Exploring Age Differences in the Initial Usability of Mobile Device Icons

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ABSTRACT
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INTRODUCTION
Mobile computer devices such as cell phones, digital music players, and personal digital assistants are becoming increasingly pervasive around the world. However, seniors (age 65+) are not adopting these technologies as quickly; for example, in the US at the end of 2003, 37% of seniors (compared to 65% of adults aged 18-49) reported having a cell phone they could use [2]. This lack of adoption may be due to usability issues that older people experience with particular aspects of mobile device interfaces [12]. Although the literature reports much emerging work on improving various parts of the mobile device interface (e.g., [9, 15, 17]), little research has looked at whether older adults have problems using existing device icons. To address this, we looked at the initial usability of existing mobile device icons – specifically those on smart phones, handheld computers and personal digital assistants (PDA) – to see whether seniors experience more or different icon usability issues than younger adults. If seniors did in fact have problems with existing icons, we were interested in understanding which icon characteristics helped or hindered usability.

Graphical computer icons are often used in mobile device interfaces because icons can convey much information in a small area, is not language specific, and can be remembered much more easily than text labels [*need ref*]. Icons have many characteristics, determined by the icon designer, that may affect its usability. One notable characteristic is concreteness, which is how much the objects displayed in the icon resemble objects in the real-world. Another one is how closely (in terms of semantic distance) the icon object is associated with the intended meaning. In addition, icons are often used in conjunction with text labels, which can be used to help learn the intended icon meaning.

We conducted two studies to examine how well seniors could interpret existing mobile device icons. First, a qualitative exploratory study was used to ground our understanding of mobile device icon usability problems across different age groups. A follow-up experimental study was conducted to look at the effects of age, and various icon characteristics (concreteness, semantic distance, and labels; see Table 1 for definitions) on mobile device icon usability. Three measures were used to access icon usability: icon object identification accuracy, icon meaning interpretation accuracy, and interpretation confidence.

The primary contributions of the work reported in this paper are our experimental results and implications for designing easier-to-use mobile device icons. Through our studies, we have found that mobile device icons are indeed harder for seniors to use, and that both the semantic distance between icon object and meaning, and the presence of a label have a significant effect on icon usability. These findings are intended to help icon designers to better understand how design decisions affect icon usability for older adults.

BACKGROUND

Factors Influencing Icon Usability

A comprehensive list of icon characteristics has been identified in the literature. At a high-level, icons can be separated into three interrelated components: 1) the icon, which displays 2) one or many objects, which is associated with 3) a particular meaning [13]. When processing icons, particularly for the first time, "the user must discover what is depicted on the icon and then link that representation to the corresponding command" [7] p. 408 (see Figure 1). Many icon characteristics are related to the way icon objects are visually presented, or the objects' association to the icon meaning (see Table 1 for list and definitions).

In addition to icon-related characteristics, the interpretation of an icon's meaning is also influenced by user-related characteristics and the context in which the icon is found [8]. The user's interpretation of the icon object is influenced by the user's culture and familiarity with the icon and metaphors used in the icon. The context for mobile device icons includes the mobile device capabilities, task, and software application interface.

Animation An icons can be either static (one still image) or animated (a series of images that are shown in sequence and can simulate movement or visual change)
Concreteness refers to how closely an icon depicts real world objects, places or people [11]. Abstract icons "represent information using graphic features such as shapes, arrows, and so on" [10]
Distinctiveness refers to how much an icon stands out visually from surrounding icons
Label An icon can be labelled with a word of phrase
Perceptual Organization refers to the degree that an icon is placed in spatial proximity to other icons with similar functions
Semantic Distance (a.k.a. articulatory distance) refers to the *closeness of the relationship* between the objects or concepts depicted in the graphic and the function being represented [10].
Visual Complexity refers to the amount of visual detail or intricacy (eg lines, shading) in the icon.

Table 1. Icon Characteristics and Their Definitions.

Related Work

To our knowledge little has been reported on designing icons for older adults. Many icon design guides have been published, but suggested guidelines generally do not target seniors.

