The Money Book: Project Report

C4: Capital Assistance

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Introduction

Motivation and Problem Statement

Many people in the world have difficulty differing the denominations between bills. Especially in the United States, the currency is uniform in color and size. This uniformity can lead to confusion and make it problematic for the individual to pay for their items on their own at checkout. He or she would have to reply on another person to perform a simple task such as purchasing items. Therefore, we, Capital Assistance, are motivated by our desire to increase financial independence in those who are unable to manage large financial matters on their own. We believe that a greater understanding of the world can come from having the ability to manage your own money, even on a small scale. Moreover, providing the opportunity to allow individuals to interact with others independently will project an increase in confidence within the individual. This project is worthwhile because our solution could help countless people at Seven Hills. However, our project does not have to be solely used at Seven Hills. We aim for a universal solution that can be adapted for other people with disabilities around the country or world.

Target Audience

Our target audience includes individuals who have difficulty organizing money and telling denominations apart, namely those from Seven Hills Foundation. However, our product may be useful for anyone who frequently loses things and needs assistance in organization.

Market Research

Through our market research, we found five different products that serve to organize money and/or tell denominations apart. Though many of them may be useful, many of them don’t serve to specifically address those who have difficulty discerning the different bills.

Device #1

The first device that was found is a wallet with 5 individual pockets for sorting the different denominations of money. However, the wallet is geared for people who are visually impaired. This wallet is great for people who are visually impaired, but this does not help for other people who cannot read or have memory issues. The wallet is sold for about twenty to twenty five dollars and includes: Five pockets for organizing paper money; a zippered, full-length change pouch; a foldout section for credit cards/business cards; and two clear window ID/photo holders. The wallet is limited because it is useless by those with memory issues as well as by people who have other disabilities that limit their ability to differentiate between different denominations of money. There are no labels on the pockets to identify which pocket is designated for which denomination.

Device #2

Another device is a coin purse. This device is used to organize bills and coins in a very simplistic way. Four to five different compartments are used to distinguish different denominations of bills and/or coins from one another. The compartments are folded up in an accordion-style for easy access and storage for the user. This design is advantageous for general use, but it does not include anything that helps the user distinguish between denominations. Like the five-pocket wallet, it is completely made of black leather with no form of markings to indicate what which bill or coin is in which pocket.

Device #3

Another device that was found was a wallet similar to the five-pocket wallet. It is set up like a regular wallet, but has impressions for the denominations inside each pocket. The wallet has five pockets for paper money, but no pockets are designated for coins. There is a clear pocket for IDs or other cards, but it’s not easily accessible for those without fine motor skills. This wallet is similar to any other wallet with the exception of the impressed numbers in each pocket. The wallet doesn’t include any other visuals to help the user identify the denominations and the format of the wallet can be confusing to individuals who have difficulty distinguishing the different types of bills.

Device #4

The Money Brailler clip is specifically designed for people with visual impairments. It is a plastic clip with different braille markings designed for impressing on corresponding bills. The Money

Brailler Clip is more of a tool than an organizer for money and has a narrow target audience. The braille markings are quite small and require another individual to make the markings for the user.

Device #5

The final device we researched was The EyeNote App which allows users to utilize their phone cameras to read a banknote. Once identified, the app will return the value of the note in an audible fashion. The app was specifically designed for the blind and visually impaired individuals who are unable to identify money without assistance. However, the flaw with this device is that the user can be unsure how to hold the bill. Additionally, it doesn't help the user organize the bills, and would need another person to do it for them, thus increasing dependency on another individual.

Preliminary Designs

Design 1

Description: A set of different sized and colored-coded, pocket-like boxes are used to hold different denominations of money. The boxes are also collapsible to allow for easier carrying. The different sizes and color-coding allow the user to more easily differentiate between different denominations, and the collapsibility of the wallet allows the device to be taken anywhere.

