The Design Journal VOLUME 13, ISSUE 3 PP 313–328 REPRINTS AVAILABLE DIRECTLY FROM THE PUBLISHERS PHOTOCOPYING PERMITTED BY LICENSE ONLY

Unaided Icon Recognition in Mobile Phones: A Comparative Study with Young Users

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ABSTRACT This article investigates whether the diversity of mobile phone icons has a negative effect on user perception, as measured through unaided icon recognition. We designed an experiment involving fifty-two young users and evaluated twenty-five icons from five different mobile phone handsets. It was found that there are significant differences between alternative icons used for the same mobile phone feature. Moreover, we found that original manufacturer icons performed better than those offered by the wireless operator. Simple metaphors from the real

world and consistent visual depictions across different handsets performed best for mobile phone icons, while abstract concepts had the lowest recognition rates. Designers of mobile phone icons have to balance a trade-off between the need of the manufacturers and wireless operators to differentiate their offerings through branding, and the need of the consumers for a familiar visual language in mobile phone menus.

KEYWORDS: icon, mobile phone, recognition, user study

Introduction

Early mobile phones functioned just as speech terminals, but newer models have introduced extra functionality depicted through icons, and moreover, contemporary mobile phones are converging with powerful multimedia mobile computers (for example, Windows Mobile, Apple iPhone, Google Android). Thus, user interface icons have been widely deployed in mobile phone operating systems in order to ease navigation and to differentiate brands. Given the variety of competitive handset manufacturers, mobile operating system vendors, and wireless operators, are all mobile phone icons equal in terms of subjective recognition?

Although desktop icons have received much attention by researchers and practitioners (Smitshuijzen, 2007), mobile phone icons have not been studied enough. As described in the next section, there is a significant body of research on desktop icons, because icons are a fundamental element of modern user interfaces. Besides desktop icons, Kim and Lee (2005) evaluated mobile phone icons and provided guidelines for the level of abstraction in the visual design of icons. Nevertheless, their study was not based on available icons, but on experimental designs.

Common sense has linked icons with sophisticated user interfaces and increased perceived usability. In this study, we asked how much does diversity of icons affect their recognition by mobile phone users?

The objective of this user study is to compare the alternative icons for a common set of features among competitive handset manufacturers in terms of subjective recognition. Moreover, we have included a set of icons by a wireless operator (Vodafone) which has decided to replace the original handset icons with branded ones. We evaluated the icons with young users, who had previous experience with at least one mobile phone.

The rest of this article is organized as follows: (1) presentation of related work into icons, (2) methodology of the study, (3) study results, (4) discussion of the results in relation to established theories

and related findings and (5) conclusions for practitioners and suggestions for further research.

Related Work

The design of graphical user interfaces (GUIs) implies a need for effective icons which represent actions and objects. Indeed, since the introduction of GUIs, icon design and user evaluation has been of importance (Rogers, 1989). The main benefit of the GUI and use of icons is that it reduces the amount of items that a user has to memorize in order to perform computer tasks. Norman (1990) has suggested that it is more effective to perform common activities by doing rather than by remembering. Icons support immediate activity because they stand for objects or actions in a computer system; for example, an application's icon loads the respective application, while a file icon supports direct copying. Therefore, icons have become an indispensable part of contemporary computer systems.

Besides the pervasive desktop GUI, icons have been an important part of other interaction paradigms, such as the Web and mobile phones. In addition, icons have been included in touch-based interfaces (such as the Apple iPhone, Google Android). Therefore, it seems that icons will continue to be one of the dominant components in future user interfaces and it is worth keeping track of their performance as they move beyond the desktop. Many icon taxonomy systems have been developed by researchers that organize icons based on their graphic elements. Most of these taxonomies classify icons according to how abstract or concrete they are (Wang *et al*, 2007).

According to Rogers (1989) there are two types of icons: (1) data icons which represent objects that could be used in actions (for example, folders and files) and (2) function icons that could perform actions (a paintbrush tool is an example). Moreover, icons can be described according to their representational technique in the following categories: (1) metaphoric (for example, a road sign for falling rocks); (2) paradigm of use (such as a fork and knife for a restaurant); (3) symbolic (for instance, broken glass stands for fragile objects); and (4) abstract representation that should be memorized by the user (for example, the symbol for electricity or radioactive places).

