USER EXPERIENCE IMPLICATIONS OF THE FLOATING ACTION BUTTON

An Honors Thesis

Presented by

Steve Jones

Completion Date:
April 2016

Approved By:

_____

Tim Richards, Computer Science

_____

Eva Hudlicka, Computer Science

ABSTRACT

Title: **User Experience Implications of the Floating Action Button**
Author: **Steve Jones**
Thesis/Project Type: **Independent Honors Thesis**
Approved By: **Tim Richards, Computer Science**
Approved By: **Eva Hudlicka, Computer Science**

The floating action button (FAB) was popularized by the release of Google's Material Design principles in 2014. Since this release, the FAB user interface component has been widely adopted in web and mobile design. However, the effectiveness of the FAB has been a controversial topic in the user experience design community. Albeit, there is no research based evidence validating user experience implications of the FAB. This study addresses the user experience implications of the FAB. Usability data was generated by employing industry standard A/B user testing methods performed on both the FAB and a traditional action button as a control. Comparison analysis of this data exhibited that the FAB component presented a slight negative usability impact upon users first use of the button. However, after having used the FAB, users repeated the action and the data demonstrated the FAB was more efficient. Once users had successfully completed a task using the FAB, they were able to use it more efficiently than the traditional action button.

1 - Introduction

1.1 - Material Design

In 2014 Google released their Material Design guidelines, a collection of suggested design principles and styles for web and mobile applications [4]. Material Design has become a widely adopted approach to contemporary web and mobile design. However, some components of Material Design have been particularly controversial in regards to their user experience (UX) implications.

The "Hamburger Menu" is a button represented by an icon of three horizontal lines. This has been popularized by Material Design, and since been criticized for its negative UX implications, with opposers even urging to "Kill The Hamburger Button" [1].

A user interface (UI) component that has been recently facing similar criticism is the floating action button (FAB). Amid the recent rapid adoption of the FAB, many UX designers have published articles online stating their opinions of the UI components negative effects. The similarity to the hamburger menu criticism can be understood by an article titled: "Is the Floating Action Button the new Hamburger Menu?" [5].

1.2 - What is the FAB?

Floating action buttons are distinguished by a circled icon floating above the user interface and used for a promoted action. The purpose of the floating action button is to make the most important action prominent and available to the user. The FAB is supposed to represent the single action users perform most often on a particular screen and it is most commonly located in the bottom right of the screen [4].

Google's Material Design guidelines suggest to "Make floating action buttons positive actions like Create, Favorite, Share, Navigate, and Explore" [4]. Arguably, the most common action that designers implement using the FAB is a "Create" or "Add New" function. This is usually represented by a FAB with a "+" symbol.

The FAB has faced criticism, yet unlike the hamburger menu, there is no existing work studying its UX implications. This study analyses the effectiveness of the FAB by performing user testing on the component. The results are compared against the results generated from user testing a more traditional action component under the same conditions.

1.3 - Importance of the FAB's UX Effect

UX is how a person feels when interacting with a digital product. A key component of UX is usability, the effectiveness of a site design and how user-friendly it is. A positive UX presents simplicity and elegance that produce products that are enjoyable to use.

UX is an often overlooked, yet integral factor of the success of a software product. The impact of negative UX can be catastrophic as demonstrated by the failure of HeathCare.gov. This impact was summarized in an article published by Wired magazine, titled: *How HealthCare.gov Taught America to Finally Care About Design* [8]. The article comments on users expectations of good UX by stating:

"Ease of use has become paramount… If it's difficult to use, it's a badly designed product — it's the designer's fault, not [the user's]. The age of spending hours programming a VCR is over. Responsibility has shifted away from ignorant people to ignorant design. High expectations from the private sector have pivoted, harshly and hotly, like a magnifying glass on an anthill, to the public sector, and, really, to all products we interact with. A revolt has begun

against hard-to-navigate airline websites, and consumer unrest and dissatisfaction has led to disruption in industries long deemed unshakeable – look at Airbnb versus the hospitality industry and Uber versus hailing a taxi." [8].

Although the FAB may be seen as a small, seemly insignificant UI component, its effects can be important. If the FAB contributes to the poor UX of an application, the consequences can be substantial. If a user does not understand how to accomplish a task in a software product, this unfavorable experience can associate negative feelings of frustration with the product. One bad experience can turn a user away from a product or brand for life.

2 - Related Work

There is no existing user experience research data regarding the FAB. My research included reading design guidelines, articles, and books to explore popular design principles and guidelines such as those of Don Norman, Jakob Nielson, Ben Shneiderman and others in the field. There is also research describing effective techniques of performing user experience testing. This research contributed to the methods I implemented in administering and analyzing user tests as well as forming insights regarding the FAB.

## 3 - Methodology

3.1 - Overview

To research the usability of the FAB, I designed a mobile application. This was a simple to do list application called "ToDay List". I created two nearly identical versions of the ToDay List application. The only difference is that one application implements the FAB to achieve

actions, whereas the other implements a classic user interface component to achieve the same actions.

