Exploring Metaphor Design for Mobile Icons: The Elderly Perspectives

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ARTICLE INFO	ABSTRACT
	Nowadays technology articulates the utilization of mobile phone not only for connection between people, but also as a medium for delivering and retrieving the virtual information globally. The design of mobile interface with concern on the needs and desires of elderly people requires a lot of understanding and consideration because their needs vary for each individual. Current mobile interface applied iconic menu whereby the features were styled in the form of signs and pictorial images to represent the functions. This paper explored the elderly mobile user's understanding on the icon designs of the mobile phone interface. Several icons picked up from the latest mobile phone's brands (Nokia, iPhone, Samsung) were sketched on a paper for the purpose of recognition test among the elderly participants. Using task participation, elderly participants were guided to determine the recognition rate for each of the icons. The results discovered three elements that contributed to the successful recognition among the elderly; familiarity, labeling and resemblance; whereby resemblance element is an important indicator to produce the metaphor icons.

INTRODUCTION

United Nations (UN) has reported that the number of people over 60 years old is projected to grow from 800 million to over 2 billion by 2050 (Mahalingam, E.,2012). With such growing figures, it gives the reflection that the evolving ageing has required for new needs, inspirations, and technology enhancements to cater the growing capacities of people aged 60 and above. In addition, a rapid growth of various designs of mobile phone has resulted in a great number of mobile phone subscribers from various levels of users including the elderly people. It is strongly supported by the previous research that the number will grow as the mobile phones penetrations has reached to 100% in developing countries (Kamssu, A., 2005). With the fast growing mobile technology, mobile phone's functions have exceeded beyond the needs with the rich features embedded to provide users with more than its typical roles of calling and messaging.

In attempting to increase usability of a mobile phone, many investigations have been done towards the design of mobile phone interface which act as an intermediate between the user and the features of the mobile phone. As for the elderly, increasing age means decreasing in memory ability and physical performances. These aspects including ageing problem such as physical and cognitive changes, as well as recognition performances (Siop, S., 2003; Hawthorn, D., 2000). Icon as mentioned by Gatsou *et al* (2011) is one type of information representations which is represented in a simpler version. In the study on effect of training and representational characteristics of design icons by Goonetilleka *et al* (2001) found that visual and cognitive features of icons give major influences on icon's effectiveness. Goonetilleke *et al* (2001) believed that graphical user interface that applied icons resulted on easier interaction with the computer systems. It helps to reduce the system complexity and cognitive load of the end users (Goonetilleka, R.S., Shih, H. M., On, H.K. and Fritsch, J., 2001), which is very important for the elderly. In addition, the graphical images help the user to memorize and recognize easier (Gatsou, C., Politis, A., anndZevgolis, D. 2011). That is, it enables the information to be interpreted quickly as well as cut across the language barriers (Caplin, S., 2001; McDougall, S. & M. Curry, 2004; Gittins, D., 1986). As for effective recognition among the elderly people, it shows that few studies have done on designing the icons with the understanding of metaphors for the less-experienced users. The study reported on this paper discovered the elements that contributed in the design of recognizable icon of a mobile phone interface via the experimental work. We studied the most used icons from three different mobile phone providers (Nokia, Samsung, iPhone) towards the most used phone's features (Phone call, Messages, Alarm, Camera, Phonebook, and Calendar) among the elderly. Hence, this paper tends to explore the elderly understanding of icons through

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the metaphor designs. Recognition test was purposely done to explore the level of user's understanding towards the icons presented by which icons that closely resemble the original images it presented will be highly identified by the users.

2. Background:
Elderly People:
A lot of definitions have been given to the range of senior elderly or "older" or "old" people to describe the elderly population. Many studies use the retirement age in defining the elderly people. In Western countries like the United States, old age is defined between the range of 60 to 65 which is equivalent to the retirement age in the country (World Health Organization, 2012).

