

Design Principles And Usability Heuristics

You can avoid common design pitfalls by following 9 design principles

You can inspect an interface for usability problems with these principles

Saul Greenberg, James Tam

Design Principles And Usability Heuristics

Broad “rules of thumb” that describe features of “usable” systems

Design principles

- broad usability statements that guide a developer’s design efforts
- derived by evaluating common design problems across many systems

Heuristic evaluation

- same principles used to “evaluate” a system for usability problems
- becoming very popular
 - user involvement not required
 - catches many design flaws

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Design Principles And Usability Heuristics

Advantages

- the “minimalist” approach
 - a few general guidelines can correct for the majority of usability problems
 - easily remembered, easily applied with modest effort
- discount usability engineering
 - cheap and fast way to inspect a system
 - can be done by usability experts, double experts, and end users

Problems:

- principles are more or less at the motherhood level
 - can't be treated as a simple checklist
 - subtleties involved in their use

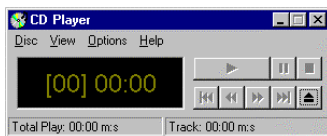
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1. Simple And Natural Dialogue

Use the user's conceptual model

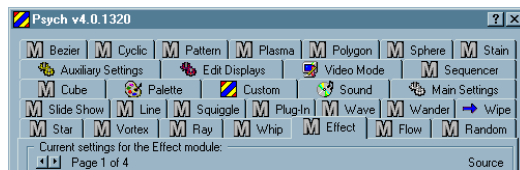
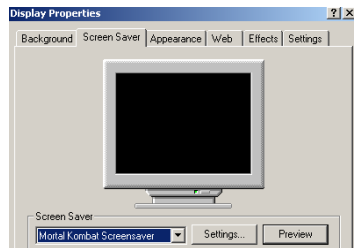
Match the users' task in as natural a way as possible

- minimize mapping between interface and task semantics



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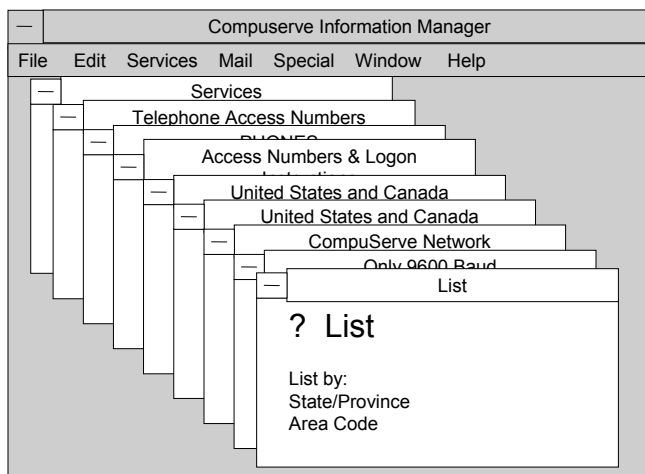
1. Simple And Natural Dialogue



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1. Simple And Natural Dialogue

Menu or window? Which window?



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1. Simple And Natural Dialogue

Present exactly the information the user needs when it is needed

- less is more
 - less to learn, to get wrong, to distract...
- remove or hide irrelevant or rarely needed information
 - competes with important information on screen
- information should appear in natural order
 - related information is graphically clustered
 - order of accessing information matches user's expectations
- remove modes
- use windows frugally
 - don't make navigation and window management excessively complex

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Dr. Drugs Pharmacy Master

Davison, Thomas

Edit Customer New Customer

First Name: Thomas Alberta Health Care #: 45688-3357
Last Name: Davison Doctor: Jane Yang
Address: 4 BRADEN CRS NW Insurer: FARMERS INSURANCE AGE
City: Prudhoe Policy #: 4215487-56
Province: Alberta Notes:
Postal Code: F4T6H8
Phone Number: 403 282-9759

Prescriptions

See List View Edit Prescription New Prescription

Alprazolam
Citalopram
Ranitidine
Folic Acid
Levothyroxine
Celecoxib
Omeprazole

1999 < Year > 2001 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

By previous 481 students Brant LeClercq, Lloyd Yoon, Amy Yang (with permission) Good: info in the same place

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Dr. Drugs Pharmacy Master

First Name: Thomas
Last Name: Davison
Address: 4 BRADEN CRS NW
City: Prudhoe
Province: Alberta
Postal Code: F4T6H8
Phone Number: 403

Alberta Health Care #: 45688-3357
Doctor: Jane Yang
Insurer: FARMERS INSURANCE AG
Policy #: 4215487-56
Notes:

Save Cancel

Prescriptions

See List View Edit Prescription New Prescription

Alprazolam	Jan	Feb
Citalopram	Feb	Mar
Ranitidine	Mar	Apr
Folic Acid	Jun	Jul
Levothyroxine	Jul	Aug
Celecoxib	Oct	Nov
Omeprazole	Nov	Dec