The type of application would not be a significant factor on the UX research because the focus was the implementation of the two different "Add" UI components. It was important to implement these components in a way that was natural and consistent with their typical usage. It was equally important to design a simple, clean, and intuitive interface to host the UI components, in order to ensure that the interface would not interfere with the testing of the UI components.

Each version of the application was designed to promote the usage of two main actions: "Add a list category" (Action #1) and "Add a to do item" (Action #2). Both of these tasks implemented the "Add" UI component being tested in each version to achieve the tasks. The justification behind having two similar tasks was to obtain a second usability metric, in order to see if the user's performance was different after already successfully using the "Add" component.

Figure 1

Control Button   FAB

Action #1   Action #2   Action #1   Action #2
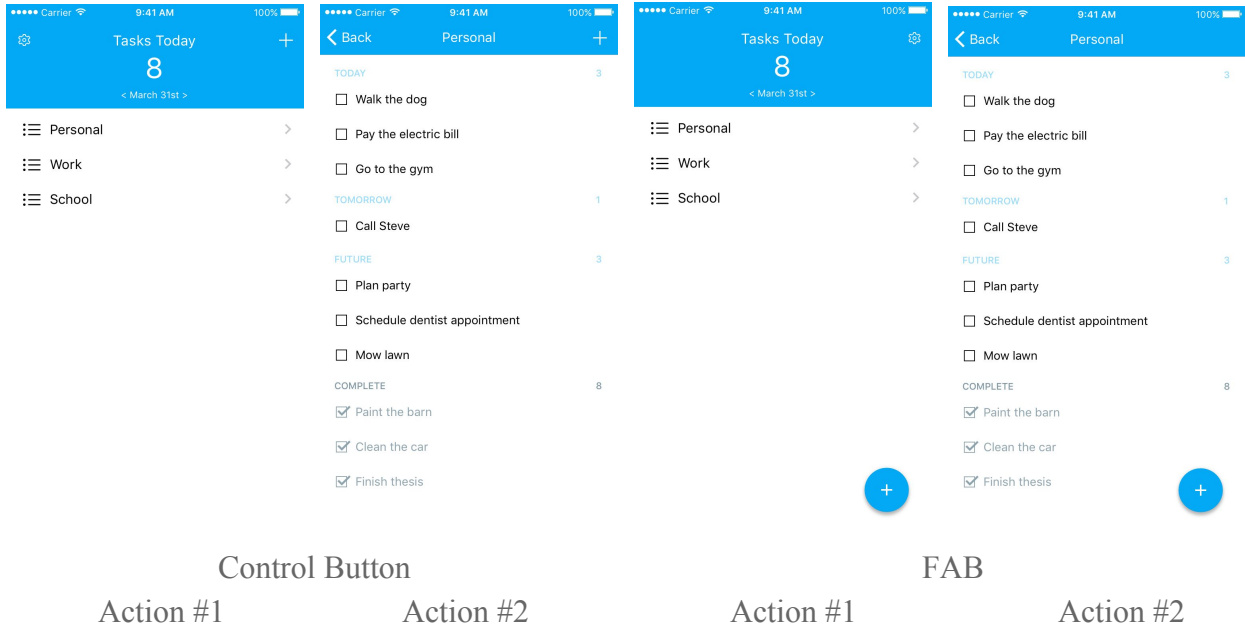
   To achieve these two actions, the first version (Interface A) implemented a common and traditional component that serves the same function as the FAB. The component was a "+" icon located in the top right of the screen in the navigation bar. This UI component and its location in the navigation bar is recommended in the iOS Human Interface Guidelines [10]. However, it's usage is certainly not limited to iOS design. This approach for an "Add" action has been widely used in web and mobile design, including Android applications. This version of the application served as the control interface. The second version (Interface B) used the FAB as directed in Google's material design guidelines.

Table 41-1 Standard buttons available for toolbars and navigation bars

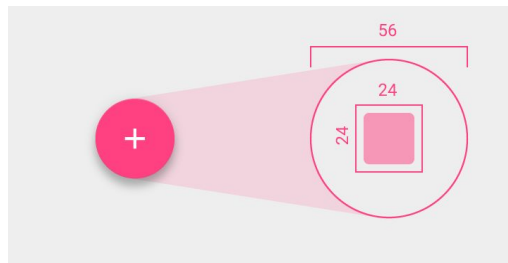| Button	Name	Meaning
+	Add	Create a new item.

