



Lavara

Wheelchair accessible public restroom

This research examines the needs of wheelchair users in using current public restrooms designated as 'wheelchair accessible' and proposes a new design based on those needs. By conducting an ethnographic study we identified issues that users with various needs expressed to have and we used these data to finally propose improvement opportunities. This research provides a greater understanding of all the user needs in a public accessible restroom. Barrier free design has

been viewed as design "for users with disabilities" which enables people with disabilities to gain access. Instead of approaching the issue of disabilities as rooted in the disability itself, I seek to argue that many of the problems wheelchair users face are due more to their environment than to their condition. As an example, someone in a wheelchair can not enter a building not because they are using a wheelchair, but because the building doesn't provide a ramp for them



Significance

Kitchin and Law (2001) have used the term “the bladder’s leash” to describe the restricted mobility of wheelchair users in the urban environment by the absence of accessible public toilets in cities. In addition, older people too are limiting the amount of time they are away from their home due to the lack of available accessible toilet facilities. Personal hygiene is a difficult activity which is also an integral and inevitable fact of our daily life (Kira, 1976, 242).

According to Census Disability Status: 2000, 6.8 million (2.6 percent) of Americans have a condition causing difficulty in dressing, bathing, or getting around inside home. There are also an estimated 1.4 million wheelchair users in the United States (Kraus, 1996). Toileting is one of the activities that

people with functional limitations especially spinal cord injured patients express problems with. 52.6 percent of the participants of Census Disability Status: 2000 experienced major difficulties with toileting (Kaye, et al. 2003). We also have to take into consideration the 77 million members of the Baby Boomer cohort which have reached the age of retirement in 2008 and aging challenges are their next stop. Studies also show that by 2031 every Baby Boomer will be 65 years and older. With this influx of need for universally designed products and spaces into the marketplace, designers are increasingly confronted with the challenge of creating accessible environments and products

What is valuable to consumers



Restroom environments can be extremely dangerous for the wheelchair users of different categories. The users are usually more attracted to designs based on their special needs but not interested in products that create or suggest a state of illness. These factors especially in assistive products can remind the user of their inability to perform an ordinary task and cause negative feelings such as disgust or frustration which make the user uncomfortable with or simply stop using

these products. Carefully designed products for the users with disabilities increase their Independence, level of activity, well-being and self esteem. If a product has positive affects on the user, this will after a time contribute to eliciting pleasant feelings as well as improved well-being. Unpleasant feelings might also be elicited from products when the user's attitudes towards the products are mismatched.



Scope

Our Key participants are wheelchair users 18-75 with some functional limitation at least in both of the legs because they are the ones who are active and have reached the age of independency and are more likely to go out and use public facilities. They are the users of accessible public restrooms and they experience the highest level of difficulties in toileting (Dell orto, 1995) Due to both their movement limitations and, bladder and bowel control issues. Users with disabilities can make

a tremendous contribution both to research and design (Newell 2008). It is always essential to hear the voices of customers in the design process, this provides considerable challenges when the user population contains disabled users who are a much more diverse population compared to most traditional user groups. It is usually most effective if the users are seen as part of the development team and their interactions with designers as well as researchers are set within an enjoyable social experience.



large
trash can



Push
downward

Push



✓ Door
✓ Trash can
✓ Surface
✓ Clean

Needs/Problems



What are the most common difficulties that electric and manual wheelchair users experience in current accessible public restrooms and why?



What are the main needs of different types of wheelchair users in public accessible restrooms based on their physical limitations and especial needs?

Tools/ Adaptations/Activities



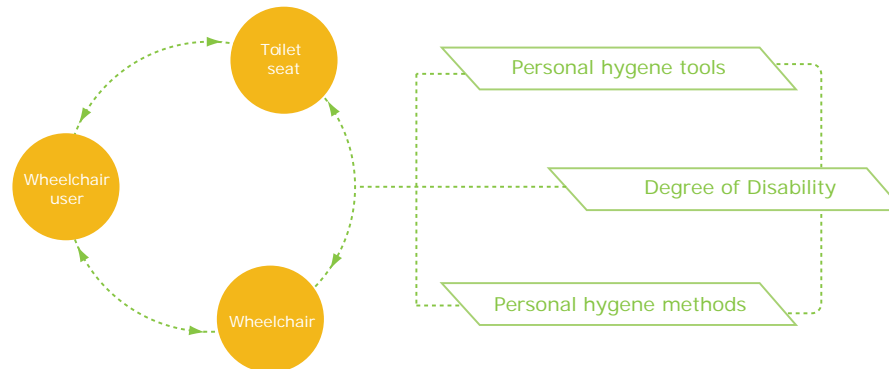
What type of personal assistive devices or tools do most of the wheelchair users use in order to help them with toileting in public accessible restrooms?



What are different activities that wheelchair users perform inside an accessible restroom and how do they perform these activities?

A Methodological triangulation (Cohen, 2000; Denzin 2006) strategy was used for this study. also Ethnographic study and document analysis were applied as two flexible designs for this research. The goal of using flexible research was to make the research process open and flexible for using new methods and data collection tools based on the ability of the participants to respond to each inquiry. Pilot studies with an open sampling of wheelchair users and their caregivers as well as

their family and friends were conducted prior to the actual data collection in order to become familiar with the success of each method in collection of accurate data about this sensitive private subject. The data collected from this pilot study was done in parallel to document analysis. These built the necessary knowledge and understanding of this subject matter. Moreover they made the researcher more familiar with different ways of approaching the users and understand their challenges.



Through Other Eyes

Freund (2001) notes that impairments may make most everyday activities increasingly complicated. Movement in most previously friendly spaces can become difficult and lead to the space becoming very 'unfriendly, dangerous and uncomfortable' (ibid, 2001). 'Through Other Eyes' was a Method developed in Canada, which later was used in countries such as United Kingdom. Through this method researchers try to understand the user experience by putting themselves in their shoes. So for the purpose of this research, the researcher restricted her joints and acted like using a public accessible restroom while on a manual wheelchair. This experience was helpful to test out hypotheses and for building a theory upon the gained knowledge by experiencing 'through other eyes'. This experiment was photo documented.





Integrating users in design process

Participatory interviews were conducted from 10 wheelchair users at the Disability Resource Center on the Arizona State University Campus in Tempe, Arizona in order to involve users in the research and design stages. As Blomberg (2002) also puts it, Ethnography helps involve the users within the design process (Blomberg et al. 2002). This ethnographic method was the main data collection method for this study. 10 wheelchair users were interviewed. The interviews were designed to be semi-structured and participatory. Sketching on Post-it easel pads was done in order to confirm the understandings of researcher ideas or the informants' issues. This method allowed the participants to comment on the ideas or correct them; some of the users also participated in sketching and expressed their ideas through sketches. The

researcher made the previous sketches available to each participant and consequently they were able to comment on the ideas generated in the previous interviews. Also at the end, some of the participants were asked to accompany researchers to an accessible restroom and simply express how they feel and what they wish was available. This method was of great help to the researcher for it put the actor in the atmosphere and also it allowed the researcher to discover some emotional connections or disconnections by monitoring facial expressions and movements of the participants during the interviews. Many of the issues that were brought up during the short visit to the restroom have never been mentioned while interviewing . It was surprising that users were also ignoring some of the issues only due to being used to it.

Virtual/Digital Ethnography

Virtual ethnography (Hine 1998) was used extensively as a method for this study. In her book, Christian Hine, warns the researchers of missing out on “understanding cultures based on connection, diversity, heterogeneity and incoherence” by focusing only on sites and places. Castells (1996) introduces space of flows, which is organized around connection rather than location. We have to consider the role of space in constructing the cultures and societies.

One of the advantages of health related online services (health 2.0) is the ability to make contact regardless of the time and place. This especially helps the integration of socially isolated chronically sick patients into communities (Wesemann and Grunwald, 2008). Also the anonymity of the

Internet eases the search for psychological help through storytelling, especially for persons with disabilities who are often afraid or ashamed to speak openly about their private issues. The Internet is particularly empowering for this user group through providing a strong tool for emotional support and exchange of personal experiences and stories.

It is worth highlighting Orgad's work (2006) in which he points that the Lack of audio visual cues and physical presence of the users on the Internet motivates patients to disclose their experience more openly through storytelling. For some users it's the distance and detachment facilitated by anonymity and disembodiment of various internet environments including blogs, message boards, social networking websites, videoblogs, forums,

mailing lists and personal journals that enables them to get involved in a lengthy intimate self-disclosure and storytelling. The anonymity of the internet allows patients to have control over their self identity as well as people's reaction to their physicality. (Orgad, 2006).

