# 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.

## Design Research Goals, Stakeholders, and Participants

### Research Goals

**Goal:** to understand how "fashion-conscious" individuals (defined broadly as anyone who puts in effort and cares about the appearance of their clothing) select an outfit for the **present** day, and manage and interact with their wardrobe on a daily basis. In order to understand these individuals, the researchers developed a combined three-part research method:

- **Observational study**: We visited the participant's home and observed their clothing storage (usually in a bedroom), recording the layout, organization, volume and other features of their storage area.
- **Contextual inquiry**: The participant performed the scenario in which he/she picks the outfit for a day as we observed and questioned.

- **Interview**: We asked a series of questions on the participant's strategies for managing his/her inventory, and opinions on styles and fashion.

Our initial design plan consisted of interviewing both individuals and professional stylists. However, the team pivoted and decided to focus more upon the outfit selection and wardrobe management aspect, rather than the fashion aspect of the project. Fashion was too difficult to define, as fashion can differ greatly upon different demographics and interests. This process was conducted on four different participants in a span of four days.

## Stakeholders

Since our design deals with the problem of excessive amount of unnecessary items in people's wardrobes and thereby the difficulty in wardrobe management and dressing decisions, we think two categories of people best meet our offerings:

- **Fashion-minded individuals**: The people that care about what they wear and spend time to search for ideal garments that matches their fashion pursuits. Our application will greatly simplify and speed up this process.
- **Inventory/functionality-driven individuals**: The people that focus on wearing based on the situation (business, sport, casual, etc.) and utility (waterproofness, endurance, number, etc.)

## Participants

**Erlich Bachman** is a senior undergrad at UW studying Electrical Engineering. Michael considers himself to be reasonably "fashionable," meaning that he invests time and effort into his appearance. The combined observational study and interview was conducted in Michael's room on Wednesday, January 18th. The environment was calm, quiet, and free of distractions.

**Laurie Bream** is a 21-year-old college female who lives in a house about 3 blocks off campus and has her own room.  Annalise's wardrobe was organized amongst different vessels by category: shoe racks, underbed shoe organizer, 2 racks, 2 dressers, a coat rack for heavier items, and a laundry basket filled with shoes. The research was conducted on Tuesday, January 17th.

**Richard Hendricks** is a senior undergrad at UW majoring in Applied and Computational Math Sciences. He is interesting to our research because of his prominent transition of dressing styles. During his first half of the college, he dressed plainly and pragmatically. However, he then became attentive to his appearance, started working out routinely and dressed in style thereafter. The research was conducted on Wednesday, January 18th.

**Monica** is a senior undergrad at UW majoring in Computer Science and Psychology. She is 23 years old and currently living in a townhouse near campus. According to the result of the contextual inquiry, Hazel tries to keep her closet clean. She cares about making items match each other to create a nice look and whether the outfit suits her schedule of the day. Also she cleans up her closet regularly and each time if she finds some idle items she usually donates them.

# Design Research Results and Themes

- During outfit selection, participants aren't completely aware of what they have due to constraints on time and effort.
    - *Participants inventory consists of many permutations*
      Normally the participants keep 3~20 items in a similar type. And when the items vary in style, exhausting the combination of styles across types becomes implausible for human capabilities.
    - *Participants want to visualize their clothing assets*
      Commonly, when a participant decided to try out one specific item, he/she would take it out of the storage area to an open space, along with other selected items, and see if it keeps the uniformity of style. This process requires the physical effort that may inhibit the participant from continuing optimizing his/her selections.
    - *The context enforces a time limitation on the process*
      For the participants, the common scenario for dressing is during the morning before school/work. Therefore, they often have a limited time to consider their selection.
- Unworn/out-seasoned items tend to get pushed towards alternative or less-accessible areas by the participants. (i.e. Under the bed, in a separate room, etc.)
- When the participants dispose their unworn clothing in their wardrobe, their most likely action is to donate the items (i.e: Goodwill, donation bin). This is likely because it requires less effort than other methods and is for a good cause.
- Weather is a participant's most important factor for choosing certain clothing, followed by occasion. In terms of style, participants tend to care the most about the consistency -- items need to match each other.
- Participants tend to have a set of items specific for certain occasions/utilities.
- Participants don't take particular pride in organizing his current wardrobe if they are in a short-term or temporary housing. This was applicable to many of our participants due to a selection bias. The researchers are all college students, so college students are easily accessible participants.