Figure 2

Figure 3

3.2 - Low-Fidelity Prototype

A low-fidelity wireframe prototype was designed using Balsamiq Mockups. The purpose of designing a low-fidelity prototype was to efficiently design the to do list application while considering how to include the "Add" UI components in a natural and realistic environment. This allowed for an iterative design process in which this important consideration would be reviewed again upon designing the high-fidelity prototype.
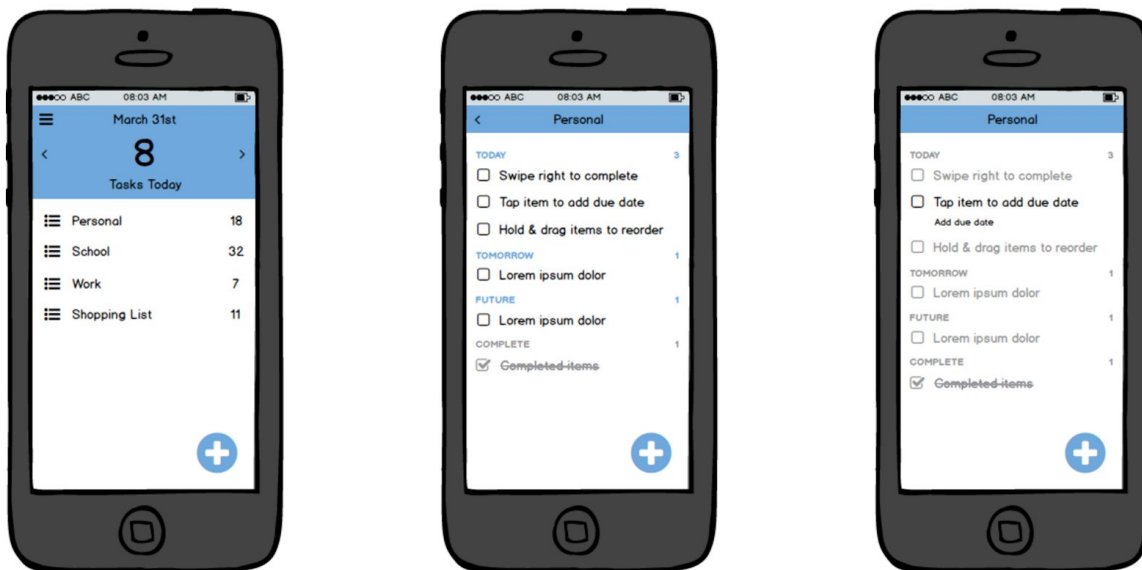

Figure 4

3.3 - High-Fidelity Prototype

The high-fidelity prototype was designed in Sketch. This prototype was a realistic full
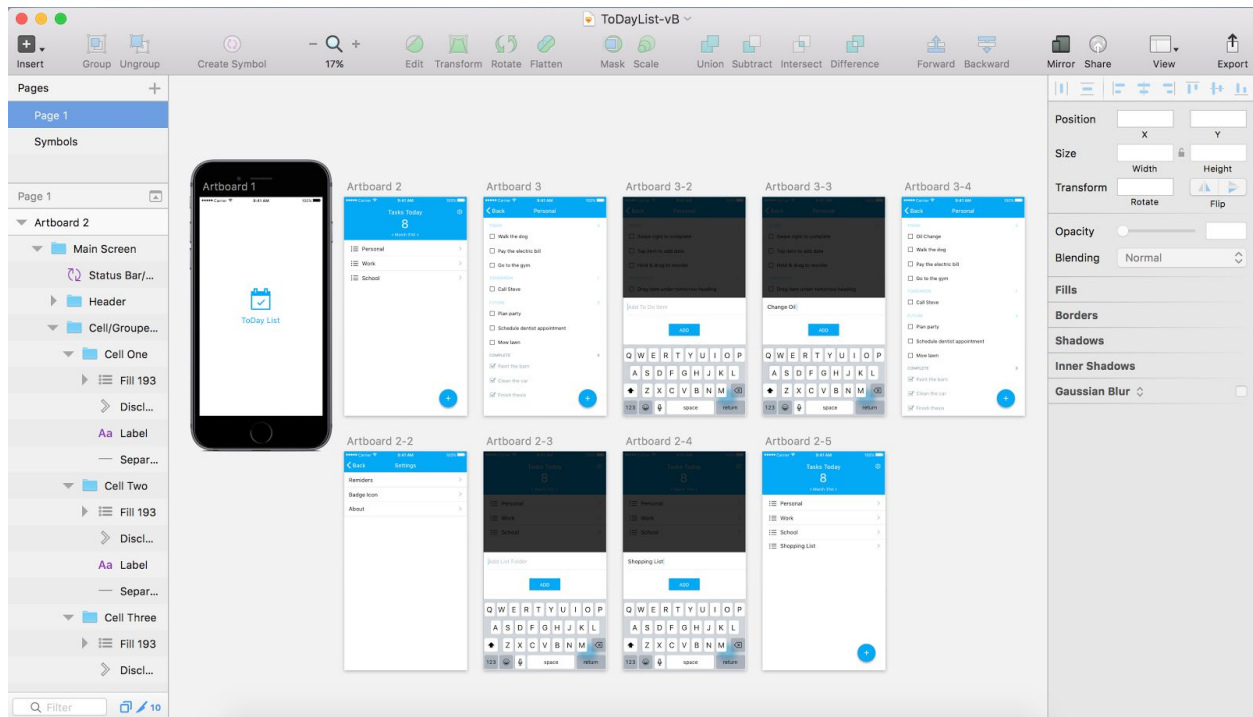
quality design consisting of 10 screens.

Figure 5

It was important to ensure that the designs felt realistic in order to make the user feel like

they were using a fully functional native mobile application. A lack of the sense of the

application being realistic could disrupt the user's natural usage. If the functionality of the

prototype contradicted the user's correct mental models of interacting with mobile applications,

they may be confused about how to interact with the interface. If this was an issue it could affect

the usability metrics produced from that user test.