Besides Rogers (1989), there are alternative approaches to the taxonomy of icons provided by researchers outside of the computing field. According to Peirce (cited in Marcus, 1993) the semiotic dimensions of a sign are: lexical (production), syntactic (arrangement), semantic (references to that for which they stand) and pragmatic (consumption). Signs by definition are icons, indexes or symbols – icons are 'naturally' meaningful like a thin pencil line to represent a line; indexes are signs caused by something and therefore referring to them, like muddy boot prints on the kitchen floor being a trace or index to the children walking through; while

symbols are abstract and must be learned. In many cases, icons in graphical user interfaces are not icons at all, but symbols.

Besides the symbolic representation, an icon is usually complemented by a text label, which provides a hint to its meaning. Researchers have established that neither text nor image alone is enough (Egido and Patterson, 1988; Haramundanis, 1996; Wiedenbeck, 1999). Instead the combination of text and image makes up a comprehensive icon.

The employment of icons is considered to reduce perceived complexity and to increase the learnability and memorability of a new system (Rogers, 1989). Moreover, visual representations are considered as a global medium of communication that work beyond borders, languages and cultures. However, no matter how global the understanding of the visual medium might be, researchers have also reported cultural differences in icon recognition performance (Kim and Lee, 2005). In addition, icons have been criticized for some of their properties. According to Tufte (1990) the information density of an icon is much inferior to that of the respective label.

According to Barr *et al* (2003) an icon is successful when the perceived meaning by the users matches the object/action that the designer has intended to communicate though the graphical portrayal of that particular image. Further empirical evidence for the design of motor vehicle displays has been provided by Green and Burgess (1980), who describe an elaborate study on pictographic displays and draw conclusions that might be applicable beyond the car industry.

Difficulties in icon design are due to the inherent difficulty of depicting complex meanings visually. This task becomes even harder when trying to visualize a group of objects/actions or when visualizing functionality that does not have a direct correspondence in the real world (metaphor). For example, there is no clear way to depict visually the functionality of the 'missed calls' option. The latter has been a rather new concept introduced by digital phones and phones with caller identification. A 'diary' or a 'post-it' icon might have been suitable, but it would also be difficult to distinguish from the phonebook or tasks functionality, respectively. Therefore, we have found that the 'missed calls' functionality has the most confusing icon so far. A possible explanation for those difficulties is that however powerful and global, the visual language does not have the syntactic and grammar rules of the spoken and written language.

Research Issues in Mobile Phone Icons

Despite the advantages of icons, there are also several unresolved issues. For example, there is no such thing as a direct mapping between images and words, be they objects or actions (Rogers, 1989). Helpfully, there are several assumptions and conventions (for example, the meaning of red, an exclamation mark and so forth) that aid the design process of icons. Most of those assumptions are

culturally dependent. Moreover, computer screen space is always at a premium, which is especially true for mobile devices that have to fulfil the requirement of portability. Therefore, the icons in mobile phones have to depict the intended functionality in a rather limited display compared to desktop computer systems. Finally, icon designers have to face one more novel challenge when working with mobile phones. Mobile phones have become much more than a computing platform and have come to express personal style and contemporary culture. Overall, aesthetics and branding considerations have become important evaluation parameters, which have been raised (Rondeau, 2005) but not completely addressed by the respective methodological approaches.

Some researchers have found that icons hold a quicker and easier recognition than the respective text (Collins and Lerner, 1982). In contrast, other researchers claim that there is no difference between the performances of the two, and that the best approach is to combine icons with text labels (Egido and Patterson, 1988). On the limited display of a mobile phone and assuming a computer-literate user, could the icons be enough to navigate the phone menus? In this study, we test icons without their text labels.

In comparison to desktop computers, mobile phones are a consumer product with a very wide user base. The diversity of consumer desires and the need for product differentiation has seen mobile phone icons become an opportunity for shaping the identity of the mobile handset. Researchers have identified the multifaceted nature of mobile phone services and claimed that the user experience of mobile phones depends on business aspects as well (Palen and Salzman, 2002; Rondeau, 2005). Could branding and short consumer product life cycles be a threat for user familiarity and easy recognition of mobile phone icons? In this study, we tested four competing brands, and we also included a handset that had its icons replaced by a wireless operator.

