Coffee of the Future:

A Usability Study of Café X

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Introduction

The experience of waiting in line at an airport coffee shop, constantly checking your watch, terrified you'll miss your flight, but desperate to be caffeinated, is one many can relate to. Henry Hu, the company's CEO, found himself in this situation and thought there had to be a better way. He observed baristas and took note of the tasks they spent the most time doing, one of which being the simple act of moving cups around. Café X opened it's first (and currently only) location in January 2017 in downtown San Francisco. The machine is located in a busy shopping center with plenty of passersby that often stop, stare, and sometimes give it a try. Users order a drink through an app, which sends an order to an automated espresso machine that prepares the drink and delivers it to the customer via a robotic arm that waves.

Café X allows hurried business professionals to order a coffee as they exit nearby public transportation and have it waiting hot and ready for them when they arrive at the center. It's also great for users that are either shy or don't want to talk to a person before they've been properly caffeinated. The automated system eliminates the need to waste precious time waiting in line for a drink. The robotic arm makes the experience efficient, but maintains an element of interaction by waving at the customer at the end of the encounter. During my extensive observation of the system, I saw several people order drinks just for the novelty of watching the robot in action. Many users smiled while the robot waved and some even waved back!

Café X is a fairly new idea, with a minimal number of comparable products, so I thought a user evaluation could provide interesting, and unexpected results. Café X also was a good fit because the app performed simple, definable tasks that would be easy to evaluate. I wanted to

pick something I genuinely cared about, something significantly different than my classmates, and something that I would enjoy designing myself.

Experienced User Interviews

User A was a 24-year-old male software engineer that visits Café X whenever he happens to be in San Francisco. With a strong interest in both coffee and robotics, he thoroughly enjoys using Café X. He likes the convenience, accuracy, and quality of the coffee. Café X eliminates two of his major dislikes about ordering through a human: misheard orders and inconsistent ingredient ratios in cappuccinos.

User B was a 24-year-old female that majored in astrophysics and is currently enrolled in a programming boot camp. She also consumes an exorbitant amount of coffee and, although she prefers making her coffee at home for cost reasons, she chooses Café X due to its close proximity to her boot camp, speed, and because it offers the ability to order coffee without "having to interact with a human while I'm under caffeinated." She considers herself shy and interacting with baristas often causes her anxiety.

The experienced users walked me through their typical experience using Café X, which, for both users, consisted of ordering, paying, and retrieving their drinks. These tasks involved selecting details about the drink, confirming the order, monitoring the machine's progress, using a code given by the app to retrieve the drink from the machine, and watching the robotic arm deliver the drink and wave at the customer.

The app also allows users to view previous drink orders, adjust default flavor settings, enter promo codes, and update payment preferences. None of these features were identified as major use components by either experienced user.

Both users were quick to express weaknesses they saw in the ordering experience. User B mentioned that she once tried to check the operation hours of the stand, only to be redirected to Yelp. She was surprised that the designers hadn't taken the time to install a simple API from Yelp so users could view the hours directly on the app. Due to time constraints, the experienced users were interviewed simultaneously. User A expressed annoyance with the size of the "change bean" button, which is small and difficult to locate. User B said that although she didn't particularly care about which coffee bean her drink was made with, she also thought the button was poorly designed and hadn't even noticed it the first few times she used the app. User A was unable to determine what "Oatly" was until he saw it advertised on one of the nearby signs. Oatly is the brand of oat milk used in some Café X drinks.

Despite these concerns, both users had overall positive things to say about their experience with Café X. Both users said they would recommend it to a friend and that they would like there to be more locations. User B said she would use it more, but it was a block out of her way and she couldn't be bothered to put the extra effort in. User B said, "If there was one in San Jose or Livermore, I'd be willing to go 3-4 blocks out of my way, easily". User B mentioned several times that she really enjoyed the robot waving at her. "The last time I got coffee I was looking down when the robot waved at me and I was really sad." User A wasn't particularly interested in the robot wave, but liked the consistency and accuracy resulting from robotic operation. User B also appreciated that, "the robot is completely 100% nonjudgmental."

