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Babyface Design for Mobile Devices and the Web

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Abstract

Small displays on mobile devices and information appliances, e.g., cellular phones and personal digital assistants, provides special challenges to effective user-interface (UI) design, especially for Web-based services. This extreme form of UI design can be called babyface design. Challenges include limited spatial and color resolution, limited font choice, limited space, and information visualization in the form of miniature charts, maps, and diagrams, particularly table/list navigation. Current products will improve as designers gain more experience.

1. Introduction

Cellular phone usage in Asia, and to a lesser extent Europe and North America, is increasing so quickly that most forecasters predict that wireless access to the Web will overtake worldwide desktop wired access within at most two years. The growth in the use of personal digital assistants (PDAs) in Asia, Europe, and North America is also increasing dramatically. The widespread availability and usage of these mobile devices, including many Web-connected information appliances, all point to one important design challenge: developing effective user experiences with small displays. The author's firm, Aaron Marcus and Associates, Inc., has coined the term "babyfaces" to describe these displays, which cover products such as the following:

Telephones, videophones, pagers
Organizers, palm PCs, PDAs, memo devices
Navigators (GPS compasses): vehicular or personal
Wrist watches, weather instruments (time, weather)
Cameras, rulers, other leisure/work tools and equipment
Appliances: for the kitchen, den, office, vehicle
Games, toys

2. What is Extreme about Babyface Design?

Why do user-interface designers need to think specifically about babyface design? Because of the extreme diversity of user communities and usage contexts as well as the worldwide distribution of the technology. Globalization implies the need for localization, because different cultural contexts as well as language preferences must be considered in the design. Already issued in approximately 40 different languages, these mobile computation and communication products will continue to multiply the support of local languages. Note that many users of such devices and appliances will be novices in the content as well as the technology of the equipment. Their lack of familiarity creates particular challenges for the designer who must provide self-evident cues and clues to the meaning of icons, hard-buttons, and other user-interface design for navigation and interaction details. One of the most obvious challenges of the displays is the small area in which to show any data or functions at all. However, differences of user's conception of their roles, tasks, and even content hierarchy will test designer's ingenuity.

The nature of the mobile device marketplace creates extreme demands on the part of consumers. Users want/need/expect portability, low cost, and constantly emerging or merged functions and features. Telephoning, messaging, organizing, scheduling, and accessing the Web, email, short messages, video, and music all become possible characteristics of products. This convergence of functions and features creates additional extreme demands on accommodating a wide variety of technology support: global positioning satellite (GPS), short messaging system (SMS), html, WAP, Cdma, and other underlying systems support. Of special note is the more important role for voice input/output and mixed visual/acoustic display and interaction techniques. Bear in mind that the products must in the end cost less than US $500, with the price rapidly diminishing to approximately $20 or even free if the user signs up for service contracts.

Another factor to consider are the legal challenges that have been raised regarding mobile device use while driving or in environments that require quiet, such as musical performances, theater, or cinema. Different countries have studied the dangers of cellphone use while driving (USA) or the use of in-vehicle navigation systems. Designers may be able to respond to these challenges with unique solutions of multi-modal input and output. Add to this convergence the challenge of designing a coherent, systematic, and efficient set of user-interface components and

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you have a recipe for a designer's headache. It is not surprising that few if any cross-device, cross-application, cross content, cross-culture, or cross-nation conventions and standards have emerged (See Figure 1)

3. User-Interface Design Components

What are these user-interface components? All user interfaces can be thought of as having these components:

Metaphors: Fundamental concepts communicated via words, images, sounds, and tactile experiences. Concepts of pages, shopping carts, chatrooms, and blogs (Weblogs) are examples. The pace of metaphor invention and neologism will increase because of rapid development, deployment, and distribution through the Web.

Mental models: Structures or organizations of data, functions, tasks, roles, and people in groups at work or play. Content, funtion, media, tool, role, and task hierarchies are examples.

Navigation: Movement through the mental models, i.e., through content and tools. Examples include dialogue techniques such as menus, dialogue boxes, control panels, icons, tool palettes, and windows.

Interaction: Input/output techniques, including feedback. Examples include the choices of keyboards, mice, pens, or microphones for input and the use of drag-and-drop selection/action sequences.

Appearance: Visual, auditory, and tactile characteristics. Examples include choices of colors, fonts, verbal style (e.g., verbose/lterse or informal/formal), sound cues, and vibration modes.

Here are some of the challenges that baby faces present to these user-interface components.

Metaphors: Baby faces will need to design new, fundamental concepts that differ from the traditional desktop metaphors (e.g., files/folders on the desk and trashcan, or even desktop Websites, e.g., pages and shopping carts). Candidates might be maps, dashboards, or other concepts not typically associated with computers.

Mental models and navigation: Babyfaces will need to simply access to desired content, to create clear "monuments" and primary routes of travel to regions or neighborhoods of data and functions.