Methodology

The objective of the study was to evaluate the semantic legibility of mobile phone icons. The main research question was:

> What is the comparative recognition performance of alternative icons in mobile phones, given the fragmentation of the market with many devices and brands?

For this purpose, we selected five types of icons from five mobile phones (twenty-five icons in total). The types of icons were selected to match common functions such as address book, applications, internet, phone settings and calls log. We then presented each one of the icons to fifty-two users of mobile phones and asked them to guess (free-form question) what the meaning of each was. Finally, we coded the results and compared the averages from the user

ratings. In the following subsections, we discuss the details of our methodology.

Approach

Previous approaches to the evaluation of icons have emphasized that it is critical to collect information about the recognizability of icons, suitability of icons and user preferences for icons (Eisen, 1990). In this study we focused on recognition of widely available mobile phone icons among young users. For this purpose, we used an open-ended question to assess the perceived meaning of each icon.

Subjects

Fifty-two students in secondary education participated in the study. Thirty female and twenty-two male students with an average age of seventeen agreed to take part in the study in exchange for course credit. All subjects had used at least one mobile phone in the past.

Materials

We selected handsets from four different manufacturers. In addition, we selected one handset that was branded by a popular wireless network operator. The selection of the handsets was based on the European market shares of the respective manufacturer. Five mobile phones were selected (Table 1) according to the brand popularity of the respective phone: (1) Nokia, (2) Motorola, (3) Samsung and (4) Sony-Ericsson. Moreover, we selected an additional Motorola mobile phone, which was branded by a wireless service operator (Vodafone). Each particular handset was selected according to convenience.

Table 1 Mobile phone handsets used in the study.

Brand	*Handset*
Nokia	6230i
Motorola	RAZR v3
Samsung	d500
Sony-Ericsson	750i
Vodafone	Motorola V360v

In our sample, thirty-eight out of the fifty-two (73%, n=52) users owned one of those mobile phones; the rest owned other brands. Notably, mobile phones manufactured by Sharp were owned by ten of the participants. The minority owned phones by Siemens and Alcatel.

Mobile phone menus form a hierarchy, which is not consistent between different manufacturers. In some cases, features found themselves at the top level of the menu with an icon (such as short

message service (SMS) messaging), while in other cases features were organized in logical groups (for example, messaging includes multi-media messages (MMS), SMS, email) represented by an icon at the top-level menu.

We selected five icons from the main menu of each phone. The icons were selected so that: (1) they stand for popular features (address book, applications, internet, phone settings, calls log) and (2) there are similar icons on other mobile phones. We did not include the SMS icon in the study, because a pre-study questionnaire revealed high familiarity with this feature. For those phones with animated icons we selected the static version of the icon; that is the state of the icon when the cursor is not over it. In total, twenty-five icons were selected. Each icon was coded (a1, a2 and so forth) in order to facilitate statistical tests (Figure 1).

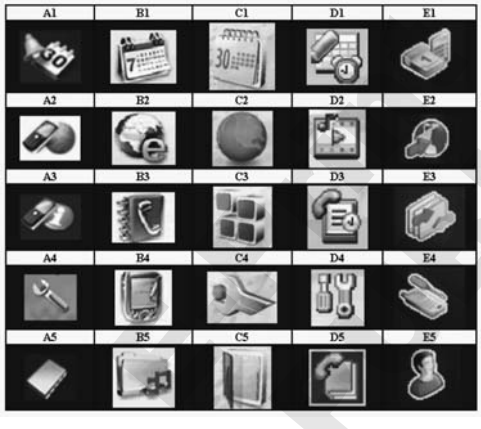


Figure 1
The icons used in the study organized in columns for each one of the brands: left to right, Sony-Ericsson (A), Samsung (B), Nokia (C), Motorola (D) and Vodafone (E).