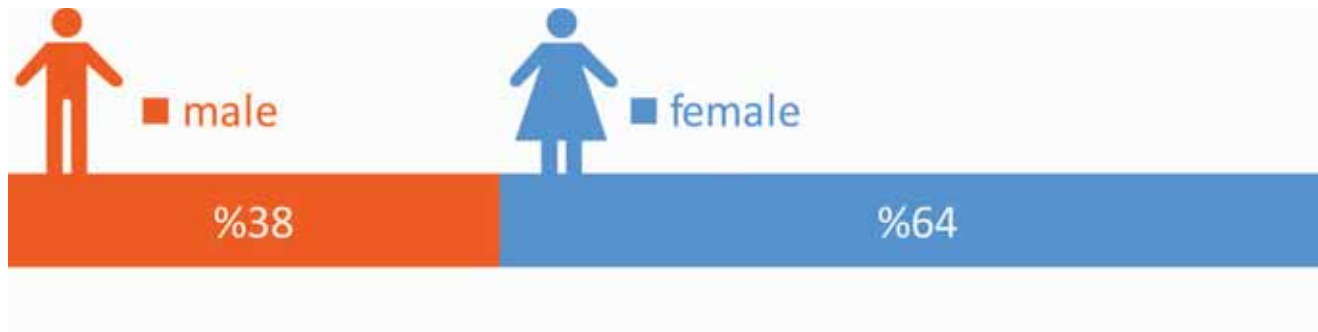
The image on the right shows snapshots of the questionnaire which was used in this study to collect data from 53 participants



Virtual/Digital ethnography tools

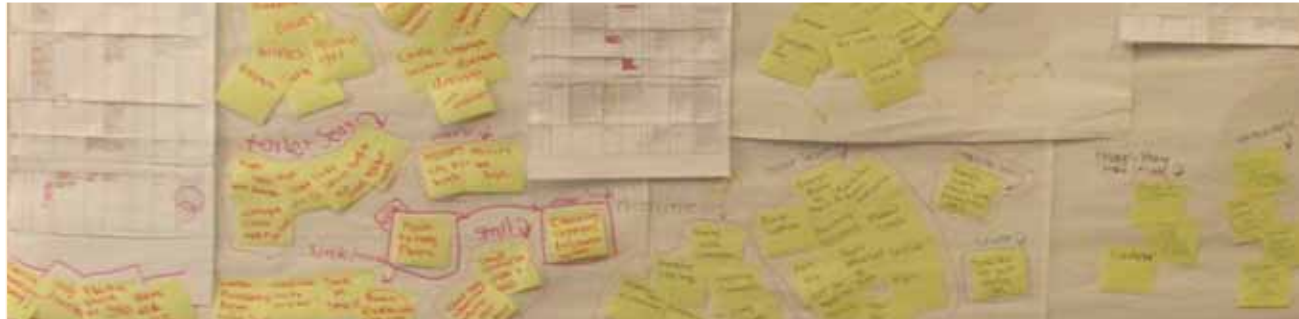
Various Internet environments including blogs, message boards, mailing lists and video blogs were used in this study. A passive observation of video blogs in different discussion boards and forums was conducted initially. Some researchers see this approach as 'Lurking'. Although there are discussions regarding whether or not 'lurking' is a valid method for virtual ethnography (Richman, 2007), many researchers have used it solely for their research (Denzin, 1999 and Schaap, 2002).

The researchers also conducted an interview from 6 users of an online paraplegia chat room namely Apparalyzed. The informants were interviewed in course of a 2 hour chat on their previously created chatroom. Digital ethnography (Murthy, 2008) was also used in this study. In an online questionnaire 53 participants were recruited through Health 2.0 and social networking websites. The questionnaire included 80% open ended questions in order to facilitate participant story telling.



Constant comparative analysis was used as primary data analysis technique in this research to develop conceptualizations of the relations between various pieces of data. This technique was originally developed for use in the grounded theory methodology of Glaser and Strauss as a tool oriented toward finding patterns and commonalities within the human experience (Thorne, 2000). Different stages of Constant Comparison method are 1: finding indicators of different cat-

egories in events and behaviors, 2: naming and coding the categories, 3: comparing the codes in order to find consistencies and differences, 4: consistencies between codes finally reveal major categories from the data some of which become more central focus in the research process and help narrowing down the research questions, topics and conceptual framework of the study.

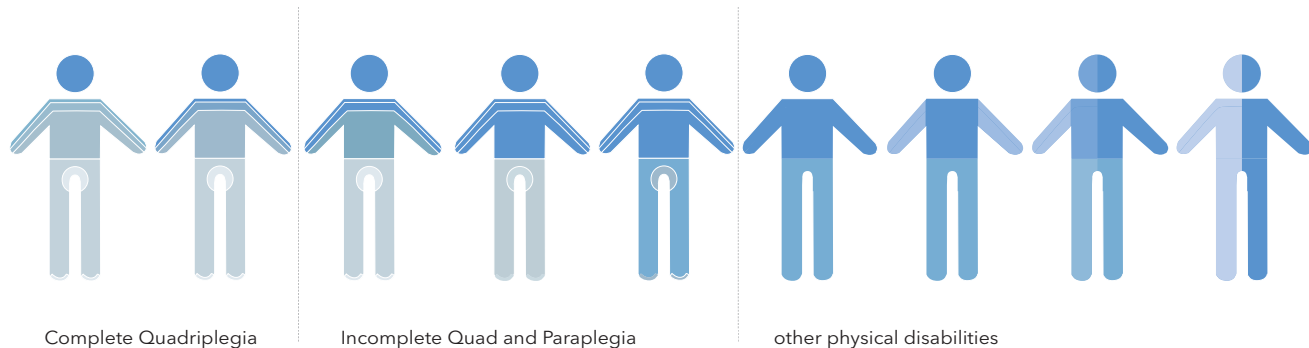


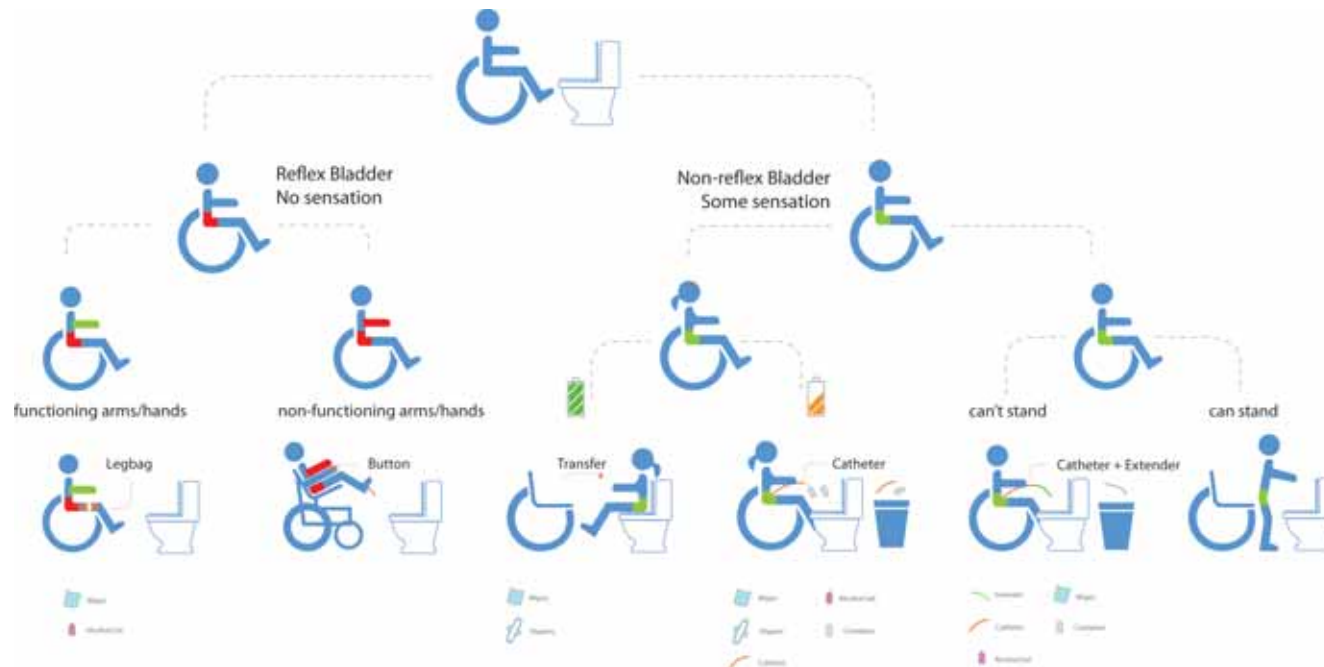


Categories

This study resulted in a more comprehensive understanding of the users as well as their attitudes and emotions towards public restrooms. After 10 participatory interviews, the virtual ethnography of 6 users, and the collection of online survey results from 53 participants, the researchers looked for patterns and found out that almost none of our participants use public restrooms for solid waste elimination since they have everyday routines for their bowel movements. Respondents reported

using public restrooms for liquid waste elimination very differently based on their level of disability. As a result their experience in and emotions towards public restrooms were different. User categories based on the level of abilities are visualized in the image below. Darker color indicates a higher level of physical and sensual ability and lighter color shows less ability in the shown area. The focus of this research is the first two categories because these groups often have incontinence.