However, Hanson (Hanson, V.L. Age and Web Access, 2009) argued that there are clinical evidences that 50 years old is suitable to define older adult because of the declining abilities among the elderly often starts at this age. Furthermore, many studies on elderly use the retirement age to define the older people (Razak, F. H. A., F. Sulo, *et al*., 2012). In Asean countries mainly in Southeast Asia however, older people is defined slightly different from the Western countries. The Star Online reported that Malaysia drafted for age between 55 to 60 years as older people, Singapore set the age between 62 to 65 years old while Indonesia, Brunei and Thailand give the retirement age at 60 years old (Mahalingam, E., 2012).

Metaphor:
It is known that metaphor is subjected to interpretation, and imperatively, in the process of developing user-interface metaphor where it needs to take consideration (Hamilton, A., 2000). The term metaphor originates from the Greek word "*metaphora*" which is derived from the word *meta* which means the "over", and *pherein* means "to carry" [14]. Hawkes (1972) referred to the "aspects of one object that is "carried over" or being transferred to another object so that the second object is spoken of as if it were the first."

The famous book "Metaphors We Live By" by Lakoff & Johnson (1993) viewed the metaphor as "*…the way we think, what we experience, and what we do every day is very much a matter of metaphor.*" Lakoff & Johnson (1993) agreed that metaphor contributed to the people's way of thinking, the way we identify abstract concepts and perform abstract reasoning (Hawkes, T., 1972). In addition, metaphor is also viewed as fundamental "trope" of figurative speech (Hamilton, A., 2000). In essence, metaphor uses understood-concept that anyone can easily interpret from one original domain to provide the point about another. The concept was supported by Shack (2000) that metaphor allows its original meanings of words or objects remain active in their metaphorical setting (Shack, S., 2000).
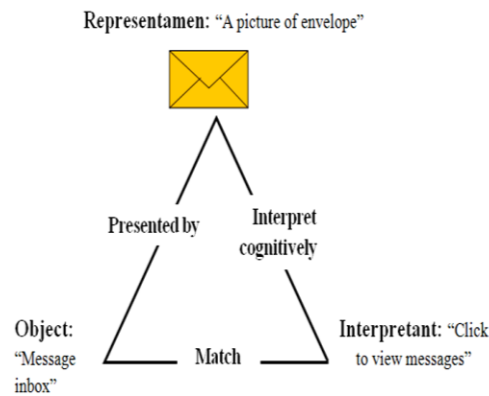
Metaphor in Icons Representation:
Icons have dominated the design of mobile phone interfaces with effective graphics for the user to experience visual and cognitive effects (Gatsou, C., Politis, A., & Zevgolis, D. 2012). Metaphor denotes the resemblance of the primary subject apparently in order to make sense for the interpreter. Interestingly, Daniel Chandler (2002) suggests the involving of iconic mode to present the resemblance. The same concept goes to the process of representing the icons. An icon is a type of representation but it is presented in the simplest way. An icon can be a pictorial, graphical images or even a symbol (Chandler, D., 2002).

However in Piercean's (1948) study on semiotics, Piercean categorized the icons as a form of signs, whereby he proposed the sign triad and defined the sign as,

"*…something which stands to somebody for something in some respect or capacity...the sign stands for something, its object" (Piercean., 1948)*

It is to be understood that for the sign to be well-recognized by people, the three elements – object, representamen and interpretant (as modeled in Piercean's triad) must not absent. The use of icons in mobile phone's interface is intuitively to signify the functions in the simplest way. Barr *et al* (2004) has used the triad to explain the generating and interpreting the sign of STOP. Similarly in this context, we applied the sign triad to the icon of "Message inbox" to see the interpretive process in the mobile phone's applying iconic menu interface.

From the Fig 1, Object intentionally brings the message of "Message Inbox" through the representation of the "envelope". The envelope's sign is used in mobile phones to signify the function of it which is used to view messages. The interpretant then translates or interprets the Fig 1. sign according to their understanding. As "Click to view message" was interpreted showing that the interpretant understands the picture of envelope is the sign of "Message inbox", if he wants to view the messages, he clicks on it.