Following Rogers' example (1989), we organized the selected icons into the following categories:

- Metaphoric – For example, icons a1, b1, c1, d1, e1 and d3 employ familiar real world objects. Also, icons a5, c5, b3 and d5 employ a book to refer to the address book.
- Paradigm of use – Icons a4, c4, d4 and e4 employ a tool to refer to the notion of fixing or changing the settings of the phone.
- Symbolic– Icons a2, b2, c2 and e2 employ an earth symbol to refer to the World Wide Web.
- Abstract – Icons a3, c3, e3, e2, d2, and b5 employ unfamiliar objects.

Notably, the resolution of mobile phone icons is (when compared to PC icons) rather low, because the displays of mobile phones had a low resolution at the time of the study. Moreover, the resolution of icons has been inconsistent among different phones, because the phones have different screens sizes and/or resolutions.

Measuring Instruments

Barr *et al* (2003) proposed an analytical approach, based on semiotics for the evaluation of icons. Although, semiotics might be beneficial for organizing icons into categories, they do not afford the quantitative comparison between alternatives sets of icons. In this work, we perform an empirical evaluation of icons between competing mobile phone makers.

We used an open-ended question to measure the comprehension of each icon (Lohse *et al*, 1994; Sorenson and Webb 1991). The answers to open-ended questions were coded in four levels of recognition: (1) right; (2) almost right, when the answer was very close to the real meaning, but did not include the right text label; (3) wrong and (4) no recognition, which we considered to be applicable to the worst kind of icon, the one that does not bring any correlation to the mind of the user. Users could write down up to three guesses about the meaning of a mobile phone icon. Finally, we employed a demographic questionnaire, in order to record basic information about the users.

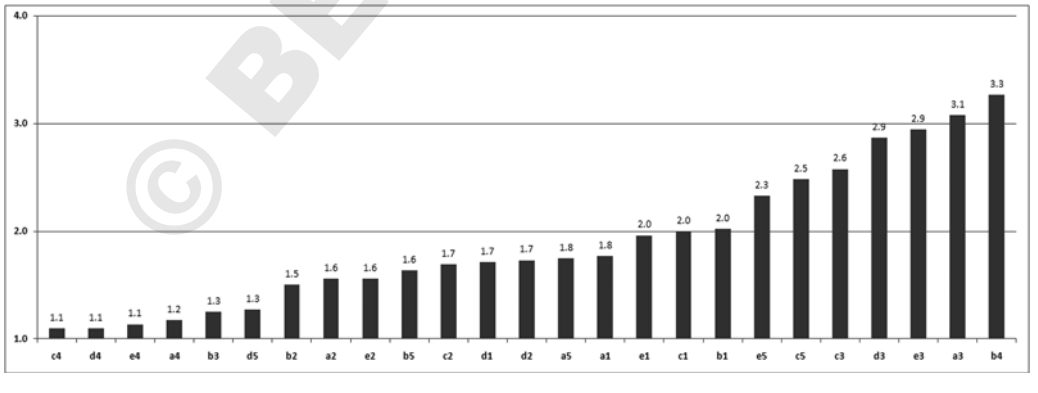
Procedure

The icons used in the study were presented one by one on a computer screen. The icons were displayed in a random order on the computer screen in full colour. Each icon was displayed without any text caption for approximately one minute (total study time was twenty-five minutes). The subjects were asked to complete a one-page A4 paper form, which had one question about the meaning of each icon (the icon was displayed in greyscale on the paper as well). In this way, recognition was measured with an open-ended questionnaire.

Results

We tested twenty-five icons on fifty-two participants and the results indicated a wide variability in the recognition of icons (see Appendix IV). Figure 2 portrays the average recognition for each one of the

Figure 2
Average recognition score for each icon (n=52) where the lowest score denotes the best performance. In brief, icons that scored more than 2.5 are not recognizable for the majority of test users.



