University of Victoria - Fall 2021
CSC497 Final Report
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CSC 497 Interdisciplinary Project Final Report

Topic: Personality traits on HCI user interface

1. Introduction

Human-computer interaction (HCI) is a multidisciplinary research field that focuses on the design of computer technology and the interaction between humans and computers [7]. The user interface (UI) is the point where the user interacts with a computer, website, or application. The goal of an effective UI is to make the user's experience simple and intuitive, requiring the user to make the least effort to obtain the greatest desired result [14]. Personality is the different characteristic pattern of thinking, feeling, and behaving between individuals, which influences people's decision-making, interests, preferences, and behaviors [8]. The well-established Big Five Personality traits model was developed from the 1980s onwards in psychological trait theory. It includes extraversion, agreeableness, openness, conscientiousness, and neuroticism [9]. Personality traits provide the human abilities and limitations that can be taken into account in the design of an effective system in technology. Thus, personality becomes a factor in the direction of exploring the interaction of users and the user interfaces. On the one hand, personality traits influence the way people seek information. People who have low emotional stability will easy to give up on information seeking and have difficulties with evaluating the quality and relevance of the information [6]. On the other hand, personality plays a role in interaction with visual metaphors. People who are an extravert, open, and agreeable prefer a decorated visualization of a creature of a user interface [6].

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To explore how personality traits play a role in the interaction of user and digital interface, this research focuses on adding personality traits features to the e-book reading. The e-book is popular in recent years. Its cheaper price and portability make the reader love it. The American Association of Publishers in 2021 reported that e-book sales among their members accounted for 13.7% of sales revenue in August, and e-books make up 21% of total book sales in September [1]. In the study of Daniel and Woody in 2012, they pointed that it has been a long time that higher education has been transformed by digital technologies, such as the Internet, laptop, mobile phones, and electronic books [11]. Thus, we targeted on this popular product in our research. Kindle is one of the most popular e-book products. It is a series of e-readers designed and marketed by Amazon. Users can browse, buy, download, and read e-books, newspapers, magazines, and other digital media via wireless networking. It supports iOS, Android, Mac and PC [15]. In order to understand whether personality traits can provide better communication between users and the digital interface, this research has chosen the Kindle iOS software application for the case study. Specifically, we designed and added personality trait features to the existing software interface. We took the Big-Five personality test as a reference, allowing users to take a self-questionnaire on their personality. The system will provide a personalized reading mode based on the user's result. The personalized reading mode changes the colour, layout, navigation, and commenting features of the reading page. The participants in this research took the cognitive walkthrough of the new features. The main goal of this research is to investigate whether the personality trait features can improve user's satisfaction with reading e-books, which can explore our hypothesis about whether personality traits play a role in the HCI user interface.

2. Related Works

Since the goal of this research is to explore how the personality traits will take a role in the HCI, we decided to add new personality trait features to the existing user interface on Kindle iOS. Kindle iOS is one of the most popular products of e-books readers. It has a large amount users and it is a well-used consumer tool. Its thorough and completed system is one of the reasons we chose it for the case study, which can reduce the other functional concerns in the project. Thus, the other thing we should be concerned about is surveying the previous studies to help us understand the relationship among personality, colour, layout, navigation, and commenting features of the user interface.

Extraversion is defined as a trait of excitability, sociability, talkativeness, and emotional expressiveness [16]. People who are high in extraversion are full of energy and enjoy engaging with the external world [17]. In the study of Choungourian in 1967 indicated that people who are extravert prefer warm colors [18]. From the research of Rider in 2010, he stated that extravert people prefer low brightness and a mix of saturated and unsaturated colors but a higher contrast in colors [19]. The study of Kim and his colleagues investigated extraversion/introversion using the user interface from depth-first or breadth-first structured learning. The results showed that extraverts prefer the first establish a conceptual overview before getting into the details. Thus, they are more fit in the breadth-first strategy [20]. Extraverts as high information seekers are more purposeful in terms of information needs. They are found to actively use, share, and exchange information to the greatest extent [21]. Extraverts are motivated by goal-oriented and instrumental use of the internet services such as sharing information and music [22]. They tend to use

information and comments as a platform for expressing opinions and sharing knowledge and information [23].

Openness trait is defined as imaginative, curious, and open-minded [16]. People who are high in this trait tend to have a wide range of interests and are eager to learn new things [17]. In the study of Ferweda in 2016 stated that people who score high in openness prefer to color with low brightness [24]. Another study by De Raad and Schouwenburg in 1996 showed that people who had a positive search motivation use diverse methods when seeking information, and use the largest range of sources were found to be openness trait of personality [25]. They are also found to be very satisfied when they are seeking information and solved most of the obstacles on their way [21]. The individuals who are high in openness use the Internet as a platform to gain new insight by tapping into the great variety of information and services online [23]. For individuals who are highly open, the changes in the user interface of familiar sites will be met with their exploration and curiosity if there is a new version of the site was provided to them, which may make them highly likely to comment on the latest technological advances [27].

Agreeableness is defined as trust, kindness, and affection [16]. Agreeable people are friendly, warm, and most of the time get along with others [17]. In the study of Ferwerda and his colleagues pointed out that people who score high in agreeableness prefer moderate colours which are neither too dark, nor too bright [24]. Individuals with high agreeability tend to seek cooperation rather than competition, and tend to avoid conflicts in social interactions [28]. Such individuals are characterized by cooperation, strong community cohesion and a user-friendly interface facilitating online contributions [29]. Halder, *et al.* in 2010 indicated that people who have high agreeableness traits are passionate with information seeking. They were found to be very diverse

in search patterns and used the information obtained more frequently [30]. Jones, Ravid, and Rafaeli in 2004 investigated that highly agreeable people often participate in online political discussions, especially in forums where there is almost no anonymity, in order to avoid potential conflicts caused by criticism and disputes [31].

Conscientiousness is defined as a high level of thoughtfulness, good impulse control, and goal-directed behaviors [16]. People who are high conscientious have a high level of self-discipline. They are responsible and they like to follow a plan and regulate their impulses [17]. From the study of Ferweda in 2016, he indicated that people who have high scores in conscientiousness prefer a mix of saturated and unsaturated colors [24]. In the research of Halder, Roy, and Chakraborty in 2010, they investigated that the quality of conscientiousness is very helpful for individuals seeking positive information [30]. Highly responsible people are found to be high information seekers. Because of their responsibility and high level self-discipline, they feel less obstructed when searching for information [30]. Such individuals are more willing to spend time online for academic pursuits or information sharing. They may tend to use the Internet for social interaction comments. For example, they may leave condolences or praise excellent work and personal achievements because this is related to their reliable and disciplined nature [32].

Neuroticism is defined as the trait disposition to experience negative affects, including anger, anxiety, and emotional instability [16]. People who have high neuroticism scores are emotionally reactive. They will have an emotional response to some events that would not affect most people [17]. The study of Ferweda in 2016 indicated that people who have high scores in neuroticism prefer high brightness in color [24]. Alves *et al.* did a review study of incorporating personality in user interface design, they stated that participants who have high scores in

neuroticism are generally performed better on search tasks with visual interfaces [33]. In the research of Heinstrom in 2013, he pointed out that people who are high neuroticism scores are found to be negatively correlated with the dimensions of information-seeking behavior compared to people with low scores on neuroticism [21]. They tend to be more attentive to problem-solving tasks up to a certain level of complexity [21]. People with a high neuroticism score showed less intention to participate in online group discussions, such as in forums, which may be due to the high level of anxiety and apprehension associated with this feature and the need to avoid criticism or confrontation from the other community members [34].

3. Case Study

3.1 Software: Kindle iOS

The research had decided Kindle iOS software application as the research basis for our case study. We designed and added the personality trait features to the existing user interface. The system will base on user's the big-five personality questionnaire to recommend a reading mode when they read the e-book. The reading mode includes the changes in background colour, the layout of the reading page, navigation, and commenting features. The application version that we used is 6.47.1, and the prototype model is iPhoneXs in version 15.0.2.

3.2 Self Questionnaire BFI-10

The research used the BFI-10 Personality Questionnaire. The BFI-10 is a 10-item scale measuring the Big Five personality traits Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness. It is an open-access instrument that can be used for non-commercial research. The scale was developed based on the 44-item Big Five Inventory (BFI-44;

John, Donahue, & Kentle, 1991; Rammstedt, 1997) and designed for contexts in which respondents' time is severely limited. Test-retest correlations suggest acceptable reliability. Correlations with other Big Five instruments, correlations between self and peer ratings, and associations with sociodemographic variables suggest good validities of the BFI-10 scores [10]. The reason why this research took it as the reference for the self-questionnaire is that ten questions are fit a reasonable time for the users to finish the questionnaire, and it is accurate for the final personality result.

3.3 Persona

The big-five personality traits are extraversion, agreeableness, openness, conscientiousness, and neuroticism. We created six personas based on their definition include each trait and a combination of two of them.

James is a 43 years old businessman. He loves to talk and socialize with people. He also is a good decision-maker. He is new to using the Kindle iOS software application. He is a more visual person, who likes to read charts or graphs (dislike text). He figures out that he prefers to see more icons on the navigation of the reading page. This persona is defined as the extraversion personality trait.

Kelly is a 32 years administrative assistant. She likes working in a team and helping with her colleagues. Kelly likes to read Romance novels and loves to leave comments and discuss with other readers. She hopes to join in the discussion when she reads e-books. This persona is defined as the agreeableness personality trait.

Charlie is a 23 years old college student. She loves trying new things and is passionate about the arts. She likes to read fiction. She has been using Kindle iOS to read books for a couple

of months but she thinks sometimes doesn't know what color of the background is best for her when she is reading e-books. This persona is defined as the openness personality trait.

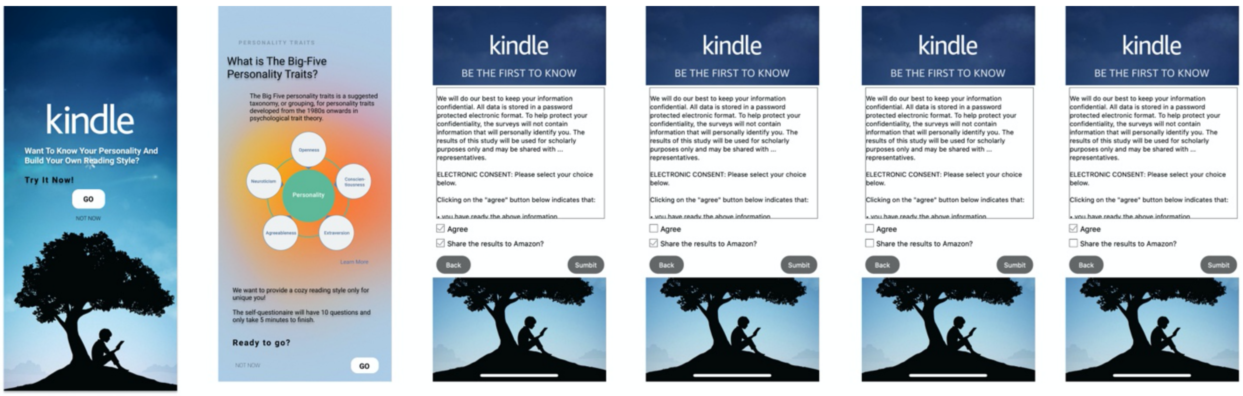
Linda is 55 years old. She is a registered nurse working at the hospital. She likes to read journals and newly published researches. She hopes to have a reading target or goals when she reads e-books. Also, she wants to read fewer lines on one page but with larger font size. This persona is defined as the conscientiousness personality trait.

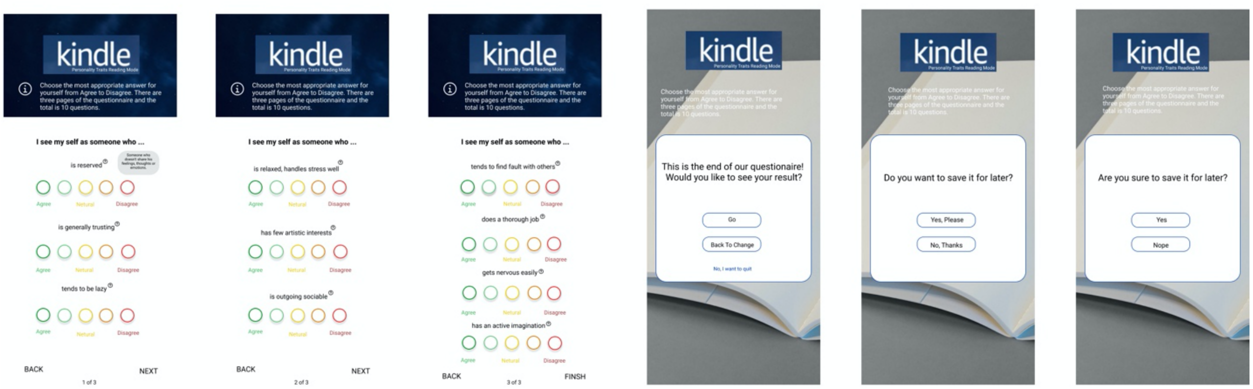
Eric is a 16 years old high school student. He loves to read comics. He prefers e-books rather than paper books. He found himself is hard to stay focused on reading. He hopes for a better way to keep his emotions stable and focus on reading for a longer time. This persona is defined as the neuroticism personality trait.

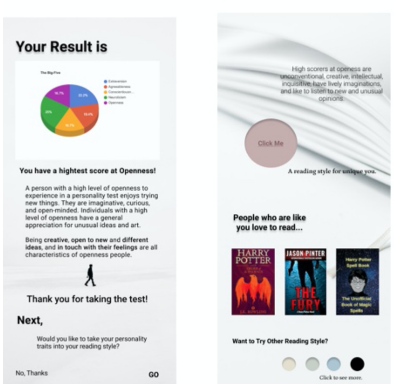
Simon is a 28 years old software developer. He has many hobbies, such as camping, diving, painting, and also reading. He likes reading e-books because it is easy to carry. He has been using kindle for many years and he is curious to recommend books based on his personality in the system. This persona is defined as a combination of the extraversion personality trait and the openness personality trait.

3.4 Prototype

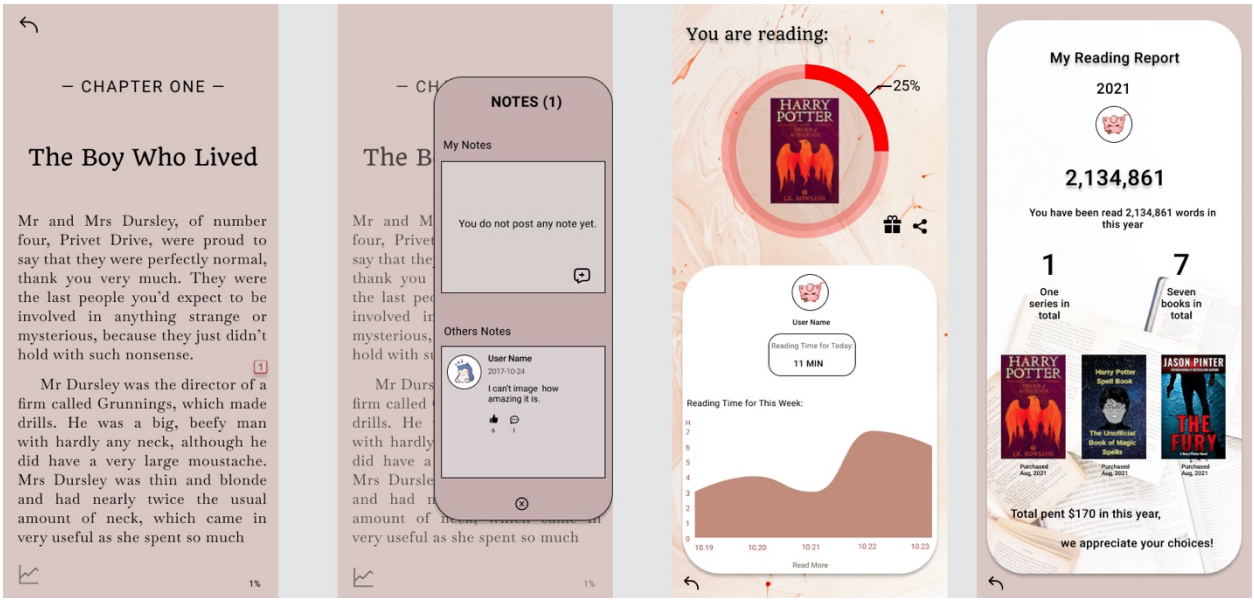
3.4.1 Introduction & Questionnaire



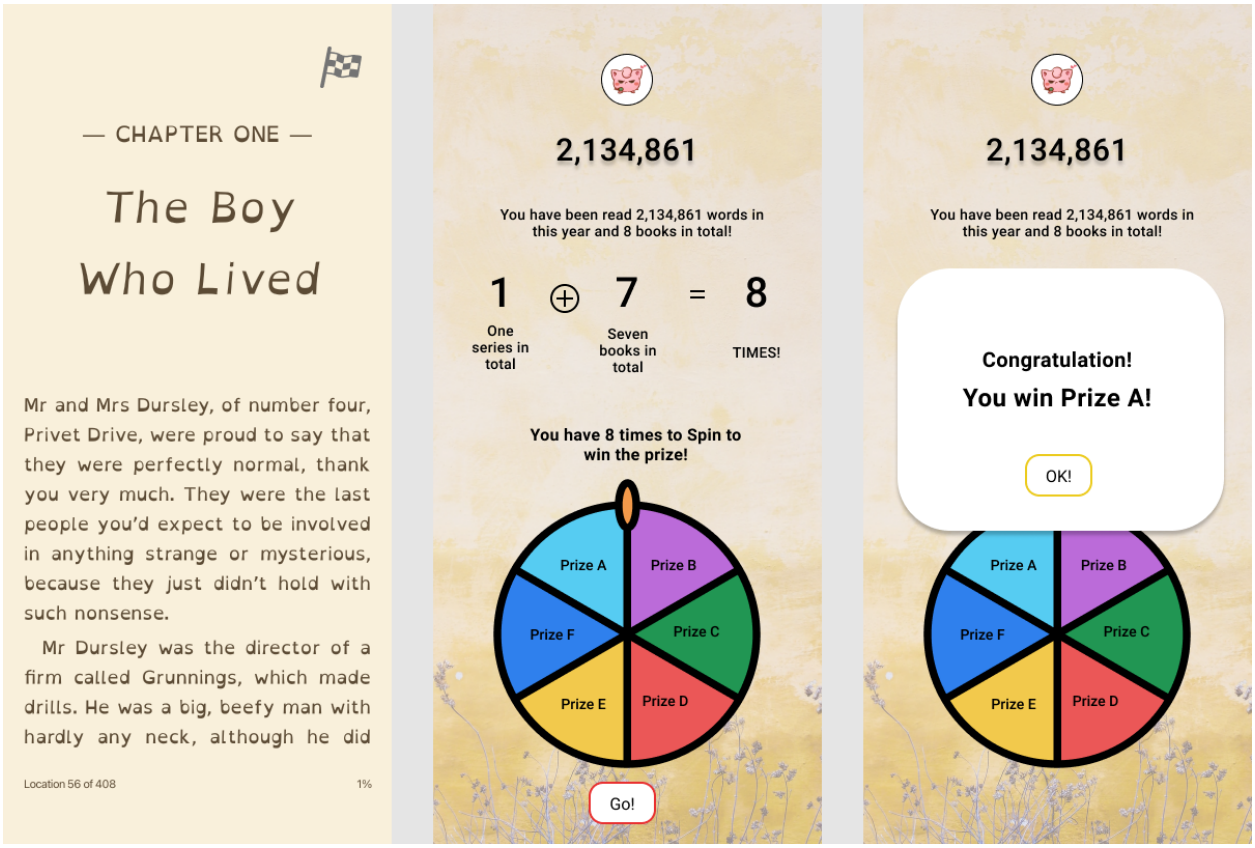




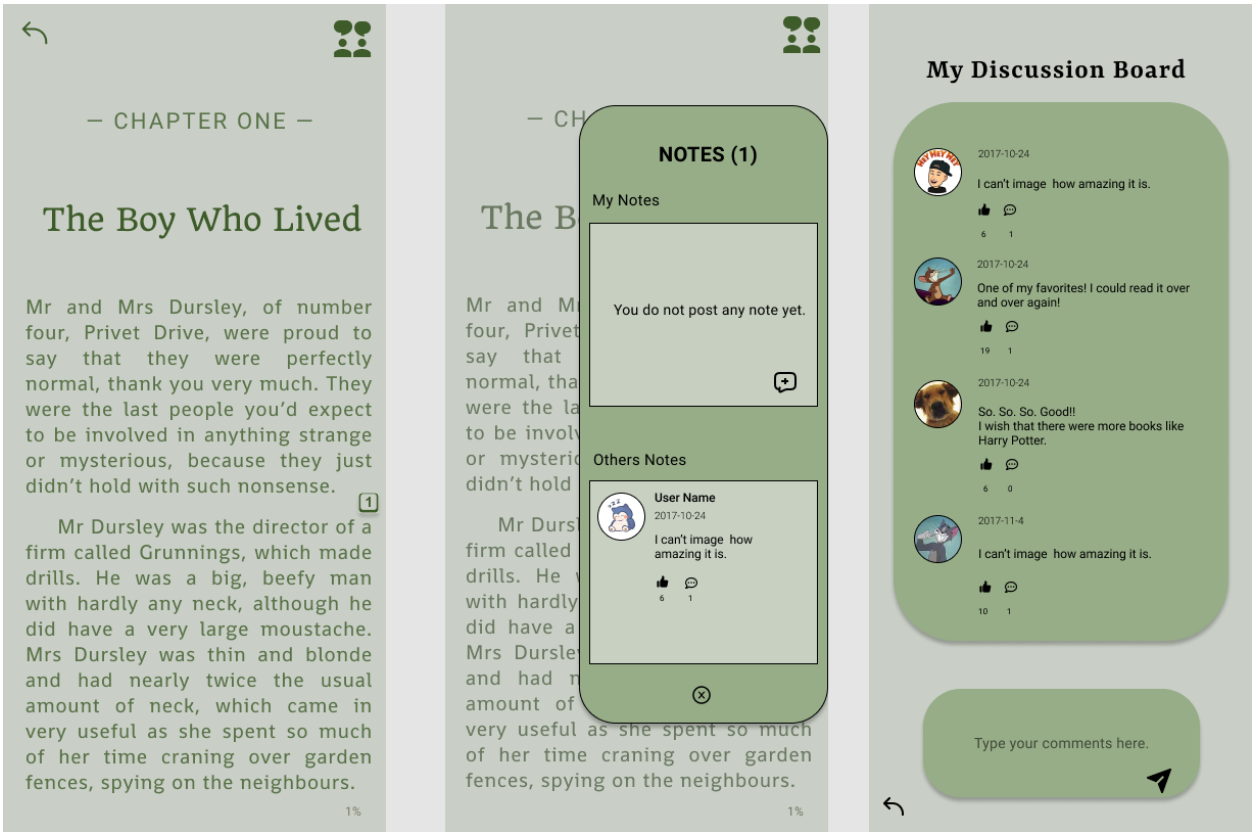
3.4.2 Extraversion Recommended Mode



3.4.3 Openness Recommended Mode

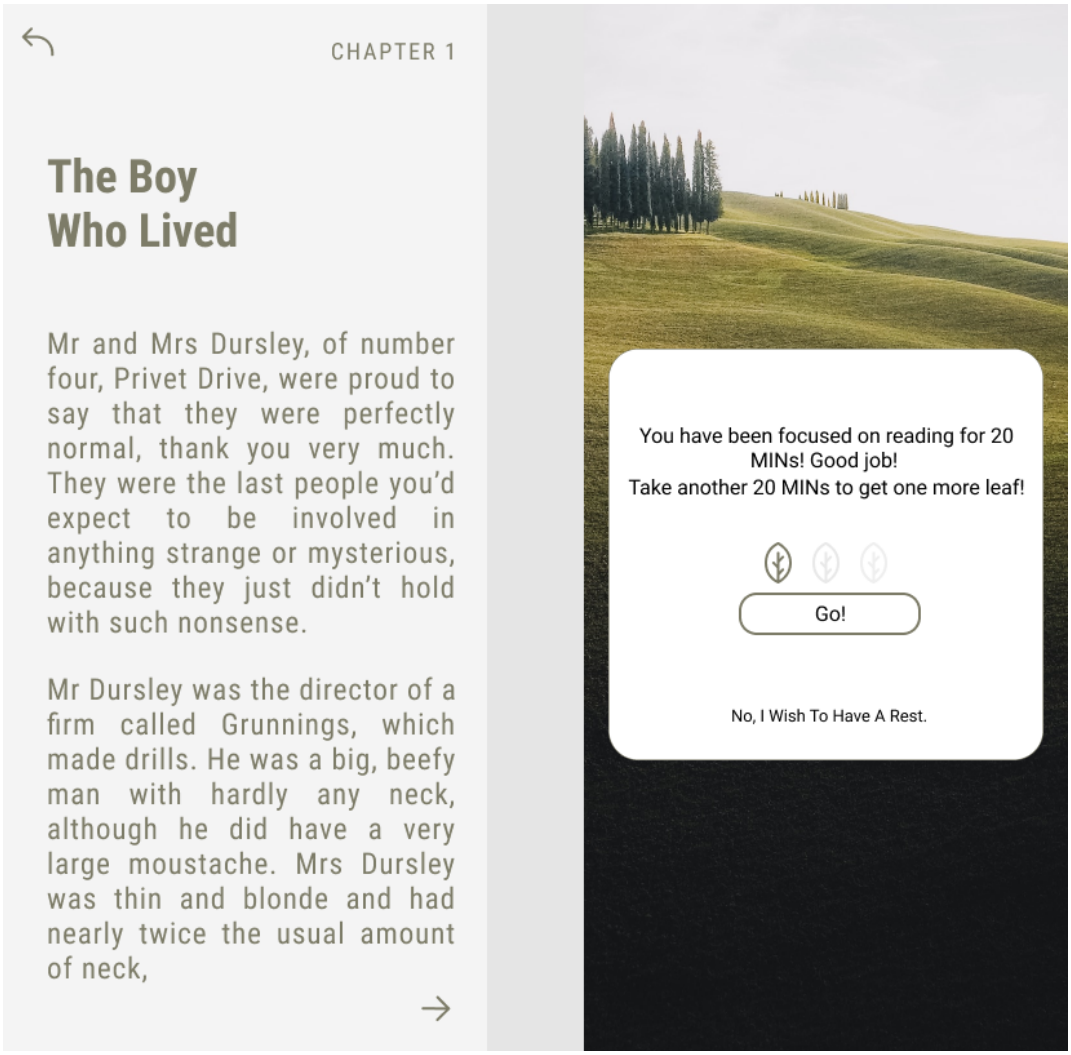


3.4.3 Agreeableness Recommended Mode



3.4.4 Conscientiousness Recommended Mode

3.4.5 Neuroticism Recommended Mode



3.4.6 Prototype Demo Video

https://youtu.be/PJPzn2yJpfY

4. Cognitive Walkthrough

4.1 Cognitive Walkthrough One

The first walkthrough's participant has no experience with Kindle iOS before. The first goal of this cognitive walkthrough was to read the introduction of the new personality feature. The

participant was successfully done with the task of reading the introduction, filling in the consent form, and filling in the questionnaire. After finishing the questionnaire, he was successfully going to the result page and recommendation page. The second goal was to try the first recommend mode, including the tasks of looking for the visualization board, and looking for the note panel. The task of looking for the visualization board was solved completely. The participant can easily find the icon of the visualization board and he noticed the additional function "Read More" in the board. However, he mentioned that the font size of the "Read More" button is too small to notice at the first read. After clicking on the "Read More" button, he was satisfied with the reading report on the "Read More" page but he was confused with the total words number that the user read this year on the reading report page. He suggested that the words of user read can be changed to a summary format, such as the words you read this year has the distance from Canada to America. The task of looking for the note panel was solved successfully. The third goal was to try the second recommend mode, including the tasks of looking for the prize board and spinning the wheel. He had done the task greatly, one suggestion from him was the "⊕" sign on the page is quite confused to him. The fourth goal was to try the third recommend mode which the task is looking for the discussion board. He was successfully done the task and back to the recommended page. The fifth goal was to try the fourth recommended mode, including the tasks of looking for the set goal board, manually marking and un-marking the checkbox, and resetting the finish day Nov 19th as Nov 20th. He was done with the three tasks but the task of reset date was set by double-tap to change but he was expected one tap to finish the resetting date. The last goal was to try the fifth recommend mode which task is to try the focused mode, and the task was successfully solved. Overall, the user

finished all tasks successfully. He suggested that the return button should be in the same position would be more understandable.

4.2 Cognitive Walkthrough Two

The second walkthrough's participant has been using Kindle iOS for almost four months. Her first goal of this cognitive walkthrough was to read the introduction of the new personality feature. She was done with the task of reading the introduction, filling in the consent form, and filling in the questionnaire. However, she felt hard to distinguish the checkbox of the consent form page is checked or not. After finishing the questionnaire, she was successfully going to the result page and recommendation page but she was stuck at the recommendation page. She said the "Click me" button was confused to her. She did not understand the intention of the "Click Me" button and where the page will go. The second goal was to try the first recommend mode, including the tasks of looking for the visualization board, and looking for the note panel. She finished the task of looking for the visualization board but she was hesitant to click the icon of the visualization board and spent some time adapting this reading page. She said that it was hard to find the additional function "Read More" and the font size and font color of the "Read More" button is hard to notice. After clicking on the "Read More" button, she was satisfied with the reading report and the notes panel. After trying the first recommended mode, she was done faster and easier on the upcoming recommend page. The third goal was to try the second recommend mode, including the tasks of looking for the prize board and spinning the wheel. She had done the task greatly. The fourth goal was to try the third recommend mode which the task is looking for the discussion board. She was successfully done the task and back to the recommended page. The fifth goal was to try the fourth recommend mode, including the tasks of looking for the set goal board, manually marking and un-

marking the checkbox, and resetting the finish day Nov 19th as Nov 20th. She was done with the three tasks but the task of reset date was set by double-tap to change but she was expected one tap to finish the task. The last goal was to try the fifth recommend mode which task is to try the focused mode, and the task was successfully solved. Overall, the user finished all tasks but she needs some time to adapt each page and read instructions. She suggested that some word's color and button colors are too close which results in hard reading.

4.3 Cognitive Walkthrough Three

The third walkthrough's participant has no experience of using Kindle iOS before. The first goal of this cognitive walkthrough was to read the introduction of the new personality feature. He was done with the task of reading the introduction, filling the consent form, and filling in the questionnaire successfully. After finishing the questionnaire, he was successfully going to the result page and recommendation page. The second goal was to try the first recommend mode, including the tasks of looking for the visualization board, and looking for the note panel. He had found the first recommended page button but he was hesitant to click the button. After going to the first recommended page, he had successfully solved two tasks and the additional function "Read More". The third goal was to try the second recommend mode, including the tasks of looking for the prize board and spinning the wheel. He had done the task greatly. The fourth goal was to try the third recommend mode which the task is looking for the discussion board. He was successfully done the task and back to the recommended page. After being done with the first three reading recommend modes, he spent a shorter time finishing the tasks. The fifth goal was to try the fourth recommend mode, including the tasks of looking for the set goal board, manually marking and un-marking the checkbox, and resetting the finish day Nov 19th as Nov 20th. He was

done with the tasks successfully but he expected to tap the calendar icon to reset the finish day instead of the “Reset” button below the icon. The last goal was to try the fifth recommend mode which task is to try the focused mode, and the task was successfully solved. Overall, the user finished all tasks successfully and he mentioned that he prefers to click icons rather than the button with words due to his subconscious.

5. Results

The three cognitive walkthroughs were done completely. The goals and tasks are almost successfully solved. The participants are all successfully done with the first goal "Read the new feature introduction". Two of the participants spent a couple of minutes finishing the second goal “Try the first recommended mode - Extraversion”, and one of them asked for instructions on the step of going to the recommended page. Three participants all mentioned the font size and font color in the extraversion reading mode of the “Read More” button is hard to read. On the additional function of “Read More” page, one participant suggested the words amount of user read can be changed to a summary format, such as the words you read this year has the distance from Canada to America. The third goal “Try the second recommended mode – Openness” and the fourth goal “Try the third recommended mode – Agreeableness” were done greatly. For the fifth goal “Try the fourth recommended mode – Conscientiousness”, two of the participants had trouble with the task of reset date. They expected to tap once on the calendar to finish the task instead of tap twice. At the same task, one of the participants expected to tap the icon to reset the date instead of the reset button below the icon. The last goal “Try the fifth recommended mode – Neuroticism” was done successfully by all participants. Moreover, two of the participants spent more time on the second

goal “Try the first recommended mode – Extraversion” and after that, they were faster on the upcoming recommended mode. Thus, it shows that some users may need some time to adapt to the new features. A tutorial or instructions can be provided to users at the first demo of the recommended mode. In addition, one participant mentioned that if the return button positions are unified would be better.

6. Discussion

The results showed that the cognitive walkthroughs bring suggestable feedbacks from the participants. During the process of the cognitive walkthrough, we found that it may contain some biases in the result. One of the biases in this research was that the participants are all colleges students. The Kindle iOS is face to every age group. Thus, further researches should be targeted other age groups, such as teenagers, adults, and seniors. Moreover, the participants are friends and classmates with the experimenter. It may result in a sampling bias or selection biases. Another bias is the familiar level with the Kindle iOS. Two participants have had no experience with Kindle iOS before, and one participant has been using it for three to four months. We need a wider range of usage time on Kindle iOS. One interesting problem during the cognitive walkthrough is that one of the participants asked for more instructions and represented hesitation in her actions. We infer that one of the reasons could be the limitation of the evaluation on the user interface because some of the functions are not completed. The other interesting problem that we found during the cognitive walkthrough was that some of the responses from participants are due to their experiences of using the other software or application. They assume the same function of each button in this research. Thus, some of their intentions and expectations may come from their

previous experiences. In addition, the big-five personality traits are combined with each other. In this project, we picked the highest score of the five traits for the result. In future studies, a combination of five traits should be considered to deliver a more accurate result.

7. Reflection on Learning

During this project, I have a better understanding of human and computer interaction. Operability, discoverability, simplicity, and learnability are some of the concerns of HCI [35]. The other problem with HCI now is that users are various, their cognitive is diverse. This kind of diversity comes from their different experiences, educational backgrounds, learning skills, and culture, etc. Thus, it is hard to define a good user interface. This diversity of the users is the motivation of this project, which is to provide a personalized user interface to users. However, the results need more data samples to support the hypothesis of personality features on the user interface can improve the satisfaction of users. Personality can be one of the factors for designing the user interface but it should not be a way to distinguish people. Thus, the prototype of this research will also provide selectable options to users for adding the mode by themselves if they prefer. In addition, from this project, I found that personality as the factor to design a personalized user interface is limited. The previous experience could also be the factor that triggers the user's decision.

For the individuals, I expanded my learning skills in user experiences design under the supervision and instruction of Dr. Adam Murray. I have learned Figma and inVision to create the high-fidelity prototype and practice the evaluation method of the cognitive walkthrough. The feedback from the cognitive walkthrough provides me with new ideation and deep reflection on

user experience design. On the one hand, their feedback implied the usability of the prototype and their experience with the interface, which provides me with the parts I should improve and the blind spot of my cognition. On the other hand, I realize the tongue of the instruction on the user interface is very important. The user interface is facing the public. Thus, each situation should be considered ahead, including diversity of culture, limitation of age group, sensitive words, etc. Moreover, predicting the possible actions of the user is also one of the keys to the user interface. I think a user experience designer should protect the users as much as possible to avoid unnecessary errors to the user. In addition, the project brings benefits for my future career. The UX designer is one of my dream jobs after I graduate. The suggestions and advice from Dr. Adam Murray bring me specific plans and thoroughly thinking for my future.

8. Acknowledgement

I would like to express my great appreciation to Dr. Adam Murray for supervising this project and giving valuable suggestions.

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