1999 < Year > 2001 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

By previous 481 students Brant LeClerc, Lloyd Yoon, Amy Yang (with permission)

Good: info in the same place
Bad: special edit mode

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Dr. Drugs Pharmacy Master

Davison, Thomas Edit Customer New Customer

First Name: Thomas
Last Name: Davison
Address: 4 BRADEN CRS NW
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1999 < Year > 2001 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

By previous 481 students Brant LeClerc, Lloyd Yoon, Amy Yang (with permission)

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Dr. Drugs Pharmacy Master

Davison, Thomas [Edit Customer] [New Customer]

First Name: Thomas **Alberta Health Care #:** 45688-3357
Last Name: Davison **Doctor:** Jane Yang
Address: 4 BRADEN CRS NW **Insurer:** FARMERS INSURANCE AGE
City: Prudhoe **Policy #:** 4215487-56
Province: Alberta **Notes:**
Postal Code: F4T6H8
Phone Number: 403 282-9759

Prescriptions [See List View] [Edit Prescription] [New Prescription]

Drug Name:
 Manufacturer: Doctor:
 Quantity: Units:
 Price/Unit: Refill Quantity:

[Save] [Cancel]

By previous 481 students Brant LeClerc, Lloyd Yoon, Amy Yang (with permission)

Good: Stable parts of the window
Bad: Prescriptions separate from graphics

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Dr. Drugs Pharmacy Master

Davison, Thomas [Add Undo] [New Customer]

First Name: Thomas **Alberta Health Care #:** 45688-3357
Last Name: Davison **Doctor:** Jane Yang
Address: 4 BRADEN CRS NW **Insurer:** FARMERS INSURANCE AGE
City: Prudhoe **Policy #:** 4215487-56
Province: Alberta **Notes:**
Postal Code: F4T6H8
Phone Number: 403 282-9759

Prescriptions [See List View] [New Prescription]

Drug Name:
 Manufacturer:
 Quantity:
 Price/Unit:
 Doctor:
 Units:
 Refill Quantity:

[New Prescription]

Prescriptions [See List View] [New Prescription]

Alprazolam	Jan	Feb
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Celecoxib	Oct	Nov
Omeprazole	Nov	Dec

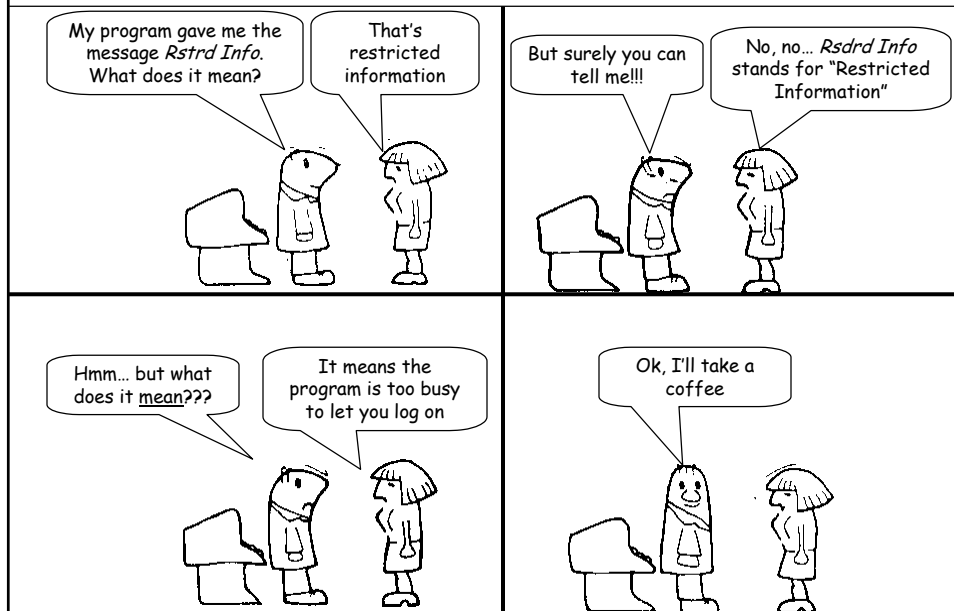
1999 < Year > 2001 | Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

By previous 481 students Brant LeClerc, Lloyd Yoon, Amy Yang (with permission)

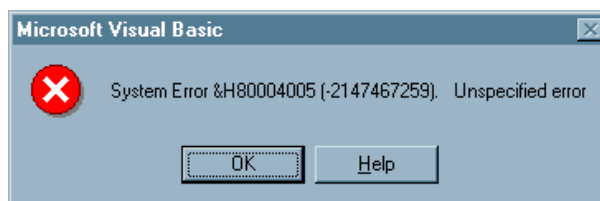
Annotations:
 - Add Undo
 - collapsed onto one screen (needs formatting)
 - Click to get info
 - Double click to edit (mode buttons gone)

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2. Speak The Users' Language