Interaction: Babyfaces will require innovative techniques for selection and character (language) input. Keyboards and keypads on small devices have limited utility, especially for novices, people with large hands, and the disabled.

Appearance: On many mobile phones, the display area may be limited to 320 x 240 (one-fourth VGA) or even100 x 100 pixels. The color and sound resolution may also be limited. Special care will be required in the use of simple spatial layout grids, limited varieties of fonts and colors in order to reliably, consistently, and clearly indicate all categories of content. Even in personal digital assistants (PDAs), varying paradigms of "real estate" usage are to be found. For example, the Palm Pilot uses a fixed area for text input while others use pop-up areas, thereby freeing up more valuable space on a limited-area display.

In all of these components, culture plays a role. How much complexity is tolerable? How much ambiguity? How comfortable are users with detailed and miniaturized displays and buttons? How do people prefer to learn content, including the functions: systematically or in an ad hoc manner? How much help is necessary? How flexible or rigid are their typical tasks and needs?

In all of these components, also, there are opportunities for manufacturers and designers to establish unique brands, product identities, and corporate identities (see Figures 2-4). For example, a particular device's metaphors might be unique and especially useful to embody the essential data items, or special table, chart, map, and diagram techniques might be very effective in presenting the typical contents of lists, hierarchies, or networks

4. How are Current Products Doing?

The marketplace of mobile devices in particular shows much innovation, but also a fair amount of chaos. Products quickly emerge and disappear, like the Scout Electromedia Modo in the USA, which provided access to urban information through a non-standard network on a small handheld device. Introduced in the summer of 2000, it was

gone by the fall of 2000 (www.thestandard.com/article/display/0,1151,19699,00.html). Many products may face challenges to business models in addition to the quality of the user experience and the user-interface design. In many of the popular mobile devices and information appliances, legibility and readability of the displays remains modest. In the USA, most models of the popular Palm Pilots and Motorola phones feature low contrast monochrome displays that make for difficult reading under many typical ambient light conditions. Even though some color PDAs can display miniature Web pages, the content is not displayed in a form that makes it easy to read the contents of page elements. In many small-screen Web-capable phones, the characters are limited in number and legibility in addition to possible low contrast. Often less than seven lines of text may be displayed. It is not surprising that a recent analysis of Web-enabled WAP phones by the Nielsen Norman Group show poor usability and low user acceptance of these devices (http://siliconvalley.internet.com/ news/article/0%2C2198%2C3531 _463321%2C00.html). Many product reviewers also urge consumers to avoid these products.

Regarding user-interface design conventions, many products have designs that seem to ignore much of the knowledge gained from usability research in user-interface design over the past several decades. Some devices feature tiny keyboards that seem to have doubtful utility, like that for the Cybiko (www.cybiko.com), a combination of a Palm Pilot and a Gameboy device. No doubt popular among teenagers for its functions as a note-passing and music-accessing device, perhaps only teenagers would find its tiny keyboard (Figure 5) appealing.

Nokia (www.nokia.com) seems to have gone farther than many of its competitors in carrying out consistent user-interface standards for its products. For example, in navigation by means of soft keys and hard keys, the left soft key is used for forwarding, selecting, and confirming. The right soft key is used for stepping back, exiting and clearing. Scroll keys are used for moving to other menu items and options. The Nokia standards allow for flexibiility in adding new features. Nokia has been exemplary but tends to be a more closed development environment. Palm Pilot third-party applications for its PDAs show a typical non-standard approach to the positioning of soft keys, their appearance, their labels, and their semantics (see Figures 6-9). This often occurs when there are little or no controls or incentives for more systematic development, such as Apple was able to accomplish for the Macintosh by offering programmers code that made it easier to do it Apple's way than a variant.

The power of mobile devices held in the hand is moving from the palm-top device to even smaller versions, the wrist-top device. Already the OnHand wrist-top PC boasts the world's smallest (www.onhandpc.com) PC, and IBM has announced porting the Linux operating system to a wrist-top device. The wrist-top real estate seems an excellent location for computing and communication functions. Consumers are already used to a wristwatch being located there, so there is a precedent for a device with additional functions. Unfortunately, the design of many of these devices seems more appropriate for the Darth Vader character of *Star Wars* fame, not for the more elegant Princess Leia, that is, most of these devices seem targeted narrowly to early adapters of high technology, typically young males, and are not designed with suffciently broad aesthetic style to qualify as high-demand, higher-cost fashion accessories of a more jewelry-like nature.

5. Information Visualization Challenges

One aspect that has received relatively little attention is information visualization. Most devices wish to provide users with a maximum amount of content. One MP3 music device boasts that 2500 items can be stored. This amount of content begs the question: how can the choices be easily displayed and navigated among so that a user can quickly pick the desired items. The content must be categorized and ordered in some efficient manner. If the content can be submitted to alphabetical, chronological, geographical, or numerical searches, that may be sufficient to quickly locate desired contents. However, in many cases, structure, hierarchical lists or networks of contents may need to be examined. How this might be accomplished best in baby faces remains to be determined.

