HCI Design Principles

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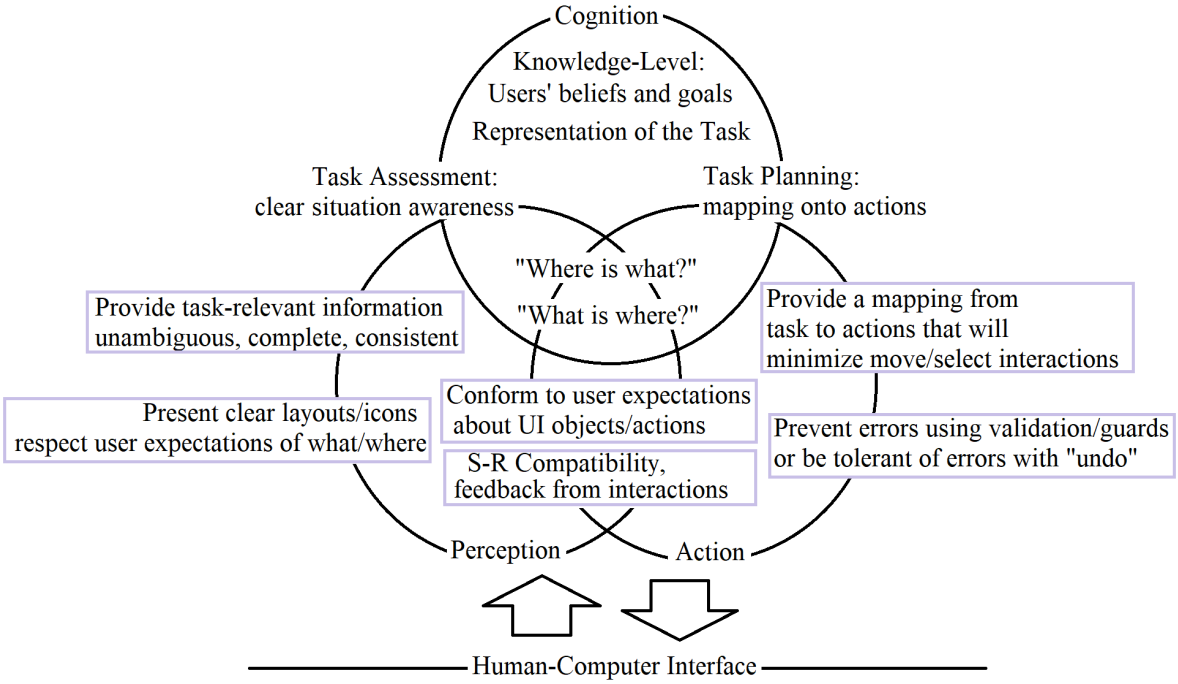
The following diagram illustrates a set of User Interface guidelines which are derived from the backdrop of the capacities and constraints of the Human Perceptual, Cognitive, and Action systems.



The relationship between these guidelines, and the information-processing model of the human, provides a context – and allows an important observation to be made: All of these principles arise from the consideration of the human side of the human-computer interface. By extension, we should not expect any other principles to arise when considering the design of user interfaces which are used as tools for accomplishing the users' tasks.

Furthermore, these guidelines are consistent with other classical observations made by others. Most notably, the diagram is consistent with Donald Norman's over-arching principles; to minimize the "Gulf of Evaluation", and to minimize the "Gulf of Execution".

Other Design Guidelines exist, but they are completely consistent with those illustrated in this diagram. These are attached here (Nielsen and Mohlich; Schneiderman). Note that these existing guidelines are not contextualized explicitly to the users' capacities and constraints, only implicitly so. As an exercise, the user can verify the mapping between these heuristic guidelines, and the ones derived in the above diagram.

Nielsen and Molich's 10 User Interface Design Guidelines

Jakob Nielsen, a renowned web usability consultant and partner in the Nielsen Norman Group, and Rolf Molich, another prominent usability expert, established a list of ten user interface design guidelines in the 1990s. Note that there is considerable overlap between Nielsen and Molich's heuristics and Ben Shneiderman's 'eight golden rules'. These 10 rules of thumb further iterate upon Shneiderman's eight golden rules 4 years after Shneiderman's initial publication.

