Jasper

Intelligent Wardrobe Assistant

A full-fledged intelligent mirror to assist fashion-conscious individuals with outfit selection and wardrobe management.

Team

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Problem and Solution Overview

Selecting an outfit for the day can be a strenuous activity for busy and time-constrained individuals. Many factors—such as weather, occasion, season, activity—can impact an individual's outfit selection decision. For example, if an individual is heading to work during the summer, they are most likely going to wear a light business casual outfit. With a large inventory of items in an individual's' wardrobe, sifting through all of one's clothing can be a tedious and messy process. One may not be able to find what they want to wear because they simply have a disorganized wardrobe, or they simply may not know how to find what they are looking for. **Jasper** aims to solve this problem by providing a two-part solution consisting of an interactive smart mirror to assist in outfit selection, and a set of location-enabled tags to be placed on clothing items to help with inventory management and tracking.

Initial Paper Prototype

Task 1: Selection and visualization

- Bob activates the mirror with the keyword "Jasper". Jasper then greets Bob, and briefs him on his schedule and today's weather, then asks if he would like to see some outfits curated for his day. Bob agrees, and Jasper overlays the first preference outfit, including Bob's tendency to wear this shirt-pants combination in its choice.

- Bob likes the pants that Jasper has selected for him, but decides to browse more tops, swiping his hand to the left.

Jasper overlays the next selected top, but unfortunately, Bob dislikes the combination so much that he never wants to see it again (and he never will).
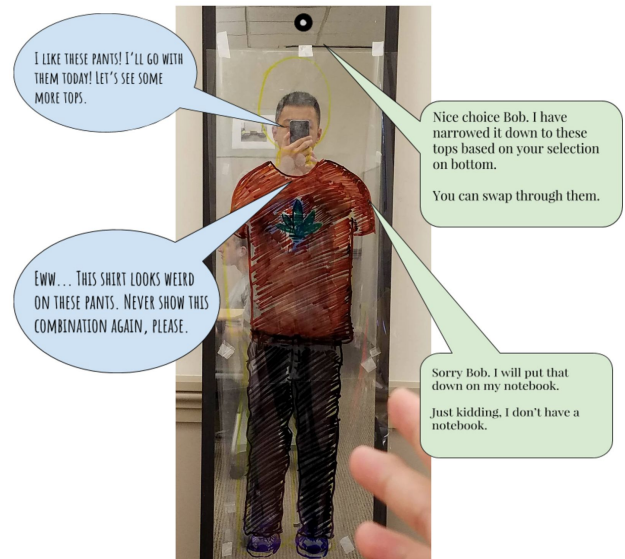
Task 2: Locating items

- Bob is looking for his black swag with Indeed logo, and since he is in a hurry he shouted at the mirror: "Where's my black swag Jasper!". But Bob has so many black swags and Jasper has no idea which one Bob is talking about. So he shows a grid of all black swags that Bob has and asks which one.
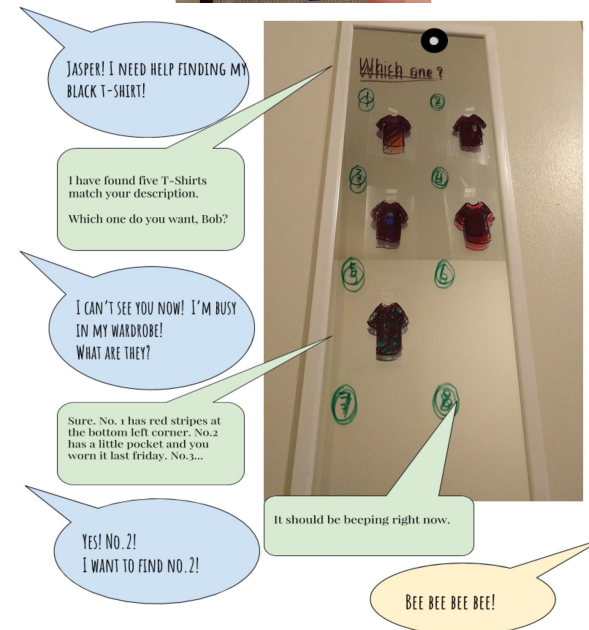
Testing Process

