifacts for food practices to prevent food loss in households by enabling users to "listen" what is going on inside their refrigerator [14]. *Save the Kiwi* is a mobile phone app that aims to prevent food waste by alerting users via notifications when their food is about to get expired [2]. Ganglbauer et al. [7] suggest an electronic food waste diary to raise awareness of the practices related to food waste such as shopping planning, gardening, cooking, storing, etc. The Grumpy Bin, which is placed in student houses, sends sarcastic messages to the social network account of the users, who is responsible for the food waste [1]. *Airshare* gives users an opportunity to share leftovers or unused foods to others in need with the help of drones [3].

In summary, the issue of hospitality food waste seems to remain underexplored in HCI. Addressing this gap, we conducted an exploratory study to understand the sources of food waste in restaurants as well as to identify potential solutions to which HCI researchers and practitioners can contribute. We made observations and interviews in a high-end hotel restaurant kitchen. We gathered information regarding the quality, the quantity and the specifics of wasted food. From these, we created three design speculations that might inspire the development of interactive technologies aimed at reducing food waste in the hospitality sector.

Exploratory Study

We conducted two field observations in a high-end hotel restaurant in İstanbul. We chose a high-end hotel restaurant as they are the places having many actors involved in the scenario, suppliers, kitchen and customers. We first observed the process of food preparation and serving between 10 a.m. and 3 p.m., so-called peak hours. Then, we interviewed two

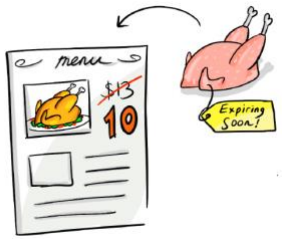


Figure 2: Smart Menu for Ingredient Management

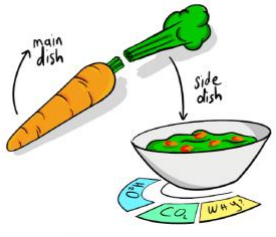


Figure 3: Root to Stem Table

executive chefs for approximately one hour. We probed the reasons for food waste, the strategies they use to deal with this waste and the influence of serving styles on food waste.

Reasons for food waste

Chefs stated that the customers of a high-end hotel are also of high socio-economic class, thus the appearance, hygiene, taste, quality of ingredients and serving of a meal should be in high-quality, causing food waste due to these high standards. Also, chefs classify the ingredients they use as edible and inedible. The chefs, who did not mind having to dispose of the organic wastes which they classified as inedible, did not consider them wasted.

Only the best-looking produce is served to the customer. Second quality ones are made into sauce or puree. Stuff like vegetable stems, shrimp shells are of course thrown into trash directly.

Strategies for reducing food waste

Even though chefs knew that the separation between (edible vs inedible) causes waste, they see this waste as necessary. Thus, they were very enthusiastic about donating. However, in such donation attempts, they had negative experiences such as encountering abusive situations (e.g., donated sandwiches are sold by using the hotel's name instead of sending them to an animal shelter) and facing extra costs (e.g., transporting the wasted food to shelters).

Effect of different service styles

Since the restaurant provides different dining options, à la Carte, open buffet and catering events, we observed differences in terms of produced food waste. As the number of customers increases, the rate of waste produced in the kitchen stage increases. Event or in buffet service produced more waste than à la Carte service. For example, while preparing the food that a customer ordered in a la Carte, chefs can save parts that they can use later such as vegetable stems for extra flavor in boiled foods, but in catering events, they must throw away a large part of them because the waste is too much. Although chefs said that this waste is the same on both the customer and the kitchen side, they believe that customers produce more waste.

Open buffet service requires pre-planning of big amount of food. The chefs said that in this type of food service, people take more food than they can eat, increasing waste. The food stays in the buffet for more than a certain period (i.e. two hours) is replaced with fresh ones. According to company policy, it was stated that there should be enough food at the service table and, the food left at the end of the repast is sent to the garbage.

À la Carte produces relatively less waste than events or buffet. Compared to the other types of services, individual orders are mentioned as one of the reasons for reducing food waste. On the other hand, when customers order from the menu, being unable to know the portion of the food to be served is also the main reason for waste. During our observations in the à la Carte service, we saw that the customers were wasting side dishes more like appetizers, bread, and salads since they did not consider them whilst ordering.

Design speculations

Based on our observations and interviews, we identified three problematic areas in which food waste is high:



Figure 4: Adaptive Buffet

food wasted by customers either due to bad choice or amount, mass waste in catering events and the parts considered inedible by chefs and consumers. Next, we present our design speculations aimed at decreasing food waste in these areas.

Smart Menu for Ingredient Management

We observed that customers may order certain types of foods more than others. This creates food waste because all ingredients should be available all the time. Coupled with the use of artificial intelligence and machine learning algorithms, it is possible to design adaptive persuasive technologies that can help users make better decisions [4]. In that sense, our first design speculation is an intelligent menu design (Figure 2) that can gather data on ingredients in stock and change or promote certain menu items to prevent spoilage and wastage. This menu can guide customers towards the meals that use abundant items in stock to prevent their waste. This can be achieved by changing price, presented images in the menu or providing food suggestions that complement each other.

Root to Stem Table

According to a study conducted in UK, most of the avoidable food waste in restaurants was generated during food preparation (65%). We also observed that one of the critical points of food waste is the loss of nutritionally valuable parts during the preparation. One way is to turn "inedible contents" into "edible content" through food design. For example, creating a new recipe that is only done with inedible parts of vegetables, which is currently a practice performed by various chefs [19]. But, the perception of inedibility is also a problem from the consumers perspective. Thus, we speculated that informing the users about the nutritional value of the food can further encourage users to consume "root to stem" meals (Figure 3).

Adaptive Buffet

Visual presentation quality of the served food plays an important role in customer satisfaction and affects their perception of fulfillment [21]. Drawing inspiration from that, we envisioned another design speculation called "Adaptive Buffet" (Figure 4). With this concept, we believe that changing the visual quality of the plate according to food inside can be effective for decreasing leftovers by motivating customers to finish certain items in the buffet. Especially for the open buffet scenario, the obligation of keeping full plates causes huge amounts of waste. This can be dealt with changing the shape of the plate in order to display only a certain amount of food (e.g., showing a certain amount of bread to avoid rest of them going bad). This way, the food can be replenished in small amounts more frequently while keeping the same visual effect of being full, and by holding less food at any given time.

Conclusion

We presented the results of a preliminary study which explores food waste in a hotel restaurant. Based on observations and interviews with chefs, we identified three instances in which food waste is high and offer three design speculations to address these instances. In the future, we will be focusing on developing tangible versions of the design speculations. Then we will conduct user studies and start real-life trials of our speculations in a pilot high-end hotel restaurant.

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