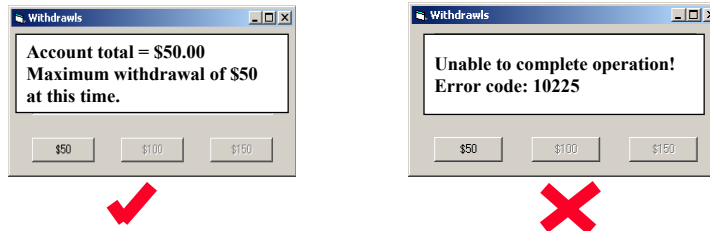
2. Speak The User's Language



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2. Speak The Users' Language

Terminology based on users' language for task



Use meaningful mnemonics, icons, and abbreviations

- eg File / Save
 - Ctrl + S (abbreviation)
 - Alt FS (mnemonic for menu action)
 - Open folder (tooltip icon)

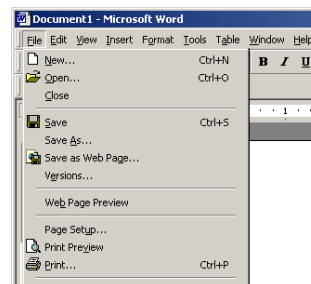
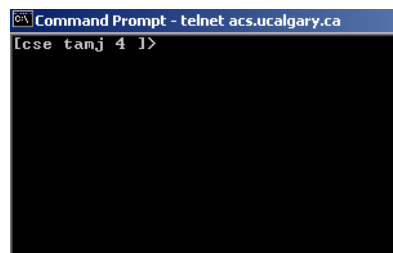


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3. Minimize The User's Memory Load

Describe required input format and example, and default

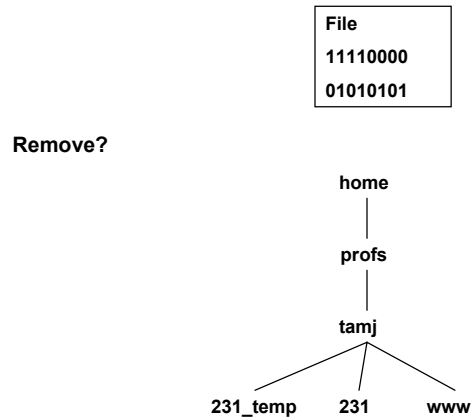
Promote recognition over recall



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3. Minimize The User's Memory Load

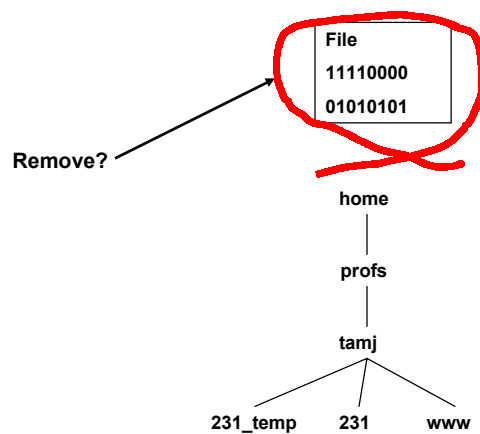
Small number of rules applied universally



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3. Minimize The User's Memory Load

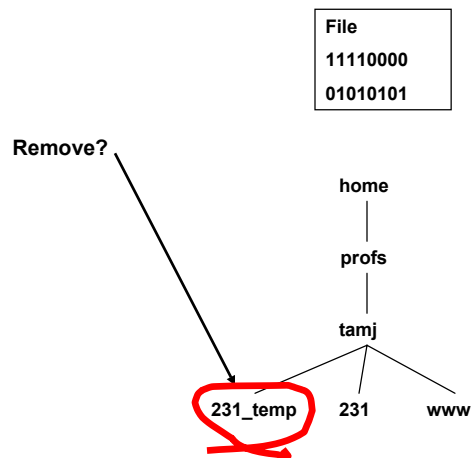
Small number of rules applied universally



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3. Minimize The User's Memory Load

Small number of rules applied universally



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4. Be Consistent

Consistency of effects

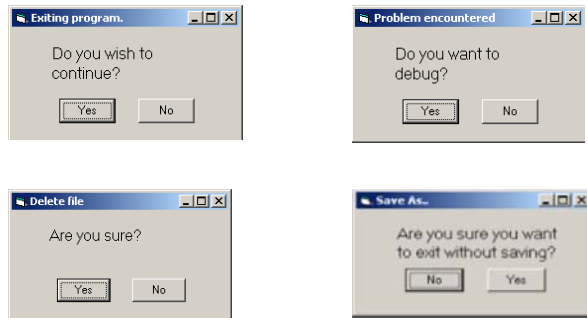
- same words, commands, actions will always have the same effect in equivalent situations
- makes the system more predictable
- reduces memory load

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4. Be Consistent

Consistency of language and graphics

- same information/controls in same location on all screens / dialog boxes forms follow boiler plate
- same visual appearance across the system (e.g. widgets)
 - e.g. different scroll bars in a single window system!