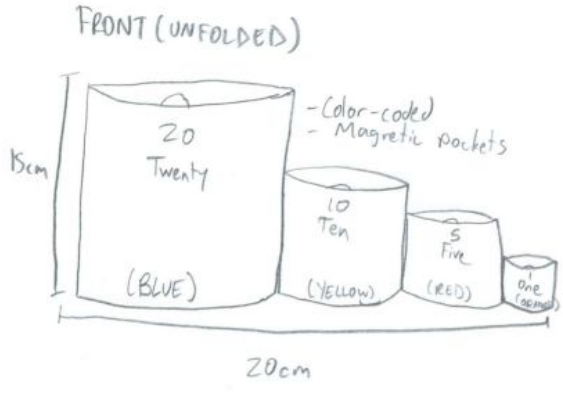

Fig. 1. The unfolded collection of boxes. The entire wallet will be made out of different colored fabric, labelled in the diagram. The wallet will have magnetic clasps.

Design 2

Description: A specialized wallet that has multiple pockets with braille and numeric descriptions. One side of the wallet will also contain basic payment options using different bills and the wallet will have a sensor and auditory feedback when the user removes or puts in bills.

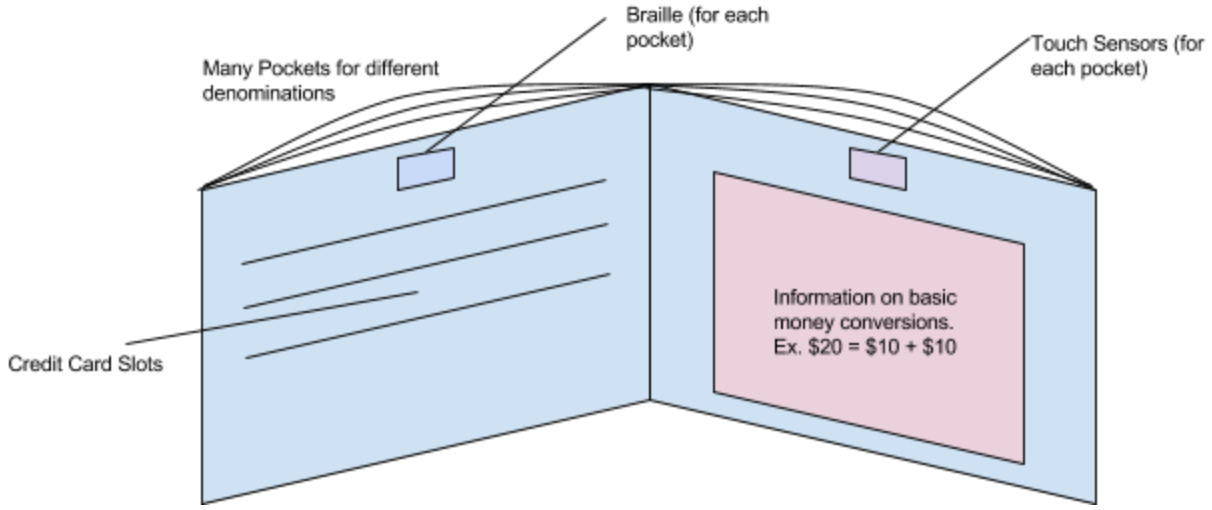

Fig. 2. The main functionalities of the wallet.

The device functions by holding money in pockets similar to a normal wallet and by providing a wealth of extra features. The device will have braille inscriptions and touch sensors to allow for touch feedback, thus helping the user locate the correct denomination of money. Moreover, basic money conversion information for those who instead have more cognitive based disabilities will be located on the wallet to provide the user with a useful guide to help them when paying for products.

Design 3

Description: A book-like design that incorporates flaps with large labels for denominations on the left “page” and a pouch for holding that specific denomination on the right “page”. This design will also have tabs on the top of the flaps for easier navigation.

