Understanding User Interface Design

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Introduction

“In successful mature technologies it's not possible to isolate the form and function. The logical design and the mechanical design of a pen or a piano bind their mechanism with their user interface so closely that it's possible to use them without thinking of them as technology, or even thinking of them at all. Invisibility is the missing goal in computing. “

Neil Gershenfeld, "When Things Start to Think”

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Some Common Interface Problems

Software industry has predilection for development of new features, bug-fixes and production of new (slightly different and “improved” versions)

Constant “improvement” often results in an interface complexity that is constantly in a state of flux.

Functionality creep and inconsistencies arise.

Not enough HCI people involved

Inattention to user needs and lack of user testing

Interface added as an after thought, subservient to underlying technology

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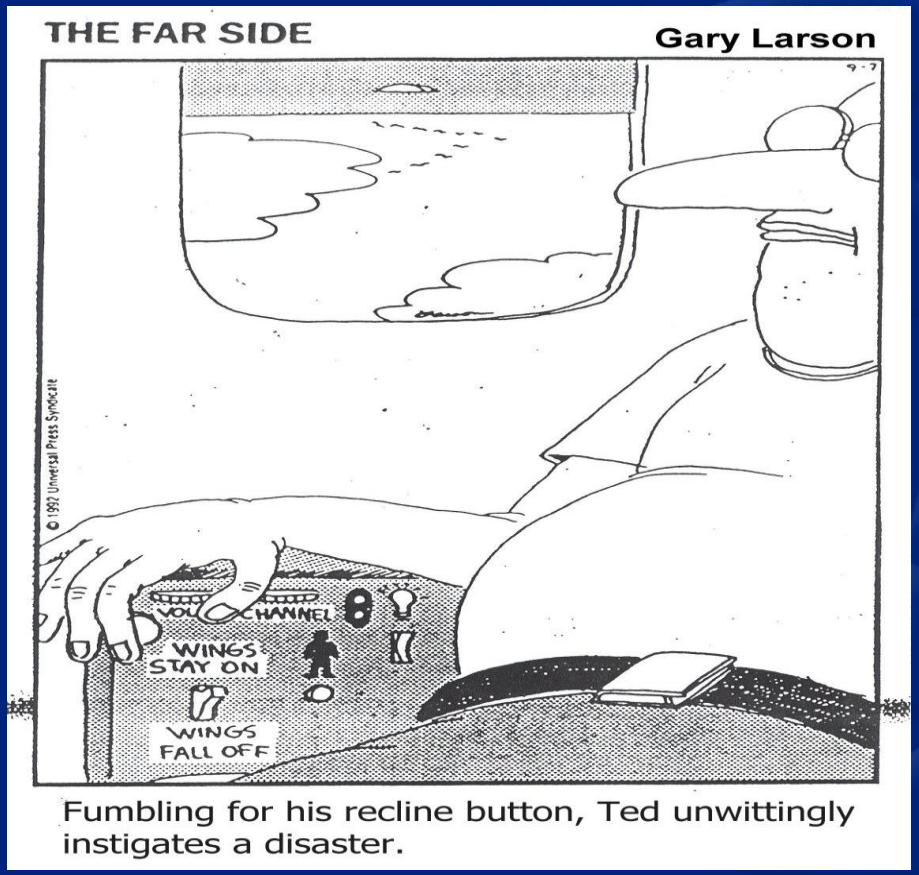
Often Leads To An Interface Like This



Fumbling for his recline button, Ted unwittingly instigates a disaster.

User Interface Economics

Good user interface may result in:

- Increased productivity
- Reduced training costs
- User satisfaction
- Higher quality products produced
- Preventable user errors

"A computer lets you make more mistakes faster than any invention in human history - with the possible exceptions of handguns and tequila."
-Mitch Ratcliffe

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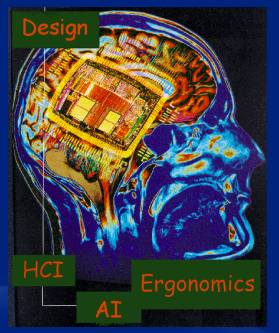
What is Usability?



ISO Definition of Usability

> *"The effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in particular environments"*

A usable product allows users to do what they *expect* and *should* be able to do:

- Quickly
- Accurately
- Enjoyably

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What is HCI?

Human-Computer Interaction Definition:

> *" to provide an understanding of how users function, the tasks they need to perform and the way a computer system needs to be structured to facilitate the carrying out of those tasks " - Faulkner*

Combines Many Disciplines:

- **Computer Science**: technology, software tools and methodologies
- **Cognitive psychology**: representation and process information
- **Ergonomics**: peoples abilities and limitations, particularly with regard to the physical working environment surrounding the computer system

Not restricted to GUI, can include **haptic**, **audio** and **multimedia**.

HCI encompasses usability: biggest challenges lie in **augmented** and **ubiquitous** computing

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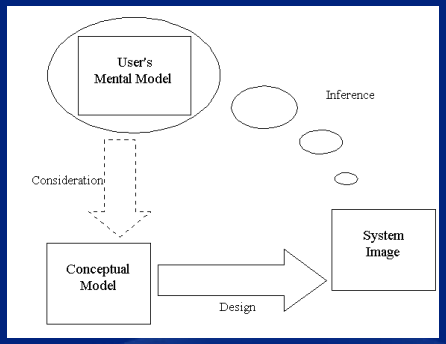
Goal Of Usability



Interface **matches** users **mental** model – make intuitive

Present **exactly** the **information** the user requires –and no more- at exactly the **moment** it is needed

Produce more **goal** oriented interfaces rather than **function** oriented

Reduce amount of technology induced **complexity** at the interface

Let the machine do the operations its better at

Consider email..

