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Designing Equal Participation in Informal Learning for People with Visual Impairment

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Abstract. Informal learning opportunities that complement formal education with diversity and flexibility are abundant in our daily lives. While sighted people take advantage of such learning and may take it for granted, people with visual impairment are sometimes excluded, due to their sight loss, from accessing informal learning, social interaction, and civic engagement. In this sense, they are not equal participants in the highly visual, sighted world. This paper investigates the needs of people with visual impairment, identifies issues, and suggests a direction to support equal participation. We propose four environment scenarios, grounded in our field work, to describe how to support learning and interaction in a sighted world. We discuss how design implications derived from our scenario-based analysis can help guide technological interventions.

Keywords: Scenario-based design; Informal, social learning; Accessibility; Visual impairment; Positive design

1 Introduction

Informal, *Onlife* learning takes place continuously in everyday, mundane places such as gyms, restaurants, department stores, or grocery stores. Generally speaking, people would not think of these places as collaborative spaces, let alone spaces for learning. However, unintentional opportunities for learning and collaboration abound in such public spaces where people observe or participate in different kinds of social activities such as socialization, enculturation, or playing [29]. Informal learning usually comes in incidental forms in which people acquire and explore how social activities and cultural rituals are carried out [22]. For example, people learn about unspoken norms or rituals, such as the proper ways to greet others or conduct small talk, that people of a specific culture or community usually do through following others' practices [11]. These informal learning opportunities demand engagement of multiple senses, especially visual one. For sighted people, such a process can occur unconsciously and they can easily make use of the opportunities and rich information that these mundane spaces offer. Yet these same opportunities are nigh inaccessible to people with visual impairments. If we take a moment to consider the rich information that is encoded in a grocery store, we begin to realize the sighted's reliance on and people with visual impairment's deficit of these encoded practices.

This deficit has many subsequent effects on people with visual impairment. For example, we found that they have a great degree of difficulty in accessing and using relatively simple pieces of information, such as what is on sale today, to more complex incidental social interactions whose catalyst is the collaborative space of a grocery store (e.g. conversations about which products look good today).

More broadly, this means that people with visual impairment's Zone of Proximal Development (ZPD) [29] is much more difficult to access than that of a sighted person's. That is, while the delta between what the learner (in this case the person with visual impairment) can do by themselves and what they can do with the help of others is quite vast (potentially larger than a sighted person's), their access to the scaffolding [3] that is encoded within the environment and the actions of others (which sighted people have ready access to) is unavailable for the most part. The implication of such exclusion in heavily visual environment can be immense in terms of access. That is, while people with visual impairment are certainly a part of social contexts, they are in a sense kept apart in terms of having unequal access to learning opportunities and social interaction. In our study, we used grocery shopping by people with visual impairment to investigate issues that they encountered and further probed different possible scenarios where different types of informal learning may take place. The premise of our study is to establish that the lack of visual support implies losing informal learning opportunities in different social contexts, not just in grocery stores.

In this paper our contribution is to highlight this phenomenon and envision a system that would make this informal learning more accessible. We do this through outlining a series of scenarios that are grounded in our observational study of visually impaired shopping. The interviewees with visual impairment in our observations expressed the desire to be equal participants in the shopping experience, or as one individual aptly described their current situation, "I don't shop, I buy." In our scenarios, we provide a proposal for technological interventions that can bring forward the mundane information encoded in our environments that is mostly accessed through the visual medium. We also expand the horizon of our analysis to more general, social outcomes situated within the community.

2 Background

Participation in everyday life and social activities provides learning opportunities not only for children to develop knowledge about the world [8] but also for adults to accumulate life experience [22]. Such informal learning opportunities are different from formal education or training in that they are not highly structured and the learners take initiatives and react to opportunistic situations in a tacit or unconscious manner [23]. People acquire the knowledge about how to behave in a normative way or engage in different types of social practices based on their observation of how others do [11]. For sighted people, all senses can be employed in order to take advantage of informal learning. To people with visual impairment, forming knowledge through informal learning is constrained by their sight loss, which prevents them from engaging as equal participants.