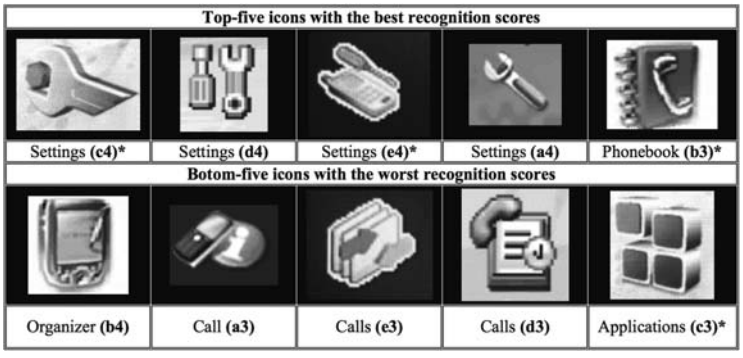


Figure 3
Top and bottom five icons (an asterisk denotes that the respective icon is significantly better/worse than a similar icon, as shown in Appendices I–III).

twenty-five icons. One denotes full recognition and four denotes no recognition, thus the lowest score denotes the best performance.

We also employed t-test (two tailed, paired) in Microsoft Excel to measure whether there is any significant difference between icons from competing manufacturers. According to the t-test tables (see Appendices I–III) there is a statistically significant difference for the highlighted pairs of icons, which account for 44% (16 out of 36) of the comparable pairs of icons. Therefore, we could claim that there are significant differences in the recognition of icons that represent the same functionality.

The 'Settings' icon was the clear winner in four out of the five handsets (Figure 3). The 'Calls log' icon was the most problematic in many handsets followed by icons that depict 'Applications' and 'Internet'.

Four out of the five icons between the two Motorola handsets (one with original icons and the other with Vodafone branded icons) depicted common functionality. It was found that the original manufacturer icons were, in all cases, at least as good as their replacements by the wireless operator. In two of the four cases, it was found that the differences were also statistically significant (meaning that the findings of the limited user test presented here, could be also held true for the respective user population), as depicted in Table 2.

Table 2 The icons provided by the wireless service operator performed worse than the original icons by the handset manufacturer.

	Motorola versus Vodafone			
Icon pairs	d1-e1	d3-e3	d4-e4	d5-e5
Two-tailed paired t-test (p<)	0,041119	0,684068	0,532307	0,000003

Table 2 portrays the t-test results between the original icons and those offered by Vodafone for a Motorola handset. In brief, every single icon in the modified Vodafone handset performed worse than the original provided by Motorola. Moreover, the difference was statistically significant in two out of the four icon pairs (highlighted).

Discussion

We found that in absolute terms, mobile phone icon performance is very problematic for such a popular interaction device. For example, icons a3, c3 and e3 had very low recognition rates, while b4 is obviously irrelevant for anyone who does not have experience with electronic organizers, such as 'Palm'. Those icons represent high-level abstract concepts (such as 'Calls log') that do not have an obvious real-world metaphor. In contrast, those icons that represent simple real-world objects or tasks had the highest recognition rates. For example, icons a4, c4, d4, e4 had very high recognition rates (all of them represent 'Settings').

It is notable that all four successful icons employed the same concept (a tool) to represent the functionality of phone settings. Therefore, standardization is indeed a great solution when everything else fails (Norman, 1990). The consistent tool metaphor seems to support learnability and familiarity when users switch between different mobile phones. Indeed, previous research on icons has emphasized that simple icons (those distinguished based on a few features) seem to help users, while complex icons are no better than simple rectangles (Byrne, 1993). Thus, the 'Settings' icon, which was depicted by a tool in all four phones, was the most recognized icon. Overall, the recorded differences are mostly due to a better selection of metaphors and symbols.

Although the lower than expected absolute performance (that is, very low average recognition rates) could be attributed to the particular experimental set-up (icons were shown on a large screen, one by one, and without any text labels), we also found significant differences between alternative icons for the same mobile phone feature. Therefore, there are icons that are much better than other icons for representing the same functionality. The absolute recognition performance of each icon might not be representative of real-world use (Ferreira *et al*, 2006), but we consider that the comparative results are trustworthy as long as the test sample (users and icons) match the real-world use.

It was surprising to find that some of the lowest rated icons belong to high-profile and very familiar handsets such as those made by Nokia and Sony-Ericsson. Actually, four of the ten icons (40%, n=10) belonging to those manufacturers had a rating of 'partial recognition' or worse (73% of the test users owned those phones, n=52). Although mobile handset manufacturers do not have the experience of established GUI developers, this issue could also be explained by a lack of proper methodological approaches, which

have been criticized as been rather intuitive than based on previous findings (Kjeldskov and Graham, 2003). Moreover, the absolute low scores could be explained by the lack of text labels. We expect that users perform much better in the real context of use.