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Why is Usability Important?

"The most compelling IT solutions are ones that are simple, natural to use, and completely in tune with users' needs and experiences. Achieving this requires building a multi-disciplinary team and involving users throughout the development process" - Tony Temple, IBM Fellow and VP.

Popular assumption is software products often **compete** on the **number** of **features** they have.

Number of features only improve product if actually **used**. Proliferation of features can cause more **complexity** than **value**.

Most powerful engineering feats are the **ones we don't notice**.

The automatic transmission is significantly more complex than manual transmission

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Consider the VCR

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Key Is Simplicity

A complex system that works is invariably found to have evolved from a simple system that worked." - John Gall

Simplicity does not mean **lack of functionality**; it means a fast initial **learning curve** and consideration for the number of concepts the user needs to understand.

Goal to produce software that is **easy to learn** but with built in path to **higher proficiency**

Consider the **affordance** of a hammer:

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Levels of User Experience - Novice

"Assumed to have little knowledge about systems and computers in general"

Be clear and simple

Present a small number of meaningful functions

Have lucid error messages

Give informative feedback

Come with comprehensible training materials

Include on-line tutorials and demonstrations

Include reversibility and protection

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Levels of User Experience - Expert

"Power users' thoroughly familiar with commands and meanings who want to do things rapidly"

- Provide powerful commands
- Allow user-defined commands
- Reduce key strokes
- Display only brief messages
- Support high speed interaction
- Give less distracting feedback

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Consider A Car

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Car Metaphor

"How would a car function if it were designed like a computer? Occasionally, executing a manoeuvre would cause your car to stop and fail and you would have to re-install the engine, and the airbag system would say, „Are you sure?" before going off." -Katie Hafner

How much **knowledge** about a car do you need to be able to drive it?

Do the best designed cars give the driver the most information about the engine, suspension, etc?

Functionality and **aesthetics** both important

Good design of the driver interface to the car includes designing controls that are

- obvious to use
- behave in the way you expect
- give fast feedback
- are comfortable to use
- hide unnecessary information from the user

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Car Interface

Great MMI interface, user has no awareness of the immense complexity of the engine or electrical system

Engineers for engine, **Designers** for MMI.

Good affordances and feedback

Lots of user testing means invisibility

User doesn't need to know **anything** about car mechanics

Car does work for user, consider **power steering**

If A Car Was A Designed by Software Engineers

- Different cars would have the clutch and accelerator pedals in different positions (**consistency**)
- Dashboard is now covered in lamps, lights and gauges in no order – finding speed now difficult
- No **customization**, cant move chair to fit your body shape
- Add more features to the engine every year, don't consider user (no air condition or environmental controls – does nothing for performance)
- User testing of UI **important**, Car manufactures test engine and road test with users, we must do the same

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How To Improve Your UI: Involve The User

Teams of developers build a technology, and then almost as an after-thought add a user interface

The ensures product won't be **designed for use**; it will be designed as a vehicle for a package of **functional** technologies.

Software Engineers are not users, often complexity of the inner workings are revealed at the interface

As software designers it's easy to fall into the trap of building things that appeal to us as **creators**, instead of things that will appeal to our **customers**

There is no substitute for observing **users** actually interacting with a product. It's the only way to determine whether the projects **intended goals** match with the **reality**.

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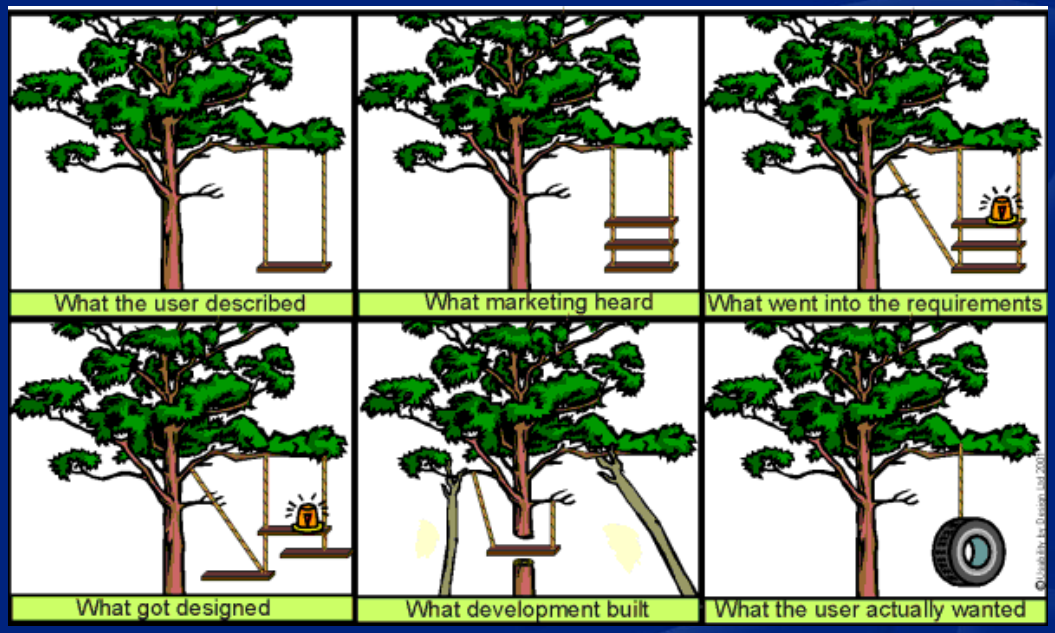
How To Improve Your UI: Involve The User



