

Usability Evaluation of the Photocopier Machine



PSYC 161: Engineering Psychology

Group 9

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March 20, 2008

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I. Introduction

Our group conducted a usability study on the photocopier machine at Imprints, a photocopy store at the University of California, San Diego. The model we tested was the Xerox® CopyCentre™ 245 (Figure 1). Our motivation to do our study on photocopier machines rooted from the mundane nature of photocopiers. Everyone uses photocopier machines sometimes in their lives, but we were under the general impression that photocopier machines can sometimes be difficult, intimidating and confusing to use. Our main goal was to discover the main usability issues with photocopiers so we can find out ways to improve it.

Getting approval to test the photocopiers was relatively simple. All we had to do was to contact the owner of Imprints. She gave us permission to go into the Imprints store located in the New Student Services Center at UC San Diego anytime during its working hours to do our study. Overall, we had a great time conducting the usability studies and were able to discover the pain points of the Xerox® photocopier, which will be described in later sections.



Figure 1

II. Methodology

Our methodology consisted of first giving the participants an introduction to the study and the goals of the study. We explained to them that they'll be completing a few tasks on the photocopier and that we'll be paying for all expenses. Participants were then given a pre-test questionnaire that asked for their prior knowledge and experiences with photocopiers, as well as their first impressions of the photocopier we were testing. Participants were then given six tasks to complete on the photocopier machine using two pages in a magazine we provided.

Participants were asked to think out loud while executing each task, and our group utilized the contextual inquiry method and asked them questions while they completed the tasks to probe for their thoughts and confusions. After completing each task, participants were given a rating to fill out that asked for the ease of task completion, their satisfaction of the time it took to complete the task, as well as their confidence of performing that task correctly. After all the tasks were completed, they were given a post-test questionnaire that asked for the overall ease of use of the photocopier, what they liked and disliked the most about the photocopier, and any other suggestions and comments they had.

III. Participants

We had a total of eight participants for our study. We decided to test eight participants because according to Nielsen and Landauer, testing eight users is the most cost effective and captures 80% to 90% of the problems because the main problems will happen quickly and frequently. All eight participants were undergraduate students at UCSD. Our participants' use of photocopiers ranged from one or two times a year to 50 times a year. In addition, their subjective skill and comfort level of using photocopiers ranged widely, as shown in this Figure 2:

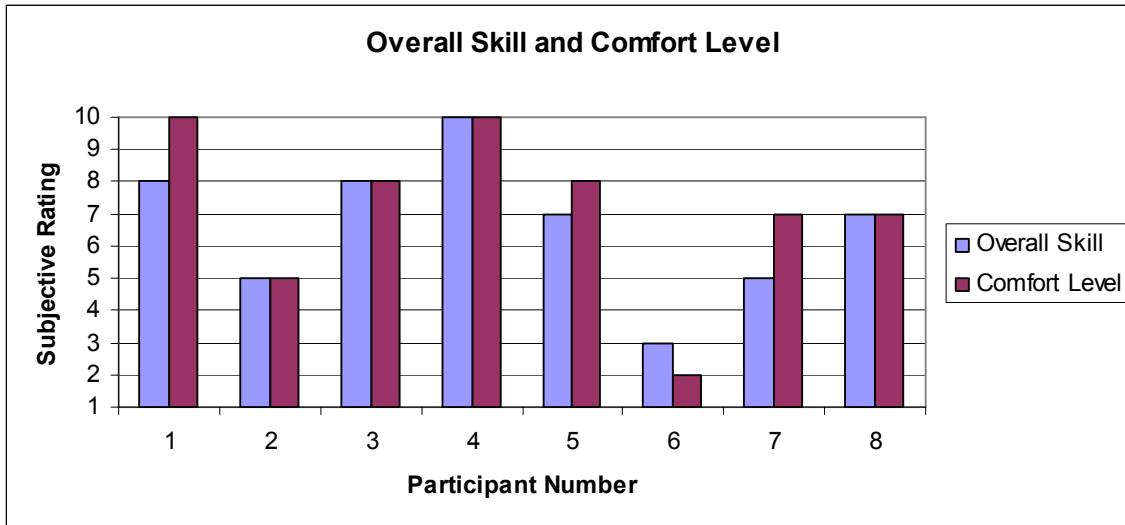


Figure 2

In general, our participants were pretty diverse in terms of frequency of use and expertise level.

IV. Tasks

These were the six tasks that participants were asked to do:

Task 1: Print out a one-sided copy

Task 2: Print out a two-sided copy from 2 one-sided sheets

Task 3: Change the image quality to the lightest setting (but don't print)

Task 4: Change all four borders of the paper to 0.15 inch (but don't print)

Task 5: Set the copy machine to make two copies at once

Task 6: Shrink a two-sided layout into one page

V. Problems and Recommendations

A. Nielsen's Usability Heuristics

Jakob Nielsen developed ten usability heuristics to guide the developers or designers in developing their interface device. However, our group used four out of the ten usability

heuristics that correlated with the errors the users made. After compiling all of our findings, we categorized the findings according to which heuristic was violated. The following is the listing and information on the four usability heuristics by Nielsen:

1. ***Visibility of system status:*** The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
2. ***Match between system and the real world:*** The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
3. ***Consistency and standards:*** Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
4. ***Help and documentation:*** Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

1. Visibility of System Status

In our findings, the most common heuristic not followed was the visibility of the system status. The first example of this heuristic violation dealt with the function of printing multiple copies at once. Some users did not notice that the number in the upper right corner of the touch screen meant the number of copies made (Figure 3). Consequently, they didn't know how to print multiple copies of one input at once. This can be problematic when a user has a mass copy task. Our recommendation would be to simply place a label such as "Number of Copies" next to the digit(s).

