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# Watch the Table: A System to Enhance the Eating Experiences of Blind People

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**Abstract**

Our study presents Watch the Table, a system that is intended to enhance the eating experiences of people who are blind. Specifically, the system is designed to help blind people more easily and effectively locate items on a table when eating in restaurants. The system consists of a wirelessly networked electronic place mat and electronic wristband.

Eating experiences are typically less predictable and less controllable in restaurants than they are at home. For many blind people, this lack of predictability and control often results in a degradation of the eating experience. Watch the Table is designed to help blind people enjoy some of the control and predictability that are characteristic of the domestic eating experience when they eat in restaurants. The goal of the design is to eliminate a type of threshold that exists between eating at home and eating outside of the home so that the latter can be as enjoyable as the former.

We describe our system and our design process, the latter including user research, prototype testing, and iterations. We also explain the limitations of our design and ideas for future improvements and elaborations.

## **Keywords**

Blindness, eating, meals, assistive technology, disabled users, tangible user interface, wearable computing

## **ACM Classification Keywords**

H.5.2. Information interfaces and presentation: User interfaces. H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous. K.4.2 Computing Milieux: Social Issues.

## **General Terms**

Design, Human Factors

## **Introduction**

Our proposed system, Watch the Table, is intended to enhance the experience of eating in restaurants for blind people. Through research, we found that blind people experience a variety of difficulties when eating in restaurants. These difficulties include reaching for a cup of liquid, cutting food, reading menus, identifying food on one's plate, and locating items on the table [2, 3, 4, interviews]. Our system addresses and seeks to alleviate the latter of these problems.

### *Space, Place, and Threshold*

The organization of one's physical eating space is an important consideration for blind people when they eat. In general, blind people are able to more effectively navigate physical space when it is organized [ref.]. A disorganized table "makes it hard to reach for what you want and easy to knock things over" [1]. One of the goals of Watch the Table is to help blind people to keep their eating environments organized in a logical and consistent manner so that they can more effectively locate items on a table when eating in a restaurant.

Eating experiences are typically less predictable and less controllable in restaurants than they are at home. When we eat in restaurants, we typically do not exert as much control as we do at home over such factors as the organization of items on the table, the physical dimensions of the table, the dining ware, or the exact portions of food that we receive. Further, to the extent that we lose such control, the eating environment becomes less predictable. As one interviewee stated, "Eating at home is more of a routine but eating at restaurants is always a bit of a new experience." This relative loss of control and predictability degrades the eating experiences of many blind people.

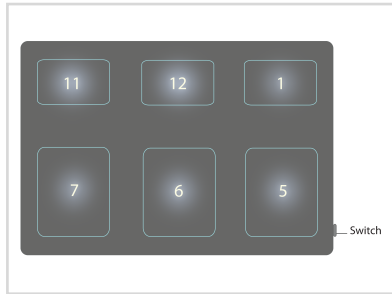
As with many other assistive technologies for blind people, the ultimate goal of Watch the Table is to "overcome the gap between what a disabled person wants to do and what the existing social infrastructure allows them to do" [5]. Our design aims to reduce a threshold that exists between home and outside of the home such that blind people can enjoy some of the control and predictability that they experience inside the home when they eat outside of the home.

## **Design Research**

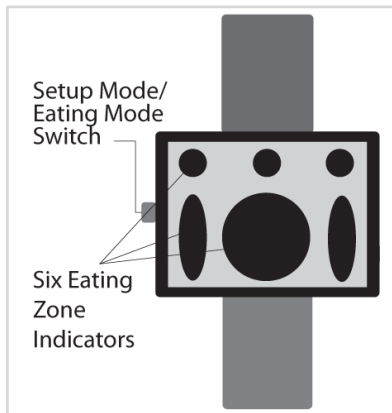
### *Methodology*

We conducted email and semi-structured in-person interviews with 4 blind adults and 1 legally blind adult. We also interviewed a male whose ex-girlfriend was blind and a female who had experience serving blind people in a retirement home.

We also reviewed literature, websites, and videos.



**Figure 1.** An overview of the place mat.



**Figure 2.** An overview of the wristband.

### Findings

One key finding was that not knowing where items are located on the table creates a variety of problems for blind people. For one interviewee, this problem led to accidents: "Location is often a problem when dining out. When a waiter or waitress refills a drink, for example, they usually fail to return it to its previous spot on the table. This means having to ask where the drink is or waving my hand around until I make contact with the glass. Unfortunately, the latter can result in knocking the drink over and spilling its contents."

