Rod Ebrahimi
Pam Griffith
Lindsay N. Lauters
Alisha Lawson
Brittany Murphy

Project II: The Espresso Machine as an Interface in the Task of Latte Making

INTRODUCTION

Since the introduction of the espresso machine in 1901, the creation of coffee-based beverages has become an artistic endeavor. Like artists experimenting with and employing new design methods, today's coffee drinkers are crafting new and exciting ways to enjoy their coffee. This creativity is in part due to the invention of the espresso machine. The new espresso process introduced coffee drinkers to strong, full-bodied coffee beverages without the limitations of traditional brewing techniques. By forcing hot water through a filter of tightly packed ground coffee, this technique allows users to make high quality beverages quickly, unlike more time-consuming brewing techniques. These first espresso machines led to the creation of widely acclaimed beverages like the macchiato and the latte. Although simplistic, the machine was, at times, very difficult to use. Fortunately, the espresso machine interface has evolved over time, making it a more effective and accessible device. In this paper we will examine in great detail how users interface with espresso machines. This contextual data will then be analyzed and applied to an exploration of the interface's virtues and shortcomings that help to support several design recommendations that are discussed at the end of the paper.

OVERVIEW OF LATTE MAKING AS A TASK

The espresso machine supports numerous tasks associated with the making of espresso beverages. For the purposes of this project, we chose to focus specifically on two central subtasks: pulling the espresso shot and steaming the milk. For the sake of consistency, we asked each user to perform the larger task of creating a latte, which is a drink consisting of a cup of steamed milk mixed with espresso, and topped with a certain percentage of foam. It is interesting to note that different users had different concepts of what proportions this drink should consist of; user 1, for example, believed that a latte was 70% milk and 30% foam with one espresso shot, whereas user 2 simply estimated proportions by "eyeballing" the drink, and did not reveal specific proportions. We focused on the task of latte making primarily because it best illustrated our two subtasks of focus, although multiple, smaller subtasks are required to complete the beverage, as will be discussed during the data portion of this paper.

USER COMMUNITY

The larger user community of espresso making consists of both professional baristas and home users of espresso machines. For the purposes of this paper, we chose to focus on professional baristas, simply because the machines were slightly more complex and the baristas were more familiar with the task of latte making as a whole. Furthermore, we chose to focus on one age group and locale, that of the college set employed at multiple cafes and coffee carts at UCSD. As the barista profession is stereotypically associated with being a college job, this focus is

consistent with current market needs. We interviewed four users total, two of which we deemed as experts due to their experience (beginning at 2.5 years at the interview location) and their streamlined performance, and two of which we designated as novices (beginning at 14 weeks at the location) and a performance consisting of multiple breakdowns.

DATA

As previously mentioned, we collected data by conducting multiple contextual interviews at different locations on the UCSD campus. For the purposes of this paper, we will focus on two users who illustrate the major subdivisions of espresso machine use in a professional setting. Our first user, user 1, is an expert user who performed in a streamlined manner, as he was both quicker at making drinks and experienced fewer breakdowns. Furthermore, user 1 operated a more automated machine that user 2, a novice who experienced several breakdowns. Users 3 and 4 fall in between users 1 and 2 in their experience and comfort with the machines. This section will focus on examining the process employed by the users in each of the two extremes, and contrasting and comparing levels of performance.

USER 1: EXPERT PERFORMANCE

User 1 is a supervisor who has two and a half years of experience working with the espresso machine. His process was considered to be the smoothest with the fewest of snags. The user described using the machine as "easy," and his comfort level with this particular machine appeared to be very high (Fig1A). Training had been provided by both in-house "experts" (i.e. the staff) and an external group (Starbucks). Despite this formal training, the user attributed most of his skill to observation and actual use of the machine. It is also worth noting that an artifact that describes how drinks are made using this device was posted nearby but never referenced during our observations (Fig 1B).

At the beginning of the order, he verified the cup sizes and drink specifications. He then prepared the espresso by pulling twice on the grinder. The grinder was set up so that one pull equals one shot to ensure the correct amount. The tamper was secured on the grinder so that he only had to use one hand to pack down the grinds. He then secured the hopper into place and moved to get the milk from the fridge beneath the counter. He poured the milk into the cup itself to ensure he did not over- or undershoot the necessary amount. The milk was then poured into a large pitcher and placed under the steaming wand. He twisted the knob approximately 1080 degrees to steam the milk. He informed us that temperature, time period, sound, and the end of the wand cued him that the milk was ready. After the milk finished, he pressed a button to start the espresso. While the espresso was brewing, he cleaned off the steaming wand with a wet rag and then twisted the knob to rinse out any remaining milk inside the wand. He poured the milk into the cup, using a plastic spoon to prevent too much foam from spilling in. He finished the latte by pouring in the espresso shot. The only snag we observed was when he threw a piece of trash and missed the hole in the counter.

USER 2: NOVICE PERFORMANCE AND COMPARISON

User 2 has been working for a quarter and a half (or about fourteen weeks, as she specified in the interview) with experience on a variety of the espresso machines. The one she demonstrated on was an older model (Fig 2)

that required more manual work and perceptual judgments than user 1's machine. Another major difference was the order in which she made the latte, which greatly affected the results.

The espresso preparations began with her pulling the level for the grinds. She had to pull it multiple times, using her eye to judge the correct quantity. To tamp (or compress) the grinds, a separate tamper was needed that required her other hand. After securing the hopper, she put two small pitchers underneath to hold the espresso shots. She then pressed the button and held it down until she judged each pitcher to be one and one-half full. With the espresso finished, she moved on to the milk foaming process. The amount of milk was judged by filling the pitcher halfway for a medium size. Another difference came from the amount of time needed to foam the milk. It took about five minutes to bring the milk up to the correct temperature. Even though customers began to line up, her full attention was directed at the milk until it finished.

The outcome of the differences in user 2's process was the quality of the latte drink. Since she made the espresso shot first and the milk took a long time to foam, the espresso was beyond its one minute lifetime. User 1 stated that an espresso shot can only sit for one minute without adding milk before the flavors begin to break down and become bitter, a fact that user 2 was either unaware of or did not make use of during the process. Due to this expiration, the latte was bitter and unsatisfactory when compared to the drink made by user 1. This is a crucial breakdown since beverage quality is integral to the business.

ANALYSIS

POSITIVE AND NEGATIVE ASPECTS OF THE INTERFACE

One positive aspect of user three's interface was the placement of where the grounds were thrown away. Instead of having problems with the garbage can like user 1, who utilized a small hole near the machine and missed the opening, leaving garbage on the counter, user 3 had a drawer directly beneath the fresh grounds container so she could easily dispose of the old grounds and replace them with the fresh ones. One of the negative aspects of the machines used by users 2, 3, and 4 was that the shelf to hold whichever containers catch the espresso did not have enough space for the larger cup sizes, which meant that instead of being able to pull the espresso directly into the cup to be served, it had to be made into separate pitchers, which is less efficient and causes more work for the barrista. Furthermore, they were forced to use two pitchers, as the mouths were not wide enough to catch both streams of espresso. User 2 was also unable to leave the milk on the shelf to heat up, but had to stand there and hold it the whole time, which meant that the customers in line were waiting longer. Her espresso machine placement and the placement of the cups also contributed to that problem; when she was at the machine, customers in line were ignored due to the large stacks of cups, which blocked her view.

TRADE-OFFS IN THE INTERFACE

One important tradeoff in the design of the espresso machines is between automation and user control. Automation can ensure better quality and make the users' tasks easier. Our second user would have benefited from some sort of automation on either the milk foaming process or in getting the shot of espresso to prevent her from spending so much time foaming the milk, leaving the espresso to sit and get ruined. The fourth user commented that she preferred the more automated machines that have a lever to control the foaming wand, rather than the knob, since it is easier to just push down on the lever than to turn the knob to the right setting.

However, while automation can ensure more consistent quality, there are cases in which the user needs to customize how they do something to better suit their own or the customer's needs. For instance, user three said that she sometimes gets requests to make the milk hotter from people who have a long way to walk to class. When we interviewed our fourth user, she also changed the foaming process, using the foaming wand for less time since the milk was already hot. She also commented that she prefers using the manual button to create the espresso shot because it gives her more control over the process.

DESIGN SUGGESTIONS

Redesigning several key aspects of the espresso machine would address breakdowns encountered during out interviews. Our new design concepts are informed by our collected data, and are planned to primarily control the quality of the beverage, as all users cited speed of preparation as their primary concern while making drinks. User 1, in particular, noted that finishing drinks more quickly would result in more time to socialize with his coworkers, an activity he cited as the reason he remained working as a barista. By controlling quality, we allow the machine to take on the burden of the cognitive load deemed less important by its operators. Secondly, we sought to improve speed, in order to further lighten the user's cognitive burden, and finally, we attempted to improve safety, as nearly all users mentioned being burned and concerns for customer allergies to milk.