Many different aspects other than the level of disability itself were involved in our user categorization. These factors are presence of sensation in bladder and bowel, gender, level of comfort with performing personal hygiene in public facilities, level of sensitivity to infections, level of spasms received due to muscle stretch, weight of body and strength in arms. wheelchair users were categorized into two major categories:


Category A: This category is comprised of those users who have enough sensations in their bladder, in other words they can tell when they should go. These users have non-reflex bladders and mostly use the restroom for catheterization more than 4 times a day. This category also contains those users who prefer to transfer on the toilet using their arms and grab bars or tools like transfer board.

Category B: This category is comprised of those who don't have enough sensations in their bladders or in other words they can not tell when they have to go but their bladders are reflex, meaning that it will empty itself in a sudden muscular contraction that the user can not sense it. These users usually use in-dwelling catheters and leg bags to collect their urine and they often use restrooms only to empty their urine bags. These are mostly users with the least amount of functions in their hands and arms so some of them find it impossible to open the manual valve on their urine containers and consequently need assistance.




Category A is divided into female and male users. Not all of the male wheelchair users like or can use urinals specifically because it's outside the stall and it's "embarrassing" or "weird" for them to use; they prefer to use the toilet bowl instead. In this category, Male users who cannot stand, use a catheter and an extender to empty their urine two or three times a day while they are away from home. Most of the users in this category have enough strength in their hands and arms to empty their bladder using a catheter and an extender without needing assistance. Since catheters need to be disposed of after each usage our participants mostly complained about not having a reachable and big enough trash can inside the stall. In order to take the catheter out of the stall most respondents have to put it on their

lap which soils their trousers. In addition to that, taking the catheter out of the stall was perceived as very "embarrassing" for the users.




Female wheelchair users who have sensation in their bladder are categorized into two groups. 1: Those who have enough strength in their arms and hands to help with transferring on the toilet, and 2: Those who don't have enough strength to transfer. These users use disposable catheters and containers only to collect the urine and pour it into the toilet. These users usually carry wipes to sterilize their hands and the insertion spot.





Category B is divided into two sub categories. The first sub category are users with very little function in their arms and hands. These users use an electrical wheelchair. Some of these users install an automatic valve opener on their catheter which operates through the chair so all they often have to do is to “get the chair high enough for their feet to reach the top of the toilet and then push a button” James, one of the participants said. If their wheelchair is not equipped with a automatic valve opener, they often need help. This sub category of users expressed emotions like fear, anxiety, and disgust. The reasons were mostly not having enough space to maneuver around in the stall; not enough space for the users to elevate their wheelchairs; the fact that these users cannot see where the urine is pouring; sometimes the

toilet is too high for their wheelchair; and often they find it very hard to flush or clean the toilet.



The second sub-category is comprised of users who have some functions in their hands and can open the valve. These users use a container to solve this problem. All that this sub category needs is drainage at the right height and right proximity to eliminate the need of an extender or a container. This will make the process more hygienic and it will prevent possible infections




John is 'Category A' user and he is physically not able to stand up. He uses a catheter and an extension tube to empty his bladder. He mentioned that he has to make sure he keeps his extension tube clean all the time but the researcher noticed that his extension tube was under his seat. This can cause infections in his bladder; it also can cause heart attacks and constant bladder accidents. He expressed emotions like frustration, and fear of infections.



Julia is a 'Category B' user. She does not have any sensations in her bladder and wears an indwelling catheter attached to a leg bag. Since Julia wears shorts almost all the time she wears her leg bag on her lap. since she does not have full functioning fingers her roommate helps her most of the time with opening the valve of her leg bag and emptying it in toilet when she is away from home. She often uses public restroom twice a day.



James is a 'Category B' user and he does not have sensation in his bladder. He only has one arm muscle working and he uses that to push a button and open the valve on his leg bag through his wheelchair. This helps him use the restroom without help and on his own. He explained, "in case of breaking the machine, the valve could be opened manually". He has to elevate his chair for the tube to be on top of the toilet.



By observing the users in the environment and while performing tasks like transferring, closing the door, maneuvering in the space, washing hands and reaching different objects like trash cans as well as the position of wheelchair in the stall we captured many things that we could not actually understand by just interviewing the users. Various issues were brought up by users such as the lack of a shelf in the stall. Rita, one of the participants said “I use the grab bars to put my stuff on” and also Aaron, another participant said “I always carry my things on my lap and when I go to the restroom, I’m like: oh, damn” as he has no other choice but to put his stuff on the ground. Getting in and out of the restroom is another issue for the users. Mostly there is not enough maneuvering space in most of the stalls.

James, said “It’s frustrating, when I can’t turn around and close, I just don’t care” and he leaves the door open. Another common issue was the use of accessible stalls by able bodied people. “I always get angry and frustrated then I say something to them and I’m sure they feel bad all they” Lisa said. Almost all of our participants expressed that when they go to use the restroom, they need to go immediately, and they are annoyed to see a non disabled person using the restroom “But I don’t know how to stop that” Aaron said. He believes it’s a cultural issue.

Users need to feel safe in the stall, specifically because their bones are fragile and falling could be very dangerous for them. Opening and stretching legs for most of the users are impossible since


it causes spasms so even if they transfer they have to do it very slowly and without stretching legs or opening them. Designers have to reduce negative affects from the accessible public restrooms as much as possible to reduce stress and consequently reduce danger of accidents in restrooms. Almost none of the users use the toilet to transfer on to; wheelchair users mostly catheterize. Catheterization requires a surface to put tools on, and drainage for

disposal. Wheelchair users often use the toilet for drainage and this causes stress and occasionally embarrassment. Sometimes the height of the toilet prevents them from using gravity to empty the urine bag or their bladder



