User Recognition and Preference of App Icon Stylization Design on the Smartphone

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Abstract. At limited area of smartphone display, it is critical that app icon should provide good recognition and user preference. Based on the key components of an icon, this study investigated app icon design across different mobile operating systems (Apple iOS, Google Android and Windows Phone 8, with different icon design principles respectively) to understand recognition performance and user preference of different icon types. In this study, current mobile apps icons collected from app stores were characterized and examined based on different composition of "stylization" (three categories: pictorial illustration, graphic rendering and graphic symbology) and "border shape" (two categories: open and close border). The six different compositions of icons were then implemented functionally on a smartphone to test recognition time, accuracy and subjective opinion. Results show that participants prefer pictorial illustration icons, but have no significant preference on border shape. For the recognition, users perform better time on simplified stylization, but make more errors relatively. Results indicate that open border shape icon is beneficial for recognition. In conclusion, icons designed with open border shape and graphic rendering is better for users' recognition and preference on the smartphone.

Keywords: Stylization · App icon · Graphical user interface

1 Introduction

With limited display space, icons used on conventional products always take abstract pictures or symbolic illustration to represent meanings of functions in terms of semantics. Today, the advancement of high definition display and touch technology allows more graphical user interface (GUI) on devices. Designers tend to use colors and detailed graphics to make icons look splendid and attractive. This leads to an issue: are the meanings of these icons still recognizable comparing to symbolic design? In 2007, Apple released the first iPhone, which changed the role of smartphone from business to consuming use with its intuitive, user-friendly and fascinating interface. Opening a program is simply touching the icon on the screen. Apple also defined the icons applied on iOS should design with colorful, real texture and more details to create aesthetic user experience. Later Google mobile system Android also took similar way on its interface design, but with more flexibility for developers, for instances, various icon stylings versus limited icon shape on Apple iOS.

Different from the competitors, Microsoft developed its new user interface named "Modern UI" and implemented on all the mobile devices and desktop products. The design language places emphasis on typography and semantics, and creates "living tiles" to represent "sleek, quick and modern" interaction. It is clear to see that this design language takes symbology as a main part of icon design, with simple graphics, single color, tile look and dynamic feedback. The different design language from the three types of icon design raises an issue worth to investigate: what types of icon design would provide better recognition and user preference? Horton (1994) indicated that meaningful icons overcome language barriers and yield their meaning with only a quick glance, saving search time and cognitive resources [1]. At limited area of smartphone display, it is critical that app icon should provide good recognition and user preference. Based on the key components of an icon (Horton, 1994, Fig. 1), this study investigated app icon design across different mobile operating systems (Apple iOS, Google Android and Windows Phone 8, with different icon design principles respectively) to understand recognition performance and user preference of different icon types.
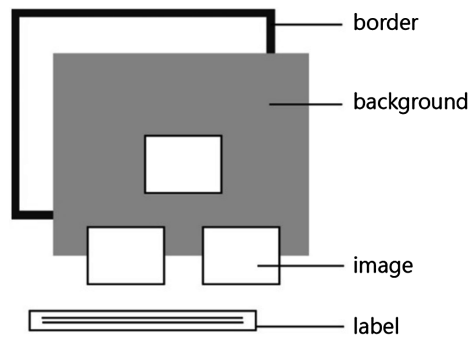

Fig. 1. Components of an icon (Horton, 1994)

2   Methods

In this study, current mobile app icons collected from app stores were characterized according to different classifications. All collected icons were then selected by experienced graphic designers for user testing. Finally, recognition time, accuracy and subjective opinion were recorded and analyzed statistically to understand the performance of different composition of icon design.

