Factor determining functional perception on technology-driven product design: a case study on mobile phone for the elderly

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Abstract

Distinctive human attribute such as age, sex, and cultural background posed much of the problems in the understanding of graphic representation. This research attempts to use pictorial icon in cell phone as a case study to reveal the age and cultural bias between age groups. Most of them are able to operate only the basic features. The study thus has an ultimate goal to discover an universally representation of iconic symbol, which would help enhance the learning ability of senior group in particular, and to improve the usage of other technological oriented appliances in general. Study in three features-complexity of iconic, the visual limitation of the aged, and the interpretation of iconic symbols. The first issue deals with the capability to learn new technology and the recollection. Next, deals with graphic icon visible format -simple, detailed and textual which include size and color. The final issue deals with the 2D/3D format, realistic/symbolic, and with/without textual display. The research found that respondents are proved to be equally able to learn complicated level as younger users. With reading glasses, they are able to visualize and understand simple icons as small as 5-10 mm. Complicated as 30 mm. Graphical icons with textual as 10-15 mm. Bright color for simple icon, cooler tone is for complicated ones. 2D is for familiar objects while 3D and realistic for unfamiliar ones. Textual representation could enhance the understanding of representation as well.

Keywords: Technology-driven, elderly, perception.

1. Introduction

Universal design is known as design which accommodates not only the able-bodied but also those who are impaired. Impairment is, however, not limited to only physical, but also includes the mental and conceptuality of the disabled. Aging is the stage of life when deterioration, physically and cognitively, bars the individual’s modern daily activities substantially. Modern technology, for instance, requires some intuition on the users’ side to self-taught the way to operate those gadgets themselves. Modern technology is also modern-culture centric in nature, comprehension can hardly occur without extensive exposure to modern lifestyle.
2. Statement of the Problems

The aforementioned situation makes universal design for the elderly more a complicated milieu than a normal design to accommodate ordinary functions. This research looks at the problems of universal design for the elderly with aging disability, both visually and mentally, using cell phone icon as a case study. Since cell phone icon operates as an interface, a medium for interaction, between cell phone users and the device.

3. Objectives of the Study

The objectives of the research are three folds:

1. To study the factors governing the extent of representational functions the graphical icon design on cell phone is able to perform.
2. To investigate, under the cultural and experiential facet, the factors governing the ability of the elderly to correctly interpret the graphical symbols which meant to indicate the functions of the cell phone.
3. To derive a set of design guidelines toward a universally design to accommodate the senior citizen’s readability and comprehension of the iconic graphic of cell phone.

4. Theoretical Background

The study bases its framework on three lines of thoughts. First, a cognitive stimuli and rationally responsive reaction line of theories are review to derive the assumption regarding the comprehension of graphical representation. Second, a pictorial simplification design principle of graphical representation is review to derive the graphical component of iconic graphic for cell phone—such as level of simplicity, size, and textual components.

![Figure 1 Conceptual Framework of the study](image-url)
5. Research Procedure

To derive the number and types of cell phone functions frequently used by the aged, the research first utilizes a structured questionnaire survey to explore the potential range of graphical symbol usage in cell phone for the aged.

Reviewing of literature regarding principles of graphical design and the senior citizens' cognitive process to derive measurement relevant to the designs for the elderly.

Generation of research tools: A set of pictorial stimulus is generated to solicit response from respondents.

Experimentation: The generated research tools were tested with a group of 50 subjects, by means of a multi-stage sampling. Responses were recorded for further statistical analysis.

Data from the experiment are complied and analyzed by means of the statistical package to derive the associative level among variables, i.e., between the level of comprehension and the graphical design features, to obtain a final recommendation regarding graphical design features suitable for the aging. A modeling for research design procedure is also synthesized and assessed (reported elsewhere) to learn an appropriate research methodology for universal design.