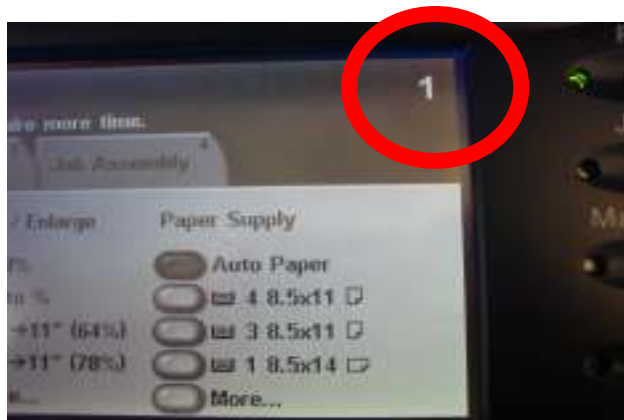


Figure 3

A second visibility problem was seen in the task of printing 2-sided copies. The original document was the magazine closed but inside-out. On the main screen, the options underneath the multiple sided copy menu had a “# → # sided” notation (Figure 4). The left “#” referred to how many sides the input document is; the right “#” referred to how many sides the output document will be. In this task, the correct choice would have been “1 → 2 sided.”

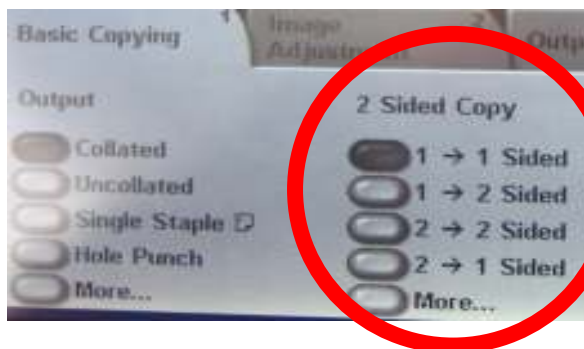


Figure 4

However, our users were confused about whether the “#” symbol meant number of pages or number of sides. An unexpected workaround was seen when users clicked on “more.” The resulting lower level page had visual representations of each option (Figure 5). Consequently, the users clarified the meanings each of the options. Provided that the visual representations were beneficial, our recommendation is to have visual representations placed directly next to the text on the top level. A second recommendation is that a “print preview” option should be on this page so the user knows how the output will appear prior to printing.

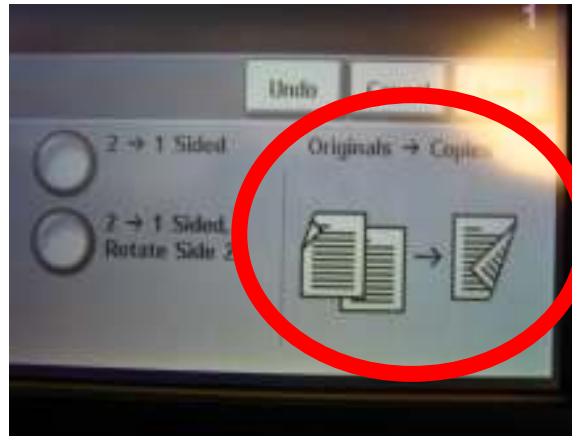


Figure 5

A third visibility problem was also seen during the task of printing 2-sided copies. The user needed to open the document feeder and switch the magazine side so that the second side could be scanned. In order to communicate this action to the user, the machine had a message at the top of the screen (Figure 6). Unfortunately, some users were unaware of the text change at the top of the screen and waited until they figured out something was wrong. These users were expecting the machine to print the output right away. Since the message was unnoticeable by the users, our recommendation would be to have a more dynamic message prompt such as a pop-up window in the middle of the screen that includes an “okay” button.

