

Chapter 2: Specific HCI Guidelines

2.1 Guideline Categories

While principles are very general and applicable to a wide areas and aspects of HCI design, guidelines tend to be more specific. Table 2.1 shows major criteria and areas for which specific guidelines can be of help in HCI design. For instance, in the criteria of "user type," there could be further specific guidelines for specific age groups or gender.

[Table 2.1] Examples of criteria/categories for HCI guidelines

Criteria	Main categories	Examples
User type	Age/Generation Disability / Accessibility Gender Consumer group Occupation Culture/Country	Kids, Elders, Visually challenged, Baby boomers, Students, Parents, East Asians, Athletes, etc.
Platform / System set-up	Mobile/Hand-held Desktop Large display / Virtual Reality	Smart phone, Pad-like device, Desktop, Kiosk, Embedded OS, Cloud based, Navigation systems,

	<p>Embedded</p> <p>Public installation</p> <p>Operating System/Network</p>	<p>Personal game players, MP3 players,</p> <p>E-book, etc.</p>
<p>Vendors /</p> <p>Organizations</p>	<p>Private</p> <p>Public</p> <p>Design style / Identity</p>	<p>NASA, Korea University, Android,</p> <p>iOS, Windows XP, etc.</p>
<p>Interface style /</p> <p>Modality /</p> <p>Technology</p>	<p>WIMP¹</p> <p>Non-WIMP</p> <p>3D</p> <p>Multimodal</p>	<p>Voice/aural, Gesture, Single/multi-</p> <p>touch, Tactile/Haptic, Multimodal,</p> <p>Menu driven, GUI/Widgets, Visual</p> <p>perception, etc.</p>
<p>Task/Operational</p> <p>context</p>	<p>Location/Place</p> <p>Time</p> <p>Noise/Lighting</p> <p>Bodily constraints</p>	<p>Office, Outdoor, Road/Street, Home,</p> <p>Automobile, Subway, Classroom,</p> <p>Eyes free, Hands free, Handedness,</p> <p>etc.</p>
<p>Applications</p>	<p>Game</p> <p>Media/Information</p> <p>Electronic commerce</p> <p>Design/Editing</p>	

¹ WIMP stands for "Windows, Icon, Mouse and Pointer," an acronym representing the conventional desktop interface [13].

	Social network service
General HCI design	Display layout Information structure/Navigation Soliciting input Information/Output visualization Design process and practices User experience General aesthetics

Many guidelines in the areas stated above have been put forth by a number of HCI researchers, practitioners, and organizations over the long years and are regarded reasonably objective. There is even an international standards; the International Organization for Standardization (ISO) 9241 document guides the ergonomics aspects of HCI designs with topics covering visual display, physical input devices, workplace/environment ergonomics, and tactile/haptic interactions [12].

Broadly, we might divide the guidelines into two categories: (1) domain specific (e.g. specific to user, platform, etc.) and (2) of general HCI design. Note these guidelines can be relevant and common across the different categories shown in the Table 2.1. For example, guidelines for e-commerce application might also address different general HCI design issues such as display layout, how to solicit input, promote vendor specific styles, or target for a particular user group.

Even though guidelines are quite more specific than the principles, it is not still very clear how to reflect them into the HCI design in a concrete and consistent manner. In this regard, Tidwell has compiled many UI design patterns in the form of guidelines [5]. Tidwell's guidelines address many categories of the "General HCI Design" issues (see Table 2.1) such as display layout, Information, structure and navigation, data entry and even aesthetic aspects. Each guideline illustrates specific UI examples with exact descriptions of what it is and what it does and why and when it should be used. Such design patterns are of great help during actual HCI design.

It is not possible to list and explain all the guidelines that exist for all the various areas. Despite differences in the specifics, most of them are commonly shared, and equivalent or can be understood in terms of the higher level principles. Here we present few examples.

2.2 Examples of HCI Guidelines

2.2.1 Visual Display Layout (General HCI Design)

One of the main focuses in many design guidelines is on display (page) layout. This problem concerns organizing and allotting various information (both the content and UI elements) in one visible screen or scrollable page. Generally, the display layout should be such that it is organized according to the information content (e.g. importance, sequence, functionality), sized manageably (e.g. divided into proper sections), attention grabbing, and visually pleasing (e.g. aligned, restricted use of colors). Here is a summarized guideline for web page layout put forth by the U.S. Department of Health and Human Services (HHS) for the US government [3].

[Table 2.2] Examples of guidelines for government web page layout [3].