Following a few weeks of iteration, our design evolved into catering towards a simplified set of themes. These themes are:

- During outfit selection, participants aren't completely aware of what they have due to constraints on time and effort. (Old)
- Participants with a large clothing inventory sometimes are overwhelmed by their size of their wardrobe and thus have difficulty finding or locating an item. (New addition)

# Task Analysis Questions

1. **Who is going to use the design?**
   People wanting to take more control over their wardrobe and optimize their dressing process (in efficiency and style).

2. **What tasks do they now perform?**
   Based on our research at this point, there are two main tasks. The first task is outfit selection and visualization. Participants tend to spend time on deciding their outfit regularly and inevitably. There are also some major external factors on the decision they make, such as weather, occasion, quality/consistency of style etc. Participants organize their wardrobe (based on types, style etc.) periodically. The second main task is outfit location, meaning how can the participant easily find items in their wardrobe, especially if it is large and messy.

3. **What tasks are desired?**
   The desired tasks need to improve the current solution on wardrobe organization and outfit selection. First, for organization of wardrobe, the following tasks are desired.
   - A better knowledge and awareness of their wardrobe (e.g. deal with excessive items).
   - Visualization of outfit choices from existing wardrobe.
   - Also in order to have a more efficient and stylish outfit choosing process, outfit recommendation based on various information (e.g. weather, occasion, etc.) is desired.

4. **How are the tasks learned?**
   The design needs to minimize its demand of people's effort. The dressing process aided by our design needs to resemble the one without, so that people deal with less overhead and smaller learning curve.
   Other approaches to ensure a better user experience include intuitive, tutorials/guidelines and simple user interface.

5. **Where are the tasks performed?**
   Near the clothing inventory of the person using the solution.

6. **What is the relationship between the person and data?**
   The data is derived from the person's choices learned over a calibration period.

7. **What other tools does the person have?**
   Tools for better style include observations on style input from other individuals (friends, family and professionals), social platforms such as Instagram. Tools for wardrobe management could be physical, such as tags, organizers and storage compartments or other digital tools, includes alternative closet management applications (e.g. Closet+, ClosetSpace, Stylicious, etc.)

8. **How do people communicate with each other?**
   We assume communication between people is unnecessary in this system, since this problem space is largely interaction-free. If any, it will be indirect, meaning other people's data might be used to optimize the process of outfit selection.

9. **How often are the tasks performed?**
   Tasks are performed every time the participant dresses or selects a new outfit.

10. **What are the time constraints on the tasks?**
    Depends on the person's schedule. For example, time constraints may be more common during the morning.

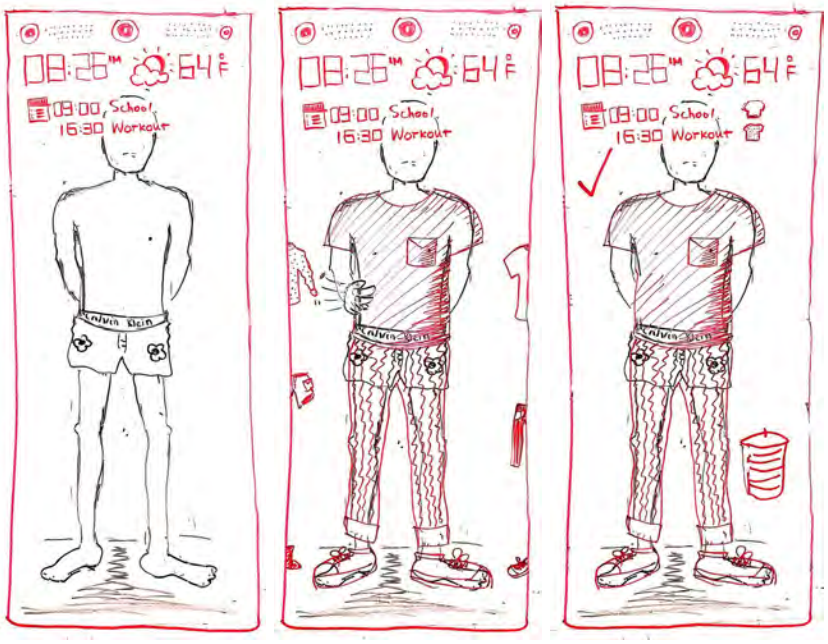
11. **What happens when things go wrong?**
    - Systems requires excessive user input (solution requires a tedious amount of time or tasks). if the amount of effort required exceeds effort saved, people will see less reasons to use the system.
    - Poor quality of item recommendation. It may also cause people to lose interest in the system. Satisfactory outfit recommendation will likely require high standards of computer vision & machine learning & data analysis.
    - Inappropriate tracking/recording methods could be treated as intrusive.