2.1 Social and Informal Learning Opportunities

Based on a social constructivist perspective of learning, the process of acquiring knowledge about the world is constructed through interacting with others and contexts [26]. According to Vygotsky's concept of the Zone of Proximal Development (ZPD), people can advance their knowledge and skills beyond their repertoire through interaction and co-construction with more knowledgeable others [29]. Scenarios can range from learning appropriate cultural practices in a new environment by observing how the local people do things, to collaborating with others in order to complete a task. Integrated in people's daily routines, informal learning can take place wherever, whenever people see the fit for their learning needs, motivations, or opportunities [23].

In contrast to formal, highly structured education, an ecological way of obtaining new information takes place in different social settings as people try to interact with others and make sense of the context and the activities [6, 13]. As people participate in a wide range of activities and internalize the experience through observing and working with others, they develop strategies and knowledge about social and cultural practices, which are consistent with what formal learning demands [22]. In other words, informal learning complements formal learning by expanding the variety and flexibility of opportunities based on different contextual stimuli [9]. With newly acquired information using what is offered by contexts and others as triggers, people are able to reflect upon what they know [9] and make assessment of the new situations [27]. As sociocultural contexts change rapidly, people deal with dynamic changes and make responses accordingly [29].

In this sense, many mundane, social settings can serve as contexts for informal learning, such as the grocery store [17]. Although people usually do not consider that informal learning opportunities are woven into grocery shopping practice, different skills are required so as to successfully perform the shopping task. For example, a shopping practice may involve making decisions about what to purchase based on the availability of coupons or sales, interpreting ingredient tables so as to follow a healthy dietary regime, engaging in social interaction with other shoppers and store workers so as to receive information, etc. [17, 27].

While people can rely on different modes of communication (including visual, aural, or haptic) to engage in informal learning in everyday settings, for people with visual impairment, social learning lacks the visual medium. When they engage in the many visual-centric environments with sighted people, they do not have equal access to learning opportunities, preventing them from fully experiencing and participating in the world. As social and informal learning contribute to ongoing civic and personal participation in a community, it is important to discuss the current practice and try to engage both people with full sight and with visual impairment.

2.2 Equal Participation for People with Visual Impairment

The concept of integration entails full and equal participation for all members in social contexts. However, for people with visual impairment, full and equal participation can be challenging. One particular aspect, the *work environment,* has

been widely discussed in the research community. Previous work has identified several barriers that prevent people with visual impairment from being fully integrated into the work environment, which contributes to a sense of exclusion in organizational settings [24, 31]. For example, interacting with co-workers in formal collaboration or informal, social interaction can be hard without the ability to interpret visual and nonverbal cues. Besides, the additional assistance and accommodation required may prevent people with visual impairment from attending onsite or offsite work-related or social events. While issues and coping strategies have been proposed in workplace situations, the subject of how to integrate people with visual impairment in *social, mundane contexts* has received less attention.

In the following sections we describe an already identified daily challenge, grocery shopping, faced by people with visual impairment [16]. However, we highlight a new facet to this activity, namely how these short-term difficulties have longer-term impacts on development and learning, and suggest scenarios that obviate the current situation by envisioning a more accessible future.

3 Study Descriptions

We conducted five in-depth interviews with people with visual impairment and three field observations, either assisting or shadowing them on their grocery shopping trips to explore how they engaged in daily activities, grasped mundane learning opportunities, and reflected upon their current shopping experience. Our participants were recruited from a local chapter of the National Federation of the Blind (NFB). At the time when we conducted our study, the chapter had six members with visual impairment and other members were their partners or volunteers. In addition to the interviews and the observations, we participated in different types of activities, held by the chapter to build a trusting relationship with the interviewees as well as other members and ground our understanding about their daily practices through our long-term interaction with them. In other words, what we report in the following sections is based on repeated and deep involvement of more than one-year field work.

3.1 Participants and Activities

Our participants all had complete vision loss without any peripheral sight left, whose ages ranged from 25 to 70. Two participants were unemployed and three were students. Among the participants, three lived alone and needed a shopping assistant, which they arranged through either a local agency or friend. Otherwise, they ordered items online and had them delivered. As a result, the three participants that lived alone went to the grocery store less frequently to the other two, one of whom had a low-vision fiancée and the other a sighted spouse. The participants who lived alone usually went shopping twice a month, whereas the other two went once or twice a week with their partner's help.

