CS 6750 Assignment M5

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***Abstract*—**Nowadays many jobs are being replaced by machines. The self-checkout machine is one of them. It is commonly seen in many places such as wholesale stores and gas stations. It provides convenience but also raises issues that require human intervention. You may have noticed that there is always at least a cashier standing by the self-checkout machines and being ready to assist the customers that have issues with the machines. I have experience of being stuck in the process of the self-checkout and end up having a semi-automated checkout with the help of the cashier. If you have the same experience, join me to find out the reason for using the HCI principle and methods, and hopefully redesign the current interface to maximize the capability to fulfill the user's needs. In this paper, we will be focusing on the report and analysis of the two evaluations which are qualitative evaluation and predictive evaluation.

1 QUALITATIVE EVALUATION

Report the evaluation

49 participants have taken part in my survey. All my questions require short answers and most participants provided their answer and the reason why they gave that answer. I did not make any changes to the survey between participants. I believe most of the participants are from the class and they are young or middle-aged. Next time, I would like to include some older participants most of whom are novice users.

Report the results

I received 49 responses to the following questions after each participant reviewed the prototype interface (see figure 1 in appendix).

1. Do you find the interface hard to understand? Please indicate which part confuses you or seems inconvenient.

2. Comparing to the current self-checkout interface or the traditional human check-out, which check-out method do you prefer?
3. Please provide the reason for your choice of the question above.
4. Which part of the prototype should be improved so that you would consider using it or use it as your primary check-out method.

Regarding the first question, 32 participants think the interface is easy to follow, while 17 participants think it is either entirely or partially confused and some of them let me know what should be added or improved.

As for the second question, 25 participants would like to try out the new interface if available, 5 participants would choose the human checkout and 19 participants chose the current self-checkout machine.

The answer to the third question is to explain the reason why the participants make the choice in the second question. The common reason to select the new interface is time-saving. The reason to choose human checkout is mostly that the customer can offload the cognitive load to the working staff. Examples are provided. The working staff at the register usually know all the codes for things like banana and vegetables that don't have bar codes, or the shopper does not have to worry about bagging or scanning errors. The reason to choose the current self-checkout machine is mostly time-saving as well.

As to the fourth question, 11 out of the 49 participants don't think there are any improvements. The rest of them provide answers in terms of the improvements. For example, "a camera that guesses the item for you", " I like that the shopping list tells where the item is, it would be nice if the next closest item could appear at the top so I can just follow directions inside a store." The comprehensive responses can be found in the appendix.

Analyze the feedback

The main takeaways are the prototype is not convenient enough comparing to the self-check machine in the market. A few new features can be added to the prototype such as the location of the item. The prototype does not support payment and instead generates a bar code to scan at the self-checkout machine to make the payment. In the survey, the participants suggest the payment step can be done on the interface. What surprises me is that people find the interface hard to understand and some people do not find it convenient to hold the cell phone

while shopping. As I expected, the reason that people like the prototype is because it provides a faster checkout process and people have concerns with using the prototype for grocery items that are priced by weight which might require a physical register machine.

