Designing an Interactive Comic for Mobile Phones Based on User Preferences in Malaysia

Submitted by

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ABSTRACT
The current trend shows a transition of information and entertainment media into handheld devices. This also attracts the development of comics from printed book and digital form in larger PCs screen into mobile phones, introducing mobile comics. Taking the direct advantages of mobile phones (i.e. vast mobile phone market, portability, and the advancement of mobile phone technology), mobile comics offers certain advantages including lightness and the ability to read the comic anytime and anywhere. However, it is also found that the shift into mobile phone influences how the comic is presented. The limited display size introduces readability and visibility issues in displaying the entire comic sequence. At the present moment, there have been many different techniques to improve readership convenience such as the extraction of the individual panels from the page and the addition of motion, sound and zooming feature. However, these techniques are lacking in considering the basic nature of comics in the production process which could influence the overall arrangement and the impact of the comic story. In addition to that, taking a variety of approaches may not necessarily be as effective in addressing the user preferences. Therefore, this study takes into consideration three areas: essential elements of comics, mobile phone user interface design and Malaysian user preferences for designing new mobile comic interface.

Two approaches are implemented in this study, including the combination of ancient linear narrative and panel-by-panel approach; and Infinite Canvas approach. These approaches are argued to maintain the continuity of the story over conventional z-path reading sequence. Moreover, interface design guidelines are considered in the development process to improve the quality of the interface design and reduce some potential usability issues when reading on small screen. In the later designing process, the two designs are combined and presented as options for viewing the same comic content. This option could provide freedom for users to choose the most suitable display layout. With the combination of both initial designs and further refinements, the final design could successfully provide better interfaces with faster completion times, enhanced consistency and visibility. The results reveal positive responses for “innovative”, “user friendly”, “new interface” and “interactive”. This outcome supports the argument that the understanding of the essential elements of comics, mobile phone user interface design and Malaysian user preferences is necessary, and these are important design considerations in creating new reading comic experience for mobile phones.
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DECLARATION

I, Astria Dhita Wandani, declare that this thesis:

- contains no material which has been accepted for the award to the candidate of any other degree or diploma, except where due reference is made in the text of the thesis;
- to the best of the candidate's knowledge contains no material previously published or written by another person except where due reference is made in the text of the thesis; and
- where the work is based on joint research or publications, discloses the relative contributions of the respective workers or authors.

Signed ________________________

Dated ________________________
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1 INTRODUCTION
This initial chapter aims to provide an overview of this research which will include the background of this study, the problem formulation, the research objectives and questions, the scope and limitation of the research, methodology and lastly, the thesis structure.

1.1 BACKGROUND
The current trend shows a transition of information and entertainment media into handheld devices, mobile phone in particular. This trend is supported by the significant advancement of mobile phone technology from time to time, getting closer to offer similar capabilities with personal computers. With the faster processing speed, higher memory capacity, internet connectivity and supporting more interactivity, it begins to oversee a promising area of mobile application development. In addition to that, this technology advancement is also followed by the tremendous growth of mobile phone penetration rate. According to International Telecommunication Union, there are 5.9 billion mobile phone subscriptions, with global penetration that reaches 87%, and 79% in the developing world (ITU 2011). Therefore it is predicted that mobile phone will continue to gain popularity for communication as well as for information and entertainment purpose.

Comics, as one of the entertainment category, have always been in high demand as a medium for telling stories not only for kids but also for teenagers and adults (Antonucci cited Kirsh & Olczak 2000). Its popularity is driven by the use of pictures and texts, thereby making it more interesting and easily readable for all ages. Commonly, comic is distributed as printed newspapers and comic books, and the Internet (web comics). However, the shift of trend into mobile phone also attracts the development of comic to evolve and adapt into this emerging platform, introducing mobile comics. Mobile comics take direct advantages of mobile phones such as huge market over the world, portability which allows users to read their favourite comics anytime and anywhere, and also the Internet connectivity, offering an instant way to get comics instead of going to the book store in person. This situation introduces interesting potentials of mobile phones as a new medium for reading comics.

These potentials have been noticed by many comic publishers. In July 2009, the number of mobile manga (comics) being released by a Japanese manga publisher to the iPhone application was 30 books per month. By October the same year, the number has increased to 170 books per month (Flurry 2009). It is assumed that this number is still growing as
some big US comic publishers also started to shift their attention towards developing comics in mobile phone format such as Marvels and Disney Publishing.

Apart from its potentials, the shift into mobile phone influences how the comic is presented. Unlike other medium, mobile phones have unique characteristics especially on the display size. The small screen size introduces new challenges in readability and visibility to display a sequence of comic panels. Thus, further enhancements are introduced to enhance readership convenience. At the present moment, most of the earlier studies (Arai & Tolle 2010; Han et al. 2009; Ponsard & Fries 2009; Yamada et al. 2004) only focused on the technology for automatic conversion into mobile comic format by taking out individual panels (panel-by-panel approach), while the mobile comic developers try to offer enhanced features such as motions, sounds and zooming features. The freedom in using more multimedia in comics in a digital environment enriches the creation of mobile comics. However, this digital opportunity may affect the intention and impact of the original comics (the essence of comics) by influencing the arrangement and flow of the comic story. Therefore, it is necessary to consider and maintain the intention and impact of the narrative when designing a new comic user interface.

As an emerging economy in Asia, Malaysia seems to be a favourable country for developing mobile comics due to a remarkable growth in its mobile phone market, in terms of penetration rate and government support. In 2010 Malaysia had over 34 million mobile phone subscribers which exceed the total population (28 million) with a 121% mobile phone penetration (CIA 2012). Malaysian market sales are expected to grow to 9 million units in 2015, as mobile subscriber penetration passes 124% (cited in Mokhlis & Yaakop 2012). In addition to that, Malaysia is one of the many countries which are committed to developing digital content. One of the supports is shown by providing a variety of grants to help the digital content development, such as Networked Content Development Grant (NCDG), the eContent Fund, Industry Creative Fund programs (Mohamad 2010). However apart from that, the production of mobile content particularly mobile comics in Malaysia is still limited at the moment as only one comic publisher comes to mind, Chill by VIBS (launched in 2010). Looking at the potential and the support available, a further study on this area becomes necessary. It is believed that taking a variety of approaches may not necessarily be as effective in addressing the user preferences which seems to be lacking at the moment. This makes it important for this study to understand the Malaysian preferences in order to enhance convenience and satisfaction toward mobile comics.
Therefore, the present research is situated in the field of: essential elements of comics, mobile phone user interface design and Malaysian user preferences in order to create a new reading comic experience on the small screen size while at the same time achieve user satisfaction. The challenge of this research stands in understanding how it is possible to combine all the aspects into a single mobile comic application that provide both positive user experience and user satisfaction.

1.2 RESEARCH OBJECTIVES AND QUESTIONS
Based on the aforementioned problems, this research aims to accomplish specific objectives as follows:

Primary objective
- To design a new reading experience for mobile comic application that incorporates the essential elements of comics and Malaysian preferences.

Sub-objectives
- To identify the essential elements of comics and to examine how they are maintained in the various comic forms available
- To identify the criteria to produce a usable mobile comic interface that achieve positive user experience and satisfaction
- To identify and address Malaysian preferences toward mobile comic application
- To measure the user experience and user satisfaction toward mobile comic application

The above objectives will be achieved by answering the following research questions. The main research question is “How can we design a new reading experience for mobile comic that incorporates the essential elements of comics and Malaysian preferences”. However, in order to address the main problem of this research, a number of secondary research questions have to be answered first:

RQ1: What are the essential elements of comics?
RQ2: What are the available comic forms in various medium and how are they maintaining the essential elements of comics?
RQ3: What are the factors or issues that need to be considered when designing a usable mobile comic interface?
RQ4: What are the mobile comics’ features preferred by Malaysian users in order to enhance reading experience and convenience?
RQ5: How do we measure user experience and user satisfaction in a mobile comic application?
Based on the outcomes of the listed questions, this thesis will propose approaches, considerations, and appropriate production processes for the future of mobile comics development.

1.3 **Scope and Limitation**
This research focuses on user interface design of comic on mobile phones. This covers the exploration on the essential elements of comics, mobile phone user interface design and Malaysian user preferences. Furthermore, the limitations of this study include:

- This study is limited to Malaysian students at Swinburne University of Technology, Sarawak Campus.
- This study was conducted to gather the Malaysian user preferences in general. The more specific scope such as different preferences between comic fans and causal comic readers is not covered in the present study.
- This study focuses on creating user interface in terms of display and interactivity, and concerns less on the size of data storage, performance speed and how the comic has been distributed technically.
- The study is constrained to mobile phones with the display size up to 4.3 inches, however it is hoped that the results can be extended for further study on other larger-screen platforms such as tablets.

1.4 **Methodology**
This study is conducted using the combination of quantitative and qualitative research method approaches to explore the area of user interface design for reading comics on mobile phones. At the beginning of study, literature review was performed to explore the areas of: essential elements of comics and mobile phone user interface design. In the next phase, a survey was conducted to collect Malaysian perceptions toward reading comics on mobile phone. It is also aimed to gather users’ preferred features and functionalities in order to enhance reading experience on mobile comics. Based on the information gathered, two different mobile comic prototypes were developed which will then be evaluated using usability testing method. This usability testing aims to examine which interface elements and interactions that work and which do not based on the preferences of Malaysian users. Additionally, the findings of this usability study were used to improve the proposed approaches for further development in order to generate the final interactive mobile comic prototype, where the accepted interaction and interface design will be kept and the problematic ones will be refined. The development process is conducted iteratively in order to get a better result (Kuniavsky 2003). The research
process in this study is illustrated in following chart. More detailed explanation will be in the preceding chapters.

![Diagram of Research Methodology]

1.5 Thesis Structure
This thesis is organized into eight chapters; each chapter will discuss different issues related to the project.

Chapter 2 provides the theoretical background for understanding the framework of the research which includes understanding the definition and the essential elements of comics, followed by the exploring the available comic forms throughout the history. Finally, the last sections of Chapter 2 are dedicated to understanding the factors or issues that need to be considered when designing user interface for mobile phone. In this section, an exploration of mobile phone characteristics and the area of user experience and user preferences are covered. Besides that, measurement metrics for evaluating user experience and user satisfaction are reviewed.
Chapter 3 explains the method used to collect Malaysian user preferences and perceptions on mobile comics. Participants, instruments, procedures and data collection are covered. At the end, results of the survey are examined.

Chapter 4 covers the initial development process of the two proposed mobile comic prototypes. These prototypes are produced using two different approaches: combination of ancient linear narrative and panel-by-panel approach; and McCloud’s Infinite Canvas theory. Design elements such as navigation, layout and interaction, fonts and colours for each prototype are given.

Chapter 5 describes experimental evaluation method on the two prototypes and provides the outcomes of the experiments with some discussion of the results.

Chapter 6 reviews the current issues found in the two prototypes based on the previous usability testing. This chapter also covers the adjustments made to produce a final design of mobile comic prototype.

Chapter 7 outlines the summative usability test to evaluate the final mobile comic prototype. It includes the explanation of the method used, and discussion of the results.

And finally in chapter 8, conclusion of the research is drawn along with both the strengths and weaknesses of the work conducted. This chapter also discusses possible future research of the study.
2 LITERATURE REVIEW

2.1 INTRODUCTION
In order to effectively design comic user interface, the idea of comics in the larger context must be understood. In particular, it is necessary to understand the essential elements of comics (Section 2.2.1). Furthermore, it is also important to recognize the available comic forms in various medium (e.g. ancient forms, printed paper, personal computers, and mobile phones) in order to understand how they maintain the essential elements of comics (Section 2.2.2). It is beyond the scope of this thesis to provide a complete review of comic evolutions. Instead, the research will only focus on the key issues within transition from one medium to another that are most relevant to the development of the mobile comic user interface. The reviews of these available comic forms are necessary to find the most appropriate approaches for designing a new mobile comic interface.

Along with the theoretical foundations on comics, technical considerations when designing user interface for mobile phone are also presented. These consist of identifying the overview of current mobile phone distribution worldwide and in Malaysia (Section 2.3.1); identifying mobile phone characteristics that affect the user interface design (Section 2.3.2); and exploring the area of user experience and user preference such as user interface guidelines, the importance of user preferences and measurement metrics for evaluating user experience and user satisfaction (Section 2.3.3). An awareness of these issues is necessary to design a usable mobile comic user interface that will engage in an enjoyable reading experience.

2.2 THEORETICAL FOUNDATIONS: THE COMICS
This section describes the definition of comics and how the comics work. Later in this section, a discussion on how the changes in technology affect the development of comics is covered, followed by review of the existing mobile comic applications.

2.2.1 DEFINITIONS OF COMICS
The early comic strips, both in England and America, were of a humorous nature. Since then, the attribute "comic" remained although some of the themes are not comical at all (Saraceni 2003). The term of comic is widely accepted and used to represent comic strip, comic book, manga, graphic novel and newspaper’s comic strip.

Throughout its unique visual language, a senior comic artist, Will Eisner (1985) coined a term to describe the technique and structure used in comic as “sequential art”. He defined
it as “an art and literary form that deals with the arrangement of pictures or images and words to narrate a story or dramatize an idea” (Eisner 1985 cited in Pannafino 2009). In his definition, he emphasized the use of pictures and words in storytelling. However this definition can also be referred to literary form in other media, film for instance.

In other words, Scott McCloud (1993), a comic author/theorist defined sequential art as “juxtaposed pictorial and other images in deliberate sequence, intended to convey information and / or to produce an aesthetic response in the viewer”. Instead of emphasizing the use of “words”, McCloud suggests to replace it into “other images”. This “other images” can refer to lettering in comic book (e.g. words presented in speech balloons, captions, and sound effects), and the “action lines” in manga (e.g. multiple lines behind a person to show movement). While describing this definition, McCloud clearly exclude single panel cartoons from comics. Even though cartoons and comics are similar in a way of using combination of words and images, he argued that these are something different.

Similarly, Saraceni (2003) also eliminate the single panel cartoons from his descriptions on the most important characteristics of comics. “Although the use of both words and pictures together, as such, is not a unique characteristic of comics, the way in which linguistic and pictorial elements interact with each other certainly is. The arrangement into sequences of panels is the other fundamental characteristics of comic. This is what makes comics different from cartoons, which are composed of one panel only” (Saraceni 2003). Besides that, in here, he is trying to emphasize the interaction between linguistic & pictorial elements and the sequential arrangements are the most fundamental characteristics in comics.

In a similar study, Magnussen (2000) explains the act of communication in comics in the explanation below:

... [the panels] are not interpreted autonomously, but in the context of each other. As a consequence, focus is on the way the signs interacts, thereby creating a bigger, more complex, sign, that of the panel itself. The panel-sign is seen in the context of its position on the page and within the sequence. The panel interacts, creating an even larger sign, the comic(Magnussen 2000, p.195-196)

Based on the statement above, she also underlines the importance to interaction between panels within the sequence. McCloud identifies the “interaction between panels” mentioned by Magnussen as closure or “the phenomenon of observing parts but
perceiving the whole" (McCloud 1993, p.63). Readers' mind will perform “fill in the gaps” between images by taking separate images and transform it into an idea. Thus, the unrelated comic panel can be fused into a complete story.

While McCloud, Saraceni and Magnussen agree that the sequence is the essence of comics, Robert Harvey argues that "It seems to me that the essential characteristic of 'comics'-the thing that distinguishes it from other kinds of pictorial narratives-is the incorporation of verbal content" (Harvey 2001 cited in Chute 2008). In his definition, Harvey focuses only on the integration between images and words. He declines the wordless comics, and at the same time includes a single panel cartoon into his comic category. This argument provides unique insight in the area of comic concepts. The integration of images and words is indeed important to better communicate the story. However, it does not mean that it should be limited to comic with text. In fact, the continuity of panels’ sequence may provide better view of the overall story, for example Garfield by Jim Davis (Figure 2).

![Garfield comic strips](image)

*Figure 2: Wordless comic, Garfield (Davis 2000)*

These arguments imply that the most essential criteria of comics relied on the combination between images, texts, and other pictorial graphics; and more importantly the sequential arrangement of images. Moreover, with this spatial relationship of these images, readers’ imagination will perform “fill in the gap” to connect the story. This unique panel relationship makes it different with other media (i.e. animated movie, games). It is argued that whatever medium used to communicate the comics, it must be able to convey the intention and impact of the narrative by maintaining the flow and continuity of the overall comic arrangement. This will be referred as the essential elements of comic in the rest of the thesis.
2.2.2 **The Development of Comics**

George Santayana, a famous Spanish novelist and philosopher in mid 1990s, stated that “understanding our present views of the future requires looking at how different ideas and approaches to it have developed through the ages; the past puts the present into perspective; the present has been built upon the past” (cited in Lomardo 2008, p.141). Therefore, to better understand the current issues and potential approaches, this study explores the development of comic forms through ages which started with the ancient pictorial narrative artworks to printed comics to web comics and finally, to mobile comics.

### 2.2.2.1 Ancient Narrative Art

Taking the history back from comic books, comics - or a sequence of images – existed since the ancient times where the stories are drawn in iconic illustration on stones, vases, or pillars (McCloud 1993; Petersen 2011). Scholarly, the early version of comics is also known as narrative art or visual narrative (used by Petersen 2011) while Murray (1995) chose to call it as narrative illustration. In her study, she defined this term as “the pictorial representation of or reference to one or more ‘events’ that occur in a sequence of time and that bring about a change in the condition of at least one character” (Murray 1995, p.17).

Generally, narrative artworks were made to illustrate religious stories from the bible such as the Buddha life stories in Dipankara jataka (Figure 3) and Chaddanta in Amaravati stupa (Figure 4), or to record the important events that happened in the past such as the war between the Norman and English Battle of Hastings in Bayeux Tapestry (Figure 6). These early artworks introduce various approaches to communicate sequential art by applying different kind of arrangements (i.e. random placement, side-by-side) and transitions (i.e. with or without border). These varieties make the early forms interesting to be explored in order to examine how they maintain the essential elements of comics.

The existing ancient artworks show some similarity in terms of the compositional elements used to structure the illustration in order to convey a story, for instance, single or multiple events (scenes), repetition of the character and small or large size. By looking at those elements, Petersen (2011) & Dehejia (1990) groups the narratives taking examples from the early Greece and Buddhist art. It consists of monoscenic, progressive, conflated, synoptic, panoramic, continuous, linear, narrative network, cyclic. However since the monoscenic and progressive narratives are more into cartoons (only present single image or panel) than comics, both of these narratives will be excluded from the discussion.

Conflated and synoptic narratives present the images in small space, allowing the viewer to see the entire illustration all at once. Conflated narrative utilizes a single figure to tell
multiple actions or events. Dipankarajataka, Gandhara (3rd century CE) is one example of conflated narrative (Figure 3) where a single figure of Dipankara Buddha (the largest figure) is used in three different events: receiving the lotuses, blessing Sumedha, as well as making the predicting (Dehejia 1990). In contrast with conflated narrative, the synoptic narrative provides repetition of the character to show the passage of time. The entire story is wrapped together without a clear divider as displayed in Figure 4. Moreover, the complex composition in both narratives introduces confusion for the viewers who have no prior knowledge on the story.

![Figure 3: Conflated narrative, Dipankara jataka Gandhara (Dehejia 1990)](image1)

![Figure 4: Synoptic narrative, Chaddanta in Amaravati stupa (Dehejia 1990)](image2)

Panoramic narrative depicts multiple thematically related events. Taking an example from Siphian Treasury frieze (525 BCE) in Dephi (Figure 5), the unbroken illustration of panoramic narrative is grouped into different nuclei in the composition. This artwork is placed on the high up on the top of large building making it impossible to view the entire narrative all at once. Moreover, the events presented in panoramic narrative do not have causal relationship one to another, but rather describe events that are happening more or less at the same time (Petersen 2011).

![Figure 5: Panoramic Narrative, Siphian Treasury frieze](image3)
On the other hand, continuous and linear narratives illustrate the serial of actions to tell the complete story. Both of these narratives have similarity in terms of size and the detail of the sequential events presented. However apart from that, continuous narrative does not utilize any visual divider to separate each event to another. Each event is indicated from the repetition of the character (Petersen 2011). The example of this narrative can be seen in Bayeux Tapestry (Figure 6) and the Tomb of Menna (Figure 7). In linear narrative, the events are divided using a vertical visual border (Dehejia 1990). The border can be part of the story elements such as columns, trees in the Vessantara jataka at Goli (Figure 8a) or unrelated to the story such as pillars in story of Nanda in Nagarjunakonda (Figure 8b). The side-by-side arrangement in both continuous and linear narrative provides a clear reading sequence and at the same serves the continuity between panels or scenes.

Figure 6: Continuous narrative, Bayeaux tapestry

Figure 7: Continuous narrative, the Tomb of Menna
For narrative network, Dehejia (1990) took an example from the murals at the monastic site of Ajanta (Figure 9). The major characteristic of this narrative is the complexity of the scene arrangements. The sequence is arranged in an unpredictable manner. There is a possibility that viewers may feel confused as to where one scene starts and ends and also which direction the action moves. To be able to unfold these sequences correctly, prior knowledge on the Buddhist text in the fifth century is required.

Different with other narratives, cyclic narratives are presented in multiple frames. Petersen (2011) described that "each picture in the sequence represents a unique scene and each subsequent picture is related through a common story or related story". Thus, between these images, there is no causal relationship that can be found. Instead, each image illustrates specific thematically related events. Petersen presented an example of cyclic narrative as the Temple of Zeus at Olympia (470-456 BCE) which tells a story about 12 labors of Herakles (Figure 6). This artwork is separated into 12 scenes where each of the scenes represents one of the labors. Moreover, this narrative can also be found in today’s literatures such as children’s book (Shaw 2011) where the picture only illustrates a single event but not leading the story forward.
These early artworks in fact have influenced the newer visual narrative, such as Chinese hand scrolls. Apart from the medium used, Murray (1995) claimed that the Buddhist narratives have inspired the idea of longer narratives drawings on the Chinese hand scrolls. Besides that, McCloud (2000b), who invented the infinite canvas theory, also cited these ancient narratives. He found that these early techniques are rarely found in the modern narratives as these early artists had more freedom to create unbroken and less structured works where the size and the compositions chosen are generally dictated only by the availability of the physical space.

In conclusion, referring to Figure 11, most of the ancient visual narratives present story in single direction as shown in conflated, synoptic, continuous, linear narratives and narrative network. However the approaches in conflated, synoptic and narrative network introduce confusion to the viewer due to the complexity of the images arrangement. A simpler and clearer images sequence is shown in continuous and linear narrative. This simple composition offers easiness for readers to connect one scene to another. Moreover, it is argued that these approaches have successfully maintained the spatial relationship between scenes or images in a side-by-side arrangement. On the other hand, an unrelated image relationship approaches in panoramic and cyclic may not be appropriate for comics as majority of comics aims to deliver a new story instead of only illustrating a famous event.

Other than that, notable information from the early artworks is also found with regards to the transition between scenes or images. It includes the changes of characters’ action or expression (used in continuous narrative) and the addition of visible divider (used in cyclic narrative).
linear narrative). A clear panel-to-panel transition is crucial to provide space for readers to use their imagination to connect the story between the scenes. Furthermore, moving forward hundreds years ahead, the next section will explore forms of comics in paper medium.

Figure 11: Summary of visual narratives

2.2.2.2 Printed Comic
A remarkable change in the history of literature occurred after the invention of the printing press in 1400s. Artworks started to appear in paper forms. Initially, in most early
works “narrative transitions depended heavily on the words printed below or above the panels of the strips, and more often than not the images were mere illustrations” (Bartual 2010). These types of works started to change when William Hogarth created sequential groups of engravings such as A Harlot’s Progress, The Rake’s Progress, Marriage a-la-Mode or Industry and Idleness since 1973. His engravings were made in separate pieces, however as they are presented together in a side-by-side manner, this “make the reader imagine what happened before and after the moment depicted in each print” (Bartual 2010). Bartual argues “Hogarth’s pivotal role in the tradition of picture stories has to do with the fact that he paved the way for his successors by developing a purely visual language to establish a narrative discourse”. The change from early works into Hogarth’s sequential stories in fact inspired many artists, including a Swiss artist Rudolphe Töpffer, a father of modern comic as called by McCloud (1993).

Rudolphe Töpffer began to gain popularity with his satirical picture stories since 1800s. In his work, he “employed cartooning and panel borders, and featured the first interdependent combination of words and pictures seen in Europe” (McCloud 1993, p.17). These additional panel borders introduce narrative pacing technique in narrative arts and comics, illustrating “a single idea over several closely linked pictures, as if one were seeing the action unfold in a play” (Petersen 2011, p.49). He also use different size panel on the page to suggest different pacing of the story (Petersen 2011, p.49). Different from Hogarth’s sequential stories, Töpffer’s work present causal relationship between images within relatively shorter period of time. The unique style and form breaks the techniques on the previous narrative works as now the pictures are telling the story by themselves.

Figure 12: Topffer’s picture stories using panel borders
In addition to that, some other artists also working on forms to visually communicate speech, including Gillray and Rowlandson. Both of them “occasionally used balloons in their political and social satires, but generally their dialogue vehicles retained the vestigial character of banners and scrolls. The balloon contours themselves were often no more than a wispy thread as if the artists wished to make them as unobtrusive as possible” (Boime 1968). These techniques were popular during the middle ages. However since 1820s, the “visual speech forms” almost entirely disappear from popular prints in Europe and the United States until the late 19th century (Petersen 2011, p.49).

The form of comic as we know now was first created in the last half of the 19th century in England as Ally Sloper in 1884 appearing as the first regular comic strip and the first comic hero. This was followed by Comic Cuts in 1890 (Saraceni 2003). While in America, comic in the printed form started to gain popularity since 1896 appearing in the Sunday edition of The New York World. Since the success of Richard Outcault’s The Yellow Kid comic characters, comic strips became a regular feature of daily newspaper and in 1930s, some publishers began to collect newspaper comic strips into books (Saraceni 2003). The Yellow Kid comic strip is also credited for “the revival of the balloon device” as the communication tool in comics (Boime 1968).

These artists show that transition into printed works affecting the conventional techniques used in modern comics. Saraceni (2003) describes components in comics as panels, gutters, balloons, and captions.

- The panels: each page is normally composed of a number of rectangular frames named panels
- The gutter: each panel is separated from the others by a blank space called the gutter
- The balloon: the space in which most of the verbal text is contained. Balloons are used to report speech or thought, and it is why the terms speech balloon and thought balloon are used. The tail of the balloon indicates the character who is speaking (or thinking).
- The caption: the other element of comics that contains linguistic elements. The caption is not positioned inside the panel, but is always a separate entity, often on the top of the panels, but sometimes at the bottom or on the left side. Normally the text contained in the caption represents the narrator’s voice, and to add information to the dialogues contained in the rest of the panel.
The development of comics in printed book continues when Will Eisner were asked to create a 16-page comic book in 1940. He sees this opportunity to explore a unique art form in comic book as he “experimented with odd-sized frames or frameless panels, to break up the dominant grid and create a different sense of the rhythms and pace of action being represented inside the panel” (Petersen 2011, p.149). He also explored the transition between panels “with combinations of panels that foreshadowed future events, or leaped from one aspect of the stories happening at the same time” (Petersen 2011, p.150).

The shifts from comic strips in newspapers and magazine to comic book allows comic artist to create longer stories. At the same time, this transition creates a new unique comic arrangement. While previously comics are arranged in single linear direction, the sequence in comic book changes to the text reading orders. For example, reading order in English texts is horizontally from right to left and from up to down (a “z-path”), while Japanese uses the opposite way, vertically from up to down and right-to-left. McCloud describe these structures as “tiny cul-de-sacs, asking readers to leap to new paths every few panels based on a complex protocol” (McCloud 2000b, p.220).

The development of comic in printed book shows how technology has affected the forms of comic. The story is dictated by the number of book pages, and the creation of comics is also restricted by the available paper space. With this size limitation, it affects the aspect of spatial relationship between images. The story is no longer arranged in a continuous way in a side-by-side manner, but instead creating new more complex reading experience, such as in z-path and page-by-page reading sequence. However the invention of new comic components such as panels, gutters, balloons, and captions should not be overlook as the uniqueness of comic form. The next section will explore how the comics develop and expand in the digital environment.

**2.2.2.3 Web comics**

The new era of comics is presented in digital environment in which comics can be viewed using electronic devices such as personal computers. Previously when comics just went digital, the comics were distributed using CD-ROMs. After the invention of the Internet, this distribution method was shifted to the web pages or what most people called as web comics. Many comic artists had an interest to embrace the web to publish their works. This was started in 1993 by Staffor Huyler’s *Netboy*, a computer-based strip which credited as the first true web comics (Campbell 2006 cited from Thorne 2010). Around 1996, web comics reached its turning point as many newspaper-style strips started to dominate the
online population (Garrity 2011). These web comic are accessed and viewed through web browsers such as Internet Explorer, Mozilla Firefox, Safari, Google Chrome and Opera.

Reaching the digital technology, the technique to create comics is no longer limited to hand drawings and the scanning process. Some image processing programs support the comic artists’ needs to work digitally in their personal computers, such as Adobe Photoshop and Adobe Illustrator. These programs provide convenient workspace with various kinds of brushes, colours, and tools. The use of such programs introduces some new styles in web comics, including comics using images from video games (sprite comics), comics using stick figures, and comics using photographs (Campbell 2006 cited from Thorne 2010). In addition to that, some other web-based programs are also available to create short comic strips online for example Garfield comic creator, Toondoo.com.

The transition into digital environment introduces advantages that were unachievable on paper in terms of easier and faster comic distribution. Initially, they have to struggle to compete with other comic artists to sell their works at fairs and conventions. While using the Internet, the publication can be done relatively fast and easy to reach a global audience automatically (Usborne 2009). According to Internet World Statistics (2012), there are more than 2 billion Internet users worldwide who figuratively refers to the web comic potential readership. Web comics not only offer the easy & fast publication and vast market, but also control. Most comic artists chose to take advantage of the creative freedoms of the web for liberation from editorial control (Thorne 2010). The comic artist has a complete control of their works, including style, contents, updates and advertising.

Currently there are millions of web comics distributed worldwide. Most of them are available as scanlations (scanned and translated by fans) of comic book pages through a single collective site such as OneManga, one of the most popular comic (manga) sites. In addition to that, there is also an online comic portal which allows comic community (both comic artists and readers) to give comments and share their works, for example GoComics, an online comics portal which describe itself as “the Web's largest catalog of syndicated newspaper strips and webcomics” (GoComics 2012). The advantages provided by web comics also attract the major comic publishers’ attention, including Marvel and DC. Many comics that were originally created for print, but have moved on to the web. Cerilli, vice president of content and programming for the Marvel Digital Media Group, said that "we've gotten to this point now where the digital delivery method is being much more widely accepted, and people are comfortable with it”. He also added “all we keep hearing is, ‘We want more.’ And we're going to try to give them as much as we possibly (cited in
Scalera 2011). Thus, Marvel provides a subscription service for viewing complete comics story on its web site. Besides that, DC Comics has also expanded their business to this digital format using a web comic brand, Zuda Comics. Comic artist will get paid by Zuda after an audition and editorial processes (Colville 2007). The shift in distribution method affects the sales of the traditional comic book. In August 2011, ICv2, a market analysis company, announced that the comic book sales were down over 8% in the direct market and in the similar condition, graphic novels sales were declining in the comic shops (ICv2 2011).

Most web comics use the same structure as the printed comics; some are presented in comic strip manner while some use the comic page technique. McCloud (2000b) on the other hand, explores the digital environment by creating comic in the ‘infinite’ digital space. He urges to see the computer monitor as a window, not as a page. Within the infinite canvas, the comic artists can explore variety of panel size, shapes and layouts which was impractical for printed comic book. He provides some samples of web comics that make use of “infinite canvas” in his website (www.scottmccloud.com) such as Zot!

*Online* - that is arranged vertically with the connecting lines between panels - and *The Right Number* – that navigate through the third dimension of z-axis. Some projects have successfully adapted the “Infinite Canvas” theory using the connecting lines between panels – or “trails” - for example Alycia Shedds’s *Work in Progress* (2005) and some of Daniel Merlin Goodbrey comics (e-merl.com), while the others explore the theory in some unique forms such as horizontal interrupted form (Slack-Smith 2006), in circular looping method (Shaw 2011).

![Figure 13: 'Infinite Canvas' web comics, Zot! Online and The Right Number](image-url)
The existence of Infinite Canvas theory brings a change to improve the spatial panel-to-panel relationship that has been broken in the printed comic books. The continuity of a sequence of images – that has been existed in the early artworks – can be maintained in the digital environment. Even though some of panels are not clearly arranged in a continuous linear manner, the addition of trail technique was argued to be successful in maintaining the flow of the story.

Digital environment also allows comic artists to enhance the storytelling using the multimedia approach such as adding a voiceover for the dialogue inside the speech balloons, limited motions inside the panels (e.g. nawlz.com) or choosing the storyline (e.g. Özgüzer 2007; Sathe 2007). However, there has been a debate on using multimedia as a digital comic tool. McCloud rejects it by arguing that “this is additive rather than transformative”. He believes that these techniques “do not change or improve the core of the comic form” but instead they tend “to supply additional information and media that are to be absorbed alongside the comic” (McCloud 2000b, p.29). McCloud sees a collaboration of comics with limited motion, images, and sound as “a slippery slope emerges: if some amount of audiovisual information can create a sense of immersive experience, won’t a fully audiovisual medium such as film be more satisfying, unhindered by the static frames of comics?” (McCloud 2000b, p.210). Garry Tyrrell, who runs the web comic blog Fleen.com also argued “Ironically, by throwing animation or interactivity into webcomics, you risk losing that essential ‘comic-ness’” (cited in Usborne 2009). On the other hand, Jung-HoonSeo (2002) agrees with multimedia as a narrative tool. He stated that “the increased hypermediacy that may result from a multimedia approach should be embraced and explored rather than dismissed”. Apart from those arguments, some comic publishers still try to explore the multimedia aspects for their digital comics, including both Marvel and Warner Bros – the owner of DC Comics. Since 2008, these comic publishers introduce motion comics, combination between traditional comic book with animation, voiceover and sound effects. The approach on motion comics will be discussed further on.

Digital environment certainly introduces new reading comic experience. With just few clicks, comic readers now can enjoy their favorite comics without the need to go to the physical book store personally. Structurally, there are more variation of comics that can be enjoyed; the static common “scanlation” comic pages, larger and attractive “infinite” comics, or animated comics. However, the technology does not stop at personal computers and the Internet. Some handheld devices introduced make it possible to read anytime,
anywhere. The following section covers the development of comics on these small devices especially on mobile phones.

### 2.2.2.4 Mobile Comics

The advancement of mobile phone technology takes part in the development of comics. Originally, the mobile phone is only made for communication purposes. However as time goes by, it started to become an all-in-one gadget. Taking advantage of its portability and vast market, varieties of information and entertainment applications are packed into this small device, including comics. Many companies are interested to expand their comics into mobile phones such as Comixology, and Digicomics. Dario Di Zanni, manager for Disney Publishing’s New Media business unit, said “We want to reach and engage with people where they spend their time, which is increasing on PCs and mobile” (Adobe 2010).

Besides that, comics on mobile phone version are sold in more affordable price as compared to traditional comic books, thus it is believed that it may have higher potential to growth in the future.

Mobile phones have different characteristics than personal computers especially the screen size. Therefore, the comic panels must be arranged differently to better suit the small screen size. One way is by extracting the comic panels and displaying it separately. This technique can be done manually using an image processing software such as Adobe Photoshop. However, this method is time consuming and therefore, not cost effective (Han, Park & Jung 2006). Several studies (Han et al. 2009; Tanaka et al. 2007; Yamada et al. 2004) have been conducted the in automatic conversion from non-digital comic to mobile phone format by separating scanned comic pages into several panels with various approach. However their study assumed that all panels have closed outlines which was explained by Ponsard & Fries (2009). Their study used high level image processing primitives which can generally cope with broken panels (absence of a panel border).

Previous studies worked in “black and white” type of comics, on the other hand Chan et al (2007) has proposed a method for coloured e-comic book by segmenting detected stripes (spaces between panels with uniform colour) with the accuracy of 83%. While other studies were mainly focused on converting offline comic books, Arai & Tolle (2010) proposed a method for adapting digitized comic pages from existing websites onto mobile phone versions. These studies imply that the major focus on mobile comic production is speed and efficiency of the conversion without having to concern about the sequential comic arrangement.
Years after its first creation in the early 2000s, a variety of mobile comics have been produced with different layouts and interactivity adapting with the small screen size of the mobile phones. Some mobile comics require simple turning page interactions; some require additional multiple tap interaction with the characters; some require more complex interaction that affects the comic story (e.g. multiline storyline); while some does not require any interaction at all from the readers (e.g. auto play). This can be differentiated into no interaction, low interaction, medium interaction and high interaction. The following section will review several examples of each category and highlight the technique they use. Each of these mobile comics has certain strengths and weaknesses that are important to consider when developing new mobile comic user interface.

a. No Interaction

One of the examples of mobile comics that require no interaction from the readers is Watchmen motion comics (2008) by Warner Bros. Watchmen motion comic was adapted from the traditional comic book and illustrated by Dave Gibbons. The entire story was separated into 12 chapters of motion comics. Taking advantage of the digital format, Watchmen motion comics is distributed on Blu-ray and DVD. Watchmen motion comic uses limited motion to show movements in the comics, such as moving eyes, footsteps and moving background image. Voice-over technique was also used in motion comic narrating the text presented on the screen while in similar type of comics, Astonishing X-Men by Marvel Comics displays few to no text in their motion comic. In addition to that, sound effects (e.g. breaking glass and rain) and background music was added. The nature of motion comic is similar with animation as users are only required to play and enjoy the whole story. As compared to traditional comic, a more detail sequence of scenes or panels are played continuously without any visible gutter, reducing the space for reader to use their imagination to “filling the gap”. This motion comic was not intentionally made for mobile phones; however the unique presentation of this comic made it interesting to be reviewed.
b. Low Interaction

This category refers to mobile comics with minimum state of interactivity such as turning pages or panels in order to navigate through the comics, for example *Princess Ai* by Sunsoft Books (2009) and *DigiComics* by Disney Publishing (2010). Providing panel-by-panel layout, both of these mobile comics have successfully solved the readability and visibility issue. However, McCloud argued that displaying a single panel at a time overlooks the essential elements of comics which is applied in the spatial relationship between comic panels (McCloud 2000b, p.209). The approach has failed to maintain the continuity between panels which may affect readers’ imagination to “filling the gap”. Although, there has been an argument about it, most comics publishers still prefer to apply the panel-by-panel approach due to the faster production process using the direct comic conversion, for example *Chill* by VIBS, iVerse and *Wallace & Gromit* by Titan Publishing.

Other than that, *Princess Ai* also provides different view modes: from panel-by-panel view, single comic book page view, up to a spread page view. Different ways of holding the device will change the view mode automatically, for example holding the device vertically will select “single page” mode, holding the device horizontally will select “spread page” mode, and double tapping on the panel will select “panel-by-panel” mode. Refer back to the essential elements of comics, the comic pages view works just like printed comic book. It has maintained the panels’ relationship, however it also create a more complex reading sequence. Moreover, to keep the continuity, this mobile comic uses simple animation for the panel/page transition. *Princess Ai* mobile comic presents some useful insights in designing mobile comic interface, especially the idea of providing users with multiple reading view modes. This shows that the developer takes user preferences seriously, giving users more freedom to choose the most suitable method for them.
c. Medium Interaction

The “medium interaction” category represents mobile comics with more interactivity, such as the addition of multimedia (i.e. animation, sound effects), transition effect, and interaction with a character. One of the examples is the Super Capers comic that was published by RG Entertainment in 2009. In this mobile comic, a panel-by-panel comic arrangement is enriched with sound effects (e.g. clapping and the sound of airplane’s machine) and additional limited animation (e.g. in the part where the airplane starts to take off). The developer also tried to keep the sense of flipping paper that occurred in comic book by adding the “turning page” transition effect (refer to Figure 17b). This effect will be activated when readers perform swipe gesture from bottom right side of the screen to the opposite side. Moreover, in few panels, readers are required to tap multiple times on a character to be able to move to the next panel. The interactivity introduces by this comic is interesting as it try to combine the “feel” of printed comic book and digital comic. Apart from the arguments on the use of multimedia (refer to Section 2.2.3), this comic offers a new reading experience. However, the panel-by-panel approach is still a problem since it only limits to display a single comic panel at a time.
d. High Interaction

Unlike other mobile comics, the readers’ interactions in these mobile comic categories are very important to generate the comic stories or to display the comics. One of the examples is *Adopt a Rapper* by Norbssoft (2010). Structurally, it shares some common technique with *Interactive Manga Site* by Özgüzer (2007) and *On All Fronts* by Sathe (2007) where the story has multiple endings. The story in this type of comic are generated according to reader’s decision. In *Adopt a Rapper* mobile comics, the decision is made by simply selecting a single path out of two or three potential options, and it will jump to the next panel straightaway. This makes the comic panels are not connected visually, and at the same time reduces the spatial relationship between panels. It is an interesting reference material to review when designing comic interface for mobile device. However, being given the ability to choose one’s own story path is sometimes referred to as a game rather than a comic.

![Figure 18: Screenshot of Adopt a Rapper](image)

Another example of “high interaction” category is Augmented Reality (AR) Comic Book (2004) created by Singh and colleagues, applying an AR technology to mix both reality and virtual world. This mobile comic requires readers to point the mobile phone’s camera to a marker (usually form in black-and-white square) at all times to be able to view the comics. This marker will then be translated into 3D characters that are displayed on the mobile phone screen. In most cases, one marker is only able to be translated into a single character or a scene. The users can move or change the angle of the character by simply move the phones or the marker. This technique provides an interactivity that may enhance readers’ enthusiasm to “play” with the comics. However, this comic has failed to be able to display a number of comic panels in side-by-side manner. In addition to that, the need of physical marker object at all time (e.g. a piece of paper) and the need to be in appropriate environment (e.g. enough lighting, motionless) to view the comics makes this particular
technology to be less-practical to be implemented for mobile comics as it reduces readers’ convenient to read or “play” the longer comic story, and reduces the mobility provided by mobile devices.

Figure 19: Screenshot of AR comic book (Singh, 2004)

Historical study on comics from the ancient narrative artworks to mobile comics presents transitions in comic components (e.g. speech balloon, with or without border), comic structure (e.g. z-path, linear), the additions of extra digital features (e.g. motion, sound, zoom) and the most important thing is the changes in the spatial relationship between panels. This is relevant to mention that medium and technology take important role in displaying a sequence of comic panels. However, the continuity of these images should be taken as the priority. Some of the mobile comic forms show that the comic presentation is only based on the availability of the space in medium and overlooked the importance of the panels’ continuity, for example in comic book pages and panel-by-panel approach as presented in the example of low interaction and medium interaction category. These comic forms have failed to maintain the spatial relationship of comic panels with the unnecessary breaks between panels (McCloud 2000b). Similarly, from the examples in high interaction category, mobile comics are divided into panels, unable to serve the panels’ relationship in a continuing manner. Moreover, the addition of interactivity (i.e. choosing the storyline, view the character in the other angle) requires more readers’ attention to interact with the application which makes it more like other media (i.e. games) than a comic. In contrast, motion comic - an example of no interaction category – provide a smooth flow between the panels by playing through the entire scene, however it eliminates space for reader to “filling the gap”. On the other hand, approaches from the ancient continuous linear narrative and from web comics, McCloud’s Infinite canvas theory are believed to successfully serve the flow between comic panels; however at the present
moment, there is a lack of study exploring these approaches for mobile comics. Generally it is found that the existing mobile comics are only focused in displaying clear image and texts but lacks in addressing panel-to-panel relationship in their interfaces. Therefore, it is necessary to design a new comic user interface that maintains the continuing relationship between comic panels, while at the same time provide an enjoyable reading experience.

2.3 Mobile Phone Interface Design
User interface (UIs) for mobile devices play a crucial role in facilitating a pleasant and rich user experience, which makes the design of simple yet effective interfaces for mobile content a top priority (Subramanya 2006). While designing user interface for mobile phone, there are few aspects that need to be considered. Firstly, it is necessary to recognize the most popular mobile phone and operating system in the market in order to suit the current trend in Malaysia. Secondly, characteristics of mobile devices are important to be analysed to understand some potential challenges in designing mobile application interface. And lastly, an exploration on user experience and user preferences for mobile application is covered. This includes user interface guidelines, importance of user preferences and measurement metrics.

2.3.1 Overview of Mobile Phone Distribution
Nowadays, mobile phones have become a must-have gadget. Due to its portability and functionality, the mobile phone becomes an essential item for everyone’s daily life. According to Gartner (2012), more than 1.8 billion mobile phone handsets are being sold worldwide in 2011 which is an increase of 11.1 percent from 2010. Nokia was the leading vendor with total global shipments for the whole of 2011 to 111 million units. Although Nokia gained 23.4 percent market share, it was a decline of 3.7 percent from the previous year. Gartner analysts expect that Nokia market share to slightly decline from year to year. This is in line with AdMob Mobile survey, which was conducted in Malaysia where it was found that the Nokia market share has continued to decline in first quarter 2010. On the other hand, market share for the Apple products increase simultaneously as Apple has already gained 36 percent market share in Malaysia (Admob 2010).

The rapid technology advancements and increasing popularity of using internet on mobile phone has created a new generation of mobile phones which are called as smart phones. Gartner defines a smart phone as “a large-screen, voice centric handheld device designed to offer complete phone functions while simultaneously functioning as a personal digital assistant (PDA).” Smart phones have been announced as the future of mobile phones that offers access to the internet ubiquitously and various applications. That circumstance has
created an extensive market for smart phone devices in the last few years. Based on the International Data Corporation (IDC), the worldwide smart phone market grew 54.7 percent year over year in the fourth quarter of 2011 (IDC 2012). IDC also announced that Apple was the leading global smart phone vendor, making up for 23.5 percent market share followed by Samsung (22.8 percent), and Nokia (12.4 percent). With shipments of 37.0 million iPhones in fourth quarter 2011, iPhone smashed the record for the most smart phones shipped globally by any single vendor in one quarter (Canalys 2012). Apple takes the lead in the global smart phones market where in the previous quarter, Samsung had a strong performance with their product, the Samsung Galaxy. At country level, HTC takes the lead in the United States’ smart phone market in the third quarter in 2011. This is a tremendous achievement by HTC that shipped 5.7 million smart phones in the United States under its own brand, giving it almost a quarter of the market (Canalys 2011).

In Malaysia, it was reported that Apple, Samsung and Google’s mobile phone operating system, Android, gained the strongest market share in 2009 (Sidhu 2010). Admob recorded the tremendous sale of Apple iPhone with 132,228 units until April 2010 (Admob 2010). The other smart phone that was gaining popularity in Malaysia was Blackberry with more than 100,000 units sold until 2010 (Sidhu 2010). However, it does not influence the dominance of smart phones that run the Android OS (OS) and Apple’s iPhone in Malaysia which had 62.8 percent and 36.8 percent of web usage in the second quarter of 2012, respectively (Russel 2012). This information presents the shift of consumer preference among Malaysian mobile phone users towards a more data-centric converged device offering multiple email functions and Wi-Fi capabilities (IDC 2009). Thus, it is relevant to believe that smart phones will continue to gain popularity in the Malaysian market as it is forecasted that smart phones will account for 23% of all new mobile phones sold annually by the year 2013 (MCMC 2010).

With respect to highly smart phone penetration, Android OS continues to gain popularity in Smartphone OS market with 50.9 percent in the fourth quarter of 2011 with a 20.4 percent increase from the same period in 2010 (Gartner 2012). Samsung remained the main contributor to Android share gains. In that case, the researcher takes note that Android operating system has an opportunity to be the future of mobile operating system.

2.3.2 CHARACTERISTICS OF MOBILE PHONES
Mobile phone user interface can be divided into two categories: software (i.e. the design of computer program logic) and hardware (the design of equipment). Even though the main focus of this study lies on the software interface, it is important to be aware with the
characteristics of mobile phone hardware in order to understand some potential challenges in mobile application development. Buchanan et al (2001 cited in Kärkkäinen & Laarni 2002) indicated that the characteristics of a device have an effect on both how information should be presented and how users interact with the device. These characteristics include display, control and input mechanism, and processing capacity (Kärkkäinen & Laarni 2002; Rondeau 2005).

- Display

The most obvious and visible characteristic is the display size. Mobile phone – cell phones, PDAs and smartphones – have much smaller display size compared to personal computers. The small size is chosen to maintain the portability and convenience while being mobile. However, this size limitation gives a dramatic impact on the amount of information that is visible at a time. Despite the limited display size, it seems that mobile phone is still preferred to access numbers of information such as for web browsing and social networking (Ericsson 2010). The needs to retrieve a large number of information influence the trend of mobile phone screen size to increase from 1.5-2.6 inches in 2005 (Shudong & Higgins 2005) to 3.5-4.3 inches in 2011. Besides that, it is found that most of the current users choose mobile phones with larger display within 4.0-inches to 4.5-inches (Brown 2012). Along with limited display size, the resolution of mobile phone screen is also poorer than personal computers. At the present moment, most of mobile phone screen resolution is varied from 128 x 160 pixels up to 690 x 960 pixels, while some advance mobile phones (i.e. Galaxy Nexus, HTC One X) have a resolution of 1280 x 720 pixels getting closer with common screen resolution for personal computer (1600 x 1200 pixels). Thus, it is assumed that resolution may no longer be a problem for mobile application development, while more importantly the proper content arrangement is required to suit the display size. It is argued that the use of zooming features (Lehtonen et al. 2006) and the appropriate selection of font size, font type and font colour (Darroch et al. 2005) could help to address visibility and readability. Moreover, it was suggested that for reading text on a small screen with resolution of 640x480 should be at the minimum of font size 8 (Darroch et al. 2005).

- Control and Input

When personal computers have keyboard and mouse, mobile phones are built with limited input mechanism to interact with the systems, such as keyboards, voice recognition, shape recognition or touch screen. Not all of them support user friendly
interaction. For example some of the older mobile phones require multiple presses on the key to find the right letter (Shudong & Higgins 2005). Giving command using voice recognition has been considered to substitute the pressing keyboard technique in mobile phones. However this technique is not mature enough to perform complex task such as typing texts (Shudong & Higgins 2005). Moreover, it may also require certain environments to be able to work properly, for example quite room. Besides that, some studies started to employ shape recognition using built-in camera, for example augmented reality technology in games (e.g. Henrysson, Billinghurst & Ollila 2006; Wagner, Pintaric & Schmalstieg 2004), comic reader (e.g. Singh et al. 2004), navigation (e.g. LAYAR), and education (e.g. Karpischek et al. 2009; Wagner & Barakonyi 2003). However, this technique may not be convenient enough for navigating through a large amount of information as the marker should be visible all the time. Apart from these techniques, most of the newer mobile phones use touch screens for entering input. In 2009, touch screen smart phones shipments were up 138% and accounted for more than half of all smart phones distributed globally (Canalys 2010). One of the reasons of its popularity could be due to the more intuitive interaction provided. Touch screen allows users to perform not only clicking or tapping gesture, but also swiping, rotating and pitching gestures. Thus, with more interactions supported, a more interactive and intuitive interface could be achieved. Nevertheless, this input method is not without weaknesses as sometimes the interaction become inaccurate due to the target being too small to be hit with the thumb (Parhi, Karlson & Bederson 2006). Therefore, appropriate button size and button spacing may need to be considered to enhance accuracy while performing tasks (Jin, Plocher & Kiff 2007).

- **Processing Capacity**

Another limitation on mobile phone's hardware is the lower processing speed than personal computers. Hence, the use of animations, 3D objects and images should be made minimum. Mobile phones also provide lower memory storage in which the highest storage capacity reaches up to 32GB at the moment. In addition to that, most mobile internet has lower connection speed. Currently, the most advance mobile phone only support the maximum download speed of 3Gs access or HSDPA up to 14.4 Mbps (Hsiao-Hui Wang & Chen 2011). Unless the Wi-Fi technology becomes available anytime and anywhere; mobile phones still need to rely on communication provider network. Therefore, the application should not rely on the Internet connection (Banerjee 2008) and should be maintained in the smallest size as possible.
Other than these characteristics, some challengers in designing mobile application are captured, such as short battery life (Banerjee 2008; Maniar et al. 2008), platform and device variation (Rondeau 2005). These variations introduce a new problem to create a standard and compatible application across different mobile phones’ platforms which is currently still lacking (Banerjee 2008; Maniar et al. 2008; Shudong & Higgins 2005).

In conclusion, to be able to maintain the convenience of reading comics on mobile phones, some criteria must be considered. It includes supporting visibility and readability by providing a zoom feature and selecting an appropriate font size, type and colour; easy and intuitive navigation by providing an appropriate button size and button spacing for touch screen displays; and relying as minimum as possible on the Internet connection. Moreover, supporting more platforms may help to increase potential users. One of the possible approaches is by selecting technology or software development kit that offers potential to expand to other devices or platforms (cross-platform).

2.3.3 User Experience and Preference

Usability is one of the main issues when designing new user interface. The term of usability is used to describe the ease of using an application/product to reach a goal while performing tasks. This usually refers to two main aspects of user experience: user performance and satisfaction across the application (Tullis & Albert 2008). With a usable interface, it allows users to perform tasks conveniently. According to ISO 9241-11, usability is 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”. The three main attributes (effectiveness, efficiency and satisfaction) are described as “the extent to which the intended goals of use are achieved”, “the resources that have to be expended to achieve the intended goals”, “the extent to which the user finds the use of the product acceptable” respectively (Bevan 1997). The achievement of these three main attributes leads to increasing user satisfaction and productivity which at the same time creates user trust and loyalty towards the application (Marcus 2001). Moreover, Quesenbery (2001) also suggested to expand the definition of usability into five characteristics – effective, efficient, engaging, error tolerant, and easy to learn - in order to guide the user-centered design tasks in achieving the goal of producing usable products.

User Interface Guidelines

Looking at the importance of usability in achieving good user experience, various user interface guidelines are introduced. Nielsen’s Ten Usability Heuristics (1994) and Shneiderman’s Eight Golden Rules (1998) are the most popular and acknowledged
guidelines. Both of these guidelines have some similarities in which some guidelines seem to overlap each other, such as consistency, error prevention and informative feedback. In similar study, Constantine & Lockwood (1999) summarize the guidelines into 6 practical principles for user-centered design which include (1) structure – obvious to users, (2) simplicity, (3) visibility – of necessary options and materials, (4) feedback, (5) tolerance, and (6) reuse-maintain consistency. However, these guidelines were originally intended for traditional desktop application and may no longer be suitable for smaller devices, which in this case refers to mobile application.

As described earlier, the physical interface of mobile device creates some issues while displaying large amounts of information. Therefore, some existing guidelines which are appropriate with mobile devices should be considered. Gong & Tarasewich’s study (2004) extends the Shneiderman’s Eight Golden Rules to be more applicable for mobile phone development. They suggest that four of Shneiderman’s guidelines can be applied for mobile devices while the rest of the guidelines require modification to be used for mobile development. Gong & Tarasewich’s study produces 15 guidelines that cover all the important factors in mobile user interface design. These guidelines not only include usability aspects in user interface design such as navigation, error prevention, and performance, but also concerns aspects of user preferences and visual design. The focus on these principles is in line with Tractinsky, Katz and Ikar’s study (cited in Su & Yee 2008) where the aesthetic quality of user interface, its perceived usability and increased user preference have an important relation with user satisfaction. 15 guidelines by Gong & Tarasewich are worth considering to address all possible issues in designing and developing mobile device interface design.

**User Preferences**

With regards to user preferences, some studies analyzed the importance of user preferences while designing user interface. Adipat and Zhang (2005) stated “because users have different preferences and characteristics, it is necessary to study what user characteristics are, in which information users are interested, and what a preferred way to present the information is”. He defined user preferences into two criteria: content and presentation. Content preference includes topics of interest which introduce benefits such as effectively using a limited screen size to display relevant information (Quiroga, Crosby & Iding 2004), reducing transmission delay and wireless network traffic (Samaras & Panayiotou 2002), and reducing time for users to locate information (Quiroga, Crosby & Iding 2004). On the other hand, presentation preference represents displaying styles or
formats of information on mobile devices that users individually prefer. This offers advantages in increasing user satisfaction and increases the possibility that mobile users might finish their tasks with minimal errors and time (Zhang 2003). At the present moment, there is a lack of research in the area of user preferences of mobile comic in Malaysia. This makes it important for this study to identify the preferences of Malaysian users.

**Measurement Metrics**

The study of user experience has also lead to several models to measure how well users cope with the systems. In most cases, developers record numerical values of user’s performance (e.g. completion time, error counts and success rate) through the observation, while some perform interviews (or questionnaire) to gather verbal feedbacks over the application. However, it is important to have a standard validation measurement during the development in order to maintain the accuracy of the result. Some studies investigate usability metrics using various methods. Sauro & Kindlund (2005) combine the four common metrics (task completion, error counts, task times and satisfaction scores) into a single usability score creating a single, standardized and summated usability metric (SUM). The study is certainly useful, however it seems that it only concerns numeric quantitative data. However, SUM may not be suitable in this study, as study in user preferences may be available not only in quantitative but also in qualitative data such as thoughts, perceptions, and observations to measure the quality of the application. While on the other hand, Tom Tullis and Bill Abert (2008) give attention to users’ verbal feedbacks as self-reported metrics. In their study, they differentiate usability metrics based on the purpose of the study which illustrated in 10 different scenarios and recommended metrics. With the selected metrics, it gives advantages as the study will only focus on the area related to the specific goal such as comparing designs or creating an overall positive user experience. Although a few of the metrics suggested were aimed for website development, most of the recommendations are valid for general applications including mobile comic application. Since Tulis & Albert only limit the usability metrics for 10 scenarios, it is possible that the design created in this study will not match with one of them. Thus, a more general measurement needs to be considered in order to obtain a clearer evaluation on the proposed design. In addition to that, Hussain & Kutar (2009) also introduced a usability metric framework by referring to the usability attributes by ISO 9241-11 (1998). Although they only used the three ISO usability attributes (effectiveness, efficiency and satisfaction), they also proposed to expand each attribute into more specific goals such as simplicity, accuracy, time taken, features, safety, and attractiveness. These

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goals have covered other characteristics introduced by Quesenbery (2001) such as engaging, error tolerant and easy to learn. The model of Husain & Kutar usability guidelines can be shown in the following table.

<table>
<thead>
<tr>
<th>Quality Characteristic</th>
<th>Goal</th>
<th>Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness</td>
<td>Simplicity</td>
<td>- Ease to input the data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ease to use output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ease to learn</td>
</tr>
<tr>
<td></td>
<td>Accuracy</td>
<td>- Accurate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Should contain no errors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Successful</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Time taken</td>
<td>- To respond</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- To complete a task</td>
</tr>
<tr>
<td></td>
<td>Features</td>
<td>- Support/help</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Touch screen facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Voice Guidance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- System resources info</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Automatic update</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Safety</td>
<td>- While using the application</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- While driving</td>
</tr>
<tr>
<td></td>
<td>Attractiveness</td>
<td>- User interface</td>
</tr>
</tbody>
</table>

In this study, Tullis & Albert’s scenario based metrics and Hussain & Kutar’s metric framework are considered to be used for further design evaluation. These measuring studies provide clearer evaluation techniques which are appropriate to be applied for the development of mobile applications. These evaluation techniques use both quantitative and qualitative information to assess user experience and satisfaction towards the proposed designs.

2.4 SUMMARY
This chapter reviewed the theoretical foundations of comics, including the essential elements of comics and the development of comic in various medium. These ideas were explored in order to propose an understanding of the concept that can lead to achieve the objectives which are to identify the essential elements of comics and to examine how they are maintained in the various comic forms available. It was argued that spatial relationship between images or comic panels is the most essential element that make comic different from other media. The evolution of comics in various mediums results in many different approaches in presenting pictorial narrative, however only few of them successfully serves the continuity between panels. Some approaches such as comic page
and panel-by-panel are dictated with the available space, creating unintentional breaks between panels. This influences the value of panels’ relationship. Other approaches with additional multimedia and interaction (e.g. sound, animation and multiple storyline) reduce the sense of comic, and rather into other media (animated movie and games). It was argued that ancient continuous linear trajectory approach and McCloud’s Infinite Canvas to effectively address the issue by connecting one panel to another. Thus in the remaining chapters, the researcher aims on explore both of these approaches.

Besides that, the concept of mobile phone interface design is also explored in this chapter. It was found that there are numbers of challenges in designing user interface for mobile phones. It includes variety of mobile phone devices, and limitation of mobile phone hardware (e.g. small screen size, limited input mechanism and low processing capacity). Therefore, to be able to produce usable interface for small screen size that achieve positive user experience and user satisfaction, some criteria must be considered in terms of visibility and readability, easy navigation, connectivity, platform supported and user preferences. This may be overcome by applying a user interface guideline for mobile devices that may act as the benchmark in the development process. Some other considerations could be providing zoom feature; selecting appropriate font size, type and colour as well as button size and button spacing; relying as minimum as possible with the Internet connection and last but not least, selecting appropriate technology that may support more platforms. Furthermore, for the further design evaluation, measurement metrics are reviewed to be able to measure user experience and satisfaction toward the proposed design.
3 USER PREFERENCE SURVEY

3.1 INTRODUCTION
At present moment, there has been very little research done on user preferences when it comes to the design of mobile comics. As indicated in Chapter 2, most of the researches focus on the adaptation of physical comic book into mobile comic format. This research tends to take user preferences as part of the study. Meeting the needs and wants of comic readers is essential to the success of mobile comic development. Given the interest in user preferences, this survey aims to collect Malaysian readers’ responses towards reading comics on mobile phone; and to find out the features and functionality that should be implemented to enhance the reading experience on mobile comics.

Based on the literature review gathered, a survey questionnaire was designed to collect data from Malaysian users on their preferences, ideas, and opinions on mobile comics. This chapter will discuss the entire survey process starting from the questionnaire planning up to the survey results.

3.2 METHODOLOGY AND DESIGN
A survey is conducted to meet the needs of addressing the research question 4 (RQ4) of the study: “What are the mobile comics’ features preferred by Malaysian users in order to enhance reading experience and convenience?” The researcher is interested to generate ideas for designing a new mobile comic interface by gathering Malaysian comic readers’ perceptions and preferences on existing mobile comics. Methodology used in the present study is based on quantitative design methods which includes questionnaire.

The survey is done in a paper-based questionnaire with a face-to-face interview as it is necessary to show the participants some samples of mobile comics. In addition to that, this approach is also used to eliminate missing values and control the completion of the questionnaires. This research has been conducted in the canteens, open labs, and library of Swinburne University Sarawak Campus (SUTS) Malaysia in November, 2010.

3.2.1 PARTICIPANT AND SAMPLING
The survey is based on preliminary analysis of selected participants. The target population used in this study includes Malaysian students of Swinburne University of Technology Sarawak Campus (SUTS) who enrolled in various programs in the Bachelor Degree, Diploma, Foundation, Intensive English and Postgraduate studies. In the second semester of 2010, it was recorded that there were 2491 Malaysian students at SUTS. The students
have, at the very least, basic knowledge of the use of current communication technology such as the Internet, computers, mobile phones and tablets. In addition to that, a distinction of profile background (i.e. races and mother languages) within this population could represent insights of the overall Malaysian population's preferences. These criteria introduce additional benefits for the researcher to perform possible surveys on a selected population.

Representation view of the population was collected using quota sampling technique. This sampling technique is used in order to get equal response from both genders. Despite being unable to represent the whole population, this technique is believed to be quicker and is the least expensive way as compared to probability sampling (Kumar 2005). Referring to Kent (1999), the minimum sample size of 100 is required to be able to statistically calculate for any kind of quantitative research. In addition, Kent also argues that if the purpose of the survey is to generate ideas for new products then a small number of participants may well be sufficient. This sampling approach has been used in a study on mobile marketing in China (Peng 2006). In present study, 150 participants are recruited with a distribution of 50% males and 50% females which is done entirely on voluntary-basis.

In 2010, the highest mobile phone user in Malaysia was aged between 20 and 24 years old which accounted for 17.3% of the overall mobile phone users (MCMC, 2012). Moreover, comics appeal to the younger age group. This can be seen from visitor demographics of OneManga.com, one of most popular webcomics, in which the majority of readers are male in the 18-24 age groups (cited in Douglass, Huber & Manovich 2011). Based on this statistic and population accessibility, this study involves Malaysian students who are between 18 to 25 years old and currently enrolled in Swinburne University of Technology Sarawak (SUTS) Malaysia.

3.2.2 INSTRUMENTATION
In the present study, a questionnaire was used to collect the information on mobile comics’ preferred by Malaysian users. As identified in Appendix B, the 25 questions listed in the questionnaire were related to the research question 4 (RQ4) and was used to identify the result. This questionnaire consisted of structured and open-ended questions which are grouped into six sections. These first three sections aim to understand the background of participants, in terms of participants’ demographic, participants’ habits on comics reading and participants’ mobile phone ownership and usage. The rest of the
questionnaire sections intend to reveal the prior experience and preferences of Malaysian users in mobile comics reading. Details of questionnaire sections are described below:

- The first section comprised of questions on participants’ demographic information such as gender, age group and race.
- The second section aimed to analyse participants’ habits on comics reading.
- The third section aimed to analyse participants’ mobile phone ownership and usage.
- The fourth section consisted of five questions about participants’ experiences in reading digital comics on mobile phones. This is divided into two sub-sections that differentiated whether (a) the participants have prior experience with mobile comics or (b) no prior experience with mobile comics. Sub (a) covered questions on how they access mobile comics, reasons for using and satisfaction of use. The latter was measured using the frequency scale of (1) very satisfied, (2) satisfied, (3) neutral, (4) not satisfied, and (5) poor. Sub (b) covered on the participants’ awareness and willingness to use mobile comics. Their willingness were measured using a scale of (1) definitely read, (2) perhaps read, (3) cannot say either way, (4) perhaps not read, and (5) not read at all.
- The next section aimed to extract the participants’ feedback on five mobile comic samples and to identify what kind of mobile comics they like most.
- The last section consisted of nineteen items that was aimed to analyse preferred features in mobile comics. The preferences were measured using a five point Likert scale which comprised of (1) most important, (2) slightly important, (3) neutral, (4) least important and (5) not important.

Together with the questionnaire, a consent information letter (refer to Appendix A) and samples of mobile comics are used during the survey. Referring to Section 2.2.2.4, there are various types of mobile comics in the current industry, which can be seen from the differences of layouts and interactivity. Therefore, to be able to collect entire views from each of these categories, five samples of mobile comics are selected, which includes:

a) **No interaction**

This type of comics does not require any interaction with readers. The readers “play and watch” without the need to turn the pages manually. In some motion comics like the sample given, there are no speech balloons. Thus, the readers rely on the voice-over and dialogues. The selected comic is Marvel’s *Astonishing X-Men* motion comics.
b) Low interaction
The only interaction involved in this comic is the turning of pages. For this category, two comic are chosen base on the presentation of comic panels: Princess Ai by Sunsoft Books to represent full-page comics (displays multiple panels at a time) and Wallace & Gromit by Titan Publishing to represent panel-by-panel comics (displays one panel at a time).

c) Medium interaction
This has more interactivity, such as tapping the screen. The comics chosen for this category is Super Capers by RG Entertainment, Ltd. This comic has additional animation, background music and sound effects.

d) High interaction
The reader plays an important role which can affect the flow of the story. The reader can decide how the story will continue by selecting one of possible actions that will happen. The sample chosen is Adopt a Rapper by NorbSoft.

All the mobile comic samples are viewed on an Apple iPod Touch. The first sample is taken from YouTube and played in media player, while the others are stand-alone applications. The goal of this comic samples demonstration is to allow participants to experience the current features available on various selected mobile comics. Thus, the response on the preferred feature section may be more accurate.

3.2.3 PROCEDURE
The activity in this survey was started by selecting the participant randomly. This random selection means that the researcher was going around the campus at different time of the day and randomly inviting students to participate voluntarily. The student must be a Malaysian whom at that point of time, is studying at SUTS and is within the stipulated age group. Random participants are asked about their reading comic habits at the beginning of the survey. This ensures only the group who reads comics will be selected for the survey.

Once the student agreed to participate, the researcher provided a consent information letter and survey questionnaire to the participant. The nature of the study was described briefly by the researcher as well as written in the consent letter. The survey then continued by answering the survey questions. While participants were completing the survey questionnaire, the researcher tracked the participant's progress and will offer further assistances if required by the participant. Upon reaching Section E (Sample Comics
Preferences) of the survey, the researcher demonstrated the comic samples one by one. The participant was also asked to try each of the mobile comics.

After the end of the survey, the questionnaire was collected. The researcher also kept count of the number of male and female participants throughout the survey to ensure the balance between both genders was maintained.

3.2.4  **DATA COLLECTION**

The gathered data from 150 participants were immediately entered and analysed using Statistical Package of the Social Science (SPSS) analysis software for evaluation. This technique was used to maintain the accuracy of the calculation. Moreover, all information entered was checked three times to prevent any typing error.

The soft copy was burned into a single CD together with the paper-based questionnaires. All the information was kept in a private and secured location that was only known by the researcher. In addition to that, no information was listed or written in the surveys that can be used to identify the respondents. This is done mainly to prevent any confidentiality issues that may or may not occur in the future.

3.3  **RESULTS AND DISCUSSION**

3.3.1  **DEMOGRAPHICS**

The samples consist of 50% female and 50% male students. All participants are Malaysian students at SUTS and 66% of them fall into the age group of 18 and 21 years old, while the rest, 34% are those between 22 and 25 years old. Given that the targeted population for the study comprised mostly of Chinese students, it was expected that the selected participants to be mostly Chinese (60%), followed by Malays (19%), other indigenous groups (18%) and Indians (3%). The indigenous groups include the Ibans, Bidayuhs, and Melanaus.

3.3.2  **HABIT OF READING COMICS**

Findings on reading habits (refer to Table 2) are analysed through the amount of time spent on reading comics per week, types of comics read, language preferred, amount of money spent for comics per month, and media used to access the comics.
Table 2: Habit of Reading Comics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time spent on reading comics (per week)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• &lt; 2 hours</td>
<td>104</td>
<td>69.3</td>
<td></td>
</tr>
<tr>
<td>• 2 - 5 hours</td>
<td>31</td>
<td>20.7</td>
<td></td>
</tr>
<tr>
<td>• 5 - 10 hours</td>
<td>11</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>• &gt; 10 hours</td>
<td>4</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Types of comics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Humour</td>
<td>90</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td>• Action &amp; adventure</td>
<td>80</td>
<td>53.3</td>
<td></td>
</tr>
<tr>
<td>• Romantic</td>
<td>55</td>
<td>36.7</td>
<td></td>
</tr>
<tr>
<td>• Fantasy</td>
<td>44</td>
<td>29.3</td>
<td></td>
</tr>
<tr>
<td>• Mystery &amp; horror</td>
<td>39</td>
<td>26.0</td>
<td></td>
</tr>
<tr>
<td>• Others</td>
<td>3</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Languages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• English</td>
<td>109</td>
<td>72.7</td>
<td></td>
</tr>
<tr>
<td>• Mandarin</td>
<td>50</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>• Malay</td>
<td>45</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>• Others</td>
<td>1</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Money spent for comics (per month)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• RM 0</td>
<td>101</td>
<td>67.3</td>
<td></td>
</tr>
<tr>
<td>• RM 5 – RM 10</td>
<td>27</td>
<td>18.0</td>
<td></td>
</tr>
<tr>
<td>• RM 11 – RM 25</td>
<td>16</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>• RM 26 – RM 50</td>
<td>5</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>• &gt; RM 50</td>
<td>1</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Media used for reading comics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Web comics</td>
<td>117</td>
<td>77.9</td>
<td></td>
</tr>
<tr>
<td>• Comic book / magazine</td>
<td>82</td>
<td>54.4</td>
<td></td>
</tr>
<tr>
<td>• Newspaper</td>
<td>24</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td>• Portable console</td>
<td>4</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>• Mobile phone</td>
<td>3</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

**Time spent on reading comics (per week).** The result indicates that 69.3% of the participants spend less than 2 hours per week on reading comics while 2.7% describe themselves as heavy-readers with more than 10 hours per week. This also shows that most of the participants read comics for leisure, not as heavy readers.

**Types of comics.** The study found that the comic categories that are mostly preferred can be sorted in a sequence as follows (from most preferred to least preferred): humour, action and adventure, romance, fantasy, mystery and horror, and sports.

**Languages.** Based on our survey result, 109 participants prefer comics in the English language, 50 participants prefer Mandarin, 30 participants for Malay, and 1 participant for other language (Japanese).
Money spent for comics (per month). More than half (67.3%) of the respondents did not spend money on comics compared to participants who spent money monthly (32.7%).

Media used for reading comics. Most participants highly prefer web comics (77.9%) because they are “easy to access”, has “fast updates”, “free of charge” and “more convenient”. The second preferred media for reading comics is the traditional hardcopy comic book (54.4%) with the reasons that they are for “collection purposes”, “light” and “portable”, followed by newspapers (16.2%). Since, reading comics on handheld devices are relatively new, this method gathered lower popularity as compared to reading comic in other media. This comprises 2.7% for comics in PSPs and tablets, and 2% for comics in mobile phones.

Preference for language options may be taken into consideration for markets that use one or more languages. Although, most of the Malaysian users prefer English in this study, the other preferred languages (e.g. Malay, Mandarin) must not be overlooked to enhance readership convenience. In addition to that, it is found that the cost for reading comics is the most influential criteria when selecting a media for reading comics. Most of the participants choose web comics because they are free. For mobile comics, each episode is sold with the average price of USD $1 to $2. It is more expensive than web comics but cheaper than printed comic books. However, with the vast mobile phones’ distribution, the portability, and the high mobile phone penetration rate in Malaysia, mobile comics development have the potential to grow.

3.3.3 Mobile Phone Ownership and Usage
The findings on participants’ mobile phone ownership and usage (refer Table 3) are based on: types of mobile phone brand owned, how often the participants accessed online content and the type of entertainment features frequently used.

Mobile phone brand. This survey result reveals that all participants have at least one mobile phone. It shows that Nokia is relatively a more popular mobile phone in use among the participants as 52.7% of them own Nokia products. The second most popular mobile phone brand is Sony Ericsson (30.4%), followed by other major smart phone brands such as iPhone (7.4%), Blackberry (6.8%) and HTC (4.1%). Cost is believed to be the reason for the popularity of these phones.

Access to online content. The mean of access to online content amongst the participants is 3.24. This result indicates that the participants rarely use internet connection such as GPRS, 3G, WAP, EDGE, HSDPA and others in daily activity.
Mobile phone usage. Other than for voice calling and short messaging purposes, there are some entertainment features that are usually used by the participants. The camera and multimedia (movie/music) player are the most frequently used features. The study also found that the internet browser and social networking applications seem to be more popular compared to radio and mobile comics. However, this is highly affected by the types of mobile phones owned by the participants where certain applications require a pre-installed hardware or software for example the camera and radio function.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent of Cases</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile Phone Brand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Nokia</td>
<td>79</td>
<td>52.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sony Ericsson</td>
<td>46</td>
<td>30.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• iPhone</td>
<td>11</td>
<td>7.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Samsung</td>
<td>10</td>
<td>6.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Blackberry</td>
<td>10</td>
<td>6.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HTC</td>
<td>6</td>
<td>4.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Others (Motorola &amp; LG)</td>
<td>9</td>
<td>5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to Online Content</td>
<td></td>
<td></td>
<td>3.24</td>
<td>1.398</td>
</tr>
<tr>
<td>(1) always, (2) often, (3) sometimes, (4) rarely, (5) never</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile Phone Usage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Camera</td>
<td>104</td>
<td>69.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Movie / Music Player</td>
<td>87</td>
<td>57.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Games</td>
<td>83</td>
<td>55.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Internet Browser</td>
<td>74</td>
<td>49.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Social Networking</td>
<td>55</td>
<td>36.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Radio</td>
<td>35</td>
<td>23.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Comic Reader</td>
<td>4</td>
<td>2.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Others (Note &amp; Novel Reader)</td>
<td>2</td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These data imply that all the participants have experience with mobile phones. Although it is found that most of the participants own the older version of mobile phones (kepad, smaller screen, limited feature), the newer mobile phones look more promising in the near future as manufacturers will produce more advanced mobile phones with larger screen, higher processing capacity, and multi touch screen at the more affordable prices. Thus, it is believed that with the advancement of the mobile phone technology, the more convenient reading environment could be achieved, which at the same time could increase the popularity of mobile comics.
In this section, participants were asked whether they have previously used mobile phones to read comics. There are only seventeen students (11.3%) out of the total number of participants who have experienced reading comics on mobile phones. Pearson’s chi-square test was conducted to examine whether there was a connection between experiences in reading mobile comics with gender. The finding reveals that there is a significant relationship between the two variables (Chi-square = 5.34, p = 0.020). Larger proportion (17.3%) of male students has prior experiences with mobile comics compared with 5.3% of female students.

For those who have prior reading experience with mobile comics, there are various methods used to access the comics, 64.7% of the participants read the comics from the Internet, 41.2% of the respondents download the comics from application market stores (i.e. Apple’s app store), and 29.4% of the participants download the comics from comics applications (i.e. iVerse, Droid Reader Mobi, and Comic Zeal).

The reasons to read comics on mobile phones are varied: “to occupy free time”, “more convenient than visiting a bookshop”, “no particular reason”, “cheaper”, “not bulky compared to books or magazine”, and privacy (“can read comics without the other person knowing”). From their prior experience, we found that 23.5% of the participants were satisfied with the current mobile comics, while 41.2% were neutral, and 35.2% think the current mobile comics should be improved.
On the other hand, the group of participants who **have no prior experience with mobile comic** were classified into two categories: “not aware of mobile comics” and “aware of mobile comic, but never tried”. This includes 39.3% and 49.3% of the total participants respectively.

Regarding willingness to read mobile comics in the future, the finding shows that more than 60% of the participants are willing to try mobile comics compared to 22.6% who are less interested in mobile comics.

<table>
<thead>
<tr>
<th>Table 5: Willingness to read mobile comics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
</tr>
<tr>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>Slightly agree</td>
</tr>
<tr>
<td>Neutral</td>
</tr>
<tr>
<td>Slightly disagree</td>
</tr>
<tr>
<td>Strongly disagree</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

These results show positive responses for the development of mobile comics. Although only few of the participants have experience reading comic on the mobile phone, a larger number of participants show enthusiasm to try mobile comic in the future. One of the reasons could be due to the mobile phones used. At the present moment, the mobile phones owned by the participants do not perfectly support clear images and texts due to the smaller display size, which can be improved by using a mobile phone with a larger screen size.

### 3.3.5 Analysis of Sample Mobile Comics

This research attempts to investigate the preferred features of mobile comics in terms of display and interactivity by demonstrating five comic samples to the participants. This was followed by the participants’ ratings of features according to their importance using five point scales as follows: (1) most important, (2) slightly important, (3) neutral, (4) least important and (5) not important. The importance of every variable was analysed by looking at its mean; below 2.5 is calculated as preferred feature and above 2.5 is considered as non-preferred feature. This takes into consideration the reading convenience and experience. As for the analysis variance features, this study focused on six feature categories including sound, display panel, story structure content, navigation, accessibility and others.
**Sound.** Table 6 shows that the mean for sound variables are over 2.5 which suggest that these features are the least important in mobile comics. This finding is also consistent with the participants’ opinion on background music, sound effects and voice-over in the samples shown. The third sample (Super Capers Comics) is thought of as “annoying” as the sound effects are too “disturbing” and “noisy”. The fourth sample’s (Adopt a Rapper) background music loop which stretched from the beginning until the end of the story elicited a response of boredom. And lastly, the usage of dialogue and voice-over in the Astonishing X-Men sample is “hard to catch” and may require external hardware (headset or speaker) to hear clearly. Besides that, participants argued that the Astonishing X-Men comics is “an animated movie, not a comics”, while “a comic should have text”. Overall, based on the response of the participants, sound features are generally believed to be “noisy”, “annoying” and “distracting” to the readers’ concentration while reading.

**Display.** For the second category, the results show that the mean of preference for single panels is 2.33 which is 0.21 lower than the mean for those with preference for multiple panels. This indicates that participants prefer single panel to multiple panel (full page) view. The reason for this is because the texts are larger compared to multiple panels. In addition to that, the images and texts in single panels are displayed clear enough even without having to zoom in. With further analysis using mobile comic samples, the participants prefer Wallace & Gromit (20.0%) which had single panels, compared to Princess Ai (18.0%) which had multiple panels. This result complements previous studies by (Arai & Tolle 2010; Han et al. 2009; Ponsard & Fries 2009; Yamada et al. 2004) which found that single panel views could be a minimalist solution to the problem of mobile phones’ limited screen size. However, it is also argued that displaying single panel at a time may influence the flow and reader’s imagination while reading the comics as the panels are separated with unintentional breaks between them. Therefore, finding a balance between visibility and the essential elements of comic is crucial for the further development of mobile comics.

**Story structure content.** Referring to Table 6, the multiple-storyline variable has a high mean value (mean = 2.99). This shows that the participants do not prefer multiple-storyline features. The multiple-storyline feature allows the readers to control the flow of the story by selecting an option of possible actions which will determine the course of the story. Thus, multiple-storyline comics can have multiple different endings. The data suggests that readers are likely to follow a predetermined story line rather than having to decide the ending. The multiple-story sample, Adopt a Rapper, has the lowest value among all samples, appealing to only 16% of the total participants. Most of the participants
seemed “not interested” with this type of structure which is closer to a game-based comics. In addition, some of the participants commented that the optional storyline makes the comics “less surprising” and “may cause confusion”.

**Navigation.** The analysis of mobile comics navigation shows that the mean of using one-handed navigation (mean = 2.03) is lower than two-handed navigation (mean = 3.17). This is an important piece of data that sheds light on the reading technique (habit) and their preferences for a simpler comic without too much interactivity. Referring to the mobile comic samples, 23.3% of the participants like *Astonishing X-Men* because it “does not require turning or sliding the page manually”.

The other variable of interaction shows that the participants prefer slide navigation (mean = 2.33) to button navigation (mean = 2.58). However, slide navigation requires the use of newer versions of mobile phones with multi-touch screens which seems to be increasing. Even though sliding or swiping gesture seems to be very easy, the participants feel bored when navigating many individual comic panels such as in *Wallace & Gromit* comics. On the other matter, this particular reason enhances the need to arrange the comics in a continuing side-by-side manner. By reducing unnecessary break, it can enhance link between these panels, providing users with space to use their imagination to “fill the gap”. At the same time, it may reduce the navigational interactions.

Lastly, the zoom feature was found in the study as the preferred feature among the participants. This can be seen from the mean value of the zoom variable which is 1.93. This feature seems to be very important as it enhances the clarity in reading which is limited by the small screen size. This feature is also needed especially for comics with small and confined texts like Super Caper Comics.

**Accessibility.** Even though Malaysia has a high penetration of internet usage supported with better infrastructure, most participants still prefer the standalone or offline format of mobile comics. This can be seen from lower offline (mean = 1.88) value than online (mean = 2.86). Most of the reasons are cost related, as cited from the survey that participants “only read (mobile comics) if the series is free” and do not want to spend extra “charge on internet usage”.

**Other features.** The last category consists of additional features such as bookmarks, comics’ library, colour, vibration, language translation and animation. The results shows that bookmarks (mean = 2.11) is also necessary for mobile comics, so that the reader can keep track of his or her reading. Participants also prefer to have a standardized comics
library as this can store their comics' collection in an organized manner and allow easier search and retrieval. Colour feature appears to be the most important feature with a mean of 1.85. This feature is easily supported by current mobile phones as most of them offer high definition colour image displays. On the other hand, vibration is not recommended at all for mobile comics (mean = 3.53). This feature is believed to be unnecessary for mobile comics as it is quite disturbing and distract readers' concentration from the story.

At the present moment, comic books in Malaysia have been distributed in various languages, either in English, Mandarin or Malay. The ability to change language setting for reading one particular comic or the language translation feature (mean = 2.08) was argued to be necessary for the participants.

Participants also thought that the animation feature (mean = 2.36) is slightly important to make comics more “attractive” and “interesting”. Even though some participants argued that the sample motion comic is “more like a cartoon or animation" instead of a comic; the Astonishing X-Men which used limited animation was found to be quite acceptable.

Table 6: Features in Mobile Comics

<table>
<thead>
<tr>
<th>Features</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sound</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Background Music</td>
<td>2.89</td>
<td>1.369</td>
</tr>
<tr>
<td>Sound Effect</td>
<td>2.83</td>
<td>1.330</td>
</tr>
<tr>
<td>Voice-over</td>
<td>2.94</td>
<td>1.302</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display Multiple Panel</td>
<td>2.64</td>
<td>1.166</td>
</tr>
<tr>
<td>Display Single Panel</td>
<td>2.33</td>
<td>1.078</td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple Storyline</td>
<td>2.99</td>
<td>1.240</td>
</tr>
<tr>
<td><strong>Navigation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Handed Navigation</td>
<td>2.03</td>
<td>1.013</td>
</tr>
<tr>
<td>Two Handed Navigation</td>
<td>3.17</td>
<td>1.116</td>
</tr>
<tr>
<td>Button Navigation</td>
<td>2.58</td>
<td>1.064</td>
</tr>
<tr>
<td>Slide Navigation</td>
<td>2.33</td>
<td>1.157</td>
</tr>
<tr>
<td>Zoom</td>
<td>1.93</td>
<td>1.130</td>
</tr>
<tr>
<td><strong>Accessibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offline</td>
<td>1.88</td>
<td>1.192</td>
</tr>
<tr>
<td>Online</td>
<td>2.86</td>
<td>1.395</td>
</tr>
<tr>
<td><strong>Other Features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bookmark</td>
<td>2.11</td>
<td>1.118</td>
</tr>
<tr>
<td>Comics Library</td>
<td>2.02</td>
<td>1.026</td>
</tr>
<tr>
<td>Colour</td>
<td>1.85</td>
<td>1.161</td>
</tr>
<tr>
<td>Vibration</td>
<td>3.53</td>
<td>1.224</td>
</tr>
<tr>
<td>Language Translation</td>
<td>2.08</td>
<td>1.167</td>
</tr>
<tr>
<td>Animation</td>
<td>2.36</td>
<td>1.322</td>
</tr>
</tbody>
</table>

Note: All mean values are on a 5-point scale, anchored on 1 (Strongly agree).
After demonstrating the samples to the participants, there was a varied stance of comments. Some of the comments supporting mobile comics were, “users can download and read anytime, don’t have to carry the book”, “it is portable, you can carry it everywhere in just the palm of your hand”, “it is more efficient than having to buy them from the bookstore”, “easy to carry around, interactive, with sound and coloured graphics”, “can save money”, and “can reduce the use of paper and provides easy access unlike a real comic book”. There was also a fair amount of comments opposing the use of mobile comics such as “staring at the screen for long periods of time sometimes causes strain on my eyes”, “screen is too small”, “computer is more convenient, and size of text and loss of detail will not be a problem”, “because it takes away the physical feelings of reading paper comics”, “drains battery life”, and “easier to read comic the traditional way (in books)”).

3.3.6 Preferred Features for Mobile Comics
Findings from the survey reveal some important criteria of mobile comic based on Malaysian users, which can be summarized into 6 user preferences:

1. Clear images and texts
   Comics are usually delivered in a combination of images, texts and other pictorial graphics to tell a story. Thus, to be able to enjoy the story, all of these components should be displayed clearly on the mobile phones’ screen. This can be achieved by using the zoom feature or displaying a single panel at a time. However, applying “panel-by-panel” approach may raise another issue on the panels’ relationship. Therefore, it is needed to find a balance to achieve both visibility and the essential elements of comics.

2. Simple and more intuitive navigation technique
   The survey reveals that users prefer simple navigation, and this can be due to them being familiar to the prevalent navigation (one finger / one handed navigation). However, this familiarity may change as technology becomes cheaper and they are able to afford smart phones with more advanced and dynamic navigation. These newer smartphones support the ability to interact more intuitively (i.e. supporting gesture interaction). As a consequence, these more advance technology comes with bigger size; it may no longer be practical to interact with only one hand. One example is while browsing on the iPhone; users need to use both hands, one to hold the device while the other hand interacts with the device. Thus, it is reasonable to
mention that at the moment, one-handed navigation will only work if the device is placed on a table.

3. **Straight-forward or linear storyline**
   Based on the information gathered, it seems that Malaysian users prefer to obtain a predetermined story instead of having to decide the story. It was argued that “multiple storyline” comic makes the story easy to predict, less surprising and reduce the “comic-ness” as it appears to be more like a game instead. Overall, linear comic storyline received higher acceptance by Malaysian users. This result eliminates the use of “high interaction” type of comics from consideration for the development of mobile comics.

4. **Full colour content**
   Due to time constraint, this study only focuses on creating the interface for displaying the comics. The comic content will be displayed in the original colour (black and white) made by the author. However, this criterion will be considered for the future mobile comic development.

5. **Less distracting content**
   When it comes to comics, Malaysian users tend to actively “read” the story instead of listening. The addition of sound and vibration features turned out to be not improving the reading experience but instead, distracting the reader's concentration. It is in line with McCloud's argument that this additional multimedia “does not change or improve the core of the comic form”. Ironically, animation is well accepted by Malaysian users. This could be due to the less interaction required to enjoy the entire story (play and watch). However, in this study, it is necessary to maintain the “comic-ness”. Hence, there is less focus on other media types.

6. **Multi-lingual**
   Currently, comics in Malaysia are distributed in many different languages, such as Malay, English, and Mandarin. Therefore, language translation becomes a very important feature to be able to communicate the same comic story to a larger population. In this present study, two languages are used in our design: English and Malay, while more language options are considered for further development.
4 DESIGN OF MOBILE COMIC PROTOTYPES

4.1 INTRODUCTION
The previous chapters reviewed the theoretical background for designing comic user interface (refer to Chapter 2) as well as analysed the preferred features for mobile comics based on Malaysian users’ perspectives (refer to Chapter 3). The information gathered will be used to enhance user interface and interaction on the future mobile comics. In this chapter, the development processes of mobile comic prototypes are discussed. The development processes consists of defining technologies to be used in the process, reviewing design requirements, describing ideas to fulfil all the requirements, and finally configuring the design aspects which includes layouts, fonts, and colours.

4.2 TECHNOLOGIES
The development process includes the selection of technology to be used. Nowadays, there are numbers of mobile software platforms available which can be divided into two classes: native platforms and managed platforms (Win et al 2009). Native platforms (e.g. Android, iOS, Symbian, and RIM) provide several advantages such as fast library updates, direct technical support and more stability (Douangboupha 2009). However, each of these platforms offer their own software development kit (SDK) which uses different programming languages and different user interface design patterns (Douangboupha 2009). Thus, it may limit the accessibility of the application to one platform only. On the other hand, managed platforms or also known as cross platforms (e.g. Flash and Java ME) offers the ability to be implemented over multiple operating systems by allowing one programming language family for all and allowing the use of common user interface design (Douangboupha 2009). The more platforms that the application can run on, the larger potential users are gathered. Thus, manage platforms are taken into more consideration in this study.

Currently, Flash and Java ME are the most popular manage platforms available. Elrom, Janousek & Joos (2009) claimed that Flash is stronger when it comes to creating user interface, games, and multimedia application, while Java ME is more powerful platform for coding and device services. In addition to that, Gavalas and Economou (2011) argued that Flash is more suited to cross platform development due to the strict control of Adobe over its runtime environment. Flash applications also provide a rich set of designer/developer tools that are easy to learn and easy to migrate (Gavalas & Economou 2011). In addition to that, prior programming experience of the research with Flash may help to ease the
learning curve and shorten the development time. Based on these reasons, it was decided to use Adobe Flash to create prototypes in this study. In this development process, some tools were used which includes:

- Adobe Flash Professional CS5
- Adobe AIR for Android
- Android SDK

Although, these technologies allow the prototypes to be expanded to many platforms, the present study only focuses on designing mobile comics on Android devices. As recorded by Gartner (2012), Android continues to gain popularity each year. Therefore, it is believed that Android has a high potential in the mobile comic development. For the purpose of this study, an HTC Desire HD device was used to test the prototypes. The device runs on the Android OS, version 2.2 (Froyo). In addition to that, this device has multiple features, including 480 x 800 screen resolution, 1 Ghz CPU processing speed and multi touch screen.

In this study, all the designing process and evaluation were done in the real device. One of the reasons is because the interaction approach used (multi-touch screen) is relatively new. Therefore it is essential to let the users interact with it personally (Lazar, Feng & Hochheiser 2010). Besides that, users may have new reading experience as comic contents are filled into mobile phone screen.

4.3 DESIGN REQUIREMENT

The main focus of this study is to design new user interface for mobile comic application that incorporates the following essential elements of comics and 6 user preferences. Early of this study reveals that spatial relationship between panels is the most important elements in comics. This is important to maintain the continuity between comic panels and at the same time providing space for reader to exercise their imagination to “filling the gap” between comic panels. This spatial relationship is necessary to maintain the continuity and impact of the comic artwork.

Some criteria to achieve positive user experience and satisfaction are also identified. This includes the application of a user interface guideline for mobile devices, the use of zoom feature, the selection of appropriate font size, type and colour as well as button size and button spacing, and last but not least relying as minimum as possible with the Internet.
Moreover, it was also found in the earlier survey which identifies Malaysian user’s preferences and perception toward mobile comics (refer to Chapter 3), resulted in six criteria: (1) clear images and texts, (2) more intuitive and simple navigation technique, (3) straight forward comic story, (4) full colour content, (5) less distracting content, and (6) multi-lingual.

Therefore, the following sections will explain a step-by-step development process to address these requirements.

4.4 DEVELOPMENT
The development of new comic user interface for mobile phone is not without its challenges. The major issue lies with the small screen size which limits visibility of the comic content (texts and images). Thus, displaying the entire sequence of comic panels at a time becomes very unlikely. Therefore, it becomes crucial to identify the most appropriate composition to display a comic story in which still maintain the essence of panels’ relationship and address Malaysian user preferences.

This study considered two approaches from the existing comic displays throughout the ancient to digital era. These approaches include the ancient Linear narrative and the McCloud’s Infinite Canvas. Both of them offer continuity to communicate a sequence of comic story by applying different techniques. The ancient linear narrative tends to maintain the continuity of the story by presenting the images in a side-by-side manner. This could be with or without extra spaces between the panels, while Infinite canvas theory introduces additional connecting lines (trails) throughout the separating panels. By providing continuing flow of comic panels, it is hoped that a better reading comic experience can be achieved. Since both ancient Linear narrative and McCloud’s Infinite Canvas are presented in different layouts, it may influence the user experience and convenience especially while reading them through mobile phones. Therefore, in this phase, both of these approaches are explored and developed as two prototypes in order to explore the potential of these approaches for mobile comics as well as to find out which interface elements and interactions that work and which do not, based on the preferences of Malaysian users. The following section will present a step-by-step development process of both prototypes

**Prototype 1**

The first prototype displays comic story using ancient linear narrative approach. Sequential images are arranged in a side-by-side structure and in a single path direction
within the available space. This provides easiness for readers to connect one panel to another. Moreover, it allows reader to exercise their imagination to “fill the gap” between the panels without any unnecessary breaks (e.g. z-path reading sequence). Even though ancient continuous narrative communicates the sequential art in similar manner, linear narrative is more preferred due to the addition of border between panels. The visible divider provides readers with clear indications of which scene they are currently viewing. Hence, preventing from navigation lost. This prototype also implements single panel approach which is argued to be able to solve the visibility and readability in small screen size (in Arai & Tolle 2010; Han et al. 2009; Ponsard & Fries 2009; Yamada et al. 2004).

Taking example from Nanda in Nagarjunakonda and Vessantarajataka at Goli, the composition involves longer composition (more than one scene or panel), side-by-side arrangement, divider between panels and displaying single scene at a time. Moreover, another additional feature, “content-zooming”, was added to enrich comics navigation.

The first technique of Linear narrative is longer composition. It refers to the details of scene illustrated to communicate a story. In longer composition, the story must be presented in more than one scene in narrative artworks, or more than one panel in modern comics. In fact, this longer composition is the basic element of comics that distinguishes comic from cartoon. Therefore, this technique was applied without any difficulty with 7 pages-long of Ninchak comic.

![Figure 21: Three possible comic interfaces in limited display size](image)

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The second technique was applied by side-by-side arrangement within the available space. Figure 21 presents three possible designs to arrange the comic panels. Design (a) is frequently used in video timeline or photo gallery (i.e. Youtube). The top area is used to see the larger picture whereas the bottom area is used for displaying iconic buttons. As the idea is to use available space, there might be not enough space to place the entire comic panels on the bottom area. Design (b) was inspired by the continuing arrangement of the ancient artwork. The panels are arranged in a zigzag manner. This design may present many comic panels, however the more panels presented, the smaller the panel size will be. This may result in a visibility problem. Lastly, the design (c) consists of two areas: the middle area is used to display bigger picture while the side area is used for navigation. In the end, this design was used in this prototype as it offers more space to include the comic panels and enough space for displaying clear images and texts.

Another benefit of this design is the possibility to arrange the comic base on story plots of introduction, rising problems, climax and resolution to increase the dramatic sense in the interface (Figure 22). The story starts from the bottom left panel to suit the common reading sequence of Malaysian users and continues in a counter-clockwise direction. The counter-clockwise layout is preferred as it can visually express the “rising problems” story plot in the climbing manner from bottom to top, and the in the falling down manner for “resolution” story plot. In addition to that, comic panels were designed without any hard border to enhance the continuity in the presentation of the story.

![Prototype 1 Layout](image)

**Figure 22: Prototype 1 layout**

The next technique is to show divider between panels. Since the panels are linked together, it is necessary to have a clear indicator which is used to identify distinct
narrative scenes. While in the ancient narrative artwork, the divider is presented as vertical objects such as pillars, scenes in Prototype 1 are differentiated from the colours and obvious changes in the background. In some cases, the “vertical divider” was also applied as presented in Figure 23.

Figure 23: Divider between panels

Lastly, the technique of allowing users to view a single panel or scene at a time was successfully applied. This idea was retrieved since it was impossible to take the whole story all at time due to the physical size and length of the ancient artworks (Petersen 2011; Dehejia 1990). Based on the arrangement from the earlier technique, smaller views of each comic panel are presented around the main screen and used as buttons to navigate to other panels. The smaller views are arranged around the border of the main screen to enable the entire comic panels to be displayed while at the same time, have a wider space for main screen. Whenever a smaller panel is touched, the selected panel will be displayed on the main screen. Using this method, users can only see a single scene at a time. This technique appropriately applies the panel-by-panel approach, while at the same time still serving the continuity of spatial relationship between comic panels. Moreover, by displaying all the comic panels on the screen, it offers extra benefits as it gives users freedom to control their own reading speed and navigation.

Additionally, content-zooming - or ability to move between levels of the comic content - was added to this prototype. This idea was modified from the technique used in DVD timeline (Barnes et al. 2010). The content-zooming feature offers options for readers to choose the comic length they want to read. In this prototype, three comic levels are provided: level 1 displays the short story version of Ninchak comics with 17 panels, level 2 displays a longer comic story version with 31 panels, and level 3 displays the entire comic story with 47 panels. The selection of panels presented in level 1 and level 2 are based on
the priority or the importance of the scene. By maintaining certain important panels and only skipping minor panels in level 2 and level 3, all the three levels communicate the same ideas of the story in general. To perform the content-zooming feature, users need to perform pinching gesture on the main screen as illustrated in Figure 24.

![Figure 24: Content-zooming technique](image)

Understanding the most important aspects of sequential art presentation, Prototype 1 was successfully applied the uninterrupted concepts of comic display in order to maintain the story flow. Although the entire panels are presented in relatively close distance, a clear time and pace transition is still perceived by the viewers as they move their finger slowly panel-by-panel. In this case, users' minds take full control in determining the duration of the story.

**Prototype 2**

The second prototype applies the McCloud’s Infinite Canvas in delivering the comics. This approach uses the digital environment to create an “unlimited” workspace. Since there is no size restriction, the comic can be arranged freely for the purpose of the story. This includes maintaining the panels' relationship, providing continuing narrative sequence as well as setting narrative pacing. To be able to successfully apply this approach, 5 techniques of Infinite Canvas introduced by McCloud are applied. The techniques consist of trails, distance pacing, narrative subdivision, sustained rhythm, and gradualism.
The first technique is trails which was defined as "radical departure from the old left-to-right and up-to-down protocol of traditional printed comics" (McCloud 2000a). In digital environment, artists can decide their own path by following the needs of the story rather than adhering to the traditional z-path or side-by-side structure (Figure 25). Hence, this may result in the comic panels being arranged in various directions. In this case, trails work efficiently to maintain a single unbroken reading line in order to avoid readers getting lost while reading. The application of trails technique in the Prototype 2 was done without difficulty throughout the entire comics. The trails were illustrated in yellow lines with grey arrows in the middle as presented in Figure 26 below.

The next technique is distance pacing which is used to manipulate the perception of time by applying varying distance between panels. McCloud mentioned that "if you follow the basic tenet of sequential art – that to move in space is to move in time – then increasing or decreasing the distance between images can strongly influence the passing of time within a story" (McCloud 2000a). This technique can be easily implemented since there is no limitation in comics’ size and length. In addition to that, McCloud suggests that in tight
pacing stories, the images should be placed closely. And in contrast, they should be placed further for the slow pacing stories (McCloud 2000a). Figure 27 shows the application of distance pacing in Prototype 2. The panels on the left were arranged in distant to represent the slower beat of the story, while the panels on the right side were closer as it represents fast movement of Ninchak to escape from the Durian by falling down to the ground.

Figure 27: The application of distance pacing in Prototype 2

The third technique of Infinite Canvas is narrative subdivision. This technique was defined as the freedom to divide the comics into sections based on the needs of each story. Sustained rhythm technique was made to eliminate the restriction occurs in printed comic book while comics are divided based on the paper size, not the comic stories. This narrative subdivision technique was applied in Prototype 2 by dividing comics based on plot of the story. This can be seen from the arrangement of the overall comics. The first section represents the “introduction” of the story which introduces the settings, location and main characters in the story. The next plot is “rising action / plot progression” which represents the main problem of the story. This section begins with Ninchak aiming at a Durian from the tree and ends when he finds out that the Durian turns into a robot. Ninchak is then trapped into a huge fight with the durian robot. The part of this fight belongs to the third section which represents the “climax” of the story. And finally, the last section is “falling action and resolution” where it describes Ninchak’s victory and celebration with the other creatures in the jungle.

The next is sustained rhythm that is described as “a natural corollary of narrative subdivision” (McCloud 2000a). By adding the artist control to subdivide the comics based on the needs of story, McCloud added that “it becomes possible to build moods through sustained, uninterrupted sequences” (McCloud 2000a). In this prototype, moods were
built from the arrangement of narrative subdivision (Figure 28). The beginning section or “introduction” was arranged normal from right to left to represent the time passing. The “rising action/plot progression” section was displayed in a going up arrangement. This simulates the increasing tension when the problems start appearing. The “climax” was placed in the highest position as it is the peak of the story. Lastly, the “falling action and resolution” section was drawn down. By applying this arrangement, it is believed that it can help to set the atmosphere throughout the story. The application of this technique can be seen in the following figure.

Figure 28: Narrative subdivision and sustained rhythm techniques in Prototype 2

The last technique of Infinite Canvas is gradualism. Gradualism refers to “the ability to gradually reveal an image or sequence of images as readers navigate through a story” (McCloud 2000a). One of the samples to achieve this technique is by creating 6-foot tall falling panel from McCloud online comic Zot! (McCloud 2000c). However, instead of creating a very long panel, this technique is applied in Prototype 2 by arranging the comic panels according to the flow of the story. For example in Figure 29, it shows the characters jumping. That particular panel is therefore placed in the higher position than the previous panel to make it appear more “real” to the users, as if the entire panel really did jumped along with the characters.
Infinite canvas comics have been created for larger screens (i.e. McCloud's *Zot!, Shedd's Work in Progress*). The application of this theory on the smaller screen size of mobile phone may face challenges such as text visibility. It is the same reason why most Malaysian users prefer to view single panel comics at a time. To solve this issue, zooming feature was added. Each panel in this prototype can be zoomed, as well as moved and rotated. This technique surely gives a new experience of interactivity in comics, but at the same time it results in the comic panels becoming rather messy. Therefore, a reset feature was also added to reset back the original arrangement by pressing the back button on the device.

The other infinite canvas comic technique used is the scrolling technique to navigate through the comics (e.g. in Slack-Smith 2006). This scrolling technique can be easily replaced with a swiping or sliding gesture in multi-touch screens. However, this technique was not used in Prototype 2 due to the complexity with the panels’ flexibility (zoom, move, and rotate) feature. Hence, this prototype was separated into eight pages. To turn to another page, users need to press on the red arrow at the edge of the screen based on the reading sequence. In addition, these red arrows may be found on the left, right, up or down side of the screen based on the direction of the story. Moreover, comics in Prototype 2 can be displayed in two views: normal page-by-page layout (Figure 38) and overall layout (Figure 40). The **overall comic layout** allows users to know where they are now in the comic plot and to know how many panels or pages are left. This can be accessed by performing the zoom-out gesture on the empty space.

Prototype 2 has successfully maintained the flow of panel spatial relationship using Infinite Canvas theory. Even though, the story is separated into several pages, the
continuity is still served by the additional flash transition that simulates movement from one page to the next.

To conclude, the list of functionalities in Prototype 1 and Prototype 2 is presented on Table 7.

<table>
<thead>
<tr>
<th>Table 7: List of functionalities in Prototype 1 and Prototype 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DISTINCTION</strong></td>
</tr>
<tr>
<td>Navigation (swipe or touch on the thumbnails)</td>
</tr>
<tr>
<td>Content-zooming</td>
</tr>
<tr>
<td><strong>SIMILARITY</strong></td>
</tr>
<tr>
<td>Bilingual (English and Bahasa Malay)</td>
</tr>
</tbody>
</table>

4.5 THE APPLICATION OF USER INTERFACE GUIDELINES
This study also takes user interface guidelines into consideration during the designing process. It is argued that it could improve the quality of the interface design and reduce some potential usability issues. The present study follows the Gong & Tarasewich (2004)'s 15 guidelines for handheld mobile device. The implementations of each guideline are discussed below:

1. **Enable frequent users to use shortcuts**
   This guideline is achieved by providing alternative menu (refer to Figure 41) in both prototypes. It provides shortcuts to go to the other menus (i.e. main menu, instructions, settings and exit).

2. **Offer informative feedback**
   Interface should provide feedbacks that are easy to understand for every operation. This guideline has been used frequently in both prototypes, for example in changing the language label in the settings menu (Figure 34), changing the panels viewed in the main screen when users touch iconic button on the side in Prototype 1 (Figure 36), and highlighting the selected panel in Prototype 2 (Figure 38).

3. **Design dialogs to yield closure**
   Every system should be organized into beginning, middle and end so that users are aware that they have completed a task. Since the present study offer the function for
reading comic repeatedly, the end sequence will only occur when users exit the application (Figure 42).

4. **Support dialogs locus of control**
   It is necessary to make users feel in charge of the system. The system should respond to every user action. This was successfully achieved in both proposed prototypes by providing users with ability to interact with comic panels (Figure 39).

5. **Consistency**
   The same “look and feel” can only be retrieved throughout interface design. This is achieved by using the same colour scheme, font, labels that are easy to remember and logical interactions (will describe further in Section 4.5). In future study, consistency can be extended to provide the similar “look and feel” across multiple platforms and devices.

6. **Reversal of actions**
   Due to the lack of available resources and computing powers, it may be difficult to perform reversal of actions in mobile application. However, in Prototype 2, a simple “reset” option was added to reorganize the comic panels into the original positions. Moreover, both of these prototypes were designed as standalone applications which are aimed to prevent any disturbances due to connectivity losses.

7. **Error prevention and simple error handling**
   Interface must not harm users and prevents user from making errors. This guideline was successfully applied as an exit command as shown in Figure 42.

8. **Reduce short-term memory load**
   The buttons and labels should rely on recognition of function instead of memorization of commands. This guide is implemented by presenting easy-to-understand labels; visible iconic buttons; selectable comic panels in Prototype 2; and accessible next-and-back button throughout the pages.

9. **Design for multiple and dynamic contexts**
   A good interface should allow users to configure output to their need and preferences. The present prototypes offer language (Figure 34) and display (Figure 37, Figure 38 and Figure 40) options.

10. **Design for small devices**
    The interaction and interface should provide small-screen oriented considering the screen size, for example providing word selection instead of requiring text input in volume selection (Figure 32) and language setting (Figure 34) menus. These prototypes use the short and simple interactions for each operation. Moreover,
panel-by-panel(Figure 36) and zooming (Figure 39) approaches are applied to solve readability and visibility issues in the small screen.

11. **Design for limited and split attention**
Interface should not demand too much users’ attention. Hence, simple interactions are used in the most operations, such as touching on the iconic buttons in Prototype 1 (Figure 36), and tapping on the next/back button in Prototype 2 (Figure 39) to navigate through the comics.

12. **Design for speed and recovery**
The designed prototypes run quickly in most events. The overall performance speed in both prototypes is relatively fast, from starting up to closing the application.

13. **Design for “top-down” interaction**
Due to the small screen size, it is necessary to present multiple levels of information and let users decide whether or not to retrieve details. This is achieved by providing content-zooming in Prototype 1 (Figure 37) and two different display modes (page-by-page and overall page layout) in Prototype 2 (Figure 38 and Figure 40).

14. **Allow for personalization**
Personalization offers users the ability to change settings to their needs and liking. This could enhance user acceptance toward the application. This is achieved by providing multiple options such in language and display modes normal page-by-page layout (Figure 38) and overall layout (Figure 40) in Prototype 2.

15. **Design for enjoyment**
The appearance of the interface takes part in the user experience. It should be visually pleasing and fun as well as usable. This is implemented by applying colourful interface and intuitive interaction in multi touch screen. It is argued that the collaboration between both of them could enhance the enjoyment when using the application. Details on the application of layout, interaction, fonts and colours used in the present study will be further discussed in the following section.
4.6 **DESIGN**

The previous sections described the development process of both prototypes referring to comic presentation approaches, Malaysian user preferences, and user interface guidelines. Therefore, the remaining sections will present the outcome of both prototypes, in terms of navigation, layout and interaction, fonts and colours.

**4.6.1 NAVIGATION**

![Figure 30: Page hierarchy](image)

Navigation is an important aspect in designing an application. It is important to organize menus in the most logical structure. Both Prototype 1 and Prototype 2 have the same page hierarchy which can be seen in Figure 30. When the application starts, the main menu will appear. This initial page presents the application title and some clickable buttons to link to other pages such as “read comics” – to view comic content -, “instructions” – to view the instruction manuals -, “settings” – to change the comic language - and “exit” – to close the application-. Under the “read comics” menu, there is a “volume selection” page where users can choose which comic series they want to read. Currently, only the first volume of Ninchak comics that can be accessed, while the other slots were prepared for future development. Once users have chosen the volume, the comics will be displayed. Here, the alternative menus can be accessed. It can be linked to main menu, instructions, settings and exit.

**4.6.2 LAYOUT AND INTERACTION**

The major difference between Prototype 1 and Prototype 2 are the presentation of Ninchak comics. The rest of the pages were designed similarly. Both prototypes were designed with the size of 800 x 480 pixels and in landscape orientation. This provides the larger view to read comics on the small screen. Besides that, multi touch screen technique
was chosen to interact with the application. Thus, some gesture techniques were applied such as single tap, zoom, rotate and drag-and-drop gesture. The details of pages’ layouts and interactions are described below:

4.6.2.1 Main menu

![Main menu screenshot]  

Figure 31: (a) Screenshot of the main menu and (b) mouse over effect on button

The main menu is displayed as the opening page of the application. The interface can be seen in the Figure 31a above. This page can be categorized in three sections. The right section is the navigational menu which displays available options in the application. The middle section presents the illustration of Ninchak, the main character. And the last section displays the title of the comics, ”The Legend of Ninchak”. The title was designed with glowing shadow to emphasize the comic title.

Buttons in this page were designed using simple mouse-over technique. Figure 31b shows the effect applied to the button while it is touched. The red marker relates to ninja’s samurai slash mark.
4.6.2.2 Volume selection

![Screenshot of volume selection](image)

Figure 32: Screenshot of volume selection

A simple volume selection page was designed to display list of comic series. In this project, only Ninchak volume 1 can be accessed. Again, a mouse over animation was added to this page. The volume being touched will be brighter than the others. Selected volume can be accessed by performing single tap.

4.6.2.3 Instructions

![Prototype 1 instruction screenshot](image)

![Prototype 2 instruction screenshot](image)

Figure 33: Screenshots of instruction in Prototype 1 and Prototype 2

Figure 33 shows the interface of instruction page in both prototypes. Instruction page was designed in sequence of the instruction title, manuals, and a button to go back to the main menu. The instruction manuals are presented in the textual basis with the keyword highlighted at the top such as “reading sequence”, “reset to original setting” etc.
4.6.2.4 Settings

![Screenshot of settings](image)

Figure 34: Screenshot of settings

Multilingual is one of the features preferred by Malaysian users (Chapter 3). Thus, the Ninchak comics used in this project were created in two languages, Malay and English. This settings page is used to change the language of the comic content. This page consists of two grey buttons to select the language options and a yellow output text to display the language being used. In addition to that, back button was added to go back to the main menu.

4.6.2.5 Comics Layout

This study proposed two interfaces for reading comics on mobile phone. The two interfaces were designed with different layouts and interactions.

**Prototype 1**

![Prototype 1](image)

Figure 35: The layout of Prototype 1
As presented in Figure 35, the layout of Prototype 1 was divided into two areas: the side and center area. The side area consists of linking buttons with the smaller view of comic panels. The center area shows the main screen to view larger image of a particular comic panel. By touching a button on the side area, the selected panel will be displayed automatically on the main screen. The illustration to navigate through the comics can be seen in the following figure.

![Figure 36: Navigation technique in Prototype 1](image)

As described in the previous section, Prototype 1 was created with three comic lengths: level 1, level 2 and level 3. The first level displays 17 panels, level 2 displays 31 panels and Ninchak comics level 3 displays the entire comics. This content-zooming feature can be accessed by performing pinching (zoom in and out) gesture on the main screen. Besides that, this feature fulfills the “top-down” interaction from user interface guidelines as it can help users to decide whether or not to retrieve details.

![Figure 37: Three length levels of Ninchak comics](image)
Prototype 2

Prototype 2 consists of comic panels that were arranged dynamically. The next comic panel may be placed on the right, left, top or bottom. Thus, a connecting yellow line was added to connect the comic panels. Arrows in the line are used to tell the correct reading sequence. As shown in Figure 38 the selected panel appears in a brighter colour compared to other comic panels. Touch screen gesture techniques can be applied to each comic panel to manipulate its size, position and orientation (Figure 39).

Besides that, another feature was added to allow users to view the overall comic layout by performing a zoom in and zoom out gesture on an empty space. The overall comic layout page consists of eight red-outlined-boxes that together form a unique structure. This structure was arranged intentionally based on the plot of the story. Moreover, the red-outlined-boxes refer to comic pages that consist of 5 to 6 comic panels on it.
4.6.2.6 Alternative menu

While reading the comics, users can access alternative menu or shortcuts to navigate to other pages. The alternative menu appears once the user press the menu keypad of the device. Figure 41 demonstrates the alternative menu with a transparent grey cover and four buttons.

4.6.2.7 Exit

Figure 42: Screenshot of exit command
Exit command will appear anytime users press exit button. The additional “are you sure you want to quit?” command was created to prevent data loss when users accidentally press the exit button. The exit page was arranged in a simple layout of white “are you sure you want to quit?” text and textual yes & no buttons.

4.6.3 **Fonts**

Previous studies found that small sizes’ sans-serif type can be read about 20% faster as compared to serifs (Morris et al. 2001). This study helps to decide what kind of font should be used for both prototypes. The limited size of mobile phone screen requires a legible font faces in the minimum size to be able delivering the information effectively. Therefore, sans-serif fonts were used in this study as it also can be easily recognised due to the simplicity of the letter shape. The sans-serif fonts being used are Gill Sans Ultra Bold Condensed, Gill Sans MT Condensed, and Arial. Moreover, bigger font size than 8px was used to enhance the readability on small screen (Darroch et al. 2005). Thus, for the comic content, Arial font was used in: 19px in Prototype 1 and 10px in Prototype 2. The smaller size of text in Prototype 2 can be solved by performing zooming gesture. Moreover, to increase the visibility, the highest contrast between text and background were used, such as yellow and black, white and black, or the opposite.

<table>
<thead>
<tr>
<th>Gill Sans Ultra Bold Condensed (56px)</th>
<th>Gill Sans MT Condensed (30px)</th>
<th>Arial (19px)</th>
<th>Arial (10px)</th>
</tr>
</thead>
</table>

**Figure 43**: Font faces used in Ninchak mobile comic prototypes

4.6.4 **Colours**

When looking for colour scheme for prototypes’ interfaces, basic colours used in action comics were considered. Thus black, red, grey, yellow and white colours were chosen. Besides that, these colours have high contrast that can help to increase the visibility of the interface elements. The comic contents used the original colour produced by the author, which was in black and white.

<table>
<thead>
<tr>
<th>Black</th>
<th>Red</th>
<th>Grey</th>
<th>Yellow</th>
<th>White</th>
</tr>
</thead>
</table>

**Figure 44**: Colour scheme of Ninchak mobile comic prototypes
5 Usability Testing 1

5.1 Introduction
In the previous chapter, two prototypes have been designed and implemented with different kinds of user interface and interactivity to enrich users’ reading comics experience on mobile phone. Therefore, in this section, a detailed description of the methodology used to evaluate the proposed prototypes is given. Basically, usability testing aims to improve the quality of an interface by finding flaws in it (Lazar, Feng & Hochheiser 2010). The main objective of this usability testing is to evaluate the usability aspects in the proposed prototypes and to collect feedback on the interface elements used. The results obtained from the testing will help to determine whether the current interface designs and interactivity techniques are suited for reading comic on mobile phones. The testing is also aimed to discover possibilities for improving the prototypes in order to produce an interactive and user friendly mobile comics, especially for Malaysian users.

The testing concerns questions listed below which were adapted from Tullis & Albert formative usability’s key questions (2008):
- What are the most significant usability issues that are preventing users from completing their goals or that are resulting inefficiencies?
- What aspects of the product work well for users? What do they find frustrating?
- What are the most common errors or mistakes users are making?

In short, this usability study aims to explore the potential of two different approaches (ancient Linear and McCloud’s Infinite Canvas) for mobile comics as well as to determine which interface or design elements of the two prototypes that work and which do not, based on the preferences of Malaysian users in relation to RQ4. Moreover, this usability study intends to measure the user experience and user satisfaction toward the proposed prototypes (RQ5).

5.2 Methodology and Design
To identify issues from the current designs, a usability test was conducted in a task based testing. This was done by observing the selected users interacting with the prototypes to perform certain tasks. In this evaluation, the tasks were provided in scenarios that were written in a piece of paper per task. In addition to that, the think-aloud protocol was used to better understand users’ feeling while using the application.
Stages performed in this usability test starts by selecting representative users, selecting the setting, deciding what tasks users should perform, deciding what type of data to be collected before the test session (informed consent, etc.), during the test session, and debriefing after the session (Lazar 2006 cited in Lazar, Feng & Hochheiser 2010).

5.2.1 Participants and sampling
Usability experts recommend that at least 5 participants should be recruited to perform usability testing (Nielsen 2000; Virzi 1992). 15 participants were invited to perform the test, however only 10 of them were willing to participate. By utilizing 10 participants in usability test, it is argued to be able to uncover a minimum of 82% of problems of a prototype tested (Faulkner 2003).

The selected participants were in the age ranged of 19 to 26 years old, with the average age of 23.2 years. An equal number of men and women took part in the tests. All participants have more than 5 years of experience in various types of mobile phones. Five participants are touch-screen phone users, while the other 5 users own a mobile phone with regular keyboard. Participants with different mobile phone experiences have different feelings and opinions regarding the interactive mobile applications. Their feedback would be very useful for evaluation.

5.2.2 Test Environment and Instrumentation
Testing was performed in a laboratory at Swinburne University of Technology campus. The laboratory environment was used to prevent any external interruptions, and disturbing noises. Moreover, HTC Desire HD device, a mobile phone with touch sensitive screen, was used in this testing. The device had both prototypes pre-installed.

Also, an interview script and 8 task cards were used during evaluation. Each of these tasks represents specific goals to better improve the quality of the prototypes, which includes the investigation of navigation, visibility of the features and layouts, accessibility of the features provided, legibility of the texts and font used, and the clearness of the information given. Since Prototype 1 and Prototype 2 provide different interfaces and interactions, different sets of test scenarios are made to test out the usability aspects of specific functionality provided in each prototype, i.e. content-zooming feature in Prototype 1 and panel flexibility feature in Prototype 2. Although Prototype 1 and Prototype 2 also have few same features such as to open the comic content, to change the language settings and to close the application, the same features will only be tested once in Prototype 1. This method is chosen to prevent redundancy of the tasks since the procedures to perform these features are exactly the same. In addition, the findings of this usability study were
used to generate the final interactive mobile comic prototype, where the accepted interaction and interface design will be maintained and the problematic ones will be revised. This method was chosen since it was believed that both approaches (ancient Linear and McCloud’s Infinite Canvas) have the same potential to maintain the essential elements of comics for mobile phone. For each prototype, 4 tasks are prepared to be performed, as listed in the tables below:

Table 8: Tasks and Elements investigated in Prototype 1

Prototype 1

<table>
<thead>
<tr>
<th>TASKS</th>
<th>ELEMENTS INVESTIGATED</th>
</tr>
</thead>
</table>
| (1) Open and read through the Ninchak comic vol.1 | • Navigation  
• Visibility of the layout and reading sequence  
• Legibility of the texts and font used |
| (2) Change the language setting to English | • Navigation  
• Accessibility of the features provided (the selection to access the “language” menu) |
| (3) Open the level 2 of Ninchak comic | • Navigation  
• Visibility of the features and different layouts between comic levels |
| (4) Close the application | • Navigation  
• Accessibility (the selection to close the application) |

Table 9: Tasks and Elements investigated in Prototype 2

Prototype 2

<table>
<thead>
<tr>
<th>TASKS</th>
<th>ELEMENTS INVESTIGATED</th>
</tr>
</thead>
</table>
| (1) Open and read through the Ninchak comic vol.1 | • Navigation  
• Visibility of the layout and reading sequence  
• Legibility of the texts and font used |
| (2) Reset the panel arrangement | • Navigation  
• Visibility of the “reset” feature |
| (3) Navigate to page number 3 | • Navigation  
• Visibility of the navigational buttons |
| (4) Display the overall comic layout | • Navigation  
• Visibility of the “overall comic layout” feature |
In addition to that, in this usability study, participants are allowed to access the “Instructions” menu to find hints in order to complete the task. This procedure is used to examine the clarity of the information given on that particular “Instructions” menu.

The completion time of each task is recorded in this study, thus a stopwatch was used to record the time each user took to complete a certain task.

5.2.3 Procedure
Kuniavsky (2003) divided the usability test into three parts: the introduction and preliminary interview (before the test session), the tasks (during the test session), and or wrap-up (after the test session). The activities in each phase are described below:

Before the test session

The participants arrived at the testing venue at the appointed time that was decided during the recruitment. At the beginning of the testing session, the investigator friendly greeted the participant, and gave a brief introduction of the study. The investigator also explained about the objective of the test, the test procedures and the estimated time duration for the entire testing process - which is approximately 30 minutes. A statement of informed consent was also made known to the participant. It sets out the participant’s rights while participating in the usability testing. The rights are listed as below:

- Participant may stop at any time
- Participant may ask questions at any time
- Participant may leave at any time
- There is no deception involved
- The answers are kept confidential

Furthermore, the participant was asked questions in regards to what type of mobile phone the participant has, how frequent the participant use his or her mobile phone, how long has the participant been using a mobile phone, whether the participant has any experience using a multi-touch screen mobile phone or not, and which interactive mobile applications the participants frequently used.

Next, the investigator gave instructions on what the participant should do and feel during the usability test. To help lessen any nervousness on the part of the participant, the investigator reminded and assured the participant that the interface is the one being tested, not the participant. The participant was encouraged to “think aloud” while using the prototypes by narrating what he or she was doing. The participant was encouraged to
narrate what he or she expects to happen when performing something on the interface. The participant was also encouraged to “think aloud” when something unexpected occur.

Before starting with the tasks-based usability testing, the investigator noted the first impression that the participant has on the main menu. The participant was asked what caught his or her attention the most when he or she first viewed the main menu. Was the design on the main menu interesting? What was the first thing the participant felt like doing after viewing the main menu?

**During the test session**

The test began when the investigator gave a task card to the participant. The participant was given some time to understand the written task. Once the participant was done reading the task card, the investigator instructed the participant to initiate the task and at the same time, start the timer. Even though, the entire task process was recorded, all interesting events, the participant’s actions or behaviours, concerns and comments were noted on a logging sheet. If needed, the participant was allowed to ask for help. The investigator will then provide hints and encouragements to help the participant along. However, users may open the instruction menu to get more complete help. The real hands-on help will only be given once the participant has given up. In the event that this occurs, it will be noted that the participant has failed to complete the task. While performing a task, the completion time, error and success rates were recorded. After a single task was completed, some questions related to the task were asked to the participant. When this has been done, the participant then continued with the next task as the investigator hands over the next task card.

**After the test session**

At the end, a few more questions were asked to the participant aiming to glean perceptions and understanding towards the application, and to gather any additional information participants may want to improve. The participant was asked to conclude the testing by mentioning three good things and three bad things from each prototype.

**5.2.4 DATA COLLECTION**

The outcome of this testing was written notes during the interview and test. The written notes were made on a piece of paper to record interesting events, completion time, error rate, and success rate.
The data gathered is in both qualitative and quantitative forms. Qualitative data is gathered based on the interviews and think-aloud procedure. Quantitative data includes completion time, error and success rate for each task. Completion time is recorded in seconds. Error rate are measured using a scale of (0) fail because of errors, (1) many errors, (2) some errors and (3) few or no errors. The scale of “many errors”, “some errors” and “few or no errors” are differentiated with the severity of the problems found by the participants. “Many errors” are assigned to represent the high frequency of unnecessary steps taken by the participants that cause confusion (or loss) and slow down the participants’ completion time. “Some errors” are given when participants immediately correct the mistakes and have no other effect than to slow down the participants’ completion time. And lastly, the “few or no errors” represents minor mistakes that do not significantly affect the task completion (i.e. double or single tap on the buttons).

Success rates are measured using a scale of (0) fail, (1) succeed very slowly in a roundabout way, (2) succeed slowly, and (3) succeed quickly. The success rate (1) and (2) are differentiated depending on how fast the participants recover from the errors.

5.2.5 Measurement Metrics
To be able to measure the usability aspects of the prototypes, some measurement are used. Task time and task success were documented as additional usability metrics for problem discovery introduced by Tullis & Albert (2008). The four metrics used in this usability study are described below:

- Task time
  This metric refers to the time required to complete a single task which reflects the efficiency of the approach used (Neilsen 2001). Each task completion time is recorded and analyzed in Section 5.3.1.

- Task success
  After the completion of each task, the success rate of each participant’s performance was recorded. This metric represents the effectiveness of the approaches taken (Neilsen 2001). The success rate of each prototype can be found in Section 5.3.2.

- Issue based metrics
  The severity of problems occurred during the task performance in each design was recorded as error rate. Error rates of each task will be discussed in Section 5.3.2. This metric is also referred to as usability problem or the details of interface issues.
found in each task. Further analysis on these usability problems can be found in Section 5.3.3.

- **Self-reported metrics**
  This metrics are answered by asking participants to choose which prototype he/she is more likely to use in future. Besides that, participants were also asked to rank his/her experience of each prototype based on certain dimensions. In this usability test, the dimensions are learnability (how easy was it to use the application the first time), efficiency (how effective the application was in delivering a comic story), ease of use (how intuitive and user-friendly the application was), and user satisfaction (how pleasant the user's experience was). The results are measured using five point Likert scale. The scale comprises of (1) strongly disagree, (2) slightly disagree, (3) neutral, (4) slightly agree, and (5) strongly agree. The complete explanation on this metric can be seen in Section 5.3.4.

In this usability testing study, all the 10 participants were asked to experience both mobile comic prototypes. The results of participants' performance in each prototype were further analysed separately since the two prototypes offer distinct functionalities and interactions. For example, Prototype 2 has panels' flexibility interactions (can be zoomed, rotated, and moved), while Prototype 1 does not. Nevertheless, it is believed that the selected measurement metrics could help to measure the usability of each prototype in order to address the objective of determining which interface elements that work specifically, and to identify the Malaysian user preferences in mobile comics (RQ4) generally.

5.3 **RESULTS AND DISCUSSION**
This section provides an analysis of the result from the evaluation method from both the implicit and explicit feedback.

5.3.1 **TASK COMPLETION TIME**
The timing for each task evaluation began when the participants touched or performed correctly on the application and ended when the participants completed the task or gave up. Figure 45 and Figure 46 shows the average time required by all participants to complete each task in both Prototypes.
From this figure, it seems that Task 1 (open and read through Ninchak comic volume 1) and Task 4 (close the application) for Prototype 1 consumed less time compared to other tasks. This is mainly because the tasks merely require common procedures such as opening and closing the comic application. Task 2 (change language settings) took a little more time to complete with 20.7 seconds as the average time, 12 seconds as the fastest time and 33 seconds as the slowest time. A more complicated task was given as Task 3 (access the level 2 of Ninchak comic) in Prototype 1. This can be seen from the longest time taken by the participants to complete the task with an average of more than 45 seconds. There were four participants who took a longer time than the average completion time in 50, 62, 64, and 67 seconds respectively.

Figure 45: Mean of task completion time in Prototype 1 (in seconds)

Figure 46: Mean of task completion time in Prototype 2 (in seconds)
In average, participants took more than 9.8 seconds to complete each task in Prototype 2. Task 1 (open and read through Ninchak comic vol.1) took the shortest time to be completed with the average of 9.8 seconds, the fastest of 3 seconds, and the slowest of 41 seconds. Majority of participants finished the task faster than the average completion time, except 3 participants who completed the task in 10, 13 and 41 seconds. Task 2 (reset the panel arrangement) and Task 3 (navigate to page number 3) occupied the most time as more than 50 seconds was needed to solve the tasks. While performing the Task 2, only 4 participants could finish the task before the average time (56.7 seconds), as the other 6 participants took 69, 71, 72, 76, 90, and 104 seconds to complete the task. Similar result was gathered in Task 3 performances where only 4 participants consumed faster time than average completion time (63.8 seconds). The participants’ performances in Task 4 (display the overall comic layout) resulted 20.7 seconds as the average time, 6 seconds as the fastest time and 44 seconds as the slowest time.

The variation of amount of time spent for each task occurs because of some possible reasons such as unfamiliarity with multi touch screen devices, difficulty in understanding the task given, and nervousness.

5.3.2 SUCCESS AND ERROR RATE
After the completion of each task, the success and error rates are recorded. The success rate is calculated based on user performance and the method used to achieve the task goal. The error rate on the other hand, is accumulated based on the number of clicks/touches performed and the number of unnecessary actions made.

Success rate

Figure 47 and Figure 48 presents the average success rate on both prototypes. It is shown that most tasks in Prototype 1 were successfully completed in relatively fast performance with majority less than 20 seconds, except the task to access the level 2 of Ninchak comic (task 3). For that particular task, 5 participants finished the task quickly, 3 participants in slow performance, and 2 participants failed the task. The mistakes occurred mostly because of a lack of prior experience with touch screen devices.
In Prototype 2, lower success rates are generated, especially in the task to reset the panel arrangement (task 2) and to navigate to page number 3 (task 3). While performing both of these tasks, most participants faced issues that affected their performances such as unfamiliarity with the mobile device used and inconsistent button placement. As a result, in task 2, there are only 6 out of 10 participants who were able to successfully complete the task. And for task 3, only 2 participants completed the task quickly, while 7 participants took longer time and 1 participant failed to finish the task. Other than that, distracting interaction due to the panels’ flexibility also claimed to affect the completion of the task to display the overall comic layout (task 4). This resulted in 1 participant failing to complete the task.
**Error rate**

Mostly, the problems found in Prototype 1 relates to the lack of prior experience with touch screen device especially understanding the zoom in and out gesture. Moreover, some of the participants claimed that they cannot recognize the difference between levels in Ninchak comics due to similarities in the interface design (colour and layout). The other tasks for Prototype 1 were completed successfully with few or no errors.

![Mean of error rate in Prototype 1](image)

*Figure 49: Mean of error rate in Prototype 1*

Based on the evaluation, it is found that familiarity with the mobile phone device, inconsistent navigation and distracting interaction were also the main issues in Prototype 2. While performing task 2 (reset the panel arrangement), some of the participants barely managed to find the back button to reset the panel arrangement. For task 3, it is argued that the navigation button is not user friendly as it is placed dynamically and is only visible when the user touches around it. Moreover, since the panels in Prototype 2 can be moved, zoomed and rotated, performing zoom in gesture on the empty space becomes harder as sometimes the application misinterprets the interaction to the panels instead of accessing the overall comic layout (task 4). This resulted in 1 participant failing that particular task.

The success and error rates in Prototype 2 present different results especially for task 2 and 3. This is depending on how fast the user was able to recover from errors. As presented in Figure 48 and Figure 50, Task 2 has more errors as compared to Task 3. However, most participants were able to recover faster in Task 2 rather than Task 3. One of the reasons could be due to the visibility of the button. Based on the observation, it seems that visible buttons are easier to recognize compared to the invisible “next” and “back” buttons (only visible when users touch the surroundings of the button).
5.3.3 Task Analysis

Below is the result and analysis of the eight tasks performed by the participants. The first four tasks belong to Prototype 1, while the rest belongs to Prototype 2.

a. Task Analysis for Prototype 1

Task 1 – Open and read through Ninchak comic vol.1

As the first task, it is important to know whether the participant knew how to navigate through the comic panels, and whether they knew which direction the story went. Based on the evaluation, it is found that once they were in comic page, 5 of the participants seem confused on how to navigate the comics at first by sliding and touching the black screen. However all of them were able to figure it out in time. The other half of the participants performed the correct action from the beginning by touching the thumbnails on the sides. As for the reading sequence, only 4 participants got the correct sequence while the other participants read the comic in a clockwise direction.

Task 2 – Change language setting

In these prototypes, multiple languages were provided. The settings were accessible in two ways: from the main menu or from the alternative menu. This task aimed to observe which menu option the participant chose to change the language setting. The evaluation shows that 2 participants changed the language setting by going to main menu while 8 participants used the setting menu from alternative menu (by pressing the menu button on the device to make the menus appear). The two participants who used the setting on
main menu claimed that they were unaware of an alternative menu. However, from the interview, it is found from that 7 of the participants agreed that the two menus are necessary for accessing the setting menu.

**Task 3 – Access the level 2 of Ninchak comic**

The functionality to move between levels of Ninchak comics, or content-zooming feature, was added in Prototype 1. Since it is a new feature, this task aimed to observe whether participants were aware of the technique to shift from one level to the other version of Ninchak comic, and to observe whether the participant recognized the difference between each level. The results showed that none of the participants knew the way to change the level; therefore all of them used the hints on the instruction menu. Even so, 5 participants were confused with the zoom-in and zoom-out gestures, and only 3 of them were able to figure it out in time, while the other two gave up. Most of the participants claimed that the levels were hard to differentiate due to similarities in the interface design. Thus, a further improvement is required to indicate different levels, for example by adding level indicator, or colour differentiation.

**Task 4 – Close the application**

To end the evaluation session for Prototype 1, a task to close the application was needed to be done. The exit option could be found from the main menu or the alternative menu. In this task, the action being observed was to know which menu option the participant chose. The result shows that all the participants closed the application using the alternative menu. This uniformity may occur as the participants have experienced with the alternative menu in the previous task. Besides that, most of the participants found that the alternative menu was easier to access from the “read comic” page.

b. Task Analysis for Prototype 2

**Task 1 – Open and read through Ninchak comics**

Prototype 2 offers different interactions from Prototype 1. Thus, a similar task was made to investigate whether the participant knew how to navigate through the comic panels, and whether they understood the reading sequence. As a result, all of them touch the comic panels once they reached the “read comic” page. Knowing that the panel will move if they drag it, the participants had various reactions. Three of them seem amazed while the rest were confused. It is also found that all of the participants were able to understand the reading sequence easily because of the arrows.
Task 2 – Reset the panel arrangement

In Prototype 2, each panel can be moved, zoomed and rotated. It is necessary to have a reset feature in order to reset the panels back to original position. This task was added to observe whether the participant knew how to reset the panel arrangement. Based on the evaluation, all of the participants had to open the instruction menu to receive a hint on how to carry out this task. Despite that, four participants were unable to recognize the back button to reset. Furthermore, the participants claimed that the instruction texts were insufficient.

Task 3 – Navigate to page number 3

Prototype 2 consisted of eight comic pages. This task aimed to investigate how the participant navigated to the third page. The evaluation shows that all of the participants went to the instruction menu. After that, 9 of them needed more time to figure where the “red next button” was as the button was invisible (it only appears once the user touches the surroundings of the button). In addition to that, 5 of them had difficulties on the second page due to the dynamic position of the “red next button”. As a result, out of the 10 participants: 2 participants completed the task quickly, 2 participants did so a little slowly, 5 participants succeeded in a rather slow performance, and 1 participant failed to finish the task. Apart from its intention for reducing distraction and providing more visibility of the comic content, the result shows that the “invisible button” also introduces confusion.

Task 4 – See the overall comic arrangement

The comic panels are arranged dynamically as well as the comic pages. Therefore, a feature to see the overview of comic arrangement was added. As the last task in Prototype 2, the participant was required to perform steps to view this feature. The evaluation shows that all the participants obtained hints from the instruction menu, and only 1 participant was not able to complete the task while 9 participants were able to complete the task with minimal errors.

5.3.4 General Feedback

Once the participants open the main menu, their first impressions are observed and noted. Initially, most of the participants’ attentions are engaged to the illustrations of the Ninchak character followed by the title of the comic “The Legend of Ninchak”. Some positive feedbacks based on their first thought after seeing the main menu, are “appealing”, “neat”, “clean” and “simple”. On the other hand, three participants argued that the current design did not present comic very well but rather similar to a mobile game interface. It is also
found that more than half of the participants would like to "read the comics" immediately, while 3 participants would like to open the "instruction" menu and 1 participant prefer to check on the "settings" menu.

![Pie chart showing percentages]

**Figure 51: Percentage on which prototype participants like most**

After the test session, participants were asked to choose which of the two prototypes they like most. From Figure 51 above, it shows that 70 percent of the participants like Prototype 1 more than Prototype 2.

**Prototype 1**

Based on the information gathered from the interviews, participants seem to prefer the first prototype due to its easiness of navigating around the application. They also like the fact that this prototype has clear images and texts without having the need to use the additional zooming feature. Most users commented that this prototype has a simple but innovative and interesting navigation. However, despite the interaction navigation, this prototype does not have any indicator as to which is the starting panel, which direction they should go to read the comics and neither do the panels contains any numbers. Also, the buttons appear to be very small. This may present some difficulty in opening specific panels. The other problem that arose was the loading time while opening a particular comic panel. This circumstance occurs because of the large image size. Even though the content zooming feature seems to be an interesting feature, users still prefer to read the longer or complete version of the comics.

**Prototype 2**

On the other hand, the second prototype is argued to have a clearer reading sequence as the comic panels in this prototype are arranged with the additional lines connecting the panels. Participants also like the overall page arrangements as it is different from the
conventional straight left-and-right page arrangement. Besides that, they find that the *overall comic layout* feature was useful to identify how many pages or panels are left. However, users find the dynamic “next and back” buttons placement to be quite confusing the first time. Each panel was created to be flexible – it can be moved, zoomed and rotated. Some users argue that this interactivity was “annoying”, “confusing”, “frustrating” and “troublesome”. They would rather have a static comic panel and use the tapping gesture to enlarge and minimize the panels instead of using the zoom in or out gesture. Using the zoom in or out gesture takes a longer time to read since users have to resize each panel in order to read the text. Users also have to minimize or move the panel whenever a particular panel was blocking another panel. This disturbs the users’ concentration while reading. In general, users find Prototype 2 to be an interesting application but the flexibility of each panel makes the interface rather messy.

**Table 10: Summary of usability test results**

<table>
<thead>
<tr>
<th>a) Reading Environment</th>
<th>PROTOTYPE 1</th>
<th>PROTOTYPE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Easy navigation</td>
<td>+ Clearer reading sequence</td>
<td></td>
</tr>
<tr>
<td>+ Clear images and texts</td>
<td>+ Interesting page arrangements</td>
<td></td>
</tr>
<tr>
<td>+ Simple but innovative and interesting navigation</td>
<td>+ Useful <em>overall comic layout</em> feature</td>
<td></td>
</tr>
<tr>
<td>- Unclear reading sequence</td>
<td>- Dynamic “next and back” buttons placement</td>
<td></td>
</tr>
<tr>
<td>- Small buttons</td>
<td>- Distracting comic panel interaction</td>
<td></td>
</tr>
<tr>
<td>- Ineffective <em>content-zooming</em> feature</td>
<td>- Invisible feature (e.g. zoom out on empty space to go to overview feature)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b) Overall Design (both in Prototype 1 and Prototype 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Understandable navigation (title and hierarchy)</td>
</tr>
<tr>
<td>+ Bi-lingual</td>
</tr>
<tr>
<td>- The overall colour and theme chosen did not represent “comics” very well</td>
</tr>
<tr>
<td>- Unclear instructions</td>
</tr>
</tbody>
</table>

| + Strengths | - Weaknesses |

At the end of evaluation, participants were asked to measure their experience with the prototypes based on some usability attributes such as learnability, efficiency, ease of use and user satisfaction. Figure 52 shows that Prototype 1 dominate all the attributes compared to prototype 2, which are explained below:
Learnability

A higher learnability value for Prototype 1 means that the steps used in this prototype are easier to understand. Therefore, users do not have to memorize steps to perform certain tasks.

Efficiency

Again, a higher value for efficiency with 0.8 gap indicates that Prototype 1 offers a more efficient technique for reading comics, especially because of the clearer text and images as well as less distraction with the zoom-in and zoom-out gesture.

Ease of use

Prototype 1 has a higher value for the third attribute, ease of use, than the Prototype 2. This suggests that the first prototype provide a more user-friendly interface, which can be seen from the less-necessity to open the instruction menu.

User satisfaction

From the overall experience, users feel more satisfied with Prototype 1 as shown in Figure 50. The result shows that the simpler and the less-distracted techniques are more enjoyable to be used to read comics on the mobile phone.

![Figure 52: Mean values for usability attributes](image)

Based on this evaluation, it is found that participants have their own likes and dislikes toward both prototypes. Prototype 1 is argued to be successful in providing easy
navigation, clearer images and text, and simple navigation, while Prototype 2 has clearer reading sequence, interesting page arrangement, and useful "overall comic layout" feature. Even though majority of the participants like Prototype 1, this information suggests that both prototypes have potential to be improved based on the needs of the users. Therefore, the next phase aims to perform refinement on both prototypes in order to produce better and more user friendly mobile comic interface by maintaining the strengths of each prototype and addressing their weaknesses.
6 PROTOTYPE REFINEMENT

6.1 INTRODUCTION

“Iterative development is based on the idea of continual refinement through trial and error. Rather than trying to create a perfect vision from the beginning, iterative development homes in on the target, refining its focus and perfecting the product until it has reached its goal” (Kuniavsky 2003, p. 28)

This study used the iterative development method in which the prototyping process is performed repeatedly. This iterative process helps to improve the usability of the mobile comic application. Chapter 5 analysed the usability aspects of the two mobile comic prototypes by performing different sets of task scenario with 10 participants. The result showed both positive responses (e.g. unique interfaces) and negative responses (e.g. frustrating) which affect the user’s reading experience. Although more positive responses were pointed to Prototype 1, this does not hinder the researcher from improving the reading experience in Prototype 2. Instead, refining drawbacks on both designs are believed to be able to produce better and more user-friendly mobile comics. This chapter reviews the main problems of the two mobile comic prototypes found in the usability test. This section also discusses the changes made including navigation, interface layouts, and colours.

6.2 CURRENT ISSUES

This study aims to find the best way for reading comics on small screen size. However it could not be achieved with only a single development process. Gathering more information and feedbacks from users give richer ideas to enhance the quality of the end-product as it mainly focuses to help users perform their task while reading comics. Kuniavsky (2003) suggests that finding a single perfect way of reading mobile comic from the beginning is unlikely, but perfecting it through trial and error is certainly possible. Therefore to produce a better and more user-friendly mobile comic, results from the early usability test were analysed. It aims to better understand the current issues affecting the user reading experience.

In the previous chapter, a detail analysis of evaluation results was presented. Generally, it was found that the main problems related to user interface design were inconsistent navigation, distracting interaction, and insufficient information. Inconsistent navigation was found in the dynamic placement of the “next” and “back” buttons in Prototype 2. This dynamic position was aimed to engage users and the comic story; however it turned to be
confusing by most users. The second problem was the panel's flexible interaction (which can be zoomed, rotated and moved). It was claimed to be frustrating, confusing and distracting users' concentration while reading. And lastly, insufficient information problem was found in both prototypes which require more interface elements to be added to tell users how to use the system. This problem results in an unclear reading sequence in Prototype 1, invisible overview feature and unclear instructions. In addition to that, some improvements were required for the ineffective feature, and overall colour and theme.

6.3 Modification
Understanding the current issues from both Prototype 1 and Prototype 2 provides insights to improve the reading experience on mobile comics while at the same time, keep maintaining the relationship between panels. Furthermore, even the earlier results show clearly the higher acceptance of Prototype 1 while Prototype 2 is still explored. It is argued that the complexity of the interactions influence the responses from users. In this phase, simpler and clearer interface design is considered.

Moreover, since the present study concerns user preferences, additional features to provide multiple display reading mode is considered by displaying the two designs as two different modes in a single mobile comic application, providing freedom for reader to choose the most suitable layout for them. This idea is inspired from the existing mobile comic, Princess Ai that provide personalization of display modes. Modifications made on the two proposed prototypes are described below:

a. Combination of Prototype 1 and Prototype 2

Initially, the two prototypes were made based on combination of linear narratives and panel-by-panel approach; and Infinite canvas theories. By understanding strengths of each prototype, it is possible to integrate the two concepts into a single mobile comic application. The concepts will not interrupt each other as they are presented in different display modes. The multiple display modes method gives users freedom to choose their own preference to read the same comic story. The three different display modes in the current prototype were separated depending on the number or the complexity of the comic panels displayed. In the overall comic layout (based on Prototype 2), all the panels are displayed, however it may not possible to view the text and pictures clearly as the panels were restricted by the limited mobile phone screen size. This layout was still maintained to fulfil its aims to show the continuity between comic panels and to give options for navigational (shortcuts) purpose. In the Infinite view (based on Prototype 2), a clearer view of the text and pictures are displayed. However, only few (2 to 4) comic
panels are presented. And lastly in Linear view (based on Prototype 1), a single comic panel is displayed, thus an even clearer view of the illustration and texts can be displayed. Figure 53 below illustrates the hierarchy of comic views in the current prototype.

![Comic views hierarchy](image)

Once the comic content is accessed, the comic is displayed in Infinite view as the default display mode. From this view, users can see the whole comic panel arrangement by accessing the overall comic layout feature. Also, users can change the display layout to Linear view by performing single touch on any comic panel. The selected panel is automatically displayed on the main screen of Linear view.

**b. Consistent navigation placement**

This modification is based on issues occurred in Prototype 2. The comics were arranged in separated pages with “next” and “back” buttons to navigate to other pages. These “next and back” buttons were placed dynamically where it can be found on the top, bottom or sides of the screen. This placement was designed to follow the plot of the story (i.e. if currently the story is in “rising problems” plot, then the next button is on the top and the back button is on the bottom). Moreover, the buttons were designed to be invisible and only appear while the users’ finger is around the buttons’ location. However, this dynamic “next” and “back” button could not be understood by most users. This can be shown from the longer duration users took to complete the Task 3 on Prototype 2 on the previous usability testing (refer to Section 5.3.1). To enhance reading performance and reduce the confusion, the “next” and “back” navigation buttons were modified to be static on the bottom left and bottom right of the screen.
c. Simple interaction

The main objective of adding an interactive comic panel (can be zoomed, rotated and moved) in Prototype 2 was to increase the visibility and interactivity to read mobile comics. However, the small screen size limited the effectiveness to interact with the comic panels. The users claimed this feature to be frustrating, confusing, and distracting while trying to concentrate on reading comics. Moreover, after interacting with some panels, the interface became rather messy and sometimes it blocks the “next” or “back” buttons. Finding these problems, it is clear that users prefer the simpler interaction. This is in line with users’ preferences from the survey in Chapter 3. Therefore, a straightforward interaction was used to replace the “interactive comic panel” technique. Panels in Infinite View were presented in a larger size, around 2 to 4 comic panels in a single page. This increases the visibility of the texts and images presented in the comics. Moreover, the comic panels were designed to be in a static position and size; the comic panels cannot be zoomed, rotated and moved to prevent confusion and distraction.

d. Providing clearer information

The other issues found in the two proposed prototypes were related with the insufficient information given, in terms of panel indicators, visible button, and the actual information on how to use the application. Therefore some modifications were made to provide a clearer reading sequence, interface design and instructions.

Figure 54: Linear view with the addition panel indicators

The unique comic arrangement in Prototype 1 introduced a few problems. Users hardly understand the correct reading sequence. For that reason, some panel indicators were
added as presented in Figure 54. In each of the four corners, an arrow showing the correct reading direction was inserted. This interface was also improved with the addition of a current panel number and the total comic panels on the top right of the main screen. Moreover, for the iconic buttons, the selected panel is displayed with thick border. Also, a bold separator was added between the beginning and ending of the story.

The next modification was done by adding an extra button to access overall comic layout feature. Previously, to access this feature in Prototype 2 users have to perform zoom-in gesture on an empty space. From the usability testing, it was found that the current interface did not clearly help the users to understand how to use the application just by looking at it. This opinion was gathered by observing how many users required hints from the instruction menu and failed the task. Thus, a visible overall comic layout button was placed in the bottom centre of the screen to increase users’ awareness for the feature. Figure 55 displays the latest arrangement of Infinite view with three buttons at the bottom: back button, overall layout button, and next button.

![Figure 55: Changes in the Infinite view](image)

This study proposed mobile comics with relatively new and unique interface. Thus, it is necessary to provide clear guidelines on how to use this application especially for first time users. The previous instruction was given in a textual basis to explain steps to perform tasks in each prototype. Most users in the usability testing suggested that adding more pictures or animation could make this information more effective. Hence, this idea was implemented for the new mobile comic prototype by modifying the instructions into six separated animations based on different navigational procedures, such as how to
navigate in Infinite view, how to switch to Linear view, how to read comics in Linear view, how to return back to Infinite view, how to go to Overall layout, and lastly how to go to a particular panel from Overall layout.

As mentioned in the new instruction sections, an additional feature was added to be able to access a particular panel from the overall comic layout feature. A simple touch on a panel will bring users to the page where the selected panel belongs in Infinite view. This new improvement could enrich the mobile comic navigation experience for users. In addition to that, an option to start the comic from the beginning was added. With this feature, users can re-read the comics from the start without have to navigate manually to the first page.

**e. More attractive colour and theme**

A mobile comic application should be able to successfully present a comic-like sense in the overall interface design. The previous interface design was argued to look more like a game interface according to some users (refer to Chapter 5). The dominance of black made the comics less interesting as the comic content was also drawn in black and white colour. Thus, to enhance the visual to be more pleasing and fun while reading this mobile comic, comic-typical-brighter colour were used. Moreover, various comic panel shapes were used for the buttons’ shape as well as the title. A 2D illustration of Ninchak characters was also used to replace the previous 3D version of Ninchak. Figure 54 below presents the new concepts for main interface. This will be discussed further in Section 6.4.2.

![Figure 56: The new mobile comic main interface](image)
f. Removal of the content-zooming in Prototype 1

Previously, Prototype 1 was developed with a content-zooming feature which allows users to view comic in three different levels. Based on the users' responses during the usability testing, this feature seemed to be an interesting feature; however users still prefer to read the complete version of the comics. Due to this ineffective use, this additional feature was removed. In addition to that, the current concept of using a combination of Prototype 1 and Prototype 2 offers a rich navigation system. Thus, it was decided to eliminate this feature in order to keep the application as simple as possible. Moreover, the “content-zooming” feature was an extra feature, so the removal of this feature will not affect the application of the initial theories of Linear narratives and Infinite canvas.

In short, the problem identified from previous prototypes and the solutions completed in the current phase are summarized in the table below:

<table>
<thead>
<tr>
<th>Problem Identified</th>
<th>Solution Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Inconsistent navigation</td>
<td>a) Modification from the dynamic button placement into static on the bottom left and right of the screen</td>
</tr>
<tr>
<td>a) Dynamic &quot;next and back&quot; buttons placement (Prototype 2)</td>
<td></td>
</tr>
<tr>
<td>b) Distracting interaction</td>
<td>a) Removal on the comic panels’ flexible interactions, creating a static comic panel with larger size to maintain the legibility and clearness of the text and images</td>
</tr>
<tr>
<td>a) Comic panels’ flexible interactions (Prototype 2)</td>
<td></td>
</tr>
<tr>
<td>c) Insufficient information</td>
<td>a) Addition of panel indicators, such as pointing arrows in four corners, panel numbers and separator between beginning and ending</td>
</tr>
<tr>
<td>a) Unclear reading sequence (Prototype 1)</td>
<td></td>
</tr>
<tr>
<td>b) Small iconic buttons (Prototype 1)</td>
<td>b) The small buttons can be solved with the sliding technique to navigate through the comic panels</td>
</tr>
<tr>
<td>c) Invisible “Overall comic layout” feature (Prototype 2)</td>
<td>c) Addition of new visible button to access the “Overall comic layout”</td>
</tr>
<tr>
<td>d) Unclear information in Instructions menu (both prototypes)</td>
<td>d) Modification from text-based into animated instructions</td>
</tr>
<tr>
<td>e) The overall colour and theme chosen did not represent “comics” very well (both prototypes)</td>
<td>e) Improvement with the more comic-sense theme and comic-typical-brighter colour</td>
</tr>
<tr>
<td>d) Ineffective feature</td>
<td>a) Removal the “content-zooming” feature and the addition of a new reading modes feature</td>
</tr>
<tr>
<td>a) Ineffective “content-zooming” feature (Prototype 1)</td>
<td></td>
</tr>
</tbody>
</table>
6.4 DESIGN
Modifications for the new prototype affects some of the design elements such as the layout and color scheme, while page hierarchy and fonts used were still the same with the previous prototypes. Details on new layout and color scheme are described in the following section.

6.4.1 LAYOUTS AND INTERACTION
Similar with Prototype 1 and Prototype 2, the new Ninchak mobile comic prototype was designed in the landscape orientation within the size of 800x480 pixels. Due to the issue related to the comic panels’ flexible interaction (refer to Section 5.2), some interaction techniques such as zoom, rotate, and drag-and-drop gesture used in the previous prototypes were removed. Consequently, all interactions in this prototype are done using single tap gesture. This single interaction technique used may seem uninteresting; however this can help users without prior touch screen experience to understand the system easily. Moreover, it provides the opportunity to expand this mobile comic prototype in non-touch screen devices such as PCs.

6.4.1.1 Main menu

The main menu has a huge impact on users’ first impression of the overall mobile comic application. Based on the usability testing, the previous main menu was argued to be more like a mobile game interface. Therefore, the new mobile comic was designed in a more comic-like way. This can be seen from the layout structure, the shape of the buttons, the illustration used to represent the character and the brighter colour chosen. Figure 57 shows the new layout for the main menu which would appear when the application is started.

Figure 57: Screenshot of the new main menu layout
6.4.1.2 Volume Selection

The new volume selection screen was arranged in the shape of square comic panels that was inspired by the comic book layout. A clear title of “Volume Selection” was placed on the top, while the comic volumes were arranged vertically on the bottom. Each of the comic volumes has its own distinct coloured background and Ninchak styles as presented in Figure 58. Currently only the first volume is available, while the rests are noted as “coming soon” products. In the volume selection screen, a back button was also added to link back to the main menu.

6.4.1.3 Instruction

The new instruction menu was designed with short animations directing the steps to interact with the application. The animations were organized into 6 different sections based on the features available. The instruction screen consists of 2 navigation next-and-back buttons, and one close button to go back to previous screen. In addition to that, an indicator showing the section number is displayed at the bottom of the screen.
6.4.1.4 Language Settings

The language settings and Instruction menu have a similar interface. This was done intentionally in order to maintain a consistency within the overall user interface. The term “Language” was used to replace the original “Settings” for the title of the menu. This term is believed to be clearer as the current options available are related to the language only. In the language screen, the language options are illustrated using the nation’s flag as displayed in Figure 60. The selected language is highlighted in a zigzag speech balloon shape. Users can easily confirm the selection by touching the “yes” button (illustrated in tick symbol) or the “no” button (illustrated in cross symbol) to cancel the selection.

6.4.1.5 Comics Layout

The current mobile comic prototype provides two reading displays: Infinite view and Linear view. Besides that, an “overall layout” feature was also added to enrich the navigational system of the application.

Figure 61: Screenshots of Infinite view

Figure 61 presents some screenshots of Infinite view in the final prototype. Modifications were made in the navigational buttons at the bottom of the screen which were placed in the static position in all comic pages. The buttons include key to link to the previous comic page, to access the “overall layout” feature and to go to the next comic page. Moreover,
larger comic panels are displayed aiming to increase the visibility of comic texts. In addition to that, the new background was designed in purple colour. This colour helps to increase the contrast from the “black-and-white” comics making it easier to see the comics.

![Figure 62: Screenshot of Linear view](image)

In the Linear view, some visual modifications were added in order to enhance the clearness of the reading environment which includes informing the correct reading direction and the current panel number. Figure 62 shows the new interface was completed with panel indicator on the right top of main screen and directing arrows on the corners. Moreover, the iconic buttons were arranged in the more structural way to maximise the use of available space, and at the same time, providing slightly larger buttons. The iconic button of the selected comic panel is highlighted with red border.

![Figure 63: Screenshot of overall comic layout](image)

There were no major changes can be seen from the presentation of the “overall layout” feature. An improvement was made so that users can link to a particular comic panel on the Infinite view by simply touching on the selected comic panel.
6.4.1.6 Alternative Menu

The new alternative menu was designed with more colours on it. A new button to start the comic from the beginning was added in this alternative menu. Moreover, the button to go back to main menu was replaced with a new button to go to volume selection. To hide the menu, users can choose to use the down arrow, the transparent space or the menu button on the device.

6.4.1.7 Exit

The interface of the exit command was changed to suit the current layout and colour. The new layout used a similar design with the introduction and language menu. It consists of an “Exit..?” title on the top, a straightforward “are you sure you want to quit?” question, and a “Yes” and “No” buttons at the bottom.
6.4.2 Colours

<table>
<thead>
<tr>
<th>Colour Code</th>
<th>Hex Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>#373535</td>
<td>#007789</td>
</tr>
<tr>
<td>#FFFF00</td>
<td>#8B8445</td>
</tr>
<tr>
<td>#330033</td>
<td>#DC9E3A</td>
</tr>
<tr>
<td>#3353B</td>
<td>#478DCA</td>
</tr>
<tr>
<td>#FFFFFF</td>
<td>#9AC649</td>
</tr>
</tbody>
</table>

Figure 66: The new colour scheme of Ninchak mobile comic prototype

The final mobile comic prototype was designed with more colour variations. These new colours were based on colour scheme used in American super hero comics. The addition of some brighter colours on the mobile comic interface aims to increase the sense of fun and joy while using the application. Moreover, it is hoped that by using more colours in the interface, it will be able to make up for the lack of colours in the comic content.
7 Usability Testing 2

7.1 Introduction
Based on the previous usability testing, a final mobile comic prototype was developed by performing refinements on the two prototypes aiming to provide better user interface and at the same time, improve the user experience and convenience. Thus, it is essential to evaluate the user experience and user satisfaction toward the new prototype using another usability test. The current usability testing is also known as summative usability which aims to ensure the optimal usability and to evaluate how well this mobile comic meets its objective which is, to address the needs of Malaysians to read comics on the mobile phone. In this chapter, the methods used and the discussion of the results are covered.

7.2 Methodology and Design
Similar methods with the previous usability testing were used. This includes the number of participants, participant demographics (gender, age group, and mobile phone experience), the instruments used, evaluation procedures, as well as the information gathered from the usability test. This usability testing was also performed in a task-based testing and talk-aloud protocol. Even so, these two usability testing were performed with different objectives. Therefore to suit the current objectives, some adjustments in the method were made, including usability tasks, and measurement metrics.

7.2.1 Tasks
The final mobile comic prototype provided new functionalities which were compressed into 6 tasks to be performed during the usability test. Each task presented certain purposes, either to introduce new features, to evaluate the reading environments, or to assess the navigation of the application. The six tasks are listed below:

| Table 12: Tasks and Element investigated in final prototype |
|---|---|
| TASKS | ELEMENTS INVESTIGATED |
| (1) Open and read through Ninchak comic volume 1 | • Navigation  
• Visibility of the layout and reading sequence  
• Legibility of the texts and font used |
| (2) Switch to Linear view | • Navigation  
• Visibility of the feature |
| (3) Read comic in Linear view | • Visibility of the layout and reading sequence  
• Legibility of the texts and font used |
During the usability test, the tasks were written in scenario formats and given in a separate piece of paper.

### 7.2.2 Measurement Metrics

At the end, the quality measurement of the final mobile comic prototype was presented. This measurement was achieved by accumulating all the usability test results. This study used the usability metric framework for mobile application by Hussain & Kutar (2009). By referring to the Usability standard ISO 9241-11 (1998), they had proposed to separate each characteristic into appropriate goals such as simplicity, accuracy, time taken, features, safety, and attractiveness. In order to properly suit the current mobile comic study, similar concepts were used and adapted, including the elimination of the safety goal. It is believed that the present study has minimal to no harm in risking user’s safety as there is no personal information required for using the application. The modified usability guideline is presented in the table below.

<table>
<thead>
<tr>
<th>Quality Characteristic</th>
<th>Goal</th>
<th>Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness</td>
<td>Simplicity</td>
<td>- Ease to input the data&lt;br&gt;- Ease to use output&lt;br&gt;- Ease to learn</td>
</tr>
<tr>
<td></td>
<td>Accuracy</td>
<td>- Accurate&lt;br&gt;- Should contain no errors&lt;br&gt;- Successful</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Time taken</td>
<td>- To respond&lt;br&gt;- To complete a task</td>
</tr>
<tr>
<td></td>
<td>Features</td>
<td>- Support/help&lt;br&gt;- Touch screen facilities</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Attractiveness</td>
<td>- User interface</td>
</tr>
</tbody>
</table>

Table 13: Usability Guideline adapted from (Hussain & Kutar 2009)
7.3 RESULTS AND DISCUSSIONS
Results from the evaluation are analyzed and discussed in this section. They are categorized into first impression of the startup screen, task completion time, success and error rates, task analysis, general feedback and quality measurement.

7.3.1 TASK COMPLETION TIME
The current usability task required participants to perform 6 tasks on the final mobile comic prototype. The duration required to complete each task was noted. Based on the evaluation, each task was completed in less than 30 seconds. Figure 67 presents the summary of time taken to complete the each tasks. It was found that the task to switch the reading display took the longest time compared to other tasks. On average, participants took 11 seconds to complete the Task 2, while 5 participants required more time than the average. And the second longest time was taken to skip the comic story using the “overall layout” feature. The participants’ performances in Task 5 resulted with 8.3 seconds as average time, 3 seconds as the fastest time, and 23 seconds as the slowest time. It was also found that only three participants took longer time than the average completion time in 10, 16, and 23 seconds respectively. On the other hand, the other 4 tasks (i.e. Task 1 - open and read through the Ninchak comic, Task 3 - read comic in Linear view, Task 4 - return to Infinite view and Task 6 - close the application) were completed in relatively short time within the average range of 3.9 to 6 seconds. It is assumed that the short procedures (requiring 1-2 clicks per task) and the clarity of the interface elements helped impacted on the faster completion time.

![Figure 67: Mean of task completion time (in seconds)](image)

7.3.2 SUCCESS AND ERROR RATES
The success and error rates of tasks were also collected after the completion of each task. Figure 68 and Figure 69 show the average of both success and error rate of each task.
During the evaluation, most of the participants were able to complete all tasks. Only one participant had failed the last task, which is to close the application. The failure was caused by the wrong assumption of the button on the device, and at the same time, the lack of the system to prevent the error. Other than that, most of the errors occurred while performing the tasks came from the confusion of trying to figure out where the different functions are. This error happened often in Task 2 and Task 5. The success and error rate values given are subjected to the user performances and also the severity of their mistakes. During this evaluation, once a participant chooses to obtain a hint from the instruction menu, the action was considered to only affect the success rate. This is because it reduces the speed performance.

![Figure 68: Mean of success rate](image)

![Figure 69: Mean of error rate](image)

7.3.3 TASK ANALYSIS
All the participants’ performances on each task were observed and analysed to further understand the level of easiness and successfulness in completing tasks in the final prototype. The results are discussed below.
Task 1 – Open and read through Ninchak comics

The first task was to open and read through the first volume of Ninchak comics. The participants were expected to understand the logical navigation of the application to open the comic content and to understand how to read the comics in Infinite View – the default view method while first opening the comic content. The evaluation shows that all of the participants knew the navigation to the comic content by choosing “read now” button and continued by selecting the first volume in the “Volume Selection”. Only one participant read the instructions first before reading the comics. When the participants reached the comic content screen, 3 of them touched a random panel, 1 performed the zoom out gesture on a comic panel, 1 performed the swiped gesture on the screen while the rest pressed the next button. Generally, it is found that all of the participants understood the comics reading sequence in Infinite view.

Task 2 – Switch to Linear view

The final mobile comic prototype provides two reading displays - Infinite view and Linear view. This task aimed to investigate how the participants switched the reading display from Infinite view to Linear view. Based on the evaluation, instead of performing the correct direction to change the reading display by tapping the comic panel, 5 participants misused the visible button of "overall layout" feature. However, once realizing their mistakes, they tried to recover and finally managed to complete the tasks in time. One participant received a hint from instruction page, and successfully performed the task. Another participant seemed confused as he was performing random actions from touching the “overall layout” button to accessing alternative menu, to selecting “start over” and “volume selection” menu and finally performing the correct action – tapping on the comic panel. The rest of the participants performed the correct action accidentally. This can be seen from the participants’ surprised expression once the interface changed. In addition to that, the (approximately) 2 seconds delay response time of the system affected the user performances as some participants seemed confused and tapped the comic panel multiple times.

Task 3 – Read comic in Linear view

The next task was added to investigate whether the participant knew how to navigate through the panels and which direction the story went in the Linear view. As a result, it is found that most of the participants understood the interface as they touched the thumbnails on the sides to change the comics on the main screen. On the other hand, two
participants started the task with the wrong action by performing the swipe gesture on the main screen. Apart from this small mistake, all participants knew the correct reading sequence because of the panel number indicator. Most participants also commented on the size of the iconic buttons. They claimed it was difficult to select a particular button due to its small size. However, participants found that they are able to overcome this problem easily when they continuously touch the screen by keeping their finger on the iconic buttons instead of releasing.

Task 4 – Return to Infinite view

A task to return to the Infinite view was added in the evaluation. This task was to observe if participants knew how to switch back to the default reading display. The result shows that all the participants knew the way to change the reading display. Most of them were able to do so intuitively by touching the main screen. One participant took a longer time to complete the task as he went to look for hints in the instruction page. Most participants claimed that the single tapping technique to switch the reading display to Infinite view was easy and convenient enough once they have learnt how to do it.

Task 5 – Skip the story to the end

A modification on the “overall layout” feature was made where the comic panels can be linked to the selected panel in the Infinite view. This new feature was tested in this evaluation by investigating whether the participant was aware of the technique to jump to a desired section of the comic storyline. Based on the evaluation, it is found that two participants appeared to be quite confused and kept pressing the next button to navigate to the last page. After a few moments, they finally figured the how to use the “overall layout” button and was able to complete the task. Besides that, one participant obtained clues from the instruction page in order to complete the task while 7 participants were able to finish the task without difficulty. In addition to that, participants agreed that this feature provides a useful function to navigate freely throughout the comic storyline.

Task 6 – Close the application

The final mobile comic prototype provides two exit options - in the main menu and in the alternative menu. Therefore, a task to close the application, that aims to observe which exit option the participant chooses, was added. The result shows that most of the participants used the exit option in the alternative menu and managed to successfully close the application. However, it was found that one participant assumed that the application could be shut down by simply pressing the back button on the device.
Performing this action in Android device will only hide the application. It works in a similar way to the minimize function in the Windows operating system. Thus, the last test session was accounted to failure in performing the task.

7.3.4 GENERAL FEEDBACK
At the beginning of the evaluation, participants were asked to express their first impression toward the startup screen. Majority of the response gathered were positive, such as “interesting”, “nice color”, “clean and clear”. Those were the participants’ first thoughts after seeing the interface. Most participants said that the Ninchak character attracted their attention the most, followed by the navigation and the title of the application. It is also found that most of the participants were interested to read the comic straight away without concerning themselves with the other available menus. Only one participant chose to open the instructions menu to understand the newly available features. In addition to that, majority of the participants agreed that the current main menu is appropriate for a mobile comic.

Post-evaluation interviews were conducted once the participants had completed all the tasks. The interview aimed to gather final comments after experiencing the mobile comic and also to collection suggestions to improve the application in the future.

The interview results showed positive responses from most of the participants. While describing the mobile comic, the terms “innovative”, “user friendly”, “new interface”, and “interactive” were used. In addition to that, some participants explicitly mentioned that they like the two reading displays method and the overall layout. As for the easiness of the application, participants explained that the application was “easy to use”, “easy to skip the comics”, and “easy to switch the reading displays”. Despite the supportive comments, participants argued that the application needs to be improved in terms of comic colour, and the application performance. Moreover, even though the current text was readable, it was claimed that it is still necessary to provide a zoom feature so that the users can see the comics clearer. Besides that, swiping or sliding gestures were claimed to be able to increase the intuitivism to navigate through the comics.

Additionally, participants suggested providing more language options, and to add slideshow and sound features (i.e. voice over). The slideshow and sound features may help users to continually read the comic with less concentration required (e.g. in the public places). As a result, 8 participants were enthusiastic to use the application and would recommend it in the future, while 2 participants seemed to be of less interest with it as they still prefer reading comic on the larger screen.
7.3.5 **Usability Measurement**

The usability test results, both explicit and implicit responses, were used for an analysis of the tested mobile comic prototype using the Usability Guideline adapted from (Hussain & Kutar 2009) presented in the Section 7.2.3. Usability was measured based on three characteristics: effectiveness, efficiency and satisfaction.

**Effectiveness**

The effectiveness of a product can be measured based on how easy it was to perform tasks and to learn the interfaces. The interactions in the tested mobile comic were designed in short sequence of actions. For unique presentation such as in Linear view, indicators were added to help users understand the interface easier. Moreover, clear and straightforward terms were also used for the navigation and instructional sentences. Based on the evaluation, most participants show few to no problem while performing normal task such as opening and closing the application. However, they claimed some tasks were hard to figure out as to where to find the function. This is probably a result of arbitrary use of the navigation buttons making it hard to understand.

In addition to that, the accuracy to successfully performing any task on the mobile comic also affects the effectiveness characteristic. Findings from the evaluation show that most participants were able to successfully complete the tasks without any major difficulties except the task to change the reading display to Linear view. The method of using the comic panel to switch the reading display from Infinite view to Linear view was claimed to be difficult to recognize for the first time as most participants were pressing any visible button to access the functionality. However, participants felt the tapping-on-a-comic-panel technique was easier after that. Flaws concerning the error prevention were also found. The error was influenced by prior experience in Android device where some participants tend to use the hard buttons on the device to perform actions (i.e. go to previous screen).

**Efficiency**

To achieve good efficiency, the system must respond in an appropriate time as well as the duration to complete any task. Findings from the evaluation show that there were flaws related with the response time, especially while switching the reading display from Infinite view to Linear view. This is possibly due to the large memory used to load many images all at once. Apart from that, the results also show that it typically requires a long time to complete a task for the first time, after which it could be done in approximately
less than 3 seconds for the next performance. Other than this, it seems that there no major problems were found in other tasks as they were accomplished in a relatively short time.

In addition to that, all functionalities expected for reading comics were included. This application was also complemented with some additional features aiming to give users freedom to choose their own preference, such as language option and reading displays. Also, simple interaction by single tapping/touching was used to interact with the application. This technique is believed to be able to satisfy all the users even those without prior experience with multi touch screen device. Moreover, multiple ways to access the menus were provided. This mobile comic was also added an instruction menu where users could gather complete help to understand the application. Despite that, findings show that participants expected a zoom functionality in a mobile comic.

**Satisfaction**

The satisfaction in this mobile comic was defined in terms of attractiveness of the overall user interface. The findings showed that the overall satisfaction towards the user interface was positive. This good result was influenced by the consistent graphic layout, colour, font and the simple interaction. As the application was tested on a real device, the responses were relatively accurate. Apart from the positive feedbacks, most participants suggested that the iconic buttons on the Linear view should be made bigger so it was easier to select. Several more feedbacks regarding the user interface were collected. It covers the need to improve the colour of the comics, the need to add in a zoom feature and the need to provide a swipe or slide gesture to navigate through comic pages.

**7.3.6 RESULT COMPARISON**

Based on the results gathered from both Usability Testing 1 (Chapter 5) and Usability Testing 2, some comparisons are made by looking at the tasks analysis:

**Task analysis**

In the previous usability testing, it was found that some issues were found in understanding the reading sequence in linear view. After the modification process, the present usability testing shows improvement as most of the participant understood the interface. The minor changes on the interface (e.g. panel indicator, thick border, arrow illustrations, and separator between beginning and ending of the story) give a huge impact for users.
Usability testing 1 (refer to Chapter 5) shows that problems also found in while accessing the “overall comic arrangement” feature as 1 participant was not able to complete the task. This in fact can be solved with the addition of a visible button. An improvement of 0.5 points for its success rate illustrates a good achievement in improving the mobile comic prototype.

Another accomplishment can be seen from the method to turn the pages in infinite view or in prototype 2. The dynamic “next-and-back” buttons in Prototype 2 surely introduced an interesting and new way to navigate the comics; however, it turned to be difficulty for most of the participants. The changes into more consistent navigation improves the user experience as there was no “turning page” problems found in the final prototype.

Lastly, the removal of panel flexibility – in which panel can be zoomed, rotated and moved - in Prototype 2 into static in the final prototype shows good responds. Although this makes the prototype less interactive, it certainly increases the consistency of the mobile comic prototype. In this usability testing, no major problem was found related to the interactivity. However, it was found that some participants still expect the zooming feature as they performed zoom gesture on the panels.

The present evaluation reveals that the further refinements on the two initial designs have successfully produced better user interface as less errors are found. Moreover, the idea of combining the two concepts as the options of reading display layout receives positive responses. This enhances user acceptance and satisfaction towards the design since they have more control in selecting the most convenient reading environment for them. The results in this evaluation also imply that the users’ familiarity with the application and technology influence users’ behavior towards the new user interface. For example, users who have prior experience with multi touch screen tends to perform gesture interactions (i.e. swiping and pinching) while general users look for visible buttons first before exploring the entire user interface. Thus, a self-explanatory interface design (e.g. clear, consistent, and recognizable) is common yet very important criterion in design new user interface.
8 CONCLUSIONS & RECOMMENDATIONS

This chapter summarizes the results contained in this thesis, with an overview of potential enhancement for further study that address some of the limitation found in the present study.

8.1 CONCLUSIONS

Nowadays, mobile phones are a “must have” gadget for everyone from teenagers to senior citizens. Following its market, the current mobile technology continues to advance with high definition (HD) screen resolution, multi-touch screen and larger screen size. This introduces opportunity to explore how this ubiquitous technology can be used to view comics so conveniently. The main objective of this study was to design a new reading experience for mobile comic application that incorporates the essential elements of comics and Malaysian preferences.

The present study was initiated by understanding the essential elements of comics (RQ1) which differentiated comics from other media (i.e. animated movies, games). The earlier studies revealed that the use of images and texts (Eisner 1985, Harvey 2001), and the sequential arrangement of the comic panels (McCloud 1993, Magnussen 2000, Saraceni 2003) are the most important elements of comics. The application of images and words in the comics provide clear storytelling information for readers. Moreover, with the continuing spatial arrangement of comic panels, the reader's imagination will perform “fill in the gap” to connect the story. These simple yet important elements of comics are necessary when designing comics for any medium.

This study was continued by analysing the available comic forms in various medium and understanding how they apply the essential elements of comics (RQ2). Comics have been evolving centuries ago from sequential art on walls and pillars in ancient artworks, to printed form, and now to web and mobile comics. The evolutions present changes in comic component (i.e. speech balloon, with or without border), comic structure (i.e. z-path, linear), the addition of extra digital features (i.e. motion, sound, zoom) and the most important thing – changes in the spatial relationship between comic panels. The present mobile comics have explored various approaches based on previous comic forms such as panel-by-panel, comic page, multi path story, and the use of multimedia aspects. However, the comic presentation on current mobile comics is only based on the availability of the space in medium and overlooked the importance of the panels' continuity. Therefore, this project focused to serve the essential elements of comics by maintaining the flow and the
continuity of spatial relationships between panels while presenting the comics story on mobile phones.

The differences in physical sizes of mobile phones compared to other medium (i.e. ancient walls, books, and computer’s screen) introduces both advantages (i.e. portability) and disadvantages (i.e. small display size, limited control and input mechanism, and limited resources). By understanding the characteristics of mobile phones, the researcher will know what should and should not be done while designing mobile comics. Due to its small display size, the content arrangement becomes crucial in displaying information. Moreover, previous studies suggests that the addition of zooming feature (Lehtonen et al. 2006), and the appropriate selection of font size, font type and font colour (Darroch et al. 2005) will support better visibility and readability. Jin, Plocher & Kiff (2007) also suggests to provide appropriate button size and button spacing for easy and intuitive navigation in touch screen displays. Last but not least, it is also necessary to rely as minimum as possible on the Internet connection (Banerjee 2008) as this will make it convenient to access the application. This information addresses the third research question of this study (RQ3) regarding the factors and issues that need to be considered when designing a usable mobile comic interface. Furthermore, in order to reduce some potential issues on the user interface of mobile comic prototypes, 15 guidelines by Gong & Terasewich (2004) are selected to assist the development process in the present study.

While most of the earlier studies focused on the technical aspect of adapting comic books to the mobile comic format, the present study also took Malaysian user preferences as an important criterion in the development of mobile comic interface (RQ4). This study demonstrates that understanding users’ needs and wants are important in order to achieve a level of satisfaction (Zhang 2003). A survey was conducted to identify what Malaysian users’ need and want when it comes to mobile comics. The survey reveals that users prefer clear images and texts, more intuitive and simple navigation technique, linear comic story, full-colour content, less distracting feature (i.e. sound and vibration), and multi-lingual features. Most of the preferences have been addressed in this study cooperating with the flow of panel-to-panel relationship. One of the approaches was by providing multiple reading display modes that offer different reading experiences, layouts and interactions.

After gathering all the basic information from the previous section, the study focused on designing as well as measuring the user experience and user satisfaction in using the mobile comic application (RQ5). This phase was conducted in an iterative development
process. Initially, the two display modes were designed in separate prototypes to better understand each strengths and weaknesses. In the later designing process, the two approaches were combined and presented as options for viewing the same comic content. In the first design, the combination of ancient linear narrative and panel-by-panel approach is used by applying longer composition, side-by-side arrangement, divider between panels and displaying single scene at a time. By providing sequential iconic buttons on the sides, this design maintains the continuity of the comic arrangement, while at the same time serving the visibility and readability with the larger main screen on the centre. On the other hand, the second design uses Infinite Canvas theory, treating the screen as a window of an “unlimited” workspace. Even though this design is display as separate pages, the panels’ continuity is maintained by applying linking “trails” between panels and by adding animated transitions to show movement from one page to another. The separation into pages is necessary to be able to display clear images and text, while the entire comic panel arrangement still can be viewed as an additional “overall comic layout” feature. Moreover, other techniques of Infinite Canvas theory such as distance pacing, narrative subdivision, sustained rhythm and gradualism are implemented. Other than comic concepts and user preferences, the development of mobile comic in the present study also considered the use of user interface guidelines in order to produce the more usable mobile application.

Chapter 5 outlined the results of the initial usability testing conducted in this study. Initially, it was assumed that by applying the interactivity on each panel using multi touch could enhance enjoyment for user. However, it turned out to be one of the usability issues - distracting interaction. Moreover, this result may also be influenced by users’ unfamiliarity with touch screen gestures. Some other issues were inconsistent navigation and insufficient information. These problems were solved by conducting iterative design. At the same time, the refinement process was conducted to perfect the flaws found in the early usability testing as discussed in Chapter 6.

The findings in Chapter 7 describe the user experiences and satisfactions toward the final product. Overall it was found that the final product has successfully achieved the three major elements of quality which are effectiveness, efficiency and satisfaction. The final product was claimed to be easy to use and have user friendly interface as most of the participants had successfully completed most of the tasks given without any major difficulties in relatively short times. By using simple and straightforward interaction of single tapping/touching, the final mobile comic has effectively satisfied all users including those without prior experience with multi touch screen devices. It also has successfully
provided extra satisfaction to users by providing more options such as languages and display modes. However, some further amendments are required to improve the comic colour, swipe gesture, zooming feature and especially the system performance (response time). Generally, the overall responses toward the final mobile comic application were positive as 8 out of 10 participants were enthusiastic to use the application in the future.

It is not the researcher’s intention to denigrate the approaches used in the existing mobile comics. However, looking at the positive results of the final product, it was argued that the final Ninchak mobile comic interface have potential in the mobile comic industry to provide a unique reading experience on small screen. The panel continuity and simple interaction may attract users to keep reading the comic stories. However, the current mobile comic is not without its weaknesses. This will only work best for comic with less than 45 panels, and does not have overflowing content to other panels (commonly appear in manga). In the future, this could be overcome by breaking the comic into several parts or volumes.

Understanding the users’ needs and wants in this study has brought about the realization of some interesting facts. Apart from the essential elements of comics, clear images and texts are the most important criterion for mobile comic as they provide the ability to view the comic content conveniently with less interaction. The addition of multimedia (i.e. sound features and panels’ flexibility) is argued to be disturbing users’ concentration. In fact, this preference is in line with the general user interface guidelines where the design must be kept neat, simple, and visible. This study also reveals that prior experience with the technology influence users’ behaviour toward the new user interface. With the increasing popularity of touch screen technology, it is believed that gestures interaction will be more accepted in near future.

8.2 CONTRIBUTIONS
This study explores the potentials of current technology in providing a new experience in reading digital comics. While other studies only focused on the technical aspects (i.e. converting traditional comic books to mobile phones format), this study aims to design a new comic reading experience for mobile comic applications while at the same time preserves and incorporates the essential elements of comics based on Malaysian preferences. By considering these aspects, it was expected that the final result could maintain the impact and quality of the original comics as well as maintain the convenience and satisfaction while using the application.
This study has produced two alternative forms of user interfaces for comics on mobile phones by borrowing principles from ancient sequential art and comics, and McCloud's Infinite Canvas. Both of these approaches provide unique and new experiences for reading comic in a small screen size by presenting a continuing flow of comic panels in different techniques and layouts. The major difference between the two approaches lies on the space used to display the comic panels. The first prototype was designed using the ancient narrative by presenting the images in a side-by-side manner within a limited space of mobile phone’s screen. On the other hand, the second prototype works with unlimited space beyond the mobile phone’s screen by applying 5 techniques of McCloud’s Infinite Canvas. Even though, the comic story is separated into several pages, the continuity is still preserved by connecting the separated comic panels with trails and adding flash transition that stimulates movement from one page to the next. The two prototypes have successfully introduced new reading comic experiences despite the issues found in Usability Testing 1 which included the problems of inconsistent navigation, distracting interaction, insufficient information given and ineffective features. Arguing that both prototypes offers a high potential in providing better reading comic experience, further exploration and development was conducted by refining the prototypes. This resulted with better user interface design as fewer errors are found. Moreover, the idea of combining the two concepts as different options of reading (with different display layouts) has successfully enhanced user acceptance and satisfaction towards the design since they have more control in selecting the most convenient reading environment for themselves.

In terms of Malaysian user’s preferences, it was interesting that Malaysian users were less interested with sounds and animation features in their comic reading experiences despite their familiarity with the current mobile phone technology and the multimedia that it is known to carry. The users tend to choose a clear user interface design and simple interaction. Moreover, the study also reveals that straight forward story, less distracting content, full-colour content and multi lingual feature are preferred. However, these results are limited to the scope of Malaysia generally and Kuching specifically. Therefore, a further study is required to know if the results can be generalised for a larger audience.

8.3 Further Study
The areas that have potential to be explored in the future cover the current limitations and suggestions such as extending the study into the larger population and also the implementation of zooming, swiping feature and colour. Moreover the present study only focus on designing a user interface and concerns less on memory size and performance speed. Therefore, a further study may be held to improve the technical aspect. One of the
possible solutions will be adjusting the size of the images and loading the selected image responsively instead of loading the entire image at once.

This present project is also lacking in terms of providing alternative interaction techniques. Currently the application can only be operated by touch. An improvement in this area to support more mobility context (i.e. voice activated commands, or slide show) may add value to this study. However, this could not be achieved within the scope of the project, but would be interesting to be discussed in the future.

Flash technology was used during the development process because of its advantages especially potential to expand the same project to other platforms (cross platform). The current study only focuses in designing mobile comic interface on one platform. It would be worth trying to expand the project to other platforms in future works such as iPhone and iPod Touch. Moreover, with the help of Flash technology, the current project was also possible to be used on desktops operating on the Linux and Windows operating systems. In addition to that, the introduction of iPad and other interactive tablet devices have grown a new market which requires content designed for a mobile device with bigger screen-sizes. Although this study is constrained to comics on mobile phones, it is hoped that the results can be extended for further study on other platforms.

On another aspect, the present study may also be explored further in terms of the development of mobile applications not only for the domain of comics, but potentially in other areas where illustrations and texts are equally necessary, for example magazines. By applying similar approaches such as Linear and Infinite views for delivering information, it may produce new and interesting reading experiences on mobile phones or tablets.
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APPENDICES

APPENDIX A – CONSENT INFORMATION LETTER

Swinburne University of Technology
(Sarawak Campus)
Tingkat 1, Kompleks Negeri Jalan Simpang Tiga
93550 Kuching,
Sarawak Malaysia

Tel: + 60 82 416353
Fax: + 60 82 423594
Website: www.swinburne.edu.my

TO WHOM IT MAY CONCERN

Introduction

You are invited to participate in a study that is being conducted by Astria Dhita Wandani, a post graduate student of the School of Business & Design at the University of Technology Sarawak (SUTS) Campus under the supervision of Mr. Gregory Wee and Mr. Wilson Suai. This survey is done as part of her Master studies in order to better understand Malaysian comic readers’ preferences in reading digital comics on mobile phones.

Project Title: Designing an Interactive Comic for Mobile Phones Based on Comic Readers’ Preferences in Malaysia

Aim of the Study

This research aims to design a new reading experience for mobile comic applications in terms of aesthetics, display and interactivity based on comic readers’ preferences in Malaysia. It is hoped that with a better approach, comic readers in Malaysia will benefit from the improved versions of digital comics on mobile phones.

This project will involve SUTS students’ participation in a questionnaire survey which is designed to collect views of Malaysian comic readers’ regarding reading comic’s experiences, perceptions and preferences on digital comic applications. The questionnaire will contain a mixture of structured and open ended questions.

Free Consent & Withdrawal from Participation

The survey will be done face-to-face as it is necessary to show samples of digital comics on mobile phones. Participation for this survey will be done by filling the answers on the questionnaire papers and returning it to the researcher. This survey questionnaire will take approximately 30 minutes to complete. Participation in this study is voluntary. You
can choose not to take part and you can also choose not to finish the questionnaire or omit any questions you prefer not to answer without penalty.

Privacy & Confidentiality

Your willingness to volunteer indicates consent to participate in this study. Your responses will be held in the strictest confidence as only the researcher will have the access to it. Your identity will not be recorded in any form and there will be no way to link the data to your personal identity. As soon as I receive your completed survey, the information will be entered into SPSS to be analyzed which will also be kept in a password-protected folder whereas the hardcopy material will be kept in a locked cabinet at the SUTS's School of Business and Design. All hardcopy and softcopy materials will be stored for at least 5 years after the completion of the study.

Research Output

The data collected in this survey will be analyzed and used as part of my Master thesis. This information will also be published in academic conferences and journals. Your participation will remain anonymous.

If you have any questions about this study, you can contact the person(s) below:

Astria Dhita Wandani  
School of Business & Design  
Swinburne University of Technology Sarawak Campus  
Jalan Simpang Tiga  
93350 Kuching Sarawak Malaysia  
Tel: +6082-416353 Ext. 7019  
Fax: +6082-423594  
Email: awandani@swinburne.edu.my

This project has been approved by or on behalf of Swinburne’s Human Research Ethics Committee (SUHREC) in line with the National Statement on Ethical Conduct in Human Research. If you have any concerns or complaints about the conduct of this project, you can contact:

Research Ethics Officer, Swinburne Research (H68),  
Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122  
Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au

I hope that you will be able to participate in this study.

Yours sincerely,

__________________________  
Astria Dhita Wandani
APPENDIX B – QUESTIONNAIRE

Designing an Interactive Comic for Mobile Phones Based on Comic Readers’ Preferences in Malaysia

This research aims to design a new reading experience for mobile comics applications in terms of aesthetics, display and interactivity based on comic readers’ preferences in Malaysia. We would like your cooperation to help us to fill in the following questions truly.

We greatly appreciated your cooperation and time to participate in our survey.

The data collected in this survey will be analyzed and used as part of Master thesis and academic conferences & journals. Your participation will remain anonymous as your identity will not be recorded in any form. In addition, there will be no way to link the answers to your personal identity.

Please place an X or ✓ next to the most appropriate choice and fill in all the answers

Section A: Personal Information

1) Gender:
   □ Male  □ Female

2) Age Group:
   □ < 18  □ 18 – 25
   □ 26 – 33  □ > 34

3) Race
   □ Malay  □ Chinese  □ Indian
   □ Others, please specify: ____________

Section B: General Information on Comics Reading

1) How often do you spend your time reading comics per week?
   □ Everyday  □ Often
   □ Sometimes  □ Rarely

2) Which comic’s category you like most? You may tick more than one option
   □ Romantic  □ Action, adventure
   □ Humor  □ Mystery, horror
   □ Fantasy  □ Others, please specify: ____________

3) What is your language preference for reading comics?
   □ English  □ Mandarin  □ BahasaMelayu
   □ Others, please specify: ____________
4) How much do you spend per month on comics?

- [ ] RM 0
- [ ] RM 5 – RM 10
- [ ] RM 11 – RM 25
- [ ] RM 26 – RM 50
- [ ] > RM 50

5) Which media do you usually use to read comics? You may tick more than one option

- [ ] Comic book / magazine
- [ ] Newspaper
- [ ] Web comics/ internet
- [ ] Portable console (PSP, iPod)
- [ ] Mobile phone
- [ ] Others, please specify: ______________________

Why do you prefer this media?

___________________________________________________________________________________________

Section C: General information on Mobile Phone

1) How often do you use a mobile phone?

- [ ] Everyday
- [ ] Sometimes
- [ ] Rarely
- [ ] Never (go to section E)

2) Which mobile phone brand and type do you use?

- [ ] Nokia, please specify: ______________________
- [ ] iPhone, please specify: ______________________
- [ ] Samsung, please specify: ______________________
- [ ] Sony Ericsson, please specify: ______________________
- [ ] Blackberry, please specify: ______________________
- [ ] HTC, please specify: ______________________
- [ ] Others, please specify: ______________________

3) How often do you use a mobile phone in order to access online content?

- [ ] Everyday
- [ ] Sometimes
- [ ] Rarely
- [ ] Never

4) What do you use your mobile phone for?

- [ ] Communication
- [ ] Entertainment
- [ ] Others, please specify: ______________________

5) Which entertainment features in mobile phones do you usually use?

- [ ] Games
- [ ] Internet browser
- [ ] Comic reader
- [ ] Movie/ music player
- [ ] Radio
- [ ] Social network applications
- [ ] Camera
- [ ] Others, please specify: ______________________

6) When do you usually use your mobile phone for entertainment purpose?

- [ ] In class/ doing assignments
- [ ] When hanging out with friends
- [ ] During meal breaks
- [ ] While waiting
- [ ] Before sleep
- [ ] In the car/ public transportation
- [ ] Others, please specify: ______________________
Section D: Experiences in reading Comics on Mobile Phones

The mobile phone is one of several portable devices that can be used to read comics.

Have you ever used a mobile phone to read comics?
If yes, please continue the following questions.
If no, please proceed to question 4

1) How did you download comics on mobile phone?
   - Using application store (e.g. Apple’s app store, Blackberry app)
   - Websites
   - Comic applications (e.g. Comixology, iVerse, digicomics)
   - Others, please specify: __________________

   If you choose comics applications, which applications do you usually use?
   - iVerse
   - Touch Comic
   - Comixology
   - Clickwheel
   - DigiComics
   - Panelfly
   - Comic Reader Mobi
   - Pullist
   - Droid Comic Reader
   - Comic Zeal
   - Others, please specify: _____________

2) Why do you read comics on mobile phone?
   - To occupy free time
   - Cheaper
   - More interactive
   - Isn’t bulky like books or magazines
   - No particular reason
   - Less trouble than visiting a bookshop
   - Privacy
   - Others, please specify: _____________

3) How satisfied are you of the current mobile comic applications?
   (Please circle one)
   - Very satisfied
   - Satisfied
   - Average
   - Not satisfied
   - Poor

   Why?
   ______________________________________________________________
   ______________________________________________________________
   ______________________________________________________________

(Please proceed to section E)

4) Did you know about being able to read comics on the mobile phone?
   - Never heard about it
   - Ever heard, but never try
   - Others, please specify: _____________

5) In the future, would you want to read comics on the mobile phone?
   - Definitely read
   - Can’t say either way
   - Not read at all
   - Perhaps read
   - Perhaps not read
   - Why?
   ______________________________________________________________
   ______________________________________________________________
Section E. Sample Comics Preferences

1) Which mobile comic application do you like more?
   - Princess Ai by Sunsoft Books (Low Interaction – full page)
   - Jazan Wild by Fun House of Horror (Low Interaction – panel-by-panel)
   - Foxfire by One Coin Comics (High Interaction)
   - Astonishing X-Men Episode 1 motion comics by Marvel (No Interaction)
   Why?

2) What feature do you like in:
   a) Princess Ai by Sunsoft Books
   _______________________________________________________
   ______________________________
   __________________________________

   b) Jazan Wild by Fun House of Horror
   _______________________________________________________
   ______________________________
   __________________________________

   c) Foxfire by One Coin Comics
   _______________________________________________________
   ______________________________
   __________________________________

   d) Astonishing X-Men Episode 1 motion comics by Marvel
   _______________________________________________________
   ______________________________
   __________________________________

3) What do you think should be improved in:
   a) Princess Ai by Sunsoft Books
   _______________________________________________________
   ______________________________
   __________________________________

   b) Jazan Wild by Fun House of Horror
   _______________________________________________________
   ______________________________
   __________________________________

   c) Foxfire by One Coin Comics
   _______________________________________________________
   ______________________________
   __________________________________

   d) Astonishing X-Men Episode 1 motion comics by Marvel
   _______________________________________________________
   ______________________________
   __________________________________

Section F. End-User Needs Analysis

1) Do you agree that mobile phone is a better way to read comics? Yes or no? Why?
   _______________________________________________________
   ______________________________
   __________________________________
   __________________________________
   __________________________________
   __________________________________
2) Rate the following as the most and the least important features in mobile comics.
(1=most important, 2=important, 3=slightly important, 4=least important, 5=not important)

**Sound**
- Background music: 1 2 3 4 5
- Sound effect: 1 2 3 4 5
- Voice over: 1 2 3 4 5

**Display**
- Display multiple panel: 1 2 3 4 5
- Display single panel: 1 2 3 4 5

**Content**
- Multiple story: 1 2 3 4 5

**Navigation**
- One handed navigation: 1 2 3 4 5
- Two handed navigation: 1 2 3 4 5
- Button navigation: 1 2 3 4 5
- Slide navigation: 1 2 3 4 5
- Zoom: 1 2 3 4 5

**Connectivity**
- Offline: 1 2 3 4 5
- Online: 1 2 3 4 5

**Other features**
- Bookmark: 1 2 3 4 5
- Comics library: 1 2 3 4 5
- Color: 1 2 3 4 5
- Vibration: 1 2 3 4 5
- Language translation: 1 2 3 4 5
- Animation: 1 2 3 4 5

What other improvement or features would like to suggest to be implemented in mobile comics to enhance convenience and reading experience?

______________________________________________________________________________________________
______________________________________________________________________________________________
______________________________________________________________________________________________

4) If you can design the best mobile comics in the world, what features would you like it to have to make it different?

______________________________________________________________________________________________
______________________________________________________________________________________________
______________________________________________________________________________________________

~ Thank you for your cooperation ~
APPENDIX C – SUHREC PROJECT ETHICS CLEARANCE

From: Ann Gaeth<AGAETH@groupwise.swin.edu.au>
Sent: Thursday, 4 November, 2010 8:05 AM
To: Astria Dhita Wandani; Gregory Lik Hoo Wee
Cc: Resethics
Subject: SUHREC Project 2010/234 Ethics clearance

To: Mr G Wee Lik Hoo Ms Astria Dhita Wandani Sarawak

Dear Mr Hoo and Ms Wandani,

Re: SUHREC Project 2010/234 Designing an interactive Comic for Mobile Phones Based on Comic Book Readers’ Preferences in Malaysia
Mr G Wee Lik Hoo Ms Astria Dhita Wandani Sarawak
Approved duration 04/11/2010 To 31/12/2011 [Adjusted]

I refer to the ethical review of the above project protocol undertaken by a SUHREC Subcommittee (SHESC3). Your responses to the review, as emailed on 21st October and 3rd November 2010, were approved in line with the guidelines set by a SUHREC delegate(s).

I am pleased to advise that the Subcommittee delegate has determined that the project, as submitted to date, meets Swinburne’s standards for human research including with respect to the National Statement on Ethical Conduct in Human Research. On-going ethics clearance conditions relate to the following:

- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards and with respect to secure data use, retention and disposal.

- The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the Swinburne student project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor requires timely notification and appropriate endorsement.

- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project.
- A duly authorised external or internal audit of the project may be undertaken at any time.

Please contact me if you have any queries about the Swinburne ethical review determination, citing the SUHREC project number. Copies of communication emails should be retained as part of project record-keeping.

Best wishes for the project.

Yours sincerely

Ann Gaeth
Secretary, SHESC3

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Administrative Officer (Research Ethics)
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LIST OF PUBLICATIONS


- Wandani, AD, Wee, GLH & Suai, WM 2011, 'Mobile Phone as Media for Reading Comics: Identifying the Features Preferred by Malaysian Users,' *International Conference on Applied and Creative Arts (ICACA)*, The Faculty of Applied and Creative Arts, University Malaysia Sarawak, 194-208.