The author's firm developed some initial approaches to solving this problem in its own prototype designs for wrist-top user interfaces placed onto the screen of the Samsung wrist-top telephone, the AnyCall ™ (www.samsung electronics.com). The design assumes a list will have key characteristics known to the user and shown by small symbols. A single line of enlarged text enables the viewer to read "marching" contents (See Figure 10).

6. Conclusion

Hand-held mobile devices may yield to their next generation, wrist-top devices, and then even their next competitors, finger-top devices or devices embedded within clothing or the body. All of these mobile devices attempt to bring into reality useful computation and communication assistants. Science-fiction writers and even

cartoonists like Chester Gould, the creator of the US cartoon strip about detective Dick Tracy who had a wrist-communicator in the 1950s, envisioned these devices long ago. Now the challenge is for designers to turn conceptual fantasies into practical realities.

What will make a significant difference for designers? Some primary factors are these: Designers must be able to manage and resolve conflicting engineering and marketing requirements more efficiently, to use more sophisticated tools to plan the business cases and usability evaluations of new devices, to maintain more control over a process in which software-oriented user interfaces are dominated by hardware engineers, to be able to use techniques that localize semi-automatically international-ready user interfaces, including cultural aspects, and to use techniques for more efficient and effective information visualization.

Compromises are always necessary to harmonize business, engineering, marketing, and design requirements. However, effective planning, innovative approaches to metaphors, mental models, navigation, interaction and appearnce can keep design quality high. Even industry breakthroughs are likely in usability and acceptance of mob ile devices and information appliances with radically different solutions for babyfaces.

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Figures

1. These mobile phones from three manufacturers show a lack of industry user-interface design standards. The only consistency seems to be putting the name of the manufacturer above the screen. Screen icons and their location differ greatly, as well as the position, shape, and labels of special buttons below the screen.

2-4. These figures show screens from a prototype user-interface for the touch-screen LCD displays of a smart-car navigation system designed by Aaron Marcus and Associates, Inc. for Motorola. The design philosophy emphasized consistent typography, color, symbolism, and layout for all lists, maps, and button arrangements. Figure 2 shows typical lists and soft buttons. Figures 3 and 4 show route guidance. Of special note was the ability of the system to visualize route guidance information in three different ways to account for cognitive differences among users who might prefer to view maps, arrows, or text displays.

5. The Cybiko music, messaging, and organizer product designed for teenagers. The device features a very small keyboard that seems to require a stylus or a very sharp finger.

6-9. Palm Pilot simulations for the Macintosh show previous third-party application screen prototypes that exhibit typical user-interface inconsistency and readability problems. Figure 6 shows a screen with left- and right-justified text that slightly inhibits easy reading of a consistent list. Figure 7 shows a left-justified text layout, which is sensible, but a centered decision button. Figure 8 shows a centered menu list, which is less readable than a left-justified list. Figure 9 shows a centered text, which is less readable than a left-justified text, above a centered button. Although the screen layout of Fig. 9 is visually consistent, the text layout is not optimally readable.

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10. The figure shows a prototype of innovative information visualization designed by Aaron Marcus and Associates, Inc., for a wrist-top device superimposed on an image of the Samsung Any-Call ™ wrist-phone. The special design, for which a patent is being applied, enables users to view detailed, categorized, hierarchical lists even on very small displays.

Fig. 1

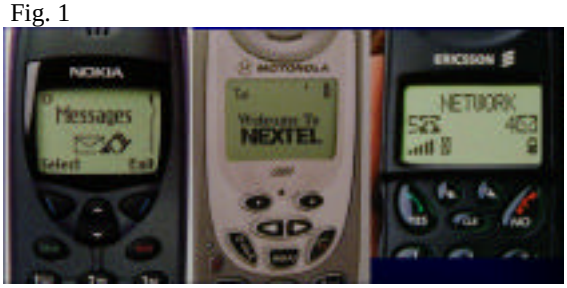
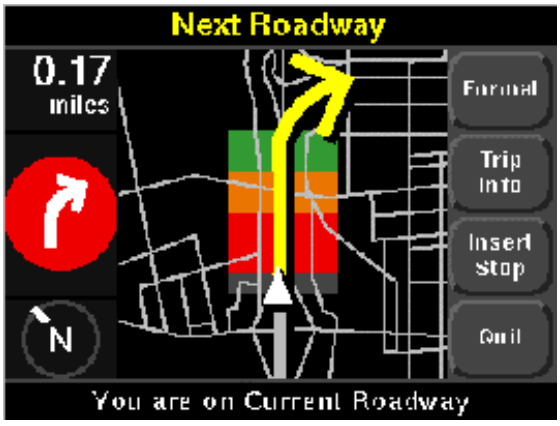


Fig. 5

Figs. 2-4



Figs 6-9 and Fig 10 below