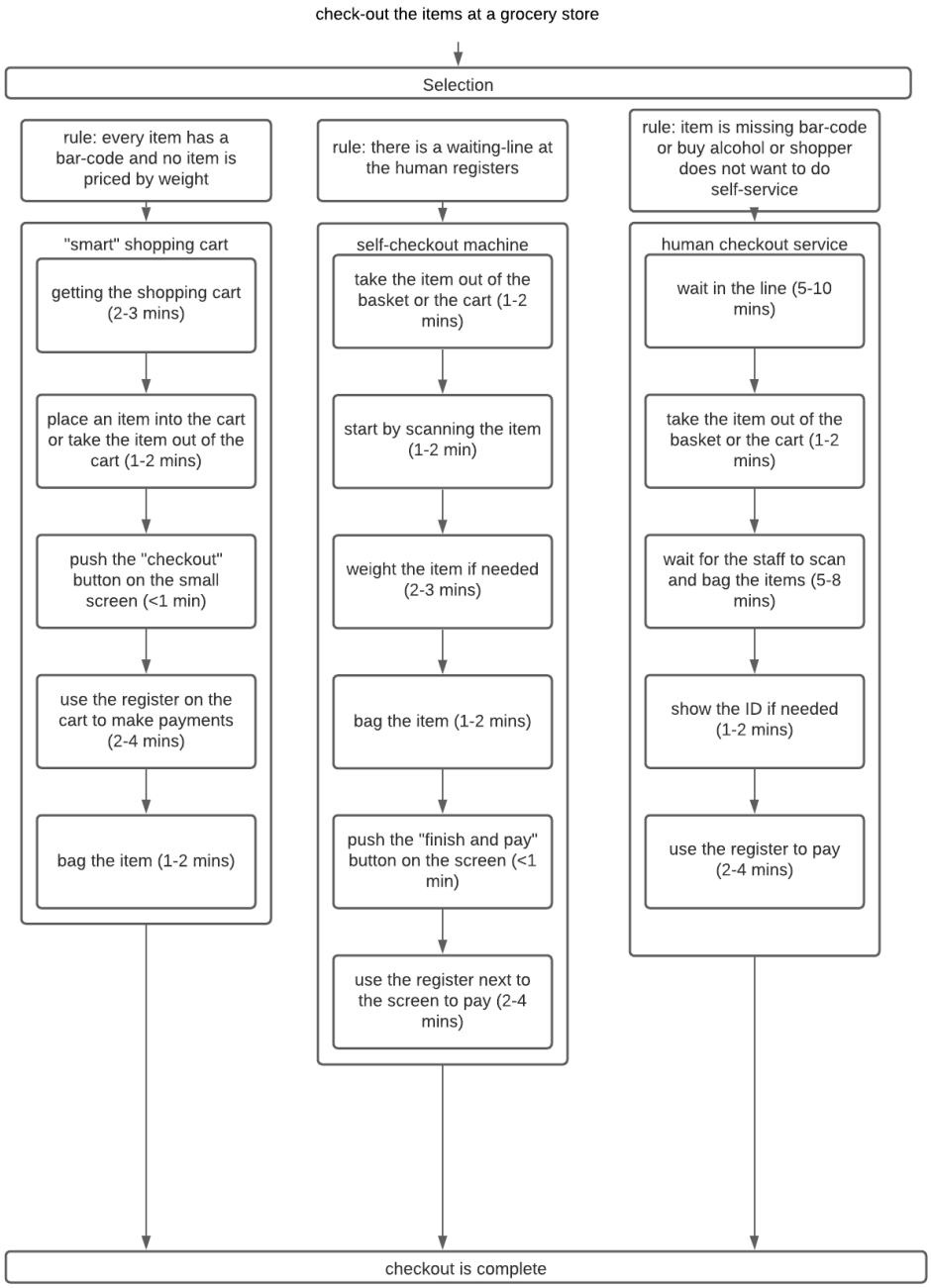
Changes resulted from the evaluation

The interface needs to be simpler and more intuitive since a lot of people find it confusing. I will add the location of the items to the interface, so the shoppers know where the items are. Instead of having a QR code for making payment at the self-checkout machine, the new interface should be able to provide the user with the ability to make the payment.

2 PREDICTIVE EVALUATION

I would choose predictive evaluation for my verbal prototype which is in the form of a loose conversation script between me and my friend. This prototype is about having a "smart" shopping cart equipped with sensors that can recognize the merchandise items as the user places them into the cart. The cart is also equipped with a small screen that lists the items that are in the cart and a register which is used to make the payment. I am using the GOMS model-based evaluation including the goal, selection rules, methods, and operators as well as the estimated time for each operator. Please see the GOMS model on the next page.