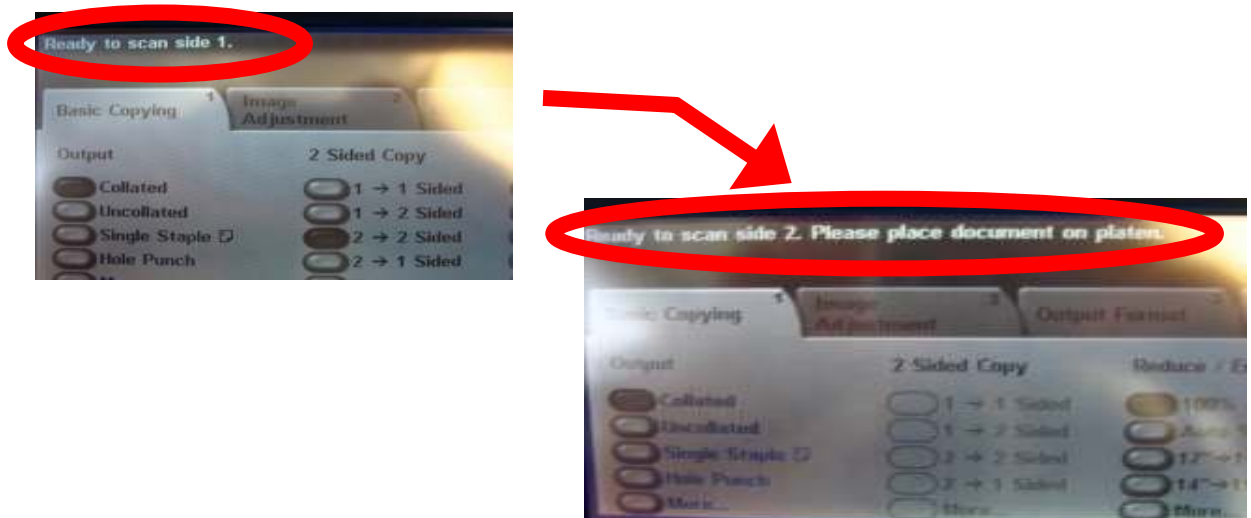


Figure 6

The fourth visibility problem was seen during the task of shrinking a two page layout to one 8 ½ x 11 inch page. In order to correctly perform this task, the user needed to choose the “Auto” option. In this context, “Auto” was defined as the default 8 ½ x 11 inch page. Unfortunately, some users did not understand *any* of the options, including the ones that were numerical (Figure 7). Either the users did not know what the output of each option would look out or whether or not the option referred to input or output. As a result, the users had to resort to trial-and-error of choosing an option and checking if the output matched the correct, desired output. Our recommendation would be to have a print preview option so that the user avoids trial and error.

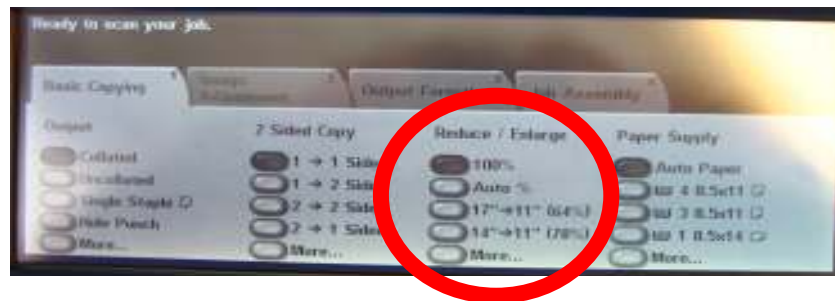


Figure 7

Also within the task of shrinking a two page layout to one 8 ½ x 11 inch page, a lower level is displayed when the user selects the “more” option. Many users selected “more” when they didn’t realize that “Auto” option is what was supposed to be chosen for this task. In this level, a user can manually change the shrinkage size by choosing a number within the range of 25-400 (Figure 8). However, these the users did not understand how these numbers would be correlated to shrinkage. As in the previous task, our recommendation would be to have a print preview option so that the user can see what their changes look like.

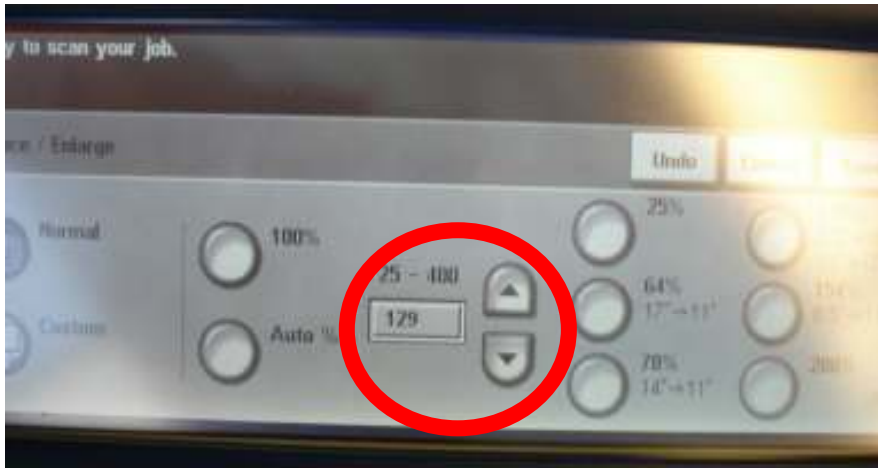


Figure 8

2. Match between the System and the Real World

One finding was a violation of the match between the system and the real world. A few of our users encountered an error message. This message read as “Raise the Document Handler and reposition the original on the platen, then press start” (Figure 9). The problem with the sentence was that the users did not comprehend the terms document handler and platen. Document handler referred to the top document feeder door and the platen simply referred to the glass. Although these definitions are simple, the representing terms were complex. Our recommendation is that the system should avoid jargon and use terminology which is understandable in the real world.