There has been some past work that has examined the effect of various icon characteristics on icon usability, such as animation [1], spacing and size [16], and distinctiveness [11]. More closely related to our work, McDougall et al. [11] investigated the effects of icon concreteness and visual complexity on tasks involving visual search and matching icons with labels. The icons used in this study were taken from a corpus of 239 icons that had been rated on a number of icon characteristics [10]. These icons included graphics from road signs and electronic symbols, as well as computer icons. Participants were recruited from the local university. McDougall et al. found that participants, upon first use, did worse on the tasks with abstract icons than concrete, and the researchers suggested that "concrete icons are likely to be most useful when icon learning needs to occur quickly or instantly" [11] p. 304 (i.e., initial use).

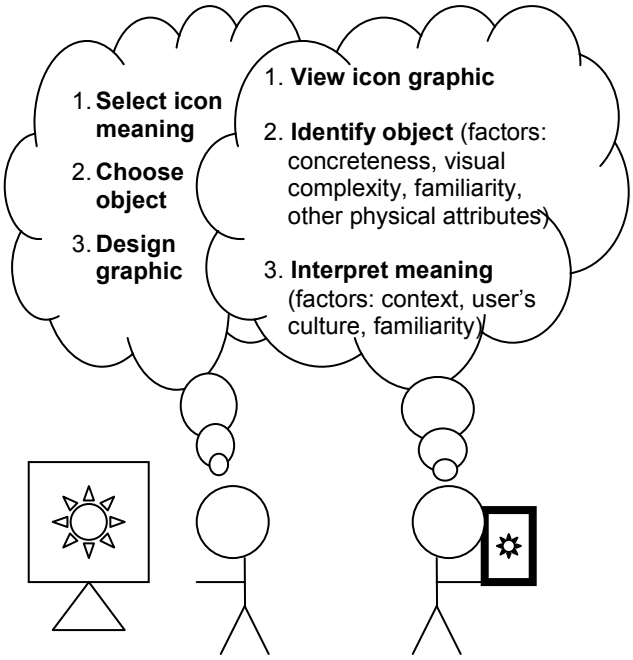

Figure 1. Icon Design and Interpretation Process (*draft figure – needs revision)*

There has also been some work on looking at the effect of labels on initial icon usability. Wiedenbeck [14] conducted an experimental study where 60 undergraduate students with little computer experience were asked to operate a desktop email program using buttons that had icons, labels, or a redundant combination of icons and labels. Usability was measured by correctness of the tasks performed, time to perform tasks, and number of times the help facility was accessed. It was found that participants performed better with text labels than icons during initial use. Participants performed similarly with labelled icons and labels alone on each of the three usability measures, but significantly better than with icons alone. Further, participants reported finding the labelled icons the most easy to use.

We sought to build on these two studies by looking at how semantic distance, as well as concreteness and labels, affect icon usability, particularly for seniors. Further, we extend this research by looking at icon usability in a mobile device context.

Although there has been much emerging work on designing computer interfaces for older users (e.g., [3, 5, 6]), little work has looked specifically at computer icon usability. There are many characteristics of senior users that can

affect usability of icons, as well as other aspects of computer interfaces, and they can be grouped into two categories: age-related decline in ability, and generational-related lack of experience with similar user interfaces[4]. Abilities that often decline to some degree with age include visual abilities, memory abilities and learning abilities. Although we did not explore the effects of these different user characteristics on icon usability, we were conscious of them so that we could control these characteristics as much as possible in our two studies.

QUALITATIVE EXPLORATORY STUDY

To ground our understanding of what affects older people's use of mobile device icons and related usability problems We specifically sought to identify which icons were harder for older people to use based on i) first impression accuracy of identifying icon objects and interpreting icon meaning, and ii) performance on tasks that required searching for and selecting icons

Methods

Ten participants from three age groups (20s, 60s, and 70s) were recruited. Those in their 20s were recruited at a local university, outside the computer science department. The other participants were recruited from a local seniors centre. Participants were pre-screened; all reported good or corrected vision, some but not extensive computer experience, some basic cell phone experience, and very little experience with more advanced mobile devices.