The semi-structured interview protocol contained questions inquiring about things that challenged them the most in a grocery shopping scenario. Grocery shopping

demands different skills which are difficult for people with visual impairment (e.g. navigating across aisles, identifying product locations, comparing different items, making judgment for healthy living [16]). All of these activities heavily rely on visual cues. Each shopping trip lasted around 1.5 hours and each interview about an hour. We transcribed the interviews and the first author analyzed the data using a bottom-up approach, which means all the findings were grounded in our participants' experience and what they said in the interview.

3.2 Equal Participation--A Valued, yet Unattainable Pursuit

From our data a salient, recurring theme emerged that indicates the challenges people with visual impairment face in grocery shopping. These challenges have been hindrances for them to equally participate and informally learn in shopping activities.

In order to compensate the lack of sight, people with visual impairments have to rely on their other senses to overcome the challenges caused by visual impairment. For example, Interviewee#02 needed to memorize the environment to smoothly navigate when she shopped. This demands more cognitive resources and skills in order to complete tasks that might be taken for granted by the sighted, not to mention it implies an inability to respond to any changes in the environment. Also, there can be limitations especially when visual cues are essential for making judgments or decisions. As Interviewee#03 pointed out, even though she could use the haptic sense to shop for produce items, indications of freshness were still incomplete.

> *... once I know where something is I pretty much can find it on my own the next time because I remember what aisle, how many steps down, or what height the shelf was … mental mapping is kind of like memorizing, but you're using all your, you know, all your senses, remembering. (I#02, F)*

> *The thing you can touch it's okay. For example parsley, it can be difficult to understand because it can feel normal but it can look yellowish. Or with strawberries you cannot touch all of them then you are going to ruin them. (I#03, F)*

While routines based on mental models and predetermined goals reduce unexpected happenings and ensure people with visual impairment smooth completion of tasks, as explained by Interviewee#02, these strategies are also problematic in that they limit the possibility of thorough exploration of the environment. Due to visual constraints, they may not act on a serendipitous opportunity as Interviewee#04 pointed out below.

> *I guess the hardest thing is not buying the same thing every week... because when you're in a store and you have sight, you walk around and are like "oh that would be a great idea." But without sight, you don't have those ideas pop in your head… let's say they have something on sale, say clams…like Zuppa de Clams…so I love that but I haven't made it in forever. And it's*

> *one of those things where if I was in a store and I saw clams on sale I would say oh "Zuppa de Clams!" Why don't I pick up some white wine? Why don't I pick up some…oh I already have garlic…why don't I pick up some pasta? I don't have any pasta...it would be nice to know sometimes what's on sale or just get different ideas of different dishes. Like you know what I'm tired of having A, B, C. (I#04, M)*

Despite the difficulties inherent in visual impairment, the underlying issue is the lack of ability to have the *actual* experience, which is the key for people with visual impairment to have equal learning opportunities and social participation.

> *It's not like, ok, I'm going to go to school. I can do that independently. I can travel to class independently. But you know there's certain limitations…There's certain aspects of our lives where there's are no workaround. And for a long time this was the perception that I had around grocery shopping…there's the actual experience of itself. Ok, can I shop smart? Can I compare prices? There's no braille on any of that stuff...like how much something costs, expiration date, or sell-by date, if it's an all-natural…like if it's a grass-fed product or not, like beef. If you're getting processed beef or grass-fed beef. I always want to feel the things that I want to buy. It's an attempt to try to be normal. An equal participant in the shopping experience. You know, wanting to go to the produce section and feel if a tomato is ripe or to smell something if it is fresh. (I#01, M)*

The current technologies and designs have devoted to solving the issues regarding in-store navigation [e.g., 2, 15] or item identification from the shelves [e.g., 7, 21] using augmented reality or computer vision. Oftentimes, it is assumed that people with visual impairment only follow planned behaviors, such as moving to and fro specific places or buying predetermined items from lists. However, our data indicated that they anticipate to participate in social activities in an equal and independent way. Instead of buying things from a predetermined list, they would like to take the opportunities and make decisions based on what is available in the social contexts, a true engagement in shopping practices. The identified issues here involved limited access to information and constrained input to decision-making from an individual perspective. Nevertheless, these individual practices influence their participation in collaborative social contexts and presumably restrict others' potential interaction with or learning from them too.