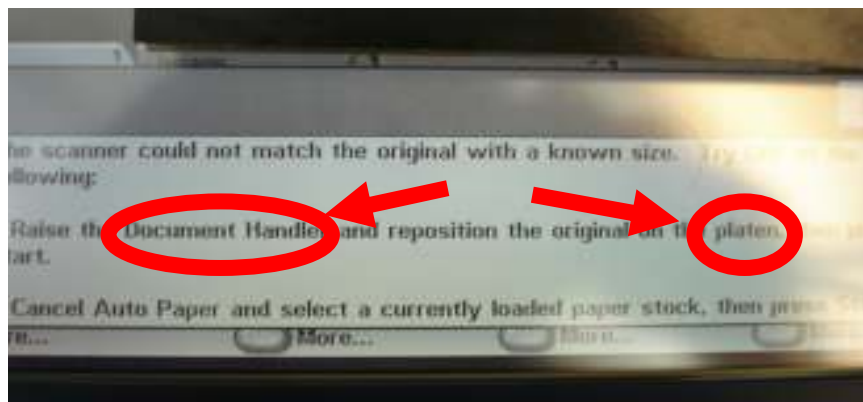


Figure 9

3. Consistency and Standards

There were a number of issues with consistency and standards discovered while the users were trying to complete the tasks. The users came across under the menu called “Paper Supply,” which had a list of numbers next to the paper sizes (Figure 10). Some of the users thought that the numbers corresponded to the number of copies that will be printed out. In actuality, the list of numbers corresponds to the tray number of the copier machine that contains the paper of the particular size. Therefore, this is a lack of consistency and standards because users were unsure if different labels mean the same thing. The recommendation to resolve this issue is to have a highlighted image of the tray that corresponds to the tray number that is selected by the users.

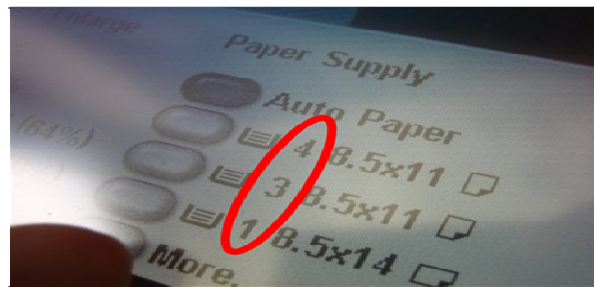


Figure 10

Another violation of consistency and standards is the “Border Erase” and “Edge Erase” labels. One of the tasks that the users were assigned to complete is to change all four borders to 0.15 inches. When the users clicked on the section of “Edge Erase,” there were three lists: Border Erase, Edge Erase, and Print to Edge. Users were confused between the functionalities of Border Erase and Edge Erase because they could not differentiate between the two meanings. When the users clicked on both of these two categories, they figured out what their differences were. The Border Erase function is that the user can change the borders of all four sides simultaneously (Figure 11); selecting Edge Erase will allow the users to change each side of the border on at a time (Figure 12). This is an issue of consistency and standards because the users

thought that the two options had the same functionalities. To reduce the confusion while reading the two labels, a recommendation is combine the two functions into one display, which will allow the users to understand that there are two solutions to change the borders all in place.

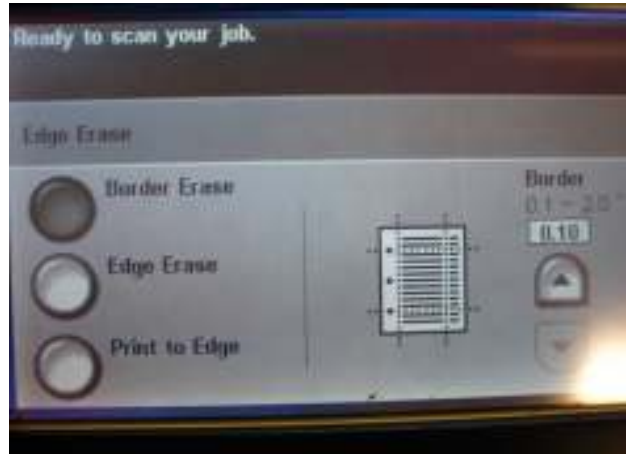


Figure 11



Figure 12

Throughout the various tasks, users were selecting the four top level tabs repeatedly. This meant that they did not automatically comprehend what the functionalities were for each tab (Figure 13). The tabs labels were ambiguous. For example, in the Reduce/Enlarge task, users switched between all three tabs, even though they were initially under the correct tab, which is under "Basic Copying." Users switched between Image Adjustment, Output Format, and Basic Copying when performing this one function. This is a problem with consistency and standards.

Users should not have to wonder if words mean the same thing. The labels for each tab should be more comprehensible of what function it will do.

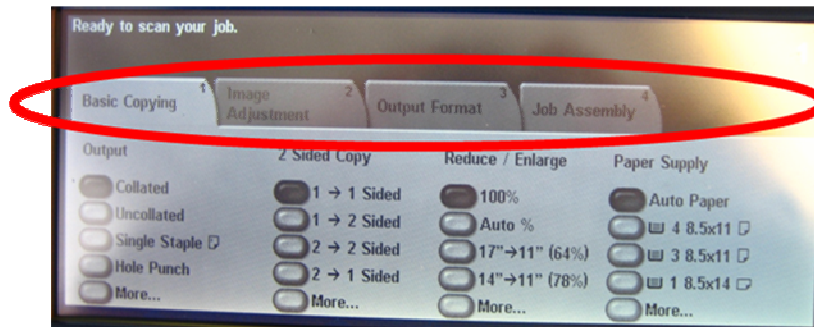


Figure 13

4. Help and Documentation

There was an interesting finding that was seen with finding help and documentation. When the users were not able to complete the tasks, they were given the option to ask the clerk for assistance. However, few users chose to use the Help function. Even out of the few users who did use the Help function, the directions were unclear. Also, none of the users noticed the physical user manual located at the bottom side of the copier machine (Figure 14). The location of where the user manual is not in viewing sight for the users. Therefore, the Help function and user manual did not serve its purpose of helping the users when they cannot figure out how to do certain tasks.



