Check Yourself

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Problem and Solution Overview

The current self-checkout experience leaves a great deal to be desired. Most systems are difficult to use, unintuitive, and put a number of obstacles in the customer's path. Customers have to scan and bag items carefully, one at a time, or risk the machine entering an error state due to 'unwanted items'. Items without barcodes have to be searched for, sometimes forcing the customer to guess at how a particular store classifies its produce. Our design intends to address many of the pain points found in current self-checkouts for the benefit of all stakeholders. By means of a conveyor and optical scanners, we will leverage computer vision to identify and tally items. This same system will help identify produce or bulk purchases, suggesting a match to the customer while they weigh the item. Our newly designed self-checkout will be easier, faster, and more simple.

Design Research Goals, Stakeholders, and Participants

For our project, we performed three types of research including contextual inquiry, interviewing, and shadowing. We incorporated follow-up interviews after our contextual inquiries in order to gain a better sense of each shopper's experience and pain points which might have been missed by contextual inquiry alone. The reasoning behind this was to acknowledge that no two self-checkouts may be the same, and our time constraints would not allow us to perform a deeper dive by following the same shopper on several trips to several different stores. Shadowing was done by quietly observing individuals while they used the self-checkout, with an eye toward facial expressions, repeated movements, or calls for assistance to the employees, and taking detailed notes of those events as well as the surrounding causes or effects. To help provide perspective, we also interviewed a small number of employees who attended the self-checkouts, to see what frustrations they experienced or witnessed. While employees are not our primary focus, their insight and observations provided a greater depth and perspective to the overall self-checkout process.

Each inquiry was performed by meeting the shopper at the store and accompanying them on their trip to pick out goods. The purpose of this was two-fold. First, to establish a rapport with the shopper by spending some time to break the ice and engage in friendly conversation. Secondly, it helped establish a sense of context for the specific trip. Because no two stores are the same, the framing between each individual trip needed to be taken into account, and this was accomplished by the preliminary experience of shopping itself.

The following participants were involved in our contextual inquiries:

"**Patel**." Patel is a 27-year-old male grad student studying human-computer interaction. He is tech-savvy, and uses self-checkouts to purchase a few items. He does not own a car and walks to the grocery store.
"**Jill**." Jill is a 20-year old female college student who attends Edmonds Community College. She lives in an apartment in Lynnwood with 2 roommates. She doesn't own a car and either bikes or takes the bus to the market. She uses full-service checkout for large purchases.
"**Bob**." Bob is a tech savvy, single white male, aged 50. He studied pre-med at the University of Washington but has no degree. He works as a manager at Amazon in the taxonomy department and used to work as a designer.

"**Jessica**." Jessica is in her late 20s and holds a Bachelor of Science degree from Berkeley. She is technologically savvy, a gamer, and health-conscious. She works as an administrative assistant for Futurewei. For shopping, she prefers meals which are easier to cook.
"**James**." James is in his mid 30s and is a high school graduate. He is extremely technologically adept, and often builds or refurbishes his own computer hardware. James is also a gamer. He is pre-diabetic, and his dietary concerns focus around staying healthy. He also prefers meals which are easier to prepare and cook.
"**Penny**." Penny is in her 50s and shops for her and her husband on the weekend at Winco. She is not technologically savvy and works at Army Corps of Engineers. She shops on Sunday mornings when the store is not busy and is aware of sales but does not use coupons. She is very sociable and normally uses full-service checkouts, but is not afraid of self-checkouts.

Design Research Results and Themes

As a result of our contextual inquiries and observations, a number of themes quickly emerged. Our key observations are as follows:

- **Bagging** - bagging ended up being one of the bigger problems facing the shoppers. The bags can be difficult to locate as they are not positioned uniformly. Customers are also required to bag items singly, as items can only be scanned one at a time (this is another theme, addressed later). Additionally, fragility is a factor which forces shoppers to consider how they will scan their items, rather than simply scanning as they go. As an example, eggs will need to be either scanned last or will have to be staged in the bagging area for later.is a tremendous problem. Lastly, the instructional demonstrations displayed to customers often do not match the behavior that is actually expected by the system, which results in errors.
- **Weight scale** - this is also especially problematic because if you decide to put your own bag on it to pack all of your groceries it will send constant alerts that there are unrecognized items in the bagging area. The weight scale is ultra sensitive, but not always accurate in understanding what's placed on it and prevents any other action from happening until either an employee overrides the system or the unrecognized item is removed.
- **Scanning** - customers are annoyed that they have to scan every item. Barcodes may be hard to find or damaged. Produce often has no barcode at all, which forces customers to look the item up on the touch screen, which was shown to be a frustrating and time consuming experience that sometimes required employee intervention.
- **Multiple interfaces** - there are two interfaces that customers interact with. This includes the main screen and the pin pad. It is confusing having two machines to work with because it's not clear when to use which.
- **Multiple payment/receipt slots** - there are two slots for cash (one to insert, one for change), two slots for change (one to insert, one for change), and two slots for paper (one for the receipt and one for coupons). All these slots for the same item make it confusing to navigate.
- **Employee is overwhelmed** - as a result of our shadowing and employee interviews, we observed that the current design is sub-optimal for employees as well as customers. Self-checkout is typically understaffed, and the current system in place is error prone such that it requires frequent employee intervention.

Additionally, we found that the self-checkout experience is not friendly to parents who are shopping, the interface can be slow, and social pressures to keep the line moving can cause shoppers frustration or anxiety. As we have begun refining our design, we also observed that the common self-checkout configurations are not accessible to people with disabilities. Although the two interface design currently used can be confusing and not helpful, preliminary designs are still open to the possibility of two screens, although both would display the same information to the customer.

Task Analysis Questions and Answers

- Who is going to use the design?
    - Ideally anyone who currently uses self-checkouts will be able to use our newly designed system because it will be an even easier, faster, and more simplified process than what is in the market today. We are also paying special attention to the fact that people of all abilities have the opportunity to use our system. However, if we had to narrow down a demographic, we would like to design for tech-savvy adults.
- What tasks do they now perform?
    - Initiating self-checkouts, choosing language, scanning items, entering in codes for items without barcodes, inserting coupons, making payment, speaking with employee when necessary, selecting number of bags, bagging items, scanning frequent shopper card.
- What tasks are desired?
    - Putting in bulk purchases without individually scanning every item; ability to use your own bag(s) without employee intervention; less scanning; more accurate weight scale; less shaming and stress when things go wrong, better and easier communication with employee when necessary; improved display for quicker checkout process.
- How are the tasks learned?
    - Repetition and memory are how people mainly know how to use current self-checkouts. Sometimes video demonstrations are there, but they are not always helpful. We are designing our system so that it is much more intuitive and mimics the behaviors learned at full-service checkouts.
- Where are the tasks performed?
    - At self-checkout
- What is the relationship between the person and data?
    - Normally, the customer only has their immediate data available to them, such as what they just purchased, how much it cost, and what their reward points are. The rest of their data and purchasing history is hidden and known solely to the store, which they use to give out coupons and similar promotions.
- What other tools does the person have?
    - Typically a person comes equipped with their method of payment, phone, and sometimes coupons and/or their shopper card. They also have the option to go to full-service checkouts. And, they can use their intuition to decide what works best for them.
- How do people communicate with each other?

    - When assistance is needed, a red flashing light is typically lit, and the employee either walks up to the self-checkout to help or takes care of the matter in their own terminal. If direct interaction is needed, verbal communication is used or gestures such as “thumbs up” help let customers know that things are okay. Sometimes customers speak to one another for help, though this is much rarer. We did notice one customer ask another customer how long she's been waiting for an employee's help.

      Our intention for our new design is to significantly reduce the need for customers to need to communicate with employees. This is because many people use self-checkouts to avoid human contact, but mainly because we want to reduce the problems encountered at self-checkouts so that customers do not constantly need employee intervention.
- How often are the tasks performed?
    - Whenever self-checkout is used.
- What are the time constraints on the tasks?
    - Taking too long between scans can cause the machine to prompt the customer to scan more items or select a payment option. The machine can also freeze up. Moreover, customers mention that they feel rushed and obligated to keep the line flowing as fast as possible. Our new design will speed up the self-checkout process and not punish customers when there is a pause.
- What happens when things go wrong?
    - Normally an employee comes to assist. A flashing light will turn on letting an employee know that a customer needs help. The customer is typically locked out from the self-checkout and can't proceed without employee intervention. The employee will either take care of the matter on his/her own terminal, or have to personally come and override the customer's self-checkout machine. Our new design remove the shaming red light, reduce the need for employee intervention, and help resolve the major pain points customers experience.