Icons for the study were selected from two commercial mobile devices – the HP iPaq rx3715 and the Palm Treo 650 – to form one icon set per device. Specifically, icons associated with the same functions were chosen from each device (e.g., icon to start the camera program, icon to start slideshow on image viewer program). The icons were characterized (by 4 independent raters and the first author) using 4 icon characteristics: concreteness, perceptual organization, semantic distance, and visual complexity.

The study session consisted of three parts. Participants were first asked to look at the icons from both sets, one after the other, to identify the objects they saw in the icon and interpret the icon meaning. The screenshots of the icons were enlarged (to ensure that they were visible to all participants) and were displayed without labels on a laptop. Participants were then asked to complete a series of tasks on each device, which consisted of finding icons in a particular application (e.g., camera program) for given functions (e.g., "find the icon for help"). Finally, participants were shown pairs of icons for a particular function and were asked to choose the one that they found most usable and explain why. Study sessions took, on average, 1 hour for those in their 20s and almost 2 hours for the other participants.

Results

We found that our participants over 60 years old were indeed less accurate than those in their 20s in identifying icon objects and interpreting icon meanings. Our older participants also made more task errors.

When given a pair of icons for the same function, participants reported a number of different icon characteristics that influenced why they preferred one particular icon over another. Their comments were transcribed, coded, and totalled by icon characteristics to see which characteristics seemed to most help or hinder their usability. Participants made many comments that concrete, semantically close, and familiar icons helped usability. They also commented often that both abstract and semantically far icons hindered usability. Other icon characteristics, such as visual complexity, being grouped with similar icons, and being annotated with misleading text labels, were also mentioned a few times to affect icon usability.

Given this evidence that suggests older people indeed have a harder time using existing mobile device icons, we sought to move forward with an experimental study with a larger sample size and more icons to validate this claim. We also sought to better understand the effect of icon characteristics that appeared to most affect icon usability for older people.

EXPERIMENTAL STUDY

Based on the findings of the qualitative exploratory study, we sought to understand through an experiment how much certain icon characteristics affected icon usability for older users.

Specifically, we sought to test the following *hypotheses*:

1. Older people would find existing mobile device icons less usable than younger people;
2. Older people would find abstract icons significantly harder to use than younger people;
3. Older people would find icons with semantically far meanings significantly harder to use than younger people; and,
4. Older participants would find unlabelled icons significantly harder to use than younger people.

To assess icon usability, we used three metrics:

- Accuracy in identifying objects in icons;
- Accuracy in interpreting the meaning of the icon; and,
- Confidence in the interpretation when the meaning was correctly interpreted (referred to hereafter as simply *Interpretation Confidence*)

Methods

Experimental Design

The experimental design included the following *independent variables*:

- Age Group (2 levels: 20-39, 65+; between subjects (b/s))
- Icon-Label Condition (3 levels: icon-only, icon with label, label-only; within subjects (w/s))
- Icon Concreteness (2 levels: concrete, abstract; w/s)

- Icon Semantic Distance (2 levels: close, far; w/s)
- Icon-Label Order (counter-balanced: 6 levels; control variable; b/s)
- Icon Set Order (latin-square: 3 levels; control variable; b/s)

Given the 6 icon-label condition orders and 3 icon set orders, 18 participants were required for each age group. Data was collected, 1 score per icon/label, for the following dependent variables:

- Icon/label Familiarity (values: 1 to 10)
- Accuracy in identifying icon object(s) (values: 0 or 1; no scores for the label-only condition)
- Accuracy in interpreting icon/label meaning (values: 0 or 1)
- Confidence in interpreting icon/label meaning (scale of 1-4)

Participants

Two groups of eighteen participants, 20-39 years old and over 65 years old, were recruited (referred hereafter as our *younger* and *older participants*). Participants were recruited through advertisements placed in a free local newspaper and online classifieds. Interested potential participants were pre-screened over the phone for some computer experience (e.g., regularly used the computer, experience with internet browsers, email, word processing), functional eyesight, no colour blindness, and fluent in English. Interested participants were also screened for very little or no experience with advanced mobile devices, such as smart phones and handheld computers, as we wanted our participants to be unfamiliar with the icons that would be presented to them in the study. To confirm participants' statements, eyesight and verbal fluency were tested at the study session using a reduced Snellen eye test and FAS test respectively.