# Proposed Design Sketches

## Design 1: Magic Mirror

The first design is a standalone smart mirror designed to be placed in the owner's walk-in closet or bedroom. The mirror will be two way, also able to act as a mirror, and display information on-screen about weather, daily plans, time, and  outfit options. This design satisfies the following four tasks:

- Selecting an outfit to wear for the day
- Properly dispensing their wardrobe of unworn items
- Exploring and evolving an individual's fashion options
- Maintaining a catalog of wardrobe items



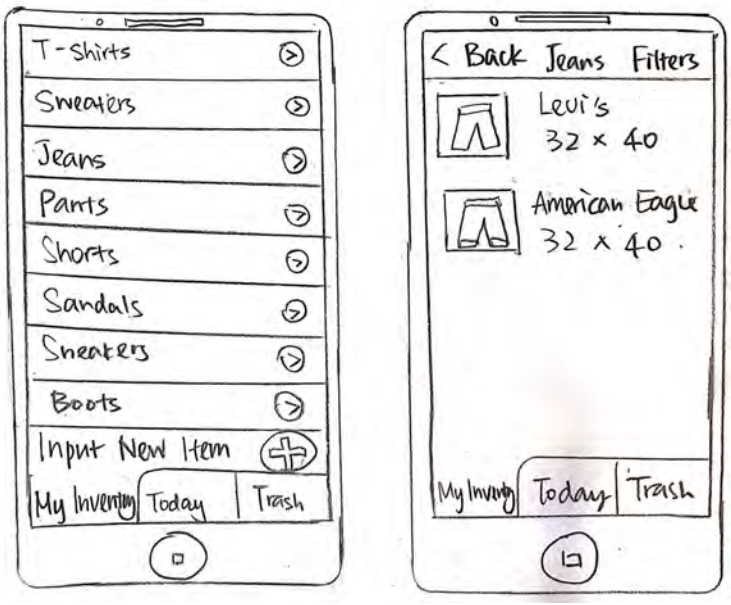

Following discussion among the group, the team decided to pursue the "Magic Mirror" design as the primary design for the product. The team found that interaction with the mirror is the most organic among the three options: mirror, mobile app, hybrid mirror/app. Getting dressed is a full-body activity, so the team didn't want to limit the person's limbs in anyway by forcing them to hold a phone. A full-body display

allows the person to use their hands and legs to get dressed, and to also interact with the mirror; the person is not constrained in anyway by holding a phone.

## Design 2: Hybrid Mobile Application & Camera Mirror

The concept for the combination product came from the research; some of the participants noted the desire to “dress themselves” when they have free time. For example, in the event he or she was bored at class or work, they’d be able to look through their wardrobe and find a suitable outfit to go out in that weekend. If the design only consisted of a mirror, the person would have no way of viewing their inventory elsewhere than the mirror. Providing a mobile application allows the person to view their outfits and visualize different permutations of attire whenever they choose and wherever they are. This design satisfies the following four tasks:

- Selecting an outfit to wear for the day
- Properly dispensing their wardrobe of unworn items
- Exploring and evolving an individual’s fashion options
- Maintaining a catalog of wardrobe items



