Behaviors, Problems and Strategies of Visually Impaired Persons During Meal Preparation in the Indian Context : Challenges and Opportunities for Design

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ABSTRACT

Meal preparation is a complex multisensorial task that requires many decisions to be made based on the appearance of the dish. This alienates individuals with low vision and makes cooking meals independently inaccessible. Products designed for individuals with low vision rarely aid with tasks that involve application of heat. As people with vision impairments have different requirements for technology, it is imperative that the behaviours and problems faced are thoroughly understood. A study to understand how users perform tasks involving heat application was conducted. Four cooking techniques commonly used to prepare Indian dishes were identified and interviews were carried out with a diverse group of visually impaired persons (n=12). The findings include insights about behaviours, problems and strategies employed by visually impaired persons while preparing meals using the following techniques: Boiling, Simmering, Roasting, and Frying. This work describes factors that affect behaviour during meal preparation by Indian visually impaired persons, and the various strategies used to mitigate challenges faced. The findings have been used to propose a set of considerations that have implications on the design of accessibility tools such as assistive devices, rehabilitation programs and strategies.

CCS CONCEPTS

• **Human-centered computing** → **Accessibility systems and tools**; *Accessibility technologies*; *Interaction techniques.*

KEYWORDS

Visually Impaired, Meal Preparation, Behaviours and Strategies, Accessibility

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1 INTRODUCTION

Preparing a meal is a complex task that involves multiple sensory organs to indicate the state of preparedness of a dish. The task of preparing a meal is sight dominant and a lot of decisions are taken based on the appearance of the dish. Being able to prepare a meal independently can directly determine the quality of life of an individual [6]. Research has indicated lower levels of nutrition among individuals with low vision and complete blindness owing to the reduced ability to shop and prepare meals independently [3]. There will be no distinction made between the level of vision impairment of the individuals as the study does not focus on the nuances between the levels of vision loss. It is for this reason, the individuals will be referred to as Visually Impaired Persons (VIPs) throughout this paper.

Preparation of dishes often requires decisions to be made based on appearance of the dish. Loss of sight leads to lowered richness of information available to VIPs to make decisions. VIPs substitute the lack of sight through the use of other senses, namely, tactile, olfactory and auditory. Assistive Devices aid VIPs by either augmenting these senses or by enhancing sensory perception. But the body of research that deals with assistive technology devices designed for use in the kitchen space for the visually impaired is slim. Considerations regarding user safety, enabling independence and accounting for preferences and desires of the VIPs is key to understanding how to design the necessary aids. The study was carried out by reviewing relevant literature, recruiting participants for semi-structured interviews and analysing the data to propose a set of design considerations necessary for designing assistive devices.

2 RELATED WORK

There is a lack of research directly related to cooking techniques and other related processes of the kitchen, especially so in the Indian context. This prompted investigation of literature that looks at the challenges, strategies, and tools devised to aid the visually impaired in daily living.

Kostyra et al. [4] note considerable amount of work done in the area of identifying needs of VIPs while shopping, understanding their desires, expectations, and obstacles with product choices and perception of food quality. The study also briefly covers meal preparation in the western context, primarily focusing on breads, cheeses, and meats.

Sirirungruang et al. [8] describe, qualitatively, the behaviours of visually impaired shoppers, highlighting behaviours in general and

online stores, informational and environmental accessibility problems and strategies such as utilising the community help (family, friends, salespersons) to complete tasks.

Kutintara et al. [5] rightly point out that kitchens and utensils are not designed to accommodate people with visual impairments, or any disability. VIPs are required to undergo rehabilitation programs to get used to using tools designed for sighted users, forcing them to adapt and look for cues from objects not designed to provide the necessary cues.

Products have been designed to provide form based cues to VIPs in kitchen tasks involving identifying containers, navigating the kitchen, and for mechanical tasks such as cutting, peeling and pouring liquids [1]. Others have suggested smartifying homes to achieve accessibility [7]. Alternate studies have pointed out the possibility of redesigning a kitchen for more universal accessibility [2, 5, 9], but this is rarely feasible in a resource constrained Indian context. Given the lack of research directed towards Indian visually impaired cooks, an extensive primary research was needed in order to define the needs and implications for design.

From the above discussion, the following gaps were identified:

- While there are parts of studies that have focused on meal preparation by VIPs, they primarily consider western audiences, whose learnings do not translate to the Indian context.
- Few products have been designed to enable VIPs to perform kitchen tasks safely, but these tasks do not involve application of heat. This necessitates further study into behaviours of individuals when dealing with foods involving heat application techniques.

The aim of this research is to thoroughly understand the various strategies and methods employed by visually impaired users while preparing a meal, analyse current behaviours and practices in the kitchen space and identify potential problem areas and needs to work on.

3 METHOD

In-person interviews with 12 participants from the Mumbai region were conducted. Interviews were conducted in two phases. In the first round of interviews, seven women were interviewed. Open ended semi-structured questionnaire, dealing with all the processes involved in meal preparation, from getting the ingredients, preparing the dish, to cleaning the utensils were discussed. This gave an indication as to where VIPs face difficulties. The second round of interviews with five women of varying degrees of experience in cooking focused on four commonly used cooking techniques in Indian meal preparation. This helped get insight into both problems faced by beginners and strategies employed and behaviours adopted by the more experienced cooks. The participant group is detailed out in Table 1.

