**Eight Golden Rules of Interface Design:**

This section covers eight golden rules that are applicable in most interactive systems. These principles are derived from experience and refined over two decades. These rules are well-received as a useful guide to students and designers.

1. Strive for consistency: This rule is the most frequently violated one, but following it can be tricky because there are many forms of consistency. Consistent sequences of actions should be required in similar situations; identical terminology should be used in prompts, menus, and help screens; and consistent color, layout, capitalization, fonts, and so on should be employed throughout. Exceptions, such as required confirmation of the delete command or no echoing of passwords, should be comprehensible and limited in number.
2. Cater to universal usability: Recognize the needs of diverse users and design for plasticity, facilitating transformation of content. Novice-expert differences, age ranges, disabilities, and technology diversity each enrich the spectrum of requirements that guides design. Adding features for novices, such as explanations, and features for experts, such as shortcuts and faster pacing, can enrich the interface design and improve perceived system quality.
3. Offer informative feedback: For every user action, there should be system feedback. For frequent and minor actions, the response can be modest, whereas for infrequent and major actions, the response should be more substantial. Visual presentation of the objects of interest provides a convenient environment for showing changes explicitly
4. Design dialogs to yield closure: Sequences of actions should be organized into groups with a beginning, middle, and end. Informative feedback at the completion of a group of actions gives operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans from their minds, and a signal to prepare for the next group of actions. For example, e-commerce web sites move users from selecting products to the checkout, ending with a clear confirmation page that completes the transaction.
5. Prevent errors: As much as possible, design the system such that users cannot make serious errors; for example, gray out menu items that are not appropriate and do not allow alphabetic characters in numeric entry fields .If a user makes an error, the interface should detect the error and offer simple, constructive, and specific instructions for recovery. For example, users should not have to retype an entire name-address form if they enter an invalid zip code, but rather should be guided to repair only the faulty part. Erroneous actions should leave the system state unchanged, or the interface should give instructions about restoring the state.
6. Permit easy reversal of actions: As much as possible, actions should be reversible. This feature relieves anxiety, since the user knows that errors can be undone, thus encouraging exploration of unfamiliar options. The units of reversibility may be a single action, a data-entry task, or a complete group of actions, such as entry of a name and address block.
7. Support internal locus of control: Experienced operators strongly desire the sense that they are in charge of the interface and that the interface responds to their actions. Surprising interface actions, tedious sequences of data entries, inability to obtain or difficulty in obtaining necessary information, and inability to produce the action desired all build anxiety and dissatisfaction. Gaines (1981) captured part of this principle with his rule avoid acausality and his encouragement to make users the initiators of actions rather than the responders to actions.
8. Reduce short term memory load: The limitation of human information processing in short-term memory (the rule of thumb is that humans can remember "seven plus or minus two chunks" of information) 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. Where appropriate, online access to command-syntax forms, abbreviations, codes, and other information should be provided.

**Goals for our profession**

Clear goals are useful not only for interface development but also for educational and professional enterprises. Three broad goals seem attainable:

(1) Influencing academic and industrial researchers;

(2) Providing tools, techniques, and knowledge for commercial developers; and

(3) Raising the computer consciousness of the general public.

**influencing academic and industrial researchers**

Early research in human-computer interaction was done largely by introspection and intuition, but this approach suffered from lack of validity, generality, and precision.

The scientific method for interface research, which is based on controlled experimentation, has this basic outline:

• Understanding of a practical problem and related theory

• Lucid statement of a testable hypothesis

• Manipulation of a small number of independent variables

• Measurement of specific dependent variables

• Careful selection and assignment of subjects

• Control for bias in subjects, procedures, and materials

• Application of statistical tests

• Interpretation of results, refinement of theory, and guidance for experimenters

Materials and methods must be tested by pilot experiments, and results must be validated by replication in variant situations.

**Potential research topics**

* Reducing anxiety and fear of computer usage: Although computers are widely used, they still serve only a fraction of the population. Many otherwise competent people resist use of computers. Some older adults avoid helpful computer-based devices, such as bank terminals or word processors, because they are anxious about-or even fearful of-breaking the computer or making an embarrassing mistake.
* Graceful evolution: Although novices may begin their interactions with a computer by using menu selection, they may wish to evolve to faster or more powerful facilities. Methods are needed to smooth the transition from novice to knowledgeable user to expert
* Specification and implementation of interaction: User-interface building tools reduce implementation times by an order of magnitude when they match the task. There are still many situations in which extensive coding in procedural languages must be added. Advanced research on tools to aid interactive-systems designers and implementers might have substantial payoffs in reducing costs and improving quality
* Direct manipulation: Visual interfaces in which users operate on a representation of the objects of interest are extremely attractive
* Input devices: The plethora of input devices presents opportunities and challenges to interface designers. There are heated discussions about the relative merits of the high-precision touch screen; stylus, voice, eyegaze, and gestural input; the mouse; and haptic devices
* Online assistance: Although many interfaces offer some help or tutorial information online, we have only limited understanding of what constitutes effective design for novices, knowledgeable users, and -experts. The role of these aids and of online user communities could be studied to assess effects on user success and satisfaction
* Information exploration: As navigation, browsing, and searching of multimedia digital libraries and the World Wide Web become more common, the pressure for more effective strategies and tools will increase

**Providing tools, techniques, and knowledge for commercial developers**

* Rapid prototyping is easy when using contemporary tools
* Use general or self-determined guideline documents written for specific audiences
* To refine systems, use feedback from individual or groups of users
* User-interface building tools provide support for rapid prototyping and interface development while aiding design consistency, supporting universal usability, and simplifying evolutionary refinement
* Online electronic-mail facilities allow users to send comments directly to the designers. Online user consultants and fellow users can provide prompt assistance and supportive encouragement.

**Raising the computer consciousness of the general public**

* Many novice users are fearful due to experience with poor product design
* Good designs help novices through these fears by being clear, competent, and nonthreatening
* Usability ultimately becomes a question of national priorities. Advocates of electronic voting and other services, promoters of e-healthcare, and visionaries of e-Iearning increasingly recognize the need to influence allocation of government resources and commercial research agendas