What is desirable to business



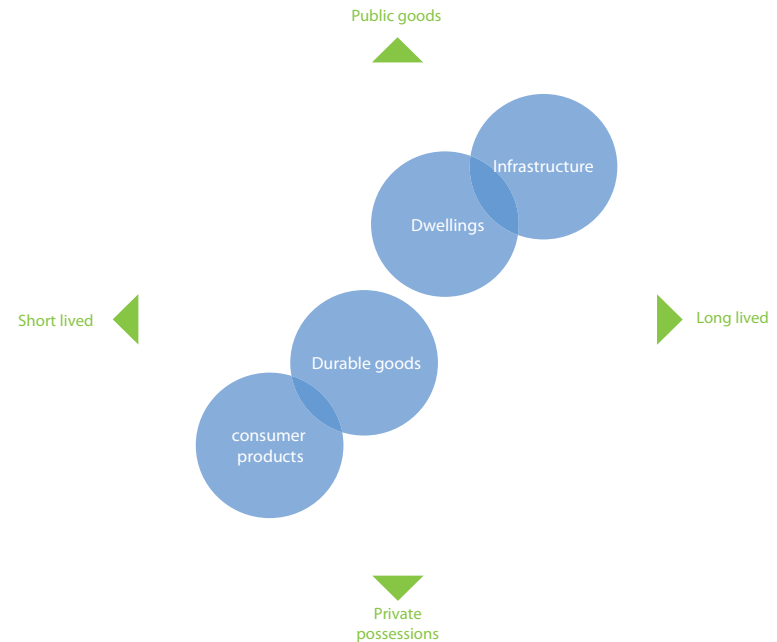


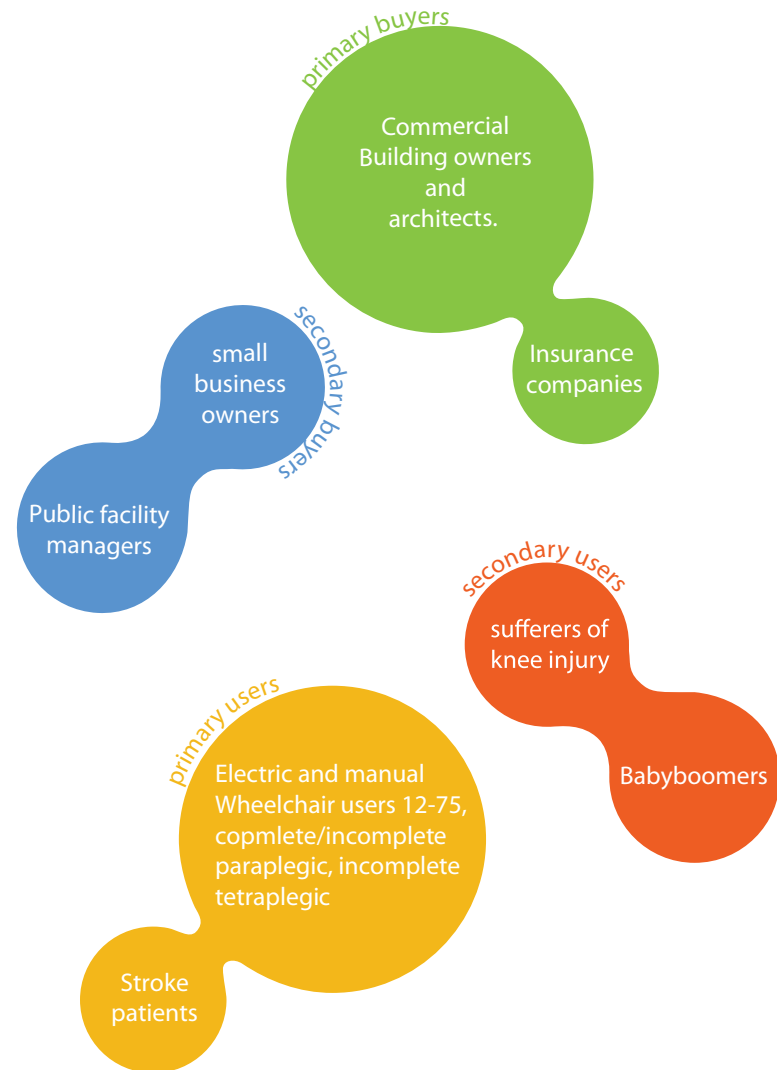
Accessible technology is going mainstream as more and more people with disabilities begin to discover the many ways it can improve their quality of life. According to the latest information from the U. S. Census Bureau (2007), nearly one in every five Americans has some level of significant sensory or physical disability. This makes the 50 million Americans having hearing, visual, or mobility impairments the largest consumer group in the nation. According to the U. S. Census Bureau, In the next 10 years, the number of Americans over 50 will increase by 40%. Between 2000 and 2030, the numbers of Americans over age 65 will more than double, from 34.8 million to more than 70.3 million representing \$150 billion in annual discretionary income, and billions more for necessities like

housing and food. Americans 50 and older represent 25% of the population, but control 50% of the nation's buying power and 75% of its assets. About 30% of all Americans become disabled prior to retirement age. Several of universal design pioneer organizations noted the advantages of being first into the field. With nearly no advertising budget, Oxo international grew at a 40-50% annual rate from 1990-1995, to \$20 million in sales. Handicapitalism a brand-new term was used by wallstreet journal which describes that People with disabilities should be viewed as profitable marketing targets. There are also other terms used by trend specialists to describe this market such as 'Sleeping giant'.

Who Pays?

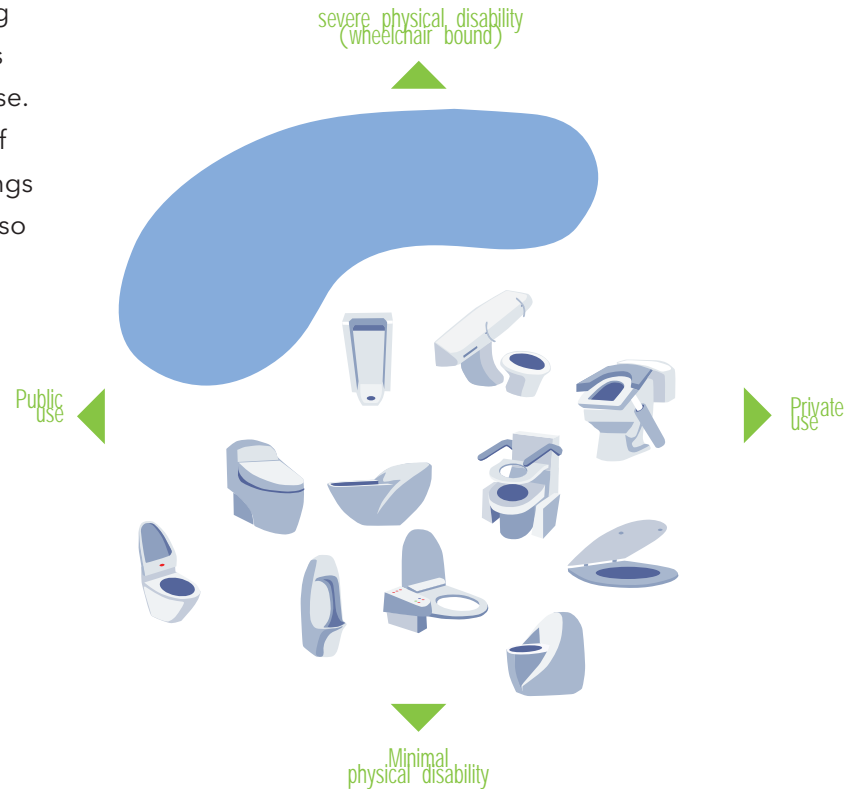
As the focus of design goes up from consumer products to housing, buildings, and urban infrastructures, there is a shift in terms of who bears the expense. consumer goods are purchased by individuals, whereas more expensive ones tend to be financed by society as a whole. there is also a tendency for designs to last longer as they become more public. Today, assistive products have a low market share compared to other ordinary everyday products, as most manufacturing companies do not operate towards persons with disability as customers. Usually other actors order the assistive product for a consumer who later will become the end user. Main buyers of the assistive products are Care homes, hospitals, and businesses that foster equal opportunity.





Market gap

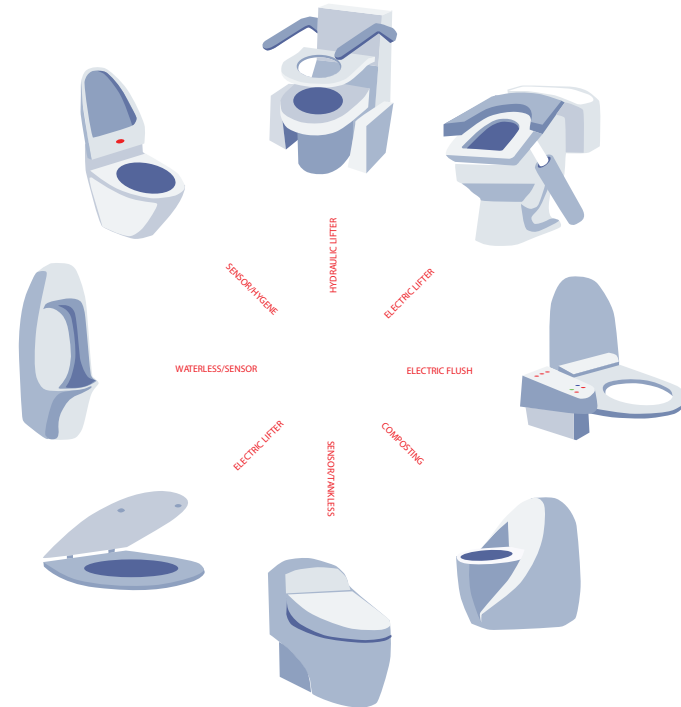
Currently there are many products in the market which are addressing different issues of toileting for wheelchair users but none of these products are designed specifically for away from home use. This can result in both fewer and shorter stays of physically challenged users in the public buildings and since they are a large minority group this also creates a huge market gap.