In order to achieve a realistic functioning prototype, the app was presented to the users in

the form of a high-fidelity interactive prototype created using InVision. This InVision prototype

simulated the function of a native application. The user could open the prototype on their mobile device and interact with it. Users were able to perform typical mobile interface functions such as tapping buttons and using gestures. These actions initiated animations and transitions of the screens that were typical of common mobile applications.

3.4 - User Testing

The main goal of user testing was to obtain quantitative usability metrics associated with each action button. This data would allow the quantitative comparison of the two components.

Although it was likely users had previously been exposed to both styles of action buttons it was important to test separate groups of users on each interface. Interface A was tested by a group of users (Group A), and Interface B was tested by a separate group of users (Group B). This prohibited any bias as a result of a user seeing one style of action button before the other. This A/B testing was performed as both an attitudinal and behavior user test. It was also both a quantitative and qualitative test.

Quantitative usability testing, unlike qualitative testing, is used to obtain statistics, rather than insights. For qualitative testing a small number of user tests can generate useful insights. However, for quantitative testing it is necessary to perform a large number of user tests. Jakob Nielsen of the Nielson Norman Group performed a study that concluded that when collecting quantitative usability metrics, testing 20 users typically offers a reasonably tight confidence interval [6]. Many user tests are required because of the possible substantial individual differences in user performance. The performance of different users can deviate significantly, so it is imperative to average these measures across a fairly large number of observations to smooth over the variability.

In order to procure a tight confidence interval I performed 40 user tests. 20 user tests (Group A) on Interface A, and a separate 20 user tests (Group B) on Interface B.

A Nielsen Norman Group study also found that "6% of task attempts are extremely slow and constitute outliers in measured user performance. These sad incidents are caused by bad luck that designers can and should eradicate." [7]. Fortunately this study also demonstrated that user performance follows a normal distribution. Nielsen found that across 1,520 measures of user time-on-task performance for 70 different tasks, the standard deviation was 52% of the mean values. For example, if it took an average of 10 minutes to complete a certain task, then the standard deviation for that metric would be 5.2 minutes. Nielsen created a quantile-quantile scatter plot with each observation's empirical value on the x-axis and its hypothetical value on the y-axis (Figure 6). [7].
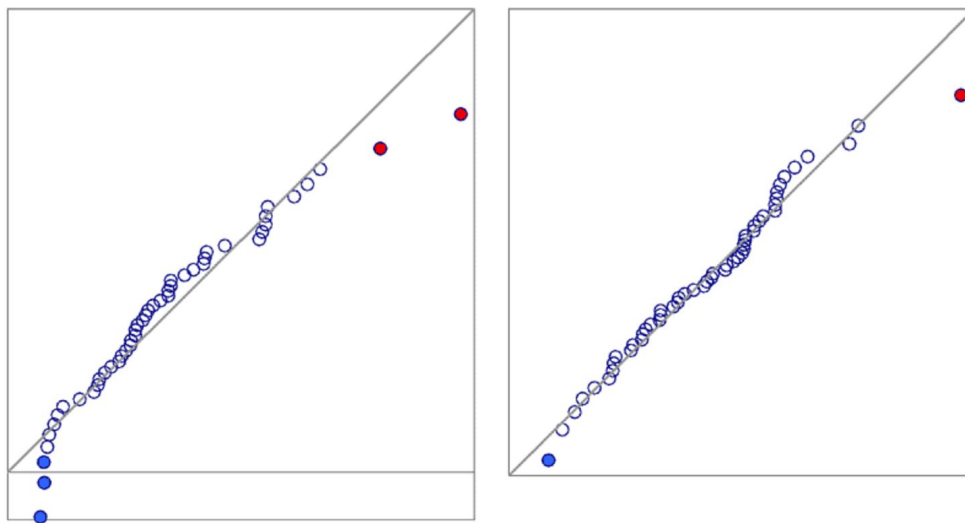
QQ plots of two user studies: a test of a content-based magazine site (New York Magazine, on the left) and a test of a transaction-based e-commerce site (Kiehl's, on the right).
Each dot represents the task time of one user. The x-axis indicates measured performance and the y-axis indicates the theoretically matching normal distribution.

Figure 6

In my user testing, to address the impact of outliers, I reviewed the usability data. Upon viewing the user tests, I saw that 4 users faced an issue while completing a task that disrupted their normal process and made the data insignificant. These issues included two users who received a notification on their phone that inhibited their ability to complete the task normally. One user's phone crashed while attempting to complete a task. The fourth user got distracted by an occurrence in the room during the task. I removed these outliers, and to maintain the confidence interval I performed an additional 4 user tests to replace this outlier data.

The tests were performed through UserTesting.com. I applied for a university research UserTesting Scholarship and was awarded credit for 50 user tests. The user tests on this platform offered features that were incredibly useful, and normally cost $100 per user test.