Another key finding was that, relative to sighted people, blind people often rely more on the help of other people -- including servers and fellow diners -- when eating in restaurants. This relatively greater reliance on the help of others sometimes results in feelings of frustration or lack of independence [3]. One interviewee stated that "Not knowing where something is often means having to ask for it, which makes me feel less independent. As an adult, I want to be able to eat a meal without having to ask for help and feel like a child." We decided that for our design to be successful, it had to properly account for the help and reliance that blind people receive when eating in restaurants.

Finally, we found that many blind people use the clock reference system to orient themselves in physical space and even when eating [4]. As one interviewee explained, "Having someone tell me my meat is at 6:00, potatoes at 11:00, and carrots at 3:00 on my plate is very helpful." We based our design loosely on the clock reference system (Figure 1) because it is something that many blind people are familiar with and already use.

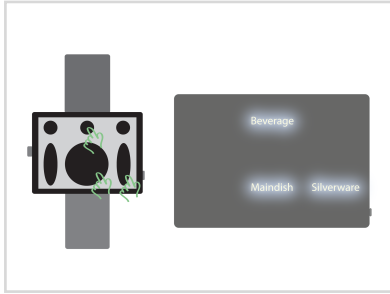
### System Overview

Watch the Table consists of a wirelessly networked electronic place mat and electronic wristband. The place mat (Figure 1) allows users to select and label up to six 'eating zones' so that waiters, servers, and other people can know where exactly users prefer to have certain items placed on the mat. The wristband (Figure 2) includes a touch-, sound-, and voice-based interface that allows users to set up the mat according to their preferences and to receive useful feedback while eating.

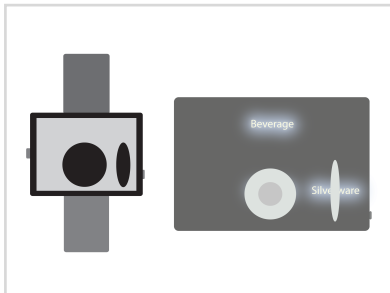
The place mat has internal weight sensors that detect when and where items are placed on the mat. The mat recognizes, via the sensors and an internal processor, six discreet surface zones that collectively comprise the entire top surface of the mat. Users can customize and receive feedback about these six 'eating' zones using the wristband, which automatically receives information from the mat via a wireless connection.

The wristband consists of a rectangular interface attached to a wrist strap. The interface is rectangular so that it can provide a relatively direct mapping of the mat itself for convenient tactile interpretation by users. The watch provides different types of input and output, which are explained in the description below of the system's two use modes.

The system has two use modes - the setup mode and the eating mode. The user can toggle between these two modes by moving a switch on the left side of the wristband. When the user moves the switch, the wristband says "setup mode" or "eating mode" in a computerized voice.



**Figure 3.** Three zones labeled on the mat using the wristband.



**Figure 4.** Two tactile indicators on the wristband to correspond with two items placed on the mat.

In the setup mode, six circular buttons protrude from the surface of the interface. Each of these buttons corresponds proportionally to the size and location of each of the six eating zones on the mat. Users can perform three functions in the setup mode:

1. Label an 'eating zone'. Users can perform this function by holding the button that corresponds with the desired zone and then verbally saying whatever label they wish to apply to that zone, e.g. "cups", "main dish", etc. The wristband records the voice of the user via an internal microphone and then transcribes the speech into text. When the user releases the button, the text label will be displayed digitally on the mat in the corresponding zone (Figure 3). If a label has already been applied to a zone, then performing this function will automatically overwrite the previous label.
2. Listen to a computerized voice read back the label that has been applied to any particular 'eating zone'. Users can perform this function by clicking the button that corresponds with the desired zone. The computerized voice will read back a text-to-speech translation of the label that is displayed on the mat so that users can determine whether or not the desired label has been correctly applied.
3. Delete the label of an 'eating zone'. Users can perform this function by double-clicking the button that corresponds with the desired zone.

In the reading mode, the same six circular buttons protrude from the surface of the mat but only when an

item is detected by its weight to be on a particular zone (Figure 4). The purpose of this feature is to allow users quick access to an overview of the items on the mat.

