The Elders Preference for Skeuomorphism as App Icon Style

Minji Cho*
Dept. of Industrial Design, KAIST
291 Daehak-ro, Yuseong-gu,
Daejeon, Republic of Korea
mjcho@kaist.ac.kr

Soyoung Kwon*
Dept. of Industrial Design, KAIST
291 Daehak-ro, Yuseong-gu,
Daejeon, Republic of Korea
kwon.sso@kaist.ac.kr

Nooree Na
Dept. of Industrial Design, KAIST
291 Daehak-ro, Yuseong-gu,
Daejeon, Republic of Korea
nooree427@kaist.ac.kr

Kun-pyo Lee
Dept. of Industrial Design, KAIST
291 Daehak-ro, Yuseong-gu,
Daejeon, Republic of Korea
kplee@kaist.ac.kr

Hyeon-Jeong Suk
Dept. of Industrial Design, KAIST
291 Daehak-ro, Yuseong-gu,
Daejeon, Republic of Korea
h.j.suk@kaist.ac.kr

* Both authors contributed equally to this work

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author.

Copyright is held by the owner/author(s).
CHI'15 Extended Abstracts, Apr 18-23, 2015, Seoul, Republic of Korea
ACM 978-1-4503-3146-3/15/04.
http://dx.doi.org/10.1145/2702613.2732891

Abstract
We explored the value of skeuomorphism as an icon style particularly for the elderly people. To identify the proper approach of skeuomorphism we articulated two factors such as degree of realism and level abstraction. We employed “call”, “contact”, and “camera” icons and created eight alternatives, four degrees of realism by two levels of abstraction for each. We conducted semi-structured interviews with 30 Korean elderly and asked about their preference and understandability depending on how the app icons are visualized. A conjoint analysis revealed that the degree of realism is more important for having an aesthetic satisfaction, whereas the abstraction level is more relevant for better understanding the function of an icon. Overall, the degree of realism is positively correlated with both preference and understandability. Moreover a direct metaphoric icon has an advantage to appeal more and to inform more efficiently, particularly for female or novice elderly users.

Author Keywords
Icon design style; Skeuomorphism; Elderly

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User interfaces.

Figure 1. A notepad application icon of iOS 6 in skeuomorphic style (left) and that of iOS 7 in flat style icon which is more simplified (right).

Figure 2. Docomo Raku-Raku Smartphone released in 2014 (F-09E)

Introduction

Population ageing is taking place in nearly all of the countries around the world, and a great effort has been made to improve the access to technologies and design which enhances aging in place [10, 12]. As an increasing number of the elderly has moved from simple cell phones to smartphones [13], the industry sees this as an opportunity to create a new market segment. The smartphone industry becomes more competitive than ever before, and therefore studies on the elderly users are highly demanding [4, 5].

In this study we investigated the elderly's preference for the graphic user interface (GUI) in context of smartphone application icons. The design of application icons influences greatly on the users' first impression when browsing. Often, the characteristics of icons of smartphone application represent the graphic identity of operating systems. For example, as Apple recently released iOS7, it set off a graphical style trend moving from skeuomorphic to a simpler flat style.

In general, along the advancement of GUI design, the improvement contributes to achieve higher usability and greater attention[3] and emotional satisfaction. With regard to enhancement of affective quality through graphical representation of icons, some recent studies examined the affective quality while the color attributes of icons are manipulated[8, 11]. As another competent graphic technique, Skeuomorphic icons offered the benefits of high learnability and metaphorical pleasure. Basically, the skeuomorphic style illustrated realistically with a textured treatment making elements appear as real objects [6]. How to manipulate the degree of realistic appeal strongly influenced the identity of GUI design. However, while depicting an object in the world, skeuomorphic style easily can become superfluous. In line with this, there are still on-going debates, as smartphone users nowadays anticipate a new GUI style after having experienced diverse skeuomorphic icons, and now being confronted with Apple's simple and flat style [15]. On the other hand, we considered that the skeuomorphic style adequately links human and machine through its rich and illustrative approach. Particularly for the elderly who start using the smartphones in their later years, an intuitive graphical guide is essential. In this study we identified what appeals more to the elderly smartphone users, particularly focusing on comparing the effects of Skeuomorphism and minimalism.