Figure 14

B. Other Observations

When the users were doing the task of changing the image quality to the lightest setting, they came across a misleading affordance of an underlined text with a circular button. Users touched the underlined text with a circular button thinking it would move to the next display mode (Figure 15). However, nothing happened. The users touched it more than once until they realized that they have to touch the image box next to the underlined text with a circular button to move on to the next display mode. The recommendation is to either integrate the underlined text with the circular button or outline around entire option and allow it to be clickable.



Figure 15

All of the users assumed that the default setting for output size was to print out a 8.5” x 11” page. However, they did not that the copier machine detects the size of the paper placed in the machine and prints out the actual size of that document. The users finally realized their misconception when they went to print. This is a knowledge-based error because the users are overconfident with their knowledge of the default settings.

C. Tradeoff between Knowledge in the World and in the Head

There are tradeoffs between knowledge of the world and in the head. Knowledge of the world has visual cues and natural mappings that allow users to retrieve the information, process

the information, and understand how things work in the world. Knowledge in the head is learning the information and figuring out how to do things based on memory. Therefore, there are some tradeoffs between these two. The users can easily retrieve whenever information is visible or audible. Users do not need to learn how to use it, but they have to heavily rely on interpreting the visible cues and natural mappings to figure out how things work. Also, the efficiency of using things is slowed down because the users need time to interpret the information instead of doing things immediately based on memory. However, the ease of use is very high with information in the world rather than in head. If there is a lot of information that needs to be maintain, then aesthetic and clutter are the tradeoffs to have information in the world. Since there is a lot of visual information from the interface of the copier machine, the user rely more on knowledge of the world than in the head. Many of the errors or issues that they came across are tradeoffs when they were interpreting the information and figuring out how the functions work (Norman, p.79-80).

VI. Metrics

Figure 16 below is a chart of the average ratings for the ease of completing each task. What's interesting here is that tasks 2 and 6 seemed to be relatively more difficult, which were printing a two-sided copy and shrinking a two-sided layout into one page, respectively. On this chart, 1 represents very difficult and 10 is very easy.

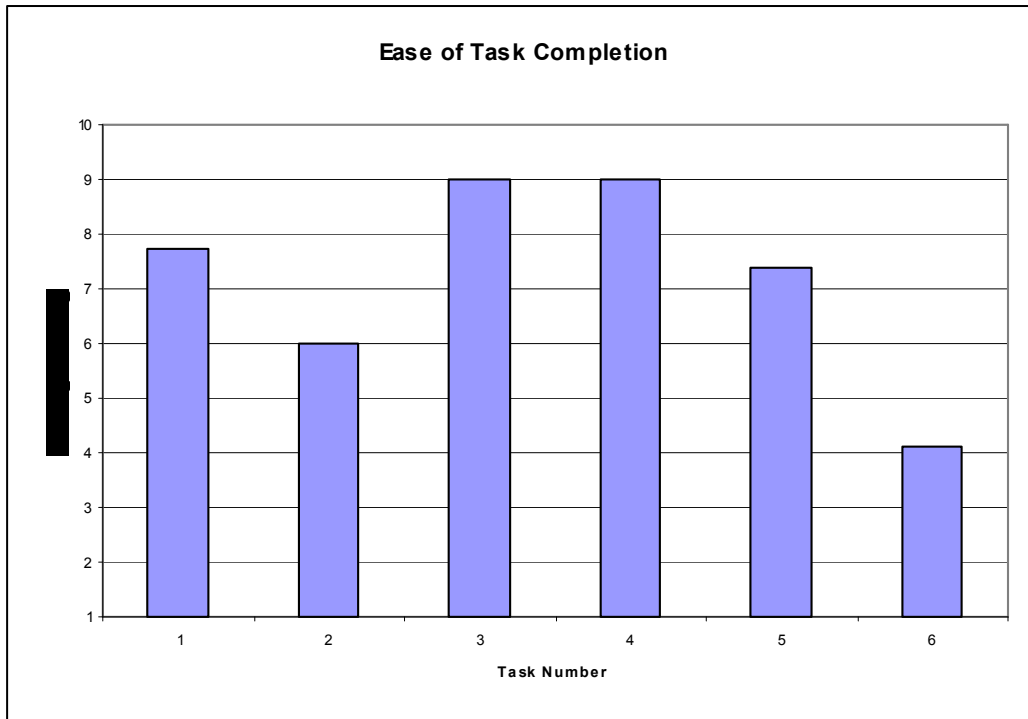


Figure 16

Figure 17 below is a table of the satisfaction of the time it took to complete each task. We did not actually time our users while completing the tasks, because they were talking and we were asking them questions at the same time. This table illustrates the satisfaction of the perceived time that they took to complete the task. Task 6 (shrinking two sides into one page) seemed to be the least satisfactory in terms of how long it took them to complete the task. On this chart, 1 is not satisfied at all and 10 is very satisfied.