"63% of software projects exceed their budget estimates, with the top four reasons all relating to product usability: frequent requests for changes by users, overlooked tasks, users' lack of understanding of their own requirements, and insufficient user analysis communication and understanding."
Leaderer & Prassad, 1992

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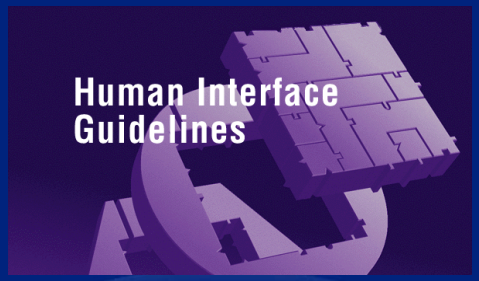
How To Improve Your UI: Understand Human Factors

Goal is to fit the **machine** to the **person** (not vice versa!)

Cognitive issues that must be considered:

- **Memory** (span, retrieval, storage capacity)
- **Visual** and **auditory** capabilities/interpretations
- **Attention** capacity (selective, focused, divided)
- **Judgment** of tones, size, loudness, brightness
- **Interpretation** of coding (traffic lights)

How To Improve Your UI: Use UI Design Guidelines



Anticipation: The user should not search for information, or evoke unnecessary tools. All the information they require and tools the need should be anticipated in design (according to goals and work flow).

Use Status Mechanisms: Keep user aware and informed. They should not have to seek out status information. I.E. Search field icon can change color and appearance.

Offer Meaningful Feedback: Provide user visual/auditory feedback to ensure 2-way communication.

Reduce Amount of Information to be memorized.

Categorize Activities by function and organize screen geography accordingly

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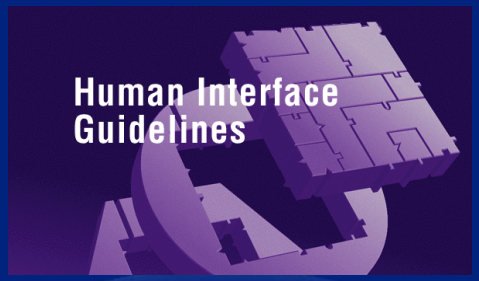
How To Improve Your UI: Use UI Design Guidelines



Display Only Relevant Information to Context: User shouldn't have to wade through menus to obtain information.

Consider Available Geography of Display Screen: If several windows open, space should be available to show at least portion of each.

Consistency:

Very important factor, **inconsistencies** leads to **confusion.**

Also important to be **inconsistent** when things must act differently.

Most important consistency is consistency of **user expectation** (it does what the user expects, based on previous experience). Only way to ascertain user experience is user testing.

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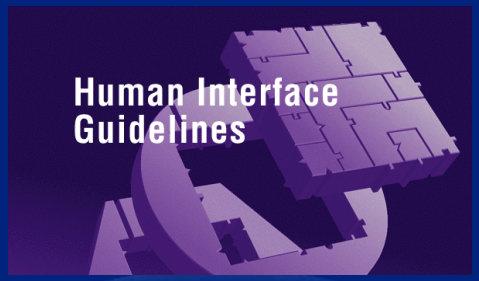

Help Messages: Very important, make them responsive to the problem and meaningful in context.

Explorable Interfaces: Place interface somewhere between dictation and total freedom. Give cues as to next step within organization of interface. Allow for both experienced and novice users.

Make Actions Reversible: Allow users to explore, implement **UNDO** actions. Gives users sense of safety and allows more direct use. Use of undo is far more cognitively effective than preventative measures such as "**Are you REALLY sure, you want to take this action**?"

Clarity: Clarity is an important issue, visual displays that are clear and concise aid user assimilation of information, and improve usability dramatically

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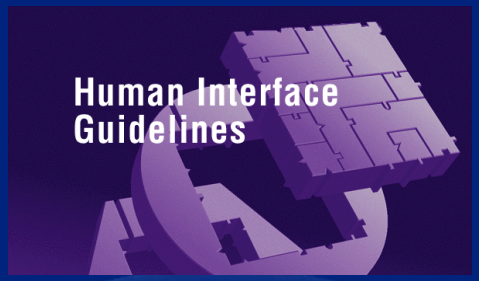
How To Improve Your UI: Use UI Design Guidelines



Use Size/Function of Objects: The time it takes to acquire a target is a function of its size and distance to target. Make important buttons (menus) larger (big buttons are faster)

Latency Reduction: Utilize Multithreading to push latency to the background. Multi-task instead of locking user into a function. Set of simple rules for latency:

- Display hour glass for actions over 1.5 seconds
- Animate hourglass so they know system hasn't died
- Display message to show potential length over 2 seconds
- Communicate actual length through progress indicator.
- Make a BEEP or large VISUAL cue when system returns from long processes (>10 seconds).

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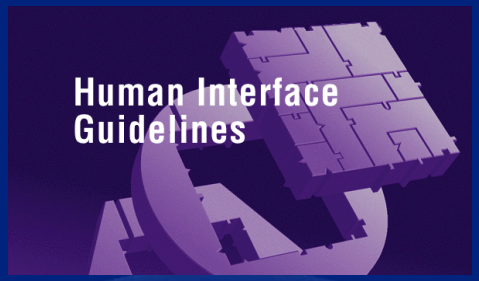

Metaphors Important: Select meaningful icons.

Readability: Much of the information imparted by a HCI is **textual**, therefore the layout and form of the text has a significant impact on the ease with which the user assimilates information.