2.1   Icon Classification

Two classification principles were adopted to investigate different types of icon design. Based on the study conducted by Wang and Lin (2002) [2], this study set three categories as the "stylization" of icon graphics (pictorial illustration, graphic rendering

Table 1. Icon stylization (adopted from Wang and Lin, 2002)

Representation	Stylization	Visual elements	
		shape	Texture
Concrete	Pictorial illustration	3	3
Semi-concrete	Graphic rendering	3	2
	Graphic symbology	2	1
Ps. 3 = complicated, 2 = simplified, 1 = geometric			

and graphic symbology, see Table 1 for the difference of visual elements). The other one classification principle of icon design is "border shape" (two categories: open and close border, see Table 2 for the illustration), based on current design languages of the three OSs. Therefore, in total six categories of icons were classified (Stylization*3 versus Border shape*2).

Table 2. Icon border

Border	Close	Open
Examples		
Outline		
Character	1. Icon designed in square (or with round-corner) outline, with distinct image-background combination.	1. Icon designed in free outline (could be any shape), without distinct image-background combination.
	2. Usually adopted by Apple iOS and Microsoft Modern UI.	2. Usually adopted by Google Android.

A broad search of current app icons across all mobile platforms was conducted in Jan. of 2013 to collect as many icons as possible. Three experienced graphic designers were then asked to classify collected icons according to the six categories. Finally 480 icons in 20 functions were collected, but only 96 icons in 16 functions were selected accordingly for later user testing.

2.2   Icon Recognition Experiment

A recognition experiment was then implemented to investigate performance and user preference of different composition of icons. In the experiment, as described above, the

six icon categories (16 icons for each category) were implemented functionally on a smartphone. Performance and subjective opinion were recorded and analyzed statistically.

Implementation. The experiment was conducted by simulating using smartphone interface. The Samsung GALAXY SII (4.3-inch, 480 × 800 pixel display) was used for loading the program. 16 app icons was arranged in 4*4 on a single frame without background to avoid visual interference. Figure 2 shows the six categories displayed on the smartphone (three stylizations vs. two borders).
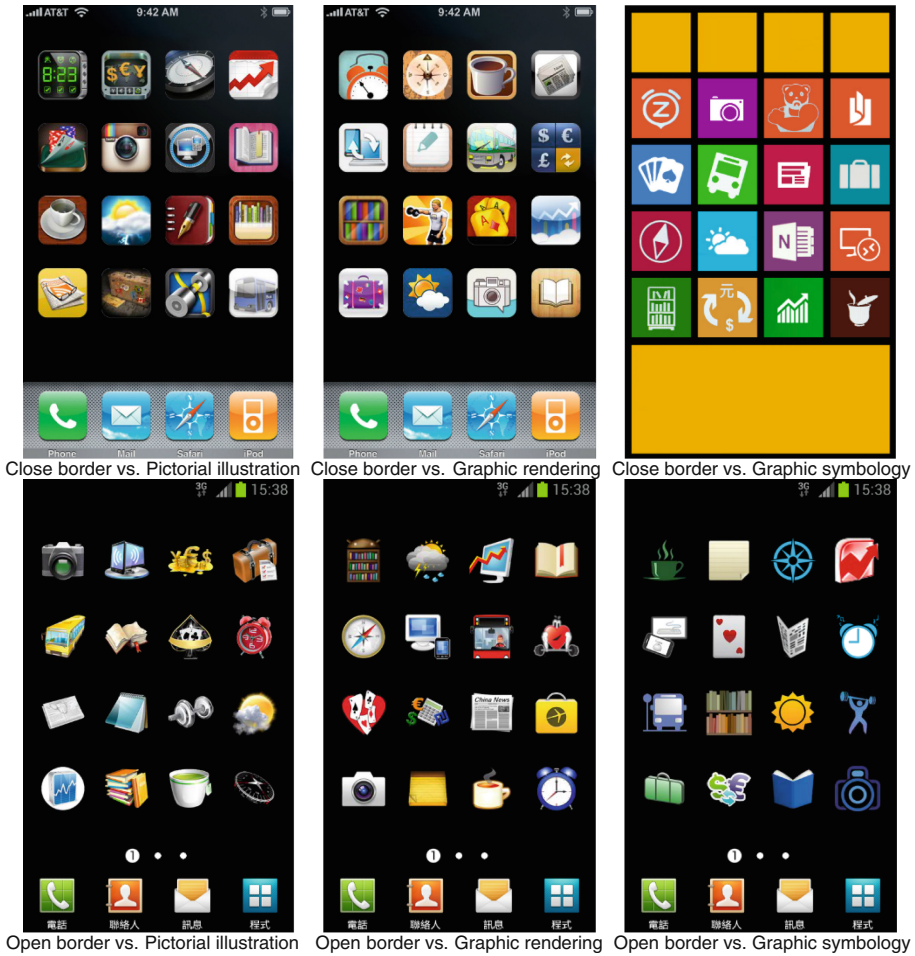