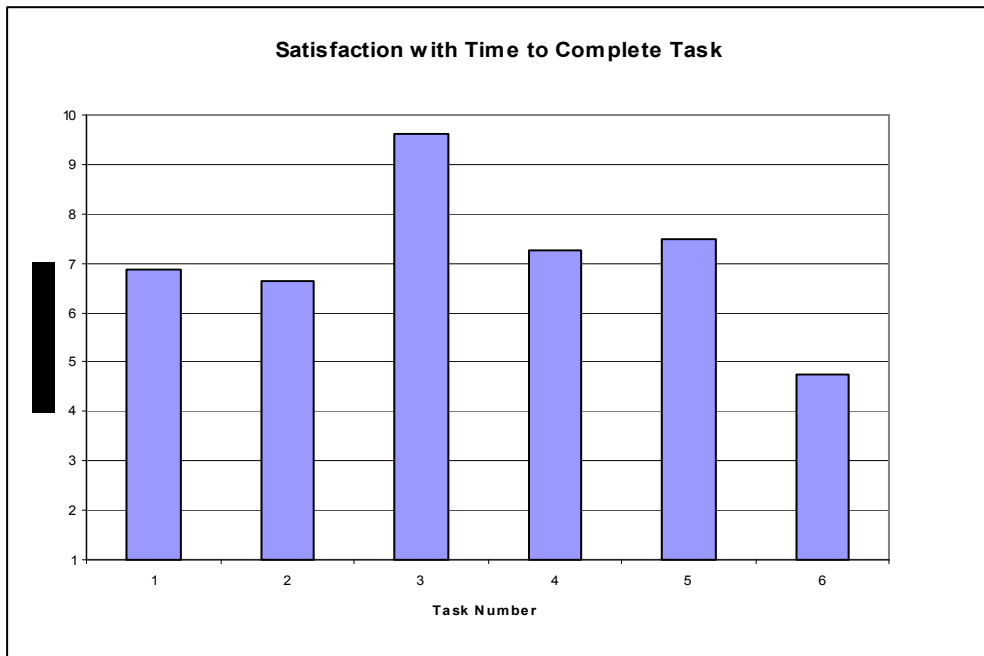


Figure 17

Figure 18 is a table of the users' confidence level of performing the task correctly.

What's interesting here is that generally, once they figured out how to complete the task they were pretty confident that they did it correctly. The task that seemed to generate less confidence was task 6, which was shrinking two sides into one page. On this chart, 1 is not confident at all and 10 is very confident.

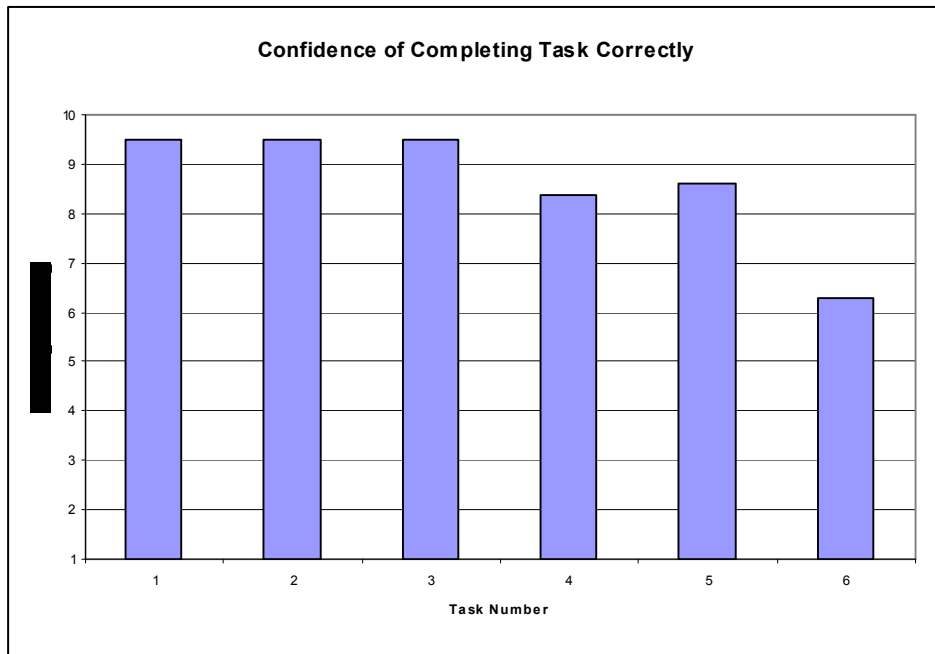


Figure 18

Figure 19 below is a chart of the overall ease of use of the photocopier machine, which was asked after they had completed all the tasks. On this chart, 1 is very difficult and 10 is very easy. The average was 6.625.

