A Multi-Angled, Multi-Purpose Universally Designed Prep Bowl

Jamie Acker
Rochester Institute of Technology

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by
Jamie Acker
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Committee Signature Page

Graduate Advisor:

Sean Rickett: Date: 2/1/09

Committee Members:

Abir Mullick: Date: 2/1/09

Jim Lentini: Date: 2/1/09

School of Design Chair:

Patti Lachance: Date: 2/3/09
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Abstract:

This thesis explores the journey of a product initially designed to help one particular demographic and how it evolved into something, which caters to all... something Universal. Jamie Acker has a personal history with stroke and its effects on people. Initially he sought to create a product, which would empower those afflicted with the extreme paralyzing side effects associated with stroke. Soon after discovering Universal Design, the entire idea evolved into something greater. Jamie designed a mixing bowl, which can be operated with one hand. The bowl rests in a base, rotates and locks into multiple positions empowering those with limited mobility and those who just want a great product.
Chapter I

INTRODUCTION

This thesis incorporates two things which are very personal, meaningful, and extremely important to me.... 1. Stroke, its effects on the victim and the ones they love 2: Universal Design, it's principles, purpose, and importance to everyone.

Background, Motivation, and Objective

The year is 1984. It's late afternoon when Susan stops to take a rest from her overwhelming amount of responsibilities in the house. Her children are home from school and her husband will be home shortly as well. Finally she thinks, I can take a rest. Dizzy and overwhelmed with tiredness, Susan goes into her bedroom to take a nap. Shortly after she awakens she goes to get up but can not move anything on the left side of her body. "This is a dream," she thinks and tries again. BOOM. She plummets to the ground after trying to stand up. Susan calls for her children who come to her aid. She just had a stroke.
I was six years old when my mother Susan Acker had her stroke; she was 34. The following months were extremely difficult for her and for good reason. She could not move anything on the left side of her body. I remember having a Spiderman grip toy where if you squeezed the base it would clench up into a fist. "Here mommy, you can use this," I would tell her and squeeze the hand open and closed. Fortunately she began getting better, and ultimately had a full recovery!

Unfortunately, not everyone who has a stroke fully recovers or even partially for that matter. When I was six years old, I wanted to empower my mother with a substitute hand — of course, now I know that toy couldn't help her. My goal is to create a product that is not only functional to stroke survivors, but also empowers people with limiting physical ailments such as arthritis, paralysis, and elderly conditions.

When I started doing research on the limitations of stroke survivors I came across many assistive, adaptive, and accessible (design) products which had been poorly designed. On top of their design problems, these products screamed "disability" — the stigma attached to them was quite evident. After doing a little more research, I discovered Universal Design. I immediately fell in love with the concept and principles. A focus on design for as many people as possible regardless of their age, race, gender, or physical ability. I realized this is what design is really about! At that moment, my thesis changed from designing a product for stroke survivors to designing a product which would benefit many types of sufferers and survivors as well as people of all abilities.

Everyone gets old; there is no fighting it. Someone who may presently be categorized as a
young, strong, active and able person will age and their capabilities will change and eventually deteriorate. The elderly are not “them” — they’re “us” a few decades into the future. Today people of all ages are fit, active, and healthier than ever. In addition, improvements in medicine add to the current population’s life expectancy. Healthier people mean longer life spans. Longer life spans mean more active “seniors.”

Our modern world has been designed from top to bottom, to match the size, shape, and style of youth—from the height of the steps in our public buildings to the length of time it takes for traffic lights to change, from the size of the typeface in our newspapers and magazines to the auditory range in our telephones and televisions, from the age and style of the models in advertisements to our embarrassment about our birthdays. In thousands of ways, over and over we are being influenced to like what’s young and dislike what’s old. The bottom line is that it is not only my responsibility and duty, but that of all designers in every field to recognize the needs of EVERYONE.
Chapter II

RESEARCH

Stroke

Everyone is familiar with heart attacks, what they do and their seriousness. What most people don't know is that a stroke is very much the same thing as a heart attack, but it occurs in a person's brain. Any stroke victim or their family members can tell you that a stroke is indeed a "brain attack." "Stroke is a disease that affects the arteries leading to and within the brain. It is the number three cause of death in the United States, behind diseases of the heart and cancer. A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is either blocked by a clot or bursts. When that happens, part of the brain cannot get the blood (and oxygen) it needs, so it starts to die." (8)