Materials

Three sets of 20 icons were produced for the study. Icons were selected from 149 existing mobile device icons (Sony Ericsson W610i, W850i Blackberry 7730, Nokia N95, HP iPaq rx3715, Palm Treo 650, Apple iPhone). Three independent raters characterized the concreteness and semantic distance of each of the 149 icons, according to the definitions in Table 1. Using these characterizations, the same distribution of concrete+semantically-close (CC), abstract+semantically-close (AC), concrete+semantically-far (CF), and abstract+semantically-far (AF) icons was selected for each of the sets (see Figure 2; one data point represents one or more icons). In the end, 6xCC, 4xAC, 4xCF, and 6xAF icons for each set were chosen (there were fewer choices for icons that could be categorized as either CF or AC). In addition, for each set of 20 icons, 15 were from a list/menu (e.g., list of programs that could be launched from the main menu; see Figure 3) and 5 were icons from an application interface (i.e., icons on buttons to operate an application; see Figure 5).

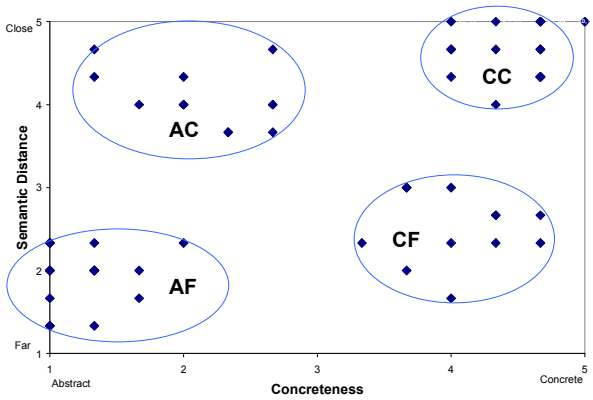

Figure 2. Average Concreteness and Semantic Distance Ratings for Icon Set Icons

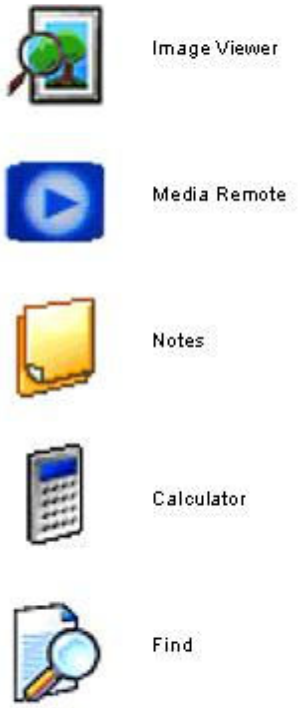

Figure 3. Icons for Programs that can Run on the HP iPaq rx3715

Figure 4. Icons that Operate the HP iPaq rx3715 Camera Program

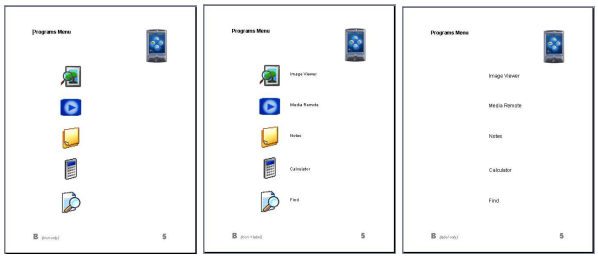

Figure 5. Example Pages for Icon-Only Condition (left), Icon-Label (centre), and Label-Only Condition (right)

Existing labels were used unless it was a product name (e.g., HP Image Zone, Quickoffice) or was abbreviated (e.g., Prefs); 5 labels out of 60 were revised with more generic, unabbreviated words (e.g., Image Viewer, Document Editor, Preferences).