In the next section, we identify several envisionment scenarios that support these opportunities in the grocery store, each of which features a specific task or skill inspired by our field work. We use these scenarios as an analytic device to outline what capabilities a device would need in order to better incorporate people with visual impairment in the shopping activities and make informal learning more accessible.

4 Envisionment Scenarios

In this section we use four envisionment scenarios, which are grounded in our observations and interviews with shoppers with visual impairment, to discuss potential learning goals and insights for user-centered designs that can be applied in other contexts [3]. The scenarios are indicative of the challenges and opportunities people with visual impairment face, which serve as stimuli and variations for potential design interventions [3].

The four scenarios we use are: finding a newly introduced item that is on sale (encoded information); shopping for produce (observation of practices); comparison shopping for wine (encoded practices); and shopping for fish (incidental interactions). In these scenarios, shoppers with visual impairments have a computer vision based device that enables behaviors and capabilities that we have identified as necessary to being equal participants in shopping. Of note, is that these envisionment scenarios are not exotic, they represent a baseline of the sighted shopping experience.

4.1 Scenario 1: New Item on Sale

> *Cathy, a shopper with visual impairment, has already constructed her shopping list. She used to have to be very specific about items and brand names when she shopped with an assistant (she did not want to waste their time), but now she is able to use generic items like 'tomato sauce' on her list. As she approaches the tomato sauce section of the aisle the system finds a new item that is also on sale, the system notifies her that there is a new brand of organic tomato sauce that is also on sale and has good reviews online. As she is not particularly fond of the brand she has been using and she an organic one anyway, she decides to buy the new brand.*

In this example, we draw from a quote from Interviewee#04, "*it would be nice to know sometimes what's on sale.*" Currently, shoppers with visual impairment do not have access to the scaffolding that the employees of the grocery store and the designers of the packaging construct to inform shoppers about items. Existing technological support includes the use of braille labels or Radio Frequency Identification tags used to identify or track tagged information [17, 26]. The major bottleneck of these practices is that it relies on a well-built database so as for the tools to identify items. New products without braille labels or not included in the database cannot be identified.

Our envisionment system would give people with visual impairment access to several pieces of information that are encoded within the environment: 1) The existence of a new, related item to the one that Cathy is buying; 2) the identifying characteristics of the item that packaging designers think that Cathy might be interested in (e.g. organic, or low-sodium); 3) this item is on sale.

While these pieces of information may seem mundane to a sighted shopper, to a shopper with visual impairment these pieces of information would enable them to

comparison shop based on their preferences and goals. This encoded information is especially important when it is intentionally encoded with the expectation of its use. For instance, the shopper may want to reduce their sodium, caloric intake or they may prefer organic produce. These types of decisions impact shoppers' ability to make healthier choices and engage in a healthier lifestyle.

4.2 Scenario 2: Comparison Shopping

> *David is planning a fancy dinner party with his friends and he would like to buy three bottles of red wine. David is not terribly knowledgeable about wine, and is not confident about which wines to buy. David remembers hearing a commercial for some popular brand of wine, so he puts that on his list. While in the store as he is picking out his wine, the system notifies him that there are several other types of wine that have a high rating, are similarly priced, and only have a few bottles left. He decides to get one of each, a French, Italian and Californian red. Later David's guests complement him on his choices.*

In this example we draw from the comments of Interviewee#01, where they explain their inability to comparison shop, as there is frequently no braille for the information that they need, or there are just too many items to touch and examine. The current technology only gives information about the scanned/interested item [26, 17]. No cross-reference or customized comparison is provided. With this scenario we see that David would previously not have access to the practices that are often encoded in our environments. In this case, other wine enthusiasts, that are more informed than David, have left traces of their wine choices in the grocery store environment. The system was able to provide him with the information that 1) the wine that he had chosen did not seem very popular and 2) that there were other comparably priced award winning wines that seemed much more popular.