Design 1: Magic Box

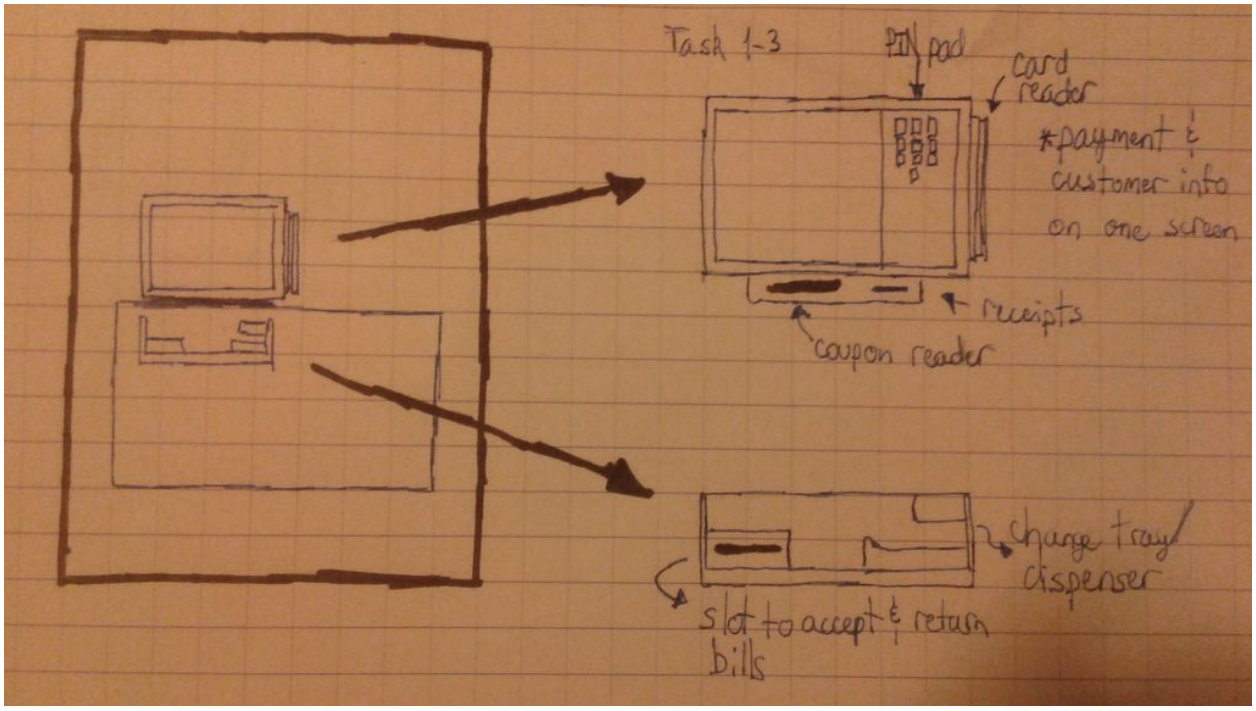
This design is a total revamp of today’s self-checkouts. Items can be placed in bulk inside a cube-like “box” which will scan all the items at once using an elevator motion. After they are scanned, the floor of the box opens up and gently drops the items inside a pre-opened bag. The bag is then placed on a hook and rolled out of the box, ready for the customer to grab and go. The floor of the box finally closes, ready for the next set of items. If an item is too large to fit in the box, a handheld scanner is available to manually scan the item.