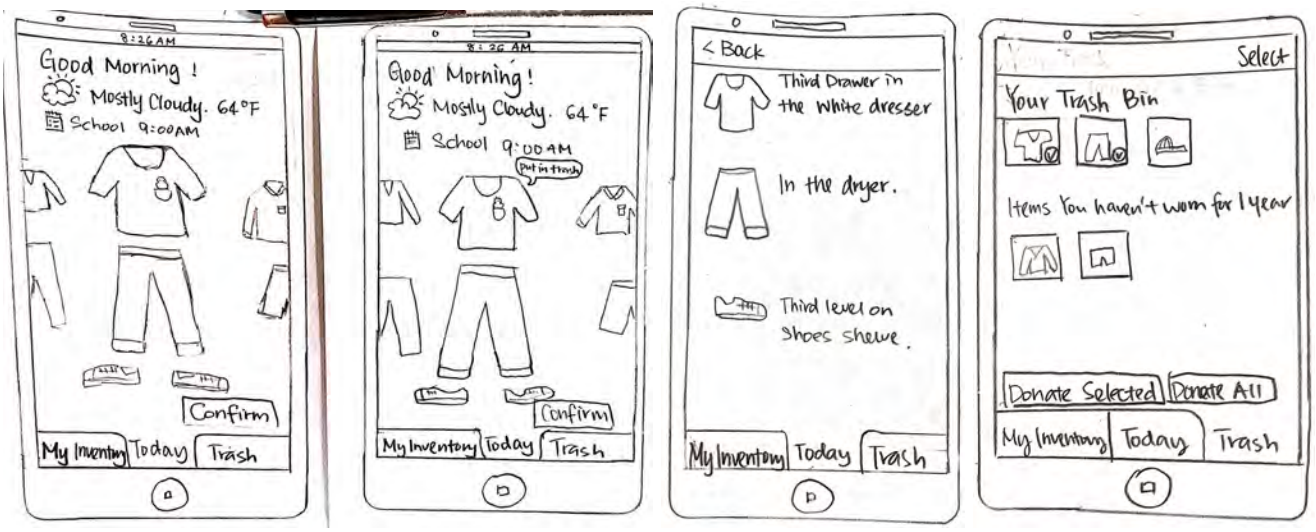

This design was eliminated for the simple reason of having too many components. In theory, a two device product would be a pleasant experience to many, as the participant could view their inventory and clothing on the go, while also having the main product statically placed in their home to use. However, the team found through feedback that two different components might be overwhelming to the individual; there might be feature overload and confusion caused by the ability to interact with both a mobile application and a mirror.

## Design 3: Standalone Mobile Application

The third design was slightly more simple than the previous two. The standalone mobile application was designed as a more basic product--nearly 80% of Americans already have smartphones so the team thought a mobile application design would be accessible to many people. This design satisfies the following four tasks:

- Selecting an outfit to wear for the day

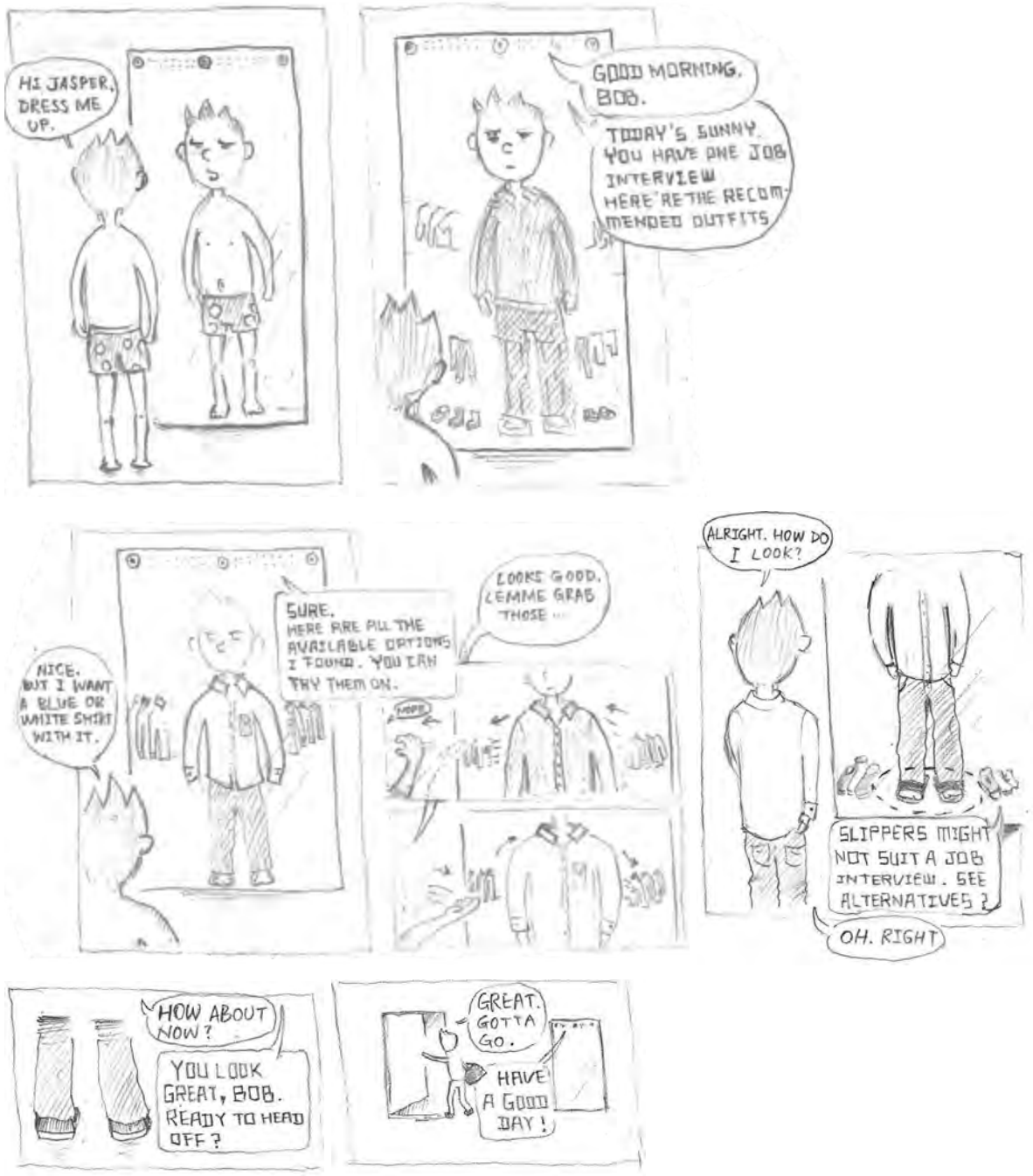
- Properly dispensing their wardrobe of unworn items
- Visualization and evaluation of the outfit selection
- Maintaining a catalog of wardrobe items