Naïve User Evaluations

Since both the app ordering process and the robot pick-up process are essential parts of Café X, I chose to do onsite evaluation instead of solely evaluating the app. I used the guerrilla interview strategy and asked people that had stopped to look at the coffee robot if they would be

willing to participate in a 10-minute study in exchange for free coffee and a chance to watch the machine in action. While this method provided the most natural results and gave me a very authentic introduction to user evaluations, it was also very time consuming and difficult. This process took 13 hours and 3 trips to Café X. Recruiting was difficult because many people were in a hurry, had headphones in, or thought I was trying to sell them something.

Participants were asked to fill out a brief survey which included demographic questions as well as several questions about coffee usage and preferences. The questions types included multiple choice, free response, "choose all that apply". The survey method was used for several reasons. First, I thought the users would be more comfortable self-reporting their age and gender identity. Second, the questions were mostly closed-ended or simple and, self reporting seemed most efficient. Finally, the online survey was an ideal way to observe the user's computer skills and draw possible connections with difficulty they have using the app. Participants were asked to rate how comfortable they were using technology on a scale of 1-10 ("it terrifies me" to "very comfortable") and while four of the participants categorized themselves as 9s, their computer skills varied noticeably. Unsurprisingly, participants tended to overestimate their abilities.

Participants ranged in age from 25-62. Three identified as female and four identified as male. Their self-reported occupations were security analyst, systems engineer, airline manager, graphic designer, sales manager, retired, and VP Underwriting. All but one participant reported drinking coffee at least several times per week. Coffee shops were the most popular place to get coffee from, with 4/7 typically getting their coffee at one and 3 going several times per week or more. When given a list of factors that impacted their decision in choosing where to get coffee, location was a factor for more than half of the participants. Variety of choices, ethics, and price were also important for 3/7 of participants. Speed of service, interaction with staff, and quality or

origin, were relatively unimportant with 2 or less of the participants choosing these options as part of their decision making process.

After reporting information about their coffee preferences, participants were asked an open ended question about their feeling toward being served coffee by a robot and toward Café X in general. Participant answers varied widely, with answers ranging from, "I don't like it. I may as well prepare a Nespresso at work for less" to, "I like any technology that simplifies any experience".

For the task evaluation portion, each participant was asked to complete three primary tasks, based on feedback from my experienced user interviews. These tasks were: choose a bean, order and customize a drink, and retrieve the drink from the machine. Participants all completed their tasks on the same iPhone 7, which provided audio and screen recording. I displayed the task list for participants to refer back to as needed. Participants were asked to explain their thought process to me as they navigated the app. Once participants placed their drink order, I walked with them to the coffee machine and asked them to describe the drink making and delivery process. We then returned to a nearby table and I asked them follow-up questions while they consumed their drink.

Although the majority of the participants self-reported a high level of comfort using technology, many struggled to use the app. Two participants had difficulty using the touch screen, either pecking quickly at it or having difficulty isolating their finger to specifics buttons. All but one of the participants were unable to navigate the first step (bean selection) on their first attempt. Several were unable to find the "change bean" button until I pointed it out to them or

Figure 1: The elusive "Change Bean" button

hinted at where to look. The button is located on the upper-right corner of the screen in a small

font and is approximately half the size of an iPhone app

icon (See Figure 1).

When participants select the "Order Drink"

button, they are taken to a page showing the drink

selections of whichever coffee brand was last ordered.

Many participants first selected a drink, falsely thinking

they would be able to choose a bean in the next step. The

next step only allows the customer to add flavor syrups

and "continue". Some participants selected the "continue"

button, which led them to the summary and payment page.

