A Generational Cohort Comparison of Icon Selection Accuracy under Varying Conditions of Icon Entropy and Concreteness

Kleddao Satcharoen* and Pikulkaew Tangtisanon

Computer Engineering Department, School of Engineering, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand; Email: pikulkaew.ta@kmitl.ac.th (P.T.)
*Correspondence: Kleddao.sa@kmitl.ac.th (K.S.)

***Abstract*—The objective of this research was to compare icon selection accuracy under varying icon entropy and concreteness conditions between different generational cohorts (Millennial, Generation X, and Baby Boomers). These generational cohorts have different levels of experience with technology, with younger generations often being framed as "digital natives" and holding stronger technological experience and competence in comparison to older groups. Generational groups also have variations in physiological factors including visual acuity and reaction time. Despite these differences between user groups, many user interaction systems and processes are designed for a single user, rather than considering differences in user processing between different groups. Therefore, this study compares generational cohorts in their icon selection accuracy under varying icon conditions, to help identify what generational differences can be observed in this task. The study selected a sample of 150 participants (*n* = 50 for each generational cohort). The experiment was a 2×2×3 design (entropy (high/low) × abstractness (abstract/concrete) × time (9/6/3 seconds), with each participant completing 60 trials (five questions per entropy/abstractness pair over three timed runs). Results showed that there were significant differences in mean accuracy per trial under all of the time conditions and icon entropy and concreteness conditions. Mean differences showed that under most conditions, Millennial and Generation X participants did not have a significant mean difference, but Baby Boomers were significantly slower under almost all conditions. The implication of this finding is that Baby Boomers are more sensitive to icon abstractness and entropy conditions than other age groups tested.**

***Keywords*—icon, icon selection, accuracy, entropy, icon concreteness**

I. Introduction

Modern icon-based computing interfaces are used by people at all ages, from very young children to elderly adults. However, the way in which these systems are used varies widely between users of different ages. Users can be considered to have general patterns of usage with and comfort with computing technology based on their generation, which can be traced to differences in childhood encounters with computing technology. Baby Boomers, the oldest generation commonly in the workplace today [1], first encountered computing technology as adults and often learned to use computing technology to accomplish workplace tasks rather than for leisure or learning activities [2]. In contrast, Generation X (especially younger Generation X) and Millennials grew up with computing technology and were habituated to technology use as part of their education and leisure time activities before encountering computers in the workplace. Prensky [2] characterised this generational difference as the difference between digital natives and digital immigrants, and argued that this would give digital natives (who grew up with technology) an edge when it came to using technology. Overall, this theory has not completely been borne out, with digital natives requiring training in new software and systems use in the same way as digital immigrants (though rarely requiring training in basic computing skills). At the same time, digital natives have shown greater comfort with and intuitive understanding of icon-based systems [3]. There is also the concern that Baby Boomers, of whom the oldest are now in their 70s, have begun to experience age-related perception and fine motor control issues which can affect icon usage [4–6]. This is important because this generation of elderly is among the fastest growing groups in Internet and smart device users, with many users taking up online interaction and the use of smart devices [7]. Even though this group is growing, many systems have not been designed for their use and therefore are poorly designed for them [7–10]. For example, screen resolution, interface sizes, and menu design may not be well structured for use by the elderly, and although there are some limited accessibility-related solutions available, these may not be obvious to users. In particular, icons may be poorly designed, with design, colours, and sizes not being well-structured for older users [7–10]. Despite this known issue, most research has focused on icon characteristics such as size, rather than on icon entropy and concreteness, which are characteristics that affect visual perception and attention and cognitive processing.

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The objective of this research is to compare icon selection accuracy between generational cohort groups (Baby Boomers, Generation X, and Millennials) under different conditions of icon entropy and concreteness and with different time constraints. The study uses an experimental cohort study to compare response accuracy. This contributes to the literature by investigating generational differences. This can support development of icon-based interfaces that are more effective for older users, who research has shown have particular challenges with icon selection accuracy and other computing tasks.