Representamen: "A picture of envelope"

Presented by   Interpret
                      cognitively

Object: Interpretant: "Click
"Message   Match   to view messages"
inbox"

Fig. 1: Example of Piercean's Triangle Triad that Applied "Message Inbox" Icon as Metaphor

3. Methodology:

A study was done through the experimental work among the elderly participants in several tasks. The techniques used including interview, observation, paper prototyping and drawing activity. Recognition test was done to capture the elderly knowledge about the icons that have been used in the mobile phone. Through the recognition process, we will know how far the participant can recognizes the icons based upon their understanding. We provided six types of icon designs which were used on three mobile service providers. We chose the icons from IPhone and Samsung to represent the Smartphone and Nokia phone on behalf of featured mobile phone. The designs of the icons were sketched similar to the one on the original icons presented on the mobile phones. We put on a code number for each of the sketched icons so that the participants will give the icon's number to match it with the features asked. At the end of the interview, we let the participant to draw or sketch the possible figure of icons which was easier for them to recognize. As for the elderly, we need to ask politely and wait for them to clearly understand what we explained.

Participant:

For the purpose of the research, we conducted an interview among the elderly whom age is 50 years old and above. As discussed earlier, we considered the retirement age in Malaysia which started at age of 58 years old, although some researches defined old age started at 50 years old (Hanson, V.L. Age and Web Access, 2009; Hassan, H,. and Md Nasir, M. H. N., 2008).

Therefore, the participants who took part in the interview were the elderly age between 57 to 79 years old and were randomly selected in Selangor area. The elderly participants were multiracial and volunteered to participate in the study as no enforcement done towards them. Eight elderly participants took part in the interview. They consisted of four male and four female elderly.

Experimental Tasks:

All the participants were contacted via phone calls and the meeting was done at their places. Before the task started, the participants were briefed about the sessions. The experiment consisted of two parts.

i) The first part was the interview session on participant's demographic background. Participants were interviewed to know about their background such as age, current job, and years of using the mobile phone.

ii) The second part, we did a recognition test of mobile phone's icon. The recognition test was done to measure the time taken by the elderly people to recognize the icons. Participant will be provided with the icons prototyped that have been sketched on the paper. They need to identify the icons matched to their functions according to their understanding. Six types of icons were selected to be recognized by the elderly participants. The icons are "Phone call", "Messages", "Alarm", "Camera", "Phonebook/Contact" and "Calendar". Those icons were the six most used mobile phone's features by elderly people that we found during the preliminary investigation.

Methods:

During the interview, discussions were recorded for future references. We used phone recorder to record the interview session, task forms, sketched icons, pens and pencils for the participants. We sketched the icons on a paper (solely without any labels or captions) to provide the participants with clear images of icons and at the same time to avoid the problem of limited screen interface which might bother our results.

Results:

The results from the experimental work suggested three important findings. The first is the elderly demographic background and mobile phone usage, second is the result of recognition test on icons of mobile phone features and the third one is the result from the drawing suggestion.

Elderly's Information Background and Mobile Phone Usage:

Table I indicates the summary of the elderly participants' background and their years of experiences using the mobile phone. Most (80%) of the elderly have been using mobile phones for more than 10 to 15 years (P1, P2, P3, P4, P5 and P8), and two participants (25%) have been using mobile phone for 5 years (P6 and P7). In Table II however, the findings indicate six elderly (75%) own "Standard" mobile phone while another two (25%) use "Smartphone". Standard mobile phone used by the elderly is the keypad button mobile phones that have typical features of calling, messaging and some other common features. While "Smartphone" is either the keypad button or touchable mobile phones that integrate the mobile phone capabilities with advanced features, and internet service. Based on Table II, we found that elderly current mobile phone and the features they use are as follows,