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4. Be Consistent

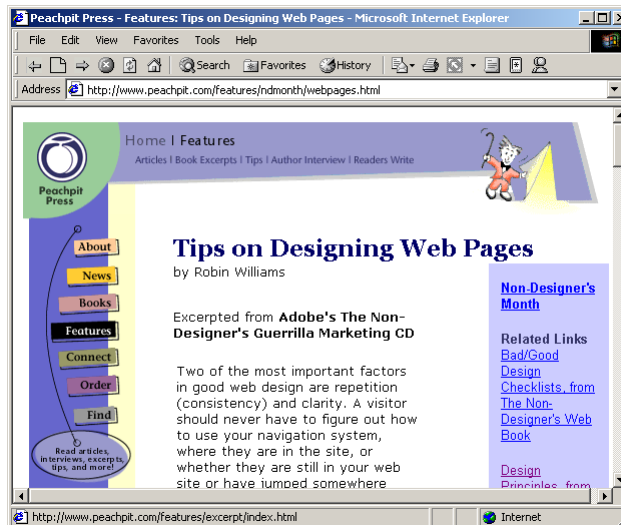
These are labels with a raised appearance.

Is it any surprise that people try and click on them?

The image shows a form titled 'Subscriber' with a grey background and a torn-paper edge effect. The form contains several input fields and buttons. At the top is a 'Subscriber' header button. Below it are two rows of labels and input fields: 'Name:' with an input field and 'Tech. Re' (partially visible), and 'Account #:' with an input field and 'Status:'. Below these is a 'Contact' header button. Then another row of labels and input fields: 'Telephone:' with an input field and 'E-Mail:' with an input field, and 'Address:' with an input field and 'St' (partially visible). At the bottom are two buttons: 'Save' and 'Cancel'. The 'Save' button has a raised appearance, indicated by a shadow and a slight 3D effect.

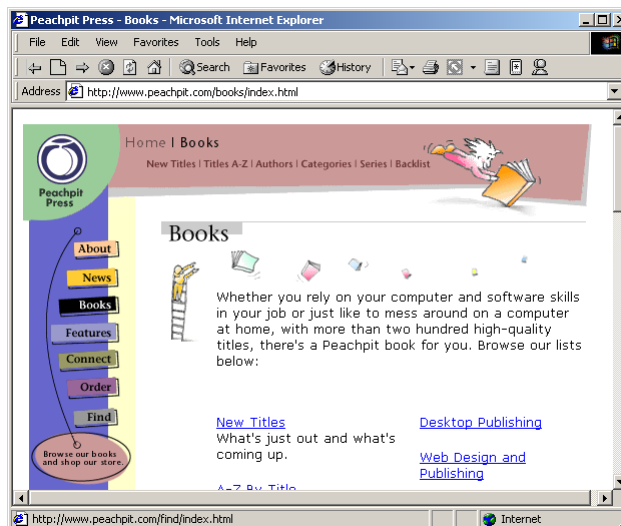
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4. Be Consistent



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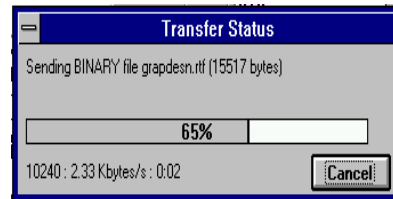
4. Be Consistent



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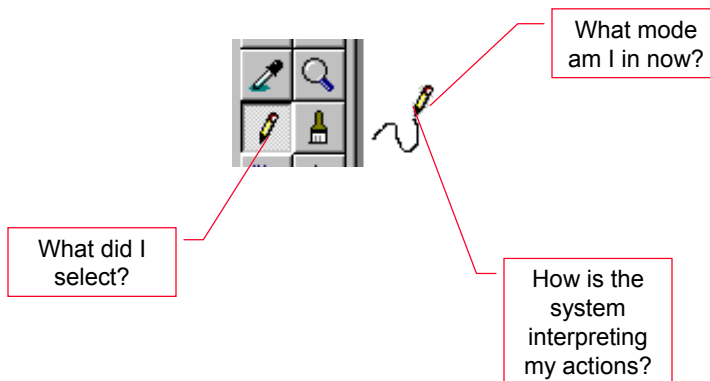
5. Provide Feedback

What is the program doing?



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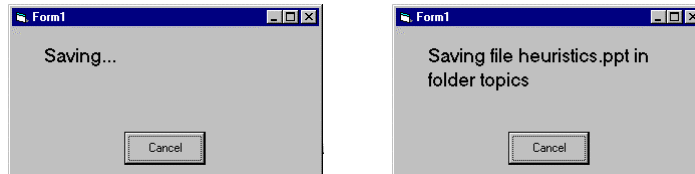
5. Provide Feedback



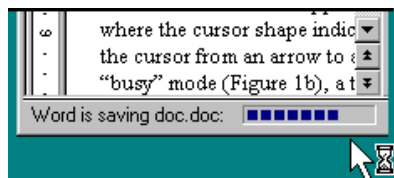
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5. Provide feedback

Should be as specific as possible, based on user's input



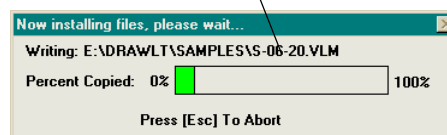
Best within the context of the action



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5. Provide feedback

Multiple files being copied, but feedback is file by file.