II. Literature Review

A. *Human Computer Interaction (HCI)*

Human-Computer Interaction (HCI) is the process of designing the interfaces through which humans and computers can communicate and exchange information (in other words interact) to achieve specific tasks [11].

HCI is a complex and interdisciplinary field that incorporates human physiology and psychology, aesthetic and visual design principles, and computer design principles to design interactive devices and settings that can maximize the extent to which humans can use computers efficiently, effectively and enjoyably [11].

Icons, or pictorial representations that trigger a specific action within the computing system, have been a feature of computer interfaces since the design of the Xerox Star graphic user interface (GUI) in the early 1980s, and are now nearly used as a nearly ubiquitous type of interface in almost all computing systems [11]. Icons, which can range from simple 2D flat images to sophisticated 3D rendered images or animated images, are typically designed as a suite to have a consistent look within a computing system, but in practice the design is mainly limited by the graphical display limitations of the system [11]. Icons are commonly used especially for HCI tasks because the human visual system is highly attuned to object recognition and distinction, which means that using icons to represent specific locations or actions is a good fit for human perception and cognition [12]. However, as will be discussed within the remainder of the literature review, icon design does not always follow best practice for designs, which can inhibit, rather than support, the usability of icons for some users.

Two key factors in HCI include reaction time (how fast an individual can select a specific task) and accuracy (the rate at which the task is accomplished accurately [11]. Selection accuracy and speed is not necessarily faster than with text-based or mixed selections, as has long been known; instead, a combination of icon and text-based menus may be fastest on full-size screens [13]. However, small-screen devices such as modern mobile devices are more difficult to navigate via text-based menu and may be more difficult than icons for users to learn and use [14]. On very small screen devices such as smartphones, text menus are unusable, and even icon-based menus must be limited in size and complexity [15]. Thus, despite early research indicating mixed or text-based menus provided better performance, the icon-based menu is now both predominant and a better fit for commonplace small-screen, touch-based devices like mobile phones. However, there is some evidence that despite the inconvenience of text-based menus and searches, many users may be “icon-blind”, preferring to use drop-down menus or other tools than memorize icons [16]. While this is not consistently observed, there are at least some users who exhibit this behavior in both prompted and unprompted circumstances. Thus, even though most users understand the purpose of icons and will use them in some situations, they are not always the intuitive choice for searching content, launching apps or performing the other actions. However, the exact reason for this is not well understood [16]. This strongly suggests despite their importance, icons are poorly designed for users. Despite this, there has been little research into what icon characteristics affect selection accuracy or how user groups differ in terms of response to icon characteristics, which is addressed by this study.

B. *Generational Cohorts and Differences in Computer Use and Interaction*

Computers today are in use by up to five distinct generations of users, of whom three are in the main workforce. A generation is an age cohort of individuals who were born at about the same time and therefore share, to a certain extent, values, cultural norms, life experiences, skills and expectations [1]. Baby Boomers (born from 1946 to 1964) are the oldest generation currently working, while Generation X (born from 1965 to 1979) and Generation Y or Millennial (born from 1980 to 1997) are the majority of workers today [1]. These generations have significant differences in life experience and norms, but what is critical for this research is the difference in computer use and current cognitive capabilities, which could affect their interaction with computers.