Skeuomorphism

Skeuomorphism in UI design has received much attention and criticism about its usefulness and purpose in the design of smartphone applications. We found several definitions of Skeuomorphism which lacked clarity. For example, *Techopedia* defined 'skeuomorphism' as a design principle in which design cues are taken from the physical world. The design has traditionally aimed to recall the real world - such as the use of folders and file images for computer filing systems to make computers feel more familiar to users [9]. Whereas, *Bop Design* defined 'skeuomorphism' as how the design is illustrated realistically with a textured treatment making elements appear as real objects [6]. As shown in Figure 1, we can easily compare the difference between skeuomorphic and flat style.

Icon Style Preference

As the smart device market rapidly expands, there are many studies related to icon design. Arledge identifies

how filled-in and outline icon style influences usability [1]. Also, Hou, clarifies the potential relationship between icon style and the users' emotion [7]. Yet, research regarding the seniors' preference and level of understanding for icon styles has not been clearly defined. As shown in Figure 2, Docomo introduced the Raku-Raku, which was a smartphone specifically targeting the elderly. Considering the elderly's poor legibility, the icons are displayed much larger than in other smartphones. By doing so, the layout design is much simpler admitting that the elderly are not capable of using smartphone services. However such support for deficiency should be addressed in a more positive way to properly achieve emotional satisfaction and cognitive performance.

Plan for Empirical Study

To distinguish Skeuomorphism from minimalism, we took two independent factors into consideration. One was the degree of realism, and the other the level of abstraction. The degree of realism indicated how realistic an icon is. The level of abstraction meant for semantic connection to the metaphoric object.

Composition of an icon set

We collected four different smartphones that were deliberately designed for the elderly, such as, Docomo Raku-Raku smartphone series (F-06F, F-09E) (Figure. 2) and Softbank simple smartphones (204SH) and Doro PhoneEasy 740. Among those smartphones, we selected the three most frequently icons: "call", "contact", and "camera".

Factor 1: degree of realism

We drafted each of the call, contact, and camera icons in four different degrees of realism. Then we let five designers rank the order of the four degrees. We modified the icon designs iteratively, until all agreed.

Factor 2: abstraction level

The abstraction level was divided into the two aspects of (a) a metaphor that signifies the object which links to the function in the real world (b) a metaphor that does not signify the object in the real world.

With the three icon sets chosen, we designed both metaphoric icon and non-metaphoric icon in four different degrees of realism. The following Table 1 displays the eight types of "contact" icons according to the two abstraction levels and four degrees of realism.

Degree of realism	**Abstraction level**	
	(a)metaphoric: Drawn object that performs the same function in the real world.	**(b)non-metaphoric**: Drawn object that does not match with the same function in the real world.
1: Flat style icon that only consists ofbasic shape.		
2: Flat style icon that is more illustrative.		
3: Realistic style icon that consist of color and contrast.		
4: Realistic style icon that is close to photorealism.		

Table 1. Eight alternatives of a smartphone application icon, "contact" characterized in terms of two abstraction levels and four degrees of realism. The elderly were presented with a pair of contact icons and asked about preference and understandability.

Figure 3. The actual survey card.

Characteristic		Subjects
Gender no.(%)	Male	10 (33.3)
	Female	20 (66.7)
Smartphone usage no.(%)	< 6 months	18 (60.0)
	> 1 year	12 (40.0)

Table 2. Demographics and baseline characteristics of the sample

Questionnaire

Considering the nature of elderly responses to the stimuli, we planned a pairwise comparison to minimize cognitive workload. As illustrated in Figure 3, a pair of "call" icons were presented in a card. Firstly, we asked "which one looks better?" (preference)Then we asked, "which one do you think would perform the given feature?" (understandability) Consequently, we prepared 84 (=$_8C_2$×3sets) cards as stimuli.

Empirical Study

Subjects

We visited two senior centers in South Korea where we could recruit a total of 38 participants ranging from 65 to 91 years. The average age was 76.5 (SD= 8.19). According to the WHO's definition of an elderly, we chose the age range over 65 years[10]. We inquired the participants' experience in using smartphone as well as the period of using a smartphone and what features they used or are still using.