Usability Test 1

In the first usability test, the participant is a 21-year-old female student in UW. We chose to do the test in the CSE building labs for convenience, especially because we had to have a full length mirror with us for the test. Our participant was chosen for her interest in the product, as well as being part of the interview process during our design research. Our primary takeaway from the testing process so far is that it is relatively difficult and should be coordinated better. During testing, Hao took notes on the process, Tong manipulated the display on the mirror, Dylan acted as the voice for jasper, and Steven recorded video. Our participant used our design to choose between three options for tops, bottoms, and shoes as a starting point. We quickly realized during testing that it was more vital than we thought to have an established tutorial for our product when our participant was unsure how to interact with the mirror. Perhaps a video demo of a person interacting with Jasper would help, especially focused on how to correctly gesture to reduce errors. We also realized that a smoother way to transition the display would

benefit our testing process; our mirror requires hanging heavy sheets of plastic for an overlay, and they regularly fall down and cause issues.

Usability Test 2

The second usability test was conducted on Sudharsan, a 22-year-old computer science student. The test took place in a small breakout room in CSE basement and lasted for 10 minutes. The team chose the breakout room because of its discretion and spaciousness, because it is relatively quiet and private – more comfortable for the test participant, and it has enough room for the usage of the paper prototype which is relatively large.

Test protocol includes a brief greeting, overview of the design, introduction of tasks, testing, and debriefing. It is worth noting that our testing strategy has improved significantly from our first participant. We implemented a tutorial, started using pre-typed scripts spoken by a computer, more reliably attached images onscreen, and had a more streamlined experience overall. For this test, Dylan played the role of the Jasper's screen, Tong controlled its voice with text to speech software, Hao took notes, and Steven recorded video. First Sudharsan was introduced to the team, and then our current iteration of Jasper, now with a start screen. Sudharshan was able to use some voice commands and recognized left/right hand gestures, but had issues changing and confirming the selected article of clothing. Jasper's overall functionality was not specific enough for him to be able to clearly distinguish its limitations and supported functions, and it was difficult to even remember the few commands mentioned in the tutorial. Despite the confusion, locating the item was a quick and successful task.
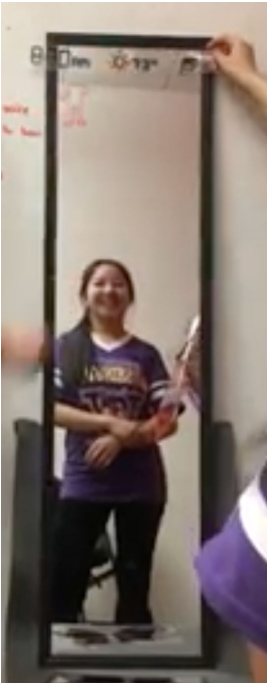
We decided to make some simple changes to Jasper to improve its ease of use and reduce user confusion. We added a hand icon that appears after Jasper is idle, and politely indicates available gestures by swiping around. The start screen had example voice commands added to demonstrate use possibilities, and the user's voice input is displayed back on screen to reinforce recognition of voice commands.
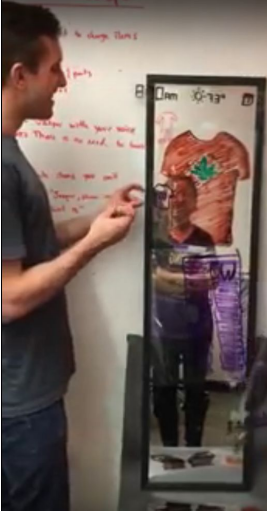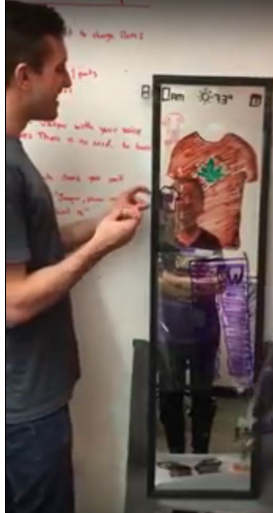
Usability Test 3