Close border vs. Pictorial illustration   Close border vs. Graphic rendering   Close border vs. Graphic symbology

Open border vs. Pictorial illustration   Open border vs. Graphic rendering   Open border vs. Graphic symbology

Fig. 2. Six icon categories implemented on the smartphone

Participants. 42 (16 male and 26 female, age from 20–40) smartphone users participated the experiment. All participants have at least two different mobile system using experience and without particular preference on either system.

Procedure. The six icon categories take turns randomly to display on the smartphone screen. The participant needs to select corresponded icon which function the system assigns. The system automatically records recognition time and frequency of errors. The experiment finishes after all six categories are tested. The participants are then asked to score the six categories subjectively.

Measurement. Three measures were recorded and analyzed statistically.

- Accuracy – To record if the icon was recognized correctly, through calculating frequency of errors.
- Recognition time – To record the time during the system instruction and the participant's reaction to the system.
- Preference – To calculate the score that participants gave on a 7-level Likert's Scale.

3   Results and Discussion

3.1   Accuracy

Errors found on border shape and stylization are summarized in Table 3. Results show that more errors were found on icons designed with close border comparing to open border. It is possible that open-border icons can be correctly recognized through the characteristics of different shape. For stylization, errors raise with the increase of icon simplicity.

Table 3. Errors on border shape and stylization

Classification	Border shape		Stylization		
Categories	Open	Close	Pictorial illustration	Graphic rendering	Graphic symbology
Errors	259	325	170	188	226

3.2   Recognition Time

Results show that icons designed with open border perform better than close border on recognition time. Various shapes of open-border icons may provide distinct characteristics for recognition. For stylization, significant differences were found under different border shape (as seen in Table 4). For both categories, however, icons designed with graphic rendering cost significant less recognition time than the others. This means extreme simplicity or details design on icons may not benefit recognition.

3.3   Preference

Preference of border shape and stylization are shown in Table 5. Results indicate that user has no particular preference on either border shape design. For stylization,

Table 4. The significance of recognition time on border shape and stylization

Categories	Post hoc
Border shape	
Pictorial illustration	Close > Open
Graphic rendering	Close > Open
Graphic symbology	Close > Open
Stylization	
Close	Pictorial illustration > Graphic rendering
	Graphic symbology > Graphic rendering
Open	Pictorial illustration > Graphic rendering > Graphic rendering

however, participants significantly prefer icons with pictorial illustration and graphic rendering to those with graphic symbology. Users may get used to colorful and detailed design icons on the smartphone.

Table 5. The preference of border shape and stylization

Categories	Significance*(p < .05)	Post hoc
Border shape		
Pictorial illustration	.497	
Graphic rendering	.197	
Graphic symbology	.050	
Stylization		
Close	.000*	Pictorial illustration, Graphic rendering >
Open	.050	Graphic symbology

4   Conclusion

In this study, it is clear to see that recognition difficulty and user preference do not perform coincidently on stylization. People prefer detailed icon design, although they are not benefited from recognition performance. Simplified icon design may improve recognition time, but cause more errors. In conclusion, the icon designed with open border shape and graphic rendering is better for users' recognition and preference on the smartphone. Graphic symbolic icon needs carefully designed in terms of semantics to increase accuracy.

References

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