While this information may also seem somewhat mundane, it provides another example of the constricted ZPD that people with visual impairment experience, as the opportunity of learning from more knowledgeable others is restricted. That is, while David may be able to choose a passible wine by himself, with the help of others (that is to say other shoppers) he was able to choose an exceptional wine that he has not tried before, or was not even aware of.

This scenario embodies how visually impaired shoppers can be made more equal participants in shopping by granting access to the practices that are encoded in our environment. Sighted individuals encounter these encoded practices throughout their day, which enable them to more confidently make choices that they are otherwise uninformed about or would not have made in the first place.

4.3 Scenario 3: Shopping for Produce

> *Miriam is shopping for avocados, but she never quite remembers how to pick the ripest ones. As she is approaching the avocado section, there is a young man squeezing the avocados, who also seems to know what he is doing. As Miriam gets closer to the avocados the system notifies her that someone is there holding an avocado, she decides to ask this person how they are picking out avocados. The system orients her in the correct direction and she asks the young man his method, he explains that he first looks for a certain color (which he gives an example of, and Miriam has the system take note of) and a certain feel. Miriam then uses the system to first look for the color, then she is directed to the best candidates and squeezes them to test for ripeness. She thanks the young man and continues shopping.*

This example is inspired by Interviewee#03's comments about picking out produce. People with visual impairment are, for the most part, denied the observation of others' practices in public spaces. In this example, while Miriam does not have direct visual access to the practices of other shoppers, the system at least makes her aware that there is a potential source of information. In the case of sighted shoppers, they can more or less tell when someone is doing something confidently, and they can emulate their behaviors to learn new skills. Consistently selecting quality produce may not seem like a valuable life skill, however, without this skill one may not be motivated to develop more health eating habits using fresher ingredients.

4.4 Scenario 4: Shopping for Fish

> *Cathy would like to try something new this week, on a television cooking show she heard a recipe for miso crusted salmon that she thought sounded good. She approaches the fishmonger at her local grocer and requests a filet of salmon. Behind her are two other shoppers who are also wanting to buy some fish and they seem to be comparing the salmon and the tuna. The system notifies her that other shoppers are also oriented to the fish section. She decides to ask them what their plans are and they strike up a conversation about which fish seems fresher and what they are planning to do with the fish. In the end one of the other women winds up buying a piece of salmon for the same recipe that Cathy is planning.*

In this example Cathy has access to the orientation of others to objects within the store. She does not necessarily need help, but she has an opportunity to have an incidental social interaction around an instrumental goal. The instrumental goal being to pick the freshest fish which may be less important than the incidental social interactions in shared public spaces.

Table 1. Informal learning opportunities for people with visual impairment.

Learning resource	Examples in grocery store	Potential use
Encoded information	Sale items; Product information (e.g. organic)	Enable people with visual impairment to live up to their preferences and goals
Encoded practices	Comparison shopping; Purchasing unfamiliar items	Learn from more knowledgeable others.
Observation of practices	Produce shopping; Coupon use	Enhance informed decision making
Incidental Interactions	Serendipitous encounter; Recognizing regular store clerk	Increase social interaction with others

5 Design Implications

From the previous section, we have identified four scenarios where informal learning for people with visual impairment can take place, but is not yet realized (see Table 1). The first three scenarios illustrate learning opportunities visually encoded in the environment and the final scenario illustrates how social interactions can be situated around instrumental goals. In this section, we move from the issues evoked by the scenarios and propose potential design features that should be considered for enabling equal participation for informal learning and social interaction.

The most striking problems that people with visual impairment face are issues like navigating environments or item acquisition. However, as we continue as a community to research and develop further technologies and solutions for people with visual impairment, we must keep in mind not just physical accessibility. Through our observations we were able to categorize several types of informal learning that are currently inaccessible to people with visual impairment. The result of this analysis is four axes (which we certainly do not claim is a complete categorization but a starting point) of resources for informal learning: 1) *Encoded Information* - this is information that is explicitly encoded for the expectation that it will be used (e.g. items on sale); 2) *Encoded practices* – this is information that is implicitly encoded without any intent or expectation that this information will be used (e.g. popular items); 3) *Observable practices* – this is information that is encoded in the actual activities that people are doing right now (e.g. selecting produce); 4) *Incidental interactions* – many pieces of information that can impact informal learning are exchanged during incidental social interactions, which are facilitated by engaging with the shared visual-spatial context (e.g. different recipes, or information from a clerk about what is fresh).