Figure 2 Research procedure
5.1 Research Instrument

The instrument that uses in this research can divided into 4 parts as follow:

<table>
<thead>
<tr>
<th>Part II Testing of readability on icon size</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mm, 10 mm, 15 mm, 20 mm, 25 mm, 30 mm</td>
</tr>
<tr>
<td>Plain Style</td>
</tr>
<tr>
<td>Detailed style</td>
</tr>
<tr>
<td>Letter style</td>
</tr>
</tbody>
</table>

**The Icon Size Illustrations**

<table>
<thead>
<tr>
<th>Simplistic</th>
<th>Complex</th>
<th>Textural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Part III The level of complexity in menu assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

Five levels of menu complexity to the tested via compute box experimentation:

- **Level I**
  - Menu

- **Level II**
  - Telephone Directory
  - Messages

- **Level III**
  - Search
  - Add new
  - Write messages
  - Inbox

- **Level IV**
  - Edit
  - Add to SIM
  - Add to telephone memory
  - Write
  - Delete messages
  - View

- **Level V**
  - View name
  - Edit
  - Send
  - Save
  - Delete, Save, Reply

**Part IV Graphic icon elements**

1.3 Matching pictures with functionalities by filling numbers into the box next to the pictures

![Figure 3 Research instrument](image)
6. Research Finding and Discussion

Experimenting with a group of 50 respondents, whose age ranging from 60 to 82 years old, the research is able to reach an understanding and make certain recommendations on iconic design for elderly cell phone users. Most of the respondents are retired civil servants, have an average monthly income of baht 20,894, and have an educational attainment ranging from high school to college graduate. Most of the elderly subjects declared their visual and / or memory impairment of some kinds. Most of their daily lives are engaging in activities such as religious, leisure, and other entertaining pursuit.

The study found that graphical symbols of objects which are recognizable and have experience with are most suitable for the elderly. Despite of their rather impaired visual and mental conditions, they have they still possess the ability to learn an unfamiliar technology, comprehend the symbolic representation, and reach the most complicated level of menus access. Most of them have no memorizing problem; all they needed is some instruction on the gadget’s utilization. They can read textual material as small as 5 mm. Complicated symbols with extensive detail would be most appropriate to be as large as 30 mm., preferably realistic pictorial types of symbols rather than the 2D type of simplified symbols. Graphical symbol together with textual explanation make it easier to comprehend than those with plain graphic alone. In terms of color, the study found that simplified graphic should be rendered in warm color, while graphic with text should be difference in colors, and should avoid using warm color tone. Finally, graphical symbols with extensive detail should be rendered with cool color tone to help enhance the visibility of the elderly.

<table>
<thead>
<tr>
<th>Graphic icon element</th>
<th>5 mm.</th>
<th>10 mm.</th>
<th>15 mm.</th>
<th>20 mm.</th>
<th>25 mm.</th>
<th>30 mm./more</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Icon sizes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Simplistic</td>
<td>46 %</td>
<td>34 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Complex</td>
<td>38 %</td>
<td>26 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Textural</td>
<td>38 %</td>
<td>26 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Understanding of utilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Plain style</td>
<td>72 %</td>
<td>80%</td>
<td>60%</td>
<td>92%</td>
<td>98%</td>
<td></td>
</tr>
<tr>
<td>2.2 Detailed style</td>
<td>84.5%</td>
<td>81.5%</td>
<td>86%</td>
<td>93%</td>
<td>96%</td>
<td>90%</td>
</tr>
<tr>
<td>2.3 Very detail style</td>
<td>68%</td>
<td>70%</td>
<td>75%</td>
<td>95%</td>
<td>96.8%</td>
<td>90%</td>
</tr>
<tr>
<td>3. Graphic icon elements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Plain style</td>
<td>46%</td>
<td>39%</td>
<td></td>
<td></td>
<td></td>
<td>14%</td>
</tr>
<tr>
<td>3.2 Plain style + messages</td>
<td>78%</td>
<td>12%</td>
<td></td>
<td></td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>3.3 Detailed style</td>
<td>14%</td>
<td>56%</td>
<td></td>
<td></td>
<td></td>
<td>28%</td>
</tr>
</tbody>
</table>

7. Additional Recommendation

This research attempts to explore the research approach for universal design utilizing the factors determining perceptual and comprehension of the elderly on the graphical icon of cell phones as case study. Since the elderly already have the visual and cognitive short coming in the first place, experimentation and interview should be as short as possible to reduce inaccuracy and experimental error due to the subjects’ fatigues.
References