Procedure

Two experimenters conducted a semi-structured interview with the elders to overcome the elders' vulnerability such as declining concentration or eyesight. They presented the 84 cards one by one in random order. However, the final valid samples turned out to be 30, as summarized in Table 2. It took 10 to 20 minutes per person on average for the whole questionnaire. In addition, the interviewer occasionally had to help by reading the questions out loud and having the participants point out their responses. Furthermore, during the interview, they tended to get exhausted after 10 minutes, but soon concentrated back, which speeded up.

Results

Based on the elders' choice, we accumulated the frequency of selected icons. Considering the frequency data as the score, we computed the rank data between 1st and 8th place among 8 alternatives. Using SPSS 21, we performed a Conjoint Analysis to identify which factor has contributed more to the judgment of preference or understandability. Moreover, we tried to observe the utility change as the levels of each factor varied.

Figure 4 shows the results of both preference and understandability. The average relative importance indicates how largely each factor influenced the elderly to make a judgment on preference for or understandability of a smartphone application icon. For example, when they decided for the preference for an icon, the degree of realism (63.61%) had twice the impact compared to the abstraction level (36.39%), [($F_{(1,58)}$=30.94, $p<.05$)]. In particular, a positive correlation existed between the degree of realism and preference. Regarding the level of abstraction, the metaphoric style was preferred [($F_{(1,58)}$=43.07, $p<.05$)].

Similarly, there was a positive correlation between degree of realism and understandability. Also the elderly considered the metaphoric style being better for understanding the meaning of an icon. The mean difference between two utility values was statistically significant as well [$F_{(1,58)}$=164.47, $p<.05$)]. Differently from the preference, we observed that the elderly considered the level of abstraction much more important than degree of realism, when having to identify the meaning of an icon. The average relative importance of level of abstraction was 63.47% while that of degree of realism was 36.53%. However the

mean difference is not statistically different at the significant level of 0.05, and therefore, the relative importance between the two factors is an individual matter. For example, for some elders taking a metaphoric object is more relevant in order to understand the meaning of an icon. At the same time for the other, how realistically an icon is illustrated is more relevant.

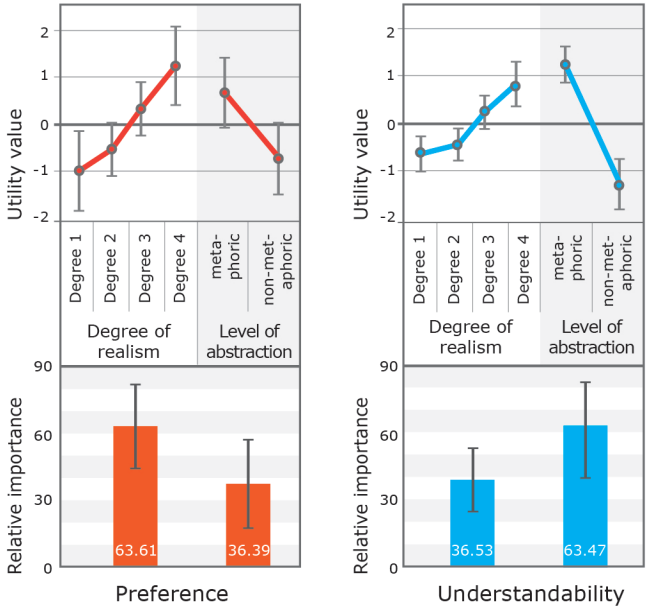

Figure. 4 (left) Utility values and average relative importance of preference. (right) Utility values and relative importance of understanding.

From the further analysis by subgroups, we found a noticeable effect of gender and previous smartphone usage on the understandability. For the female group, abstraction level was more important than degree of realism ($F_{(1,38)}$=15.48, p<.05), while it was not for the male group ($F_{(1,18)}$=5.81,p<.05). This implies skeuomorphic style is an especially efficient method when explaining to female elders about the meaning of an icon. In addition, for the non-smartphone user group, the relative importance of abstraction level was higher than that of realism ($F_{(1,34)}$=11.49, p<.05), whereas the previous smartphone user group had no significant difference between abstraction and realism ($F_{(1,22)}$=.23, p=.64) (Figure. 6).

Figure 5. Value of relative importance for understandability by gender group.

Figure 6. Value of relative importance for understandability by smartphone and non- smartphone user group.