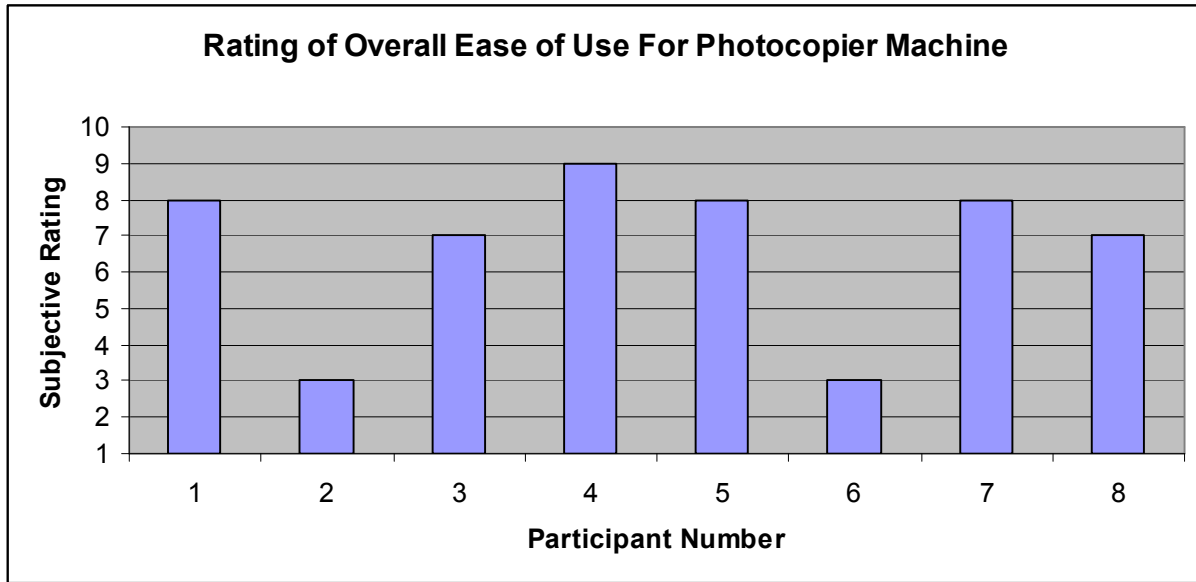


Figure 19

VII. Conclusions

According to Norman, errors should never happen in the first place. The many usability issues which caused errors are indicative that the Xerox® photocopier needs improvement. Many of these issues could be corrected by the users receiving feedback of their actions. While the photocopier is capable of many functions, the design did not take into account user expectations, abilities, and knowledge. By improving the current user interface, the photocopier will be more user-friendly and the user tasks can be employed more effectively and efficiently.

VIII. Next steps

More future studies are in the next steps in usability evaluation of the copier machine, which are to assess learnability of the device by measuring how effectively our users in this study interact with the photocopier machine. Once the studies are completed and analyzed, the findings will also potentially be presented to Xerox®.

IX. References

Norman, D. (1988). *The Design of Everyday Things*. New York: Basic Books.

Nielsen, J. (2005). Ten Usability Heuristics. Retrieved March 12, 2008, from useit.com Website: http://www.useit.com/papers/heuristic/heuristic_list.html

Reason, J. (n.d.). James Reason's Taxonomy of Errors

X. Appendices

Appendix A: Moderator Script

Imprints Photocopier Machine Usability Study

Moderator Script:

Thank you for agreeing to participate in our study. The study should take approximately 20 – 30 minutes. The goal of the study is to evaluate the usability of the photocopier machine at Imprints. First you will be asked several questions regarding your experience with and thoughts about photocopier machines. Then you'll be asked to perform several tasks with the photocopier machine. You'll be making a few copies, but don't worry, we'll be paying for the expenses.

[administer pre-test questionnaire]

You will now be given six tasks to perform on the photocopier machine. The tasks will be given to you one at a time, and there will be a rating to fill out after each task. As you complete the tasks, please think out loud and let us know what is going through your mind. For example, let us know where you are looking on the display, what you are trying to find, what buttons you want to press, etc. Remember that we are testing the photocopier machine, not you, so please don't be afraid to tell us if you into any confusion or problems. Also let us know if you dislike or like something.

Do you have any questions before we begin?

Tasks:

1. Print out a one-sided copy.
2. Print out a 2-sided copy from two 1-sided sheets.
3. Change the image quality to the lightest setting (but don't print).
4. Change all four borders of the paper to 0.15 inch (but don't print).
5. Set the copy machine to make 2 copies at once (and print out the copies).
6. Shrink two pages into one page (and print out a copy).

[administer post-test questionnaire]

Appendix B: Pre-test Questionnaire

Participant # _____

Previous Knowledge and Expertise

1. How often do you use a photocopier?
 - a. 0-5 times a year
 - b. 5-12 times a year
 - c. 13 + times a year

2. How often have you used the photocopier at Imprints?
 - a. Never. This is my first time.
 - b. 0-5 times a year
 - c. 5-12 times year
 - d. 13+ times a year

3. On a scale of 1-10, please rate your overall skill with photocopier machines.

	<u>Beginner</u>			<u>Average</u>				<u>Expert</u>		
Skill Level:	1	2	3	4	5	6	7	8	9	10

4. What kinds of tasks do you use a photocopier for?

5. On a scale of 1-10, please rate how comfortable you are with using photocopier machines.

	<u>Not comfortable at all</u>			<u>Average</u>				<u>Very comfortable</u>		
Comfort Level:	1	2	3	4	5	6	7	8	9	10

6. What kinds of problems have you encountered before while using photocopier machines? How do you feel generally about photocopiers?