To further develop these axes in the context of a design activity, it is important to consider how they serve to expand people with visual impairment's ZPD. That is, what capability do they currently have and how could they expand this capability with the help of others' everyday activities. In the case of the grocery store, opportunities to expand the ZPD abound, as we have shown in our scenarios.

These axes emerged from our observation in a grocery store, however, we see them having a broader range than just in the grocery store. Consider: the *encoded*

information in the signage of a downtown area that informs passersby about an upcoming festival; the *encoded practices* when moving to a new neighborhood about when trash pick up is; when travelling to a new country, the *observable practices* of the local etiquettes and practices; and finally, the *incidental interactions* with individuals who you pass by everyday, with whom you share a visual-spatial context with. The social activities suggested in our scenarios entail diverse forms of informal learning.

It is important for designs to facilitate people with visual impairment to manage their ZPD and push it forward so as to make their life experience richer.

6 Discussion

In our scenarios, we discussed how sighted people pick up cues embedded in the environment that provide opportunities for informal learning. Without vision, people with visual impairment are deprived of such opportunities. Instead, they occupy a more routine world, where they need to memorize the items in the environment or draft a shopping list and follow it exactly, any deviations from which will cause increased difficulties. While the current technological designs that feature precise item recognition and identification [e.g., 2, 20] are certainly valuable and necessary, they only make the current tasks people with visual impairment are already performing easier. However, social practices like grocery shopping that are rich in learning opportunities are reduced to instrumental tasks if we do not take a broader social perspective into consideration. Taking the types of activities that we outlined in our scenarios into account will enable people with visual impairment to achieve a higher degree of engagement with their environment and the people that inhabit it. Drawing on the concept of ZPD [29], observing practices and engaging in social interaction with more experienced and knowledgeable others provides learning opportunities. Not only does it serve as scaffolding for informal learning but it equips people with social competence to react to other similar situations [3, 32]. In the context of grocery shopping, social participants may include other shoppers, store clerks, and shopping assistants with whom people with visual impairment go shopping. What they do and how they do it when shopping varies depending on their age, gender, preferences, experience, etc., which constitute rich information sources. In workplaces, people with visual impairment are disadvantaged in collaboration and relationship building with their coworkers due to hindrances of picking up visual and non-verbal cues [24, 31]. Whereas, in mundane situations like grocery shopping, they are kept a distance from diverse forms of informal learning from a wide range of social actors.

The implication of physical-constraint-based social exclusion can be immense, as many benefits associated with the ability of social interaction and engagement are overlooked if we only design *physical accessibility* for people with visual impairment. Social contexts, like cafes, bookstores, or in our case, grocery stores, are important arenas that spawn diverse and novel experience, encourage new information and perspectives exchange, and enhance a sense of well-being and quality of life, all of which may not otherwise be derived from one's home and workplace [25]. Interacting

with people who co-exist in these social places is the key to building a sense of participation, identity, and community [32]. How people position and identify themselves is grounded in the social interaction with others. These social interactions are grounded in sharing experiences or viewpoints with others to form an understanding not only about the self but also about the community. Moreover, dialogues and conversations revolve around people's daily lives, specifically many of the civic, deliberative discussion in a community come about from informal social participation in these mundane, everyday social contexts [10]. Visual impairment and its associated physical and social hindrances thus elicit implications about many forms of *social accessibility*, which is under discussed in the previous studies or included in the current designs. As such accessibility issues influences both people with full sight and visual impairments. While the issue of social accessibility is most apparent to people with visual impairment in terms of their equal participation in learning and interacting with the sighted, it is equally challenging for them to contribute their experience for the sighted people to benefit. Either way, full integration and equal participation is not realized.