System Response Time - Length and Variability: Too long unacceptable. Too much variability breaks rhythm of interaction.

Error Information Handling: Errors presented to the user should:

- Be described in easily understandable form
- Contain information on what to do next, how to recover.
- Indicate negative consequences of error (potentially corrupted data)
- Accompanied by visual/audio cue
- NEVER blame user (YOU did the wrong thing)

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How To Improve Your UI: Add Customisation

Make **default representation** suitable for all users (including novices)

Customisation allows user to make the interface more easily reflect their preferences and thought processes

Allows **hidden complexity** to be revealed when needed

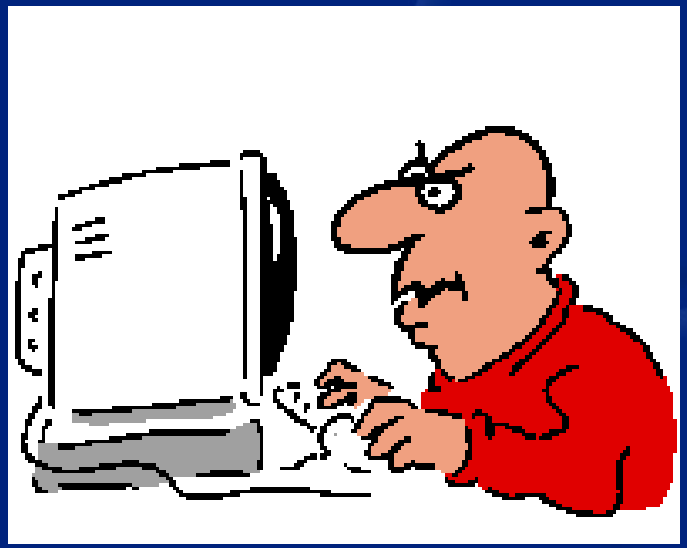
Macros/Learning by examples can eliminate the need for unnecessary **repetition**

Allows the product to grow, as the users experience and knowledge grows

How To Improve Your UI: Don't Forget The Details!

Ease of use is not wholly about design decisions at the top level

It is often the trivial points that most frustrate users



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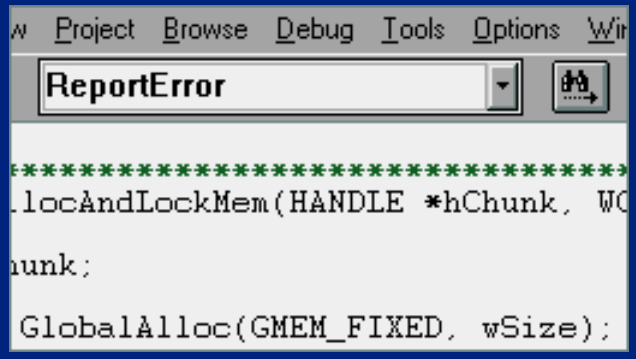
How To Improve Your UI: Don't Forget The Details!

- Theory called **Learned Helplessness**, developed Seligman
- Great deal of depression grows out of a feeling of **helplessness**
- Often small, but alter moods, frequently overlooked
- By paying attention to these details, user satisfaction can be increased dramatically
- Small things can pay off: *Bookmarks, Auto-Completion*



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How To Improve Your UI: Remember Aesthetics

Aesthetics are how things are **shown** and **presented**, and the style in which things are communicated to the user

Aesthetics often come down to simple choices -- it's not the number of colors used, it's picking two or three complementary ones.

Improving aesthetics is all about details

- The rounded corners and smooth edges
- Making sure the pixels line up
- Precision is what creates energy and movement in a design

Makes product more **competitive**

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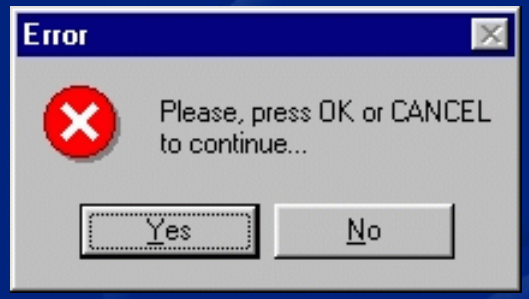
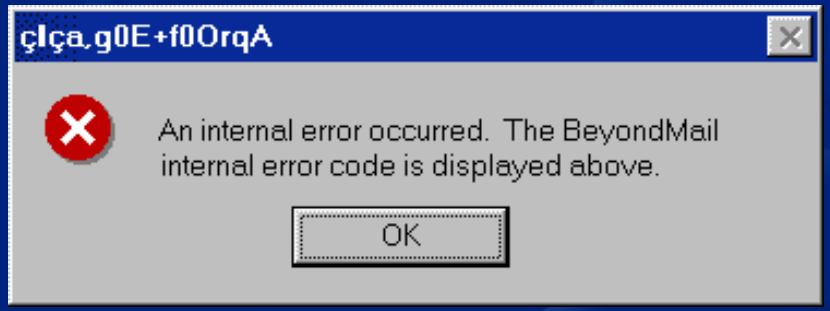
Examples of Bad UI Design!

Error Messages: They should be meaningful!!