At that point, they either selected the small "back" button

in the upper-left corner or they turned to me hopelessly

and asked for help.
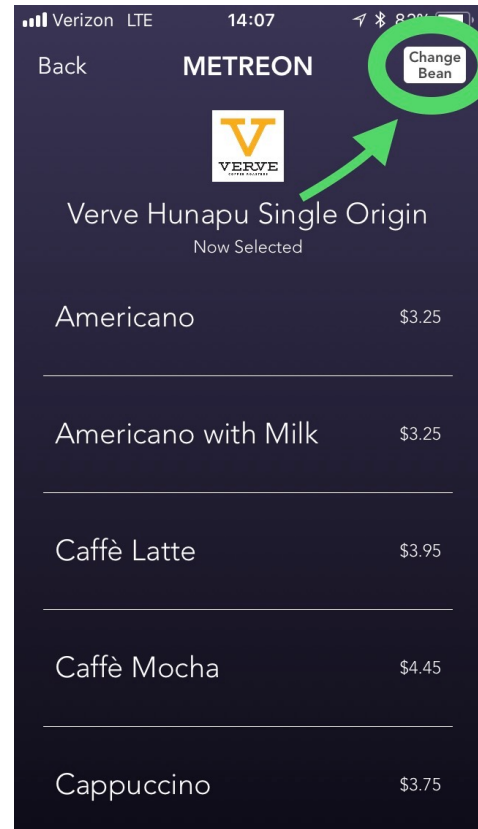
Once participants were able to locate the "change bean" button, they were sometimes

stumped about what to do after selecting it because the first thing displayed is a box with a

description of the coffee brand that was displayed on the previous screen. Small dots on the

bottom of the screen are intended to indicate that a user must swipe right to view other options.

This is a common method to indicate swiping, but several participants didn't notice or didn't

understand the meaning behind the dots. At the bottom of the coffee brand description is a

"select" button. Two of the users pressed this thinking it would take them to a selection screen,

but the button actually returns the user to the drink selection screen for that brand. One

participant believed that the descriptions of the coffee brand (taste notes, growing altitude, and

variety/processing method) were selectable buttons and would allow him to change these details to those of another brand.

Several participants remarked on the Oatly options, either saying they had no idea what it was and others guessing it was a coffee brand. If a user selects a drink with Oatly, they are taken to the selection confirmation page, which allows them to customize the drink with flavored syrups, but never giving a description of what Oatly is. One drink is even labelled as, "Oatly Americano with Milk", which directs users away from the idea that Oatly is a milk type. As mentioned by an experienced user, this information is only located on a dynamic, changing display board or the company's website.

Completion times were measured with Screen Recorder. On average, participants spent 2 minutes and 58 seconds between opening the app to submitting their order, with a range of 44 seconds between the quickest (2 minutes 41 seconds) and slowest (3 minutes 25 seconds) users. One user's time was eliminated because they frequently stopped to chat about features, which brought their time up to 6 minutes and 15 seconds and made it difficult to determine how much of that time was spent actually ordering. In comparison, the average experienced user completion rate was 28 seconds. This large discrepancy is partially accounted for because many Naïve users spent time exploring the app, asking me questions, or reading out what they saw on the screen. Naïve users believed that they would be able to navigate the app significantly faster if they were to use it again.

Summary

The app was evaluated (Appendix C) using Nielson design heuristics (Neilson, 1994a). The scored well in the areas of "recognition rather than recall" and "visibility of system status". Although users often failed to notice status updates on their order, a series of clear progress

checkpoints existed. Underperformance was most notable in "consistency and standards" and "aesthetic and minimalist design". The Oatly milk, incognito "change bean" button, and difficult to recognize buttons all fell under these categories.

Coherence to Norman design principles (Norman, 2003) was also evaluated. Norman's principle of consistency, as previous outlined in Nielson's, "consistency and standards" heuristic, needs improvement. Inconsistencies existed in selectable items including text box button designation, background color change when selected, and button response action. Text size and boldness were not consistently representative of importance. One strength in consistency is the fixed location of the the "back" button in the upper left corner, a standard location convention.

Visibility was a key issue for the app with the difficult to find "change bean" button, small change payment type and add a promo code buttons, and unnecessarily large location display name (Metreon is displayed prominently on every page of the ordering process, often larger and bolder than the main selection options.) When asked to read me what he saw on the order summary page after he paid, one user was able to list Metreon and the name of the drink, but even upon further prompting hadn't noticed the order confirmation text appear at the bottom of the page.

