ENSC 304
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Self-Checkout Machines

Topic: Critique a bad design and redesign it

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Introduction

What is a self-checkout machine? Figure 1 below is an image of what a self-checkout machine is. It consists of a scanning area, a paying area, and a bagging area. It is the machine that you see in the checkout counter alongside the cashiers near the exit and entrance of a retailer. Their purpose is to enable the customers to process their own purchases by themselves. Self-checkout machines are scattered in many retailers around the world. There are currently 200,000 of these machines globally and according to a research and consulting group RBR, by 2020 there will be 335,000 of these machines in circulation around the world [7].

Figure 1: This is what a regular self-checkout machine looks like [10]

There are many criticisms about the effectiveness of this machine yet it is still very popular. It is still increasing in numbers every year. If this trend continues then in the future all the checkout cashiers would be replaced by these self-checkout machines. There would be no more checkout cashiers as their jobs would be replaced.

However, the current self-checkout machines today have many design problems. The current versions that exist today need significant improvements. There is no possibility that the current versions of these self-checkout machines would be able to take over the checkout counter. If these self-checkout machines continue to be as badly designed as they are now then checkout cashiers will remain as the kings of the checkout counter. They are better and will always be better than the currently badly designed self-checkout machines.

Motivation

After learning about the design of everyday things, human factors, and usability engineering there have been many designs that revealed themselves. These designs, good or bad, were not even there before learning the three things mentioned above. It is as if a new world was opened up. The world of everyday design. As a new witness to the newly discovered world, everything now looks different when factoring in these everyday designs.

The design of everyday things, human factors, and usability engineering have created a new perspective towards things that before were taken for granted. It is amazing to notice in real life the many things that Don Norman mentions in his book, “The Design of Everyday Things.”[6]

The weekly journals have been a fun challenge to explore the design of everyday things and while in the process of looking for a bad design the one that stood out the most was the self-checkout machine. Checkout counters with a cashier and a cash register have been used for almost 130 years yet these self-checkout machines are creeping in, trying to replace 130 years of what works. It follows the popular idiom “If it ain’t broke, don’t fix it.” [8][9]

Problem Definition

Self-checkout machines are used by retailers to save money on the reduced labor costs. They exist because of the marketers that think that it is what the customers need. What retailers need are happy customers so that they get a high conversion rate. Stores need to be able to afford the customers going in and buying what they want as efficiently as possible.

The customers who look at a self-checkout machine will follow a reflective process because as they are lining up on the regular cashier checkout they are wondering if maybe those self-checkout machines would be better. Which one really is better? Which one really is faster? These customers do not really research and compare and contrast these kinds of things. So they just follow the behavioral process of using the self-checkout machine because they see that others are using it, too. The typical user does not see the self-checkout machine as a faster or more convenient way of checking out products, they see it as just another way to be able to buy whatever they wanted so they can get out of the store as fast as possible.

Customers may get the benefit of avoiding human interaction by using the self-checkout machines, but that is inconsequential because avoiding human interaction is also affordable even when using cashier checkouts. These self-checkout machines are supposed to be better than cashier checkouts, but they are not.

There are several problems with self-checkout machines. Since they have been introduced more than two decades ago they have still not completely removed attendant check out [1]. One of the reasons cashier checkouts are still dominant in retailers is the hard initial learning curve of the self-checkout machine. Learning how to use a self-checkout machine takes time and effort many are not willing to spend time on it.

Furthermore, self-checkout machines cannot accommodate non-barcode items (e.g. produce products) as fast as cashier checkout can. In order to scan a non-barcode item the user must select the correct item from the screen of the self-checkout machine. This process is shown in Figure 2 below.

A problem arises when the user cannot tell the different kinds of apples from the other ten kinds of apples and therefore the user can purposely select an apple that is cheaper than what they intended to buy. As a result theft is more prevalent for non-barcode items. Furthermore, in an environmentally friendly progressive world, many people would like to bring recycled bags from home to use for their grocery baggage. Unfortunately, the system for most self-checkout machines cannot account for the weight difference of a reusable bag. The user must can only use the plastic bag that the store provides.

