

# Zachary Davenport

*Design Portfolio*  
2018

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# Anthropology & Design Research in a Textile Mill

## Introduction:

I spent the summer of 2017 conducting field work to design and engineer a better textile chute aimed at improving workflow, overall efficiency, communication, and health of employees in an old textile mill.

## Background Information: The Challenge

Riverway Knitting Company (pseudonym) is a sixth-generation family run business that has been in continuous operation in New England for over 160 years. They have recently lost much of their business to overseas production where the same products can be produced at a much lower cost. The company struggles both with bringing new business in and keeping up with their current demands; this is in part due to bottlenecks in their current production process. One significant bottleneck was the chute that transported large bundles of fabric from upstairs to downstairs. The chute had a cover for safety and to block noise and heat, but it severely hindered the line of sight and communication between departments. The old chute also prevented larger pieces of fabric from sliding down effectively, or at all, requiring the use of the unreliable freight elevator on the other side of the factory floor. Other problems with the original chute included the rough interior that often caused fabric pieces to get caught or rip, and the low-hanging sprinkler head inside that prevented large quantities of fabric from being loaded all at once.

## User Insights and Research

We quickly learned from working alongside the users of the chute that their methods of loading fabric put significant strain on the employees and therefore limited which employees could do the job. One of the most significant hindrances to production was the inability to load the 90+ yard sewer liners down the chute. Each of these pieces had to be trucked across the factory floor to the freight elevator to move downstairs, which we learned took more than ten minutes per fabric bundle. Eliminating this would increase productivity tremendously.

Throughout our ideation processes, we made sure to involve all stakeholders of the chute. This included the workers on the receiving end who moved the fabric off of the chute and into the shear line for finishing. We learned that the old arrangement of the chute often caused the fabric bundles to land in the wrong orientation, which would require the workers at the bottom to manually flip them before they went into the shear line. Ensuring the fabric fell in the right orientation became a primary concern.

We first made sketch model mock-ups of the chute to present our initial ideas to the mill's president and the chute workers in a hands-on, visual way. Next, we conducted a number of tests in which we involved the employees to test some options for better solutions to both the sewer liner problem and how to load fabric better in general. These included sliding the fabric down the chute while still on its pallet; layering low-friction plastic sheets between the fabric bundles so they could slide into the chute easily when pushed; using a pulley system suspended from the ceiling to tip one end of the pallet up and slide fabric in; and using a hinged pushing device to slide the bundles in. These tests proved that the ideas were feasible, but not without the cost of increased operational time.

These insights told us that while we could make physical changes to the chute in order to improve visibility and communication, any new ways of loading fabric would come at the cost of time. This led us to carefully observe how each employee loaded the chute and find the most time-efficient method; from there, we could teach other employees this method.



Figure 1: The old fabric chute had a cover that hindered communication, as well as the fabric's ability to slide down easily.



Figure 2: We worked alongside the primary users of the chute to test new ways fabric could be loaded into the chute, like sliding it off of a pallet.



Figure 3: One solution we tested was using a block and tackle pulley system to tip the pallets and slide the fabric into the chute.



Figure 4: We used low-cost materials to make sketch models to present potential solutions to the employees of the mill, like this scale model of the chute.

## Our Solutions

The most effective physical improvement we made to the space was removing the chute cover and replacing it with a safer, more open guardrail system that allowed access from two sides instead of one. This allowed the large sewer liner bundles to be sent down the narrow side of the chute by placing the pallet at the edge of the chute and tipping the fabric in using an electric pallet jack.

The new open layout of the chute allowed the operators to observe the chute's current capacity from the mending perch where they normally worked using a strategically positioned convex mirror. We added plastic curtains in the mouth of the chute to block out the heat and noise of the shears below without sacrificing visibility. The new chute was also lined with low-friction plastic sides to make the fabric slide more quickly and easily. In addition, a short landing ramp was added at the top to eliminate the initial drop that often caused the fabric to land in the wrong orientation.