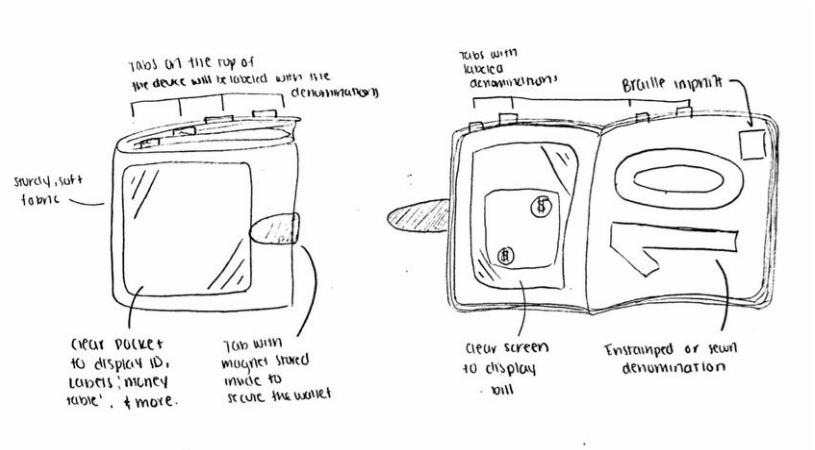

Fig 3. The right diagram displays the device when it's closed and the left diagram display the device when it is opened.

Selection Process and Final Design

Selection Process

After discussing our preliminary designs with our POC, we decided that our final device should be discrete, personalizable, and easily accessible. The reason we wanted to keep the wallet discrete was so there was less of a chance the wallet would be stolen. The wallet would also be personalized with pockets for ID cards and a retractable key chain holder. Lastly, we wanted to make the device easy to access, so that a majority of users can use it.

Final Design

The final design we ended up making was a book like wallet. We made the wallet book like so that it would be more discrete in public. Along with the pockets for bills and coins, we decided to add a ID card pocket and a retractable key chain. The pockets for bills would be labeled with a picture of the denomination and with the actual value of the bill. This makes it easy for the user to find the denomination they want. The entire wallet is held together with binder clips. This gives the user customization, because they can choose which pockets they want to use. The entire wallet is held together with a clasp, so that none of the money will fall out.

Fig. 4. An example of what separate pages will look like in the book.

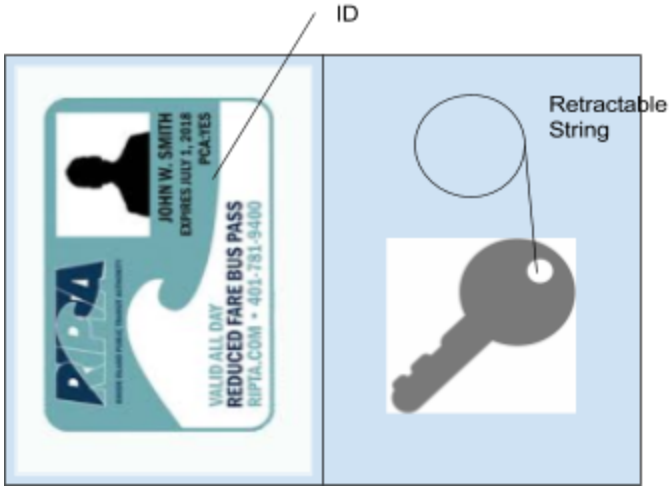

Fig. 5. The inside covers of the book which will hold the clear pocket with the bus ID and the retractable key chain.

Table 1. The engineering matrix used in determining which design to go with.

Engineering Matrix					
Criteria	**Req#s**	**Weight (1-10)**	**Design 1 Score (0-5)**	**Design 2 Score (0-5)**	**Design 3 Score (0-5)**
High protection of bills	6, 8	8	3	4	4
Low Cost	1, 2, 3	7	5	3	5
Lightweight	11, 12, 13	5	4	2	2
High durability	16	5	1	3	3
Clear purpose	7, 9, 15	4	5	4	5
Small size	14	3	5	3	3
		Totals:	119	103	121

