Paper # 090, IT P401

Cognitive Responses to Engineering Designed Products

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Abstract

The cognitive process has the task of interpreting myriads of information [1]. Instructions of any nature, such as symbols or alphanumeric characters, are developed to provide information to the operator for ease and correct use of a device [2]. It is imperative that critical features included in such instructions yield correct interpretation and, in particular, visual instructions that symbolize universal understanding in global communication. Symbols or icons are developed to provide visual instructions or a representation that will convey information accurately and in a timely manner. As a practice, engineering designed products and, in particular, communication devices are expected to overcome language barriers. Communications devices used globally are expected to be simple to operate. A universal language, such as icons, is used on such devices. Blackberry symbols (Home Screen icons) were employed to investigate to what extent they could be identified and interpreted correctly for use by operators.

Problem

Since no information was available to the author at the time of the study regarding how well the symbols communicated their functions, such a study was deemed necessary as part of Human Factors Engineering design. The intent of the study was to redesign or replace icons, if any, that did not communicate their functions easily. The target population for the redesigned icons was for:

- A foreign user who spoke and understood very little English.
- A user that understood the number symbols representing zero through nine.
- A user that was familiar with operating a telephone and a Blackberry type device.

Approach

Two phases were used for this study. The first phase was to investigate to what extent the blackberry symbols communicated their functions. The second phase included redesigning or replacing symbols that seemed to not or did not communicate their intended functions to 60 percent or more of the population. A redesigned or replaced set of icons would be assembled and tested to show if better function communication could be achieved.

Phase One: Blackberry pictures and symbols (see appendix A) were used in the study. The description below each icon was deleted so that participants could write their interpretation of the each icon in the space provided. The researcher surveyed five people that had never owned nor operated a Blackberry. The research took place in a semi-rural location in northwest Ohio. To get the five participants, the researcher randomly asked individuals if they had ever owned or used a Blackberry. If their answer was "yes," no further action was taken; however, if the answer was "no," a follow-up question was asked. These participants were asked if they would volunteer to participate in a study to identify Blackberry symbols. Each person surveyed would identify the function of each icon. A participant was given a copy of the Blackberry pictures and symbols and used a pencil to describe the function each icon conveyed. The survey instrument had 21 symbols that needed to be identified.

Phase Two: The author used results from the survey and replaced icons that were perceived not to communicate their functions correctly to 60 percent or more of the population (see appendix B.) The new icons were tested to determine to what extent they were able to convey the intended function to a population (using different set of participants.)

Results

Study results of phase one are shown in Table 1. The table's first row represents the Blackberry's 21 Home Screen icons by number, beginning from the top left and reading across to the last icon found on row 4, column 3 (as shown in appendix A.) In Table 1, row 2 represents the number of participants identifying functions, with "5" representing correct identification by all participants and "0" representing no correct identification from any participant.

Table 1: Raw Data Representation

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
5	5	4	4	1	5	3	2	5	3	4	2	4	5	0	5	4	3	4	4	2

From Table 1, the following was clear, all participants identified six functions correctly; four participants identified seven functions correctly; three participants identified three functions correctly; two participants identified three icon functions correctly; one participant identified one icon function correctly; and one icon was not correctly identified by any of the participants. Table 2 provides the same information using function identification.

Table 2: Function Identified

Function	Number of Participants Correctly Identifying Function from Icon Representation
6	5
7	4
3	3
3	2
1	1
1	0

Study results of phase two are shown in Table 3. The table's first row indicates the icons that were previously not identified for their intended function by 60 percent or more of the population. The second row indicates the number of participants in the second phase who correctly identified the functions corresponding to redesigned icons.

Table 3: Replaced Icons

Icon No.	5	7	8	10	12	15	18	21
Participant	5	5	5	1	5	1	5	5

Six functions were correctly identified from the new set of icons. Two icons were selected to correctly identify the intended function by one participant each. The two icons that showed difficulty in relaying the functions correctly were the "Brick breaker" and "Tasks."