Using the platform, 44 users of heterogeneous demographics were recruited. The only screening requirements were that the users must speak fluent English and perform the test on a mobile device. The tests were performed on the user's own phone in the UserTesting application which recorded the user's screen and audio. This application prompted the users to open the ToDay List InVision prototype to get started. The ToDay List prototype loaded within the UserTesting apps in-app browser and essentially simulated launching the to do list application locally on the user's device.

The user was able to tap an icon that appeared unobtrusively over the ToDay List interface in order to access an overlay screen that contained a prompt of the task description. After the user read the prompt they returned to the ToDay List interface to complete the task. Upon completion the user would access the overlay screen and could then proceed to the next

task prompt. The test I deployed included 18 tasks for the user to perform. The 44 recordings recordings of the user's screen & audio averaged ~10 minutes each.

The moderating techniques employed included Concurrent Think Aloud (CTA), and the users constantly verbally communicated their thoughts. The Retrospective Probing (RP) moderating technique was also used, where the test prompt asked the user to comment on the task after completion.

I watched the entirety of each of the 44 user test recordings and noted the user's actions and verbal communication of their thoughts throughout the recorded test. The tasks included performing an action in the ToDay List app, as well as answering questions about the app. Each question was answered in the form of either a verbal response, written response, rating on a 1-5 scale, or a selection from multiple choices. These responses generated both qualitative and quantitative data.

The most useful data collected from the user tests was the quantitative time-on-task metric. I did this manually by starting a timer after the user had read the task prompt and returned to the ToDay List app interface. The timer was stopped upon the user successfully locating and tapping the add action UI component. I recorded this data for both the task #5 which prompted the user to "Add a new task to your to do list", as well as for task #12, "Add a new list category".

4 - Results

4.1 - User Demographic Data

The demographic data below (Figures 7 - 10) demonstrates that the users recruited were a heterogenous group which accurately represents the typical users of applications that would contain the action buttons being tested.
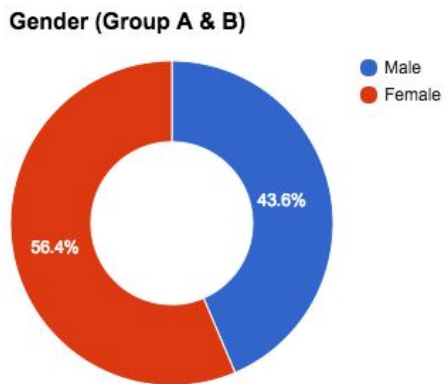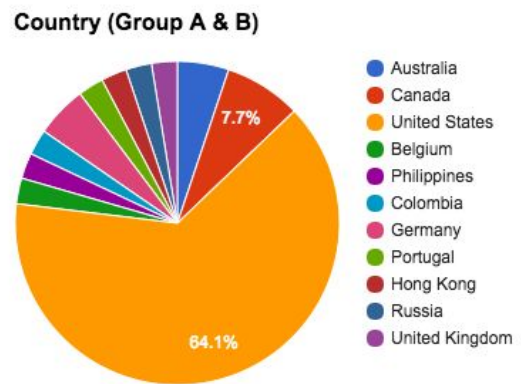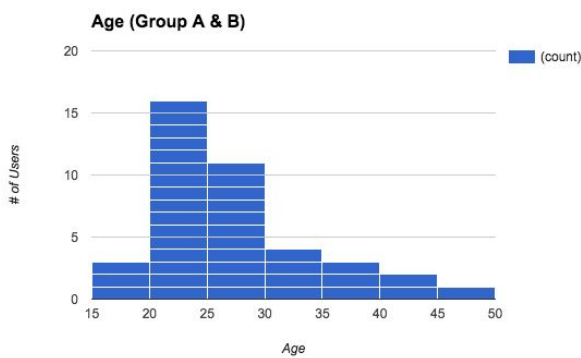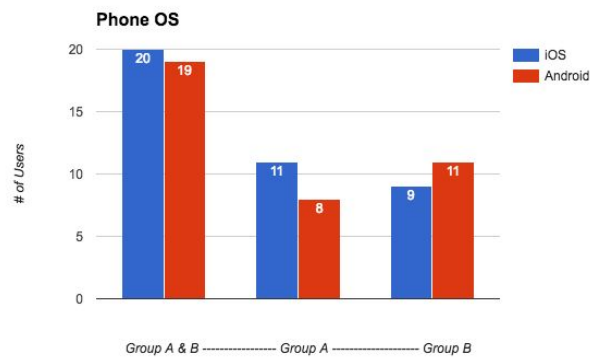

Figure 7

Figure 8

Figure 9

Figure 10

4.2 - Notable Qualitative Feedback

NOTE: Users were shown both action buttons after test

Post-Test Question #1:

Which style of add button do you prefer?