Prototyping Process

Beginning of Prototype

The prototyping process began in mid-April with the final design being confirmed after a visit to Seven Hills. The visit to Seven Hills marked a large change in the prototype from PDR to CDR, with a new focus on an audience that had specific difficulty differentiating between denominations of money. The visit to Seven Hills also eliminated to use of Velcro, and emphasized the importance of being discreet. After the visit to Seven Hills, we decided to move forward in our design with the book-like idea. The book-like idea, however, was refined to be more discreet in public, and to include a keychain and ID pocket. These features came from a discussion in which it was mentioned that many participants at Seven Hills had difficulty with misplacing house keys, and retrieving bus passes while in line to get on the bus. It was suggested that the wallet be changed to include features to improve this. The MoneyBook became, after this visit, more expansive than a wallet, as it included a wider range of organizational features.

Before beginning construction of the prototype, a design study was conducted to determine the main fabric and plastic that would be used throughout the majority of the prototype. The design study compared three fabrics and three plastics to determine which had the lowest Cauchy strain. The design study compared denim, cotton, and polyester's resistance to stretching, as well as sandwich bag plastic, freezer bag plastic, and binder sheet plastic.

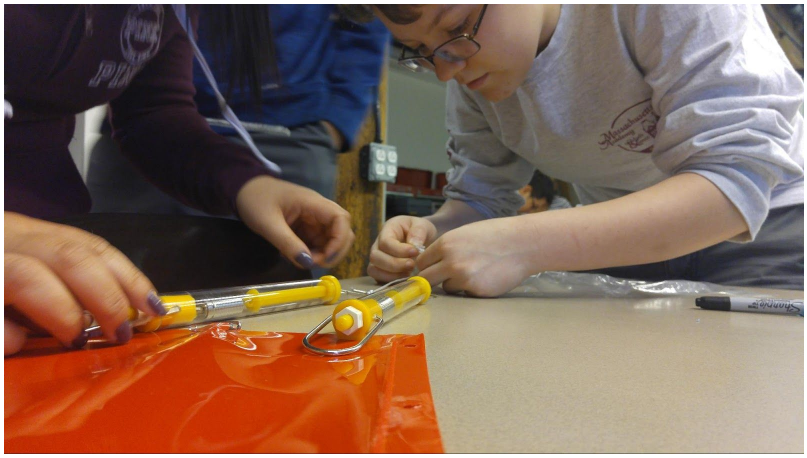

Fig. 6. A photo taken during the first design study.

Washers were attached to either the fabric or the plastic. A pulling force of ten newtons was applied to the fabric, and a pulling force of five newtons was applied to the plastic. The distance the material had stretched was then measured.

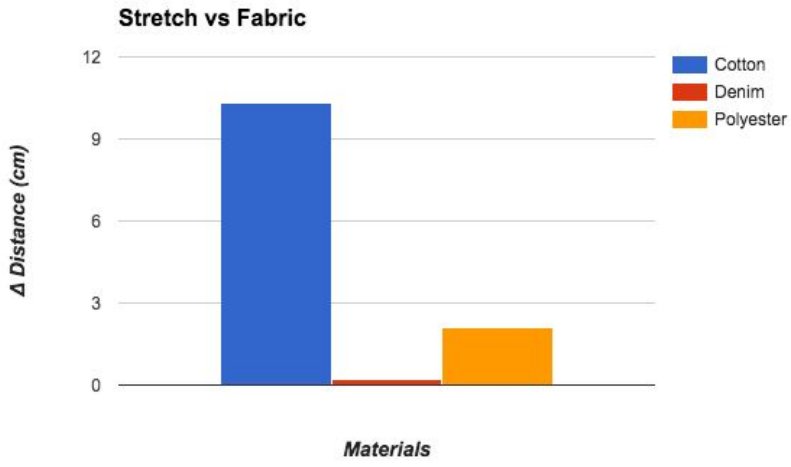

Fig. 7. Results from the first design study for fabric.