Drawing Board LT

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5. Provide feedback

Feedback response time

- how users perceive delays
 - 0.1 second max: perceived as “instantaneous”
 - 1 seconds max: user’s flow of thought stays uninterrupted, but delay noticed
 - 10 seconds: limit for keeping user’s attention focused on the dialog
 - > 10 seconds: user will want to perform other tasks while waiting

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6. Provide clearly marked exits



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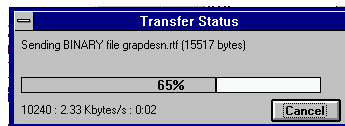
6. Provide Clearly Marked Exits

Universal Undo

- e.g., <Ctrl>-<Z> and <Ctrl> <Y>

Progress indicator & Interrupt

- Length operations



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6. Provide Clearly Marked Exits

Restoring defaults

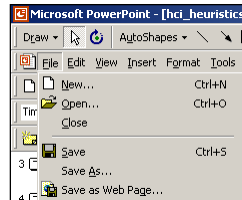
- Getting back original settings



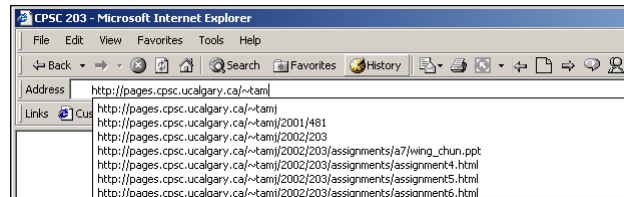
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7. Provide Shortcuts

Keyboard accelerators



Name completion



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7. Provide Shortcuts

Experienced users should be able to perform frequently used operations quickly

- type-ahead (entering input before the system is ready for it)
- navigation jumps
 - e.g., going to window/location directly, and avoiding intermediate nodes
- history systems
 - WWW: ~60% of pages are revisits



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The image shows a screenshot of the Microsoft PowerPoint application window. The main slide content is as follows:

7. Provide shortcuts
 Experienced users should be able to perform frequently used operations quickly

Strategies:

- keyboard and mouse accelerators
 - abbreviations
 - command completion
 - menu shortcuts
 - function keys
 - double clicking vs menu selection
- type-ahead (entering input before the system is ready for it)
- navigation jumps
 - e.g., going to window/location directly, and avoiding intermediate nodes
- history systems
 - WWW -> 60% of pages are revisits

Annotations on the left side of the screenshot include:

- Keyboard accelerators for menus
- Customizable toolbars and palettes for frequent actions
- Split menu, with recently used fonts on top
- Double-click raises toolbar dialog box
- Double-click raises object-specific menu

An annotation on the right side of the screenshot includes:

- Scrolling controls for page-sized increments

At the bottom right of the screenshot, the text "Saul Greenberg, James Tam" is visible.

8. Deal With Errors In A Helpful And Positive Manner

People will make errors!

Errors we make

- Mistakes
 - arise from *conscious deliberations* that lead to an error instead of the correct solution
- Slips
 - *unconscious behaviour* that gets misdirected en route to satisfying goal
e.g. drive to store, end up in the office
 - shows up frequently in skilled behaviour
usually due to inattention
 - often arises from similarities of actions

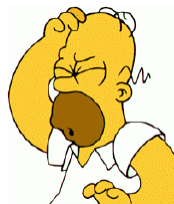


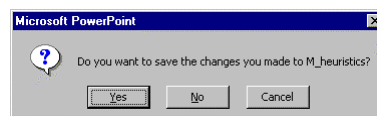
Image and sound file from "The Simpson's"

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Types Of Slips

Capture error

- frequently done activity takes charge instead of one intended
 - occurs when common and rarer actions have same initial sequence
 - change clothes for dinner and find oneself in bed (William James, 1890)



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Types Of Slips (Continued)

Description error

- intended action has much in common with others that are possible
 - usually occurs when right and wrong objects physically near each other
 - pour juice into bowl instead of glass

Loss of activation

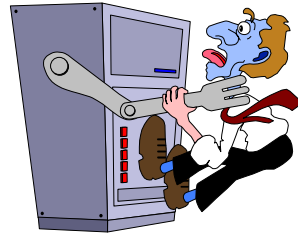
- forgetting what the goal is while undergoing the sequence of actions
 - start going to room and forget why you are going there

Mode errors

- people do actions in one mode thinking they are in another

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Designing For Slips



General rules

- Prevent slips before they occur
- Detect and correct slips when they do occur
- User correction through feedback and undo