There are two types of stroke, Ischemic and Hemorrhagic. A Hemorrhagic stroke is not as common as an Ischemic stroke. A Hemorrhagic stroke happens when a weakened blood vessel ruptures and bleeds out into the surrounding brain and compresses the surrounding brain tissue. An Ischemic stroke occurs in 85% of stroke victims. "Ischemic strokes occur as a result of an obstruction within a blood vessel supplying blood to the brain. The underlying condition for this type of obstruction is the development of fatty deposits lining the vessel..."
Ischemic strokes can cause people to be weakened or paralyzed in portions of their body. If the stroke occurs in the right brain, the left side of the body will be affected and vice versa. See image below:

**right brain**
- Paralysis on the left side of the body
- Vision problems
- Memory loss
- Quick, inquisitive behavioral style

**left brain**
- Paralysis on the right side of the body
- Speech/language problems
- Slow, cautious behavioral style
- Memory loss
Disability

An understanding of the disabled demographic is absolutely necessary in order to design an inclusive product. A large percentage of Americans are currently disabled, and as lifespans increase, these numbers will only become greater. With the staggering amount of baby boomers approaching retirement, disability due to age is almost guaranteed.

Federal law defines a "disability" as a "physical or mental impairment that substantially limits or restricts the condition, manner, or duration under which an average person in the population can perform a major life activity, such as walking, seeing, hearing, speaking, breathing, learning, working, or taking care of oneself. (An impairment or diagnosis, in and of itself, does not necessarily constitute a disability: it must "substantially limit" these activities. Disabilities do not necessarily impair the individual's performance but may require the individual to seek alternate methods of carrying out a given task.)"[3]

According to the U.S. Census Bureau, the percentage of people between the ages of 16-64 with disability in 2003 is 12% (see figure A).[4] The Cornell University 2004 Disability Status Report states that the percentage of "working people" between the ages of 21-64 whom are living with disabilities in 2005 are 12.1% (see figure B).[5]
An estimated 20.6% (53.9 million people) met the criteria for disability as measured by the Survey of Income and Program Participation (SIPP) in 1995. One in five Americans has a
disability. An estimated 20.6% of non-institutionalized civilians (53.9 million people) met the criteria for disability as measured by the SIPP. Women and girls with disabilities are estimated to number 28.6 million, which is 21.3% of the female population. An estimated 25.3 million men and boys with disabilities make up 19.8% of the male population. (6)

Figure C. Americans with and without disability, by gender (6)

Disabilities come in many shapes and forms ranging from physical to sensory to neurological.
For some people, their impairment may not be outwardly apparent, however, for others it can be unmistakable. Whether an individual's ailment is clearly visible or not, the fact is they are handicapped and often need assistance.

The Disability Discrimination Act categorizes disabilities as listed:

- Physical
- Intellectual (or learning)
- Psychiatric
- Sensory
- Neurological
- Physical disfigurement
- Presence of the body of organisms causing or capable of causing disease

Because this thesis focuses on physical disabilities, that is the topic which I'll explore in detail.

Physical disability affects a person's day-to-day life. It can limit a person's dexterity or mobility. Doing everyday things can be extremely difficult and/or impossible. Physical disability can be the result of an accident, injury, or illness.

When hearing the term disability, many people associate it with paraplegia or quadriplegia. Paraplegics can perform all functions of a non-injured person from the waist up, but from the waist down, they can not stand or walk. Quadriplegics however, cannot move their arms in
addition to their legs. They are paralyzed from the neck down. The term quadriplegia (ac­
cording to dictionary.com means "paralysis of four limbs or the entire body below the neck."

"A physical disability is one that affects a person's mobility or dexterity. A person with a
physical disability may need to use some sort of equipment for assistance with mobility. It also
includes people who have lost limbs or who, because of the shape of their body, require slight
adaptations to be made to enable them to participate fully in society.

A physical disability may have existed since birth or it could be the result of an acci­
dent, illness, or injury suffered later in life. Paraplegia and Quadriplegia are what many people
first identify with a physical disability. Paraplegia results from injury to the spinal cord, occur­
ring below the neck, while quadriplegia refers to damage to the spinal cord in the neck. Vary­
ing degrees of loss of limb and other mobility may result from either condition. The conditions
are often caused by motor vehicle accidents. Other forms of physical disability, such as polio
(an acquired disease), cerebral palsy (damage to brain tissue during fetal stages) and some
genetic conditions can result in loss of mobility. "(7)
Chapter III

Primary Research
Interviews and Surveys

I joined several different online disability communities and have made a lot of friends in the process. After speaking with people of all different ages and abilities, I posted an online survey in the hopes of obtaining a better understanding of their ailments.