The arrows used to indicate a drop down menu are a good use of affordances, but the inverted triangle didn't afford the idea of a drop down menu as much as the traditional arrow downward triangle. Swiping between coffee brands is indicated by a row of dots on the bottom with the highlighted dot showing the current position in the list.

The app uses minimal mapping. Some of the buttons are boxed to imply that they can be selected. Syrup levels are adjustable by a drop down menu, indicated by an inexplicably upward facing arrow. Users can also press the selection button itself to turn the presence of flavor on or

off, although several users assumed "low" was already selected, not just had potential to be selected.

Feedback is provided with various changes to the text when a button is pressed such as text blinking, color changes, or color fading. Activational feedback is provided by changing the background color on some, but not all buttons. The summary page utilizes behavioral feedback by displaying the drink making steps, and placing a checkmark, and changing the text from gray to white when the step has been completed. A pick-up code appears upon completion of these steps.

Constraints are well established through display simplicity. Invalid options disappear when appropriate, such as the option to add flavor syrup to matcha lattes.

Conclusions and Design Recommendations

Overall, Café X provides a good user experience. Most participants said they would recommend it to a friend as well as try it again themselves. Many users primarily enjoyed the coffee pick-up experience, which I believe aligns with the intentions of the company. As for the app element, the app had several clear usability problems. Despite these nearly universally experienced difficulties, many naïve users still had overall positive feedback on the app. Most said it was easy to use and some found it very intuitive. All of my users were able to complete the essential tasks without substantial guidance. One user did say that she likely would have given up out of frustration had I not been there to help her through the process. Like any new product, Café X has room for improvement, but I think they're off to a good start.

In regards to improvements, the obscurity of the "change bean" button was the largest problem both reported and observed. Both naïve and experienced users commented on it.

Improving the clarity of the flavor syrup buttons would also improve usability. The drop down menu design is fine as is, but having a "no flavor" option in addition to "low", "standard", and "insane" would eliminate the need for the white background indicating selection and give users more certainty in their order. The triangle would also be more intuitive as a drop down menu if it faced down as is standard convention. Oatly was another large issue. This could be remedied by allowing the user to select their milk option during the drink customization process. Having Oatly labelled as a milk option next to whole cow's milk would make it far more apparent what the user is ordering. This would also make the drink menus shorter, which could help users feel less overwhelmed by the numerous drink options. The minimalist color design of the app is aesthetically pleasing, but results in users not noticing updates. Several users experienced change blindness, not noticing the pick-up code until I pointed it out to them or expressing confusion about the status of their drink. While the app tries to make this clear, users might notice the changes more easily if they were displayed on a new page that appears after the order is placed. Adding contrast or other attention grabbing features such as flashing the pick-up code in large, bold print when it appears would also be helpful.

References

Norman, D.A (2013) *The Design of Everyday Things: Revised and Expanded Edition*. The MIT Press, Cambridge, Massachusetts.

Preece, J., Rogers, Y., & Sharp, H. (2015) *Interaction Design: beyond human-computer interaction*. Chichester, West Sussex: John Wiley & Sons Ltd

Nielsen, J. (1994a) *Enhancing the explanatory power of usability heuristics*. Proc. ACM CHI'94. (Boston, MA, April 24-28), 152-128.

Appendix A

Materials:

iPhone 7 used for:

- Voice Memos app

- Screen recording

- Café X app usability test

QuickTime software

Laptop

Google Forms used for:

- Pre-task survey (completed by participant)

- Post-task interview (completed by researcher. Used for participants 2-5)

- Transcription and error analysis (completed by researcher using voice recordings from user test and post-task interview)

Microsoft Word used for:

- Transcribing responses from experienced user interviews

- Naïve user evaluations (first participant only. Google Forms was used for remaining participants)

- Introductory script

Basic Information and Coffee Habits

Please answer the following questions to help me learn a bit more about you . These questions are optional and your results will remain anonymous.

1. **Age**

   _____

2. **Gender**

   _____

3. **Occupation**

   _____

4. **How comfortable do you consider yourself with using technology?**
   Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
It terrifies me	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very comfortable

5. **How often do you drink coffee?**
   Mark only one oval.

   ◯ Every Day
   ◯ Most days
   ◯ Several days per week
   ◯ 1-2 days per week
   ◯ Less than once a week
   ◯ Rarely
   ◯ Never

Appendix B

Pre-Task Naïve User Question

6. **Where do you typically get your coffee from?**
   Mark only one oval.

   ( ) Home

   ( ) Work or school

   ( ) Coffee Shop

   ( ) Other

7. **How often do you go to coffee shops?**
   Mark only one oval.

   ( ) Daily

   ( ) Several times per week

   ( ) Several times per month

   ( ) Rarely

   ( ) Never

8. **What factors do you consider when choosing a coffee shop. (Choose all that apply)**
   Check all that apply.

   [ ] Price

   [ ] Location

   [ ] Speed of service

   [ ] Ethics (fair trade, organic, environmental factors)

   [ ] Quality or origin of coffee beans

   [ ] Variety of choices (different roasts, milks, or types of drinks available)

   [ ] Interaction with staff (speed of service, friendliness, accuracy, etc.)

9. **How do you feel about being served coffee by a robot? What are your initial thoughts on Café X?**

   _____

   _____

   _____

   _____

   _____

Appendix C

Experienced User Interview Script:

Hi, my Name is Mandi. The goal of this interview is to learn about your experience with Café X. This interview should take about 20 minutes. As part of the interview, I will also have you order a drink using the app and walk me through the overall process. You are welcome to stop this interview at any time or skip a question if you are uncomfortably answering.
To aid in future analysis, I would like to record this interview. Do I have your permission to record this interview?
Thank you. I am starting the recording now.

<u>To get a better understanding of you as a user, can you tell me a bit about yourself?</u>
How old are you?
What is your profession/occupation?
How comfortable would you consider yourself with using technology?

How much caffeine do you consume on a daily basis?
Can you give me an estimate of how much time you spend acquiring or making coffee?
Where do you normally get coffee from? Home, school, work?
What is most important to you in a cup of coffee? (price, flavor, origin, ethics, etc.)
What type of coffee drink you order most often?
Do you usually go out for coffee? How often? Where?
What do you like most about Café X?
Think back to the first time you used Café x. Did you find the app difficult or easy to use?
What areas did you struggle with, if any?
What, if anything, do you find frustrating to use?
     (Explained through questions. Didn't end up asking)
Can you walk me through the process of ordering a drink? Feel free to be as detailed as possible and explain your thought process out loud. <u>*Give example*</u>
     (explained through questions. Didn't end up asking)
Would you recommend this to a friend?
Are the coffee descriptions helpful to you?
Do you have a favorite product? If so, what is it and why is it your favorite?
How often do you use?
How does this differ from a traditional coffee ordering experience? What do you find preferable about Café X? Is there something you prefer about traditional coffee shops?
<u>*Verify perceived main feature usage*</u>
Is there anything else you'd like to share with me about your experience with Café X?

Appendix D

Post-task Naïve User Interview

1. **Participant number:**

2. **Other Responses:**

3. **How is your drink? What do you like or dislike about it? Is it what you were expecting?**

4. **Overall, was the app difficult or easy for you to use? What did you like about it? What did you dislike about it?**

5. **What did you think about the pick-up process? Was it intuitive or were you unsure about what to do?**

6. **What was your favorite part about picking up your coffee?**

7. **Was there any part of the experience you disliked? Why?**

8. **What did you think of the robot? Did it change your experience?**

9. **Which do you prefer? Why? In what ways is a coffee shop better? In what ways is the robot better?**

10. **How is it different from normal coffee shops?**

11. **Would you use it again? Why or why not?**

12. **Would you recommend to a friend?**
        Yes
        No
        Maybe/unsure

13. **What are some words you would use to describe the ordering and pick up process?**

14. **Is there anything else you'd like to share with me about your experience?**

Appendix E

Nielson Heuristics:

Good:

1. **Visibility of system status** (loading circles, check mark updates),

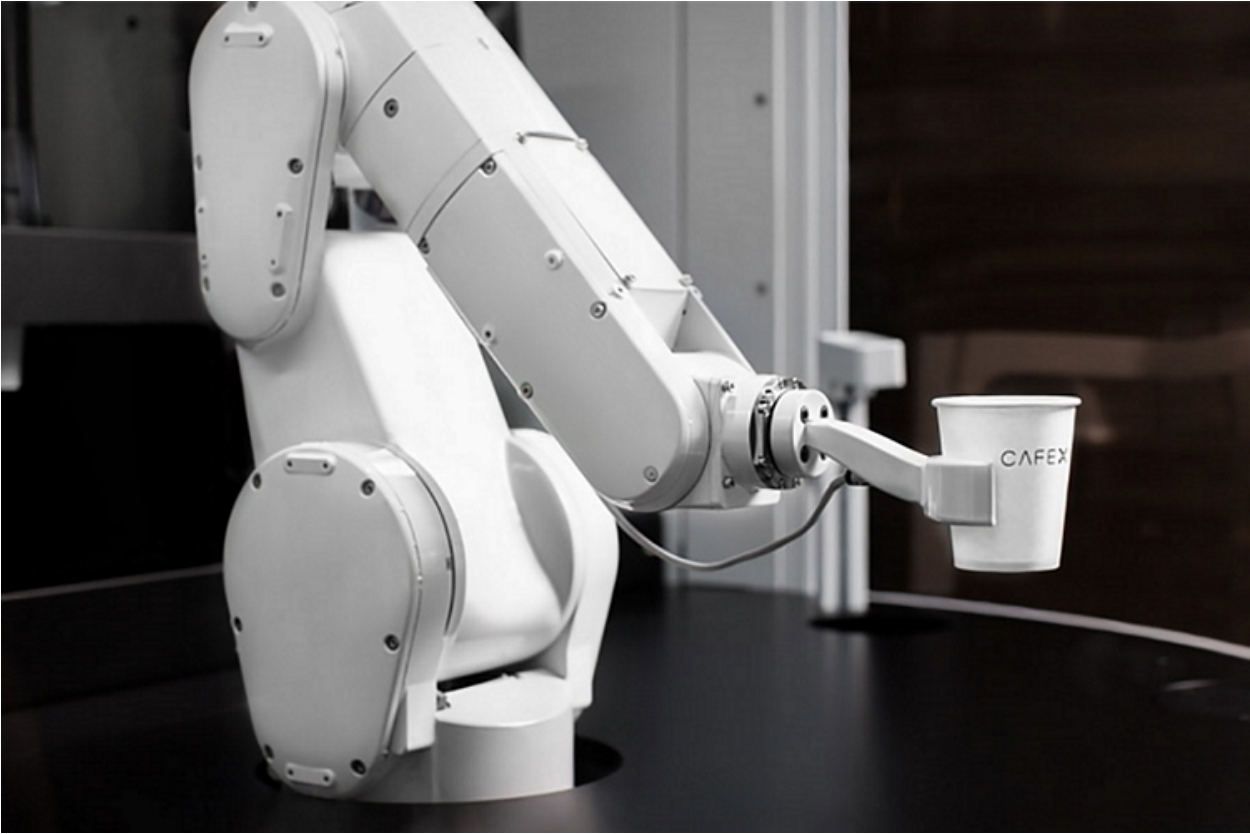**6. Recognition rather than recall:** no recognition required.

Mixed/Non-prominent:

2. **Match between system and real world**: follows in-person coffee ordering experience, except for bean selection. Robotic wave and delivery mimics human interaction)

3. User control and Freedom: back button always available in expected location, but could be larger

5. Error Prevention and 9. Error Messages: Company currently has human employees fix errors. App not involved other than to say order won't process.