Initial Impression

1. On a scale of 1-10, please rate how easy the photocopier appears to use?

	<u>Very Difficult</u>			<u>Average</u>				<u>Very Easy</u>		
Difficulty:	1	2	3	4	5	6	7	8	9	10

2. Estimate the amount of time you will spend interacting with the photocopier to complete each task.

- a) Print out a one-sided copy. _____
- b) Print out a 2-sided copy from two 1-sided sheets. _____
- c) Change the image quality to the lightest setting (but don't print). _____
- d) Change all four borders of the paper to 0.15 inch (but don't print). _____
- e) Set the copy machine to make 3 copies at once (and print out the copies). _____
- f) Shrink two pages into one page (and print out a copy). _____

3. Do you believe that the photocopier will use understandable terminology?

Appendix C: Task Ratings

Please fill out these ratings for each task.

Task 1: Print out a one-sided copy.

Please rate the ease of completing this task.

	<u>Very Difficult</u>				<u>Average</u>				<u>Very Easy</u>	
Difficulty:	1	2	3	4	5	6	7	8	9	10

Please rate the satisfaction of the *time* it took to complete this task.

	<u>Not satisfied at all</u>				<u>Average</u>				<u>Very satisfied</u>	
Satisfaction:	1	2	3	4	5	6	7	8	9	10

How confident are you that you completed this task correctly?

	<u>Not confident at all</u>				<u>Average</u>				<u>Very Confident</u>	
Difficulty:	1	2	3	4	5	6	7	8	9	10

Task 2: Print out a 2-sided copy from two 1-sided sheets.

Please rate the ease of completing this task.

	<u>Very Difficult</u>				<u>Average</u>				<u>Very Easy</u>	
Difficulty:	1	2	3	4	5	6	7	8	9	10

Please rate the satisfaction of the *time* it took to complete this task.

	<u>Not satisfied at all</u>				<u>Average</u>				<u>Very satisfied</u>	
Satisfaction:	1	2	3	4	5	6	7	8	9	10

How confident are you that you completed this task correctly?

	<u>Not confident at all</u>				<u>Average</u>				<u>Very Confident</u>	
Difficulty:	1	2	3	4	5	6	7	8	9	10

Task 3: Change the image quality to the lightest setting (but don't print).

Please rate the ease of completing this task.

	<u>Very Difficult</u>			<u>Average</u>				<u>Very Easy</u>		
Difficulty:	1	2	3	4	5	6	7	8	9	10

Please rate the satisfaction of the *time* it took to complete this task.

	<u>Not satisfied at all</u>			<u>Average</u>				<u>Very satisfied</u>		
Satisfaction:	1	2	3	4	5	6	7	8	9	10

How confident are you that you completed this task correctly?

	<u>Not confident at all</u>			<u>Average</u>				<u>Very Confident</u>		
Difficulty:	1	2	3	4	5	6	7	8	9	10

Task 4: Change all four borders of the paper to 0.15 inch (but don't print).

Please rate the ease of completing this task.

	<u>Very Difficult</u>			<u>Average</u>				<u>Very Easy</u>		
Difficulty:	1	2	3	4	5	6	7	8	9	10

Please rate the satisfaction of the *time* it took to complete this task.

	<u>Not satisfied at all</u>			<u>Average</u>				<u>Very satisfied</u>		
Satisfaction:	1	2	3	4	5	6	7	8	9	10

How confident are you that you completed this task correctly?

	<u>Not confident at all</u>			<u>Average</u>				<u>Very Confident</u>		
Difficulty:	1	2	3	4	5	6	7	8	9	10

5. Please set the copy machine to make 2 copies at once (and print out the copies).

Please rate the ease of completing this task.

	<u>Very Difficult</u>				<u>Average</u>				<u>Very Easy</u>	
Difficulty:	1	2	3	4	5	6	7	8	9	10

Please rate the satisfaction of the *time* it took to complete this task.

	<u>Not satisfied at all</u>				<u>Average</u>				<u>Very satisfied</u>	
Satisfaction:	1	2	3	4	5	6	7	8	9	10

How confident are you that you completed this task correctly?

	<u>Not confident at all</u>				<u>Average</u>				<u>Very Confident</u>	
Difficulty:	1	2	3	4	5	6	7	8	9	10

Task 6: Shrink two pages into one page (and print out a copy).

Please rate the ease of completing this task.

	<u>Very Difficult</u>				<u>Average</u>				<u>Very Easy</u>	
Difficulty:	1	2	3	4	5	6	7	8	9	10

Please rate the satisfaction of the *time* it took to complete this task.

	<u>Not satisfied at all</u>				<u>Average</u>				<u>Very satisfied</u>	
Satisfaction:	1	2	3	4	5	6	7	8	9	10

How confident are you that you completed this task correctly?

	<u>Not confident at all</u>				<u>Average</u>				<u>Very Confident</u>	
Difficulty:	1	2	3	4	5	6	7	8	9	10

Appendix D: Post-test Questionnaire

Please rate your overall ease of use for this photocopier machine

	<u>Very difficult</u>				<u>Average</u>					<u>Very easy</u>
Easiness:	1	2	3	4	5	6	7	8	9	10

What did you like most about this photocopier machine?

What did you like least about this photocopier machine?

What would you do to improve this photocopier machine?

Other comments: