Exploring the benefits of animation in user interface design

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Abstract

The design of animations in user interface design remains under-studied. The range of possibilities with animations in user interfaces is vast, and the movement can have positive and negative effects in shaping the user experience. This study sets out to explore how animations can be used by interface designers to improve how people interact with applications, especially as they are learning a new system. Through usability tests, we study how to incorporate animation iteratively by testing new interface designs and listening to participants who are invited to contribute their own ideas and suggestions. This study is conducted in a research approach that prioritises practice and it generates three research outcomes: an exegesis, a design portfolio (the artefact) and an annotated portfolio that bridges between these two. The results indicate that animations should be applied based on the task context and users' need, otherwise it can cause a negative user experience.

Keywords: Animation, user interface, usability test, user experience

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Attestation of Authorship

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."

Yutong Zhou

Signature:

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1 Introduction

The number of people with Internet access in 2020 is approaching five billion (Internet World Stats 2020). This suggests a wide diversity of internet users who use a variety of devices and web services across very different contexts and age groups. Such staggering numbers show how valuable it is for a growing number of users to have access to good user interfaces to meet their needs when it comes to using digital technologies. This research project seeks to contribute to the study of user interface design with the idea to explore ways to increase the accessibility and usability of digital products and services for as many people as possible. The aim of this project is to identify how user interfaces can incorporate animation (movement) as a means to improve the design of more inclusive user experiences including by addressing unfamiliarity and disorientation.

This project is inspired by a desire to build more inclusive and more intuitive user experiences, particularly to explore the potential of animations to create more dynamic and smooth user interfaces. Most user interfaces today consist of primarily static elements; this project identifies and sets out to study opportunities to use movement to improve the user experience. If animation has been used in the design of user interfaces, it has mostly been done in ways that cause negative effects on working memory, and it is easy to create navigation problems using animated interface elements. Research has shown some of the challenges caused by using animation in user interfaces, such as, increased cognitive load and the problems to infer the connection between the current and preceding states (Halarewich, 2016). In a small set of iconic cases, animation has been applied masterfully in the design of aesthetically and functionally successful interfaces, showing its potential in this area. However, animation is an interface tool that remains under-studied, so practitioners have limited access to studies that inform their work. Used wisely, animation has shown the potential to help the user understand what is happening before, during, and after the action while they interact with the interface. Animation can also provide visual cues regarding what is happening throughout the action, which can provide users with a sense of confidence and the ability to use their intuition. This study aims to obtain evidence to assist interaction designers in their work based on a better understanding of how animation augments usability.

This paper uses Research through Design (RtD) as its main research methodology, which acts as a mainstay to support the study adapting and applying other research methods, such as, usability testing and participatory design. This thesis is presented in a format named practice-based research. According to the research from Candy (2006), the principle of

conducting practice-based research is to generate knowledge mostly through the practice. Because this thesis adopts an inductive approach to study how animations in user interface (UI) can improve the overall user experience, it applies generative usability tests. The term *generative* indicates that these sessions go beyond simply asking users to evaluate the ideas, as imagined and implemented by the designer. Rather, the participants here are invited to join in as both evaluators and generators of ideas. In addition to studying how participants use the system and accomplish a task, they are also invited to give their feedback, ask questions, and generate alternative design ideas in relation to the use of animations to improve the user interface.

To this end, an interactive prototype application is presented to the participants, allowing them to interact with it and asking them how they would improve specific aspects related to using animations to improve the application. The interactive application provides a platform to collect the data including possible new design ideas from users. This study is informed by the academic literature as well as by the experiences of expert professionals documented in online blogs, forums, and videos as it is considered that both types of sources play an important role to support this type of applied and inductive study. The academic literature offers principles and tools based on systematic studies, while professional practice provides concrete examples and informed commentary on successful and not-so-successful cases of animation that are being used in user interface design. These complementary sources adequately reflect the nature of this project as a practice-based research study where critical thinking as well as reflective methods can be applied in my creative work.

This study produces three research outcomes aligned with practice-based research: the exegesis, a design portfolio (artefact) and an annotated portfolio (Gaver & Bowers, 2012). The decision to include an annotated portfolio was shaped by considering that some key analysis, data, and references cannot be adequately presented in the traditional artefact exegesis outputs. The annotated portfolio connects the creative work with the data, their analysis and the design insights that emerged during the project. It also has the advantage that it presents the interactive design process annotated to interpret each part, to show how the data reveals the design issues, and to present how the design issues are connected to the analysis of the study. The annotated portfolio in this thesis creates the possibility “to capture the situated, multidimensional, and configurational nature of design” (Gaver & Bowers, 2012).

2 Literature Review

Well-designed interfaces elicit positive emotions and provide a positive experience for users to improve usability. Positive emotions not only create a psychological comfort to users, they can also facilitate comprehension of design content (Tettegah & Gartmeier, 2015). Users appreciate products that create a positive feeling, this can directly influence the usability of a product (Heni & Hamam, 2016). User satisfaction, a significant factor in human-computer interaction, is reflected in factors of usefulness and usability in a product (Zhang & Walji, 2011). This type of study tells us that usability is equally determined by functional as well as aesthetically pleasant experiences.

2.1. Animations can be hard to use

Traditionally, most user interfaces are static, which seems to limit more dynamic means to convey information smoothly. However, using animation in interface design has remained difficult in practice, as it can easily be misused and cause negative effects. Wu and Chen (2016) described that sometimes animation in interface design can cut off the working memory without bringing the sense of a positive experience. Users must mentally build up and infer the connection between the current state and the preceding state. Pilgrim (2012) described that users can be lost themselves in an interface which cannot visualize the interrelationships between pages.

Bederson and Boltman (1998) expressed there is an inevitable trade-off between the time for animation and the time for an interactive interface. If the animated transition is too fast, users cannot build a connection, and if the transition is too slow, users may lose patience (Bederson and Boltman,1998). Skytskyi (2018) also mentioned that the time and speed of the animation is crucial to influence user experience. It is difficult to be recognized by users if the animation is too fast and it can bring a sense of delay to users if it is longer than one second (Skytskyi,2018). However, the time and speed can be changeable if the screen size is different. For example, the animation's time in a desktop application is longer than a mobile application, due to the fact that the objects need to take a longer path on a desktop than a small screen.

2.2. Animations can be valuable to use

Although animation elements are difficult to use, they have shown potential to improve user experience in the design of interfaces. Fang, Lin and Chu (2019) stated that animation is more useful to convey information than other types in the user interface, such as, text, diagram and image. Chang and Ungar (1993), in their study of animation in the user interface, claimed that

animation could provide a better user experience and emotion, to help the user understand what is happening before, during, and after the action as they interact with the interface. Novick, Rhodes and Wert (2011) described that animation could provide a powerful communication between the user and the interface.

Trapp and Yasmin (2013) discussed that animated transition is crucial to contribute to the user experience. Without it, users cannot visually follow the changes between the previous state of the screen to the new screen. Animation can provide a sort of feedback because the action can be recognised by the system (Laubheimer, 2020). For instance, a drop-down menu can be triggered by users pressing the hamburger menu. The animated transition drop-down menu can inform users the action is achieved. Harley (2014) explained that animation is effective to enhance the users' attention and comprehension. Animation also can keep users from getting lost (Fanguy, 2018). For example, if the animated object moves out of the screen to the downside and goes to the next page, the same animated object should appear on the upside in the next page, to connect the two pages directionally and logically. Animation can provide hints, to provide further interaction, and give feedback based on users' response (Liddle, 2016).

From a technique perspective, the interactive animation can bring a sense of engagement with the data, to encourage users to spend more time to discover further (Dix, Finlay, Abowd, Beale, 2003). Willenskomer (2018) indicated that animation can enhance the usability in a user interface by addressing four factors: 1 expectation, how a user can perceive the function of the objects; 2 continuity, how animation can keep the consistency; 3 narratives, how animation can build an appropriate spatial framework to users; 4 how animation can achieve the relationship between the spatial, temporal and hierarchy structure around the interface objects, to give users a better understanding and help them in terms of decision making. As a result, it is significant to consider how to apply animation to the user interface, and what kind of animation can provide a more positive emotion to users as a way to improve usability, when animations should be applied into the user interface based on the task context? Can animation reinforce the elements in the user interface and also, how animation can cause an attention shift in an appropriate way?

3 Research Methodology

3.1. Research through design methodology (RtD)

This study uses Research through Design where designers connect their practice with research activity. Designers engage with what is referred to as “wicked problems” that contain interdependent factors that are usually incomplete and difficult to define (Zimmerman, Forlizzi & Evenson, 2007). Therefore, a deep understanding of the stakeholders involved, and an innovative approach used by design thinking is necessary to deal with wicked problems. This study applies RtD to bring together various research methods as required by the creative design project, which constitute the ‘backbone’ of the study (Findeli et al., 2008). Since the aim of this project is to explore how animation can be used creatively and effectively to design and build better user experiences, a tangible, practical design workflow needs to be developed and assessed to demonstrate its relevance and value. As a result, this study applies “format 3” defined by AUT as practice-based research.

Practice-based research needs to focus on the research questions and problems, the context of questions and problems, as well as the research objective in order to specify the methods to solve these problems (Candy, 2006). The practice is more like a site of research rather than elucidating a theory. The purpose of the exegesis is to shed light on the relationship between the concepts of design, and the contexts and methodology around the practice-based work.

A design thinking framework was used to structure the creative work in five design stages: empathy, define, ideate, prototype and test. Criteria, such as, effectiveness, efficiency and user satisfaction are used to assess the quality of the design work (Preece et al., 2015). Wayfinding is also a research area that helps guide and evaluate these designs, for instance, it is about how people navigate a physical environment with a sense of orientation (Passini, 1996). As a result, the potential is clear to build a connection between wayfinding and UI design, which can generate a potential idea or solution to help guide this project. As shown in Figure 1 below, the design thinking framework is combined with different research methods in order to form more holistic research outcomes. Each method supports each stage in the design thinking process.

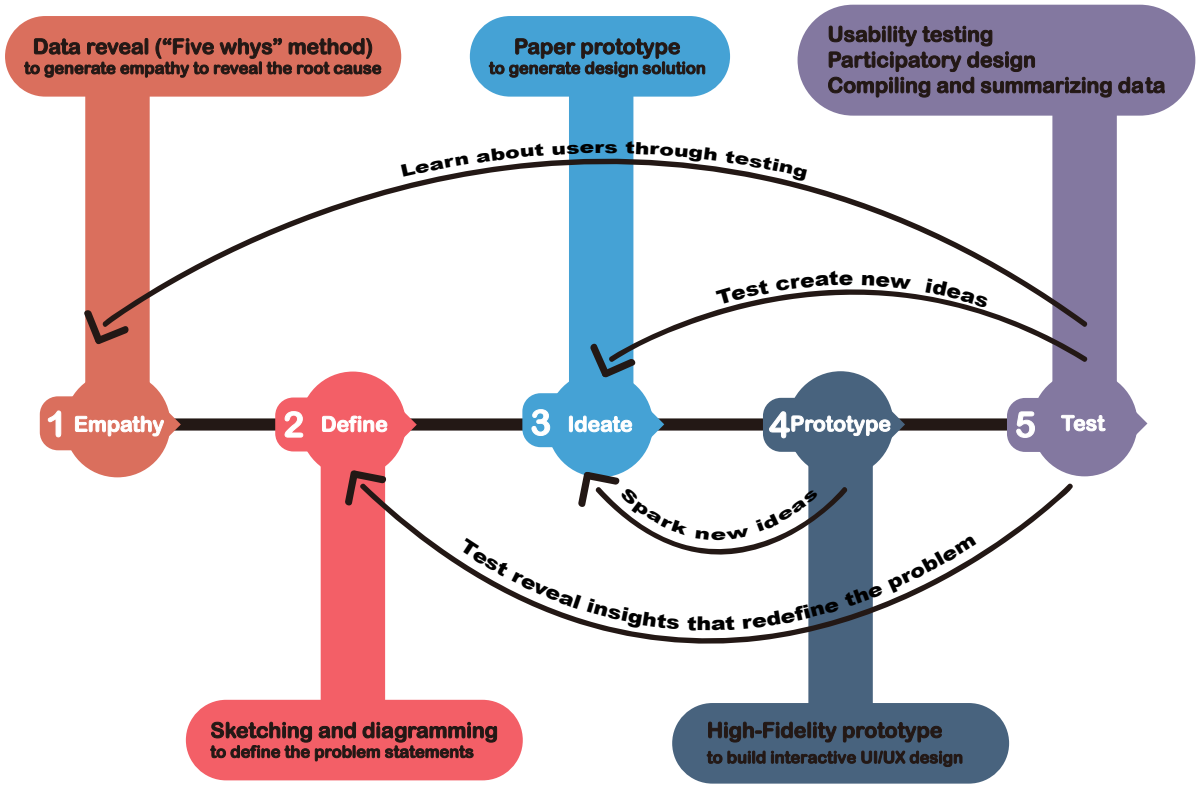

Figure 1

Research methods used in this project structured in a design thinking process

Note: Figure 1 presents how design thinking functioning by adapting five key stages. Each stage connects to others with iterative cycling. Besides, the five stages are supported by different related research methods. For example, data reveal (Five whys method) contribute to form empathy to trace the root cause, which can be analysed in to next define stage where sketching and diagram used as another research method to define the problem statements.

Design thinking is an iterative process that consists of five stages: empathy, define, ideate, prototype and test (Lesson 2.1, Interaction design foundation). These stages do not prescribe a linear process, they suggest an iterative cycling that includes back and forth changes as the project is defined and new ideas reshape both the solutions and our understanding of the problem. Empathy can help designers to define the problems statements, where the problems statements help designers ideate solutions and build prototypes for testing. During the test stage, new ideas can be created by the participants, both by what they do and what they say. Participants can also reveal new insights that help the designer redefine the problem statement and re-engage with ideation and further prototyping.

3.2. Sketching and diagramming

Diagrams and visual annotations can help designers to collect and analyse information, users' requirements and suggestions, insights, design ideas, and so on when applied to the data from existing cases or to the data from usability test sessions. By visualising the data, all of the information can be put together to find the interrelationship, to form holistic problem statements. It is a step-by-step process, that can help designers to create a synthesis of their findings. Diagramming can be crucial to form problem statements based on the data observed by the participant's performance.

3.3. Prototypes

Low-fidelity prototypes are used in the ideate phase in the design thinking process. These are easy, inexpensive and flexible models that are adequate for the early design phases (Hudson, 2019). They can help designers create, modify and evaluate ideas, including a range of UI elements. Paper prototyping is suitable to get feedback because it is sketchy, which means people can feel more comfortable to criticize the sketches than the polished design (Babich, 2020). Paper prototyping is ideal for generating concepts, building navigation and workflow, creating content, setting up a page layout and discovering functionality (Snyder, 2001). Due to its flexibility characteristic, it can generate many ideas and solutions more efficiently to ideate.

However, paper prototypes also have limitations. Babich (2020) expressed that utilising the paper prototype it can be challenging to collect feedback from participants who lack excellent imagination skills. They need to imagine how the future design product will look like based on the current paper prototype. Snyder (2001) mentioned that a paper prototype could not address the technical feasibility. It is possible to create something that it is impossible to achieve in real-time. Also, from the usability test perspective, the interactive mode is limited to the paper prototype. Tap, swipe and other interactive gestures are not easy to simulate with this approach, and animation only is based on the imagination. As a result, the high fidelity, the digital prototype needs to be generated anyway. Digital prototypes are usually used in more advanced phases in the design thinking process. A digital prototype can achieve realistic interactive functionality. While conducting a usability test session, it can provide an end product characteristic to participants, in order to collect the data for a user's performance (Lesson 6.4, Interaction design foundation).

3.4. Usability testing

The usability of a system can be defined as “The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO, the International Organization for Standardization). Usability testing is used to inform the design through collecting data by identifying product deficiencies, in order to ease the design problem and improve profitability (Rubin & Chisnell, 2008). The objective of conducting usability test is to improve a system in four dimensions: 1 ease of use; 2 quality of support; 3 ease of learning; 4 satisfaction (Stoll et al., 2017). So, the question is how to conduct a usability test in this study?

The Usability test is conducted in the early design stage, especially for the formative stage, in order to test whether the preliminary design ideas or concepts are reasonable and effective (Rubin & Chisnell, 2008). For example, suppose the test is about the user interface. In that case, the designers need to focus on the most fundamental and indispensable elements of the user interface in the early stage, such as, how UI supports users’ task with clear goals, how to provide a communication in the workflow, and how to let users navigate from screen to screen with thinking effortlessly. Besides, usability test can also verify designers’ hypothesis in the early and exploratory stage (Rubin & Chisnell, 2008). It includes questions, such as, how easily users can visually capture the button that is animated, to amplify its affordance? In addition, how a user interface is easily used, based on the user’s previous experience? Verifying these hypotheses is valuable, especially if not confident about the testing in the early development stage.

The usability testing follows the principle of iterative testing if the time and budget are available for a small usability study (Barnum, 2020). The iterative testing usually can reveal where the problems come from, on an ongoing basis through the follow-up studies that are conducted repeatedly (Barnum, 2020). For example, usability testing can help designers to build empathy with participants. Then the empathy can contribute to forming problem statements, in order to ideate solutions and build prototypes for future testing. The benefits of iterative testing are that designers can learn from users and make changes based on what they learned, in order to test iteratively. Also, the iterative testing can improve the product visually, as fewer and fewer issues are revealed alongside with the iterative process. In addition, due to its speciality for learning, the co-creator and co-designer mode can be added, where users can contribute to the design process alongside the designers.

Comparison testing is usually applied to compare the different user interfaces, especially for the exploratory stage, to determine which user interface is easier to be used and learned,

and the potential to develop it in the following study (Rubin & Chisnell, 2008). By conducting the comparison testing, a designer can screen out the most valued design. Comparison testing can also be applied with other test methods, such as, iterative testing. For example, designers can learn from users by providing the different UI animation design for the button, such as, whether users feel that button is animated via a bouncing effect if it is easier to be perceived than the button that is animated by zooming in effect. In addition, comparison testing can make the test results more holistic if the usability testing can be conducted both in a laboratory and in the field. This usability test is conducted both in a laboratory and in the field. In the laboratory setting, it can probe participants while they are interacting with the product. It can allow a moderator to give assistance to participants who need support during the test session. As for the field testing, there are unknown situations that may intervene in the testing. One of the usability tests was conducted in a restaurant where people were eating and chatting with each other. The participant performance may be discounted and may not achieve the designer's expectation. Nevertheless, the real-life situation should be considered in this study as users can use a calendar anywhere and anytime. As a result, the comparison test can provide different results in order to form more holistic problem statements in the following design process.

The usability test uses the think-aloud method. May (2019) mentioned that the think-aloud method can gather useful information in real-time while users are interacting with testing devices, which can reveal how users actually use a device. In this process, participants are encouraged to speak out about their feeling, emotion and what they are doing at each moment while their voice can be recorded by a voice recorder. However, thinking aloud has its own limitation. Charters (2003) mentioned Vygotsky's theory for think-aloud methods, indicates that sometimes our thinking cannot be expressed by speaking appropriately, due to the fact that our thoughts are increasingly abstract. This means the verbal expression is not enough to be viewed as the only way to document data. Observation for user's performance should be included in the research as well.

Participatory design is used to design the usability test. Greenbaum and Loi (2012) identify four principles for participation: equalising power relations, situation-based actions, mutual learning, tools and techniques. These are crucial to integrate participants as co-creators and co-designers during usability testing. The participatory design makes sure all participants can engage in decision making and contribute to the group. In order to achieve this, this usability study chooses comparison testing by providing different options, such as, the same button but different animation forms, in order to allow participants to make choices. In this

process, designers should lead participants and give them power to make a decision by using comparison testing methods. By providing a sort of comparison environment, participants can feel more freedom to participate by voice their thoughts as co-creators and active roles to provide more ideas and suggestions in the testing session.

Each participatory design project is highly contextual rather than universal practice (Luck, 2018). For example, one of the various tasks for usability testing is how a button animation can capture users' attention if there are more than three dynamic elements on one page, and can the participant reach the animated button easily with their thumb? If the animation is effective, participants should give a correct response quickly without overthinking. Besides, the designer can ask the participants whether the animation met their expectation before they proceeded to make a decision. Therefore, a participatory approach to user testing requires a situated and specific task requirement.

Mutual learning enables participants to become co-designers and creators by learning from designers about design expertise and related information (Velden & Mörtberg, 2015). Mutual learning can also help designers to understand the user context, user's background and their need. In this process, participants not only provide their opinion, value and suggestion but they also learn themselves (Karasti, 2001). For example, during the test session, users can check whether the design meets their expectation by interacting with the devices. In addition, the mutual learning is also essential to build empathy, so designers will not only be able to understand participants' need, participants can appreciate and respect designers' effort, in order to give more helpful and positive support.

3.5. Data collection

The data collection includes three key resources, video, audio recording and notes. Video recording is extremely useful to document the user's performance as the error analysis. (Rubin and Chisnell, 2008). For example, a participant should press the arrow button to go to the next page in order to finish the UI task, but they press the text box. The video recording can document where, when and how as it relates to user's error performance, which can be used for analysis as the key resources to reveal the design issue (Rubin and Chisnell, 2008). Besides, video recording can be reviewed after the testing session, where the points that notes are not included, the feedback can be found. As for the audio recording, it can clearly document a user's expression during the session. Rubin and Chisnell (2008) clarified that audio recording can even document a user's emotion by documenting their tone, the way of speaking, which may help to uncover the potential issue behind the design. Finally, taking

down a user's performance by notes is important as well. This study uses handwriting to take notes. Compared with digital notes, handwriting doesn't make any typing noise to distract participants (Farrell, 2017). But one thing should be minded that notetaking shouldn't take much time, otherwise it may elude the key feedback during the session.

3.6. Compiling and summarizing data

By the end of the test session, all of the data is compiled into one file, including the audio and video recordings. The handwriting notes are transferred to the digital version later, especially the quotes from participants. This process is helpful for the overall data analysis. Moreover, it can be seen as a checklist to make sure the data matches the problem statements (Rubin and Chisnell, 2008) Each participant's data is summarized into a Word file, which includes the screenshot of the error, quote, and data analysis. Each screenshot contains the error analysis, highlighted by annotations.

3.7. Data reveal ("Five whys" method)

The raw data is transferred to usable data based on the principle from the empathy stage in design thinking. In the empathy stage, using the "five whys method" it is possible to figure out the potential problem statements. For example, a participant should press the arrow button but presses the red frame in the calendar. In the debriefing section, the observer asks the question followed by the principle recommended by the "five whys method".

Observer: "Why you press the red frame rather than the arrow button"

Participant: Because the red frame is more obvious than the arrow button

Observer: "Why it is obvious"

Participant: "The colour is obvious, compared with the arrow button. Also, the location of the red frame can catch my eyes first"

Observer: "How did that location catch your eyes"?

Participant "Because it's in the middle of the screen".

Observer: "Why neglect the arrow button"?

Participant: "Because it's not obvious".

Observer: "Why isn't is obvious"?

Participant: "Because there is no hint to inform users to press".

Based on this model, the reason for error performance is due to the three essential facts, the colour, and the location, and no hints which is called low affordance. But that's not finished.

From the location, it reminds us of the previous page design, where the red frame is the trigger to the next page. So, the fourth reason that the participants may not realize it is the trigger to the next page, is because they have gotten used to pressing it. As a result, the inconsistent design is the cause of the error performance. The five whys methods is an excellent way to trace back where the errors originated. According to the description from IDF (Lesson 3.6, Interaction design foundation), “The Five Whys is an iterative interrogation technique used to uncover the root causes of problems.”

3.8. Think aloud protocol

The think aloud protocol is an excellent way to capture users’ performance in real-time. Massey, Whitehead, Marchant, Polman, and Williams (2020) expressed that the think-aloud protocol can record a user’s cognitive process while keeping its dynamic and complex characteristics. May (2019) mentioned that the think-aloud method could gather useful information in real-time while users are interacting with testing devices, which can reveal how users use a device. In the testing session, users do not need to explain their thoughts. All they need to do is speak their feeling in real-time as usual, as comfortable as possible. However, thinking aloud has a limitation. According to Charters (2003) research from Vygotsky’s theory, the drawback of conducting think-aloud usability test is that people cannot verbally express their thoughts properly sometimes, since their thoughts are increasingly abstract, which means verbal expression needs to be combined with other usability methods to document data. Observation for user’s performance should be included in the research as well, such as, video recording.

3.9. User testing with open-ended questions inviting users to ideate

User testing can be seen as a way of co-designing to the interface. Based on the explanation by Guía, Cazorla and Molina (2017), users play a significant role as the principal instrument in the co-design process. They are welcomed to generate ideas and contribute to the design process. In turn, designers can use these ideas generated by users as sources of inspiration for future work. Also, from the case study for the children-centred design, children take part in the design process through the interview guided by researchers. Researchers encourage them to share their understanding of some design concepts, encouraging them to generate ideas, even include the mock-ups and prototypes (Marti & Bannon 2009). Participants feel that they contribute not only by grading the design ideas but by voicing their own ideas too. As a result, participants and researcher can benefit each other.

3.10. Annotated portfolios as a research outcome

One of the research outputs in this study is called an annotated portfolio (Gaver and Bowers 2012). An annotated portfolio reflects six aspects which can reflect all the design concerns, including functionality, aesthetic, practicalities, motivation, identities or capabilities and socio-political concerns. By showing these aspects through the annotated portfolio, it is intelligible to external evaluators. In some cases, "traditional methodological and theoretical work may jeopardise the possibility for designers to work, due to the inadequacy to capture the situated, multidimensional, and configurational nature of design" (Gaver & Bowers, 2012, p. 42). However, in an annotated portfolio, theories can positively match the practical design work by showing how these theories can match the design problems. Because the design work is a problem-solving focused project, using related theories can be treated like a toolkit to assist the design problems. In addition, usability testing collects data from participants. The annotated portfolio can connect the data, theories analysis and design work consecutively to show how the data reveals the design issue, and how to solve the issue which can be solved by related theoretical analysis.

From the Interaction design foundation discussion (Lesson 1.7, Interaction design foundation), the portfolio should not be a photo album where it includes a various screenshot of the design work. A good portfolio should provide the way the designers approach a problem, how research motivation and background influence the design work, and how to describe the research journey as an ongoing project. It is significant to include why, how and which concepts in the annotated portfolios.

3.11. Practice-based research: value of applying COVID-19 as a practical outcome

Candy and Edmonds (2017, p. 63) define practice-based research as "an original investigation undertaken in order to gain new knowledge partly by means of practice and the outcomes of that practice." It is a kind of experiment to demonstrate the idea inspired by practice. Based on the research from Apple's calendar tutorial, using the existing knowledge to build a new design product can test whether the idea is usable and useful. The motivation for making my own UI is the coronavirus. Covid-19 has swept the globe. I decided that if I can make a short mobile UI animation, focus on how to ensure people are aware about how to protect themselves by using UI animation, too. Based on the content in the Covid-19 app, including how the virus goes into a person's body, how soap helps to resolve the virus, and how to positively stay at home during the quarantine, whether animations can help people understand these processes and change or adapt their behaviour to prevent the spread of the virus.

4 Research Stages

This chapter aims to formalize design stages, specifying research questions and context, generating design outcomes. Unlike the research methodologies chapter addressed by introducing different research methods, this chapter focuses on how to apply these different research methods through the design process.
Figures presented in this chapter are only used for annotations and analysis of existing gaming app rather than designed by the researcher.

4.1. Stage 1: Defining the research scope from UI cases

To develop a better understanding of the use of animation in UI design, an activity of collecting, sorting and analysing existing cases was conducted as the initial stage of this project. Twenty-five cases were selected of UI interfaces including those on websites and mobile applications addressing a wide range of domains and target users: education, game, entertainment, business, lifestyle and so on. A selection criterion for selecting these cases was the frequency of usage, as we wanted to consider user interfaces that are used daily, weekly or occasionally. In the first stages, this analysis focused only on the home page or start page of each application, including a desktop website and mobile platform. In each UI homepage, there are different kinds of icons and elements that contain different functions. This stage of research has to do with comparing the differences and similarities between different apps and websites, to have an early understanding of the way user interface's elements are arranged and how it may influence the animation's form in recent times.

Grammarly
Daily

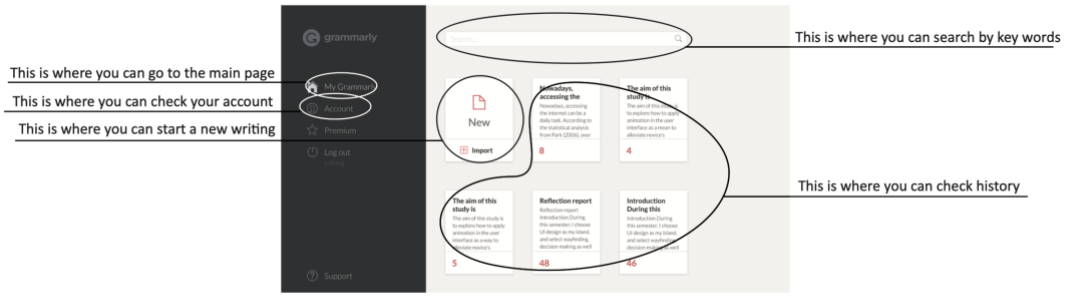

Figure 2

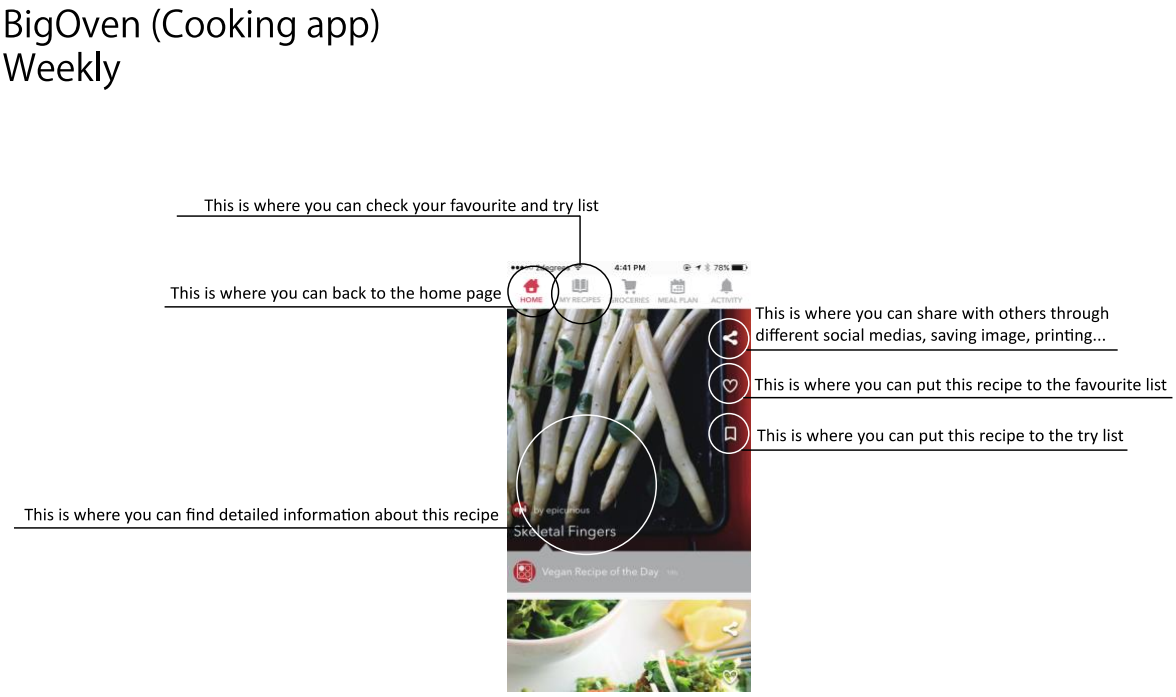

Figure 3

UI analysis for cooking app

The first analysis stage shows that animations in the user interface are not widely used, especially for the home page. Most of the elements on the user interface, such as, the icons or buttons, are static and can only be highlighted by changing colours. Most of the animations on the user interface are function-oriented and straightforward, such as, transited animation for the drop-down menu. However, stage 1 still stays on a preliminary basis. There should be more analysis for every single case, in order to figure out the value and function behind each animation, especially for the different tasks and the context.

4.2. Stage 2: Analysis of cases

In order to compare cases in the same UI category, the analysis of cases was narrowed down to a few sample interfaces including library websites, food delivery apps, and music apps across the desktop version and the mobile version. This analysis gave a better

understanding of the different hierarchy structures used across domains, such as, how pages are related to each other by clicking an icon, and the navigation path which mentioned how many steps users take to reach their goal.

The websites from AUT and Auckland University in a mobile platform provided useful insights for this project. As shown in Figure 4 below, the 'hamburger menu' for both of these interfaces is located on the right-side corner. However, if people press it, the drop-down menu is different. AU's drop-down menu can be presented with a quickly animated transition. Trapp and Yasmin (2013) have mentioned that the animated transition is critical to improve user experience, by efficiently and effectively interpreting what has happened from the previous status to the next status. The animated transition can provide a sense of a user's attention; therefore, a user's eyes can be caught by the movement (Huhtala et al., 2010). As for AUT, the drop-down menu is presented instantly without transition. However, AUT's hamburger menu has its own animation. Once the hamburger menu is triggered, the "three bars" form is changing to the "X" form, to show a living statue. Because the animation for the hamburger menu is on the right side of the mobile screen, it also called the peripheral animation. Harley (2014) has discussed that the peripheral animation can quickly inform users but not intrusively; in the meantime, users can still focus on the other task.

Figure 4

Comparison the drop-down menu between the AUT website and UOA website

From this stage, which is stage two, an early appreciation for animation has developed, yet for the more comprehensive analysis, such as, animation's speed, frequency, time, as well as what kinds of animations can match certain given tasks, is developed further in stage three and four based on the user's testing and self-analysis. Based on the initial analysis of these interfaces from different platforms, there are several common characteristics. Firstly, most of these animations are subtle, and all serve a different purpose. For example, animations are used to bring visual feedback on users' actions, in order to confirm the system has accepted users' action. The most common animation is the animated transition, especially for a hamburger menu since the multiple options can be expanded. Secondly, animations can provide visual hints. If a user is a novice using an interface which contains unusual or unique interaction, the animations should provide visual hints to give a clue to users related to what is going to happen. Visual hints can also inform users regarding how they should interact with the user interface. The most important finding is that animations in user interfaces are still underestimated. For instance, although animations can provide visual hints to users, they may still be lost because some animations cannot pop out properly, especially since there are various elements on one page. As a result, it is valuable to figure out which kinds of animations can be visually captured by users, especially from the multi-tasking and multi-option perspective.

4.3. Stage 3: An inductive definition of types of UI animation

Based on the previous preparatory work, we decided to find some references based on video games. There is a great number of video games which include various types of animations. It is interesting to use animations from games, which can be analysed and redefined to some daily used application. The animations in games usually provide a more interactive function to users. The game we selected includes racing, RPG, simulation game and even puzzle games. More importantly, the UI animation in-game can contribute to forming a taxonomy for different sorts of animations, which can be used into the project-based research.

The three initial stages break down the mass of animations from different applications into specific, function-oriented constituents, based on the task context. As a result, the ten principles of animation can be inductively formulated.

4.3.1. Animation principles for user interface design

Type 1: zoom in/out

The zoom in/out function can let users acquire more detailed information related to a given task by zooming in and out. In this process, the related information shows up in separate windows but still on the same page. The advantage of applying zoom in/out is that it can let

users know the relationship between the previous and next information. Users can understand where the individual windows come from and belong. However, there should be some consideration for using the zoom in/out function. Firstly, the speed of zoom in/out is crucial. Whether it is too fast or too slow, it influences users' experience, especially if the animation is about the cause-and-effect relationship. Harley (2014) mentioned that "For an animation to effectively convey a cause-and-effect relationship between UI elements, the effect must begin within 0.1 seconds of the initial user action." The 0.1 seconds is good for building a connection between related elements. If the zoom in and out function takes more time to complete, users may feel out of the connection between the two elements and their cause-and-effect is less obvious, and it may delay their understanding.

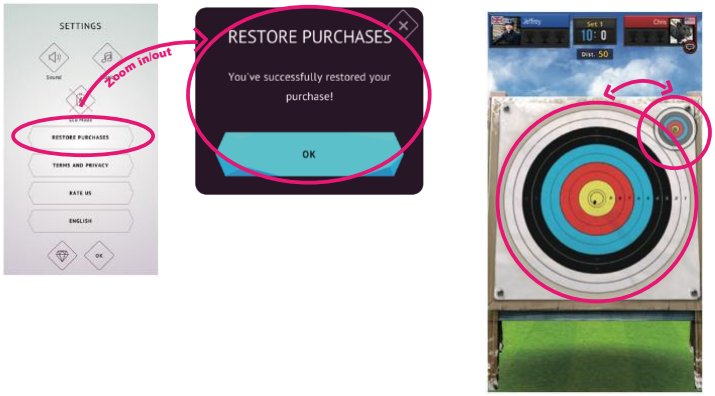

Figure 5

Zoom in/out animation of game analysis

Note. Polysphere, Playgendary GmbH (Version 1.45, 2019).

Type 2: Feedback

Feedback can be seen as responsiveness. It can bring a sense of a feeling of confirmation. According to the research from "animations and transitions" for responsiveness, most animation and transitions should be interactive, therefore users can interact with it while the animation is running.

Feedback also can attract attention. There are different kind of animations for the purpose of attracting attention. Rapid flashing is suitable for immediate attention. Rapid flashing can break users' attention no matter where the flashing is occurring. Rapid animation is appropriate for the home page, especially to novices who have no idea where they should start and except for rapid flashing, bouncing animation is also appropriate for feedback. One feature of bouncing animation is that users are likely to notice but continue to concentrate elsewhere, depending on the frequency of the animation, for example, the button for the "top-up" function in games should be perceived by users even though it is less intrusive.

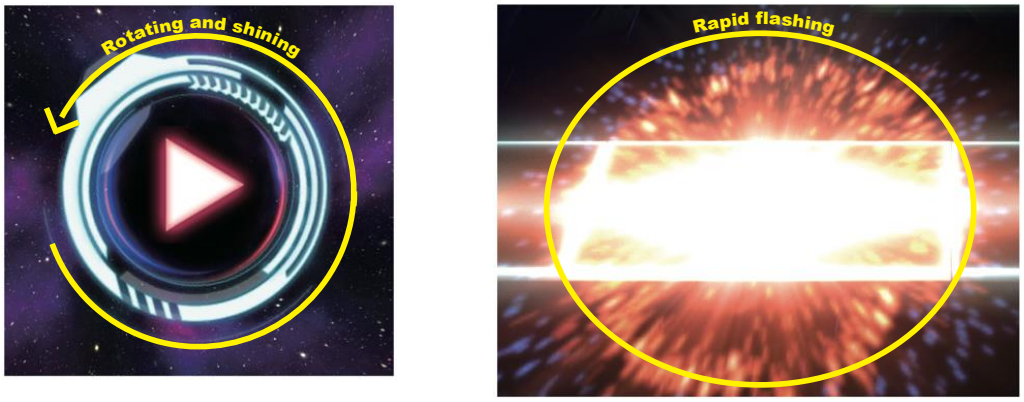

Figure 6

Feedback animation of game analysis

Note. Galaxy on fire, Fishlabs (2018).

Type 3: Label

The label animation can help users to understand the related tasks. It is apparent in most tutorial contents where users need to have a basic guiding before taking action. However, this animation should not be too obvious, as it may influence its serving targets. This situation has happened in the next user testing sessions, and it will be discussed later.

Figure 7

Label animation of game analysis

Note. Archery king, Miniclip game (2017).

Type 4: Loading

This type of animation is positive to convey information that the system has not crashed. It can be viewed as progress feedback. Progress feedback indicates that a good animation of time process, duration and wait can reduce mental waiting time. To achieve this goal, the animation of time process, duration and wait should be smooth and continuous.

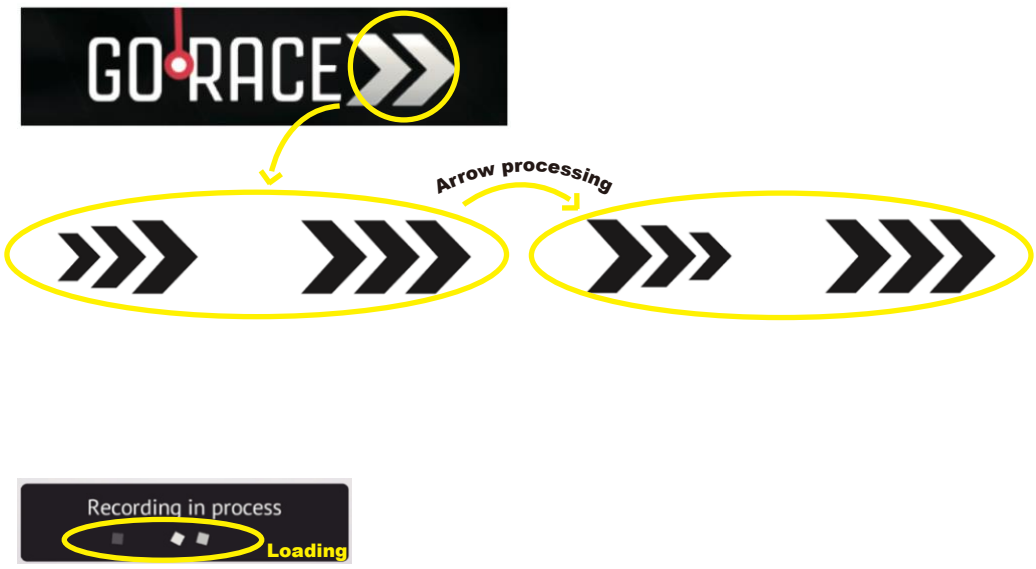

Figure 8

Loading animation of game analysis

Note. CSR Racing, NaturalMotion, Boss Alien (2019).

Type 5: Ease in/out

The easing animation is crucial to contribute naturalism to the user experience. For example, if one object is moving, the speed should obey a physical law: start to move, accelerate, keep the speed, decelerate and stop. Similarly, the physical law for speed should also be applied to animation.

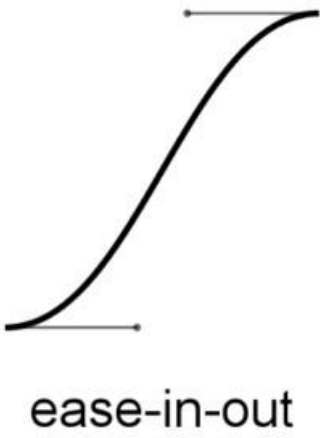

Figure 9

Ease in/out animation

Type 6: Timer

The timer is a sort of UI animation which Integrates the property of the focusing and processing bar. The benefits of this animation are that it can help users to focus on the tasks while providing extra information, for example, processing statues.

Figure 10

Timer animation of game analysis

Note. Archery king, Miniclip game (2017).

Type 7: Pointer move

The pointer move can show a real-time interactive gesture to users. It may include various hand gestures, such as, swipe, tap, double-tap and so on. The pointer moves not only to show its animation form it can also be seen as a reminder to keep users informed about where they should focus.

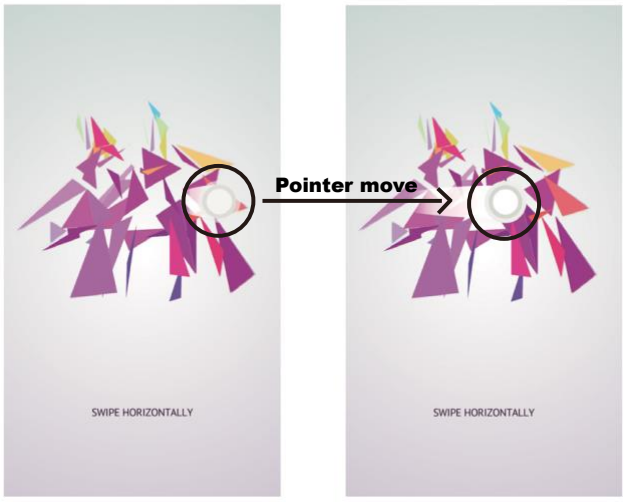

Figure 11

Pointer move animation of game analysis

Note. Polysphere, Playgendary GmbH (Version 1.45, 2019).

Type 8: Transparency

The transparency has several benefits to improve usability. Firstly, it can create a focal point, where users can focus on the transparency area via the visual focus. Secondly, the transparency can create a sense of a layer, to show the relationship between the different elements.

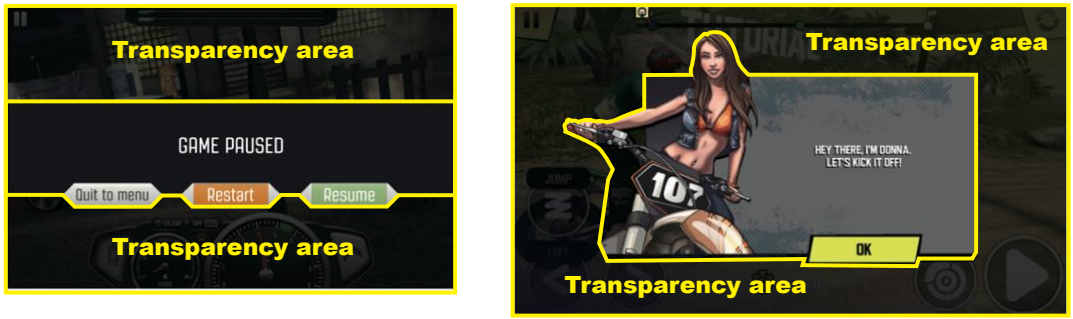

Figure 12

Transparency animation of game analysis

Note. Trial xtreme 4 moto bike game, Deemedya INC (Version 2.8.0, 2019).

Type 9: Focus, readiness

The highlighted area can tell users what is going to happen, in order to assist them focus on the task. It can allow users to preview how many kinds of information are on one page, therefore they can have a basic idea of how much time they will need to expend.

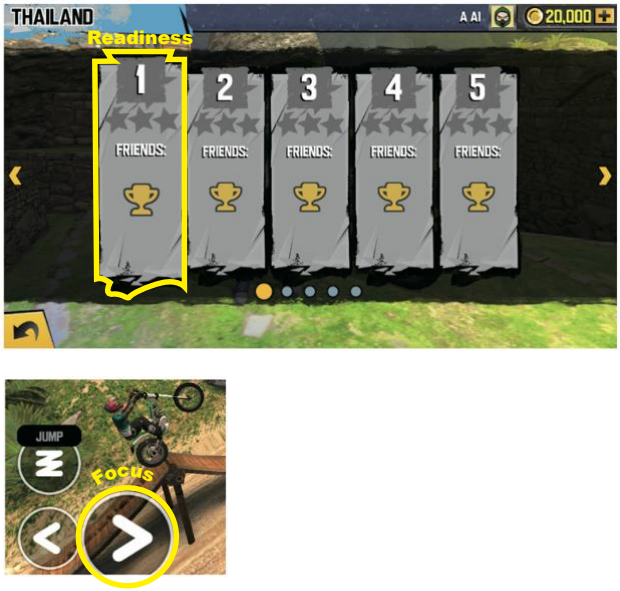

Figure 13

Focus, readiness animation of game analysis

Note. Trial xtreme 4 moto bike game, Deemedya INC (Version 2.8.0, 2019).

Type 10: Locking/unlocking

This type of animation is useful for organizing the majority contents into one place. If all of the options are displayed on one page, users would be overwhelmed quickly. The most frequently used Locking/unlocking animation is the hamburger menu.

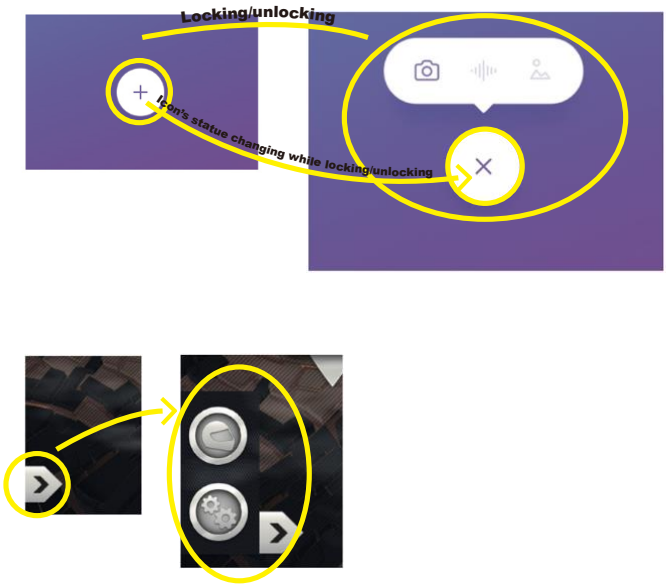

Figure 14

Locking/unlocking animation of game analysis

Note. CSR Racing, NaturalMotion, Boss Alien (2019).

Compared with the Disney principles of animation (Willenskomer, 2018), there are several common characteristics. For example, “Zoom in/out” in my animation principle list is similar to the “squash and stretch” in the Disney animation principle list. Both are trying to change the object’s form by enlarging or dwindling, in order to represent the object weight and flexibility. “Ease in/ out” from 10 animation principles is similar to the “slow in/out” Disney principle. Objects can be moved by speeding up and slowing down without any abrupt movement. “Feedback” from the ten animation principles and “secondary action” from Disney principles are the same, in order to give a second action to make the object more prominent. However, the difference between the two animation principles is noticeable. Zoom in/out is based more on the task and function-oriented perspective, such as, using zoom in/ out can let users know the relationship between the related information in a more direct and visual way, compared with the squash and stretch Disney principle, since it only shows its form and does not stress how to use it based on the task context. As for the “feedback”, here it is talking more about how the speed of the animation may have an influence on its feedback, such as, rapid flashing can break users’ attention no matter where the flashing is occurring. The key differences between the two list are that the Disney principle is focused more on the general form of the animation and its characteristics, while the ten animation principles from

my research are focused more on how to apply it and the pros and cons of the different animations.

4.3.2. Stage 3 Use Apple calendar as the trial targets to build animation

After realizing the role and function of each of the animations, it is time to think about which UI categories need to be researched. UI/UX history shows there are many UI principles, but only a few of them are easily used by users (Komlodi et al., 2007). Instead of creating new UI design, improving the existing UI from some apps that are mostly used on a daily basis may be a good choice. Interestingly, many apps that are used daily fail to provide hints or tutorials the same way that they are found in most games. The design of animations in videogames gives me an inspiration to design a tutorial that can help users, especially novices, to understand how to use it.

In terms of a mobile app that is widely used in the calendar, in the default setting for the iOS version, the calendar app is located on the first screen page, top left corner. People know how to check the date because it is displayed on the app's icon. Nevertheless, people may not know how to create an event, add a location or set a time for the future meeting, or they may not be confident to access these functions, especially those who do not use these functions often. As a result, the decision was made to design a tutorial to guide people about how to use the calendar app. More specifically, the design intent is to use animations to design such a tutorial system. It serves as the research site to ask questions about the kind of animations that are suitable for specific tasks, how the speed and time of animations can influence users' reaction and what are appropriate places, functions, and times to apply animations?

4.4. Stage 4 Usability test with key design versions

In this study, one of the research outcomes is an annotated portfolio. With respect to the traditional exegesis, especially for interactive design aspects, it is challenging to connect the thesis, data, reference and insights adequately due to the disjoint between the exegesis and the design product. However, the annotated portfolio can connect each of the key design stages by showing how the data reveals the design issues and how the design issues contribute to the analysis and to the re-design process. The other consideration for designing the annotated portfolio is that it is impossible to show all if the design process in a detailed way. The annotated portfolio can show the design process with fewer words by combining the interactive animation and analysis to improve the understanding of each of the key design stages. The annotated portfolio has three versions, version 1, version 2 and version

3. The annotated portfolio is a video format, which means it supports the pause, fastforwards and back-forwards at any time.

In this section, the reader is encouraged to consult the annotated portfolio. To do this, first open the exegesis from this section and open the annotated portfolio video file in a video player. Secondly, when a label shows up in the annotated portfolio, such as, “label 1”, you can pause the video and return to the exegesis to find the corresponding analysis for “label 1”. This process is the best way to understand the design and testing journey described in the following sections. Each analysis in the exegesis includes the label’s name and the exact time that it appears in the annotated portfolio, the intention is that you can locate the relevant information effortlessly both in the annotated portfolio and in the exegesis.

4.4.1. Version 1

The creative work presented here is in response to the brief “design a tutorial has to help users learn how to use the calendar app using animations to improve the user interface”. The first step is to figure out how many functions the apple calendar supports and how many of them need to be addressed by the tutorial. The first prototype includes most of these functions. However, it is impossible to ask the participants to finish them all due to the time limitation for usability testing. As a result, the most frequently used functions were screened out. The tutorial addresses three primary functions: setting a title, time, and location for an event. Version 1 is therefore more like a hypothesis, since it is designed as a baseline system to support user evaluation.

Screen 3

Label 1: Lacking a sense of contrast between the “X” button and “create an event” (00:31 seconds)

Lacking a sense of contrast between the “X” button and “Create an event” button, the layout of two icons and its symbol cannot provide an opposite scene between the two functions. If there are two opposite options, users can use one option as a reference in order to know the other option. One option is proceeding, and the other is quit. Let us take the example of a lift. People need to press the close door button. They know that the symbol of a close button may depend on the symbol of an open button as the contrast or reference. Back to the UI cases, it could be solved by adding two different animations to stress their dissimilarity.

Screen 4

Label 2: Consistency design (00:35 seconds)

Besides contrast, consistency is also an excellent way to distinguish between the two functions. Let us take the lift as an example again. Users know the close button or open button not only by the contrast or its own form, they also know it depends on its consistency. They know the closing button is next to the open button, and most of the design is parallel. Meanwhile, keeping the design style of two symbols the same can also help users know their relationship and help them to make a decision, such as, “create an event” and “quit a tutorial” both use the same text box.

Screen 5

Label 3: Lacking words to support the meaning of the “X” button (00:40 seconds)

Participant 3 feels confused about the meaning behind the “X” button, since there is no explanation about what happens after you click it. One factor to explain this situation is that the connection between the icon and its meaning is not easy to ascertain. Ideally, before pressing the icon, users should have a rough picture in mind about what will happen. One possible way to deal with it is adding a text, such as, “quit” to inform the users this is where they can leave the tutorial.

Screen 6

Label 4: Affordance for the “X” button anticipation (00:46 seconds)

The X button does not support the affordance of knowing the function. In this instance, affordance not only means the user can perceive the X button is there, the user could also perceive the function behind the X button.

Screen 8

Label 5: Lacking hints (00:56 seconds)

The first page of Apple calendar does not give any hints or clues for the participant regarding how to start. During the testing, the participant is asked “should I start”. Even though the principle for moving to the next page in this page is press anywhere, the participant still feels confused at the moment.

Screen 9

Label 6: Hesitation to give a response (01:01 seconds)

The participant 1 is a little bit hesitate to press the next button. From the observation, I can see that he waved his fingers in the air, which seems to indicate where he should press to

move on. If he only uses the bold text font it cannot give enough affordance to guide the participant to keep going.

Screen 10

Label 7: Adding a mark to inform the task has been completed (01:09 seconds)

Participant 2 provides an idea that there should be a mark in order to give feedback to the users that they have finished the task.

Screen 14

Label 8: Error operation for the arrow button (01:22 seconds)

Participant 1 should press the “arrow” button to move on but press the “red highlighted frame” area.

Screen 15

Label 9: The same speed for all elements (01:26 seconds)

All elements were moving with the same speed, so it is not easy to distinguish which element should be highlighted and focused on by users.

Screen 16

Label 10: Disjoint between the text and text box (01:30 seconds)

Participant 2 expressed that the text is disjointed with the text box, which makes it weird somehow.

Screen 17

Label 11: Over highlighted element (01:35 seconds)

The highlighted area is much more evident compared with the other elements. That is why the users pressed it.

Screen 18

Label 12: Colour issue (01:40 seconds)

The arrow button is difficult for the participant to notice it. The colour of the arrow button is similar to the background colour, so it is not easy to distinguish. Besides, there is no animation or motion for the arrow button to draw the attention of the users.

Screen 21

Label 13: Error operation for the arrow button (01:50 seconds)
The observation indicates that Participant 2 press the text box or the highlighted area rather than the arrow to go to the next page.

Screen 22

Label 14: Cause and effect of error operation for the arrow button (01:54 seconds) The main reason is that the arrow button is hard to for the users to perceive compared with the red frame box.

Screen 23

Label 15: Inconsistent design for the arrow button (01:58 seconds)
The other reason can be an inconsistent design. According to the description from IDF(Interaction design foundation), “inconsistent design forces users to engage with the visual display consciously rather than rely on experience to help guide their interactions. “Consistent design can avoid cognitive overload by keeping the same visual display in a user interface. Because our short time memory and attention are limited, using a consistent design lets users become familiar with the contents by applying knowledge from one interface to all interfaces without considering or realizing it.

Screen 27

Label 16: Time-consuming introduction (02:10 seconds)
Participant 1, 2 and 3 all describe that the introduction is a little longer than their expectation.

Screen 28

Label 17: No distinct shape button (02:13 seconds)
During the user testing, participant 3 asks whether next is a button or not, which only reveals that using text without a button is not ideal. Admin (2019) in his article "Why Text Buttons Hurt Mobile Usability", has discussed the idea that the text button is not as easy for users to recognise as there is no distinct shape to catch their attention.

Screen 29

Label 18: Lack of visual cue for text button (02:18 seconds)
From the usability aspect, the text button could also be harder to trigger. As you can see, if the finger covers the text button, there is no visual cue to confirm if the action has been

activated (Admin, 2019). However, If the icon combined with text and shape is big enough, the user can easily get the visual cue to know its meaning and how to interact with it.

Screen 32

Label 19: Hesitation (02:40 seconds)

Participant 1, 2 and 3 all took longer than my expectation to give the response, respectively, taking 4, 6 and 3 seconds individually.

Screen 33

Label 20: Reasons for error performance for the plus button (02:43 seconds)

Participant 5 pressed the actual date twice rather than the arrow button. There are two reasons for the error performance: firstly, the plus button is not highlighted and animated; it is static and the same with the other icons. Secondly, the background colour does not provide a contrast to make it easy for the users to perceive the plus button.

Screen 36

Label 21: Error operation for pressing text box (02:52 seconds)

Participant 1, 2 and 3 all had the wrong response for this page. Participant 1 pressed the text "here" in the text box rather than the add button. As for participant 2, he pressed the red frame five times then realised the add button should be pressed. Participant 3 took 8 seconds to analyse this page first and then decided to press the add button.

Screen 37

Label 22: Reason for the wrong operation of pressing the red frame (02:58 seconds) One drawback here is that participant gets used to pressing the red frame which also appeared on the previous page.

Screen 38

Label 23: No hint for the add button (03:05 seconds)

The add button did not give any hint to inform the participant this is clickable.

Screen 39

Label 24: The text leads to the mis-operation (03:08 seconds)

The text need to be changed as 'here' looks more tempting to some participants to press.

Screen 41

Label 25: Spatial orientation (03:18 seconds)

The red frame is not connected from the previous page. They should be related to each other, but the animation cut off. One principle to point regarding this issue is spatial orientation: continuity. Seelie (2019) discussed that animating related elements can let users know where these elements are going rather than just disappearing. The animation of spatial orientation is beneficial to help UI elements crossing different screen types and sizes. Even a slightly and quickly spatial orientation can decrease users' confusion.

4.4.2. Version 2

Screen 45

Label 26: Advantage of applying consistent design for the two icons (00:08 seconds) It is keeping the two icons consistent. Both of them use the dark circle as the icon's background. The location of two icons is on a horizontal line, which can provide a sense that they are not only related to each other they are also different. Increasing the size of the next button is also an excellent way to improve its affordance.

Screen 46

Label 27: Benefits of adding the text to enhance the icon's meaning (00:11 seconds) Adding text under the two icons in order to give users a hint of each icon's meaning.

Screen 47

Label 28: Benefits of adding leading animation (00:17 seconds)

Compared with version 1, the next button adds a kind of leading animation to lead the user press the next button.

Screen 48

Label 29: How to design the button animation for the one-hand operation (00:21 seconds) It is crucial to think about how to make the animation for the button design so it is easily used by only one hand. That is why the "arrow button" and the "quit button" are arranged on the lower area, because most people can use one hand to manipulate it, mostly the thumb, to quickly reach there.

Screen 55

Label 30: Adding the text label to inform participants (00:37 seconds)

Based on the previous feedback from participant 1, the starting page has added a text label to inform participants where and how to start.

Screen 57

Label 31: The benefit of adding text with icon (00:46 seconds)

Using the icon and text together can give a better affordance to let the user keep going. According to the description by Harley (2018), adding text alongside the icon can reduce the ambiguity and increase communication with users.

Screen 59

Label 32 Adding a checking mark to inform users (00:52 seconds)

Based on the feedback from participant 2, a sort of green frame combined with a check mark was added to give users a sense of confirmation. The check mark is located on the right side of the text box. The aim of this is to act as a peripheral motion. According to the description from Harley (2014), the peripheral animation is good to keep users' energy as they may still need to focus on other tasks at the same time. Adding a peripheral animation is enough to give users feedback about their achievement, but also not to influence them to move on to the next task. The trick is about how to keep the balance between the two animations.

Screen 62

Label 33: The benefit of providing sequence for different animations for different elements (01:07 seconds)

Based on the feedback from participant 1, adding a sequence in order to present the animation is better to clarify the relationship between the different elements. Showing the red highlighter frame first can give users a basic idea of what the task is that people want to focus on. Then provide the text to explain what is meaning of the task is. Next, show the arrow button to inform the users where they should keep going.

Screen 63

Label 34: Colour making the arrow button prominent (01:10 seconds)

The colour of the arrow button has changed, which is easy for users to perceive compared with version 1.

Screen 64

Label 35: Value of separate the read-only tutorial and interactive tutorial (01:12 seconds)
Participant 7 provides critical feedback which may reveal why sometimes participants press the wrong area. This tutorial contains two sorts of tutorials, which are a read-only tutorial and an interactive tutorial. It is not easy for the user to distinguish the two sorts of the tutorial. That is why sometimes participants press the red frame, which is supposed to be the read-only elements. As for the arrow button, it's an interactive button to let the users keep going. Both of them are animated to some degree, which would be hard for users to distinguish their roles. It gives some reflections on how to deal with this problem in version 3.

Screen 67

Label 36: Button animation (01:22 seconds)
In version 2, an animation for the button was added to better inform users where they should press. The principle of this animation is slightly moving from left to right to provide users with a cue what will happen if they press it.

Screen 70

Label 37: Saving time for introduction by adding two text boxes on one page (01:37 seconds)
To deal with the issue in version 1, it was important to keep the two text boxes on the same page while still keeping the full information. It is good thing not only because it saves time and space it can also show the relationship between text and text.

Screen 71

Label 38: Benefit of floating action button (01:41 seconds)
The floating action button is a significant design to help users to navigate, due to its prominent characteristics. It is widely used with an unfamiliar screen (Pibernik et al., 2019).

Screen 73

Label 39: The benefit of adding bouncing animation effect for the plus button (01:50 seconds)
A bouncing effect for the "plus button" was added to inform users where they should press.

Screen 74

Label 40: The benefit of change the background opacity (01:57 seconds)
To deal with the issue that happened in Version 1, the background opacity was changed to 50% to make the plus button and text box pop out.

Screen 75

Label 41: Issue for wrong operation (02:02 seconds)

Nevertheless, unfortunately, participant 6 pressed the actual testing date, just like participant 5 did in Version 1, which means changing the background's opacity is not enough for some participants.

Screen 77

Label 42: The benefit of adding the effect of the zooming out and bouncing animation together (02:11 seconds)

Compared with version 1, the add button was animated by zoom out with bounce effect, in order to inform participants where they should press to move on. The animation for the text box was added as well. Torre (2017) described that the animation must serve a purpose. Here, the purpose for adding animation to the text box is to give participants a hint where the text belongs and enhance the relationship between the text box and the add button.

Screen 81

Label 43: Why cluttered layout brings error operation (02:22 seconds)

One of the many reasons users may press the wrong area on the screen is the cluttered layout. Skrba (2018) provided a point that a user's attention will be dispersed if there are too many elements on one page. Users are not confident to figure out where to look and can easily miss the critical target on the screen.

Screen 82

Label 44: Why inappropriate visual hierarchy brings error operation (02:26 seconds)

The visual hierarchy on this page is not reasonable. Users can navigate easily if the UI elements are adequately organised (Alomari et al., 2020). Here, the time for showing the animation for the red frame and arrow button is the same, which can give users the idea that all of the elements are equal and the same. It may also result in the Z pattern scan mode. In terms of the Gestalt theory, users tend to scan the upper part of the information first. Next, they scan following down and left side, which forms a diagonal line. Finally, they will scan the bottom. As a result, the red frame can be perceived first by users, and it is the most likely pressed area, instead of the arrow button.

4.4.2.1. Empathy stage

Observation and engaging are how you can build a connection with participants and users to achieve empathy. During the observations, the process can be divided into three sections: what, how and why. Participant 3 showed confusion when pressing the button of “create an event” this belongs to the what section for noting down what is the participant doing. In the how section, the participant took a while to press the button to create an event. She was even frowning at the moment and she said that she was confused about the function of the “X” button, as there is no hint to inform the participant what would happen if he or she pressed it, in other words, to describe how the participant was doing, describing their physical and emotional response (Lesson 3.3, Interaction design foundation). As for the why, it is about interpreting the participant’s emotional drive behind the performance.

Figure 15

“Create an event” from Apple calendar tutorial UI

4.4.2.2. Defining stage

The define stage is to form appropriate problem statements based on the previous empathy phase. The goal of the define stage is to figure out what the users' problems are and how to solve them in an executable way (Stevens, 2019). Let's go back to the issue mentioned in the empathy stages. After collecting the data from user testing and interpreting the user's thinking it is time to display all the possible design flaws, the problem statements. In order to

achieve a holistic problem statement, one of the collecting methods is called diagram or called "space saturate and group" from the IDF explanation (Lesson, 4.3, Interaction design foundation). The principle is to display all the information gathered in the empathy stage, which involves visualizing each of the problem statements and trying to build connections between the statements of these problems.

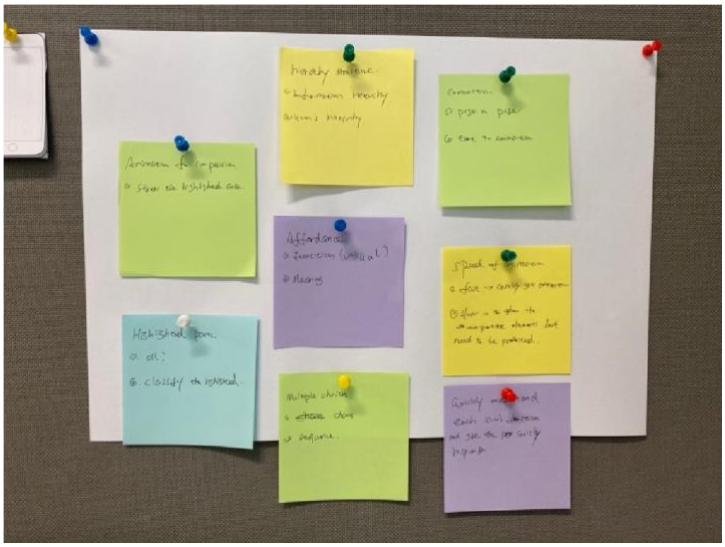

Figure 16

Diagram/space saturate and group method to generate problem statements

The problem of “create an event” and “x” button include three stages as follows:

1. The disconnection between the button and its meaning. If a text can support the button, it would be more apparent (Tubik Studio, 2018).

2. Insufficient affordances to let the participant know the meaning before making a decision.

3. Not enough comparison between the “create an event” and “the close” button.

Comparison can enhance difference between the two objects in order to make the choices quickly. Taking an example from lifts, sometimes people need to press the close door button in order to arrive at their desired level quickly. Interestingly, they can recognise the close button possibly depending on the comparison for the open button as a reference.

Based on the three problem statements, it is time to think about the kinds of animations that can solve these problems. Furthermore, that is the reason the design comes to the next stage, the Ideation.

4.4.2.3. Ideating stage

The aim of ideation is to generate and provide a lot of ideas related to the problem statements. During the ideation process, designers can screen out the best design solutions for the future prototype stage (Lesson 5.1, Interaction design foundation), in order to make the animation in a way to solve the problem. First, the animation should provide enough affordance to let users recognize its function quickly. Secondly, the animation should be clear enough to let users know the meaning of the button. Finally, the animation should enhance the difference between the “add an event” and “close” button.

Through the sketch and paper prototype, it is helpful to generate a variety of animations and motions, some of them are effective to deal with the three problem statements mentioned in the define stage. The paper prototype can also be attributed to lateral thinking. For example, before the ideation stage, the focus is only about how to design animations specifically to this page, such as, enlarging its size, adding the text under the button and so forth. However, the designer should be aware that the animation should also keep its consistency with the previous page and the next page. The characteristic of the arrow button from the previous page should match the arrow button on the next page if the button is the same. The animation for the arrow button also includes “the guiding function” from page 3 to page 4. The benefits are that users do not need to overthink to make a decision. It is a kind of way to encourage users to start on the next page.

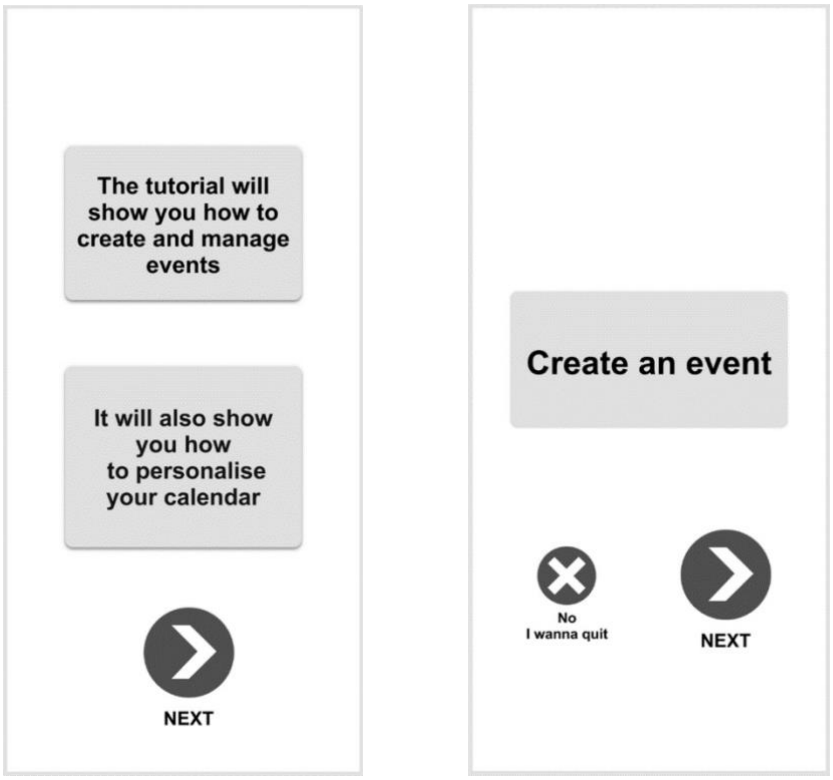

Figure 17

Introduction page from Apple calendar tutorial UI

It should also be possible for users to press the animation for the button design. A phenomenon of mobile phones these days is the screen size that is increasingly larger and larger, even so many people still prefer to hold it with one hand and most people use one hand to manipulate most of the tasks on their phone. According to the research from Pandey (2017), while 49% of users use their right hand to hold their mobile phone while manipulating, 36% of users use their left hand to hold their phone and they and use their right hand to manipulate it. Only 15% of users use two hands to hold their phone while they are manipulating it. It is essential to think about how to make animations for the button design that can easily be used by only one hand. That is why the “arrow button” and the “quit button” are arranged on the lower area, so most people can use one hand to manipulate it and their fingers, mostly their thumb, can quickly reach that area. The other consideration for arranging the next button on the right side is that compared with the quit button, the next button is a little bit easier to be triggered by the thumb because the space between the thumb and the “next button” is shorter than the space between the thumb and the “quit button”.

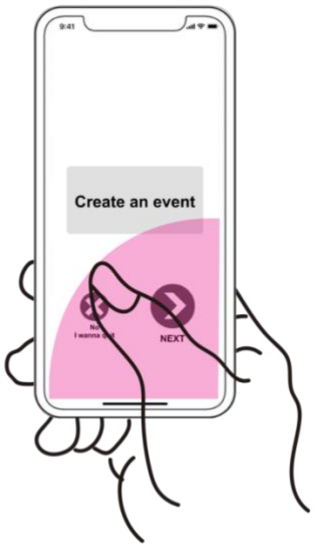

Figure 18

Hand reaching area from Apple calendar tutorial UI

4.4.2.4. Prototype stage

The prototype includes two parts. One is the paper prototyping, which is used in the ideation stage for generating design solutions and to give a basic overview of which design solution can be developed latterly. The paper prototype can be seen as a low fidelity prototype, which is low cost, rough and easy to establish (Lesson 6.4, Interaction design foundation). The other prototype is called the high-fidelity prototype, which is much closer to the final product, it is a highly detailed design, but it took much time to build (Lesson 6.4, Interaction design foundation). Building the high-fidelity prototype needs specific UI/UX software. The Invision studio was chosen because it can quickly build animation interaction by setting its animation form, such as, bouncing, zoom in/out, overlay, and the speed, time and so on.

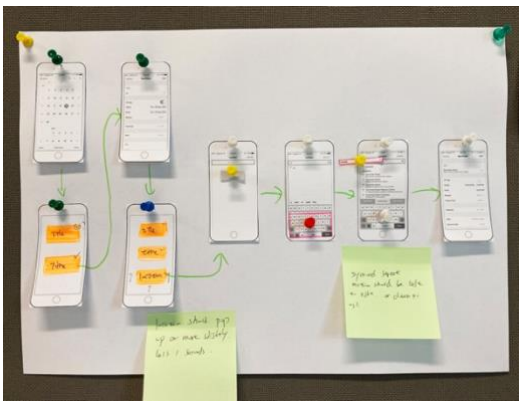

Figure 19

Low-fidelity Paper prototype

Figure 20

High-fidelity Paper prototype

Animated transition

One of the many improvements is called an animated transition. According to the description from Trapp and Yasmin (2013), the animated transition contributes significantly to the user experience of mobile apps. It can provide a clear visual track from the old state of the screen to the new screen. By making the animated transition natural and smooth, it can provide users with a sense of pleasure. More importantly, an excellent animated transition can improve its usability and efficiency (Huhtala et al., 2010). As users are manipulating tasks on the one page and move on to the next page, the animated transition can effectively build a connection from the two pages.

4.4.2.5. Generative testing stage

The usability test takes about 15 to 30 minutes to complete, depending on the participant's background, how frequently they use and how familiar they are with the digital application, and how their age may have an influence their response. There are eight participants from a different discipline, including the product designer, VR designer, full-stack developer, accountant and so forth. The usability test uses the think-aloud protocol, where the participants are encouraged to speak out about their feelings and emotions at each moment. In this process, the participants have the opportunity to share their ideas and suggestions about the user interface design. Since this usability test does not involve the conventional method which likes guerrilla testing to gather user feedback and ask them about their thoughts, the user testing can be seen as a way of co-designing in terms of the interface. Participants feel that they contribute not only by grading the design ideas but also by voicing their own ideas, too. The participants can communicate with the primary researcher while they engage in the task. The usability test requires collecting data from the users' performance. The data is gathered through a screen recording with audio. The usability test can provide critical feedback, data, and suggestions from users, which is a fundamental resource to redefine and reveal the potential flaws in this project. The collated resources and feedback can also be used to redesign this project based on the potential flaws.

The usability test requires three stages: the preparation, test session and data analysis.

The preparation

Before running the usability test, the primary researcher explains to the participants that it is acceptable and expected to make errors during the usability test because these errors are highly valued for revealing the potential flaws in the project. During the usability test, the

participants are never criticized by the primary researcher. The primary researcher never shows surprise about the participants' error performance. If the participants did something different from what was expected, such as, an error performance, the primary researcher could ask them what they expected to happen. For example, if participants press an icon that is not related to an ongoing task, the primary researcher asks questions, such as "how close was that to what you expected? You seemed puzzled, what happened? What are you thinking right now?"

Test session

During the test session, the participants need to be asked to manipulate the user interface design on a desktop. Even though the project is based on the mobile platform it is necessary to work on the desktop. Firstly, the video recording is based on a desktop application. Secondly, the bigger size of the screen can let the participants manipulate it while the primary researcher can observe their performance. However, the most important reason is that the desktop has a cursor. The participants use a cursor to interact with the interface. The cursor can be tracked by video recording. The cursor is critical to reveal the potential issue behind the design. For example, if the cursor stays on the "next button" too long, it may reveal the animation for the button design is not clear to the participants, as they spend more time to consider. Participant 3 was stuck on the "next button" for 8 seconds.

4.4.3. Version 3

The text label was removed from version 3. The next button is coming from the previous page, following an animated transition to move on to the next page. The animated transition can effectively provide a sense of continuity and connection. If there is an alternate meaning for a single icon, adding a text label is necessary to reduce the ambiguity (Harley, 2014). However, the next button is a universally recognized icon these days. The size of the next button in version 3 is bigger than in version 2, which provides more affordance to participants.

Screen 86

Label 45: Why change the arrow button from bouncing animation to enlarging animation (00:11 seconds)

The showing of the arrow button has changed. Before it was bouncing up from the bottom, now it is showing up from its current location by enlargement. The previous way is a little bit confusing to users as its motion effect is too exaggerated.

Screen 87

Label 46: Why delete the text label below the icon (00:17 seconds)

The text label is deleted under the icon. Based on the explanation from Harley (2018), when there are so many alternate meanings for a single icon, adding a text label is necessary to reduce the ambiguity. However, in the Apple calendar tutorial, the arrow button is a relatively clear symbol to a participant. More importantly, the arrow button is the only way to move on to next page that is there. So there are no alternate meanings or an alternate way to move on.

Screen 89

Label 47 Adding a dark layer for the finished task (00:25 seconds)

Participant 7 has expressed that he may press the "Add a title" again because the animation for the checking mark and green frame looks more attractive than the "add a time". To deal with this problem, a slightly dark layer was added on the top of "Add a title" in order to give users a sense of finished feedback to inform users they should work on the next task.

Screen 92

Label 48: The benefit of the bouncing effect for the red frame as an interactive trigger (00:38 seconds)

Using the bouncing effect to address the red frame is more attractive to users to press it.

Screen 93

Label 49: Why change the way to move on next page by deleting the arrow button in version 1 and 2 (00:42 seconds)

The way to move to the next page has been changed. There are different ways to connect each page in version 1 and 2, keep pressing the arrow button. However, from participant 7's feedback, it would be great if the designer can distinguish the "read-only" tutorial and "interactive" tutorial. Indeed, keep pressing the arrow button, it is a kind of "demo-only" tutorial, so users interact with it without overthinking. However, this may lead to the problem that users cannot truly understand how to use the Apple calendar. All they need to do is keep pressing. Therefore they can finish the task. However, the aim of this task is how to let users understand the task rather than finish the task. As a result, the arrow button should be deleted and only use the highlighted box as a trigger to move on to the next page, which is more interactive than before. It also solved the possibility that users may press the wrong area.

Screen 96

Label 50: Why changing the button animation from the moving effect to the enlarging effect (00:53 seconds)

Showing the animation by the form of enlargement is better to inform the user how to click it. In Version 1 and 2, the form of animation for a button is moving left to right. It is useful to inform the user, but they may slide it rather than press it, which may not trigger the action. As a result, Affordance here not only includes how to let users know its function, it also provides a clue about how to interact with it, whether to slide it, or press it, or something else.

Screen 98

Label 51: Using a bouncing effect with zooming out animation to amplify the affordance of the plus button(01:04 seconds)

By adding an animation that has a bouncing effect and zooming out at the same time, users can visually catch the plus button effortlessly. Besides the plus button is located on the corner of the right side, which also takes advantage of the peripheral animation.

Screen 100

Label 52: The benefit of adding a dark layer on each screen background (01:14 seconds)

A dark layer has been added on as a background, except for the highlighted area. It will be tested in the future to see whether it is an excellent solution to decrease the error performance that happened in Version 1 and 2. In version 3, a dark layer was added on all of the pages, except for the add button and text box, in order to assist the participants to easily focus on the task. The add button looks like it is more clickable and definite by adding the shadow and boundary. However, a decision was made to deleted the animation for the text box. Lindberg (2019) provides an idea that users are likely to experience cognitive overload and become confused if there are too many animations in UI. It also decreases the possibility that some users may press the text box as a trigger.

Screen 105

Label 53: The benefit of proving less choice to users (01:29 seconds)

In version 3, the unnecessary animation was deleted, and fewer choices and options are provided to users, it only focuses on the interactive elements. According to the discussion about keeping it usable, sometimes less choice means more satisfaction, especially for people who want to make a quick and easy choice or action and people who do not have exact preferences. Coincidentally, these features match the requirement of the tutorial for the Apple calendar, since it is the original intention is for people who are not very familiar with it, but also seek to provide a friendly user experience for them.

4.5. Stage 5 Using animation principles to build the COVID-19 app

This year, the most commonly known pandemic, the Coronavirus 19, has swept around the world. However, some people do not take it seriously. A decision was made to create a short mobile UI animation, focus on how to ensure people are aware about how to protect themselves by using UI animation, too. Based on the content in the Covid-19 app, including how the virus goes into a person's body, how soap helps to resolve the virus, and how to positively stay at home during the quarantine, whether animations can help people understand these processes and change or adapt their behaviour to prevent the spread of the virus. The mobile application for Covid-19 animations come from the ten principles animations. The animations include zoom in/out, easing in/out, and so on, based on the task context and the user's need.

The reason to make the animation for Covid-19 is not only to build a self-project, it also seeks to identify how the different types of mobile application can influence the form of animations. For example, the apple calendar is one of most used mobile applications. Therefore, the animations shouldn't be too intrusive and complicated, too many animations can result in cognitive overload and distraction. However, the Covid-19 mobile application can be a "timeliness" application. Users may only watch it once or twice, and they may only watch it until the virus can be eliminated in the future. Therefore, the animations should be attractive sufficiently when people watch it for the first time. Besides, the most important reason is that the animations can clearly explain how the virus can influence us. For instance, showing the virus by pointing to the lungs while using the "zoom in/out" animation principle can amplify the process (00:25 seconds). Using label animation to explain the definition of each element of soap alongside other animations can explain how soap can dissolve the virus (01:18 seconds).

The COVID-19 mobile application has two versions. One is the linear animations that users can watch directly without any interactive manipulate, except using the pause, fast-forward and fast-backwards, because this is an mp4 format. The other version is an interactive mobile application, which is still in the formative stage as it an on-going project that will be completed in the future.

5.Reflection

This section has two parts. One is the “curve” phenomenon which indicates how and why animations experience a curve pattern. The other is how the roles change from the participants to the co-creator during the usability testing session.

5.1. The “curve” phenomenon

Through the iterative design process and the usability test, there is an exciting phenomenon that UI animations were experiencing a "curve" pattern. In the first version of the Apple calendar tutorial, the animations are simple and there are fewer of them, due to the inexperience for the animation design for the user interface earlier on. In the second version, the animations are more massive than before, where all of the elements are animated in different ways. However, the number of animations in the third version are fewer again.

Through the design research, without a doubt the animations as moving UI elements are a powerful tool to grab user's attention. "Movement, motion is a characteristic our mind processes pre-attentively, without effortfully directing attention to an object" (Harley, 2018). However, too many animations can make the users confused, which causes error performance. For example, in version 2, the text boxes and buttons were animated. The participants were supposed to press the button, but some pressed the textbox. Because the animation for the textbox is peripheral animation, it can grab the attention of the participants compared with the zooming in of the button animation. Textboxes and texts shouldn't be animated because this is where users need to read. Also, adding more animations can increase the time to finish the task, which does not conform with the principles of efficiency from HCI. Besides, some animations can drive the participants' attention away from the task. For example, an arrow button was sliding up from the bottom to the screen. Even though it definitely grabs users’ attention, it also transfers the attention to the button rather than understanding the task itself, which indicates that animation should be less intrusive but still keep its affordance. Therefore, animations should match the context and the user needs. The is the reason in version 3, unnecessary animation for some elements was deleted. From the participant's feedback, he mentioned about how to distinguish the demo-only animation and interactive animation. It gives me a reflection that by keeping two sorts of animations, the demo and interactive animation, the participants cannot identify which elements are supposed to be pressed, such as, a highlighted area and button, both of them are animated. Besides, a majority way to connect each page in version 1 and 2 is keeping pressing the arrow button. If users keep pressing the arrow they manipulate it effortlessly. However, bearing in mind, this may lead to a problem that participants cannot understand the task itself, because all they need to do is keep pressing, and they can finish the task. As a result,

As a result, the unnecessary arrow button was deleted and the highlighted box was used as a trigger to move on the next page. Therefore, it is more interactive than before. Only animating the highlighted area and using it as the interactive trigger can eliminate the confusion for where it should be pressed while providing enough attention-grab to help the participants understand the task properly.

5.2. Roles transforming from participants to co-creators

In the conventional usability test, the participants were asked to perform tasks, to gain insights from them. However, they still stand on the outside of the design and product. In contrast, in terms of the co-creator mode, they can take an active role to contribute and design products alongside the designers (Domingo, 2020).

So, how to let participants become co-creators? In order to achieve this, it helps to invite the participants to join the usability test as early as possible, because the product is still in the preliminary or formative stage, where participants can feel more freedom to perform the tasks. Besides, designers should make sure participants can review the design process even though the product is still in the formative stage, especially if participants attempt to go deeper into the design (Rubin & Chisnell, 2008). Therefore, the prototype should not be well established. Introducing paper prototyping can easily collect feedbacks from participants because its sketchy characteristics, which means participants can feel more confident to judge or citizen the design flaws than the neat, polished design (Babich, 2020). In addition, the prototype should provide different design concepts to the participants. For example, in version 1, there are several ways to animate the button in different user interfaces, such as, sliding from bottom to screen, zooming in and bouncing, in order to ask the participants to decide which form of animation is more user-friendly. By providing the options to the users, they can feel more freedom to speak out and give their opinion and it encourages them to generate ideas actively.

6 Discussion

This exegesis has presented how animations in the user interface designed and developed during the research, by applying different research methods, including RtD, UCD, HCI, usability test, data analysis and collection. Animations as a powerful and communicative tool in the user interface, can help users in different ways. Animations can grab user' attention, by providing a sort of noticeable, visual feedback, in order to inform users that the system is operating. It also provides a sense of emotional security, ascertainment and satisfaction.

Animations can provide a visual hint, providing expectation to users of what is going to happen. Besides, animations contribute to the navigation in the user interface, to decrease the possibility of getting lost to novices. By providing the animated transition, users can clearly understand how state changes in the user interface work, this can define the spatial relationship and help users understand how the elements and screens are changing. However, animations are not easy to apply to the user interface. Too many animations on the same page can cause users to be confused. It also increases the time it takes to finish tasks. If it is too fast or too slow, it will cause a negative user experience. Animations can drive user's attention away from a task, if the animation is intrusive. As a result, animations should be applied based on the context of the task and users' need.

In the conventional usability test, participants were asked to perform tasks, to gain insights from them. However, they still stand on the outside of the design and product. In contrast, when it comes to the co-creator mode, they can take an active role to contribute and design products alongside the designers (Domingo, 2020).

The usability test fulfilled a significant role in the design process. This study uses different usability testing methods, including iterative testing, comparison testing and the think-aloud method. By conducting iterative testing, the quality and functionality of a design product can be improved by identifying usability issues which may happen in the user interface. Comparison testing allows participants to choose which design they prefer in order to motivate their participation actively. The think-aloud testing method can encourage participants to speak their thoughts while they are interacting with the design product. If participants give the error performance or have misconceptions about the product, their performance usually can transfer into a sort of actionable redesign and it needs to be changed in the following stages. The core of the usability test is to collect data and eliminate design problems. A usability test is useful for the target audience, to make sure the product is easy to use and easy for users to learn. By observing user's performance, we can develop a sense of empathy for users, in order to acquire more understanding of their need. After we collect enough empathy, holistic problem statements can be defined, as it can ideate the design solutions. Next, developing the prototype, both a low and a high-fidelity prototype can form a tangible, practical product, to be used into the next round of the usability test.

The findings for this study are still limited and insufficient. Firstly, the usability test was conducted only by primary researcher. Ideally, there should be two persons to conduct a usability test. One person is communicating with the participants as a moderator, and the other

person is focusing on recording a participant's performance as an operator. Therefore, the testing results may not be holistic. Secondly, due to the Covid-19 situation, more usability tests could not be conducted. There should be more concrete and well-defined testing results. The usability test needs more participants from different backgrounds. Besides, even though the portfolio and the annotated portfolio were in an interactive format, it was changed to the read only format as an MP4. Due to the Covid-19 situation, it was not possible to present it via a face to face presentation and use the interactive mode to explain the whole study process.

Future work

In the future, I will focus more on ethnography. How can different nationalities influence animations in the user interface? Do they prefer some types of animations based on their background and their environment?

Regarding how to apply eye-catching technology in mobile usability test in the future, nowadays, most eye-catching technologies are used into desktop usability test. In order to acquire more precise and scientific data from the participants in a mobile platform, it is necessary to record and trace their eye's movement. Poole and Ball (2006) have explained that eye-catching technology can reveal how participants process visual information and how the usability of the system can be influenced by participants' performance. In this respect, more objective data can be collected, which can improve the interface design.

Undoubtedly, the technology of mobile phones is increasingly advanced. These days, the curve-edge phone is quite popular, for example, the Samsung Galaxy S10, or the foldable touch screen phone, the Huawei Mate Xs. It is interesting to explore how animations influence the user experience in these devices, will the foldable touch screen influence the usability of the animations, will there be differences in the animations if we compare the flat screen and the foldable screen and how can we design animations that can improve the usability in these devices?

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8 Appendices

Appendix A :Ethics Approval

Auckland University of Technology Ethics Committee (AUTEC)

Auckland University of Technology
D-88, Private Bag 92006, Auckland 1142, NZ
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

19 November 2019

Ricardo Sosa
Faculty of Design and Creative Technologies

Dear Ricardo

Re Ethics Application: **19/406 Exploring the benefits of animation in user interface design**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 18 November 2022.

Non-Standard Conditions of Approval

1. Update logo on advertisement.

Non-standard conditions must be completed before commencing your study. Non-standard conditions do not need to be submitted to or reviewed by AUTEC before commencing your study.

Standard Conditions of Approval

1. The research is to be undertaken in accordance with the Auckland University of Technology Code of Conduct for Research and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard.

AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted. When the research is undertaken outside New Zealand, you need to meet all ethical, legal, and locality obligations or requirements for those jurisdictions.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact ethics@aut.ac.nz. The forms mentioned above are available online through http://www.aut.ac.nz/research/researchethics

Yours sincerely,

Kate O'Connor
Executive Manager
Auckland University of Technology Ethics Committee

Cc: gdx8921@autuni.ac.nz; Claudio Aguayo

Appendix B Tools

Participant Information Sheet

Participant Information Sheet

Participation Information sheet for AUT students.

Date Information Sheet Produced:

16 October 2019

Project Title

Exploring the benefits of animation in user interface design.

An Invitation

Hello, my name is Yutong Zhou (Jeffrey). I am researching user interface design, especially focusing on the benefits of animation/motion in user interface. To achieve this goal, this project needs participants to join the usability test. This information sheet is an invitation for you to participate in the usability test. This usability test will not involve any conflict of interest to you. Would you like to join this usability test?

What is the purpose of this research?

The aim of this study is to explore how to apply animation in digital user interface as a means to alleviate novice's potential negative emotions, such as a sense of unfamiliarity. A majority of user interface elements are static, we identify an opportunity to use movement to improve the user experience. Animations have the potential to help the user understand what is happening before, during, and after the action when they interact with the user interface. Animation can provide visual cues of what is happening before, during, and following a given action, which can provide users with a sense of accessibility and usability. This study aims to obtain evidence to better understand how animation can improve usability. The research findings also can attribute academic publications.

How was I identified and why am I being invited to participate in this research?

You were identified as you are a AUT student who older than 18 years old. You are being invited in this research because you showed your interest.

The reason for only choosing AUT students is that it is logistically convenient to conduct the usability test on campus, both to the primary researcher and potential participants. The usability test will be taken in a laboratory located in Building WG Room 1106. AUT students can find this place easily. Besides, an invitation poster for the usability test will be distributed across the AUT City campus, making it convenient to AUT students to find key information regarding the usability test.

Consent form

Consent Form

For use when usability test is involved.

Project title: Exploring the benefits of animation in user interface design

Project Supervisor: Ricardo Sosa, Claudio Aguayo

Researcher: Yutong Zhou, (Jeffrey)

- ● I have read and understood the information provided about this research project in the Information Sheet dated dd 16/10/2019.
- ● I have had an opportunity to ask questions and to have them answered.
- ● I understand that data will be recorded by screen recording with audio.
- ● I understand that taking part in this study is voluntary and that I may withdraw from the study at any time without being disadvantaged in any way.
- ● I understand that the video and audio recording will be used for academic purposes only and will not be published in any form outside of this project without my written permission.
- ● I agree to take part in this research.
- ○ I wish to receive a summary of the research findings (please tick one): Yes● No○

Participant's signature: Lifu Wang .....

Participant's name: Lifu Wang.....

Participant's Contact Details (if appropriate):

gvt6202@autuni.ac.nz.....

.....

.....

.....

Date: 12/11/2019

Approved by the Auckland University of Technology Ethics Committee on type the date on which the final approval was granted AUTEC Reference number type the AUTEC reference number

Note: The Participant should retain a copy of this form.

A poster for inviting participants to join the usability test

Appendix C Research outputs from thesis

1 Design portfolio (Artefact)

Version 1

Version 2

Version 3

2 Annotated portfolio

Version 1

Version 2

Version 3

3 Covid-19 portfolio

Interactive version

Linear version