Our first suggestion considers the quality of the espresso shot. Due to the poor results of user 2's latte making process, we propose a timer located above the espresso pitchers. It would count down from one minute to indicate the life-time of the espresso, and would sound a warning tone once the shot is no longer viable.

Our second suggestion considers user's need for exact control in steaming milk by revising the controls. There was a varied preference to levers, switches, and knobs across the users interviewed; user 2, for example, preferred a knob because she felt it gave her more precise control over the amount of steam being pumped through the wand, making it less likely for her to splatter the milk with too much steam. User 4, on the other hand, preferred a lever because it was faster to turn the steam off and on. She also cited some need for control of the amount of steam, however, as it was important to her that the lever have resistance so she could receive tactile feedback about the amount of steam present. Both of these users had experience with different types of controls as they had used various machines across campus. We addressed both the concern for a discrete, fast on/off state, and a need for precise control of the amount of steam, by suggesting a knob that can be pulled out to stop and in to stop, but can be twisted to control the flow of steam. Temperature controls would be displayed in a continuum above the twistable knob in order to maintain user control. The ease of turning the steam off increases the speed and eliminates the redundant 1080-degree knob turn. Pulling the knob out to start and in to stop is more efficient, and prevents accidentally starting the steam as the user is more likely to accidentally depress the button by bumping into it; pulling the knob outward requires more conscious control and is, therefore, used as the control to move the machine in its more dangerous, "on" state. In this way, we were able to consider both user goals while still increasing the overall safety of the machine.

Other ideas addressing safety include an insulated milk pitcher, as both user 1 and user 2 were not able to hold the pitcher in both hands due to its high temperature during the steaming process. To address concerns of customer service, we would also add a cup dispenser to prevent spills and improve safety and sanitation, as this

system would decrease the likelihood of users dropping cups on the floor. Furthermore, this would keep the cups out of the way, as user 2 ignored a large group of customers during our interview, perhaps because a large stack of cups were blocking them from her view.

Finally, we suggest an adjustable shelf to facilitate speed; this shelf would be fixed underneath the steaming wand, but would be high enough that a user could leave a milk pitcher on it to help bring the milk to the proper temperature. User 1 left his milk pitcher under the wand and moved to the cash register to help a customer because his shelf was substantially lower than user 2, who had to hold the pitcher by the handle while steaming even though several customers were waiting in line at the time. This was especially devastating to user 2's productivity, as she experienced a breakdown in steaming (she noted that the milk temperature was lower than normal), and was forced to steam the milk for nearly five minutes instead of her usual one or two. In this case, adjustability is not needed as only one size of pitcher is used; there is no direct need for flexibility as long as the shelf is low enough to fit the pitcher. However, the shelf under the espresso spout must be adjustable in order to fit many different sizes of cups without compromising shot temperature and quality. User 1 noted that, if we had ordered a small latte, he would have simply placed the paper cup under the spout to collect the espresso shot instead of using a steel shot glass. User 2 also noted that she got burned most often when cleaning out the steel glasses with hot water after pulling a shot. The adjustable shelf would allow users to place a cup of any size directly under the spout, facilitating safety by eliminating the need to sterilize shot glasses, and increasing speed by eliminating the extraneous step of pulling first into a shot glass and then pouring into a paper cup.

CONCLUSION

Differences in the espresso machine itself and in user familiarity with the task of espresso making vastly affected the process of making a beverage, consequently changing the speed, efficiency, and safety of the task, as well as having effects on the quality of the finished drink and, consequently, the customer's likelihood of revisiting a particular coffee shop. It is, therefore, incredibly important to take into account the task a particular interface supports, and whether any changes in design will effectively support the manner in which a user accomplishes work. In the case of the espresso machine, we found that the primary users valued speed of preparation in general, whereas it became clear the company or store valued quality, as Starbucks sent a representative to user 1's place to work to control quality. In order to effectively meet the needs of both user bases (the barista and the company), our design changes and analysis attempted to take into account these two different needs. As our users, baristas, found speed their most important concern, we would recommend attempting to control quality overall when designing an espresso machine, and allowing the user more control over the speed at which he or she prepares the drink. By paying attention to differing goals and the methods through which real people accomplish real work, these design suggestions will facilitate the task of latte making.