Guidelines	Explanation
Avoid cluttered displays	Create pages that are not considered cluttered by users.
Place important items consistently	Put important, clickable items in the same locations, and closer to the top of the page, where their location can be better estimated.
Place important items at top center	Put the most important items at the top center of the web page to facilitate users' finding the information.
Structure for easy comparison	Structure pages so that items can be easily compared when users must analyze those items to discern similarities, differences, trends, and relationships.
Establish level of importance	Establish a high-to-low level of importance for information and infuse this approach throughout each page on the web site.
Optimize display density	To facilitate finding target information on a page, create pages that are not too crowded with items of information.
Align items on a page	Visually align page elements, either vertically or horizontally

Set appropriate page lengths	Make page-length decisions that support the primary use of the Web page.
Choose appropriate line lengths	If reading speed is most important, use longer line lengths (75-100 characters per line). If acceptance of the web site is most important, use shorter line lengths (fifty characters per line).
Use frames when functions must remain accessible	Use frames when certain functions must remain visible on the screen as the user accesses other information on the site.

2.2.2 Information Structuring and Navigation (General HCI Design)

A single display is often not sufficient for the whole information content or control UI for a given application. Thus structuring the information and making it easy to move (or navigate) among them becomes a very important issue for high usability. Structuring information content and control interface for the purpose of HCI is closely related to the principle of "Understanding the Task" (see Chapter 1). By understanding the task, we identify the sequence of subtasks and actions and each task will be associated with information either for making input or for resulting output. The task structure, action sequence and associated content organization will dictate the interaction flow and its fluidity. Also this way, only the right amount of information or control

will be available at the right time.

Aside from such internal structure, it is also important to provide external means and the right UI for fast and easy navigation. Fast and easy navigation means enabling the user to find the needed action (e.g. menu item) and information quickly. Here, we introduce a summarized guideline for easy navigation interface design from Liavitt [3].

" ... Navigation refers to the method used to find information within a Web site. A navigation page is used primarily to help users locate and link to destination pages. A Web site's navigation scheme and features should allow users to find and access information effectively and efficiently. When possible, this means designers should keep navigation-only pages short. Designers should include site maps, and provide effective feedback on the user's location within the site ... "

" ... To facilitate navigation, designers should differentiate and group navigation elements and use appropriate menu types. It is also important to use descriptive tab labels, provide a clickable list of page contents on long pages, and add 'glosses' where they will help users select the correct link. In well-designed sites, users do not get trapped in dead-end pages ... "

[Figure 2.1] An example of a site map for a web site²

² <http://www.korea.ac.kr/content/S/S1.jsp>

As a more concrete example, we illustrate two design patterns from Tidwell [5]. Note that as design patterns, very specific uses of UI elements are suggested addressing the concerned issue.

" ... Put two side-by-side panels on the interface. In the first, show a set of items that the user can select at will; in the other, show the content of the selected item. Use when you're presenting a list of objects, categories, or even actions ... You want the user to see the overall structure of the list. Physically, the display you work with is large enough to show two separate panels at once ..."

[Figure 2.2] The use of a two-panel selector, a design pattern for information structuring and facilitated navigation [5].

" ... Show each of the application's pages within a single window. As a user drills down through a menu of options, or into an object's details, replace the window contents completely with the new page ... Use when your application consists of many pages or panels of content for the user to navigate through ... for a device with tight space restrictions ... (or for) you may have a complexity limit ... for (non) habitual computer users ..."

[Figure 2.3] The use of one-window drilldown as a design pattern for content organization and fast navigation [5].

2.2.3 Taking User Input (General HCI Design)

Clever designs for taking user input (e.g. raw information or system commands) can improve the overall performance, both time and accuracy wise, for highly interactive systems. Modern interfaces employ GUI elements (e.g. window, text box, button, menu, forms, dialog box, icon), support techniques (e.g. auto-completion, deactivating irrelevant options, voice recognition), and devices (e.g. mouse, touch screen) to realize user input in different ways. It is up to the UI designer to compose these input methods for the best performance with respect to the design constraints (e.g. user type, task characteristics, operating environment, etc.). Here is a collection of guidelines in applying these input methods for facilitating data entry from [3][4].

1. Consistency of data-entry transactions: Similar sequences of actions should be used under all conditions; similar delimiters, abbreviations and etc.
2. Minimal input actions by user: Fewer input actions mean greater operator productivity. Make proper use of e.g. single key commands, mouse selection, auto-completion feature, automatic cursor placement rather than typing/pressing in of the full alphanumeric input. Selection from a list (e.g. by a menu, mutually exclusive radio buttons) also reduces possibilities of error. Avoid switching between the keyboard and the mouse. Use default values.
3. Minimal memory load on users: When doing data entry, use e.g. menus, button choices so that users do not have to remember lengthy list of codes and complex syntactic

command strings.