With regard to loading the chute, we realized that the "flip and tip" method used by one employee was most efficient and was the easiest for others to master. The pallet gets lined up with the long edge of the chute, the top fabric bundle is flipped 180° onto the floor, and then it is tipped directly into the mouth of the chute. We produced an infographic that hung in the space to instruct employees how to conduct this method properly and safely.

## Progress and Results

Our new solutions allowed a higher volume of fabric to be transported from upstairs to downstairs due to the increased communication between the departments and the physical improvements that let the fabric slide more easily. The improved processes made the jobs of the workers at the bottom of the chute significantly easier and more efficient now that they could rely on the fabric consistently landing in the right orientation. Our improvements also allowed other employees to work the chute more often, which was particularly beneficial in the event that the primary chute operators were absent.

One of the biggest success of our improvements were that the sewer liners could now be sent directly down the chute instead of sending them down the freight elevator. We estimate that this improvement could potentially save the company around \$130,000 in wasted labor annually. This figure comes from estimating the frequency of the sewer liner bundles and the time it takes to transport them (about 33 bundles every two weeks at ten minutes per bundle). This improvement should allow the employees to spend more time on normal production procedures.

Overall, the employees and the executives of the mill were pleased with the improvements we had made over the summer. We had taken into account as many voices and concerns as we could, and the final solutions drew from the perspectives of employees from throughout the company. This project helped me grow as a designer by giving me more experience in working directly alongside the stakeholders of the project, by forcing me to consider all potential outcomes from a variety of different viewpoints, and by implementing a physical solution under significant time and material constraints.



Figure 5: The new chute's open layout can now accommodate the large sewer liner bundles by tipping the pallet with an electric jack and sliding the fabric in.

Chute: Wide Side View

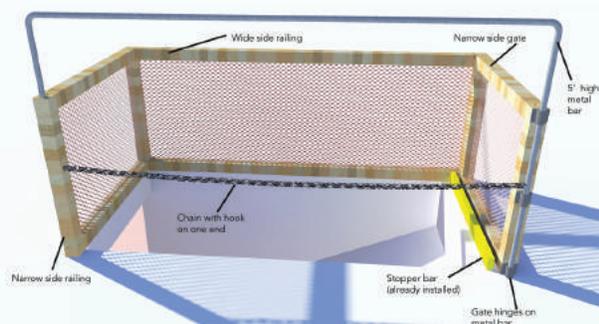


Figure 6: The final renderings of the chute show how both the wide side and the narrow side can be used to load fabric.



Figure 7: The final version of the chute had clear sight lines on all sides, let the mender view the chute as it was being emptied, and allowed larger pieces of fabric to be transported downstairs more efficiently.

# Co-Designing a Digital Calendar

## Introduction:

I worked on a team of three students to design a product for and with an older adult in the community to benefit them personally. This project was for my Engineering for Humanity class in Spring 2017.

## Background Information: The Challenge

Judy (pseudonym) is an 84-year-old retired design educator who likes to remain very active in her community. Her schedule is constantly filled with events from lectures that have invited her as a guest presenter to family birthday parties. Judy has aged very well, but she is starting to show some signs of memory loss. She tries diligently to embrace technology as much as possible by using the calendar in her smartphone, but this calendar was often at odds with the calendar hanging on the side of her fridge.

## Principles and Insights

Judy readily acknowledged that her memory wasn't as good as it used to be, and in doing so, she made conscious efforts to make herself notes about how to use the new technology she so desperately wanted to embrace. We learned early on that Judy has led an impressively diverse life, and she likes being able to share her stories with others by sifting through her collection of old family photos and keepsakes. Recognizing that there was so much to this wise woman, we utilized a variety of organizational frameworks in our studio that helped us visually represent Judy's principles and how we could apply them to solutions. This helped us create several sketch models of early ideas, such as a task management board.

We found that Judy remained attached to her physical calendar because it is an annual gift from her daughter-in-law featuring original artwork. She also liked the feeling of being able to flip the calendar pages and see what artwork was associated with each month. As a result, we sought to create a system to combine the best of both worlds and let Judy seamlessly manage her events. The device should be subtle and blend in with its surroundings, be easy to use, and allow all her events to show up in one place.