The third usability test was conducted on John, a UW student and an acquaintance of one of our team members. We also conducted this test in a CSE labs breakout room, the same setting described in our second usability test. Our team decided to maintain the same testing roles from test two, as we had become more accustomed to them, and we were also performing the third test immediately after the second one. John recognized availible hand gestures right away, and was very conscious about using the keyword "Jasper" when issuing voice commands. John's intuition for the gesture based interface made us notice another issue: voice confirmation to change selected clothing type is unnecessary and disruptive. Asking for confirmation reduced the fluidity of interaction, which would certainly get more annoying as you become more familiar with the interface. John also was not aware that Jasper actively curates clothing options based on the current selection, so he often asked "what should I wear" when switching to new articles of clothing. In response, we made slight tweaks to the dialogue to suggest this was occurring, such as "now showing matching pants". There was also an issue with moving back to previous items. Once John had confirmed an item and moved on, he did not know if he could move back or not. This confusion was another factor in our decision to remove audio confirmations from Jasper.

Testing Results

Test 1:

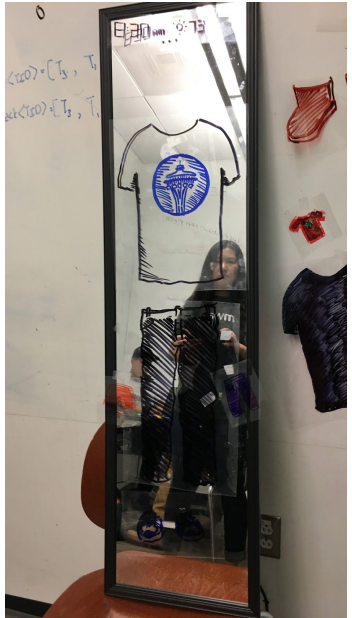| Image	Incident	Severity	Fix	Fixed image
	Match between system and the real world: The arrow icon on the sides of the item is rather unintuitive and does not encourage wiping gestures from the user.	2	Scroll attire icon instead of arrow.	
	Aesthetic and minimalist design: The time/weather/events information on top of the mirror is confusing and unnecessary when dressing.	1	Ability to remove Time/Calendar/Weather display with gestures.	 The three dots indicate the ability to "drag" up and down the status bar, allowing the person to hide or show it.

Image	Incident	Severity	Fix	Fixed image
"Okay so you have a job interview today.. .umm probably should look nice for that" *pauses* "Oh wait also going to the gym later"	**Consistency and standards:** The response of Jasper is improvised and unprofessional. Since we were trying to make Jasper sound more intelligent, we used real human interactions in the prototype. The reactions given by Jasper seems to be confusing and gives out too many hints to the user.	2	Have the scripts predefined and makeup responses according to the flow chart as well as some special guidelines.	*"Good morning Participant, the forecast is 73 degrees and sunny; you have two scheduled events: job interview at 11am and gym at 2pm"*

Test 2:

