

Washable: An Interactive Shower Assistant to Increase Autonomy in Bathing

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Background and Problem Statement

Our team began with the goal of creating a product for a group whose needs are not well addressed by current products and design. We decided to initially focus on individuals on the autism spectrum in order to identify their unmet needs, which we expected would be shared by other groups. More specifically, we recognized a major lack of products directed towards young adults on the autism spectrum, who desire independence and self-sufficiency but often do not have the proper tools to accomplish these goals.

We began our design process by interviewing parents, educators, therapists, and individuals with cognitive disabilities. We used these initial interviews to pinpoint a common need that we could address through our design process. One of the most consistent areas of

difficulty that came up during our interviews was hygiene. Personal hygiene is a critical and constant part of life, but individuals with cognitive disabilities can have difficulty performing these tasks or require assistance from a parent or caretaker. We have spoken to over 40 educators, therapists, parents, and health professionals, all of whom expressed their desire for more resources and products that cater to the unique needs of this group.

In our interviews with parents and caretakers, we heard repeatedly that hygiene was a frustrating task for both them and their children or clients. Challenges in hygiene tasks for our user group - individuals with cognitive disabilities - include remembering the many steps to processes like showering or self-regulating the quality of their bathing. Another common challenge is being able to dispense the correct amount of shampoo or soap. In many cases, the parent or caretaker is present to guide them through the process or assists them with the difficult tasks. Individuals who also have dyspraxia can also have difficulty with the fine motor skills required to complete tasks like brushing teeth, opening and operating bottles of shampoo or soap, and adequately washing all areas of their body. Since tasks like brushing teeth and bathing occur on a daily basis, they represent a significant amount of time investment. Parents and caretakers expressed frustration with the process of guiding their children or clients through tasks that they find difficult or unpleasant. Parents and caretakers said that they often intervened or completed the task themselves because it took less effort and time than guiding their children or clients through doing it semi-autonomously.

Showering, in particular, is a frustrating task for both parties. The experience is sensory-intensive, which can make it unpleasant for our user group. It also demands both cognitive and fine motor skills in a restricted space. It is also a difficult environment for those parents and caretakers who need to be present throughout to guide their children or clients through the process. Showering is also an inherently intimate task. Throughout our interviews, many young adults expressed a desire to have more independence from their parents in bathing. Though frustrated with their lack of privacy, these young adults must accept their parents help. While parents empathize with their children's desire for more autonomy, they must prioritize ensuring that their child maintains proper hygiene habits for health purposes.

Our mission is to make the bathing process easier for young adults with cognitive disabilities and to help them gain more autonomy in their personal hygiene. The goal of our product is to align the interests of both the caretakers – ensuring the quality of bathing – with the goals of their children or clients – to gain more autonomy in their personal lives.

Approach and Methods

Our first step was to interview educators, therapists, parents, health professionals, and individuals with cognitive disabilities. We used these interviews to narrow down our focus to bathing for young adults as described in our Background and Problem Statement.

Next, we began to design ways address the needs that we identified. One of the major needs we heard repeated was that caretakers had to prompt their child or client through the bathing process. For example, many parents used visual schedules to help their child work through the steps of bathing, but that requires them to point and give verbal cues throughout the process. Our initial intent was to find a way to decrease the demand of prompting on caretakers by automating that process. In some cases, our product might be a tool for caretakers to use while supervising the user, while in other cases the product might replace the need for the caretaker's presence entirely.

In order to discuss and test our ideas, we partnered with organizations in the area with whom we had connections. One notable resource for us was the Open Mind School in Redwood City, which is a research school that serves as a testing place for innovative programs based on inclusive learning and presumed intelligence. It serves as a model for mixed-demographic equal education in any school setting. Our second major partner organization is the Morgan Autism Center in San Jose, which runs both a school program and adult program for individuals on the autism spectrum whose needs are not well addressed by existing public school programs. It also focuses on improving the independent living and vocational skills of both its students and adult participants, which has made the Morgan Autism Center a great environment for us to discuss and test our prototypes.

Because of the intimacy of bathing, we had to find creative ways to prototype with our users. We used role play, where users interacted with our prototypes outside of the shower and pantomimed the actions they would take in an actual shower or bath. We also used parallel testing in which we created a walk-through for the task of hand washing instead of bathing. This allowed us to see our product in action and helped us refine our application and product based on how users interacted with and responded to it. Figures 3 and 4 show us testing a prototype and getting feedback about our design from clients at the Morgan Autism Center.

As we build higher-resolution prototypes, we plan to send them home with users so that they can use them in their home setting. We will ask caretakers to observe and take notes on the strengths and areas for improvement of our product so we can continue refining it.



Figure 1: An early prototype of the dispensers that uses visual cues to prompt the user.



Figure 2: Our functional prototype running the application on a screen.



Figure 3: User testing at the Morgan Autism Center. A participant gives us feedback about our prototype.



Figure 4: A participant at the Morgan Autism Center role plays showering while interacting with our prototype.

Final Approach and Design

Our current product is a device that features a waterproof screen through which users interact with an application that guides them through the steps of bathing with audio and visuals. The product is mounted on the shower or bath wall such that users can see and follow the program as they themselves go through the bathing process. The product also functions as an automatic soap and shampoo dispenser. This feature alleviates some of the potential motor

challenges posed by the bathing routine like operating shampoo and soap bottles as well as cognitive challenges like dispensing the correct amount of shampoo or soap.