See figure D, E, and F.

Stroke Survey

1. At what age did you suffer stroke? Have you had any reoccurring strokes since?
2. What type of stroke did you have?

3. How has the incidence of stroke affected your body? Please explain.

4. Are there stronger and weaker aspects of your body? What are they?

5. How has the incidence of stroke limited your ability to perform tasks of everyday living?

6. What tasks are the most difficult for you? Why?

7. What kind of difficulties do you encounter while performing tasks in the bathroom?

8. Do you have difficulty applying toothpaste onto your toothbrush? If yes, please describe the process, and the difficulties.

9. How have you altered your bathroom since having stroke?
10. What type of assistive devices do you use while in the bathroom?

11. How effective are these devices?

12. What kind of difficulties do you encounter while grooming yourself? ie: combing hair, applying deodorant, make up, washing your face etc...

13. What kind of difficulties do you encounter while performing tasks in the kitchen?

14. How have you altered your kitchen since having stroke?

15. What type of assistive devices do you uses while in the kitchen?

16. How effective are these devices?

17. What kind of difficulties do you come across while utilizing plates, bowls, and cups?
18. How do you feel about existing assistive dishes? ie: large lipped plates, cut out cups etc...

19. What type of difficulties do you encounter while reading?

20. How do you turn the pages while keeping the book open?

21. What type of difficulties do you encounter while writing?

22. Which tasks did you perform prior to your stroke which you miss most?

23. What types of difficulties do you encounter in and/or while operating a vehicle?

24. Do you find it more difficult to put on a seatbelt since the stroke?

25. Please describe your process of putting on a seatbelt
Universal Design

Because my bowl has been designed following the principles of Universal Design, I’d like to go into some detail of what it is and what it isn’t for those not familiar with it. According to Ron Mace, the founding father of Universal Design: “Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.” The problem with designing all inclusive products is that many people including designers correlate this with the stigma of disability and age. In reality all users benefit and there is no stigmatization.

Often times people confuse Universal Design with assistive, adaptive, and accessible design. All three have good intentions at heart, however in most cases they simply bring attention to ones disability. Assistive products are designed only for people with disabilities. The majority of these products have a sterile “hospitality” look which screams out “I WAS MADE FOR SOMEBODY WITH A DISABILITY!” These products in general are so non mainstream that you either have to go to specialty stores to find them or mail order catalogs/websites. In addition, because it’s such a small market, the prices are typically expensive. Examples of assistive products are bathroom and toilet aids.
Adaptive products are designed to enhance existing products. These adaptive products essentially point out the original product's flaws. "they demonstrate a product's inability to meet the needs of the people who use them." (9) Examples of adaptive products would be a lamp switch attachment and door knob extender. Both are attachments placed onto existing products that users can not utilize properly.
In theory, accessible design is great. Ramps and water fountains of different sizes are great and they do give access to users that couldn't normally use standard existing solutions. They do however segregate users with disabilities from those without. Often times ramps are not conveniently located in the front of buildings like most stairs are. A person in a wheel chair should not have to go to the side of a building or rear in order to enter while others can easily walk in from the front. Often times there are large handicapped signs bringing attention to the users disability.
Simulation

In order to even begin to understand how a person with physical limitations interacts with products, I needed to give myself limitations and interact with the world. I was inspired by what Patricia Moore had done when she transformed herself into an elderly woman. She restricted her motion and even went as far as to simulate arthritis in her hands. (See image below). (10)

I went through a day with a splint on my left arm and leg which did not allow me to bend either joint. Getting up out of bed was no easy task. In fact, falling out of bed was more like it. This exercise blew my mind. Simple things that I did regularly without even thinking about, were suddenly very difficult. I could not support myself at all with my left arm. Despite several different attempts at sitting upright, I ended up on the floor. (See image below).
In addition to giving myself physical limitations, I also experimented with doing daily activities with the use of only one arm. The example I used below is the "simple" task of brewing coffee. Most people don’t think about how many steps it takes to complete daily mundane tasks. People with full dexterity take their abilities for granted.
Simulation

One handed coffee making process:

1. Open lid on coffee can
2. Open coffee maker lid
3. Measure out proper amount of grinds
4. Close both lids
5. Pick up carafe
6. Walk to sink and put down carafe
7. Turn on faucet
8. Pick up carafe and place under faucet
9. Place carafe on counter
10. Turn off water faucet
11. Pick up carafe
12. Walk over to coffee maker
13. Pour water into machine
14. Place carafe into machine
15. Close lid
16. Turn button on
After recording the amount of steps it took to brew a pot, I had some coffee, then tried it again with two hands. The timing and steps were cut in half. I repeated this study numerous times with other daily activities such as:

- brushing teeth
- putting on shoes
- putting on pants
- preparing food

I was amazed at how much more time and effort it took with just one limitation. For people with disabilities or limited dexterity, this is normal. These people have grown accustomed to their routines and don’t expect anything more. They see the flaw being their disability. The real flaw is in our every day products. Products which are thoughtlessly made. Products that are made with profit in mind rather than humans well being. With today’s technology and educated designers, I see no excuse for this lack of consideration. I am certain that inclusive, universally designed products can be made at equal or lesser cost than current products. Again, there is no excuse for bad design.

After simulating disability, I met up with several different people with varying physical ailments such as stroke, arthritis, and limitations due to age, as well as accident victims. I asked these people to tell me what daily activities bothered them the most. What I learned was that these people adapted to life quickly. Taking extra steps to do simple things such as apply toothpaste to a toothbrush was no longer cumbersome, but accepted as normal. I had better luck observing them. One of the people I observed, Charlie squeezed toothpaste onto his
sink and then scooped it up with his toothbrush. Charlie age 85 is a stroke survivor and had been doing this for years. He became accustomed to it and saw nothing wrong with it. Gloria age 59: "I lay the brush on a wet washcloth then squeeze paste onto the brush. This was learned in occupational therapy." Not only is new behavior accepted, but it is taught by professionals. The thought of creating single handed operated products for people with disabilities crossed my mind, then I realized that a larger population could also benefit from these products.

I dug deeper and my research proved to show that there were two areas where people could benefit most from having universally designed products: grooming/bathroom products and kitchen products. Interviewing, observing, and personally emulating people with disabilities, I found the following could use the most improvements.

**Grooming:**
- Brushing Teeth
- Bathing
- Getting dressed
- Hair Styling

**Kitchen:**
- Operating kitchen appliances
- Turning oven knobs
- Lifting pots and pans
- Utilizing kitchen gadgets ie: spatula, ladle etc...

A good majority of the products on the market not only discriminate and stigmatize its target population, but also lack optimal functionality. Assistive products such as bathroom high chairs and kitchen utensils scream disability. Adaptive products are not better, because they point out the fact that the product being adapted is in itself flawed.
Because the results of my research pointed me towards kitchens and bathrooms, I got to work and decided to create a one hand operated toothpaste dispenser. After coming up with countless concepts and models, I went back to the source, the experts! People were thrilled with the idea and agreed that it could help make their lives a whole lot easier. I was happy to get positive feedback from all my hard work, but still, something was missing - something human. I wanted to create a product that did more than just help somebody physically. I wanted it to enable them both physically and emotionally. I went back to the drawing board and back to my experts - the people who used these products. After more interviews with stroke survivors and other people with disabilities, I found that one of the activities people missed doing most was cooking. After exploring all available products on the market, assistive, adaptive, and "regular," I chose to design a one hand operated mixing bowl.
One Hand Operated Toothpaste Dispenser
Chapter IV

Design Process
Mixing Bowls

While a one hand operated toothpaste dispenser would have completely enabled and empowered people with physical limitations, it was not intimate enough. My product needed to connect to its user at an emotional level. When asked what they missed doing the most, cooking and baking was at the top of the list. I wanted to design a product that not only functioned perfectly for everybody, but would also make people happy. Mixing bowls are so diverse. They vary in size and are used for so many different things ranging from mixing to baking to marinating. What astonished me the most when observing people using mixing bowls was how difficult it was for people with no physical limitations! If you asked them they would have said it was no problem. I watched the bowl flop around as they tried to hold it down with one hand while mixing at the same time with the other hand. I watched as they fumbled while trying to pour the contents from the bowl into containers. Some people with limitations would put it between their legs and mix, others would keep it on the table. In both cases, the bowl and its contents ended up all over the place.

The current solutions on the market were far from solutions. The closest thing I could find that even came close to functioning as a one hand operated bowl looked like a torture device.
Not only that, but it wasn't truly one hand operated. Many steps needed to be done in order to get the bowl to lock into place, completely defeating the purpose.