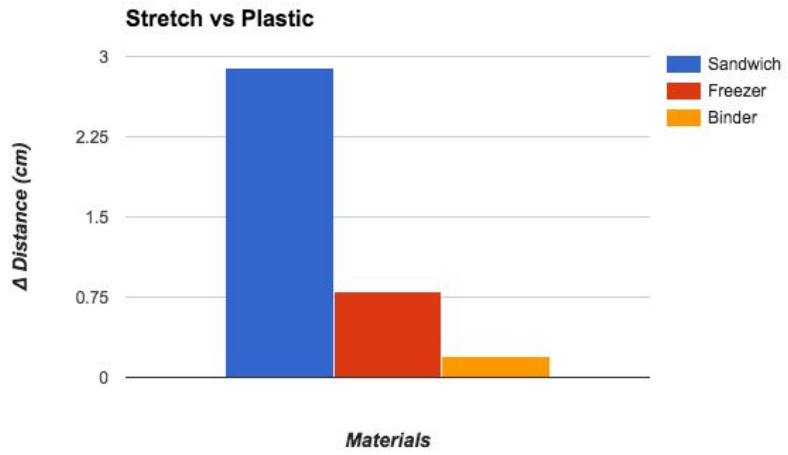

Fig. 8. Results from the first design study for plastic.

A similar design study was conducted afterwards to decide what the use in the shell of the MoneyBook. We compared plastic from a Tupperware bin, a medical supplies bin, and a sheet of thin plastic. A weight was hung from each plastic by a string connected to the plastic strip through a hole, and the change in vertical distance from the table where the plastic strip laid on was measured. From this study, we found that the medical box plastic to be the most effective for our purposes.

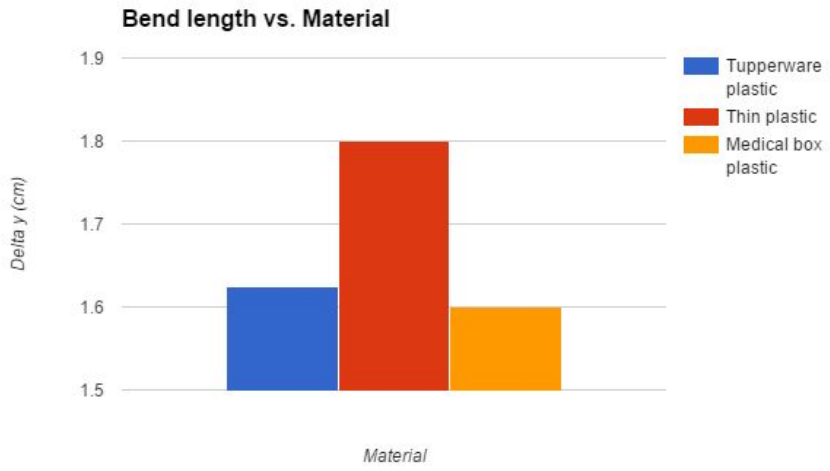

Fig. 9. Results from the second design study.

After our design studies were conducted, we began construction of the prototype. The original pockets were constructed from thin sheets of denim and sandwich bag plastic, to produce a proof of concept. The Ziploc bags that were implemented, however, had locking mechanisms that were difficult to use, and were not intuitive. For these reasons, the zippers on the internal pocket were replaced with clasps.

Fig. 10. The first version of the pockets for the MoneyBook.

The second version of the pockets were formed from two pieces of thicker denim, with a window cut out. Inside of these pockets, two pieces of binder sheet plastic were placed as a protective measure, as well as a blocking for the window in the denim pocket. Inside of these pockets, small images of the denomination intended to be placed within were secured. On the outside of the pockets, the value of the next-highest denomination was printed in large font. Due to the book-like nature of the MoneyBook, when it was opened, the pocket with the intended bill would have its information on the back of the next-lowest denomination's pocket.

Fig. 11. The denim pockets without the plastic insert from the final prototype.

To create the binding of the MoneyBook, part of a three-ring binder was taken and repurposed. The binding was glued to the shell of the MoneyBook, and during the final construction, holes were made in the bottom of the pockets to allow it to be easily slipped into the device.