## Our Solution

The solution we developed allowed her daughter's artwork to be physically displayed in a changeable manner while utilizing a digital interface to sync calendar events with her phone. A small computer monitor connected to a Raspberry Pi displayed a Google Calendar that allowed her to view all events that were entered in her phone as they were created. The front face was made of cork which helped the device blend in with the wood decor in her home and also serve as a place to pin up important notes. The entire device hung over her fridge with strong fabric straps so that the original calendar's location remained unchanged. Judy's favorite feature of all, though, was the calendar's custom photo screensaver. This gave her a tool to be able to share her stories and memories with others without having to dig through piles of old photos.

## Progress and Results

Judy used the calendar successfully for several months and mentioned to us how much she loved the concept of it. Her family mentioned to us that she especially liked to spend time watching the slideshow. As we continued to keep in touch with her and her family, we learned that her memory issues had progressed to the point where she could not easily use calendar interface. She nevertheless took great joy in staring at her favorite photos and sharing them with friends. After learning about this, we decided that the best course of action would be to remove the calendar function for the sake of simplicity and shift the focus to displaying her favorite memories.



Figure 1: We learned early on that Judy takes great pride in being able to share the stories of her family.

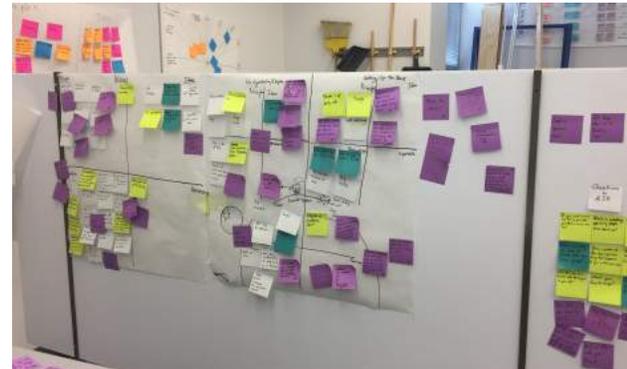


Figure 2: We utilized Post-Its and large pinboards in our studios to map out observations, design principles, ideas, and experiments we could try with Judy.

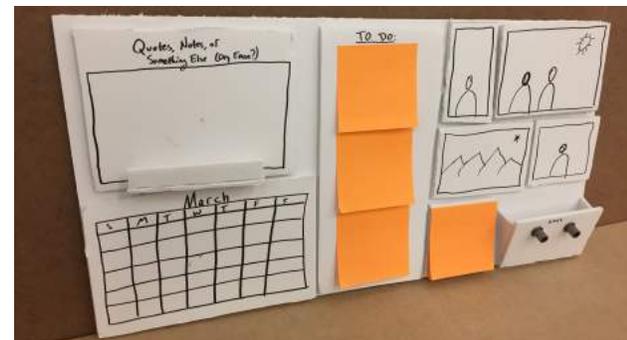


Figure 3: Using basic materials, we produced sketch models of early ideas and concepts like this task management board that we used to present to and interact with Judy.



Figure 4: Judy's favorite part of the final product was enjoying her family memories on the custom photo slideshow.

# Designing an Urban Triplex for Tulsa, OK

## Introduction:

My senior year, my high school English teacher approached me and asked if I would work with him to design a future rental property for him after seeing some of my previous design work.

## Background Information: The Challenge

My high school English teacher, Douglas (pseudonym), and his husband have been living in a home along the Arkansas River in Tulsa, OK, for several years now. The neighborhood has been historically a poorer part of town, and they have tried to play their part in reviving it by renovating their own home and buying the home next door to use as a rental property. They fell in love with the properties' views of the river and the Tulsa skyline and wanted to take advantage of it as much as possible. Douglas approached me and asked if I would be willing to help them design their dream home; it would serve as a home for them as well as other tenants interested in revitalizing the area. We negotiated a flat rate payment in exchange for me working to develop designs, floor plans, and property renderings for them.