7 Conclusion

Having full and functional participation in social contexts and making the best of informal learning opportunities are integral to social experience, and yet they remain challenging for people with visual impairments. Physical constraints associated with vision loss provide us a lens to look at the underlying social barriers people with visual impairments face. The findings of our interviews indicate the needs for equal participation and the gaps or lost opportunities in mundane but rich social environments. Grounded in our interview study, we proposed four scenarios that highlight the appropriation of environmental cues for making preferred choices (scenario one), how to weigh on all possible details and make informed choices (scenario two), the practice of comparison shopping based on observation of others' practices (scenario three), and serendipitous encounter for social interaction (scenario four). Leveraging our scenarios, we point out the missed learning opportunities in everyday situations. In addition to the physical barriers that influence instrumental task completion, social and interpersonal interaction is impeded for people with visual impairments. The associated social barriers may seem small difficulty in making incidental contact in a grocery store, but these small interactions can lead to establishing new relationships or forming a sense of community. The envisionment of our scenarios depicts equality that is anticipated but not yet attained. By using ordinary and concrete examples, we intend to evoke responses and reflections from sighted people that social practices in everyday contexts are key to empowerment and integration. Similarly, we call for inclusion of social contexts and interaction opportunities for future technological interventions.

We draw further attention to the current deficit-driven design philosophy of developing technologies for people with visual impairments, which we certainly are still guilty of. However, this serves to highlight what is "normal" and how to make up what is missing. This undertone of deficiency may incur users' resistance to use

[10] and perhaps ill serve their needs. In contrast of this deficit-driven design, is a positive design perspective, meaning that it is equally important to focus on what people with deficits have and do well in order to strengthen them. Positive design places values at the hand of its users and appreciates their existing practices and experience [1]. Contextualized in our case, perhaps future designs can recognize and value people with visual impairments to the point where they can capitalize on their abilities to the extent that sighted individuals are found lacking.

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References

1. Asif, Z., & Klein, H. K.: Open and Free Deliberation: A Prerequisite for Positive Design. *Information and Organization*, *19*(3), pp. 186--197 (2009)
2. Blum, J. R., Bouchard, M., & Cooperstock, J. R.: What's Around Me? Spatialized Audio Augmented Reality for Blind Users with a Smartphone. *Mobile and Ubiquitous Systems: Computing, Networking, and Services*, pp. 49--62. Springer, (2012)
3. Bruner, J. S.: From Communication to Language—A Psychological Perspective. *Cognition*, *3*(3), pp. 255--287, (1975)
4. Carroll, J.M.: Making Use: Scenario-based Design of Human– Computer Interactions. MIT Press, Cambridge, MA, (2000)
5. Carroll, J.M.: Scenario-Based Design: Envisioning Work and Technology in System Development. Wiley, New York, (1995)
6. Coiro, J., Knobel, M., Lankshear, C., Leu, D.: Central Issues in New Literacies and New Literacies Research, in J. Coiro, M. Knobel, C. Lankshear, & D. Leu (Eds.), Handbook of Research on New Literacies, pp. 1–21, New York: Lawrence Erlbaum Associates, (2008)
7. Dramas, F., Oriola, B., Katz, B. G., Thorpe, S. J., & Jouffrais, C.: Designing an Assistive Device for the Blind Based on Object Localization and Augmented Auditory Reality. In *Proceedings of the 10th International ACM SIGACCESS Conference on Computers and Accessibility, Assets '08*, pp. 263--264, (2008)
8. Dunst, C. J., Bruder, M. B., Trivette, C. M., Hamby, D., Raab, M., & McLean, M.: Characteristics and Consequences of Everyday Natural Learning Opportunities. *Topics in Early Childhood Special Education*, *21*(2), pp. 68--92 (2001)
9. Eraut, M.: Informal Learning in the Workplace. *Studies in Continuing Education*, *26*(2), pp. 247--273 (2004)
10. Finegold, M. A., Holland, B. M., & Lingham, T.: Appreciative Inquiry and Public Dialogue: An Approach to Community Change. *Public Organization Review*, 2(3), 235 (2002)
11. Goffman, E.: *The presentation of self in everyday life.* Harmondsworth, (1978)
12. Habermas, J.: The Inclusion of the Other: Studies in Political Theory. The MIT Press, (2000)
13. Hansman, C. A.: Context-based Adult Learning. *New Directions for Adult and Continuing Education,* 2001(89), pp. 43--52 (2001)