Fig. 12. The binding from the final prototype.

Fig. 13. The final prototype.

Final Device Summary

Prototype Description

Our device was constructed using denim as an outer fabric, medical box plastic for the main structure, and sandwich bag plastic for the bus ID holder. Each pocket contains a photo of the

designated denomination for that pocket. In addition, there are small holders for coins in one extraneous pocket and a key holder.

Functionality

Our device's primary function is to allow the user to store money and to provide the user with special accessibility features. Specifically, our device works by allowing the user to store various denominations in distinct and sorted pockets. This feature allows the user to more easily put in and take out money from our device. Further, our device contains a bus ID holder that allows for easy access and storage of an ID. Having an easy to access ID allows the user to use their ID in a real life situation without having to struggle to take it out. Finally, our device has a key holder that provides a convenient way for the user to store keys and use them without having a separate key chain.

Final Requirements Matrix

Table 2. The final requirements matrix.The ADR column represents if the requirement was met by the final prototype.

#	Requirement Type	Requirement Statement	Level	ADR
1	Cost	The device shall be made of materials less than $50.	1	Yes
2	Cost	The device shall be made of materials less than $35.	2	Yes
3	Cost	The device shall be made of materials less than $15.	3	Yes
4	Documentation	The device shall be delivered with a user's guide.	1	Yes
5	Documentation	The device shall be delivered with a design document.	1	Yes
6	Functional	The device shall be able to securely hold money.	1	Yes
7	Functional	The device shall have a way of helping the user to sort different denominations.	1	Yes
8	Functional	The device shall be able to store keys.	1	Yes
9	Functional	The device shall be able to store cards.	1	Yes
10	Functional	The device shall not damage the bills during use.	2	Yes
11	Functional	The device shall be discrete.	2	Yes

12	Functional	The device shall be accessible to individuals who are blind.	3	No
13	Physical	The device shall be made of a soft non harmful material.	1	Yes
14	Physical	The device shall weigh less than a pound.	1	Yes
15	Physical	The device shall have a method for easily accessing an ID card.	1	Yes
16	Physical	The device shall weigh less than a fourth of a pound.	2	No
17	Physical	The device shall be smaller than 15cm by 20cm.	2	Yes
18	Physical	The device shall clearly show how it will operate.	2	Yes
19	Physical	The device shall not wear or tear throughout its usage by the user.	2	Yes
20	Physical	The device shall weigh less than an eighth of a pound.	3	No
21	User	The user shall be able to hold and manipulate a small rectangular object.	1	
22	User	The user shall know that there is a difference between denominations.	1	
23	User	The user shall know that there is a difference between bills and coins.	1	
24	User	The user shall have at least one hand with fine motor skills.	1	
25	User	The user shall be able to use both hands.	1	

The MoneyBook satisfies all of our level one requirements. The MoneyBook also satisfies all of our level two requirements, except that it does not weigh less than a fourth of a pound. Lastly, the MoneyBook does satisfy our level three cost requirement, but it does not satisfy our requirement that it would be accessible to the blind and it does not satisfy our level three weight requirement.

Future Work

Ideal Materials

Our ideal materials would include using leather for the outer fabric. We would also have a more reinforced plastic, a reinforced binding, and metal clasps instead of plastic ones. Better zippers could be useful as well. In terms of price, we believed that our final price was sufficiently low enough already.

Next Steps

We could add a place for credit cards to be stored and embroider the denominations on the pocket. Another option going forward could be to expand the MoneyBook to a broader market or to create different versions of the MoneyBook targeted at different audiences. An accompanying app would provide additional functionality to the MoneyBook experience and could be used as a money balance tool in addition to the physical MoneyBook.

What Would Have Been Done Differently

If we were to redo this project, we would first try to determine a more specific focus from the start. This focus would allow us to get feedback from potential users at Seven Hills earlier and start with a more focused design during PDR. We would also take into account how easy a fabric is to sew when choosing one.

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