- Six elderly (75%) use Standard mobile phone which applied keypad buttons, another two (25%) use Smartphone for the latest 2 years.
- Obviously the most usable feature is "Phone Call" whereby all of the elderly use it either to make calls or receive calls.
- The second usable feature is "Message" (used by P1, P2, P4, and P5).
- The third feature is "Camera" (used by P1, P2, P4, and P5).
- The next features are "Alarm", "Phonebook", and "Calendar" (used by P1, P2, and P3)

The findings from Table I shows that most of the elderly people have experiences using the mobile phones for more than 10 years. They started using the phone since the mobile cellular had coming into the country several years back and still using it until now. However, the results in Table II showed that most of them use "Standard" mobile phone and only two of the elderly used "Smartphone". Example of an excerpt from P3, who used "Standard" mobile phone provided the following reason,

"For me…mobile phone is used for communication only, as long as we can hear and talk to others, enough already"

Another participant, P8 that used "Smartphone" said,

"My phone is a present from my daughter and I used the phone mostly for calls and sometimes for receiving the messages. I don't use any other applications...in fact I don't know it has all these applications…now that you showed me"

In summary we found that it is very important to have a mobile phone for the elderly. They use mobile phone mainly for making calls and receiving calls. This has been agreed by the research done by Kurniawan's on the mobile phone usage among elderly people (Kurniawan, S.H, 2008). They do not mind of other applications as long as the "phone call" function is well functioned. However, there are some elderly that showed their interest on trying and learning more features other than the basic ones. During the interview, P8 was the one that boosted his interest on the applications on the "Smartphone". Moreover, the icons when touched have impressed him of the function that contained inside.

We also found that elderly that used "Standard" mobile phone mostly know a little about Information Technology (IT) knowledge and we categorized them as a beginner or novice compared to the elderly who owned "Smartphone" is an intermediate type of Information Technology (IT) user. They know better about Information Technology (IT) might be their phone has the ability to connect them to the Information Technology (IT) world through internet services. Another important finding is that, even for "Standard" mobile phone or "Smartphone" user, surprisingly they did not notice the other applications on their phones rather than the common features they usually used. The findings showed that even the mobile phone consumed by this group is increasing, however the usage is not fully engaged to them.

Table 1: The Elderly Participant's Information Background

Participant	Age	IT Knowledge	Occupation	Mobile Phone Experience
P1	62	Novice	Pensioner	More than 15 years
P2	57	Intermediate	Pensioner	More than 15 years
P3	63	Novice	Retiree	More than 10 years
P4	60	Intermediate	Retiree	More than 15 years
P5	60	Novice	Retiree	More than 10 years
P6	57	Novice	Housewife	5 years
P7	70	Novice	Pensioner	5 years
P8	79	Novice	Retiree	More than 15 years

Table 2: The Elderly Mobile Phone Usage Information

Participant	Current Mobile Phone Used	Mostly used Features
P1	Standard	Phone call (Call in, Call out), Messages, Camera, Alarm
P2	Standard	Phone Call (Call in, Call out), Message, Phonebook, Calendar, Camera
P3	Standard	Phone call (Call in, Call out)
P4	Smartphone	Phone call (Call in, Call out), Messages, Camera, Alarm, Calendar
P5	Standard	Phone call (Call in, Call out), Message
P6	Standard	Phone call (Call in, Call out)
P7	Standard	Phone call (Call in)
P8	Smartphone	Phone call (Call in, Call out), Camera

Result of Recognition Test:

From the recognition rate derived, we found that most of the elderly can recognize the icons and only several participants have matched wrongly for several icons either. Based on the result gathered, we listed the most recognizable icon chosen by the elderly participants. Table III shows the recognition rate of the most recognizable icons chosen by the elderly. Among all the icons, icons in the very left column have considered to be the most recognizable with highest selections between the participants.