Assuming all the items have a bar-code and no items need to be weighed to be priced, the new interface is the most efficient. The trade-off is this method does not work when the item is missing a bar-code, or a scaler needs to be used for the final price. The self-checkout machine can handle all scenarios and provide convenience when there is a waiting line at the human register. However, the trade-off is the user, especially the novice user, needs to spend time figuring out how to use the machine compared to the new interface and the human checkout. When I evaluate the human checkout, I take into account the waiting time since it is part of the check-out process for most of the time. The human checkout service offloads the cognition from the user so it is friendly for the novice user or the expert user who sometimes does not feel like using the self-service.


check-out the items at a grocery store
Selection
rule: every item has a bar-code and no item is priced by weight
rule: there is a waiting-line at the human registers
rule: item is missing bar-code or buy alcohol or shopper does not want to do self-service
"smart" shopping cart
getting the shopping cart (2-3 mins)
place an item into the cart or take the item out of the cart (1-2 mins)
push the "checkout" button on the small screen (<1 min)
use the register on the cart to make payments (2-4 mins)
bag the item (1-2 mins)
self-checkout machine
take the item out of the basket or the cart (1-2 mins)
start by scanning the item (1-2 min)
weight the item if needed (2-3 mins)
bag the item (1-2 mins)
push the "finish and pay" button on the screen (<1 min)
use the register next to the screen to pay (2-4 mins)
human checkout service
wait in the line (5-10 mins)
take the item out of the basket or the cart (1-2 mins)
wait for the staff to scan and bag the items (5-8 mins)
show the ID if needed (1-2 mins)
use the register to pay (2-4 mins)
checkout is complete

3 EVALUATION SUMMARY

Some participants in the survey mention that they don't want to hold the phone while shopping for the grocery. I want to investigate more and brainstorm how to fulfill this need. Maybe I can use the idea from the "smart "cart interface so that the user does not have to use his/her phone to scan the item. People in the survey also mention they would need a counter or desk to bag their items or measure the weights of the items. People also prefer to know the location of the items from the interface so that they can find each item easily in the grocery store. All these needs worth some further investigations. The result from the GOMS indicates the limitation of using the “smart” cart interface. The item without a bar-code will not be recognized and added to the check-out list, and the “smart” cart is not equipped with a weight scale.

The evaluations brought to my mind some additional design to fulfill the users' needs. I will explore these designs in the second iteration of the design life cycle.

People in the survey mention they are confused with my current prototype and need more clarification on the self-checkout app. I have already expected to break down the current interface into several simple interfaces rather than cluster all the functions into one page. Another critical improvement is to add payment methods to the app and make the payment process easy and fast. I cannot wait to see people's responses to these improvements in the next round of evaluation. As for the people who like the new self-checkout app, the reason they provide is mostly around time-saving. However, they provide the same reason for using the self-checkout machine in the market. I am not clear what are the advantages to them of using the app over the self-checkout machine. The new interface should've brought benefits in more dimensions than the current interface. This is the next level of fidelity I want to raise to.

After I make changes to the current design, I would again select qualitative and predictive evaluations to gather more feedback. The survey can be administered asynchronously at a pretty low cost. Also, I have created two surveys so far and gained some experience from people’s feedback in terms of how to create a good survey. As for the predictive evaluation, I would continue to do the GOMS model but recruit a real user this time to avoid me over emphasizing my own option. I am not my users.