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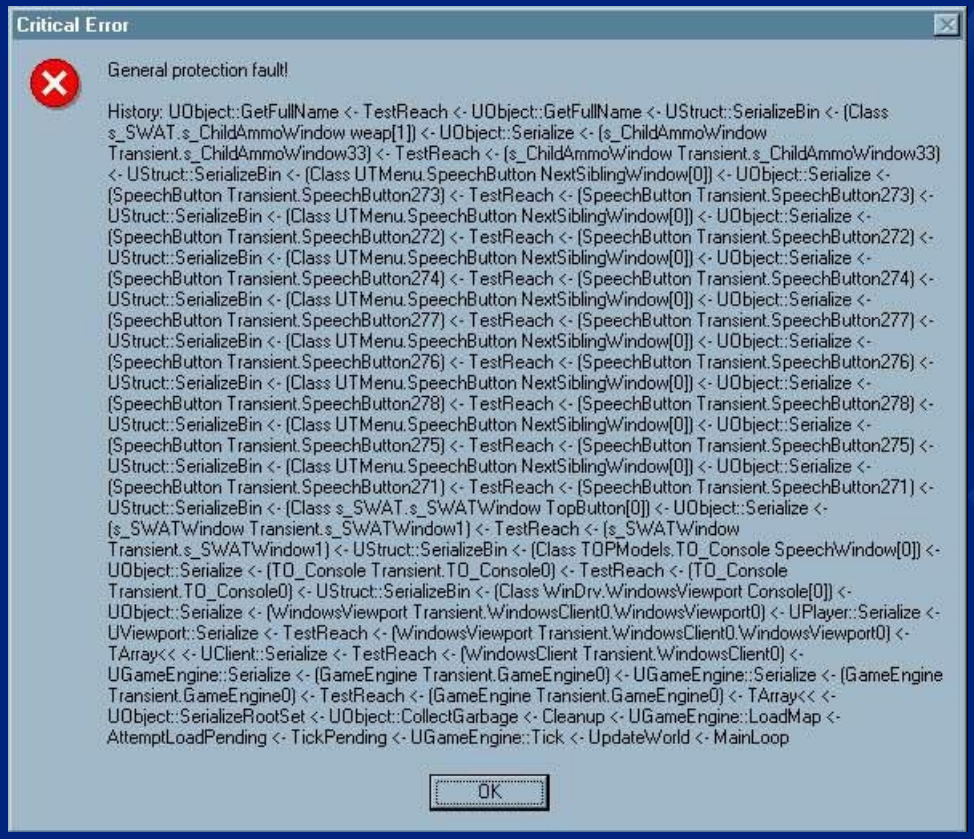
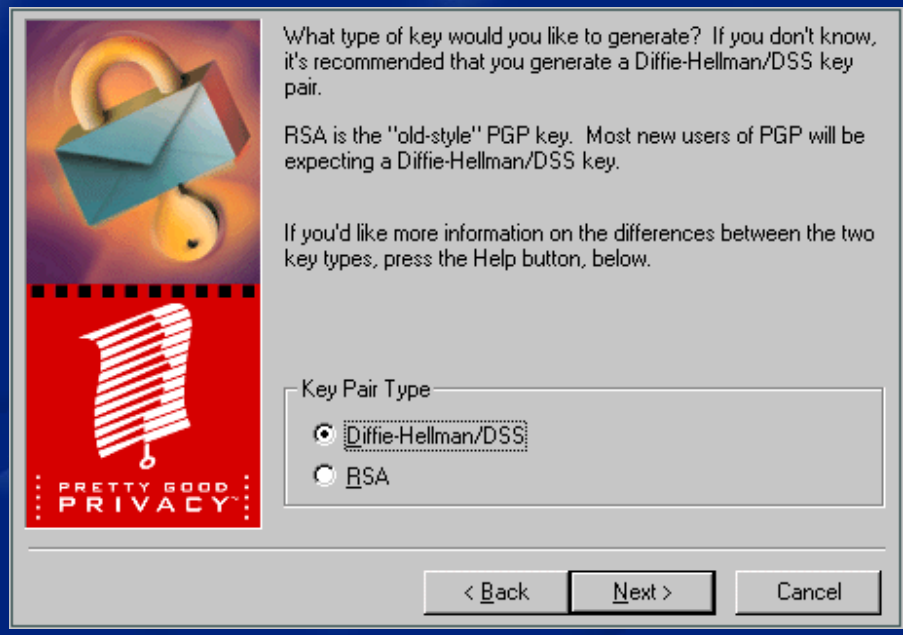
Examples of Bad UI Design!