**Current Solutions on the Market:**

I found a bowl that rests in a rubber base which enables the user to rotate it into several different positions. In theory this is great, however, with gentle mixing, the bowl will not stay in place and is likely to topple over. In addition, the handle is far from anything resembling a handle meant for a human hand. The handle is a thin sliver of metal with a little round dent in the center which makes it far from ergonomic. The base of this bowl is round and therefore
can not stand upright if there is anything in it. Aesthetically it's nice, but aside from that, it's not a perfect solution.

OXO has several different mixing bowls which work great, were designed to be universal (to a certain extent), and have no stigma attached. I own every one of their bowls, however despite their history for creating award winning universally designed products, their bowls do not pass my test. There are several things about the bowls, however, that I do like. I like that the base is coated in rubber on some models. On other models, the entire outside of the bowl is coated in rubber. This is great if you wanted to tuck the bowl under one arm and mix with the other. That however is not my objective. The handles on most of their bowls are coated in rubber which is of course their staple. Aside from the handles being coated in rubber, I don't like the shape of them and have seen people struggle using them.

**OXO Mixing Bowls**
A handle should be just that, a handle... something you can grip onto. I liked the idea of having the handle hold onto the user as well, but in a way that the user can detach from easily. The bowls must also be able to remain stationary and rotate and lock into several different positions. Below is an image of a bowl with a grip that holds onto the user. I liked the way the tea kettle was able to rotate in the image below. I didn’t, however like the contraption it was sitting in which enabled it to do so.

So far, I liked a lot of individual elements in several different bowls that existed, but didn’t like any one single bowl. I immediately got to work and started to create hundreds of sketches and sketch models incorporating all the different elements that I did like as well as other elements that were pretty bizarre.
Sketches, Renderings, and Models
Out of nowhere I had my eureka moment. It was an early Saturday morning on a hot June day. I went to turn my fan on when all of a sudden... THAT'S MY BOWL! The answer had been staring me in the face for months.

Immediately I whipped out my sketch book and went to work.
The Bowl had to have a handle that could be utilized in several different ways and had to be coated in rubber for traction and comfort. The bottom of the base and both side pieces, or the "yoke's" as my engineer began to call it also had to be coated in rubber and remain unobtrusive.

After watching people interact with the mockup, I noticed that when rotating the bowl, users sometimes completely bypassed the handle and went straight for the front lip. At this point I realized that the bowl needed a collar. Not only would the collar add hand traction when rotating the bowl, but it could be used in other ways as well. Because I wanted the bowl to be versatile, it was mandatory that the bowl be able to come out of its base and function on its own independently. The rubber collar served as under arm traction when cupping the bowl under their arm and mixing with the other. Although this bowl was designed with a one armed user in mind, it is also inclusive to those with complete dexterity.
Renderings and Mockup of Bowl with Rubber Collar
At this point, I knew I was ready to make a working prototype. I still asked everybody I knew to try the bowl out. Just before I got cracking on the prototype, I noticed that people were getting caught on the sides of the handle. I also realized that because it was completely exposed on the sides, that it could be a hazard. The handle was revised as shown:
Chapter V

Final Product
The bowl rotates and locks in 3 different positions. The home position for normal use, 45 degrees for ease of mixing and so that the user can see its contents, 76 degrees so that the contents of the bowl can be easily transferred into a different dish.

A spring pin in the yoke keeps constant pressure on a small metal part which pushes up into a notched part attached to the bowl. There are three different notches on the part for the springed part to lock into. The yoke, which is coated in rubber, easily slides outward enabling the bowl to be removed from the base. When removed from the base, the bowl acts as any normal bowl with the added bonus of the outer rubber collar and ergonomic handle.
Components

The stamped bowl is made of brushed stainless steel, and comes in two sizes, 3 qt and 5qt. The handle, collar, and yoke are nylon coated in rubber. The base is a rubber coated bent rod.

As a result of all my work, I've designed a mixing bowl which is elegant, functional, and universal!
Chapter VI

Universal Design Principles Applied
While designing the bowl, I made sure to adhere to the 7 Principles of Universal Design as closely as I possibly could. I can confidently say that I have succeeded in creating a truly universally designed product.