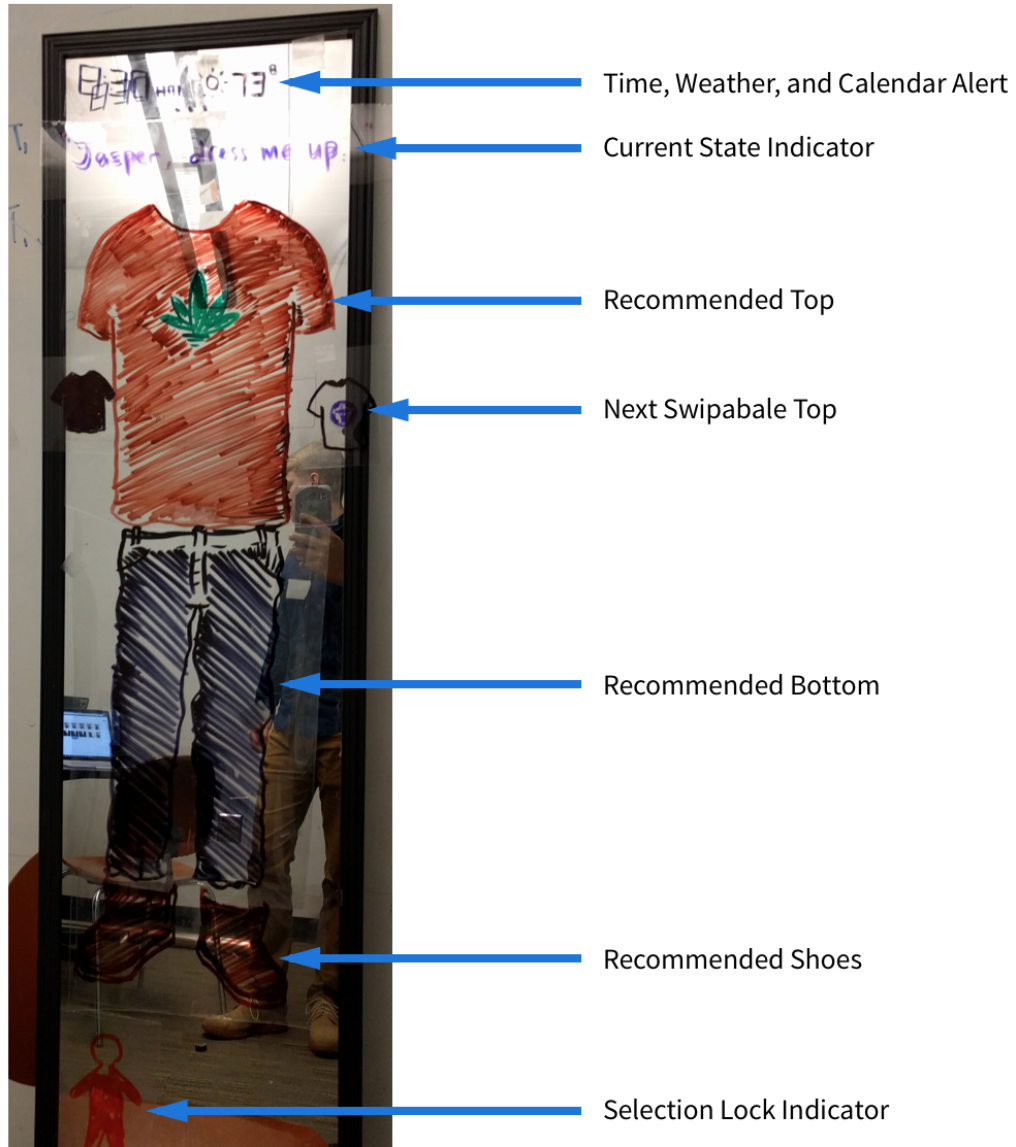| Image	Incident	Severity	Fix	Fixed image
(No image as no onboarding screen existed prior)	**Help and Documentation:** He did not fully understand the coverage of Jasper's functionalities. "Does it do everything?"	2	An onboarding screen displaying briefly major commands and functionalities, and a microphone image that suggests voice input.	

(No image as no command text existed prior)	**Recognition rather than recall:** He could not quickly recall the voice commands at each stage, because they were only given at the beginning of the test but not reminded in progress.	2	Display and visualize user's voice input, thereby reinforcing the recognition of voice commands.	
	Recognition rather than recall: He did not understand how to switch between categories of items and process to the next step. Up/down hand gestures were not mentioned or hinted to him.	4	When there is no user input for a period of time, an overlay image of a hand appears and moves around to suggest available gestures.	
	Visibility of system status: When the ringer was activated on an item, he was not sure if it was the specific item he chose or if he chose the right item.	2	When an item is selected and its ringer is being activated, an indicator appears on the mirror specifying which item it is.	

Test 3:

Image	Incident	Severity	Fix	Fixed image
	Aesthetic and minimalist design: Voice confirmation is unnecessary and distracting. When he has decided on one of the T-Shirts, he swipes up and starts to choose bottoms. And Jasper says, "Are you satisfied with the T-Shirt?". He thinks he has already confirmed the top by swipe up so there is no need to confirm again.	1	Eliminate audio confirmations and assume he has decided on the item when he swipes over an item.	
(No image as audio existed prior)	**User control and freedom:** System display (progress avatar) and voice always prompted for confirmation of the current item and moved to next items. He did not know if he could come back and change previous selected items.	3	Eliminate audio confirmations and add instructions on how to move back to previous item selection.	
(No image existed prior)	**Consistency and standards:** User did not realize that the default section was already based on the most recommended selection, and instead actively prompted for "What pants should I wear?". The system was not prepared for such inquiry.	3	Added audio guidelines every time he decided on something and moved on to another selection. For example, Jasper says: "Now showing all bottoms matching this T-Shirt after he decides on one top.	(Audio guidelines)