This study had several limitations that might affect the actual performance of each icon. First, in realistic scenarios of use, icons appear on a small mobile phone display and not on a large computer display. Moreover, icons were evaluated individually, but in many cases they appear in groups on mobile phone displays. Second, the majority of mobile phone menus provide some kind of text description, in addition to the icons, which affects significantly the recognition performance (Haramundanis, 1996). Last, but not least, familiarity with a particular icon set might be the most important factor in the usability of icons (Goonetilleke *et al*, 2001). Nevertheless, the focus on this user study was on the comparative performance of icons between different handset manufacturers. In further research, it is suggested that a qualitative post-evaluation by experts could provide additional guidance in icon design for mobile phones.

We found that even popular and familiar handsets employ icons that had low recognition rates. In our sample, more than 80% (n=52) of the participants owned one of the mobile phone brands employed in the study. The rest of them owned other brands, such as Sharp, Siemens and Alcatel. Notably, more than 60% (n=52) of the users owned either Nokia or Sony-Ericsson phones. Thus, we expected that the respective icon sets would have a higher recognition rate. Although both Nokia and Sony-Ericsson icons had some highly recognizable icons (c4, c1, a5 and a4, for example), both brands also feature low recognition icons, such as c3 and a3. Therefore, despite familiarity with particular icons, there was limited comprehension of those icons in an unaided recognition test (that is, without a text label), which confirms results by previous studies for desktop icons (Egido and Patterson, 1988; Haramundanis, 1996).

Finally, although we did not focus the study on the effects of branding on recognition performance, we found evidence that supports a negative effect of branding on the usability, as depicted in the Motorola versus Vodafone case. Still further research is needed to validate this claim, as well as to provide a more elaborate framework for usability and branding. In particular, further research should examine the research question of typology of icon versus brand. An interesting research question would be whether we are going towards standardization, or could icons be used as a tool for design strategy differentiation and consequently unique brand positioning? For example, further research could examine whether competing brands are using a similar type of icon for a specific action/activity: if so, standardization prevails on differentiation.

Kim and Lee (2005) found that there are also differences in icon recognition between different cultures. Therefore, it is expected that the results of this study might differ both in absolute terms for each

icon, and also in comparative tests, if the study was repeated in the context of a different culture.

In summary, it was found that in contrast to the few sets of personal computer icons, the mobile phone icon sets were rather fragmented. Therefore, it is suggested that mobile phone icons are standardized in some way, at least with regard to those functions/objects that have become established (such as messaging, address book, calls log, mobile internet and so on). Nevertheless, there might not be as much motivation to standardize mobile phone icons, as there is in safety applications (Hancock *et al*, 2004). In the case that mobile phone icons are not standardized, then users might experience increased variation in performance across different handsets. Previous studies have indicated that if standardization is not possible, then the designers should at least make the icons as learnable as possible (Moyes and Jordan, 1993). Finally, it was found that besides the competition between the manufacturers of handsets there is additional fragmentation due to the branding of the user interface by network operators.

Conclusion

In this article, we have shown that despite widespread use and acceptance in diverse computing environments (for example, desktop, entertainment and so forth), there are still several issues in the design of icons.

One explanation for the reduced performance of icons might be the diversity of the available icon sets. In terms of mobile phone icon design, we could distinguish between three discrete generations. The first generation of mobile phones lacked graphics, so the menus were text based, without any icons. The second generation of mobile phone icons concerns those of the present study, which are rather fragmented (due to increased market competition), hence the increased differences in recognition performance between handsets. The third generation of mobile phone icons is based on operating systems developed by software companies. On the one hand, operating system providers might exploit previous knowledge on icon design, but, on the other hand, handset manufacturers have been rather reluctant to get locked into any of the many mobile operating system offers (such as multiple versions of Windows Mobile and Symbian, Google Android, Apple iPhone, Palm Pre). Therefore, icon sets might continue to be rather diverse in the mobile phone field.