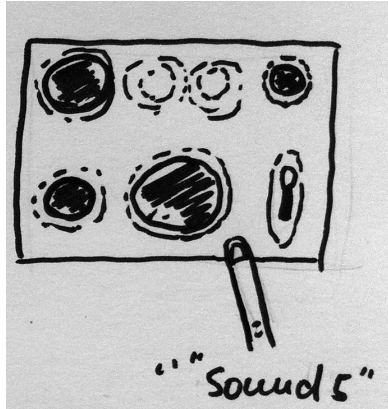
## Design Process

Our design process began by attempting to determine the nature of the domestic experience as it relates to space, place, and threshold. We began by brainstorming and making multiple affinity diagrams to think about and discuss some common themes about these dimensions of the domestic experience.

Through brainstorming and affinity diagramming (Figure , we decided that the concept of home means different things to different people and that, therefore, we should determine a target group as a reference point for further analysis. We chose blind people through a process of brainstorming and voting.

Initially, we chose to focus on eating, food, and cooking in general as these were all domains associated with everyday domestic experiences. After we began to research the needs of blind people in these areas, we iteratively contracted our research focus until we decided to focus on eating in restaurants exclusively. We chose this particular context because there seemed to be a lot of problems that were not currently addressed by existing designs.

After determining our target group and context of use, we performed additional research to get more precise inspiration for our design. We also created two user personas named Charlie and Helen. We referred back to these personas throughout the design process to ensure that we didn't lose sight of the nature of the needs that we were seeking to address.



**Figure 5.** Early concept of a place mat with a wireless linked finger piece to detect the location of items.

Once we had defined a clear set of needs and embodied these needs in our personas, we began to brainstorm and sketch various concepts, both individually and as a team during team meetings. Collectively, we sketched and discussed over 20 different concepts. Initially, we did not restrict ourselves to the general concept of a place mat. One early concept consisted of a table cloth that helped the user locate items on the entire table. Once we decided on the general concept of a place mat, we explored many different ideas. One early concept (Figure 5), we considered a mat that was linked with a wearable finger piece that could detect items in front of it. In another early concept (Figure 6), preferred eating zones were determined and displayed according to the habits and recorded memory of the location of items on the mat over time. Our final design is the results of iterations that we performed during and after user testing and additional research, brainstorming, and concept ideation.

### Testing and Iterations

We performed two rounds of usability testing using two different usability prototypes. In each round of testing, we tested two blind women. Based on the results of our tests, we made iterative changes to the design.

In the first prototype, the mat had only four eating zones. According to the design concept, the user could adjust the size of each of the four areas. After testing, we determined that the option to adjust the size of the zones was unnecessary since the intention of the mat is not to offer such a precise guide but rather a general guide for others to know where items should be placed. We also decided to add more eating zones but to not make them all necessary; both users indicated that they would normally place items on both sides of the

main area, but our prototype did not allow for this possibility. We decided to allow for more zones to account for these kinds of preferences.

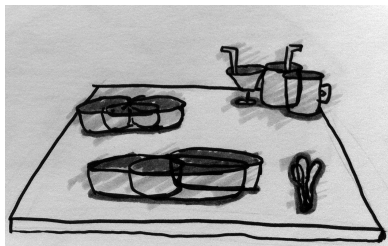
In our second prototype, the mat had eight eating zones, all of which were equal in size and none of which were necessary to label or to use. Based on the results of our first test and more ideation through brainstorming and sketching, we decided to allow for a greater degree of flexibility in customizing which areas of the mat the user could use and label. Through testing, we realized that there was no strong rationale for all of the zones being the same size. Thus we changed the mat so that it has one large zone, two medium-sized zones, and three small zones.

### Limitations and Future Work

One of the limitations of our design is that it accounts only for a limited space, i.e., the space that is right in front of the user. A more useful design would account for the entire table such that the blind user can exert more control over and enjoy more awareness of his eating environment.

Another more general limitation of our design is that it accounts only for the problem of locating items on the table; it does not account for other problems that blind people experience when eating at restaurants, including such commonplace things as ordering from a menu, cutting meat efficiently, recognizing what food is on the plate, pouring liquids safely and efficiently, and reading the bill for the meal. These were all problems that we encountered during our research.

Our design is a work in progress. The core of our design is to help blind people more effectively locate



**Figure 6.** Early concept of a place mat in which the eating zones are defined automatically by the user's habits.

items on the table so that they can better enjoy the experience of eating in a restaurant. We received generally positive feedback about our design both from waiters and blind test participants and interviewees. The technical details of the mat have to be better

elaborated, and there is a clear opportunity to incorporate this kind of system into a symbiosis of assistive devices to help blind people better enjoy the experience of eating.

### **Acknowledgements**

We thank Marty Siegel, anyone who provided critique of our design, interviewees, and usability test participants.

### **Citations**

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