The application that runs on the screen is our main design focus. We created our own graphics and visuals that give users a visual prompt of what to do for each step. These graphics are supported by text and audio prompts that match the step demonstrated by the character in the visuals. The user can pause the program if they get behind or need more time to complete a given step.

One critical feature of the app is that it is customizable. Users or caretakers can personalize aspects of the program such as which steps appear on the screen, the order in which they appear, and which prompts (text, visual, audio) are given. They can also adjust the timing of each step to allow the specific user an appropriate amount of time to complete each step. We also plan to make the character in the visuals a customizable avatar that allows users to easily build a character that suits their own identity and is under their control.

We feel this level of customization is important for the product to be beneficial to a wide range of users, all of whom will have different needs and preferences. While it adds complexity to our product, it also makes it applicable to a wider audience. One challenge here is to offer these options while maintaining simplicity and ease of use for both the users and caretakers. One of our main goals for our product is to save time, so we are sensitive to how much time and effort are required to initially set up the product.

Outcome and User Feedback

We conducted a survey about bathing needs, challenges, and habits that received over 60 responses. This survey helped us pinpoint the common needs and challenges for our user group within the bathing routine. These included remembering all the necessary steps, doing each task for an adequate amount of time, and using the right amount of products like soap and shampoo. Of our respondents, 70% reported that they were interested in our product, and over 80% of respondents expressed desire to remain in contact about our project going forward.

We have tested versions of our product with 15 students from the Morgan Autism Center. We have spent extensive time testing our product specifically for hand washing, as this action is far less intimate and personal than showering. For the handwashing simulations, we put a prototype of our product with the app video by a sink. The user pressed “begin” and observed as a cartoon turning the faucet on appeared on the screen with text beneath, and audio telling the user to turn on the faucet. After each step, a “bubbling” sound cues the user to move on to the next step, which then appears on the screen and directs the user to his/her next action.

We were extremely pleased by the outcome of these tests as every one of our users kept looking back to the screen to see what it would direct them to do next. They would not move

onto the next step until prompted by the screen, and if distracted, the user would often look back at the screen when hearing the transitional bubble noise that directs him/her to the next task. Every user we tested with successfully completed the steps of washing his/her hands and did so in the timing that the video dictated.

While most of these experiences were quite positive, we did notice certain timing that was awkward for some users and certain tasks that users accomplished much quicker than the time we provided. For example, turning on the faucet happened quite rapidly for most users, and for our next iteration we adjusted the timing such that it would occur in accurate time. This reinforced the importance of customizability of our app, which would allow caretakers to adjust the duration of each step to suit the individual user. We do, however, want to provide a baseline timing and order of steps to minimize the amount of effort each user or caretaker must spend to initially set up the application. Additionally, there are further options for customizability. For example, some users may benefit from the ability to scroll through steps themselves, while others would not be capable of doing this and need strict timing to ensure they perform each action for an appropriate duration. Such features are options within our program based on the specific needs of the user.

We continue to refine our product's design to address technical issues as they come up. For example, the volume of the tablet's audio is one issue that is particularly challenging in a shower, where the sound of water can be overpowering. We are working on amplifying the volume, and finding noises that are distinct and may be heard over the water.

Our plan of action includes more user testing of our product and application. We are currently transitioning into the engineering and manufacturing stages in which we will determine how we want to manufacture our final product. We are also working on building a community around

Cost

Because of the complexity of our product, which involves electronics and complex mechanics, we plan to source the screen and dispensing motors from wholesale suppliers. We will manufacture the shell of the product via 3D printing or injection molding depending on the volume of our initial release. We expect the part costs to be total at approximately \$70 with the following breakdown:

Part	Cost per unit
Waterproof tablet for screen	\$30
Automatic dispenser motors and electronics	\$6

(2)	
Rechargeable batteries (2)	\$15
Shell (3D printed)	\$10
Packaging and Miscellaneous e.g. screws, adhesive)	\$10

The figures above do not include assembly and shipping costs, which will increase the total cost of the product. Our goal is to keep the final price under \$100.

Significance

During our many interviews, we learned that personal hygiene can be one of the greatest barriers to independence and one of the greatest sources of tension between caretakers and their children. As a child approaches adulthood, increased independence is crucial for one’s confidence and their sense of self. Moreover, bathing is one of the most intimate tasks. Many of our users were frustrated with their caretaker’s involvement in their bathing, while the caretaker only wanted to provide a successful bath or shower. This product will have a tremendously positive impact on users and caretakers, as it facilitates independence and self-sufficiency in a very personal task that happens almost everyday. It would increase confidence in our users, as we already witnessed with our hand washing testing, through which many of the people we worked with were beaming and quite excited by the conclusion of their handwashing. Providing a screen in the shower or bathing area makes the task more entertaining, a mother and two educators mentioned to us, and can captivate the attention of our user during an activity that can be uninteresting or stressful. Through a survey with over 60 respondents and interviews with over 40 caretakers, doctors, therapists, educators and individuals with autism, we have had an overwhelmingly positive response to our prototypes and our concept. So few products exist that facilitate bathing, and we have been quite moved by the level of interest and excitement our various users have expressed.

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Resources

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