Task 1 - Scanning multiple items at once: The “Magic Box” can scan items in bulk automatically, reducing the customer’s wait time. The customer simply places all their items inside the box, and the scanner reads the attached RFID stickers.
Task 2 - Paying for items: The touchscreen UI integrates a card reader and pin pad to reduce confusion. The slots for cash, coupons, change, and receipts are reduced to 3 for ease of use.
Task 3 - Bagging items: Items are automatically bagged for you with this design. Items will also be bagged correctly as each bulk scan results in one bag.
Task 6 - Ease of the self-checkout from beginning to end: This design should require much less employee help as there is no weight scale for the customer to deal with. The improved UI will be much faster and give the customer more necessary control.

Design 2: Self-Checkout 2.0

In this design, our primary focus is to examine the current self-checkout system and rework those aspects which don’t provide an excellent experience for the customer. One of the first changes is to reduce the amount of confusion that the current system can produce due to having two screens: one for payment (i.e. pinpad) and one for managing the checkout process (i.e. mainscreen). We accomplish this

by fusing the card reader with the primary screen, so that all input and output is handled through a single terminal. For people paying with cash or coin, and for those using coupons, we have combined the input slots with the output slots, reducing the total number of slots to 3. If a customer wants to use their own bags, one of the first options they will be presented with is to inform the machine of this. Items which prove to be difficult to scan will instead have their image captured with optical cameras mounted alongside the lasers, and the customer will be presented with several likely matches for their purchase.



Task 1 - Scanning multiple items at once. With a keypad available on screen, the customer can enter in a quantity before scanning an item. Then, the full set of items can be weighed and bagged.
Task 2 - Paying for items. Now the card reader is integrated with the screen, allowing the customer to use a single terminal if paying by card. Cash and coin are accepted and dispensed just below the scanning area.
Task 4 - Using coupons. The coupon receptacle is located just above the scanner, allowing users to quickly enter their coupons, then feed them to the receptacle all at once.
Task 5 - Buying items that don't have barcodes. When purchasing items with damaged or absent barcodes, the customer presents the item to the optical scanner located next to the scanner. The item is recognized and potential matches are presented on the screen, where the customer selects the correct one, then weighs their purchase if necessary.

Design 3: FastShop

FastShop is a revolutionary new way to do grocery shopping where a person simply taps to shop! A customer is given a FastShop card. Whenever they want an item, all they have to do is use their FastShop card and tap the electronic shelf label immediately in front of the item, and then bag that item (multiples of any item can also be added through the electronic shelf label). That item is then added to

their FastShop card. The card can be reviewed as the customer shops, so they can see the items added and the total cost. To checkout, a customer simply proceeds to the self-checkout and taps their card again. The list of purchases will be displayed on the screen, and a customer simply needs to review, pay, and leave.

Task 1 - Scanning multiple items at once. It's easy to add multiples of items. When the FastShop card is scanned on the electronic shelf label, customers have the option to add more than one item without hassle.
Task 2 - Paying for items. Paying for items is super easy. To checkout, a customer simply proceeds to the self-checkout and taps their card for a final time on the screen. Their list of purchases is displayed, and all that's needed is for the customer to simply review, pay, and leave.
Task 4 - Using coupons. Coupons can be added at the electronic shelf label with a simple tap of the FastShop card.
Task 6 - Ease of the self-checkout from beginning to end: This design gives customers a far greater amount of independence when grocery shopping while still adding an element of accountability at the end with the final self-checkout screen. The process is much easier because there is no scanning done at self-checkout. All that's done is reviewing the items, paying, bagging (if necessary), and leaving.

Moving forward, our team is going to progress with the "Magic Box" and "Self-Checkout" ideas because they address the greatest pain points. We address more than just four tasks in our latest design, and they include using coupons, buying items that don't have barcodes, ease of self-checkout from beginning to end, paying for items, and scanning multiple items at once. We also intend to make our design as accessible as possible so that we can help a broader range of demographics. We also want the design to be feasible and affordable for companies and something that benefits all stakeholders involved.