Meaningful Error Messages





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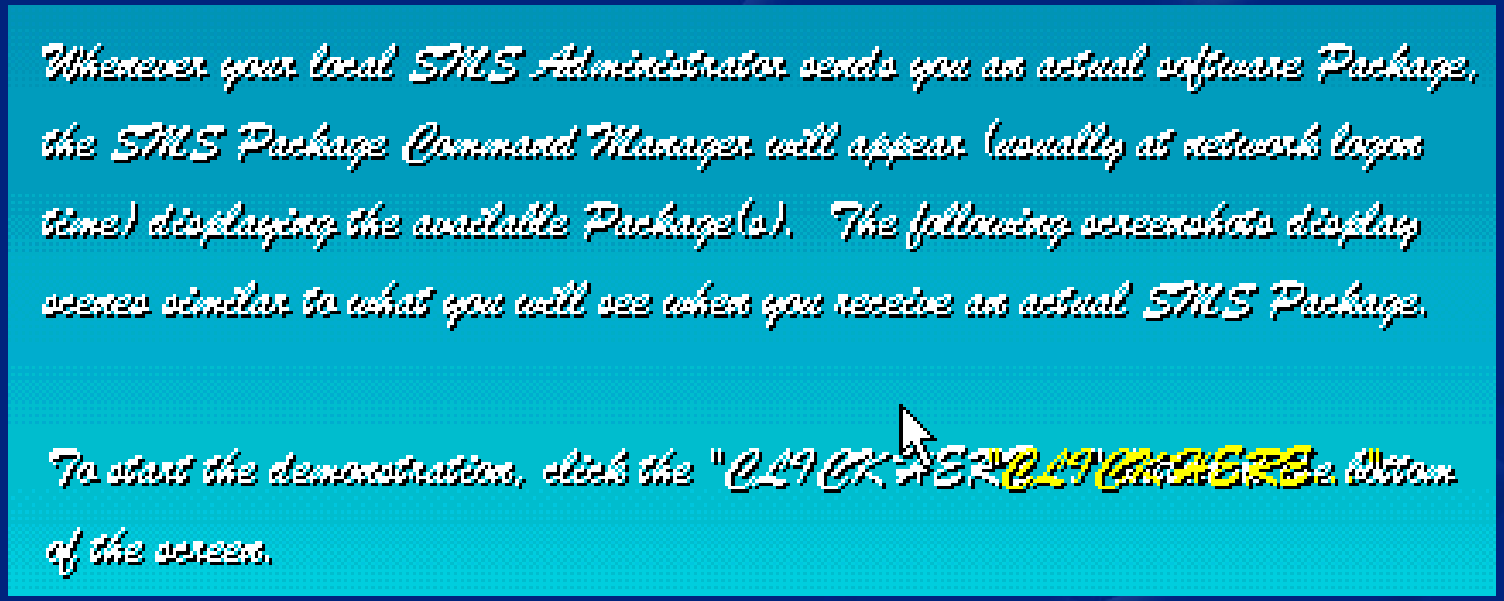
Examples of Bad UI Design!

Readability: Text should have necessary clarity to ensure users can disseminate information correctly.



Examples of Bad UI Design!

Use of Color: The color scheme should aid clarity. Too much color is distracting.

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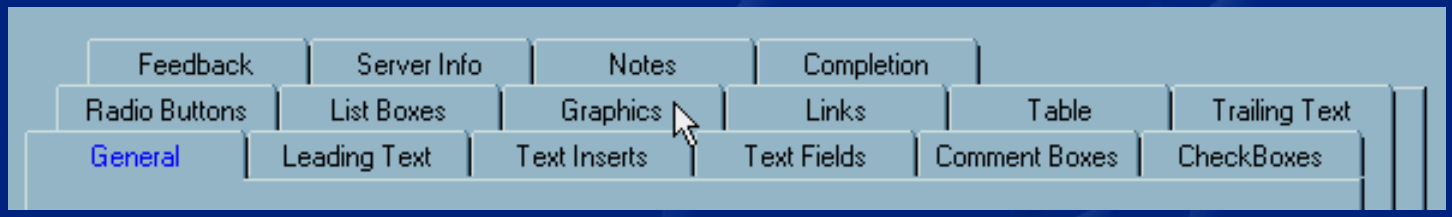
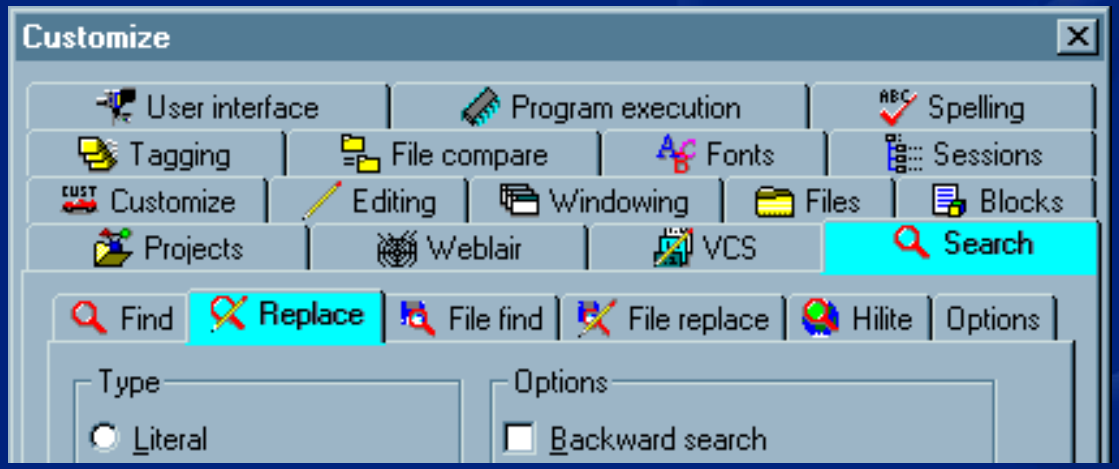
Examples of Bad UI Design!

Tabbed Folders: Be judicious with use, ensure names are relevant to content.





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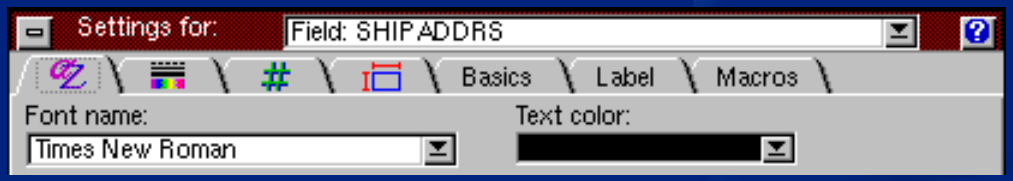
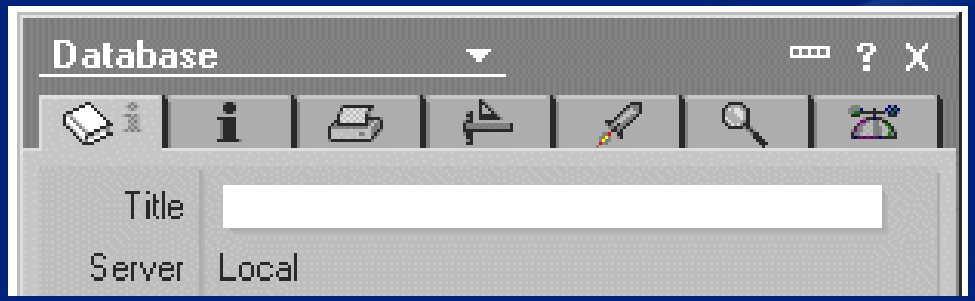
Examples of Bad UI Design!