Final Paper Prototype

Overview

Time, Weather, and Calendar Alert

Current State Indicator

Recommended Top

Next Swipabale Top

Recommended Bottom

Recommended Shoes

Selection Lock Indicator

Task 1: Outfit Visualization and Selection

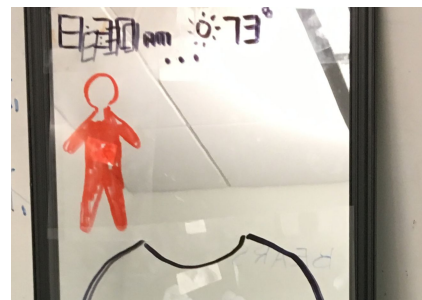**Top (T-Shirt) choice selector**
The person has the ability to change tops by swiping left or right with their hands.

Bottom (pant) choice selector
Following shirt selection, the person can swipe down with their hands to begin choosing bottoms. The person can choose bottoms with the same motion as they chose their top: with a left and right hand swipes

Outfit completion indicator
In order to indicate that different "areas" of the outfit have been chosen through voice commands, we've included an icon indicator. If the top attire has been chosen, the middle of the figure's body will be shaded. If the bottoms have been chosen, the bottom of the figure is shaded, and so on with the shoes.

Task 2: Item Location

The item location task can be triggered from two different situations while interacting with Jasper:
1. During the outfit selection process--the user can't find an item that Jasper recommends
2. Ad-hoc clothing locating without getting dressed (i.e.: locating a rain jacket midday after you are already dressed)
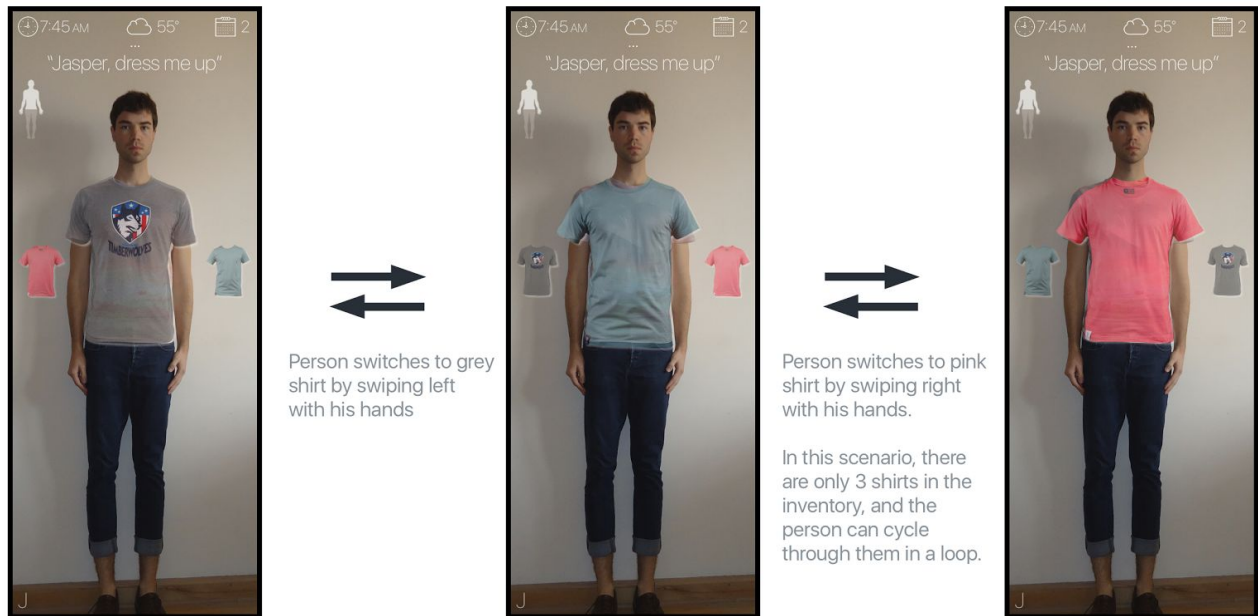
Option #1 (outfit selection process):

Option #2 (Ad-hoc clothing locating):

Step 1

The person says "Jasper, please located my black T-Shirt." Since the person's inventory consists of multiple black shirts, Jasper presents options of the person's black shirts for clarification selection. The person replies with "Shirt #4 please."