4 APPENDIX

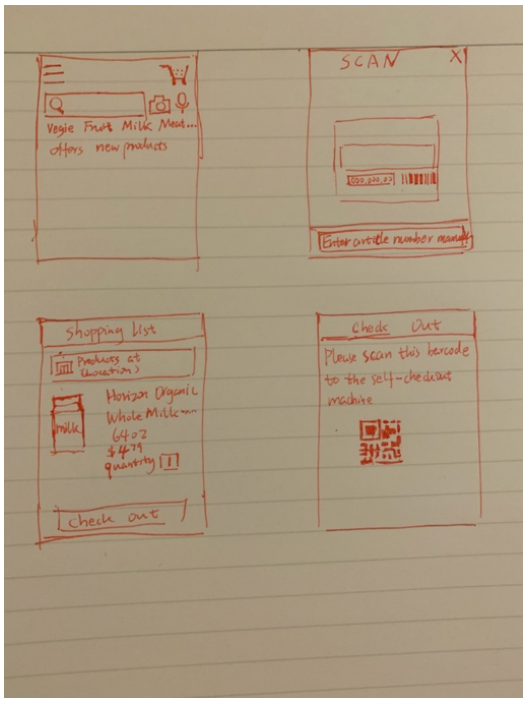


Figure 1

Do you find the interface hard to understand? Please indicate which part confuses you or seems inconvenient.

1. I think I understand it.
2. No it is not confusing. The first card is slightly confusing, but I think all of the text are probably just links. Should make those clearer as buttons.
3. No it is easy to follow. The first screen has a lot of whitespace.
4. No, seems pretty straightforward
5. No, it looks reasonable.
6. I don't know if I would prefer scanning things as I go along. The rest is pretty intuitive, except how to remove an item.
7. Need a remove items button maybe.
8. No
9. I think this is intuitive and easy to understand. You use your phone's barcode to pay at the end, right?
10. Yes, I don't know where to start.
11. The order of the steps
12. This is a little hard to understand, but I'll try to explain my thought process in interpreting the interface. It seems to me like you can add items to the your

shopping list by searching for it on the app or scanning the bar code After you have all your items, you tap Check Out, pay, and then scan the QR code on a machine to confirm you have paid before leaving. If so, I think Shopping Cart would be a better phrase. Shopping List implies to me I can prepare the list in advance, and then grab the items and leave (again not sure if I'm interpreting this right). Also, I think it would be inconvenient to hold my phone and the item at the same time to scan the bar code. Almost seems to defeat the purpose of buying things first if I still have to stop by the self-checkout and scan another code. At least at the check out I can bag my items on a surface properly.
13. It seems convenient
14. I can understand
15. The interface is clear. However, I do not see an option to remove an item that I may have scanned accidentally. I can reduce the count of the item to 0 but a remove button will be handy.
16. its not
17. No
18. I'm not sure how to remove items from grocery list.
19. pretty straight-forward / easy to understand
20. what is the purpose of the last image? Why scan again?
21. I don't think so, I assume a shopper would scan the items as they are shopping
22. NA
23. I am confused by the shopping list, is it the items in your cart or the items you still need to buy?
24. No its intuitive
25. Not hard to understand at all.
26. i dont get the first screen, is that my list?
27. No it is easy
28. none
29. It all seems pretty straightforward. It is a little confusing on what the search is and how that is different to the scan. Wouldn't the search be able to search by barcode number as well?
30. how to select payment type or my coupon ?
31. at first i was confised that it was on your phone but after looking it over twice i understand
32. It was pretty clear
33. No, looks convenient.
34. how does it work with produce
35. No. But is searching and scan in different interface? They seems to be needed to be combined
36. it is easy to understand

37. n/a
38. No
39. Easy to understand.
40. no
41. None as we have all options covered
42. I'm not really clear on what gets scanned where and how it works in relation to grocery shopping.
43. Would be nice if the scan screen was part of the home page rather than having to click on the camera - just always show me the scan view
44. I find it easy to understand. I think adding some description on the interface might help for a new user.
45. Everything looks straightforward.
46. Missing few details. Where is quantity
47. no
48. Seems clear
49. YES

Comparing to the current self-checkout interface or the traditional human check-out, which check-out method do you prefer?