What is possible through technology



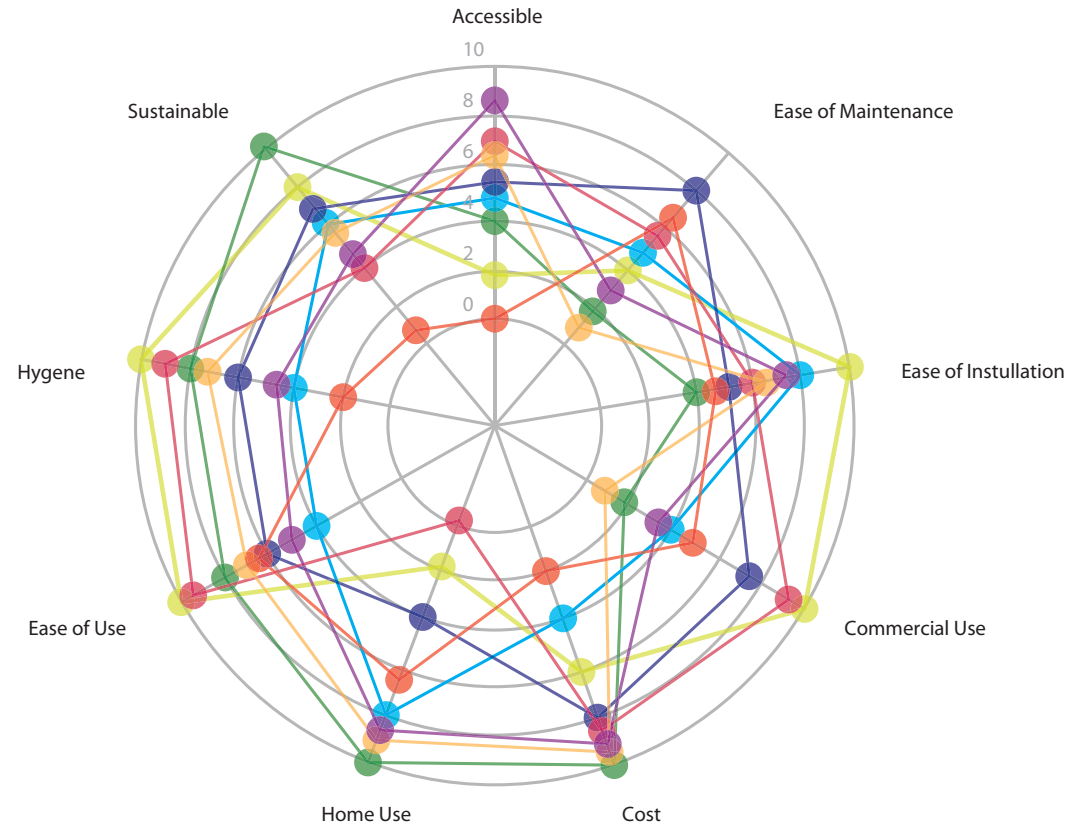
Technology has always had an essential role in extending our capabilities in work, leisure, social and recreational events, and in our journey into, through and from this world. The idea of assistive technologies that help restore or enable a greater degree of functionality is hardly new. Application of technologies like rehabilitation technologies, materials engineering, nano, and bio-mimic materials has potential to produce more humane products and services. Today companies use technologies to make the toileting experience more sustainable, hygienic, and accessible for users. For example companies like, Toto, Biolet, and Kohler design waterless urinals and companies such as Naturum, design waterless toilets. Also companies like Phillips Lift Systems, and Clos O Mat, design lifters for elderly and disabled users.



Technology benchmarking

- Waterless Urinals
- Waterless toilets
- Dual Flush
- Flushometer
- Automatic Flush
- Washlets
- Toilet lifts
- Regular tank toilet

	Accessible	Ease of Maintenance	Sustainable	Ease of Installation	Hygiene	Commercial Use	Ease of Use	Cost	Home Use
Waterless Urinals	2	4	8	10	10	10	10	6	2
Waterless toilets	4	2	10	4	8	2	8	10	10
Dual Flush	5	5	7	8	4	4	4	4	8
Flushometer	5	8	7	5	6	7	6	8	4
Automatic Flush	7	5	4	6	9	9	9	9	0
Washlets	6	1	5	7	7	1	7	9	9
Toilet lifts	9	3	5	7	5	5	5	9	9
Regular tank toilet	0	7	1	5	2	5	6	2	6



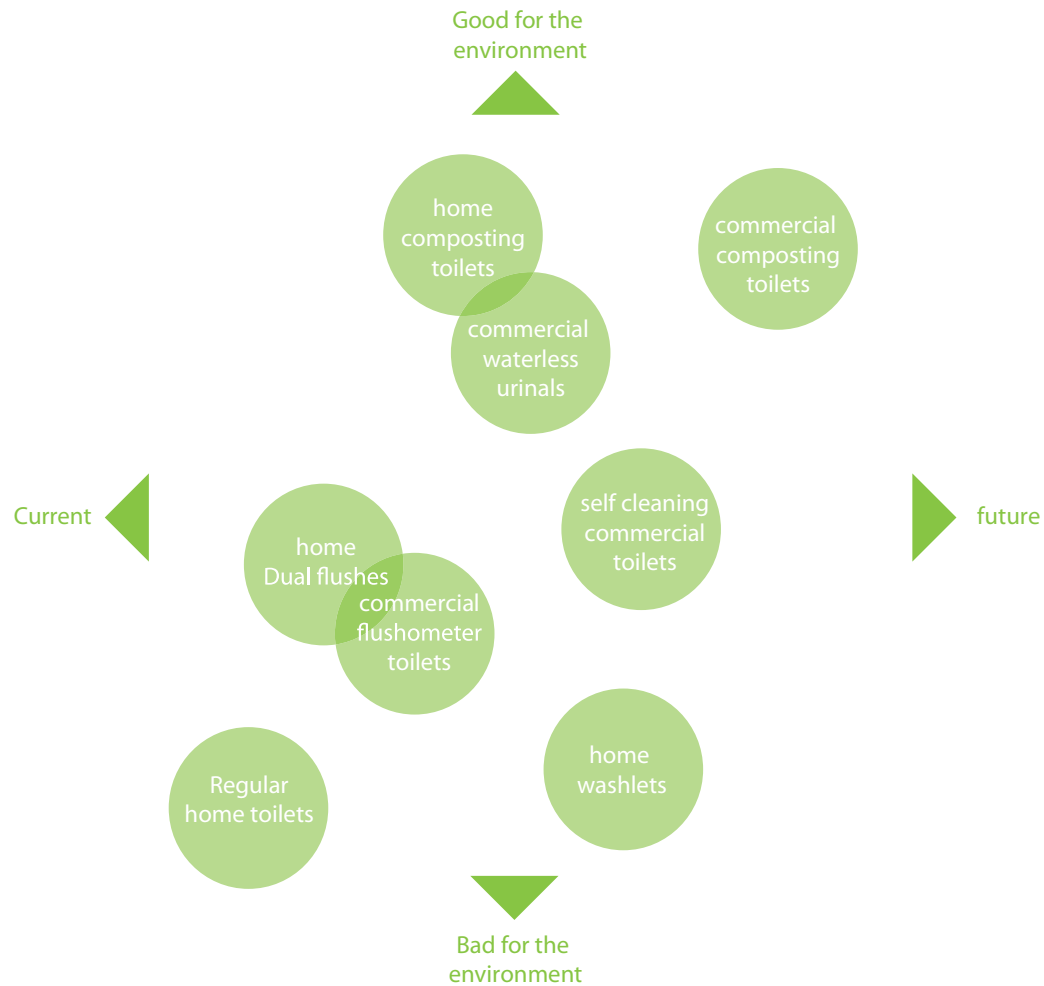
What is good for society/environment



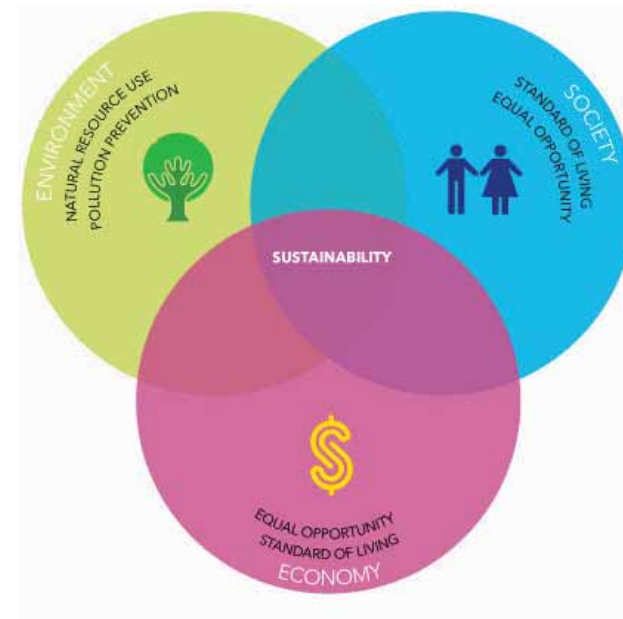


Around the world, temperatures are rising and sources of freshwater are becoming increasingly unpredictable. Two and a half billion people already lack access to basic sanitation, and nearly one billion people lack access to safe drinking water. Adding to the problem, global warming is also expected to lead to more floods and more droughts, both of which reduce the availability of safe, clean freshwater for drinking, sanitation, irrigation and other basic needs. Fortunately, there are technologies such as waterless toilets and urinals that can improve sanitation, protect existing supplies of freshwater, and create new sources of safe water. Water consumption at public restrooms depends on the number of fixture units and the intensity of restroom usage. If we assume that an average

size public restroom consists of a total of 8 flush toilets (3 men's and 5 women's), 2 urinals and 5 lavatories and it's being used for 4 hours which is a high intensity usage, the total demand at this restroom would be about 500,000 gallons per month. A study shows waterless 21 urinals and 42 low flush toilets saved \$4200 annually and cost \$700. Replacing 21 urinals and 42 toilets in a high traffic place could save 761,326 gallons of water annually enough water to fill over 4 Olympic-size pools. Waterfree urinal involves a vitreous china or stainless steel fixture and a replaceable cartridge that is connected to a drainpipe.