14. Hayes-Roth, B., Hayes-Roth, F.: A Cognitive Model of Planning. *Cognitive Science 3,* pp. 275–-310, (1979)
15. Joseph, S. L., Zhang, X., Dryanovski, I., Xiao, J., Yi, C., & Tian, Y.: Semantic Indoor Navigation with a Blind-User Oriented Augmented Reality. In *Proceedings of the 2013 IEEE International Conference on Systems, Man, and Cybernetics, SMC '13*, pp. 3585--3591, (2013)
16. Lamoureux, E. L., Hassell, J. B., & Keeffe, J. E.: The Determinants of Participation in Activities of Daily Living in People with Impaired Vision. *American Journal of Ophthalmology*, *137*(2), pp. 265--270 (2004)
17. Lanigan, P. E., Paulos, A. M., Williams, A. W., Rossi, D., & Narasimhan, P.: Trinetra: Assistive technologies for grocery shopping for the blind. In: International IEEE-BAIS Symposium on Research on Assistive Technologies (RAT) (2007)
18. Lave, J. Cognition in Practice: Mind, Mathematics, and Culture in Everyday Life. Cambridge, England: Cambridge University Press, 1988.
19. Livingstone, D. W.: Adults' Informal Learning: Definitions, Findings, Gaps, and Future Research. NALL Working Paper# 21 (2001)
20. Marsick, V.J., & Watkins, K.E.: Informal and incidental learning. *New Directions for Adult and Continuing Education 89*, pp. 25–34 (2001)
21. McDaniel, T. L., Kahol, K., Villanueva, D., & Panchanathan, S. Integration of RFID and Computer Vision for Remote Object Perception for Individuals Who Are Blind. In *Proceedings of the 2008 Ambi-Sys Workshop on Haptic User Interfaces in Ambient Media Systems, HAS '08*, pp. 7:1--7:10, (2008)
22. Marsick, V. J., & Watkins, K. E.: Informal and Incidental Learning. *New Directions for Adult and Continuing Education*, *2001*(89), pp. 25--34 (2001)
23. Marsick, V. J., & Volpe, M.: The Nature and Need for Informal Learning. *Advances in Developing Human Resources*, *1*(3), pp.1--9 (1999)
24. Naraine, M. D., & Lindsay, P. H.: Social Inclusion of Employees Who Are Blind or Low Vision, *Disability & Society, 26*:4, pp. 389--403 (2011)
25. Oldenburg, R.: *The Great Good Place: Cafes, Coffee Shops, Bookstores, Bars, Hair Salons, and Other Hangouts at the Heart of a Community*. Da Capo Press, (1998)
26. Pal, J., Pradhan, M., Shah, M., & Babu, R.: Assistive technology for vision-impairments: An agenda for the ICTD community. In *Proceedings of the 20th International Conference Companion on World Wide Web* (pp. 513-522). ACM (2011)
27. Palincsar, A. S.: Social Constructivist Perspectives on Teaching and Learning, 49, pp. 345--375 (2005)
28. Roth, W. M., & McGinn, M. K.: Inscriptions: Toward a Theory of Representing as Social Practice. *Review of Educational Research*, *68*(1), pp. 35--59 (1998)
29. Ruth, P. & Rogoff, B.: Side by side: Learning by observing and pitching in. *Journal of the Society for Psychological Anthropology*, pp.102–138 (2009)
30. Vygotsky, L. S.: Mind in Society: The Development of Higher Psychological Processes, Harvard University Press, (1978)
31. Ward, A. C., & Baker, P.: Disabilities and Impairments: Strategies for Workplace Integration. *Behavioral Sciences & the Law*, *23*(1), pp. 143--160 (2005)
32. Wenger, E.: Communities of Practice and Social Learning Systems. *Organization*, *7*(2), pp. 225--246 (2000)
33. Woolgar, S.: Science: The Very Idea, Chichester: Ellis Horwood, (1988)