Images of the icons were taken from screenshots. Most icons were enlarged to 1"x1" (300dpi) and smaller icons were enlarged to 0.5" x 0.5" (300dpi). Icons were presented to users on paper in colour.

Icons were grouped by mobile device brand and by menu/list/application, and there were 6 pages of icons per icon set. Pages were created for each of the 3 icon-label conditions (e.g., see Figure 5). The 6 icon set pages were randomly ordered for each session.

Procedures

All study sessions took place in a usability lab on the university campus. After giving consent, some time was spent to familiarize participants with the capabilities of existing mobile devices. They were asked to list the ones that they knew of and then the experimenter briefly presented other existing capabilities. Participants were also given a reference sheet listing general capabilities of mobile devices that they could use if desired.

For the rest of the study session, participants were shown the three sets of icons and were asked a series of questions for each icon/label that was presented (60 total). Icons were shown in three blocks, one block per icon set paired with a different icon-label condition.

For each icon or icon with label, participants were asked:

- To identify the *icon objects* ("What is shown in the icon?");
- To interpret the icon's *function* ("How might the icon be used?" or "What would happen if you 'clicked' on the icon?);
- About how *familiar* they were with the icon ("Have you seen this particular icon before? If so, have you used this icon before?"); and,
- About their *confidence* in their interpretation ("How sure are you of the icon's function?").

For each label shown without an icon, participants were asked:

- To describe the label's *function*;
- About how *familiar* they were with the label ("Have you seen and used this exact label before, say on a computer, mobile device, etc.?"); and,
- About their *confidence* in their interpretation ("How sure are you of the label's function?").

The experimenter used participants' responses to the above questions to assess whether the icon object(s) were correctly identified, and whether the icon meaning was correctly interpreted. The experimenter focused more on the expressed concepts and ideas, rather than whether or not the right technical words or phrases were used. Participants' responses about whether they had previously seen and used particular icons or labels were converted to a familiarity score between 1 and 10. Care was taken to not let the participant know whether or not they gave the "right" answer.

For abstract icons, participants needed to identify the objects or concepts behind the abstract shapes and graphical features and not just describe the shapes themselves. For example, the visual element (i.e., object) in the Calendar program's "Day View" icon represents one day and not just 1 dot (see Figure 6).

Figure 6. Example of Abstract Icons Used in Study. The Icon for "Day View" is on the Far Left

Results

To test our hypotheses, an ANOVA was conducted on each of our three dependent usability measure variables. We ran a 2 icon-label condition (no label-only scores) x 2 concreteness (CC) x 2 semantic distance (SD) x 2 age groups ANOVA on our mean icon object identification accuracy scores. We also ran a 3 icon-label condition x 2 CC x 2 SD x 2 age groups ANOVA on both our mean icon interpretation accuracy scores and mean interpretation confidence scores for icons. Post-hoc pairwise comparisons,

using Bonferroni correction to protect against Type I error, were used to find significant differences in statistically significant interactions. Along with statistical significance, we report partial eta-squared (η^2), a measure of effect size, which is often more informative than statistical significance in applied human-computer interaction research [*to be filled in*]. To interpret this value, 0.01, 0.06, and 0.14 can be considered a small, medium, and large effect size, respectively [*to be filled in*].