4. Compatibility of data entry with data display: The format of data-entry information should be linked closely to the format of displayed information (i.e. what you see is what you get).
5. Clear and effective labeling of buttons and data entry fields: Use consistent labeling. Distinguished required and optional data entry. Place labels close to the data entry field.
6. Match and place the sequence of data entries and selection fields in a natural scanning and hand movement direction (e.g. top to bottom, left to right).
7. Do not place semantically opposing entry/selection close together: For example, do not place "save" and "undo" button close together. Such a placement is likely to produce frequent erroneous input.
8. Most visual display layout guidelines also apply to form and dialog box design.

Note most of the guidelines above apply only to when using mouse/keyboard driven GUI elements. Situations become more complicated when other forms of input are also used such as touch, gesture, 3D selection, and voice. There are separate guidelines for when incorporating such input modalities [refs].

[Figure 2.4] Display layout and user interfaces for facilitated date entry³: Selection menus, default values and structured forms are used to reduce errors.

2.2.4 Users with Disability (User Type)

The W3C has led the "Web Accessibility Initiative" and published the Web Content Accessibility Guidelines (WCAG) 2.0 [6]. It explains how to make Web content more accessible to people with disabilities. Web content generally refers to the information in a Web page or Web application, including text, images, forms, sounds, and such. The following is the summary of the guidelines.

1. Perceivable
 - A. Provide text alternatives for non-text content.
 - B. Provide captions and other alternatives for multimedia.
 - C. Create content that can be presented in different ways, including by assistive technologies, without losing meaning.
 - D. Make it easier for users to see and hear content.
2. Operable
 - A. Make all functionality available from a keyboard.

³ https://incorp.interpark.com/member/memberjoin.do?_method=initial&authnp=adult

- B. Give users enough time to read and use content.
 - C. Do not use content that causes seizures.
 - D. Help users navigate and find content.
3. Understandable
- A. Make text readable and understandable.
 - B. Make content appear and operate in predictable ways.
 - C. Help users avoid and correct mistakes.
4. Robust
- A. Maximize compatibility with current and future user tools.

[Figure 2.5] Adjustment feature for visually challenged users⁴. The colors of the background and foreground text can be changed.

2.2.5 Mobile Device (Platform Type)

⁴ Hansweb, <http://www.hants.gov.uk/>

Recently, with the spread of smart phones, usability and user experience of mobile devices and applications has become even more important. Many conventional principles equally apply to mobile networked devices but the followings are more specific and important as summarized by [5].

1. Fast / status information (especially with regards to network connection and services)
2. Minimize typing and leverage on varied input hardware (e.g. buttons, touch, voice, hand-writing recognition, virtual keyboard, etc.)
3. Fierce task focus (for less confusion in a highly dense information space)
4. Large hit targets (for easy and correct selection and manipulation).
5. Use screen space efficiently (and condense information)

Following is a similar set of guidelines available from the Nokia's developer's homepage [11]

1. Enable shortcuts (e.g. hot keys) for frequently used functions
2. Maintain the user informed of its actions
3. Follow the device's (vendor's) interface patterns (positioning of the buttons and menus).

[Figure 2.6] Comparison of two mobile game interfaces⁵ (the initial entry screen): (a) information and object density is needlessly high and distracting (left), (b) simple and minimal layout, and object sizes fitted to ergonomic usage (right).

Figure 2.7 shows another design pattern put forth by Google for the Android mobile interface [8]. It concerns the limited and different sizes of a family of hand-held devices (e.g. smart phones, pad-like devices, mobile internet devices, net books) and more specifically suggests the use of "panels" as a way to achieve usability under such hardware constraints.

" ... Make sure that your app consistently provides a balanced and aesthetically pleasing layout by adjusting its content to varying screen sizes and orientations ... "

" ... Panels are a great way for your app to achieve this. They allow you to combine multiple views into one compound view when a lot of horizontal screen real estate is available and by splitting them up when less space is available ... "

[Figure 2.7] Android design guideline promoting the use of list views and detailed views (multiple panels) to efficiently use the screen size of mobile devices [8].

⁵ www.com2us.com

2.2.6 Icons for Apple iOS and Fonts for Windows XP (Vendor)

Major vendors publish style guides for user interaction elements to be used for applications running on their platform [refs]. For instance, Apple has published a design guideline document [7] which details how application icons should be designed and stylized (as shown below).

1. Try to balance eye appeal and clarity of meaning in your icon so that it's rich and beautiful and clearly conveys the essence of your app's purpose.
2. Investigate how your choice of image and color might be interpreted by people from different cultures.
3. Create different sizes of your app icon for different devices. For iPhone and iPod touch both of these sizes are required: (1) iPhone: 57 x 57 pixels and 114 x 114 pixels (high resolution) and (2) iPad: 72 x 72 pixels and 144 x 144 (high resolution). When iOS displays the app icon on the Home screen of a device, it automatically adds the following visual effects: (1) Rounded corners, (2) Drop shadow and (3) Reflective shine

Another example is the suggested choice of fonts/sizes for Windows XP or applications based on

it [10]. These guidelines promote organizational styling and its identity and ultimately consistency in user interfaces.