The following Principles and guidelines for Universal Design are as cited by the Center for Universal Design published on North Carolina University's website:
http://www.design.ncsu.edu/cud/about_ud/udprinciplestext.htm

Compiled by advocates of universal design, listed in alphabetical order: Bettye Rose Connell, Mike Jones, Ron Mace, Jim Mueller, Abir Mullick, Elaine Ostroff, Jon Sanford, Ed Steinfeld, Molly Story, & Gregg Vanderheiden

*Red indicates guidelines applicable

**PRINCIPLE ONE: Equitable Use**

The design is useful and marketable to people with diverse abilities.

Guidelines:
1. Provide the same means of use for all users: identical whenever possible; equivalent when not.
2. Avoid segregating or stigmatizing any users.
3. Provisions for privacy, security, and safety should be equally available to all users.
4. Make the design appealing to all users.
As shown in the previous images, the bowl is adjustable and can be used from several different angles by multiple users with different levels of dexterity. Charlie, as seen in the first image can only use the right side of his body. He effortlessly moves the bowl from one position to the next. Although Felice has full range of motion, she only has use of one hand because she's holding her baby with the other. Here you see her mixing the contents of the bowl with it in a 45 degree angle.

The following images prove that the bowl is appealing to all users and has absolutely no stigma attached to it. The bowl is sitting on a counter next to other "mainstream" stainless steel products including a coffee maker, coffee grinder, and various kitchen gadgets. The bowl looks like it belongs there with the other items.
Here the bowl is sitting on the counter of a modern kitchen right next to a stove.
PRINCIPLE TWO: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

Guidelines:
2a. Provide choice in methods of use.
2b. Accommodate right- or left-handed access and use.
2c. Facilitate the user's accuracy and precision.
2d. Provide adaptability to the user's pace.

Because the bowl rotates and locks in multiple different locations, the user is left with multiple methods of use. In addition, the bowl can be rotated by not only using the handle, but by placing pressure on the front lip as well.
PRINCIPLE THREE: Simple and Intuitive Use

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Guidelines:

3a. Eliminate unnecessary complexity.
3b. Be consistent with user expectations and intuition.
3c. Accommodate a wide range of literacy and language skills.
3d. Arrange information consistent with its importance.
3e. Provide effective prompting and feedback during and after task completion.

As soon as a person is handed this bowl, they know how to use it. The handle is inviting and does what it looks like it's supposed to... act as a handle. Because the bowl makes a clicking sound as it engages into each location, the user is immediately given an auditory and sensory feedback.

PRINCIPLE FOUR: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Guidelines:

4a. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
4b. Provide adequate contrast between essential information and its surroundings.
4c. Maximize "legibility" of essential information.
4d. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
4e. Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

As mentioned earlier, the bowl can be operated by using the handle or the lip. In addition, the bowl also comes out of its base and can be used traditionally.
PRINCIPLE FIVE: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Guidelines:

5a. Arrange elements to minimize hazards and errors: most used elements, most accessible, hazardous elements eliminated, isolated, or shielded.
5b. Provide warnings of hazards and errors.
5c. Provide fail safe features.
5d. Discourage unconscious action in tasks that require vigilance.

Once the bowl is locked into the base, it is not coming out unless the user wants it to. This eliminates the possibility of food spilling all over the place.
PRINCIPLE SIX: Low Physical Effort

The design can be used efficiently and comfortably and with a minimum of fatigue.

Guidelines:
6a. Allow user to maintain a neutral body position.
6b. Use reasonable operating forces.
6c. Minimize repetitive actions.
6d. Minimize sustained physical effort.

The bowl is designed so that tall, short, and even seated users could use it with little to no physical effort. The bowl rotates to accommodate different users. Very little effort is needed to have the bowl rotate and engage into different positions.

PRINCIPLE SEVEN: Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user’s body size, posture, or mobility.

Guidelines:
7a. Provide a clear line of sight to important elements for any seated or standing user.
7b. Make reach to all components comfortable for any seated or standing user.
7c. Accommodate variations in hand and grip size.
7d. Provide adequate space for the use of assistive devices or personal assistance.
Conclusion:

This thesis has taken me on quite a journey. In the beginning I was hoping to create a product which would empower those afflicted with stroke. In the end, I created something that not only will empower stroke survivors, but people of all different levels of dexterity. During my journey I discovered universal design and met so many amazing people along the way. I can confidently stand behind my bowl and proudly state that I've successfully designed a product that truly is universal. I understand that more studies need to be done in order to see if the bowl needs any improvements down the line. I look forward to continuing my journey and in process hope to educate people and designers on universal design.
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