Table 1: Participant Information

Participant	Vision Impairment Status	Experience in Cooking
P1	Complete blindness from birth	30+ years
P2	Low Vision	5 years
P3	Born with sight, complete blindness for 11 years	35+ years
P4	Low vision, continued vision loss since age 10	10+ years
P5	Born with sight, continued vision loss to full blindness since age 9	40+ years

4 RESULTS

The first round of interviews made it clear that most of the preparatory activities such as cutting vegetables, soaking dals, etc. are tactile activities that can be performed without needing many interventions or supervision, unlike activities involving heat application, where providing tactile feedback is not an option. Participant P5 said,

"Not everything requires use of eyes while cooking. A lot of it is understood by the feeling."

In order to identify relevant design opportunities, questions were centred around four cooking techniques that are used for preparing Indian dishes - boiling, simmering, roasting, and frying.

4.1 Boiling

Boiling is the process of cooking food in boiling water, or other water based liquids such as milk resulting in vegetables becoming soft and tender. Cues such as bubbling of water, softening of foods, and temporal estimations which improve with experience are good indicators of how well a food has cooked. Boiling related tasks require constant checking to see if the food is done cooking.

Most challenges faced when boiling are teething problems such as navigating around vessel without burning one's hand, estimating quantities of liquids, not causing spillage when stirring, etc. Longer lasting complications involve understanding the state of the food being cooked. Strategies employed by VIPs to combat these problems involve developing an understanding of the smell of the spices when cooked, taking a small bite of the food, recognising the bubbling noise of water and estimating how long the food has been on the burner.

4.2 Simmering

Simmering is a process in which foods are cooked in hot liquids just below their boiling temperature, commonly used to prepare most Indian gravies. There are processes that precede simmering such as making the tadka (tempering of spices in oil or ghee), adding the vegetables, etc. which are essential to preparing the gravy dish, but are not discussed in this paper. The key change informing the preparedness of the dish is the change in colour while stirring the liquids. VIPs attempt to grasp these changes through sounds, smells and temporal estimations, which get better with experience. However, if there is no indication provided about the food from other senses, VIPs need to rely on help from sighted individuals. Olfactory and auditory perception are the major senses VIPs rely on to understand the preparedness of food. Each element has distinct sounds (oil: sizzles; jeera/rye: pops; curry leaves: hard popping noises; liquids: boiling bubbles), and distinct smells to them. Temporal perception too plays a key role in ensuring the dish doesn't get overcooked.

4.3 Roasting

Roasting is a technique that involves cooking food with dry heat by applying a small amount of fat on the pan to prevent foods such as rotis, dosas, processed meats, etc. from sticking to it. As was with simmering, there are preparatory processes that precede the activity of roasting, which primarily involve mechanical tasks like

kneading and grinding, and as such, will not be discussed in this paper.

Most VIPs are slightly hesitant to try roasting in the beginning, with family members not encouraging this activity either, as noted by P2, P3, and P4. Challenges such as locating the centre of the pan to place food, understanding when a food is cooked, picking the food up with a spatula without folding it upon itself or dropping it all without losing orientation to the pan and the stove, flipping it back onto the pan, and doing these activities with multiple foods such as meats and cutlets on the same pan, while also keeping track of which ones have been flipped and which ones are yet to cook are sight dependent and difficult for VIPs to perform without some form of assistance. Roasting foods is also sensitive to time, with a lot of change taking place in a short span of time. Some strategies VIPs use to cope with the difficulties posed are using external elements of the environment to maintain orientation (handle of a pan), using smell and texture as an indicator of preparedness as noted by P1, P2 and P3, and using an auxiliary utensil to help grip the food while picking it up. These techniques, while useful to an extent, do not go all the way in helping with the process.

4.4 Frying

Frying is the process of cooking food in oil or any fat to prepare foods such as puris, vadas, french fries, etc. As with roasting, mechanical tasks precede the activity of frying will not be discussed in this paper. Challenges such as being able to engage reflexes to withdraw from splash-backs of the oil, understanding when a food is done frying and preventing over-frying of foods, and cleaning spillage of oil deter VIPs from frying foods. Strategies such as frying foods one at a time, and prodding with long handles to check for preparedness are used to mitigate some of the problems, but given how uncommon frying is among the vision impaired community, definitive strategies are hard to come by.

5 DESIGN IMPLICATIONS

Many considerations need to be taken while developing solutions that reduce the entry barrier to preparing meals independently. Ensuring safety of the VIP is of utmost importance when dealing with techniques involving application of heat. Including more fail-safes in the design will make cooking more accessible and inclusive. Reducing cognitive load will allow the VIP, especially less experienced cooks, to focus better on the task they are performing, easing the amount of effort required to prepare a meal. Keeping both buying and maintenance costs low is key to ensuring higher adoption rates of assistive devices, especially so in a resource constrained Indian context. Ability of a solution to integrate into the user's lives while maintaining familiarity is critical in increasing adopt-ability and flattening the learning curve.

6 DISCUSSION AND CONCLUSION

In-depth study about behaviours, problems, and strategies are required to develop and design tools for VIPs with consideration about local practices and methods. Key takeaways from the above discussion were: many tasks in the kitchen can be accomplished through auditory and olfactory senses. Further research in accentuating and amplifying these senses will reduce the entry barrier while ensuring familiarity with current practices. While ensuring familiarity and ease of integration into one's life is important, the first implication to design will always be guaranteeing the safety of the individual performing the task. Finally, while keeping costs low and ensuring ease of use is imperative, understanding how positioning the solutions as positive and progressive symbols of change can impact adopt-ability will be an interesting study in the Indian market. It is acknowledged that the participant group is small, but would like to add that the participants' diversity in terms of experience in the kitchen, family backgrounds and age provide reasonable grounds to develop future work. The main contribution is in the description of the behaviours identified, challenges faced and strategies employed by visually impaired persons while preparing meals in the Indian context.

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