7. **Flexibility and Efficiency of Use:** Default option in settings, although redundant. Allows repeat orders based on history.
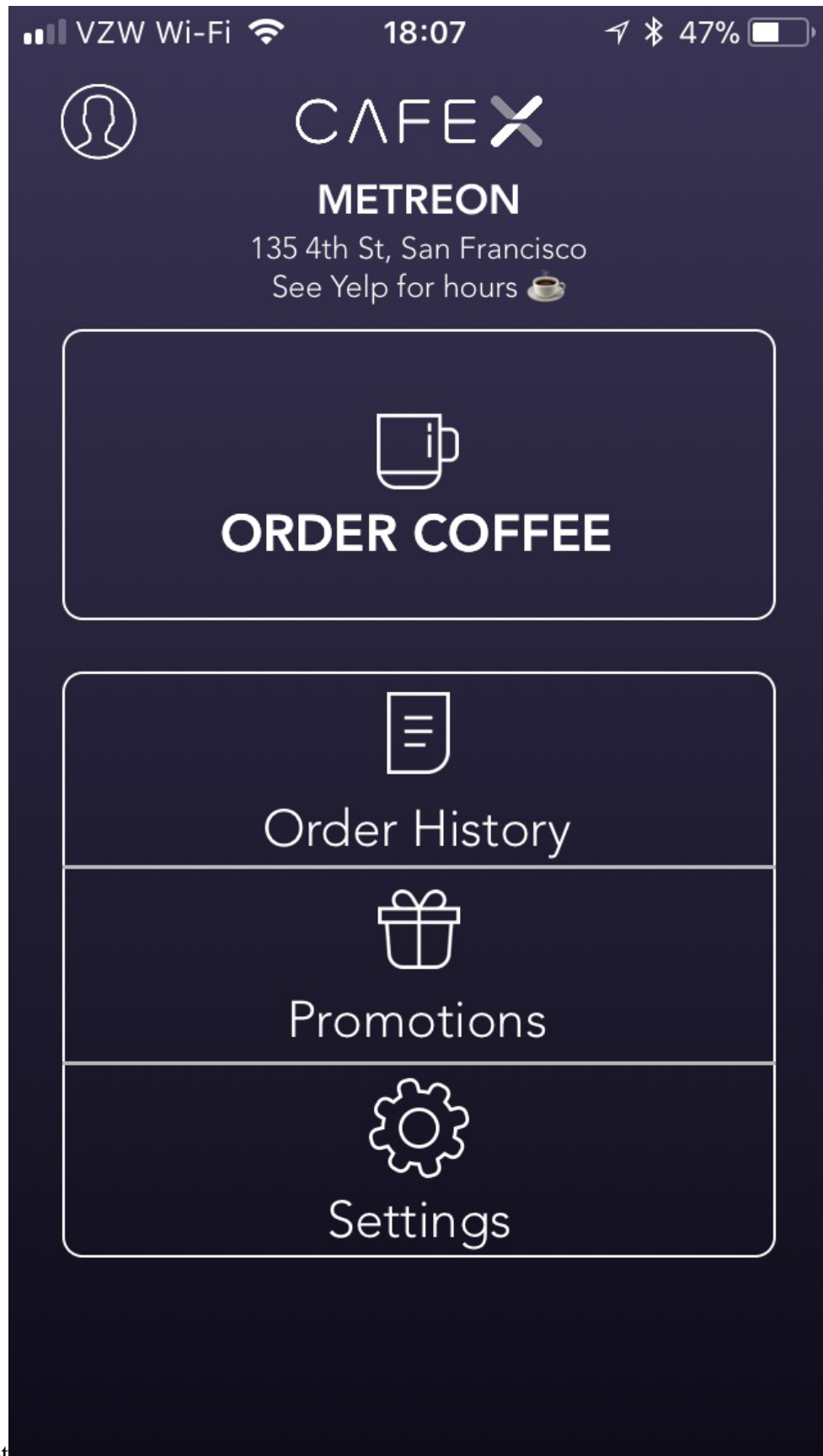
Bad:

4. Consistency and standards: Inconsistent boxing and response coloring for buttons

8. Aesthetic and minimalist design: details given when unnecessary (name of location) but not when useful (Oatly). Important buttons hard to find while unimportant prominent. Redundant side and main menus

10. Help and documentation: non-existent. Could have first time user tutorial or explanation of Oatly.

Appendix E

Appendix F

Screen Shot