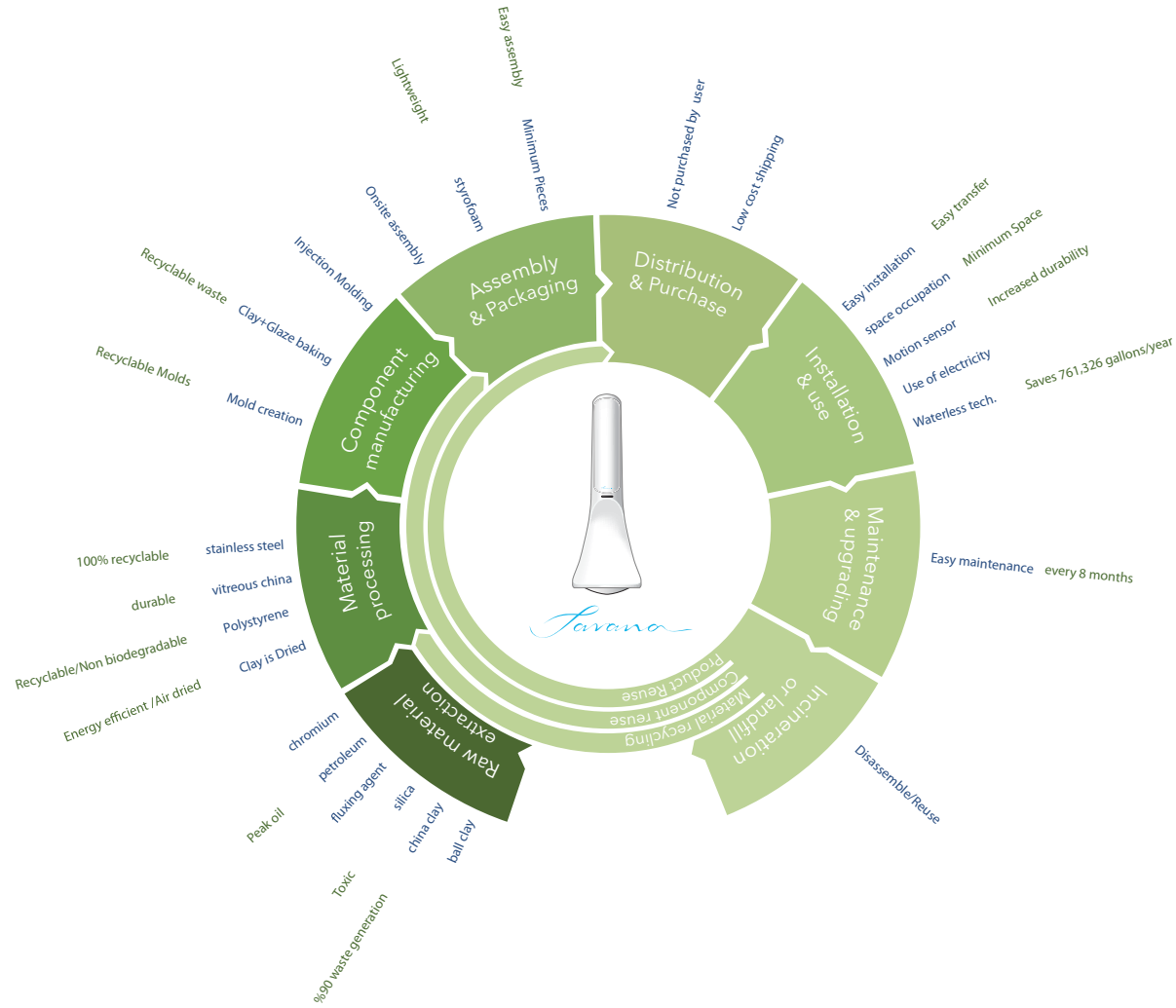


Until the 1980s, business leaders used the word sustainability to mean a company's ability to increase its earnings steadily. The term became widely used in its present sense in 1987, after it appeared in a United Nation report by Gro Harlem Brundtland, Norway's former prime minister, who defined sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable development does not focus solely on environmental issues. Interdependent and mutually reinforcing pillars of sustainable development are economic development, social development, and environmental protection.



The materials that are used in this restroom fixture include Polystyrene for the moving parts of the fixture which is %100 recyclable but not suitable for landfill since it's not biodegradable. Moreover Vitreous China is used for the body of Tavana. Vitreous china makes this restroom fixture specially suitable for public use since it is durable, stain resistant, hygiene and easy to clean. Vitreous china is not easily recyclable although as previously mentioned many companies are using recycled toilets for making tiles and other objects. China clay which is the main component of Vitreous china produces %90 of waste at the time of extraction. This waste is not usable for any other purposes and is usually land filled yet the durability of this material makes it an overall environmentally friendly material.







Product Opportunity Gap

New Design of toilets with wheelchair users personal hygiene methods in mind

Using technology to make the products user friendlier

Removing the concepts of illness and disability from the appearance of product

Encourage businesses and building owners for retrofitting the existing facilities

Make the environment hygiene to prevent infections

Make the environment different to prevent able bodied use

Very easy to install and maintain products encourage the buyers to buy more

Shelves and hooks are essential artifacts in a accessible public restroom

Appearance benchmarking

Tavana is a very unique and progressive restroom fixture with no competitors. Tavano's humble appearance suggests comfort and privacy. The white ceramic and the finish is an indicator of cleanliness and smooth organic shapes are used to make the environment calming and safe. These give the products a fairly stylized personality.