The team ended up scrapping this design after hearing feedback from the section TAs and other groups. The team found that the mobile application was too broad of a scope, for the mobile app allowed for both current and future outfit planning. Focusing on both of those areas would apply to too wide of a population, so the team wanted to narrow the design down to just current (for the present day) outfit planning. Additionally, the only way to scan an individual's current outfit would be to take a full-body selfie with the device's camera. A full-body selfie is difficult to achieve and would result in poor quality image recognition, on top of the fact the process is unpleasant for the participant.

# Written Scenarios & Storyboards

## Outfit Selection and Visualization




Bob, a 21-year-old senior at the University of Washington studying Human-Centered Design and Engineering, wakes up and begins to prepare for his day. He has one job interview scheduled for the day. Bob gets out of bed, and heads to his mirror to choose an outfit. “Hi Jasper, please dress me,” Bob says to Jasper, grabbing the mirror’s attention. Jasper begins the outfit selection process by reading into Bob’s schedule. Jasper notes the job interview scheduled for 10 AM, and presents Bob with a set of recommended outfits appropriate for a a business-casual job interview setting. Jasper is also able to take voice input recommendations, so Bob specifies he is looking for either a white or blue shirt because he feels confident

in those colors. Using arm, leg and foot gestures, Bob is able to cycle through the filtered recommended set of outfits until he finds exactly what he wants: business casual attire with a blue or white shirt. He is able to do all this without even looking into his wardrobe. Jasper makes sure to not recommend clothing items that are currently being washed or in the hamper.

Next, Bob grabs the recommended outfit from his closet and dresses himself. Before he heads out, he returns to Jasper and asks “How do I look?” to get any final advice on his outfit. Jasper recognizes Bob is wearing slippers--shoes that are not appropriate for a job interview and recommends Bob change his shoes. Bob repeats the previous two steps; he finds recommended shoes, puts them on, and checks with Jasper to make sure everything looks appropriate. This time, Bob’s outfit fits the attire criteria for the day. Jasper heads out to his interview.

## Item Location


It’s a warm summer Friday night in July. Bob just got off work from his new job he recently landed a few months ago. On the way to work everyday, Bob stops at his local cafe to grab a cup of coffee. On Wednesday, however, Bob started to converse with a woman in line. Feeling confident because of his new job, Bob asked the woman to a date on Friday. Preparing for the date, Jasper is scrolling through the recommended outfits under the “social” criteria. Bob chooses an outfit with his favorite short-sleeved collared shirt. As he goes to grab the shirt, he can’t find it in the normal spot where it is usually stored. Bob lets Jasper know he can’t locate the item, prompting Jasper to trigger the sound locating function.

Within seconds, the item begins beeping so Bob can locate it in his room. It turns out, the item had been accidentally swept under his bed a few weeks ago. Jasper is able to trigger a ringing sound on a particular item because each clothing item is equipped with a small tag. Bob grabs the item, dresses himself, and heads out the door for his date.