Tabbed Folders: Use text, no reason to use icons.





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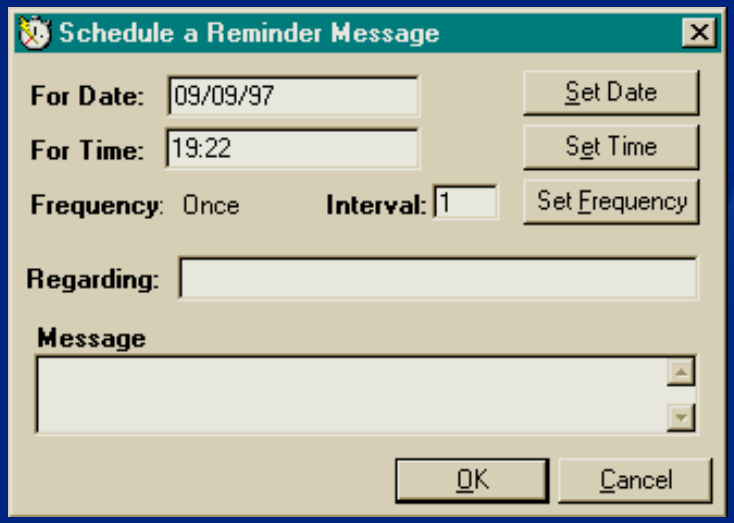
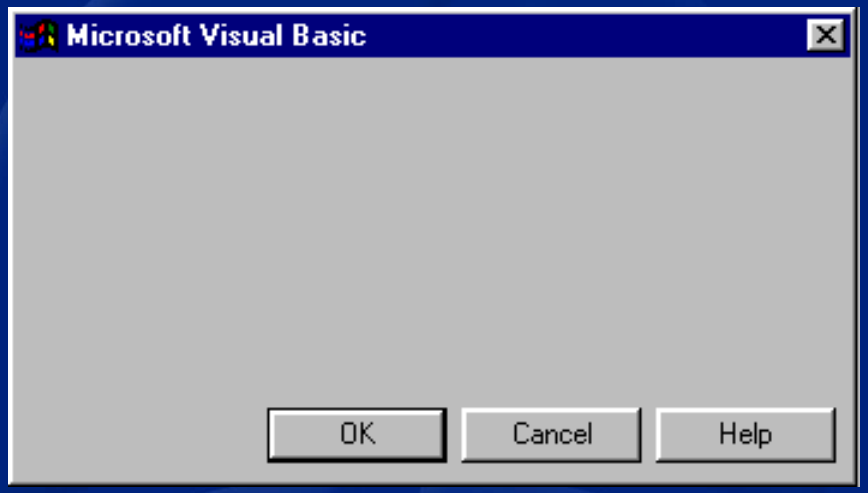
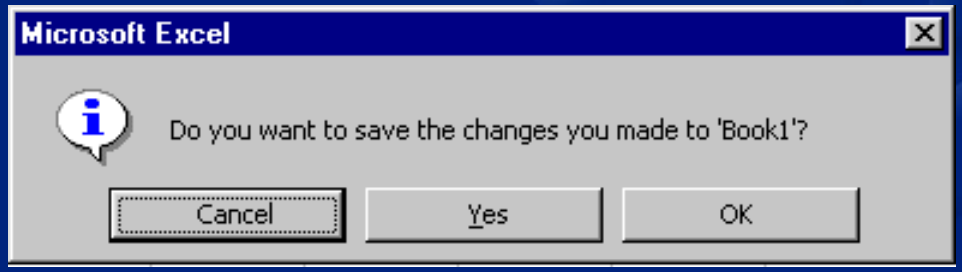
Examples of Bad UI Design!

Consistency: Must work in a way expected by the user.







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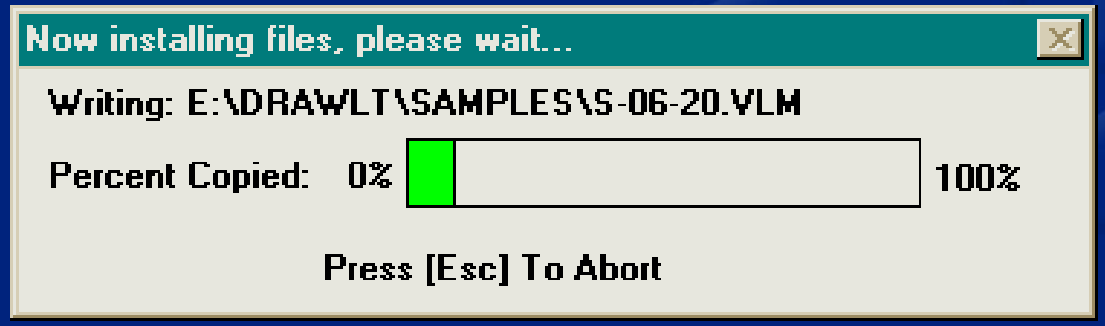
Examples of Bad UI Design!