CLEAN

HELPFUL

EFFORTLESS

SIMPLE

INVITING

INNOVATIVE

↘ PERSONALITY



INVITING
PROGRESSIVE
CALMING
BOLD

↘ FORM



ORGANIC
SMOOTH
SAFE
SIMPLE

↘ MATERIALS



CERAMIC
ALUMINUM

↘ DETAIL



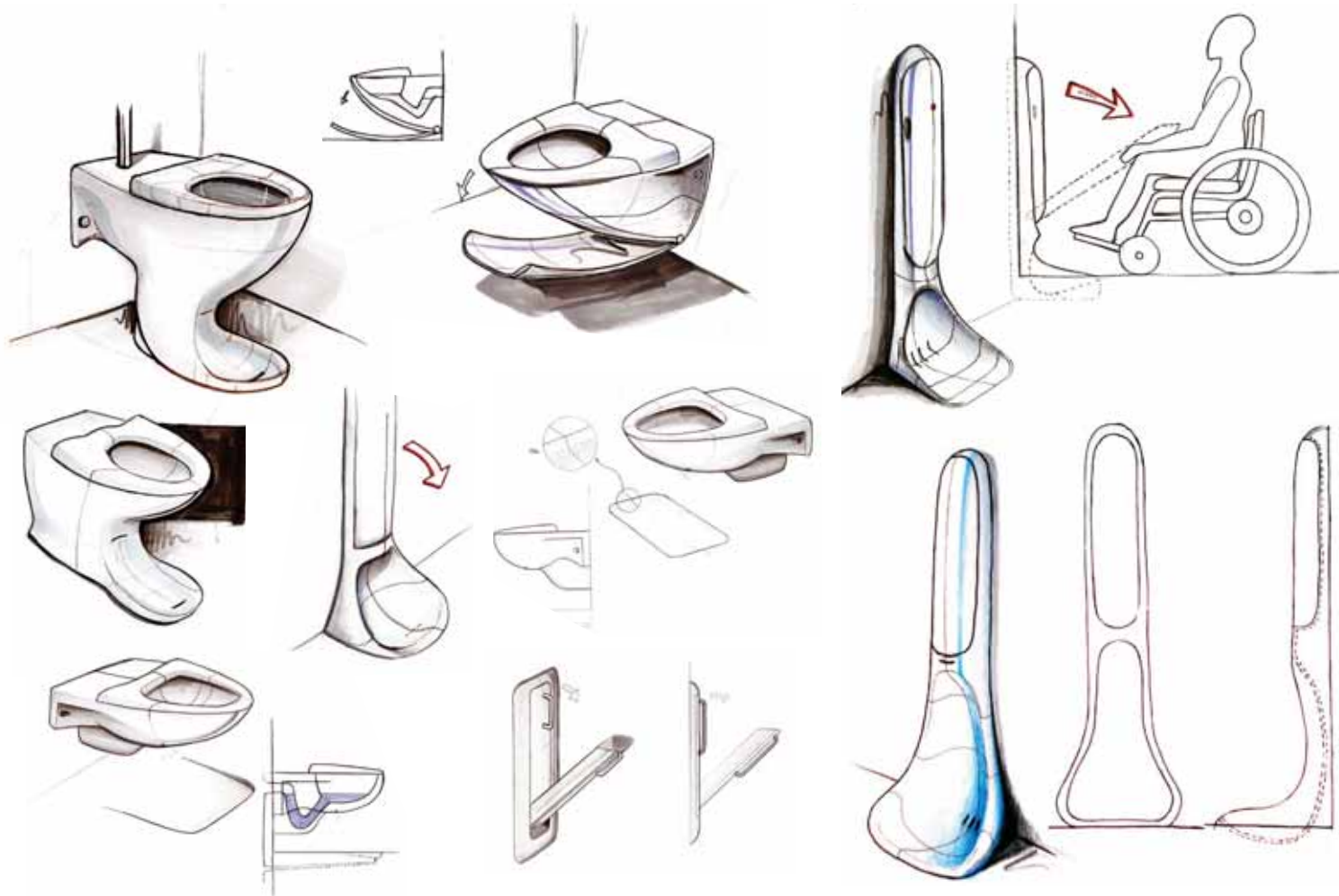
MINIMAL
SMOOTH
SIMPLE
ATTRACTIVE

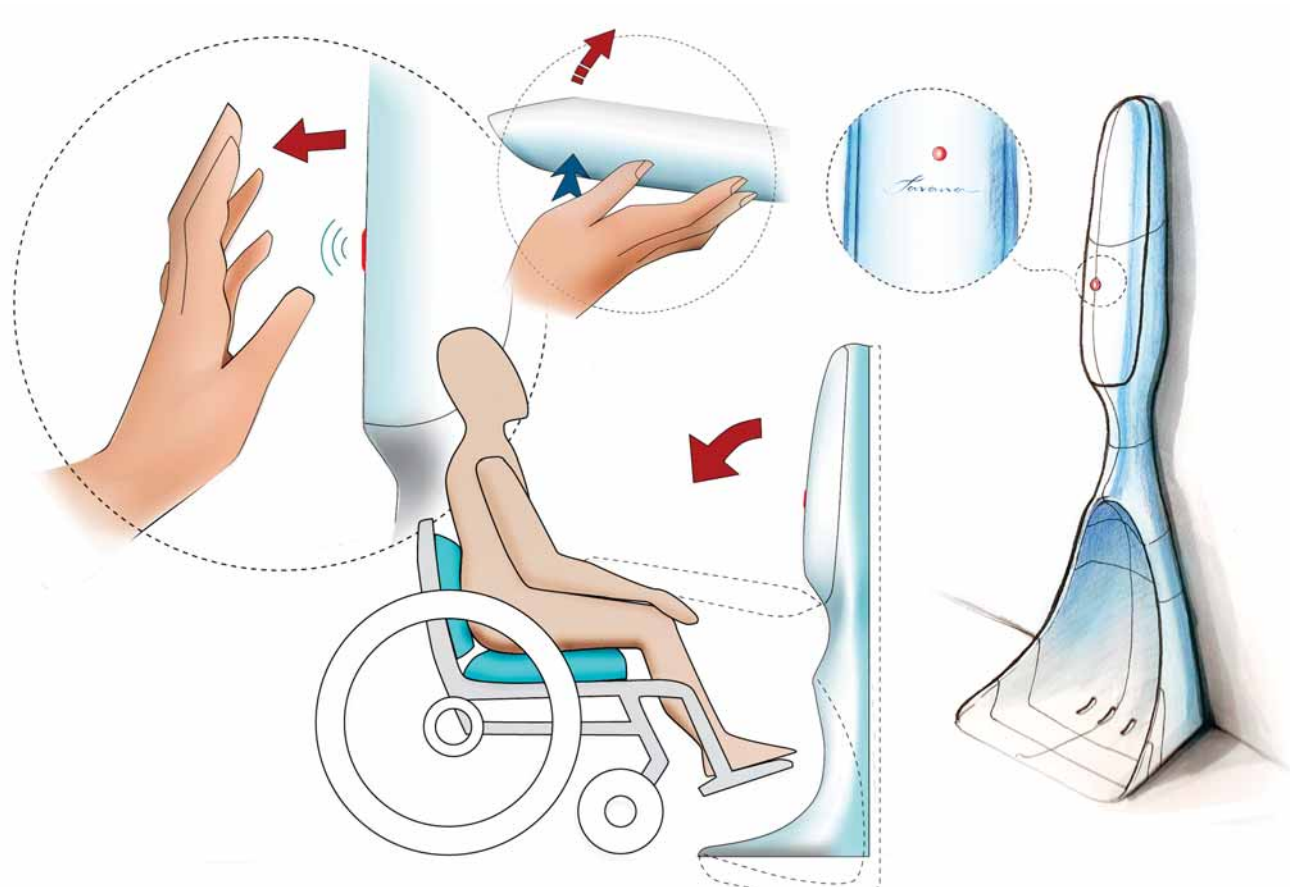
↘ COLOR



WHITE
RED
METAL FINISH

Concepts

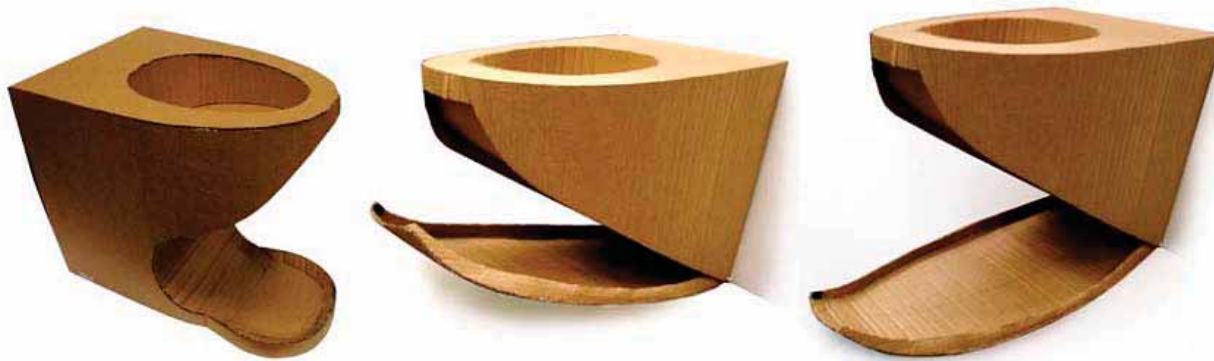




In order to test the ergonomics and usability of some of the early concepts, low fidelity prototypes were made using corrugated cardboard and foam. These prototypes were tested with different users. Moreover an online concept evaluation was conducted with more than 20 wheelchair users. In this concept evaluation, users rated each concept based on the perceived usability of the product considering their own specific need. These initial concepts targeted users of catheters and indwell-

ing catheters and are focused on the elimination of the stressful steps from the experience of these users who frequent the accessible stalls as much as possible. By designing a restroom fixture specifically for needs of wheelchair users we can make the restroom environment safer and more inviting.

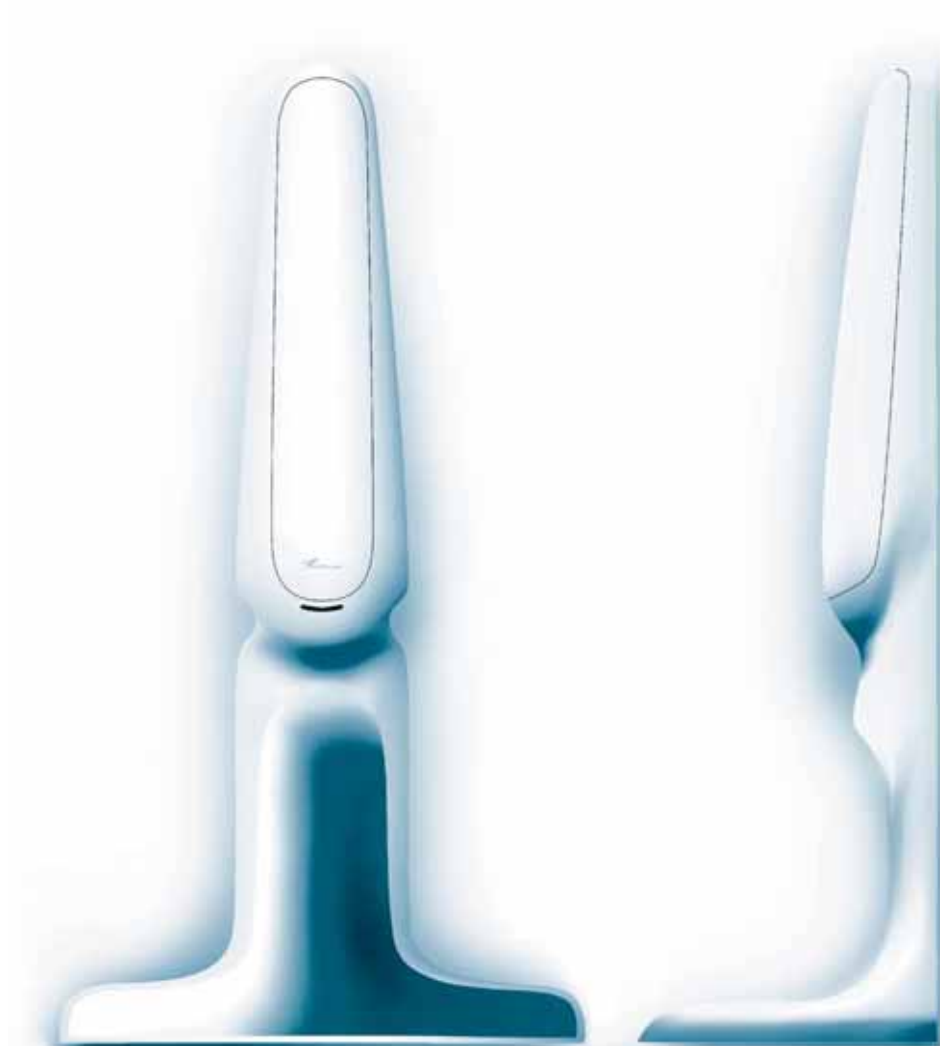
71% of the participants rated concept 4 very helpful and 52% rated concept 1 as very helpful. Concept 4 is a combination of concepts 1 and 2.