- **Visibility of system status**. Users should always be informed of system operations with easy to understand and highly visible status displayed on the screen within a reasonable amount of time.
- **Match between system and the real world**. Designers should endeavor to mirror the language and concepts users would find in the real world based on who their target users are. Presenting information in logical order and piggybacking on user's expectations derived from their real-world experiences will reduce cognitive strain and make systems easier to use.
- **User control and freedom**. Offer users a digital space where backward steps are possible, including undoing and redoing previous actions.
- **Consistency and standards**. Interface designers should ensure that both the graphic elements and terminology are maintained across similar platforms. For example, an icon that represents one category or concept should not represent a different concept when used on a different screen.
- **Error prevention**. Whenever possible, design systems so that potential errors are kept to a minimum. Users do not like being called upon to detect and remedy problems, which may on occasion be beyond their level of expertise. Eliminating or flagging actions that may result in errors are two possible means of achieving error prevention.
- **Recognition rather than recall.** Minimize cognitive load by maintaining task-relevant information within the display while users explore the interface. Human attention is limited and we are only capable of maintaining around five items in our short-term memory at one time. Due to the limitations of short-term memory, designers should ensure users can simply employ recognition instead of recalling information across parts of the dialogue. Recognizing something is always easier than recall because recognition involves perceiving cues that help us reach into our vast memory and allowing relevant information to surface. For example, we often find the format of multiple choice questions easier than short answer questions on a test because it only requires us to recognize the answer rather than recall it from our memory.
- **Flexibility and efficiency of use**. With increased use comes the demand for less interactions that allow faster navigation. This can be achieved by using abbreviations, function keys, hidden commands and macro facilities. Users

should be able to customize or tailor the interface to suit their needs so that frequent actions can be achieved through more convenient means.

- **Aesthetic and minimalist design**. Keep clutter to a minimum. All unnecessary information competes for the user's limited attentional resources, which could inhibit user's memory retrieval of relevant information. Therefore, the display must be reduced to only the necessary components for the current tasks, whilst providing clearly visible and unambiguous means of navigating to other content.
- **Help users recognize, diagnose and recover from errors**. Designers should assume users are unable to understand technical terminology, therefore, error messages should almost always be expressed in plain language to ensure nothing gets lost in translation.
- **Help and documentation**. Ideally, we want users to navigate the system without having to resort to documentation. However, depending on the type of solution, documentation may be necessary. When users require help, ensure it is easily located, specific to the task at hand and worded in a way that will guide them through the necessary steps towards a solution to the issue they are facing.

Shneiderman's "Eight Golden Rules of Interface Design"

These rules were obtained from the text *Designing the User Interface* by Ben Shneiderman. Shneiderman proposed this collection of principles that are derived heuristically from experience and applicable in most interactive systems after being properly refined, extended, and interpreted.

To improve the usability of an application it is important to have a well designed interface. Shneiderman's "Eight Golden Rules of Interface Design" are a guide to good interaction design.

Shneiderman, Ben. (1986) Designing the user interface: strategies for effective human-computer interaction / Ben Shneiderman, Catherine Plaisant (2005).-4th ed.

1 Strive for consistency.

Consistent sequences of actions should be required in similar situations; identical terminology should be used in prompts, menus, and help screens; and consistent commands should be employed throughout.

2 Enable frequent users to use shortcuts.

As the frequency of use increases, so do the user's desires to reduce the

number of interactions and to increase the pace of interaction. Abbreviations, function keys, hidden commands, and macro facilities are very helpful to an expert user.

3 Offer informative feedback.
For every operator action, there should be some system feedback. For frequent and minor actions, the response can be modest, while for infrequent and major actions, the response should be more substantial.

4 Design dialog to yield closure.
Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions gives the operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans and options from their minds, and an indication that the way is clear to prepare for the next group of actions.

5 Offer simple error handling.
As much as possible, design the system so the user cannot make a serious error. If an error is made, the system should be able to detect the error and offer simple, comprehensible mechanisms for handling the error.

6 Permit easy reversal of actions.
This feature relieves anxiety, since the user knows that errors can be undone; it thus encourages exploration of unfamiliar options. The units of reversibility may be a single action, a data entry, or a complete group of actions.

7 Support internal locus of control.
Experienced operators strongly desire the sense that they are in charge of the system and that the system responds to their actions. Design the system to make users the initiators of actions rather than the responders.

8 Reduce short-term memory load.
The limitation of human information processing in short-term memory requires that displays be kept simple, multiple page displays be consolidated, window-motion frequency be reduced, and sufficient training time be allotted for codes, mnemonics, and sequences of actions.