Scenarios:

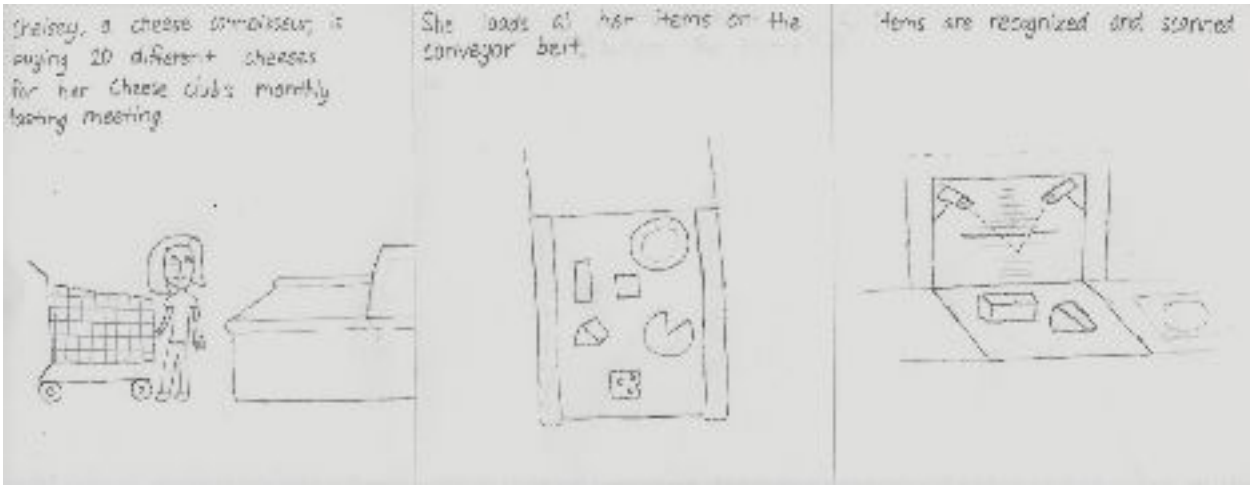
Our team has decided to build upon the idea of the "Magic Box" while incorporating elements of our "Self-Checkout 2.0" design. We thought this struck the best balance between feasibility and ease-of-use.

We made updates to the original "Magic Box" idea based on feedback from TAs and classmates. In our updated design, items are placed on a conveyer belt, and then go through a scanner. The scanner includes barcode scanners and cameras, and uses computer vision to identify the items, the quantity of items, and the total cost. If an item happens to go unidentified, customers will be alerted on a screen (which also serves as the payment screen) and select from one of the options presented (based on what it thinks it is.) If the item is still not recognized there is a search bar with a software QWERTY keyboard to allow people to search for the item. If the item needs to be weighed, the console will notify the customer who will weigh the item immediately before bagging it.

By exploring Self-Checkout 2.0, we were able to incorporate subtle enhancements to the checkout experience we might have missed otherwise. For instance, there is only one screen that the customer engages with, whereas previously it was two (i.e. the PIN pad and the main screen), and the number of slots has been reduced from 6 to 3, one for cash, one for coins, and one for print (i.e. coupons and receipts). The card reader is attached to the side of the screen, and customers only have to deal with a single terminal to make things more simplified.

The new “Magic Box” design mimics the natural behaviors that are learned at full-service checkouts, but the process is significantly sped up. The two tasks we chose to focus on are “buying items that don’t have barcodes” and “scanning multiple items at once.” We narrowed it down to these two because our research doing contextual inquiries, shadowing, and interviewing revealed that these tasks are two of the greatest pain points that customers have with current self-checkouts. Addressing these pain points will also help customers save a lot of time, which is the fundamental reason many people tend to chose self-checkout to begin with.

While we focused on these two tasks, our design still naturally covers other tasks including paying for items, using coupons, and ease of self-checkout. Our target audience, tech-savvy adults, will benefit from the ease and time saved in our self-checkout design, but the broader community will enjoy it as well.



Barcodeless products:

We have massively simplified the control flow for checking out items that don’t have barcodes. When there is an item without a barcode, the customer simply puts the item on the belt like anything else. The checkout machine should be confident at what item it is, and it will automatically recognize it, add it to the ledger, and the user will bag it like anything else. In those cases where the machine doesn’t recognize it, it will call the user, highlight the item on a live camera feed on the screen, and the customer.

Scanning multiple items:

Scanning multiple items is very simple. All the customer needs to do is put all the items on the conveyor, and it will scan and add all of them.