One of the most significant differences between Baby Boomers and older Generation X members and younger Generation X and Millennial members is that younger people can be described as digital natives [2]. A digital native is an individual who has been using computing technology since early childhood, and to whom basic computing skills are naturalized. For example, Prensky [2] described digital natives as those who routinely played video games as children, who used computers in schoolwork from an early age, and who communicate naturally via email, text, and other electronically mediated methods. In contrast, digital immigrants are people who have learned their computing skills more formally as adults, and therefore do not have naturalized knowledge of computing technology. Prensky argues that the position of an individual as a digital immigrant or native creates fundamental changes in how individuals think and how they process information, leading to differences in how they use and understand technology. For example, digital natives are more likely to use the Internet for entertainment and not simply as a communication channel or to accomplish specific tasks [17]. This does not necessarily mean that younger people do not need to be taught how to use specific technologies (for example, software programs) or that they are adventurous or effortlessly skillful; in fact, Margaryan *et al.*’s [18] study of university students showed that most such students used a relatively limited number of technological tools. However, it does mean that digital natives may be more comfortable with and have a better intuitive understanding of familiar interfaces such as icon-based tasks and with ubiquitous computing systems [3]. Therefore, even though individuals of all ages may use and understand computers effectively, it is possible that younger users may have a slight advantage in effective use of icon-based systems, even with unfamiliar systems.

There are also several age-related factors that can affect computer interaction, and which could have a negative impact on use of input mechanisms like icons. Age-related changes in visual acuity, visual perception and motor skills can make traditional input devices like icons more difficult for older users to use effectively [18]. For example, users may have trouble recognizing some types of icons or may lose selection accuracy, impeding their device use and reaction time. This can lead older and younger users to have different icon style preferences; for example, while both younger and older users make more efficient use of skuemorphic icons, younger users prefer the aesthetics of flat icons [9]. This is relevant because many current operating system designs, both for mobile systems (e.g., iOS and Android) and for computers, use flat rather than skuemorphic icons. Furthermore, the use of flat icons without a significant amount of visual difference, which is also a current fashion in user interface design, can inhibit the ability of older users to recognise and distinguish icons [8]. For example, icons that are designed with a similar colour scheme, or which feature abstract designs that are not directly related to specific functions, can be difficult for older users. Since the visual icon design cannot easily be changed, unlike icon size, this is a significant usage barrier [8].

Older users may also be more reluctant to adopt new technologies due to cognitive challenges, although this is not a universal characteristic [19]. This problem may be particularly acute for Baby Boomers and older computer users, who did not learn computing technology at a young age [19]. There are several ways technology can be designed for older users to improve their effectiveness, including changing icon size and placement to meet individual user needs [20]. However, what has not been studied is the extent to which this positively or negatively affects usefulness for older users.

There has been a limited amount of research into the effect of icon characteristic variation on users of different generations, but studies have investigated icon characteristics that benefit older users. One such study found that concrete icons, familiar icons, labelled icons and semantically close icons (those where the image depicted mirrored the function of the icon) were easiest to recognise for older users (aged 65+) [5]. Other studies have also found that semantic distance affected the reaction speed of older users more than younger users when selecting icons [7, 10]. This implies that older users may respond more slowly to abstract icons (which have a high semantic distance) compared to younger users. Another study demonstrated that younger users were more able to identify mobile icons, especially abstract icons [4]. There have also been a limited number of other studies that have investigated icon usability as an aspect of mobile device usability for older people [6]. Overall, however, there has not been a lot of attention to icon characteristics and how different generations of users respond to these characteristics. This research focuses on two different types of icon characteristic, including entropy and concreteness.

C. Icon Entropy

Visual entropy refers to the variation within a visual field [21]. This can be measured as

$$H_{Factor} = \sum_{i=1}^{n\ levels} p_i\, log_2 p_i$$

where *H* is the level of visual entropy, *i* is a visual factor (e.g., a colour), and *p* is the probability of occurrence of factor *i* [21]. In this equation, an object in which each pixel is the same (a solid colour) has the lowest entropy.