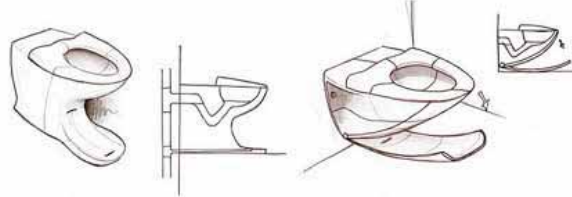
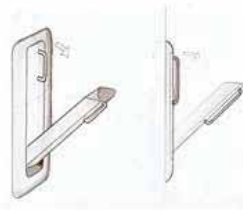


Behavioral Prototype





Concept evaluation



Very helpful

9 (52%)

Somewhat helpful

5 (29%)

Neutral

1 (5%)

Very little helpful

1 (5%)

Not helpful at all

1 (5%)

3 (23%)

8 (61%)

2 (15%)

0 (0%)

0 (0%)

2 (15%)

8 (61%)

3 (23%)

0 (0%)

0 (0%)

10 (71%)

2 (14%)

1 (7%)

0 (0%)

1 (7%)

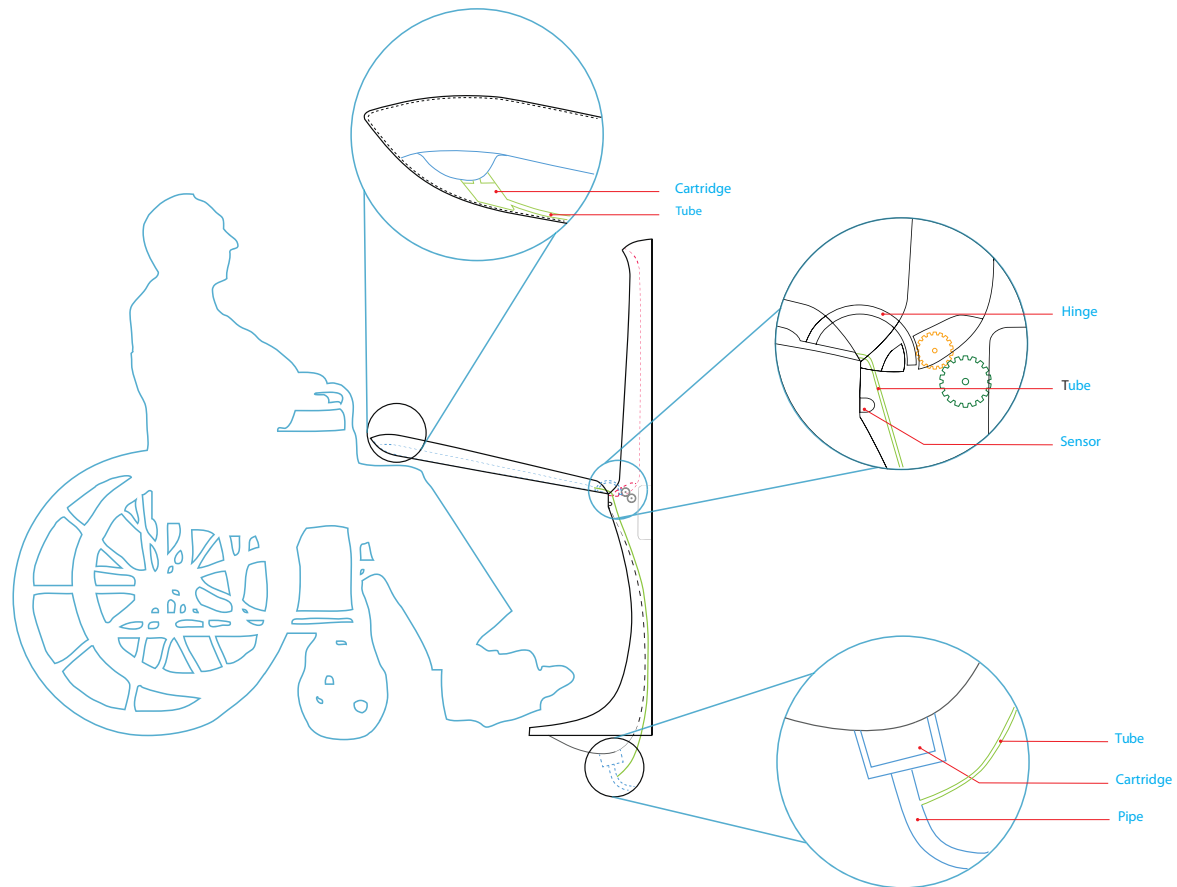
✚ Tavana accommodates the needs of both consumer groups, manual as well as electric wheelchair users who often catheterize in order to eliminate their liquid waste in a public restroom. This product has a moving part that act as an adjustable waterless urinal which opens through triggering a motion sensor and closes up with a slight pressure. This helps users who have less strength in their arms to use it independently. The lower part is designed for users of indwelling catheters who operate their catheter valve opener manually or electronically through their electric wheelchair. This can also eliminate dangers of elevating the wheelchair inside the restroom stall.



Orthographic views

Tavana requires minimum space and this allows for installation of this fixture in most accessible stalls without the need for renovation. The installation requires a small opening on the floor for the bowl to be placed in. Since Tavana is waterless there is no need for plumbing for water however, there is a need for connecting this fixture to the buildings' sewer system. Moreover, there is a need for electricity since the moving part of the fixture requires electricity to operate.

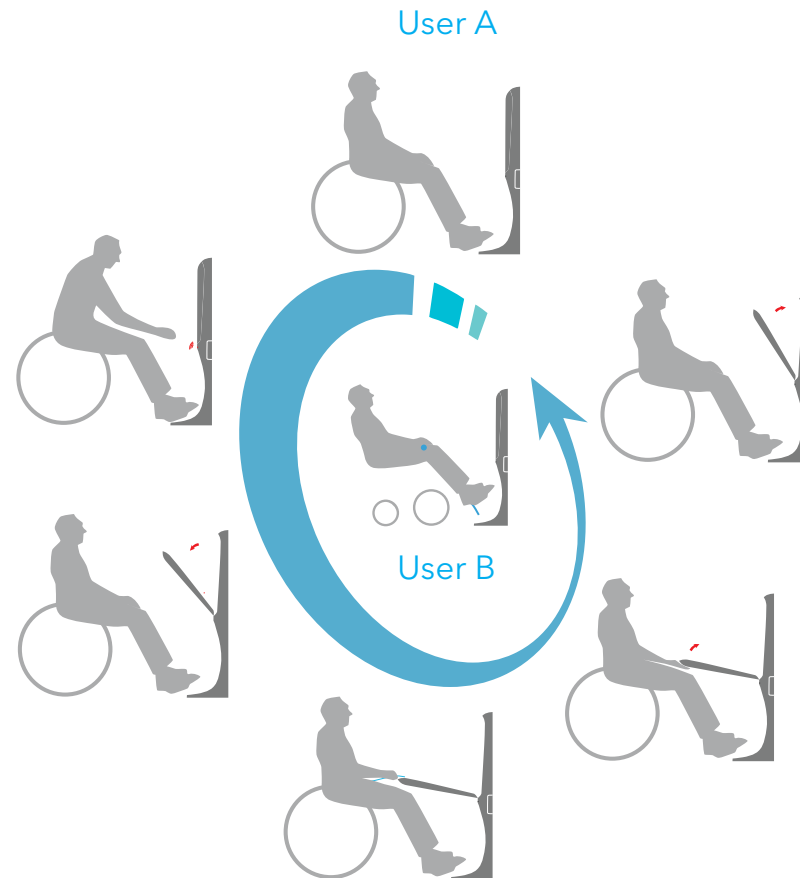












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equal
participation
democracy