A: http://stevejones.io/add-a.png

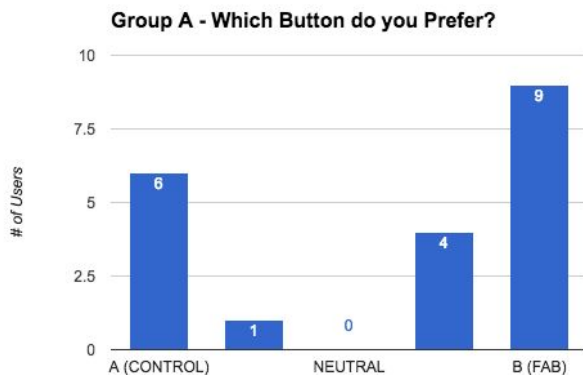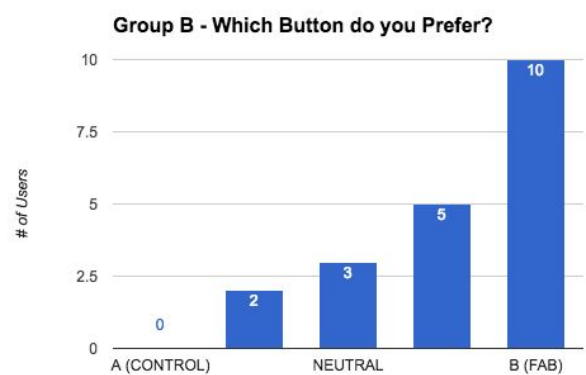B: http://stevejones.io/add-b.png

Figure 11

Figure 12

Post-Test Question #3:

On a scale of 1-10 how much do you like the add button that was used? Was it easy to use? What would you prefer?

Group A (control)

"I really like the traditional add button. It's widely recognized and easy to use."

    - User A2

"Yes it was very easy and intuitive. I did like the [FAB] even better because I think it is more modern."

- User A3

"It was easy to use and I prefer it's clean design."

- User A4

"My personal preference is the add button at the top of the page, although I have used the encircled add buttons before as well. I just find the top add button easier to find."

- User A6

"I like it. It was straightforward. If I have options, I would prefer the [FAB] because it looks better and speaks to me right away."

- User A7

"After seeing the [FAB], I like that option better because it's easier to see, bigger, and closer to the thumb."

- User A9

"5 it is easy to use but I like the [FAB] better. it goes with the standard material ui"

- User A13

"10 out of 10, very simple, easy and well recognized. Definitely prefer it over the [FAB]."

- User A16

"4. The [FAB] was Better looking and easier to find."

- User A17

"10, it was very easy to use and I liked the easy access of the add button at the top of the screen."

- User A19

Group B (FAB)

"8. I love how the [FAB] stands out and is easily accessible. Very easy to use and I prefer that design over more traditional."

    - User B1

"8 yes very easy to use I prefer [the FAB]"

    - User B3

"10. [The FAB] was very easy to use!"

    - User B4

"I had no problem using the [FAB]. I have no preference between the styles of buttons as they seem quite similar."

    - User B11

"Yes the app was very easy to use and I enjoy the circular add button. It's sleek and simplistic which is very visually appealing."

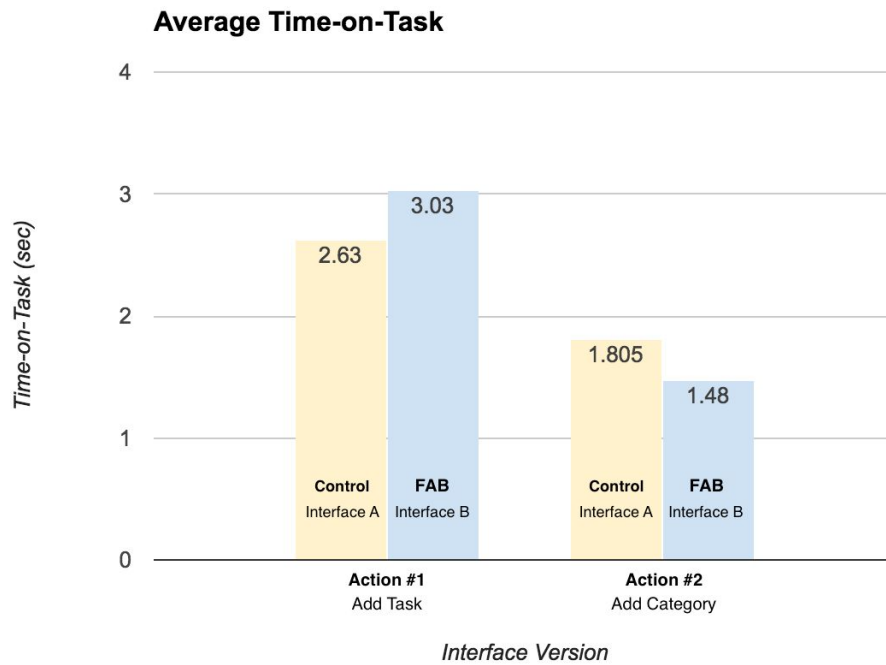   - User B13

4.3 - Quantitative Metric Data

Average Time-on-Task

Figure 13

Time-on-Task Improvement: Action #1 → Action #2

	#1 - ADD TASK	#2 - ADD CATEGORY	IMPROVEMENT
A - CONTROL	2.63	1.805	31.37%
B - FAB	3.03	1.48	51.16%

Figure 14

5 - Conclusion

5.1 - Qualitative Insights

There were two compelling results of the user experience research. The first was from the qualitative data generated by post-test retrospective probing questions. Each group of 20 users had just finished testing the application using either the control action button or the FAB. Upon completion of the test, users were shown examples of both of these buttons. Group A had not seen a FAB during the test, and Group B had not seen the control action button during the test.