Intuitively, visual entropy is perceived as the diversity or busy-ness of the visual field or object; for example, a patterned, textured object or an object with multiple colours will be viewed as high entropy, and colour objects are perceived as having more entropy than black and white or greyscale objects [21]. Visual entropy is used as an aesthetic aspect of design, and can be appealing visually and draw the key [22]. At the same time, visual entropy demands a high degree of visual attention and differention during the perception process in order to differentiate an object from its field [23]. Under ordinary conditions, humans can perceive and distinguish objects well even with high visual entropy. However, very high entropy can distract visual attention away from salient features of the object, which can affect visual recognition of a given object [24]. Under extreme cases, this can create difficulty even in recognition of basic shapes [25]. High visual entropy has been shown to affect visual attention and recognition in computing tasks [26]. However, there is limited research into the effect of high entropy within the icon on recognition accuracy that compares generational differences, as only a few studies have addresed this aspect of visual perception and icon characteristics [6].

D. Icon Concreteness

Icon concreteness is the extent to which the icon directly represents the underlying action it triggers [27]. A concrete icon is an icon that has a direct semantic link between the visual depiction and the action; for example, the image of a clock face typically used to access time functions. An abstract icon does not have this direct semantic link; for example, many icons use software company logos. Concreteness and abstractness are not absolute values, but instead are a spectrum, and to some extent is a subjective factor can be influenced by the individual’s idiosyncratic associations [28]. In general, concrete icons are considered more easily recognized, especially for users unfamiliar with a given system or who are generally inexperienced with icon-driven systems [28]. Users also generally tend to prefer concrete icons to abstract icons, which previous studies have shown may be a universal preference [29]. A cognitive analysis has shown that concrete icons, particularly those that represent familiar objects or concepts in a simple fashion, are most effective in terms of cognition and retention, which means that users are more likely to remember and recognize the icon and associate it with a specific function [30]. This is true of all user groups, not only older users, indicating that in general users respond more rapidly to concrete icons. Thus, in general, there is a strong body of research suggesting that concrete icons are preferred by users over abstract icons, even though concrete icons cannot always be used, for example because there is no obvious concrete representation of the action triggered by the icon [27].

Unlike icon visual entropy, there have been several studies that have examined icon concreteness for older users [4–6]. These studies have routinely shown that older users have faster reaction times and better accuracy when selecting concrete icons rather than abstract icons, which in some cases has been shown to be different from younger users. Therefore, it can be stated that for older users, icon concreteness is likely to be a factor in selection speed and accuracy for icons. However, it is not clear at what age this change takes place. Thus, this generational cohort study is intended to examine which users find concrete icons easier to recognize.

III. Methodology

Subjects. The sample consisted of a total of 150 participants, who were recruited through on-campus announcements and snowball sampling recruitment strategies. The sample was divided into three sub-sample groups by generational cohort, including: Millennials (born 1980–1997) (n = 50); Generation X (born 1966–1979) (n = 50); and Baby Boomers (born 1945–1964) (n = 50).

Experiment design. The research used a 2×3×3 experimental design (entropy (high/low) × concreteness (abstract/concrete) × time (9/6/3 seconds)). An experimental apparatus consisting of a mobile tablet device was used for each participant. The experiment drew on four sets of icons prepared during previous studies, including 1) Concrete/high entropy icons; 2) Abstract/high-entropy icons; 3) Concrete/low entropy icons; and 4) Abstract/low entropy icon. For each icon group, five icons were selected at random from the icon set. Respondents were asked to identify each of these five icons and select them. The total round of trials therefore consisted of 20 questions. The question rounds were repeated three times with different icons, but differing time limits (9s, 6s, and 3s respectively), leading to a total of 60 questions for each participant. Items were scored 1 if selected accurately and 0 if selected inaccurately.

Scoring. The results of the five trials of each of the four conditions were added together to achieve a single accuracy score (0 to 5). The following accuracy ratings were assigned to each:

0 to 1: Definitely not accurate

2: Not accurate

3: Neutral

4: Accurate

5: Definitely accurate

This analysis resulted in a total of 12 scores per participant (Concrete/high entropy, Abstract/high entropy, Concrete/low entropy and Abstract/low entropy in each of the three-time conditions.

Analysis. Responses were grouped by generational cohort and means and standard deviations were calculated for each group. One-way ANOVA was used to identify significant mean differences ($p < 0.05$) between each of the three groups. Post-processing (LSD) is then used to identify which groups have significant mean differences.