Discussion and Conclusion

More than 60 percent of the Blackberry icons were able to represent their functions to the population in the study without requiring redesign. After replacing the misrepresented icons, representation increased to 90 percent. A 30 percent increase in function identification from icons was realized after replacing the original Blackberry icons with new ones. The icons that were difficult to identify were the Brick breaker and the Tasks. The Tasks icon function identification dropped from 60 percent to 20 percent after icon replacement. The population participating in the first phase was comprised of adults, while the second population was comprised of high school students. There is no reason to believe that one group had an advantage over the other. The cognitive process of relating an icon or symbol to function is of great essence. Engineered products are increasingly being intended for use in worldwide communication and industrial arenas. Icons provide the avenue for a universal meaning and should be designed and utilized to communicate effectively.

Bibliography

[1] Anitei, Stefan (2008). “The Limit of the Human Mind.” Softpedia. http://news.softpedia.com/newsPDF/The-Limit-of-the-Human-Mind-84585.pdf.

[2] Hodge, Sean (2008).“7 Principles of Effective Icon Design.” http://psdtuts.com/articles/7-principles-of-effective-icon-design/.

[3] http://www.iconarchive.com/show/email-me-icons-by-mayosoft/all-mail-icon.html.

[4] http://www.iconarchive.com/category/system/tulliana-2-icons-by-umut-pulat.html.

[5] http://www.northerntool.com/webapp/wcs/stores/servlet/product_6970_478862_478862.

[6] http://www.iconarchive.com/show/cats-2-icons-by-mcdo-design/Lightbrown-Wall-icon.html.

[7] http://news.bbc.co.uk/2/hi/technology/7163547.stm.

[8] http://www.protecdirect.co.uk/Non-reflective-road-traffic/Men-At-Work-Symbol-(Rigid-Plastic,400-X-400mm).htm.

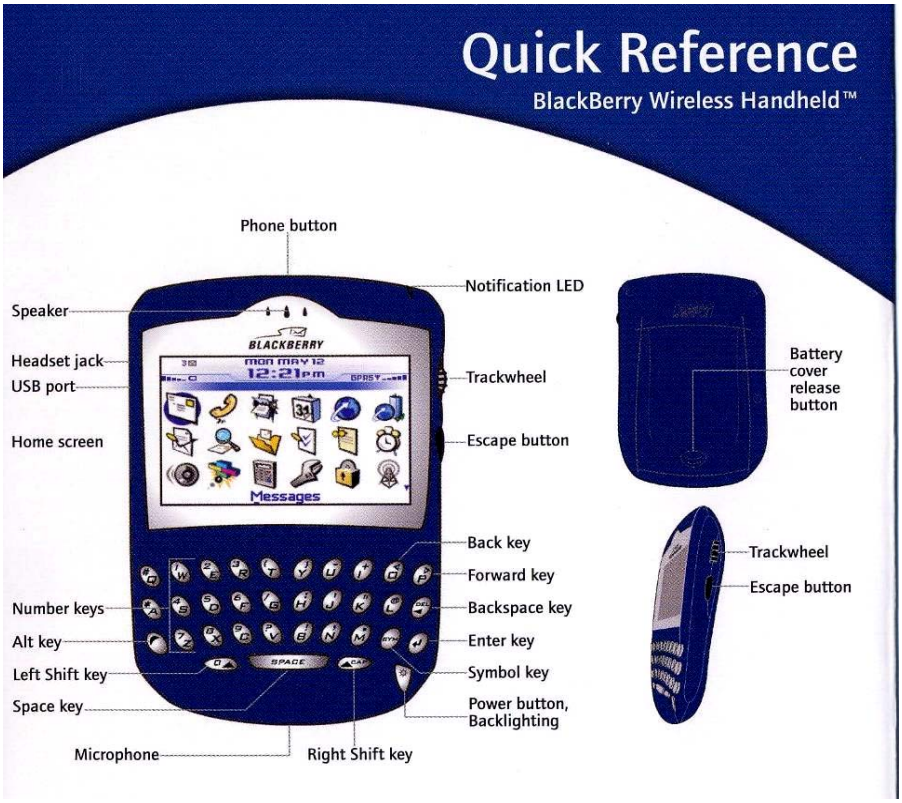
[9] http://www.google.com/search?sourceid=navclient&ie=UTF-8&rlz=1T4DMUS_enUS245US245&q=Lock+icon.