Table 3: The Most Recognizable Icons Chosen by the Elderly

Features	Icons			
Message				
Recognition Rate	40%	20%	20%	20%
Phone call				
Recognition Rate	85.71%	14.29%		
Camera				
Recognition Rate	62.5%	25%	12.5%	
Alarm				
Recognition Rate	100%			
Phonebook				
Recognition Rate	80%	20%		
Calendar				
Recognition Rate	44.86%	28.57%	28.57%	

In this study session, we also asked the participant on how they recognize the icons, what they see and how they interpret the sign to match with the features. P1 has referred to her mobile phone to answer the test. P1 said she could not remember the meaning of the icons without referring to her owns mobile phone. Even though her mobile phone has the entire icons menu, she still could not recognize because she usually reads the label instead of referring to the picture of the icons. We then agreed on their behaviour as P3 and P5 were also referring to the labels to recognize the icons. They just made it true that icons with labels are easier to recognize compared to icons without label (Batu Salman, Y.; Young-Hee Kim; Hong-In Cheng, 2010).

P2 and P4 answered the test quite faster than other participants. This was because P2 owned another mobile's gadget (IPad) and P4 used mobile phones with the similar icons. P2 used to answer correctly all of the features and has chosen the icons' designed by IPhone which used the similar design with her IPad. P4 also gave the answer all corrects. This was possible because he was familiar with his mobile phone icons. The finding has been supported by the researched done by Kurniawan et. al (Kurniawan, S.H, 2008) on the use of mobile phone by elderly people. She agreed that familiarity influenced people to recognize things better (Kurniawan, S.H, 2008).

Table IV indicated the feedbacks from the elderly participants on how they understand and able to identify the icons. Based on the feedbacks given, we summarized that the design of the icons gave the effects on correct interpretations by the users. User will look on the design to find the similar characteristics of the original object it brings. However, they may found inequalities on the design to what they usually used to.

Thus, at the end of the interview session, we asked the elderly to give suggestions or add some ideas to the icon designs so that it will be easier for them to recognize. The findings were summarized in Table V.

Table 4: Elderly Comments on how the Icons Influenced their Recognition Rate

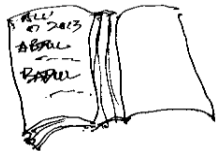| Features	Icons	Comments
Message		*"This one is for Messages because I have seen it…it is similar to the one on my phone"*[P5]
		"I know this icon is for Message because I used IPad…I am familiar with the icons"[P2]
		"This one is much more easy to recognize because it has the picture of "Stamp" here"[P3]
		"I think this one…because it has a letter inside"[P4]
Phone call		*"I know this icon is for calling because it shows the phone's handle"*[P1][P2][P3][P4][P5][P8]
Camera		*"This one is more likely to the camera, it got square sign on top…the flash comes from here"*[P3]
Alarm		*"This is for alarm because it has the bell sign on it to show the ringing sign"*[P1][P3]
Phonebook		*"This phonebook look like a diary, but the binding tells that it is a book"* [P3][P5]
Calendar		*"The calendar however should have year"* [P3]

Finding And Discussion:
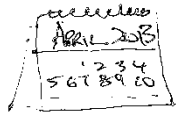
In this study, we learnt that the elderly usually remember the steps when using the mobile phone. However, they did not notice their phones have all the features of icon. When we introduced the icons, they were very glad to learn it as they also can use it later. Although the elderly can be categorized mostly as a beginner in Information Technology (IT) world, they also can learn within a period of time. Those equipped with Information Technology (IT) knowledge can adapt faster with the new technology compared to those who did not have the Information Technology (IT) knowledge.

We also discovered the elements that influenced the successful of the recognition rate of icons. Based on the elderly understanding, we found that *familiarity*, *labeling* and *resemblance* play the significant roles in recognizing the icons. Referring back to the results gathered in the experimental task,

- Both P2 and P5 remember the icon for "Message" because they are familiar with that icon.

▪ P1 stressed on putting a caption or text together with the icons so that it will fasten the recognition process. P8 also did a drawing of an envelope with a piece of paper to signify the "Message" icon.