IV. Result

Table I summarizes the means and one-way ANOVA result significance for the groups for each of the four trials under 9s, 6s and 3s conditions. Table II summarizes significant between-groups differences for each of the trials. The results in Table I represent the mean response accuracy for each of the generational groups (Millennial, Generation X, and Baby Boomers) under three different time conditions. These results are also accompanied by an interpretive value which indicates whether the mean selection accuracy was extremely accurate (4.00 to 5.00 accuracy), accurate (3.00 to 3.99 accuracy) or neutral (under 3.00). Table II shows the significant inter-group differences between the three generational groups.

9s time condition. Under the 9s time condition (the most accurate time condition), all three groups had very high mean accuracy, with all groups rated as “accurate” to “definitely accurate”. However, means shoed that Millennials and Generation X subjects had higher means approaching 5, while Baby Boomers had means around 4 to 4.5. The LSD post-processing showed that within this time group, there was a specific pattern. Generation X and Millennial subjects had no significant mean difference, but Baby Boomers had significant mean differences from both groups.

6s time condition. Accuracy fell under the 6s time condition, although it still ranged in the “accurate” to “definitely accurate”. There were significant between-groups differences under all four conditions. Post-processing showed that for high-entropy icons, there were mean differences between Baby Boomers and Millennials, but not between Baby Boomers and Generation X. There was a significant difference between Generation X and Millennials for abstract/high entropy icons but not for concrete/high entropy icons. There were significant differences between all three generations for Concrete/low entropy and abstract/low entropy icons.

TABLE I. ONE-WAY ANOVA OF MEAN ICON SELECTION ACCURACY BETWEEN GENERATIONS GROUPS

Icon	Generation	9 seconds			6 seconds			3 seconds		
		Mean Value		Sig.	Mean Value		Sig.	Mean Value		Sig.
Concrete icon with high entropy	Millenniums	4.80	Definitely Accurate	0.000	4.46	Definitely Accurate	0.007	4.38	Definitely Accurate	0.000
	Generation X	4.82	Definitely Accurate		4.14	Accurate		3.72	Accurate	
	Baby Boomer	4.08	Accurate		3.84	Accurate		3.38	Neutral	
	Total	4.57	Definitely Accurate		4.15	Accurate		3.87	Accurate	
Abstract icon with high entropy	Millenniums	4.80	Definitely Accurate	0.000	4.70	Definitely Accurate	0.000	4.48	Definitely Accurate	0.000
	Generation X	4.68	Definitely Accurate		4.20	Definitely Accurate		4.06	Accurate	
	Baby Boomer	4.24	Definitely Accurate		3.92	Accurate		3.46	Accurate	
	Total	4.57	Definitely Accurate		4.27	Definitely Accurate		4.09	Accurate	
Concrete icon with low entropy	Millenniums	4.86	Definitely Accurate	0.000	4.74	Definitely Accurate	0.000	4.54	Definitely Accurate	0.000
	Generation X	4.76	Definitely Accurate		4.38	Definitely Accurate		4.20	Definitely Accurate	
	Baby Boomer	4.30	Definitely Accurate		3.76	Accurate		3.70	Accurate	
	Total	4.64	Definitely Accurate		4.29	Definitely Accurate		4.15	Accurate	
Abstract icon with low entropy	Millenniums	4.98	Definitely Accurate	0.000	4.82	Definitely Accurate	0.000	4.46	Definitely Accurate	0.000
	Generation X	4.90	Definitely Accurate		4.52	Definitely Accurate		4.24	Definitely Accurate	
	Baby Boomer	4.48	Definitely Accurate		4.00	Accurate		3.22	Neutral	
	Total	4.79	Definitely Accurate		4.45	Definitely Accurate		4.16	Accurate	