## Principles and Insights

In my first meeting with Douglas, he laid out his basic requirements for the space. There would be four units, each of which would have two bedrooms, a master and guest bath, and an open floor plan. The design should take full advantage of the river and skyline views by implementing picture windows on the north and west walls. All units should be accessible from a shared stairwell beginning in the garages on the lower level. I took this information and began preliminary sketches which I soon converted into CAD in SketchUp.

When I presented these rough ideas at our next meeting, Douglas and I agreed that squeezing two units per floor seemed a little cramped, and he suggested that perhaps a triplex would be a better idea. After some discussion, he decided he wanted the upper units to have their own balconies and the lower unit to have a garden patio. One challenge that was becoming increasingly clear is that the house would require serious site work as it was being build almost into a hillside. This and other new requirements continued to pop up: Douglas and his husband decided they wanted a full rooftop deck accessible to only the upper unit, a greenhouse, and wraparound balconies for each of the upper units. While completely manageable, these additional requests helped me realize how much of an iterative process this project would be.

## The Final Design

The final design successfully incorporated all of Douglas's wants and needs: each unit had an open concept floor plan with picture windows to maximize the view, lots of balcony spaces, and plans for how to utilize the hillside alley for easy parking access. I added simple yet modern furniture of my own design to the interior to give suggestions for how the space could be laid out. After Douglas and his husband approved, I created a set of 19 final renderings.

## The Results

Douglas and his husband were incredibly enthusiastic about the final design and told me that the work I had done for them had helped them bring the visions alive from deep within their minds. They recently had the structure quoted for a building cost. Because they wanted to build the structure out of steel, the \$500,000 quote from the builder was a bit more expensive than they had expected, but they still plan on moving forward with it. They are currently in the process of figuring out how to fund the project and how to turn my designs into legitimate construction plans.

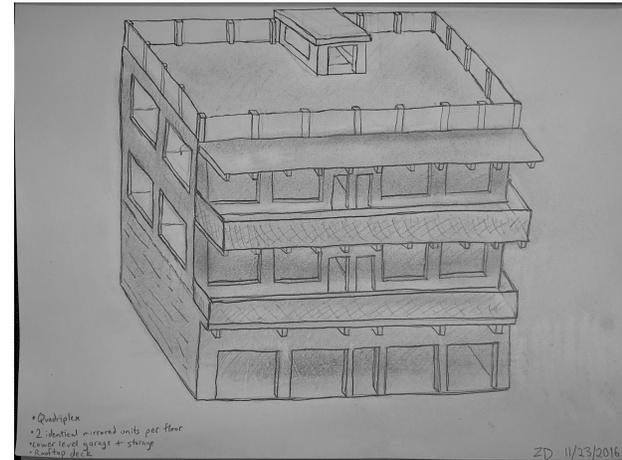


Figure 1: As seen in this preliminary sketch, the original idea for the rental property was a quadruplex with identical mirrored units, lower level garage and storage, and a large rooftop deck.



Figure 2: The front-facing view of the property shows the several balconies and large windows, as well as the greenhouse and rooftop deck.



Figure 3: The slatted awning provides shade to the inside in direct sunlight without prohibiting the view of the river.

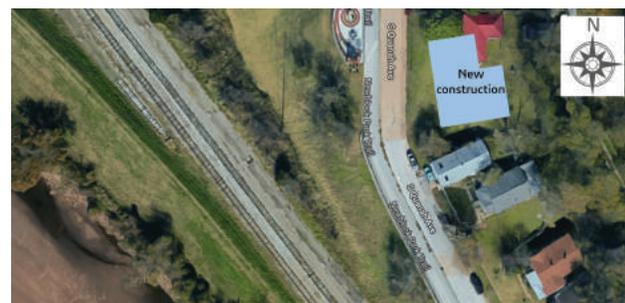


Figure 4: The triplex will be oriented as shown in the above site plan with the west edge (the front of the house) overlooking the Arkansas River.