Effect of Familiarity

We attempted to control and minimize participants' familiarity with the icons presented in the experimental study, as our study focused on initial usability. An ANOVA was conducted on the self-reported familiarity scores and our younger participants had significantly higher scores (4.8 out of 10) than our older ones (2.6 out of 10) ($F(1,34) = 21.5$, $p<0.001$, $\eta^2=0.39$). Because of this difference, we looked at how much influence familiarity had on our dependent measure scores (i.e., correlation). Although we found that familiarity did in fact have some significant correlations with each of our three usability measures, the amount of variance in our scores that can be attributed to familiarity (r^2) was under 18% for all dependent measure scores (see Table 2). We then took our scores and controlled for the effect of familiarity (i.e., co-varied familiarity to produce residual scores), ran our ANOVAs on the new scores, and found that most significant effects were still present after controlling on familiarity, except where noted.

	r	*r²*	*p*
Identification	.27	.08	<.001
Interpretation	.42	.18	<.001
Confidence	.37	.14	<.001

Table 2. Correlation Between Perceived Familiarity and Icon Usability Measures, r (Pearson Correlation) and r^2

Overall Usability – Hyp. 1

In general, our older participants were significantly less accurate than our younger participants in identifying icon objects, and interpreting icon meanings (see Table 3 for mean scores). However, there was no significant difference in overall interpretation confidence scores between the two age groups.

	Mean Scores (Std Error)				
	20-39	***65+***	$F_{(1,34)}$	*p*	η^2
Identification	91% (1.6%)	79% (1.6%)	30.7	<.001	.47
Interpretation	76% (1.9%)	62% (1.9%)	30.1	<.001	.47
Confidence	3.14 (0.083)	3.02 (0.083)	.852	.36	.02

Table 3. Mean and Standard Error Scores for Dependent Usability Measures

Effect of Concreteness and Semantic Distance – Hyp. 2 & 3

In general, semantically far icons led to worse scores on all three of the usability measures.

Identification: A significant interaction was found between the effects of age group, icon concreteness and semantic distance on icon object identification accuracy ($F_{(1,34)}=4.22$, $p=.048$, $\eta^2=0.11$; see Table 4 for mean scores). Participants performed significantly worse with abstract icons compared to concrete icons, and icons with semantically close (SF) meanings compared to those with semantically far (SC) meanings. Further, both groups of participants performed significantly worse with abstract icons with semantically far meanings, and this effect was significantly larger with older participants (see Figure 7).

Interpretation: For icon interpretation accuracy, a significant interaction was found between the effects of age group and semantic distance ($F_{(1,34)}=9.34$, $p=.004$, $\eta^2=0.22$; see Table 4 for mean scores). Both groups of participants performed significantly worse with semantically far icons but older participants were significantly worse than the younger participants. A *marginal* interaction was found between the effects of age group and concreteness ($F_{(1,34)}=2.94$, $p=.096$, $\eta^2=0.08$); our younger participants performed slightly better with abstract icons and older participants performed slightly better with concrete icons.

Confidence: A significant interaction was also found between the effects of age group, icon concreteness and semantic distance on interpretation confidence ($F_{(1,34)}=5.20$, $p=.029$, $\eta^2=0.133$; see Table 4 for mean scores). Participants' perceived interpretation confidence was significantly lower for semantically far icons. Further, younger participants reported being less confident with semantically far abstract icons than with concrete ones (see Figure 7).

	Mean Scores (Std Error)			
	20-39		***65+***	
	SD: Close	SD: Far	SD: Close	SD: Far
Identification				
CC:Concrete	93% (2.2%)	88% (2.2%)	94% (2.7%)	87% (2.7%)
CC:Abstract	97% (1.9%)	87% (1.9%)	81% (3.5%)	53% (3.5%)
Interpretation				
	88% (1.6%)	64% (2.9%)	80% (1.6%)	44% (2.9%)
Confidence				
CC:Concrete	3.5 (.09)	3.0 (.11)	3.2 (.09)	2.7 (.11)
CC:Abstract	3.4 (.09)	2.7 (.11)	3.2 (.09)	2.9 (.11)