APPENDIX

Figure 1A

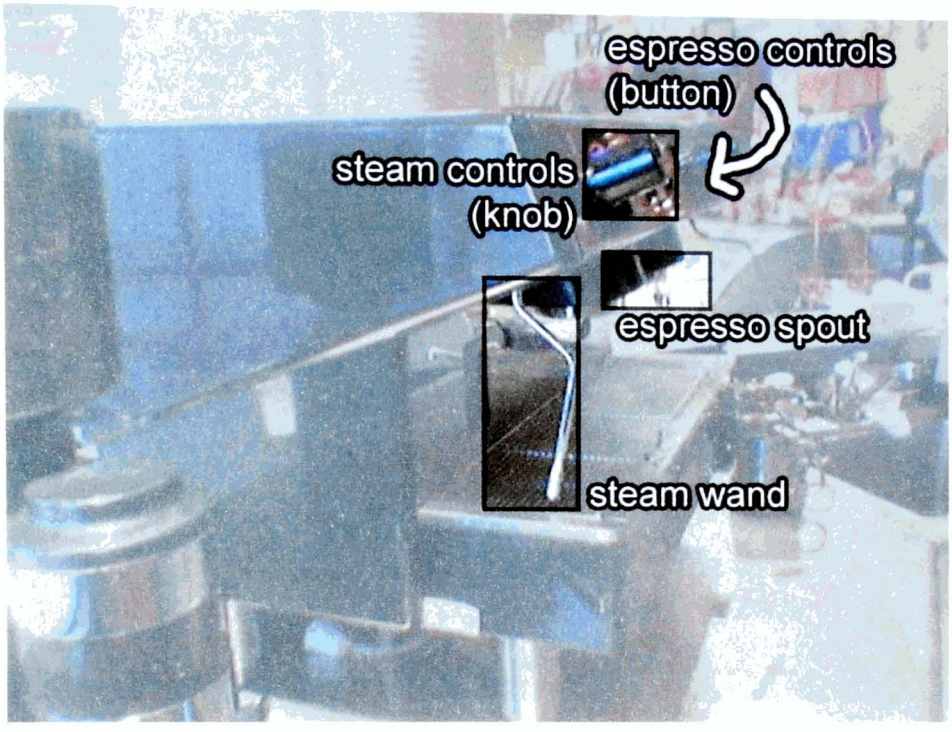
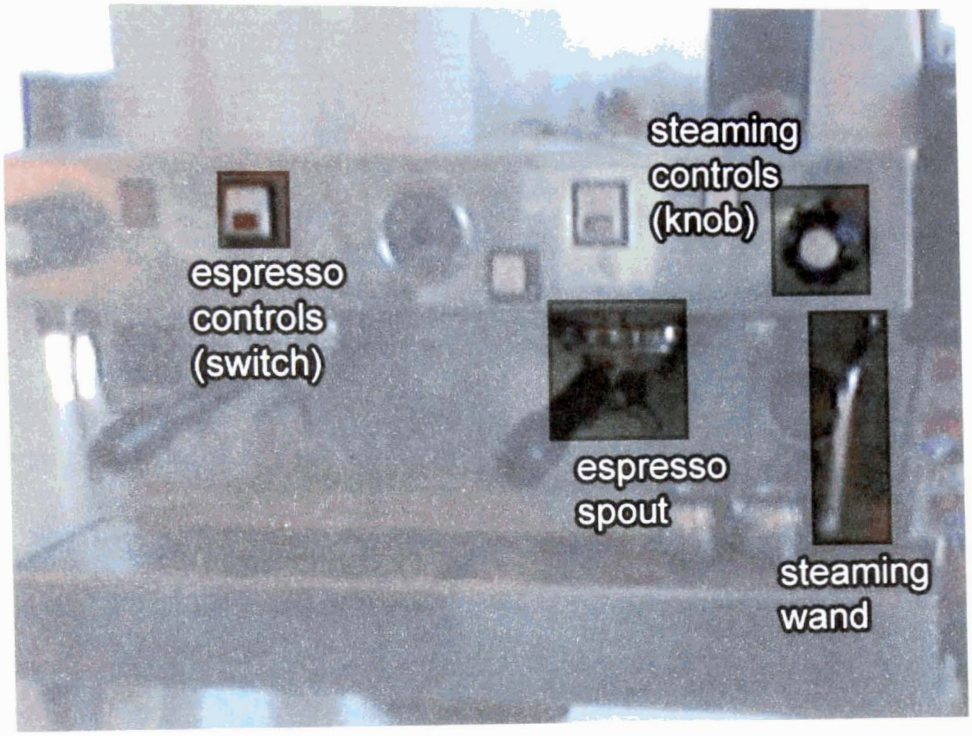


Figure 1B

Figure 2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