1. Franklin Gothic is used only for text over 14 point. It is used for headers and should never be used for body text.
2. Tahoma is used as the system's default font. Tahoma should be used at 8, 9, or 11 point sizes.
3. Verdana (bold, 8 point) is used only for title bars of tear-off/floating palettes
4. Trebuchet MS (bold, 10 point) is used only for the title bars of windows

[Figure 2.8] An example of Trebuchet font used for a window title bar [10].

2.2.7 "Earcon" Design for Aural Interface (Modality)

Blattner et al. have suggested few guidelines for designing "earcons," an auditory analogue to visual icons [1]. Similarly to visual icons which must capture the underlying meaning (for

whatever it is trying to represent) and draw attention for easy recognition, earcons should be designed to be intuitive. They suggest three types of earcons, namely, those that are (1) symbolic, (2) nomic, and (3) metaphoric. Symbolic earcons rely on social convention such as applause for approval; nomic ones are physical such as a door slam, and metaphorical one are based on capturing the similarities such as a "falling" pitch for a falling object [1]. Aural feedback (including earcons) involves a careful choice of sound related parameters such as the amplitude/loudness, frequency/pitch, timbre, and duration. We take a more in-depth look at the aural modality in Chapter 3.

2.2.8 Cell Phones (or Making Calls) in Automobiles (Task)

Green et al. has categorically outlined interface guidelines for automobiles and vehicles whose interfaces are nowadays mostly electronic and computer controlled [2]. The categories include design guidelines for manual control, spoken input and output, visual and auditory display, navigation guide, cell phone consideration, just to name a few.

[Table 2.3] Samples of guidelines for car phone interfaces in vehicles by [2].

Subcategories	Number	Guideline
Basic	11.1	Car phones should operate like phones people have at home. The use of "send" to make a connection and

		"power" to turn a phone on and turned off are notable inconsistencies.
Voice Dialog	11.16	Verbal commands and button labels should use the same terms. Commands of interest include "dial," "store," "recall," and "clear." This is an instance of the consistency principle.
Manual Dialing	11.24	The "store" and "recall" buttons, used for similar functions, should be adjacent to each other. This is an instance of the grouping principle.

[Figure 2.9] Phone interface for automobiles.

2.2.9 E-Commerce (Application)

Kalsbeek has collected and formulated very extensive, detailed and structured HCI guidelines for e-commerce applications [9]. A total of 404 guidelines structured in four groups (general, input/output forms, UI elements, and check out process) is given and applied to several real systems for validation and evaluation. The following is a guideline under the "Check- out process" section concerning the steps of a subtask (the check-out process).

"... check-out should start at the shopping cart, followed by the gift options or shipping method, the shipping address, the billing address, payment information, order review and finally an order summary. ... Then the site displays a confirmation page and gives customers the option to register. The checkout process is linear ..."

[Figure 2.10]: Status information (circled) shown in the process of a book purchase at Amazon.com⁶.

2.3 Summary

While most of the guidelines, specific or general, seem quite commonsense and are easy to understand, incorporating them in actual design and implementation is very difficult. Many guidelines are still quite high level, similarly to the HCI principles, and leave the developer wondering how to actually apply them in practice. Another reason is that there are just too many different aspects to consider (especially for a large scale system). Sometimes, the guidelines can even be in conflict of each other, which requires prioritizing on the part of the designer. For instance, it can be difficult to give contrast to an item for highlighting its importance when one is restricted to using certain colors for e.g. a corporate identity purpose. Another example might be when attempting to introduce a new interface technology (e.g. touch

⁶ www.amazon.com

gestures). While the new interface may have been proven effective in the laboratory, it still may require significant familiarizing and training on the part of the user. It is often the case, external constraints such as monetary and human resources restrict sound HCI practice.

There is no straight answer to how such conflicts can be managed and how to incorporate all the requirements simultaneously, particularly under stringent external constraints. One must realize all designs involve compromises and trade-offs. Experienced designers understand the ultimate benefit and cost for practicing sound HCI design. In spite of the acknowledged aspect of "black art" to HCI design (in which good judgments made by the experienced), the HCI guidelines still help greatly to assure overall usability and performance. In the next chapter, we will study cognitive and ergonomic knowledge (more theoretical), which along with the principles and guidelines we have learned (more experiential), will be applied to HCI design.

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