Table 4. Mean and Standard Error Scores for Dependent Usability Measures

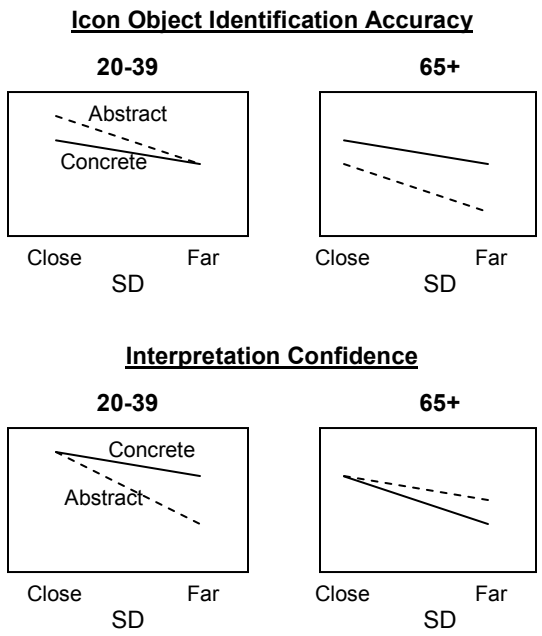

Figure 7. Statistical Interactions Between Age Groups, Semantic Distance and Concreteness (*graphs needs revision)*

Effect of Labels – Hyp. 4

As expected, the presence of labels improved both groups of participants' scores on all three usability measures. More specifically, scores associated with icons with out labels were generally worse than scores associated with labeled icons and labels alone.

Identification: A *marginal* interaction between the effects of age group and icon-label condition was found on icon object identification accuracy ($F_{(1,34)}$=3.82, p=.059, η^2=0.10; see Table 5 for mean scores); older participants were somewhat more accurate with labels than without.

Interpretation: A significant interaction was found between the effects of age group, icon-label condition, and semantic distance ($F_{(1,34)}$=4.53, p=.014, η^2=0.12); however this interaction was not significant when familiarity was controlled ($F_{(1,34)}$=1.37, p=.26, η^2=0.04).

Confidence: A significant interaction was found between the effects of all four factors (i.e., age group, icon-label condition, semantic distance, concreteness) on interpretation confidence ($F_{(1,34)}$=6.09, p=.005, η^2=0.15). **How should I describe this hairy and possibly non-interesting four-way interaction??**

	Mean Scores (Std Error)	
	20-39	***65+***
Icon-only	87% (2.8%)	71% (2.8%)
Icon-Label	95% (1.3%)	87% (1.3%)

Table 5. Mean and Standard Error Scores for Dependent Usability Measures

Limitations

A ceiling effect on younger participants' scores was observed in many experimental conditions where participants identified or interpreted 100% of the icons correctly. Thus, our results may hide some of the differences between scores of different conditions, and possible effects that might exist if the icons were harder to interpret. Our older participants' scores rarely reached the ceiling.

DISCUSSION

Existing icons are harder for older people to use initially

We found evidence in both studies that older people did in fact have more difficulty correctly identifying and interpreting existing icons, even though icon usability issues appear to be similar for both young and old. Based on our findings, similar guidelines for designing icons appear to be applicable for both young and older groups, but a poorly designed icon may be much harder for an older person to use while a younger person may be able to "get by"

Effect of Concreteness

Our results show a smaller effect of concreteness on icon usability than expected. As mentioned earlier, McDougall et al.'s [11] found that concrete icons lead to higher accuracy and response times in their search and select task, and were suggested to be more useful for initial usability and novice users. Based on this finding, we hypothesized that concrete icons would be easier to use. However, we found that participants sometimes performed better with abstract icons.

Our differing results may be due to the fact that even though our abstract icons did not include representations of real-world objects, they often referred to symbols commonly used in the real-world, such as +,-,*, musical notes,✕,?. McDougall et al. [11] had similar symbols in their icons, which were classified as being more concrete than abstract. About half of the Abstract and SC icons had symbols commonly used in the real-world, while only 1-2 of the abstract and semantically far icons had commonly used symbols.

Looking at the abstract icons, we noticed that some incorporated commonly used symbols and visual cues (eg X for closing a window/program, bullets and lines to represent file details), whereas some used less commonly used graphical elements (especially those related to a specific brand). Incorporating symbols and graphical elements that are familiar to a population would have a large effect on icon usability for these people. Another difference is that the icons in our study were interpreted in context of a mobile device and task. These symbols often have very precise meanings, which make them easier to interpret.