These users were asked to select on a scale of 1-5 "Which style of add button do you prefer?" The users in Group A who had just tested the application that implemented the control action button had varied answers, but leaned slightly towards preferring the FAB (Figure 11). The users in Group B who had just tested the application that implemented the FAB significantly prefered the FAB (Figure 12).

Although users of each group may be biased towards or against the action button they just used, the majority of both groups prefered the FAB. This data could be supported by the users responses of Post-Test Question #3. Some users in Group A said that they prefered the FAB because of its ease of use, explaining that it "speaks to me right away" (User A7), and it's "easier to see, bigger, and closer to the thumb" (User A9). Users in Group B had similar reasons for preferring the FAB such as how it "stands out and is easily accessible. Very easy to use and I prefer that design over more traditional" (User B1).

Other users explained their preference of the FAB because of its sleek and modern look. These users said they "like the [FAB] even better because I think it is more modern." (User A3).

Another user explained that he likes it because "It's sleek and simplistic which is very visually appealing" (User B13). Others saying "I prefer it's clean design" (User A4) and simply because "it looks better" (User A7).

A visually pleasing interface may not improve usability. However, emotion is a factor of user experience. If a user finds it pleasing to use an application because they find it visually attractive, this can have positive UX effects. The impact of an interface being enjoyable to use can certainly improve a product's UX. Of course, not all users may find the FAB appealing. However, a significant amount of users attributed their preference of the FAB to its visually appealing qualities. This could to some degree support the FAB contributing to an applications UX positively.

5.2 - Time-on-Task Data Insights

The time-on-task data shows that the average time for Group A to add a task (Action #1) using the control button was 2.63 seconds, while Group B averaged 3.03 seconds using the FAB. While this data may seem close, for completion of a simple task this difference of 0.40 seconds can be considered significant.

The most interesting data I discovered was the average time-on-task results for the Action #2 (adding a category). When approaching Action #2, Group A had already completed adding a task using the control button, and Group B had already completed adding a task with the FAB. For Action #2, the users were prompted to perform nearly the same action as Action #1, but on a different screen. It would be reasonable to expect that the users would more likely complete the action faster this time. The user may consciously or subconsciously assume that they have to repeat the same action of tapping the action button they used in Action #1. Even if the user did

not initially think that it would be the same, they would presumably recognize the action button and understand the function of that button. This recognition of the function of the button would likely contribute to a faster time-on-task.

The time-on-task results of Action #2 were indeed faster. The average time for Group A decreased from 2.63 seconds on Action #1 to 1.805 seconds on Action #2. The interesting result was that the average time for Group B decreased from 3.03 seconds on Action #1 to 1.48 seconds on Action #2. On Action #2 Group B not only had a faster average time-on-task than Group A, but the time dropped by a substantial 51.16%.
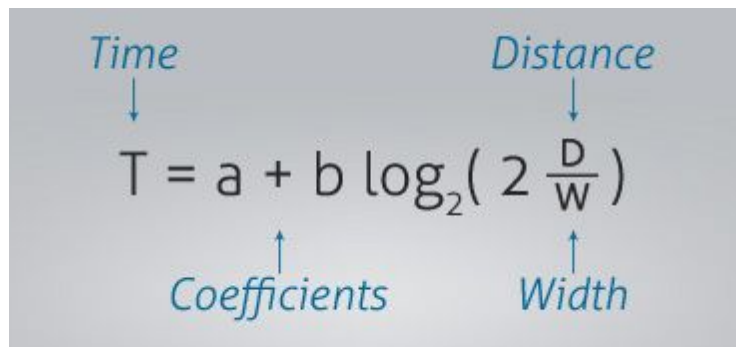
5.3 - FAB UX Principles

There are certainly many factor that could contribute to the FAB having a faster time-on-task than the control action button. A possible contributing factor could be a result of the prominent size and color of the FAB. One of the three principles in Material Design is titled: "Bold, graphic, intentional" [4]. The bold and prominent colors and size of the FAB can increase users ability to recognize the component. Psychologist and cognitive scientist Dr. Susan Weinschenk claims "People are programmed to pay attention to anything that is different or novel. If you make something different it will stand out." [2]. The uncommon location, unique bold color, and atypical large size of a FAB component are factors Dr. Weinschenk claims can help quickly grab the user's attention.

Nielsen Norman Group claims that designers should "Make buttons at least remotely resemble physical buttons. In order for an object to be recognizable, it must retain the right visual cues to trigger the right associations quickly and accurately" [3]. Google satisfies this well with

the floating action button because its appearance of floating over the interface uses shadows to give make it appear more like a clickable button.