1. I think it is much better. The lines at the super market would disappear. I think one issue is that the customers could pack stuff and not scan it?(steal)
2. This would be easier and faster. Would use this.
3. I prefer this phone checkout method.
4. I would prefer the phone app.
5. Self- checkout mostly.
6. I would have to try it out, I think if there was a line I would prefer to do it on my phone. I guess my question would be why couldn't I also pay from my phone as well?
7. Mobile
8. self-checkout
9. This interface is good for small purchases. The human checkout ("traditional") method is good for large purchases because a team (two people?) take care of bagging and scanning everything for you.
10. I will prefer the current self-checkout interface.
11. Human
12. Traditional human checkout
13. Self checkout
14. self checkout
15. Cellphone
16. I think the cell phone version
17. Current if I don't have produce.
18. This new interface

19. tbh, old method
20. current self-checkout interface
21. I prefer the current self checkout at regular grocery stores over a phone app or human checkout, but I could see myself preferring the phone app over the traditional human checkout if it saves time waiting in line.
22. NA
23. The app
24. I like the self-checkout machine
25. Human Checkout.
26. current self-checkout.
27. I prefer self checkout
28. none
29. I would prefer the self-checkout interface.
30. i don't see any improvement for short time , or fast pay or other idea ?
31. self checkout
32. Self check out
33. I'd prefer this cell phone interface
34. self
35. The old one since it has a search function. However, customer can lie if they can search and select the item by themselve.
36. both the same
37. human check-out
38. Current self-checkout.
39. I prefer self-checkout methods.
40. I like the self-checkout but why not just pay on your phone
41. Self Checkout
42. I'm not clear on the functionaity of the new interface.
43. self-checkout interface
44. Human checkout
45. I believe being able to do this checkout workflow while shopping for groceries is pretty convenient.
46. I prefer Amazon smart basket.
47. I'd use this as an app if available!
48. New design
49. Self-checkout Interface

Please provide the reason of your choice to the question above.

1. Fast checkout.
2. Because it is quicker if you are only grabbing a couple items. Would go traditional with full grocery run.
3. It seems faster because I can scan as I shop. The shopping list can keep track of what I have left to buy.

4. self-checkout is better than human check-out in large part because it's often faster, but this would be even faster and more convenient.
5. Quick, and fun.
6. I think the main pro of your design is less waiting, but I think unless it easy to remove items it may just be better to do it all at once.
7. Scan-as-you-go would be great because you could price check / coupon validate as things enter your cart and this eliminates congestion at the checkout line
8. much easier and i can do it on my own without waiting in line
9. Provided in above question
10. The learning curve is relatively flat.
11. Easier, normally there's some issue that cause the self check out slower.
12. As stated above, it seems inconvenient to hold your phone to scan all your items while shopping. Additionally the interface is currently confusing to interpret so I'd rather stick with what I'm familiar with.
13. It is convenient for self checkout
14. its faster
15. Faster checkout as I need not scan the items at the checkout counter. However, I would like a pay from credit card option through the phone so that I can skip the checkout line alltogether.
16. I don't have to wait in a queue, less stress and saves time especially if the payment method is already saved.
17. Allows me to quickly scan if I don't have too many items, also produce introduces difficulty in the process.
18. It seems more streamlined and effortless. I dont want to go in line to check out because I feel that the cashiers are slow
19. security concerns
20. self-checkout is faster
21. The app might be preferable over having to wait in long lines.
22. NA
23. You can "check out" as you shop, making it faster
24. It gives the buyer more control of the process
25. Human checkout is much easier as they usually know all the codes for things like bananas and vegetables that don't have bar codes.
26. i dont want to have to hold my phone as well, when removing items from the cart and bagging them.
27. In current situation of COVID it is safe.
28. none
29. I would definitely speed up the checkout process if everyone already scanned their items.