TABLE II. POST-PROCESSING OF GENERATION GROUP MEAN ICON SELECTION ACCURACY

	Group 1	9 Seconds		6 Seconds		3 Seconds	
Concrete × High Entropy		Millennial	Gen X	Millennial	Gen X	Millennial	Gen X
	Gen X	0.865		0.100		0.007	
	Baby Boomer	0.000	0.000	0.002	0.123	0.000	0.159
Abstract × High Entropy		Millennial	Gen X	Millennial	Gen X	Millennial	Gen X
	Gen X	0.305		0.006		0.030	
	Baby Boomer	0.000	0.000	0.000	0.121	0.000	0.002
Concrete × Low Entropy		Millennial	Gen X	Millennial	Gen X	Millennial	Gen X
	Gen X	0.349		0.047		0.091	
	Baby Boomer	0.000	0.000	0.000	0.001	0.000	0.013
Abstract × Low Entropy		Millennial	Gen X	Millennial	Gen X	Millennial	Gen X
	Gen X	0.361		0.031		0.237	
	Baby Boomer	0.000	0.000	0.000	0.000	0.000	0.014

3s time condition. Accuracy fell again under the 3s time condition, with concrete/high entropy and abstract/low entropy icons dropping into the neutral range for Baby Boomers. Once again there were significant mean differences. The post-processing shows that there were significant mean differences between Millennials and the other two groups for Concrete/high entropy icons and Abstract/high entropy icons. For Concrete/low entropy icons and Abstract/low entropy icons, there were significant differences between Baby Boomers and both of the other groups, but no difference between Generation X and Millennials.

Abstract vs. concrete icons. It is noticeable that means for the concrete icons are noticeably higher than the abstract icons under both entropy conditions for Baby Boomers, but younger groups (Millennials and Generation X) had similar or sometimes even higher means for abstract icons compared to concrete icons. This suggests a noticeable preference for concrete icons in the Baby Boomer group that did not exist in the younger response groups.

Low entropy vs. high entropy icons. As expected, means for low-entropy icon conditions were higher than the same concreteness category under high-entropy conditions. However, in comparison, Baby Boomers had higher gains from low entropy icons compared to high entropy icons. For example, the Baby Boomer mean difference for concrete/low entropy versus concrete/high entropy in the 9s trial (+0.22 points) was more than that of either Generation X (−0.06) or Millennials (+0.06). However, this was not a consistent difference and analysis did not show that this was a significant generational pattern.

V. DICUSSION

The findings of this study supported two basic propositions. First, it showed that Baby Boomers have overall lower selection accuracy under all mobile icon selection conditions. This is not really noticeable under most generous time conditions (9s as tested in this research), but under time constraints (6s and 3s) the difference between generational cohorts grew much higher. Under the strongest time constraint, average accuracy fell to neutral (around 3 of 5 trials) under all four icon conditions. This shows that in general, there is a gap in icon selection accuracy between Baby Boomers and younger respondents. In contrast, the results did not show many significant differences between Millennials and Generation Y. The other finding of note was that although the effect of concreteness was more pronounced for Baby Boomers compared to the younger cohorts in the study. Baby Boomer respondents showed a wider mean difference between concrete and abstract icons under both entropy conditions and in different time periods than did the other cohort groups. In contrast, there was no clear difference between the Generation X and Millennial accuracy for concrete and abstract icons. Baby Boomers also showed a slight preference for low entropy icons, but this difference was less consistent than others.

These findings were generally consistent with the previous findings on icon selection accuracy for older users. For example, Leung *et al*. [15] showed that concrete icons and semantically close icons were among the easiest to recognize for older users. It was also consistent with findings of previous studies which have shown that abstract icons were easier to recognize for younger users rather than older users [4, 6]. These previous studies have not always directly compared the performance of older users (who in this research were the Baby Boomer cohort) to younger cohorts, although some have [4]. Overall, these findings do support the idea that concrete and low-entropy icons offer better recognizability for older users and improve icon selection accuracy, and that concrete and low-entropy icons are more important for older users than they are for younger users. Thus, this both supports and extends the previous research into the differences in icon selection usability for older users. This research can be used to refine icon design for older users, which will become increasingly required as computer use becomes ubiquitous in society and digital natives age.