Although there are a few popular operating systems on the desktop (for example, Windows, MacOS, Unix), there might not be so few in the case of mobile phones and they may have to coexist with simpler second-generation handsets for those users who prefer a no-frills handset (that is, voice and text only). Thus, the performance of icons will remain an issue during the third generation of mobile phone icons as well.

Although icons have a history of more than thirty years in research and practice (Dreyfuss, 1984; Modley, 1976), we found that there are significant differences in the performance of different offerings. In particular, in this study we found that:

- There were significant differences in the recognition of alternative/competitive mobile phone icons that represent the same action/object.
- Icons branded by the wireless service operator had significantly reduced recognition performance, when compared to the originals provided by the handset manufacturer.
- The absolute performance of images without text labels was very low.
- The best recognition performance was recorded for simple icons that represent concrete actions/objects (for example, contacts, settings and so forth) and the worst performance by abstract icons that represent broad meanings (internet and applications, for example).
- The majority of our test users have not been loyal to a single brand, thus mobile phone icons might need to be standardized, to ensure early familiarity, when users switch brands.

We plan to continue this line of work with studies on different types of mobile phone icons and user interfaces modalities. For example, we plan to repeat the study for the icons found in mobile phone operating systems (such as Apple iPhone, Windows Mobile, Google Android, Palm Pre). Those icons are expected to perform better, because they have been created by the respective experienced GUI developers. Moreover, we would like to evaluate the differences between two-dimensional, three-dimensional and animated mobile phone icons (Baecker *et al*, 1991). In addition, we would like to compare user preferences between different mobile phone user interface modalities, such as icons, voice and gestures. Finally, it is suggested that a similar study takes place across cultures (by using participants from a variety of cultural backgrounds), as well as across time. For example, is a certain brand really improving icons over time? Or, are handset brands changing icons just for the sake of change (style trends), which is very evident in most consumer products?

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Acknowledgements
This study was partially supported by the European Commission Marie Curie Fellowship programme (MC-ERG-2008-230894). We are also grateful to the participants of the study and to the anonymous reviewers for their many constructive comments.

Appendix I Sony-Ericsson icons

	Sony-Ericsson														
Icon pairs	a1-b1	a1-c1	a1-d1	a1-e1	a2-b2	a2-c2	a2-e2	a3-d3	a3-e3	a4-c4	a4-d4	a4-e4	a5-b3	a5-c5	a5-d5	a5-e5
Two-tailed paired t-test (p<)	0.010923	0.009142	0.496619	0.141941	0.763933	0.417921	1.000000	0.200867	0.473274	0.159305	0.289414	0.687205	0.000565	0.001097	0.003886	0.019872

Appendix II Samsung icons

	Samsung							
Icon pairs	b1-c1	b1-d1	b1-e1	b2-c2	b2-e2	b3-c5	b3-d5	b3-e5
Two tailed paired t-test (p<)	0.811039	0.001129	0.672493	0.228712	0.717781	0.000000	0.048793	0.000002

Appendix III Nokia and Motorola icons

	Nokia								**Motorola**			
Icon pairs	c1-d1	c1-e1	c2-e2	c3-e1	c4-d4	c4-e4	c5-d5	c5-e5	d1-e1	d3-e3	d4-e4	d5-e5
Two-tailed paired t-test (p<)	0.000640	0.718785	0.350192	0.004605	1.000000	0.000000	0.000000	0.553881	0.041119	0.684068	0.532307	0.000003

Appendix IV Summary table with number of answers for each level of recognition (full, partial, wrong, no recognition)

a1	a2	a3	a4	a5	b1	b2	b3	b4	b5	c1	c2	c3	c4	c5	d1	d2	d3	d4	d5	e1	e2	e3	e4	e5	Recognition
13	41	7	47	35	3	42	45	5	25	2	39	21	49	23	17	22	7	49	44	13	42	12	49	26	**full**
38	0	1	2	0	46	1	3	0	22	49	1	1	2	1	33	24	4	2	3	33	0	0	1	0	**partial**
1	4	25	2	12	2	2	2	23	4	0	1	9	0	8	2	4	30	0	4	1	1	19	0	9	**wrong**
0	7	19	1	5	1	7	2	24	1	1	11	21	1	20	0	2	11	1	1	5	9	21	2	17	**nothing**