Figure 2: Checking out apples

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Many users are not used to scanning their items at the self-checkout lanes, so they often do accidental double scans. This slows down the whole checkout process because they now have to manually remove the item from the screen. Also, the assumption that self-checkout machines are faster than a cashier checkout is questionable. If a person stands behind someone who has a lot of coupons to scan, it will take a while for that person because most machines don't have coupon multipliers and if they encounter a problem with their coupons, they will need to ask an attendant, further wasting the time of that person standing behind.

Figure 3: Broken self-checkout machine [5]

Finding an attendant not only defeats the purpose of faster checkouts, but it also troubles the user by having to move and re-scan everything if the machine they are currently using breaks and if there is no one to fix it for them. There is a reliability issue in this supposedly advanced technology. A small problem like a lack of receipt paper can delay the whole check out process. This kind of issue could be easily fixed in the cashier checkout. Lastly, current self-checkout machines are not designed for handicapped users. For example, wheel chair users cannot reach the monitors, cash & receipt machine which accounts for physical constraint

Design process

A self-checkout machine is designed to increase a store's profitability. With a self-checkout machine the store will be able to employ lesser amounts of employees to man the checkout aisle. The machine arguably creates faster checkouts and it also affords the customers to avoid cashier interaction. Self-checkout machines are designed for ease of use by having multiple signifiers and affordances for its users. As seen on the figure below, signifiers and affordances are not only placed in close proximity to its function area but they are also very visible for users by having large and printed letters.

Figure 4: Example of a self-checkout machine [4]

The self-checkout machine's type of mapping is a best style of mapping because the signifiers are right on the affordances. Table 1 below shows the examples of signifiers and affordances for a regular self-checkout machine.

Signifiers	Affordance
Labels (e.g. cash, credit, receipt)	Computer screen
Sound (e.g. tutorial on the screen, beeps)	Barcode scanner, weight sensors
Lights on the barcode scanner (e.g. ready to scan = green)	Coins & receipt dispenser, plastic bag holder

Table 1: Fundamental Principles of Interaction

When using the machine for the first time, a steep learning curve is needed which requires knowledge in the head. There is also an interlock forcing function when the first part of the machine scans the product and then the next area weights it. In terms of design and the gulf of execution and gulf of feedback, the user plans to put their product on the scanning part of the machine, specify where the barcode is, perform the scan, perceive how the scanner works and interpret that the product must be bagged in order to scan another product. The bagging area has a semantic constraint because it is positioned after the scanning procedure. This is purposely done with an assumption that the user will bag the product immediately after scanning it. Therefore this constraint is dependent on the knowledge of the situation and of the world.

Currently, most self-checkout machines do not have image recognition scanners therefore non-barcode items (e.g. produce products) must be inputted manually on the self-checkout screen shown in Figure 5 below:

Figure 5: Selection screen for non-barcode items [3]

Once the user has selected the correct item on the screen they will need to move on to the next step which is bagging the product. Weight sensors which are physical constraints are installed on the machines to prevent users from stealing products. Shown in Figure 6 below is a prompt for theft prevention. When the user has scanned the product, in order to proceed to the next step they must bag the items.