Examples

- capture errors
 - one action captures another
 - allow actions to be undone rather than asking for confirmations
- description errors
 - correct action on the wrong object
 - make objects look physically distinctive and/or far apart
- loss of activation
 - forgot goal
 - if system knows goal, make it explicit
 - if not, allow person to see path taken or shorten steps
- mode errors
 - mistake modes
 - have as few modes as possible (preferably none)
 - make modes highly visible

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Generic System Responses For Errors

General idea: Forcing functions

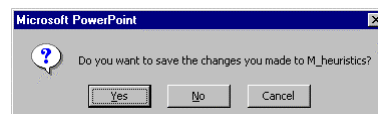
- prevent / mitigate continuation of wrongful action
 - e.g., range selection for dynamic queries

Gag

- deals with errors by preventing the user from continuing
 - eg cannot get past login screen until correct password entered

Warn

- warn people that an unusual situation is occurring
- better than nothing but when overused, becomes an irritant
 - e.g., audible bell, alert box



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Generic system responses for errors continued...

Do nothing

- illegal action just doesn't do anything
- user must infer what happened
 - e.g., enter letter into a numeric-only field (key clicks ignored)
 - e.g., put a file icon on top of another file icon (returns it to original position)

Self-correct

- system guesses legal action and does it instead
- but leads to a problem of trust
 - e.g., spelling corrector

Lets talk about it

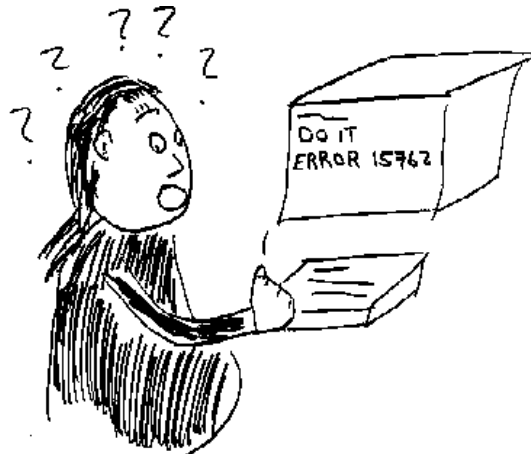
- system initiates dialog with user to come up with solution to the problem
 - e.g., compile error brings up offending line in source code

Teach me

- system asks user what the action was supposed to have meant
- action then becomes a legal one

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The Old Fashioned Approach To Error Handling



What is "error 15762"?

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Don't Make Things Seem Worse Than They Really Are



A problematic message to a nuclear power plant operator

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Rules Of Thumb For Error Message

Provide meaningful error messages

Don't make people feel stupid

Compare the following:

- Try again, bonehead!
- Error 25
- Cannot open this document
- Cannot open "chapter 5" because the application "Microsoft Word" is not on your system
- Cannot open "chapter 5" because the application "Microsoft Word" is not on your system. Open it with "Teachtext" instead?

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Examples Of Dealing With Errors In A Positive And Helpful Manner

Prevent errors

- try to make errors impossible
- modern widgets: only “legal commands” selected, or “legal data” entered

Form1

Date: []

Month Day Year

May 22 1997

Month Day Year

May 22 1997

Appointment

General Attendees Notes Planner

When:

Start: 8:30AM Wed 5 /14 /97

End: 4:30PM Wed 5 /14 /97

Description:

Smart Technology Sen

May 1997						
S	M	T	W	T	F	S
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

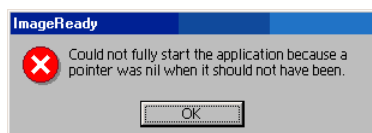
Where: []

Provide reasonableness checks on input data

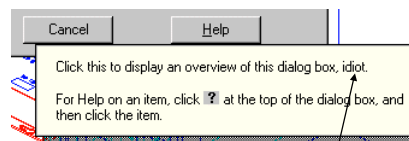
- on entering order for office supplies
 - 5000 pencils is an unusually large order. Do you really want to order that many?

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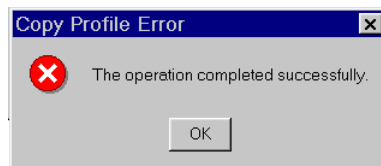
Examples Of Bad Error Messages



Adobe's *ImageReady*



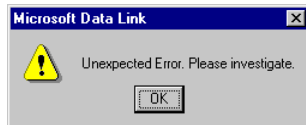
AutoCAD Mechanical



Microsoft's *NT Operating System*

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Examples Of Bad Error Messages (Continued)



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Examples Of Bad Error Messages (Continued)

The screenshot shows a Microsoft Support Services article page. The title is "Error Message: Your Password Must Be at Least 18770 Characters and Cannot Repeat Any of Your Previous 30689 Passwords (Q276304)". The page includes a list of applicable Windows versions, a "SYMPTOMS" section, and a "NOTE" section. The text in the "SYMPTOMS" section is highlighted in red.