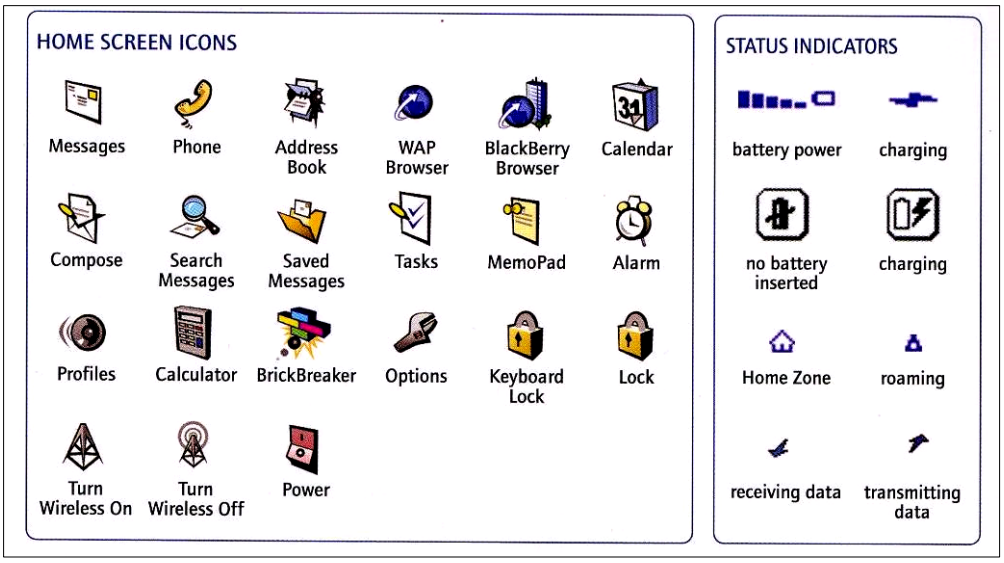
[10] http://www.google.com/search?hl=en&rls=com.microsoft%3A*%3AIE-SearchBox&rlz=1I7DMUS&q=Alarm+Icon&btnG=Search.

[11] http://www.google.com/search?q=Power+Icon&rls=com.microsoft:*:IE-SearchBox&ie=UTF-8&oe=UTF-8&sourceid=ie7&rlz=1I7DMUS.

John M. Mativo is member of the Faculty of Engineering, Workforce Education program at The University of Georgia. His research interests are in engineering design and engineering education. He has taught for 13 years at the university level, six of which he served as department chair. He is a member of the Order of the Engineer, ASME, ASEE, ITEA, and Sigma Xi.

Appendix A


Quick Reference
BlackBerry Wireless Handheld™
Phone button
Notification LED
Speaker
Headset jack
USB port
Home screen
Trackwheel
Escape button
Back key
Forward key
Backspace key
Enter key
Symbol key
Power button, Backlighting
Number keys
Alt key
Left Shift key
Space key
Microphone
Right Shift key
Battery cover release button
Trackwheel
Escape button


HOME SCREEN ICONS
Messages
Phone
Address Book
WAP Browser
BlackBerry Browser
Calendar
Compose
Search Messages
Saved Messages
Tasks
MemoPad
Alarm
Profiles
Calculator
BrickBreaker
Options
Keyboard Lock
Lock
Turn Wireless On
Turn Wireless Off
Power
STATUS INDICATORS
battery power
charging
no battery inserted
charging
Home Zone
roaming
receiving data
transmitting data

Appendix B

Dear Volunteer,

Thank you for volunteering to identify what function the Icons below represent. These icons are intended to convey functions that would be on a Blackberry. By responding to this instrument, you are stating that you have never owned or operated a Blackberry.

Thank you.

Sincerely

John (Investigator)

[3]


[4]


[5,6]

_____ _____ _____


[7]


[8]


[9]

_____ _____ _____


[10]


[11]

_____ _____