Another significant factor that could contribute to a faster time-on-task for FAB is Fitts's Law (Figure 15). Fitts's Law is the scientific law which predicts that the time required to rapidly move to a target area is a function of the ratio between the distance to the target and the width of the target. The FAB demonstrates great usage of Fitts's Law, especially compared to the control button. The FAB is a wide button and placed, a short distance from a user's thumb.

$$T = a + b \log_2\left(2\,\frac{D}{W}\right)$$

Figure 15

The FAB's bold and prominent colors and size, clearly clickable design, and positive usage of Fitts's Law all are factors that could contribute to the positive usability of the FAB. These factors could have contributed to the FAB's low time-on-task on Action #2. However, all of these positive UX factors should also apply to the FAB in Action #1. This does not explain why for Action #1 the time-on-task for the control buttons was faster.

It is quite possible that these did indeed have a positive effect on the FAB in Action #1. However, there could have been a stronger negative effect that cancelled the positive effect. The improvement in Action #2 could be a result of a decrease in the negative effect.

One factor that could attribute negatively to the Action #1 time-on-task for the FAB, is that many users may be unfamiliar with the FAB. Although the FAB is been quickly adopted in

the past two years, the style of the control button has continued to be commonly used since many years before. Even today the control button is much more common.

Frequent usage of UI components like these action buttons develop a user's mental model. A mental model is what the user believes about how a system or interface will function. These are established based upon the user's previous knowledge and experience interacting with similar interfaces.

Having an action button in the navigation bar is incredibly common and some users have mental models supporting this. It could be subconscious, but theses users may spend a fraction of a second confused while looking for a navigation bar button. This can delay the user's ability to locate and tap the FAB. This could be a significant impact on the higher Action #1 time-on-task from users in Group B who are less familiar with the FAB.

When approaching Action #2 both Group A and Group B have already completed a very similar task with the same action button. If most users of Group A were already familiar with the common control button before this test, we would only expect a slight improvement in time-on-task for Action #2 and this occurred. If users in Group B were less familiar with the FAB, the successful completion of Action #1 could have a large impact of their understanding of the purpose and functionality of the FAB. This development of their mental model could explain the substantial improvement on the time-on-task for completing Action #2. If this explanation is true, the aforementioned positive UX advantages of the FAB could validate the faster time-on-task for Action #2 of Group B (1.48 seconds) compared to Group A (1.805 seconds).

Based on the 40 users tested the qualitative data did demonstrate that the majority of users prefer the FAB over the traditional component represented by the "+" icon located in the

top right of the screen in the navigation bar. Comparison analysis of the quantitative data exhibited that the FAB presented a slight negative usability impact upon users first use of the button. However, after having used the FAB for Action #1, users used it for Action #2 and the data demonstrated the FAB was more efficient. Once users had successfully completed a task using the FAB, they were able to use it more efficiently than the control button.

Although the users were able to complete Action #2 more efficiently with the FAB, this does not confirm that the FAB presents positive UX. The two actions that were tested had split results, and there is no concrete evidence of what influenced that change.

It was not possible to obtain an accurate metric of how users familiarity with each style of action button, affected their performance on Action #1 and Action #2. It is possible that there could be many factors involved in this change between Action #1 and Action #2, and as a result we cannot make a conclusion on the UX implications of the floating action button.

6 Future Work

The future work for this would be to run another user test that will ensure the right data to be able to make a conclusion. There should certainly be more data points measured. I would also be very interested in trying to quantify or track the progress of how widely adopted the FAB is in mobile design. It would be interesting to see how the data from this study would change if it was done in a few years and the FAB was incredibly common.

7 Bibliography

[1] Constine, J. (2014). Kill The Hamburger Button. Retrieved from

  http://techcrunch.com/2014/05/24/before-the-hamburger-button-kills-you/

[2] Fitts, Paul M. (June 1954). "The information capacity of the human motor system in

  controlling the amplitude of movement". Journal of Experimental Psychology 47 (6):

  381–391.

[3] Loranger, H. (2015, March 8). Beyond Blue Links: Making Clickable Elements

  Recognizable. Retrieved from https://www.nngroup.com/articles/clickable-elements/

[4] Material design - Google design guidelines. (n.d.). Retrieved from

  https://www.google.com/design/spec/material-design/introduction.html

[5] Moss, B. (2015, November 20). Is the Floating Action Button the new Hamburger Menu?

  Retrieved from

  http://www.webdesignerdepot.com/2015/11/is-the-floating-action-button-the-new-hamb

  urger-menu/

[6] Nielsen, J. (2006, June 26). Quantitative Studies: How Many Users to Test? Retrieved from

  https://www.nngroup.com/articles/quantitative-studies-how-many-users/

[7] Nielsen, J. (2006, March 6). Outliers and Luck in User Performance. Retrieved from

  https://www.nngroup.com/articles/outliers-and-luck-in-user-performance/

[8] Valberg, C. (2014, October 1). How HealthCare.gov Taught America to Finally Care About

  Design. Retrieved from

  http://www.wired.com/2014/10/big-design-awakening-healthcare-gov/

[9] Weinschenk, S. (2010, May 19). The Psychologist's View of UX Design. Retrieved from

https://uxmag.com/articles/the-psychologists-view-of-ux-design

[10] IOS Human Interface Guidelines: Bars. (n.d.). Retrieved from

https://developer.apple.com/library/ios/documentation/UserExperience/Conceptual/Mobi

leHIG/Bars.html