Miscellaneous



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The Future – Intelligent Interfaces

Augment user, do the things humans are not good at, (Can't run fast - augment by car. Can't see well - augment with glasses)

Design interface to **compensate** for our cognitively **limitation** - spatial awareness, short and long term memory.

Interconnectivity and problem solving, computer is much quicker at finding appropriate information, if information is indexed and stored correctly. (knowledge pump)

Ubiquitous computing, connect and query related computers (including devices)

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The Future – Agents

Software Agents perform user's sub-goals on their behalf

Offer new interface paradigm **Indirect Management** rather than **Direct Manipulation**

Take on complex tasks on behalf of user, help manage **information overload**

Interface Agents, deal with humans, a least a order of complexity more difficult to deal with humans

Can negotiate with other software agents on their behalf for services.

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The Future – Agents

- Increasing number of **untrained** users, have to initiate and monitor all tasks explicitly
- Agents allow **co-operative** process in which human-machine allocate tasks **appropriate** to ability
- Agents **hide complexity** of difficult tasks, perform on behalf of user, they can train or teach user, help user co-operate. (find other agents with similar users and connect together)
- Can aid user by making suggestions, exploring and demonstrating alternatives
- No reason why agents shouldn't converse with others to help solve problem..connect experience

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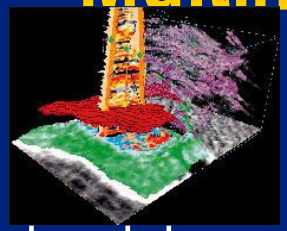
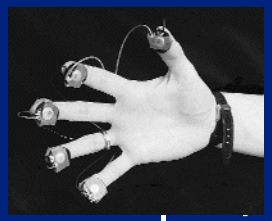
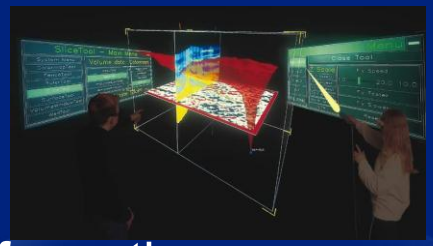
The Future – Multimedia

Multimedia makes inherently complex information more **comprehensible**.

Can transmit information in form most **appropriate** for type.

Use redundancy: i.e. car not just visual cues, sound and feel important (redundant because not essential to pure goal, but provide important information)

Humans prefer **parallel** sets of redundant info, i.e pool table with overhead view.

Redundancy in SIS, use of IR, haptic and audio.

As scan information, feel rock…hear water..

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The Future – Adaptive Systems

Systems which **change behaviour** according to context.

Novice user, simpler interface as gain experience offer more features.

Adaptive system can improve the **cognition** for bandwidth limited systems (2 monitors) by optimising **information** shown.

Spatial adaptation, representation adaptation (most appropriate for context)

New representations such as **Ecological** Interfaces.

Differentiate *skill* from *knowledge* based behaviour use to set interface level (novice->expert)

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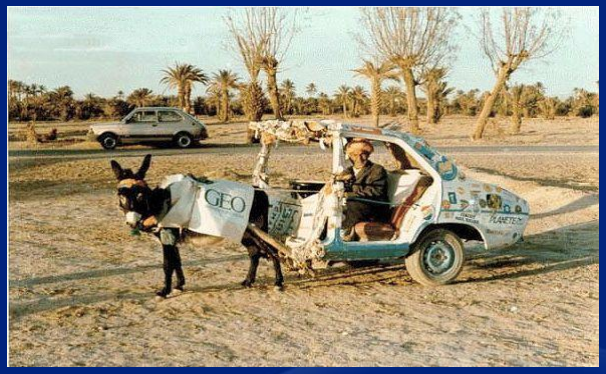
The Future – Personalization



Personalization is important for future of interfaces.

Parts of interface designed with user **characteristics** in mind should support users who differ (low experience->high for example)

User should be able to adapt system to support individual strategies for **planning**, **problem solving** and **information processing**.

Allow for individual preferences with regard to structural, procedural and physical aspects.

Conclusion

Goal of user interface design is to make the experience for the user as simple, pleasurable and useful as possible.

To do this, the design must be closely aligned with the user's mental model.

The design must be usable by a novice but have the ability to be fully utilised by an expert.

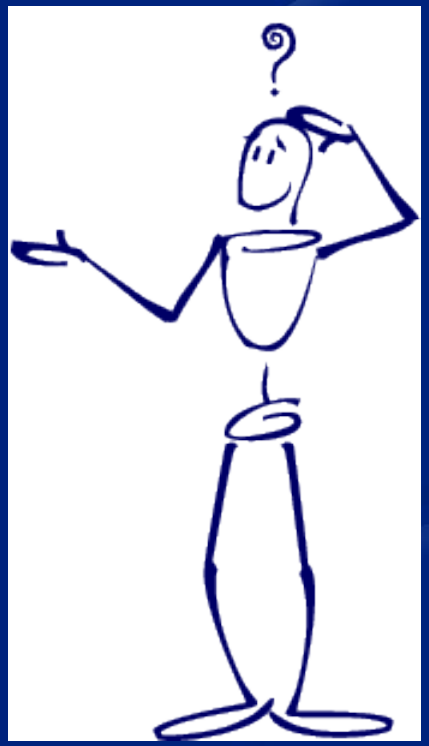
To achieve this involve the user at all cycles of the software's development.

UI designer must understand *user*, *cognition* and be knowledgeable about *UI Design Heuristics*.

Details and aesthetics are as important as functionality and usability.

THANKS VERY MUCH!

ANY QUESTIONS?



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