▪ P3 suggested a "Phonebook" drawing that looks like a book with a list of contact number.

Table 5: The Icons as Sketched by Elderly Participants

Features	Drawing	Comments
Alarm	a picture set alarm	P1 drew a picture of Alarm. She stressed that an Alarm with the ringing sign will be much easier to notice. She also put on a text as a label.
Message		P8 has sketched a picture for Message. He drew a piece of paper inside an envelope and added a text on it.
Phonebook		P3 sketched a picture for Phonebook icon. He claimed that, it must be similar to a book and contains several contact number on it to represent the "Phonebook"
Calendar	APRIL 2013 1 2 3 4 5 6 7 8 9 10	P3 also sketched a picture for Calendar icon. He put on a month and year together with the dates. He also stressed on drawing a "binding" on top of it to show the similarity with the original calendar.
Camera		P3 also sketched a picture of camera from the year early 50s. He said that the lens and the stand much resembled the camera he used to know.

Familiarity - It is to be highlighted that the recognition process happen based on the user's (elderly) understanding. Their understanding has created a mental model on how the icons are to be recognized. Their mental model translated what it's been seen faster than the first time seeing it. What is contributed to the fast recognition is the element that we found it as the *familiarity* element. In this case, icons provided visual images that later being interpreted by human visual system. The human visual system constructed a model of icons (been seen or familiar with) by transforming, enhancing, distorting and discarding the information (Gregory, L.,1974). It is highly supported that user's mental model plays an important roles in interpreting visual images or pictorial metaphor in computer display (Macmillan J, Getty D, Tatum B, and Rropp G, 1997). From the view, we understand that *familiarity* contributed as part of indicator in the process of recognition.

Labeling - Icon that comes with the text is easier to understand compared to the icons without any text with it. The interpretation of the icon will be much easier as the text contains direct meaning to what it holds. Research done by Salman et. al (2010) on designing icon for elderly also gave the finding that elderly can recognize icons with supported of clear label (Batu Salman, Y.; Young-Hee Kim; Hong-In Cheng, 2010). In conjunction with our study done with elderly either, the use of labelling does help the elderly to be more recognizable of the icons as they can read the text instead of taking time recalling the image.

Resemblance – One of the characteristics of the design principles in icon design methodology proposed by Peter Chen (2003) is the resemblance principle whereby the icons must resemble the real things or tasks (P.P. Chen, 2003). On the other hand, through the *resemblance* element, we linked it with the metaphor aspect. In this study, every icon was designed to represent it's functions. For instance, icon for "Message" is represented by an envelope with a piece of paper inside it. If we interpret it, it is to show that a letter which contains a message in it. Then, an icon for "Message" is understandable to be an envelope with a piece of paper. When an icon is successfully interpreted, it signifies that the user understand and receive its message.

Conclusion And Future Work:

Designing metaphor icons require a deeper understanding on the nature of the first object to be represented as well as the second object as representment without loses its original meanings. When researching for the metaphor design, it is very important to get the user's contribution into the study in order to understand the issues from the user's perspective. In the view of Gatsou *et al* (2012), in designing visual metaphor for mobile interfaces, he agreed with Stagger & Norcio (1993) that designers need to consider both user's experience and task to be completed (Stagger. N., & Norcio. A ,1993). This paper reports on our experience of the experimental work for exploring the design of metaphor icons from the elderly perspectives. Results of recognition test demonstrate three elements; familiarity, labeling and resemblance as the elements of succesfull recognition among the elderly. From the results, it is clear that design of metaphor icons help the elderly to recognize faster and easier compared to non-metaphor icon design.

However, the results indicated in this study do not represent the entire population of the elderly people. It signifies a possible dimension of the issues of information interface within the context of information representation in mobile interface design.With such experience in the study, later, this study will continue on expanding the research studies which will be focuses on the diffences of the recognition rate of the icons for usability purposes. We wish to identify the design characteristics that likely to meet the inexperienced mobile users and design the prototype to evaluate the empirical work.

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