Microsoft Product Support Services Canada

All Products | Support | Search | microsoft.com Guide

Home | Search | FAQs | Downloads | Newsgroups | Contact Us | Français | Send | Print | Help

Error Message: Your Password Must Be at Least 18770 Characters and Cannot Repeat Any of Your Previous 30689 Passwords (Q276304)

The information in this article applies to:

- Microsoft Windows versions 2000 , 2000 SP1 , Professional
- Microsoft Windows versions 2000 , 2000 SP1 , Server
- Microsoft Windows versions 2000 , 2000 SP1 , Advanced Server

SYMPTOMS

If you log on to an MIT realm, press CTRL+ALT+DELETE, click **Change Password** , type your existing MIT password, and then type a new, simple password that does not pass the dictionary check in Kadmin, you may receive the following error message:

Your password must be at least 18770 characters and cannot repeat any of your previous 30689 passwords. Please type a different password. Type a password that meets these requirements in both text boxes.

Note that the number of required characters changes from 17,145 to 18,770 with the installation of SP1.

NOTE : This is not a common case; it occurs only when you configure Windows 2000 to authenticate against an MIT Kerberos domain.

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9. Provide Help

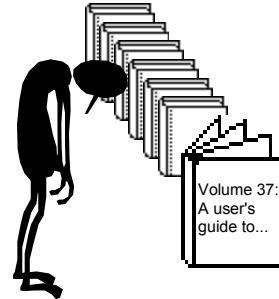
Help is not a replacement for bad design!

Simple systems:

- walk up and use; minimal instructions

Most other systems:

- feature rich
- some users will want to become “experts” rather than “casual” users
- intermediate users need reminding, plus a learning path (novice to advanced)



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Documentation And How It Is Used

Many users do not read manuals

- prefer to spend their time pursuing their task
- paper manuals unavailable in many businesses!
 - e.g. single copy locked away in system administrator's office

Manual design should consider user's immediate situation

- Panic, quick reference, expert reference, reminders, context sensitive help, wizards, tips

Usually used when users are in some kind of panic, need immediate help

- indicates need for online documentation, good search/lookup tools
- online help can be specific to current context

Sometimes used for quick reference

- syntax of actions, possibilities...
- list of shortcuts ...

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Types Of Help

Reference Manuals

Reminders

Context-sensitive help

- Tool tips
- What's this (Balloon help)

Wizards

Tips

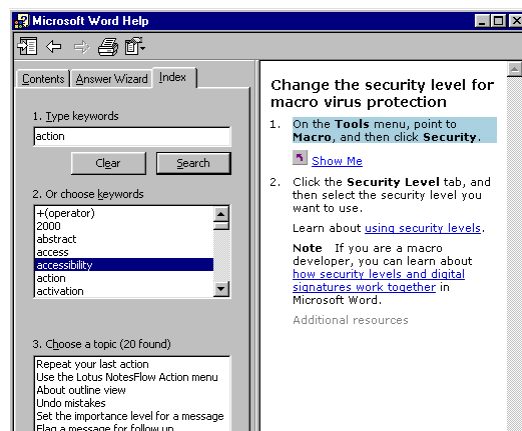
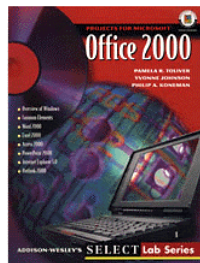
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Reference Manuals

Traditional form of help

Detailed

Paper or online



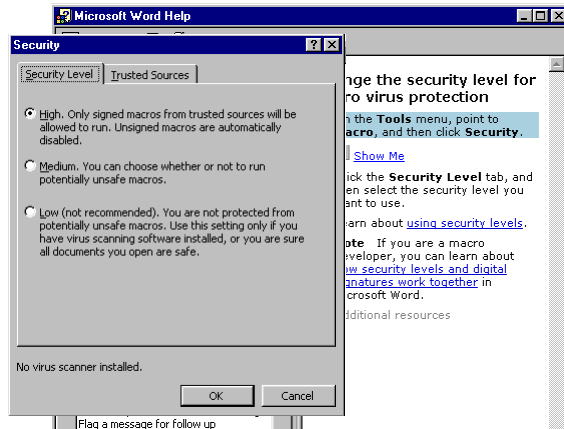
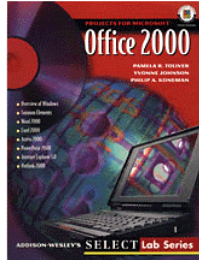
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Reference Manuals

Traditional form of help

Detailed

Paper or online



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Reminders

Short reference cards

- expert user who just wants to check facts
- novice who wants to get overview of system's capabilities

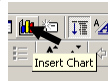
Keyboard templates

- shortcuts/syntactic meanings of keys; recognition vs. recall; capabilities

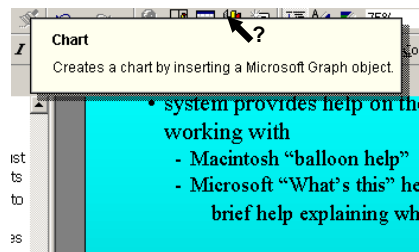
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Context-Sensitive Help