Step 2

Jasper begins locating the item by ringing the clothing attire item's tag. The tag makes a ringing sound so the person can find the item. The display also provides label message and a ringing icon above the selected shirt, providing another indication of the ringing process.

Step 3

The person finds the item in their bedroom (or wherever it may be in their house). The person puts on the piece of clothing and heads out the door.
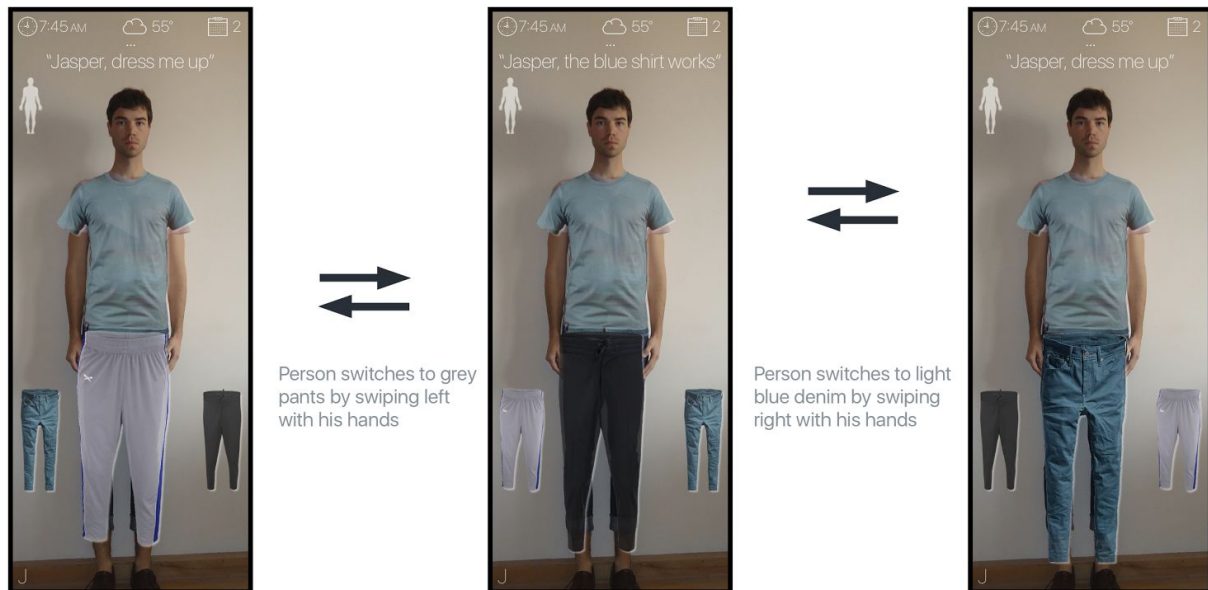
Digital Mockup

Task 1: Selecting an outfit

Person begins the outfit selection process by walking up to the mirror and saying "Hello, Jasper." The mirror initiates the outfit selection process and presents recommended items based up the weather, calendar, and occasion.

Person switches to grey shirt by swiping left with his hands

Person switches to pink shirt by swiping right with his hands.

In this scenario, there are only 3 shirts in the inventory, and the person can cycle through them in a loop.

At this point, the person has chosen their prefered shirt out of the recommended options, and is ready to move to the bottom selection process. The person has alerted Jasper they have selected their shirt with the phrase "Jasper, the blue shirt works." In response, Jasper fills in the top half of the silhouette in the top left of the screen, signaling that the shirt is locked in. The person has indicated they are moving to the bottoms (pant) selection process because they have swiped down with their hands, moving the selector to the bottoms. The icons near the person have shifted from the top to the bottoms, indicating the selection area. Now if the person swipes left or right, the bottoms will change, not the tops.

Person switches to grey pants by swiping left with his hands

Person switches to light blue denim by swiping right with his hands

The person has now selected the dark pants as their bottoms, and confirms with Jasper they will be wearing those items. In response, Jasper fills in the bottom part of the silhouette.