30. the design is to solve problem or provide more, I don't see the point of design though (I might be wrong)
31. i can go at my own pace and do not have to deal with anyone
32. Less human interaction and faster
33. I wouldn't have to take everything out of my shopping cart only to put it back in after scanning at the current self checkout
34. save time
35. Customer may select an item cheaper from the search result. If a machine can read a bar code, it should read. Then searching function is useless.
36. I think the differences between the two is that current self-checkout interface has a search function
37. removes cognitive load for user
38. I think it really depends on if you are shopping with a cart or with your own shopping bag. If you are shopping with a cart full of stuff, you will probably want to bag the items and bags are available at the current self-checkout stations. However, if you are going to the store with your own shopping bag, then it would be much more convenient to scan the items as you put them inside of your bag from your cell phone.
39. My grocery store has handheld self scanners and that is all I use.
40. this question feels redundant
41. Scan , Pay and Go
42. The proposed interface isn't clear and would take some experience or documentation to learn.
43. This prototype would be preferred since it takes away some of the wait and I don't have someone else handling my items (pandemic times and all)
44. I don't have to worry about bagging or scanning error
45. I find this pretty convenient and efficient.
46. I just used Amazon smart basket. I don't think I need anything else.
47. I hate waiting in lines for self checkout
48. Saves more time if I don't have to wait in line
49. It's more user friendly

Which part of the prototype should be improved so that you would consider using it or use it as your primary check-out method.

1. As a customer I would use it all the time. But I think you also need buy in from the actual super market. I think they would have issues with people stealing groceries.
2. A way to save credit card for future uses maybe. Also a way to pay on the app to rather than having to go to self checkout machine.
3. I like that the shopping list tells where the item is, it would be nice if the next closest item could appear at the top so I can just follow directions inside a store.
4. I don't think anything needs changed.

5. Scan by mobile make the receipts collectively and paperless.
6. I might consider the option to pay from your phone, and making a way to remove an item.
7. Need a working prototype to answer this question
8. N.A
9. For large orders, having an employee bag would always be preferable. I think this prototype is preferable for small orders because it eliminate numerous subtasks. You can use your phone for checkout. That's pretty simple and intuitive. One suggestion would be to have a button on the screen to easily switch payment methods (i.e. make it possible for multiple methods to be pre-entered into phone / app system, and then make it easy for user to immediately choose pmt method and select a preferred method).
10. I don't think using the designed interface will save time unless there are a lot people checking out. The customers still need to put the grocery into bags, so a table is needed.
11. If the procedure is as easy as a human check out, I'll definitely use it
12. I don't like the final QR code scan, and I don't like the idea of having to hold my phone to scan while I go shopping.
13. The scan part as I am unsure which product to scan. It could be a bit more specific
14. Add where product is located
15. Adding a pay and go option.
16. I think its good
17. I see no issues
18. Show me where my item is in each aisle so I can go there faster
19. information about privacy policy, security features, etc.
20. The last interface
21. The prototype itself looks easy to use, but there are some grocery items that are priced by weight which might require a physical register machine.
22. NA
23. The shopping list, see previous answer to what confuses me
24. I like it as is
25. I think if you had like a way to detect vegetables and banana codes without a bar code that would be good.
26. for the reason above, i think trying to handle the phone while doing the other tasks one-handed would not work. I do prefer using my phone to pay, and hate touhing the checkout equipment. perhaps phone scanning for coupons or discounts or something, i might do.
27. No need of improvements
28. none

29. It would be cool if the device knows the location of the store you are in and displays items that are nearby so you can select it that way instead of searching.
30. To save paper receipt is a good/sustainable idea,
31. have a shortcut menu for recently bought or most often bought items
32. It's good
33. I'd already consider it as my primary checkout the way it's designed now
34. more clarity on how to scan produce
35. Search and ask a staff come to confirm
36. I think it is ok and enough for the function as a self-checkout interface
37. a camera that guesses the item for you
38. Instead of a QR code, the application should just give the user the ability to pay from within the app.
39. I would like to see a total count of the items in the "cart" so I can verify this against the actual number of items in my cart to ensure I didn't skip anything.
40. allow to pay in app
41. Have the standard QR code size increased for easy scan
42. I would need a better sense of how to use it.
43. I would use this as is but maybe give me the ability to load up a shopping list that tells me where the items are as well before I go to the store.
44. It looks great. I would consider using it.
45. I believe the last improvement is not needing to scan the barcode from the phone to the checkout machine. Should be able to purchase all items via the phone.
46. I just used Amazon smart basket. I don't think I need anything else.
47. none
48. n/a
49. Nothing