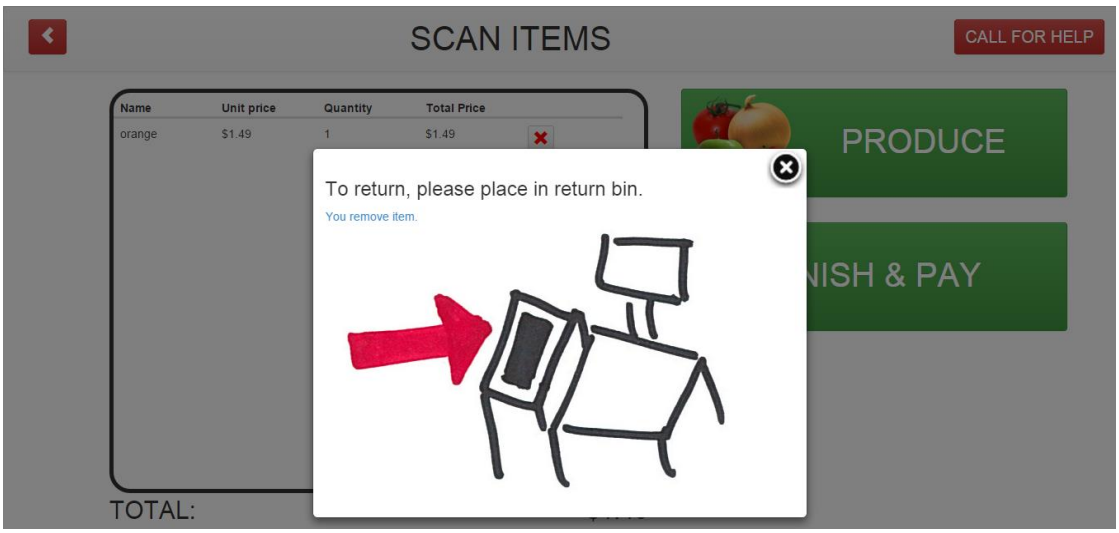

Figure 6: Pop up of bagging after scanning [2]

This theft prevention is an example of a lockout forcing function because it prevents the user from proceeding to the next step until the desired operations have been done. Similarly, there is also an interlock forcing function when a user tries to remove items that have already been scanned. The bagging area has weight sensors which prevents the user to steal items by not bagging the items they have already scanned. Table 2 shows a list of constraints for the self-checkout machine.

Type of Constraints	Examples
Physical Constraint	Weight sensors
Semantic	Bagging area
Forcing Function	lockout - bagging pop up interlock - deletion of products

Table 2: Constraints of Self-Checkout Machines

For payments, most self-checkout machines accept different kinds of payment methods (e.g. coins, cash, credit, and debit). Therefore, the user has complete control of their checkout experience. In cases when the machine needs maintenance (e.g. breaks down or needs a new receipt paper) the only way to resolve this issue would be to contact an attendant to assist the user.

Recommendations

Three possible solutions to fix the problems of the current versions of the self-checkout machines are an integration of a portable scanner, a 3D scanning instead of laser barcode scanner, and a lowered self-checkout machines for wheelchair bound users. The portable scanner can be used by the customer to scan and bag the item while shopping. When the customers are done shopping, they can bring the scanner to the revised self-checkout machine where the purchase information would then be downloaded. The customer would pay and receive their receipt at the self-revised checkout machine as well. This solution can shorten the overall shopping time as customers can scan while shopping. Also it removes problems like double scanning because the scanning is done individually and on the spot for each product. However, the portable scanners would have a significant drawback. It would cost much more money for the retailer store to keep these scanners. The portable scanners would also be a hassle to carry around while browsing the store.

An improvement that can be made to the existing self-checkout machine is adding 3D scanner instead of barcode reader. The current scanning system for a self-checkout machine is done through reading the barcode assigned to the product.

Sometimes customers input a different product when the machine is asking for the exact product they purchased. As discussed in the problem definition section, there may be ten different kinds of apples and users may forget the type of apple they picked. 3D scanning system will fix this problem as it can recognize the non-barcoded products. This solution is appealing, but the development of 3D scanner that can detect objects that are irregularly shaped and colored can be a challenge.

Lastly, wheelchair bound users have a hard time accessing the self-checkout machine. These machines should be partial for everyone, but it is impartial for those in wheelchairs. A solution so they could also use the self-checkout machines would be to change the ergonomics of the design of the machine. The limited reach that wheelchair bound users have can be can be easily adapted to by lowering the self-checkout machines.

Conclusion

Self-checkout machines are widely used in many retail stores in order to reduce labor costs. There are currently 200,000 of these machines globally and by 2020 there will be 335,000 self-checkout machines in circulation around the world [7]. Their numbers keep increasing even though there are many issues with these machines. The issues vary from shoplifting, usability issues, low reliability, hard initial learning curve, and limited accessibility for wheelchair bound users.

These self-checkout machines are marketed to be faster than the normal cashier registers. However, from the problems that have been mentioned above in the problem definition section, that being faster claim is very arguable. The current versions of the self-checkout machines will not last into the future. They will not be able to replace the regular cashier checkouts unless the bad designs are revised.

Possible suggestions for the revised self-checkout machines would be to implement a portable scanner, add a 3D scanning system, and make it more accessible for wheelchair bound users. These are only some of the many possible solutions that could fix the bad designs of self-checkout machines.

The optimization of these solutions need to be incorporated with the good features of the current self-checkout machines. Then, maybe the revised self-checkout machines would be able to satisfy those with an eye for design. It would become what the designers know that the customers need and it would also be what the marketers think that the customers want.

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