For the purpose of this mockup, the shoe selection process is not shown. The shoe selection process is identical to the top and bottom selection process.

Task 1: Selecting an outfit

Person begins the outfit location process in one of two ways:

1. Continuation of Task 1: the person notifies Jasper that they cannot find the recommended item; Japser begins the location process.

2. Ad-hoc locating of an item; the person may be ready to head out the door and they need to find one specific item (not included in recommended outfit) like a rain coat. The following mockups demonstrate this task.

To begin, the person says "Jasper, locate my black shirt.

7:45 AM   55°

Which black shirt are you referring to?

1.   2.
3. **W**   4.
5.   6. I <3 DOGS

J

Since the person has multiple black shirts scanned in their inventory, Jasper must clarify which black shirt he is talking about. Jasper displays the inventory items that match the person's voice query. The person has six items.

The person says "Shirt number four," so Jasper begins ringing the item using the sounding tag attached to every clothing item

7:45 AM   55°

Sounding shirt #4...

1.   2.
3. **W**   4.
5.   6. I <3 DOGS

J
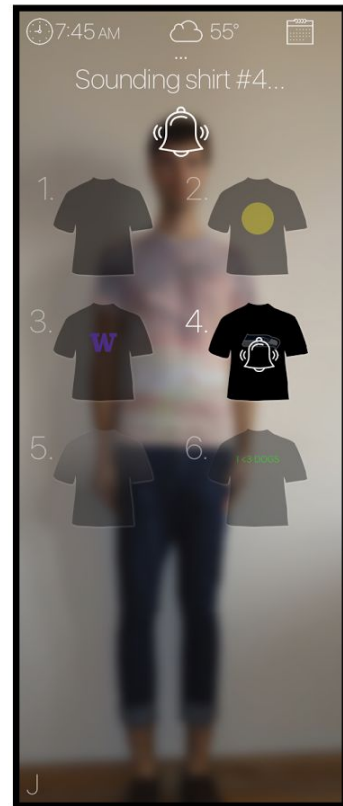
The shirt rings, and the person finds the shirt. The task is now complete.

Discussion

The process of iterative design allowed our group to make more subtle, successful refinements to our design without scrapping it and starting over. At each point in the design process, we received meaningful feedback that continued to push our design in the right direction. We learned that it is extremely important to analyze and consider all feedback when designing the next iteration. In each iteration, we used feedback to slightly refine aspects of our design which were successful, changing them enough to have an impact and get additional feedback, but without reworking the design too much. Negative feedback led to more significant changes, especially in reducing feature creep. For example, most changes we have made during iterative design are related to the audio interaction of Jasper and the person. First during the evaluation we had many complaints about making the gestures and commands too vague and confusing. Also during the usability test, we observed that most of the participants have been mislead or confused by how to use the system properly. In response to it, we have added tutorial and instructions in both audio and gesture displaying. Overall, we learned that exploring and reflecting on several designs leads to a much more guided, successful outcome.

Initially, we had a very rough and preliminary overview of design, which was reflected by our paper prototype – There were only essential elements such as clothing items and selection screens. It offered few visual clues for interaction and had very limited capability of presenting data. The heuristic evaluation helped us spotted several missing components and holes in the flow of system operation.
After the heuristic evaluation, we added several visual guidelines and made the display more robust and fault-tolerant and conducted out first usability test. However, a simulation of real life usage of our design exposed many problems undetected by the heuristic evaluation. We found that we were lacking a composed script for the voice interaction of Jasper, and the user was often confused or lost at several occasions.

The first test gave us very constructive feedback for the following tests. We added a complete start screen for onboarding and transitioning and we switched to using computer text-to-speech voices to better simulate the scenarios. Our test was more standardized and went much more smoothly, except for a few hiccups when switching item type and location the items. Following this test, we changed some of the perspectives and added some specific improvements to the prototype such as visual indicators. During the third test, the user was able to quickly understand and use the design. We found several smaller flaws and came up with quick solutions, but the design overall has proved its robustness.

Although we think that our design has drastically matured over time and will suffice into final implementation, we still think there is considerable potential for it to improve and we can use some further evidence of its effectiveness. Therefore, we estimate that one or two additional iterations would be optimal.