One issue that this research did not address was what factors affected selection accuracy within the generational cohorts. There are different possible explanations that have been proposed, including the skill-based explanation of digital natives [2, 27] and the cognitive and perceptual changes associated with ageing [18–20]. For example, older computer users may experience increasing degradation of visual acuity which affects their attention and perception, or physical issues that affect their fine motor control and coordination. While issues related to reluctance to adopt computer technologies or lack of existing skills are unlikely to affect younger Generation X and Millennials, physical and cognitive issues associated with aging will affect these users over time. Therefore, there is a strong need to consider how these issues affect icon selection accuracy and as a result to adapt icon design to meet user needs for an ageing user base in future.

VI. CONCLUSION

This research was a generational cohort study that compared icon selection accuracy between Baby Boomers, Generation X and Millennials under varying conditions of icon concreteness and icon entropy. The results showed that in general, the oldest generation of Baby Boomers had lower selection accuracy than younger groups, especially under lower time constraints. This was not true between Generation X and Millennials, who had approximately equal selection accuracy. The results also showed that Baby Boomers were more sensitive to differences in icon concreteness and entropy compared to the other generational cohorts. Baby Boomers had noticeably better performance under conditions of icon concreteness and low entropy, while differences were not nearly as pronounced for the younger groups. Thus, in conclusion, this study supports the general idea that older users may need additional support, especially in areas like icon design. This study could only investigate a limited number of icon characteristics due to the experimental structure. Furthermore, all the participants came from the same culture (Thailand). However, the lack of clear empirical evidence on age effects of icon characteristics extends beyond concreteness and entropy. For example, icon size and arrangement, icon colour, 2D or 3D representation, semantic distance, and other characteristics all could affect usability of icons, and these factors may affect older users more than younger users. Furthermore, there is an increasing need to distinguish the effects of age-related attention, perception, and motor control issues from cultural resistance to technology use, since digital natives will begin to age into such physical and cognitive limitations within the next few decades. Therefore, there is a need for more research into the age-related effect of different icon characteristics on icon usability (for example reaction time and accuracy). This offers many opportunities for further research into areas that have not been explored until now.

CONFLICT OF INTEREST

The author declares no conflict of interest.

AUTHOR CONTRIBUTIONS

Kleddao Satcharoen collected the data. Pikulkaew Tangtisanon created the questionnaire coding. Kleddao Satcharoen and Pikulkaew Tangtisanon designed the experimental how the participants carry out the experiment task, analyzed the data, and wrote up the paper. Both authors had approved the final version.

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Kleddao Satcharoen was born in May 1978, Thailand. She earned her DPhil in computing (2017) and MSc in computing (2003) from the University of Buckingham, UK, and a MA in political science (2005) from Ramkhamhaeng University, Bangkok, Thailand. She also holds BSc in management technology (2000) from King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand.

Since 2004, she has been working as the lecturer in Faculty of Engineer, Department of Computer Engineering at King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand. She currently teaches 4 main courses: human computer interaction, user interface and innovation and system analysis and design, and Web Technology. Therefore, her interest is on human computer interaction area, specific in icon characteristics, perception, and algorithmic/programmatic techniques for icon characteristics measurement.

Pikulkaew Tangtisanon received her B. Eng. and M. Eng. degrees in information technology engineering from King Mongkut's Institute of Technology Ladkrabang, Thailand, in 2003 and 2005, respectively. She continued her study and received her Ph.D. degree from Tokai University, Japan, in 2009. Since 2009, she has been a professor at King Mongkut's Institute of Technology Ladkrabang. Her research interests are in the artificial intelligent, internet of things, bioengineering, and sensors.