Tool tips

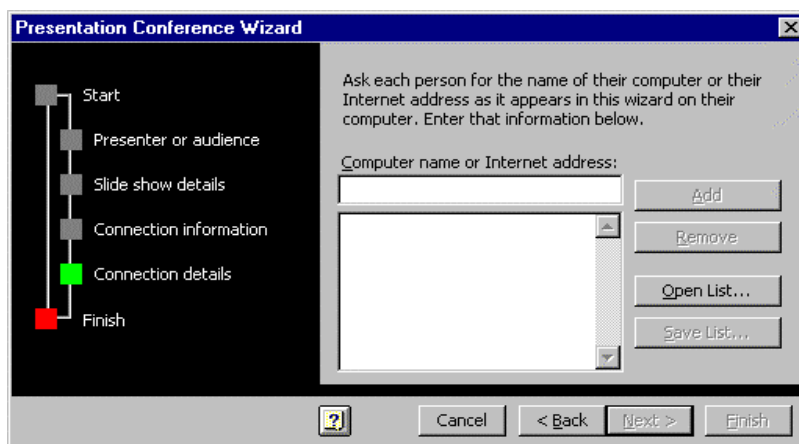


What's this (Windows) or Balloon help (Mac)



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Wizards



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Tips

Advanced features

Point out incorrect use



Change Awareness

- What is change awareness
- Why is it an important area of study
- Issues in change awareness
- Future work




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Tips

Advanced features

Point out incorrect use



 **Text is too small**
Some of the text in this placeholder might be too small for your audience to read.

- Change text to be at least 36 point
- Ignore this style rule for this presentation only
- Change style checker options for all presentations

Don't show me this tip again

OK

Char

- What is change aware
- Why is it an important
- Issues in change aware
- Future work



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Conducting A Heuristic Evaluation

Systematic inspection of a user interface design for usability

- use principles to find the usability problems in design and fix them

Method

- small set of evaluators (3–5) examine interface using heuristics as a structure
 - individual evaluators inspect in isolation (~1–2 hours for most interfaces)
 - compare notes afterwards
 - single evaluator only catches ~35% of usability problems
 - 5 evaluators catch 75%

Who should inspect?

- Interface experts
- Project team
- End users
- Double experts



Works for paper, prototypes, and working systems

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Other Guidelines: Style Guides

Guidelines published by producers of graphical user interfaces (GUIs)

- examples:
 - Open Software Foundation MOTIF
 - Open Look
 - MS Windows
 - Apple

Describes the “look and feel” of the GUI

- e.g. Open Look
 - grouping items in the same menu:

Use white space between long groups of controls on menus or in short groups when screen real estate is not an issue

Good, but hard too follow

- GUI and widget specific
- vast number of guidelines
- may miss fundamental design principles

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Example Pages From Motif Style Guide, Release 1.1

Message Dialogs

Description

MessageDialogs should be used to convey a message to the user. They must not interrupt the user's interaction with the application. They should include a message, and one of the following button arrangements.

- OK
- OK Help
- OK Cancel
- OK Cancel Help
- Yes No
- Yes No Help
- Yes No Cancel
- Yes No Cancel Help
- Cancel
- Cancel Help
- Retry Cancel
- Retry Cancel Help

Related Information

For more information, see the reference pages for DialogBox, ErrorDialog, InformationDialog, QuestionDialog, WorkingDialog, and WarningDialog

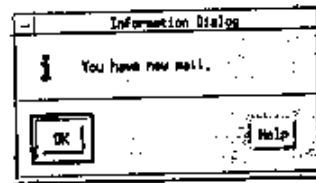
Information Dialog

Description

An InformationDialog should be used to convey information the the user. It must not interrupt the user's interaction with the application. It should include an information symbol, a message, and one of the following button arrangements.

- OK
- OK Help

Illustration



Related Information

For more information, see the reference page for DialogBox

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Other Guidelines: Widget-level “Guides”

Toolkit “hard-wires” guidelines

- repertoire of widgets
- look & feel of particular widgets
- grouping behaviour of widgets

Outside of “normal” programmer’s control

- easier to use defaults than to re-invent the wheel!

Some toolkits

- look & feel is programmer-settable or platform-dependent

Advantages:

- easy to be consistent
- widgets developed by experts (graphical designers, etc.)

Disadvantages

- can be hacked around
- interfaces “assembled” by non-interface designers can still be terrible

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You Now Know

Nine principles of design

- Simple and natural dialog
- Speak the user's language
- Minimize user's memory load
- Be consistent
- Provide feedback
- Provide clearly marked exits
- Provide shortcuts
- Deal with errors in a positive manner
- Provide help

Heuristic evaluation

- Principles can be used to systematically inspect the interface for usability problems

Style guides are mostly platform-dependant design principles

Widget-level guidelines are built into the widgets themselves

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