Discussion and Conclusion

Preference-wise, the level of abstraction had the most significance, and skeuomorphic icons were more preferred to abstract icons. This supports previous studies. Hou identifies that users prefer miniaturized designs of real goods to abstract icon designs, while doubting the success of skeuomorphism due to the new generation of users' higher preference for abstract icons [7]. Also, it is shown that elderly prefer realistic and photographical representations to simple and flat icons. Though this is slightly different from Robbins' findings the age group of 46 and older had a slight preference for flat design, it was not clarified how many participants of the group were above 65 [14]. In terms of the understandability, there was no significant difference in the relative importance score. A higher degree of realism was had a tendency to help understanding. With the understandability, key factors were found for both gender and the smartphone usage period. We found that our results were different from Chanwimalueng's argument, in that heavy smartphone users show the best perception and satisfaction with concrete complex icon, while occasional users do the same with concrete simple icon [2].

In conclusion, using the same metaphor from the real world has influence on the elders' understandability, while illustrative and realistic representations play an important role on the elder preference. The elderly seem to prefer familiar expressions that look realistic. The elder might need a cue to guess the function. In addition, this result indicate that there is a contradiction between actual usability and emotional judgment. It is expected for services targeting elderly users to depict an icon rather realistic and skeuomorphic than flat and abstract.

Further work

This study has potential improvements that suggest some directions for future research. This study might further extend target participants to younger age groups. After comparing results for different age groups, it will be more objectively clarified if this result is due to elderly-unique characteristics or overall tendency. Lastly, it is required to evaluate the validity of icon design guidelines for the elder. In order to test this guideline, a new comparison set can be prepared by modifying the existing icons of smartphone and public devices to follow the guidelines. After examining the elder's preference for those modified icons and existing icons, the validity of this guideline will be shown.

References

[1] C. Arledge, Filled-in vs. Outline Icons: The Impact of Icon Style on Usability, Carolina Digital Repository, 2014.

[2] W. Chanwimalueng and M. K. Kasemsan, The acceptance and satisfaction of smartphone users toward icon concreteness and complexity, in *Proceeding of 16th Business Information Management Conference on Innovation and Knowledge Management a Global Competitive Advantage*, 783-790.

[3] K. Choi and H. J. Suk, Optimal employment of color attributes to achieve saliency in icon matrix designs, *Color Research & Application* (2014).

[4] S. J. Czaja and C. C. Lee, The Human-computer Interaction Handbook, J. A. Jacko and A. Sears, Eds., L. Erlbaum Associates Inc., Hillsdale, NJ, USA, 2003, 413–427.

[5] A. D. Fisk, et al., Designing for Older Adults: Principles and Creative Human Factors Approaches, Second Edition, 2 edition ed., CRC Press, Boca Raton, 2009.

[6] D. Hill. *Flat vs. Skeuomorphism Design: Which to Choose?* Available: https://www.bopdesign.com/bop-blog/2014/02/flat-vs-skeuomorphism-design-which-to-choose/

[7] K.-C. Hou and C.-H. Ho, A Preliminary study on Aesthetic of Apps Icon design, 2013-08-27 (2013).

[8] J. Jang and H.-J. Suk, Disappearing icons: Informative effect through changing color attributes of app icons, in *Consumer Electronics (ICCE), 2014 IEEE International Conference on*, 341-342.

[9] C. Janssen. *What is Skeuomorphism?* Available: http://www.techopedia.com/definition/28955/skeuomorphism

[10] C. Jaschinski, Ambient Assisted Living: Towards a Model of Technology Adoption and Use Among Elderly Users, 319–324.

[11] S.-W. Ju*, et al.*, Changing the color attributes of icons to inform of the application status, in *Consumer Electronics (ISCE 2014), The 18th IEEE International Symposium on*, 1-2.

[12] C. Lee, User-centered system design in an aging society : an integrated study on technology adoption, Thesis, Massachusetts Institute of Technology, 2014.

[13] V. Oksman, Young People and Seniors in Finnish 'Mobile Information Society', *Journal of Interactive Media in Education* 2006 2006-11-03 (2006), 2.

[14] W. Robbins, Design Practices in Mobile User Interface Design, *Graphic Communication* 2014-06-01 (2014).

[15] A. Zhou, Cybernetics and human-computer interaction: Case studies of modern interface design, in *Norbert Wiener in the 21st Century (21CW), 2014 IEEE Conference on*, 1-6.