Familiarity and context may have a stronger effect on usability than concreteness

Effect of Semantic Distance

We have found a large effect of semantic distance on icon usability. Many factors influence semantic distance from the icon object to the icon meaning, such as the choice of object, and familiarity of the metaphor.

We have observed in our two studies that familiarity with the metaphor used in the icon often plays a large in icon usability. When designing icons for seniors, who likely has had less exposure to commonly used computer metaphors (eg floppy disk for saving, wrench for device settings), we suggest using familiar everyday metaphors.

Some may argue that lack of experience with commonly-used computer metaphors is a generational issue that will not apply to the younger generation who currently have relatively more computer experience. However, one could argue that as future generations become seniors they will still have less exposure to commonly used computer metaphors at the time because computer metaphors evolve continually and these adults who are no longer part of the work force generally have less need to keep up to date and are exposed less to new computer technology.

Effect of Labels

We have found that labels greatly help both young and old to initially use icons. Labels may be of greater benefit to the older people population because they are likely to have less computer experience and find icons to be less familiar. The usability of icons with labels was similar to the usability of labels alone. Although one could argue to use labels alone, without icons, the icon's ability to support recognition over recall makes it valuable for use over time. This is inline with findings reported in [14].

Labels help people to use new icons and to learn its meaning. Although mobile devices have limited screen real estate, labels are valuable in initial usability and should be given some priority at least during initial use. Further, it is important to provide informative labels using words and phrases with which users will be familiar. Produce names, unless familiar, should be avoided.

Effect of Familiarity

Although we focused on initial usability where the user is unfamiliar with a particular set of icons, we did observe in our studies that familiarity does indeed affect icon usability. There are many aspects of the icon in which the user can be familiar, such as the icon itself and the label if present. The familiarity with the capabilities of the technology also influences what features the user imagines might match best with a particular icon. Further, the familiarity with common-used computer or mobile device icons could greatly influence the usability of an icon, even if user has never seen this particular icon before. For example, many of our older participants were puzzled by the use of a wrench image to be associated with options.

Why Seniors Have More Usability Issues with Icons

Concreteness is more important to older people; abstract harder to remember

Memory…

IMPLICATIONS FOR DESIGN

We have found through our studies that existing icons are much less usable for seniors than younger adults. Thus, there is a great need to design better icons if seniors are expected to use that technology on which the icons reside. Based on our findings, we suggest a number of guidelines for designing easier to use icons for seniors, which should apply to younger users as well:

- Provide good labels where possible
- Choose concrete objects or use familiar symbols
- Choose icon objects semantically close to meaning
- Ensure that users are familiar with metaphors
- Teach unfamiliar metaphors

CONCLUSIONS AND FUTURE WORK

Conclusions…..

Now that we have explored the initial usability of mobile device icons for seniors, we plan to explore icon usability of these icons over many exposures. We are interested in studying the effects of icon concreteness and semantic distance on longer-term usability. McDougall et al. [11] found that abstract icons tended to become as usable as concrete icons for their participants who were in their 20s. We are interested in seeing whether this happens with seniors as well.

We are also interested in understanding how much text labels help icon usability over many exposures. If older people, as well as younger people relied less on icon text labels over time, the labels could be removed without significantly affecting usability allowing more screen real estate for other interface elements. However, there may be age differences in text label reliance.

Further, it would be interesting to investigate how the placement of text labels affects icon usability. Mobile devices have limited screen real estate and labeling all icons may not feasible. Many text label placement techniques

have been proposed (e.g., all labels shown all the time, tool-tips, dedicated label area where one label can be shown at a time) and we are interested in knowing how they affect icon usability for seniors.

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CONTRIBUTION AND BENEFITS STATEMENT

Results and implications for design from an experimental study looking at effects of age and icon characteristics (i.e., concreteness, semantic distance, labels) on the usability of existing mobile device icons.