



User Interfaces  
of  
Interactive Statistical Graphics Software

by

Martin Theus

VIAG Interkom

[martin.theus@viaginterkom.de](mailto:martin.theus@viaginterkom.de)



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

Summary

Outline

- History of GUIs .....Early Mistakes  
A History of User Interfaces
- Hall of Shame
- Hall of Fame
- Reasons for Failure
- Design Approaches ..... Principles  
Heuristics  
Aesthetics  
The Process
- Do's and Don'ts
- Examples .....DataDesk  
MANET  
Mondrian  
XGobi
- Summary



Outline

History of GUIs

Early Failures

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

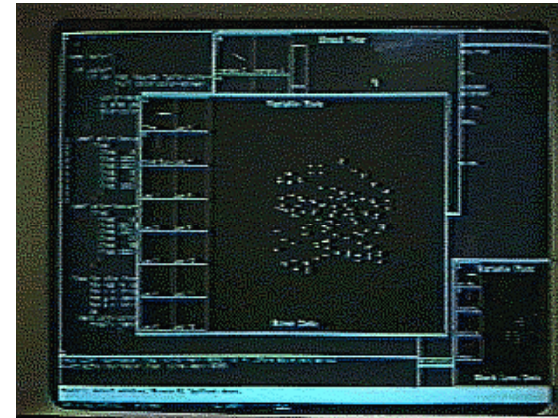
Summary

## History of GUIs

- Early Failures



Is this a Keyboard?



A peculiar Desktop

*"Real Men don't use Mice!"*



Outline

History of GUIs

Early Failures

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

Summary

## History of GUIs

- A History of User Interfaces
  - Smalltalk Desktop †
  - MacOS
  - Atari ST †
  - Special Workstation's Desktop (e.g. Lisp-Machine) †
  - X11
  - Oberon Desktop †
  - Windows (3.1, 95, 98, 2001, NT)



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

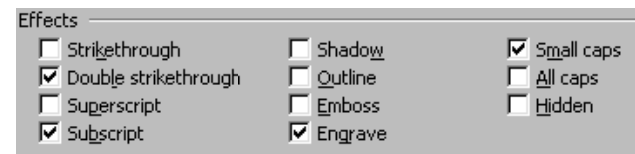
Examples

Summary

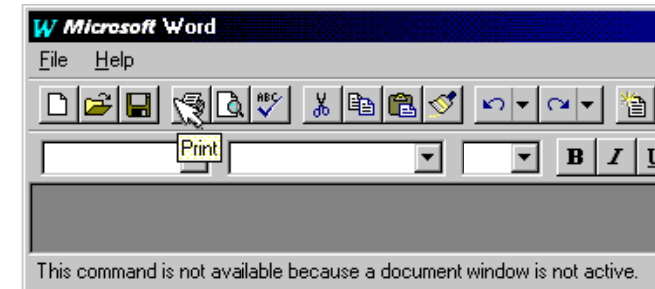
## Hall of Shame

- Selecting the wrong controls

Word95 for Windows:  
Font Attributes



Print Button in Tool Bar



Excel95 for Windows:  
Cut & Paste

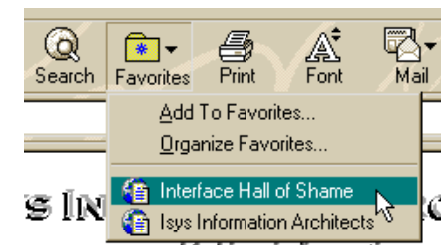
Region	January	February
North	10111	13400
South	22100	24050
East	13270	15670
West	10800	21500

Internet Explorer:  
Menus



vs.

Buttons





Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

Summary

## Hall of Shame

*"Where do you want to get lost today?"*



*"How will the layout change when clicking on Graphics?"*





Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

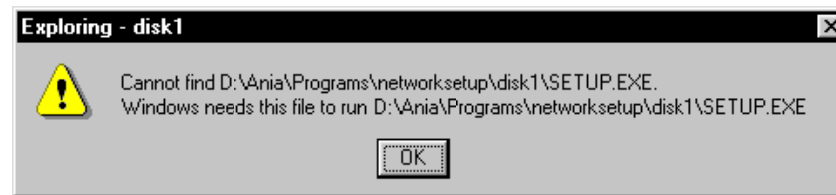
Examples

Summary

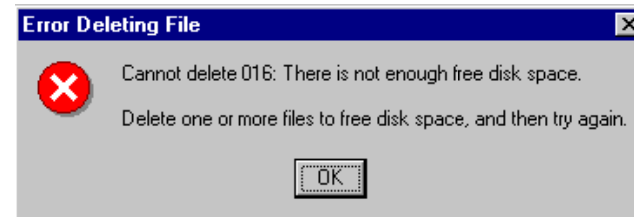
## Hall of Shame

- Misleading Error Messages

Windows98:  
Explorer

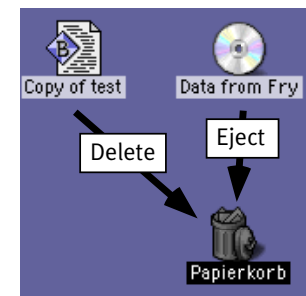


Desktop Operation



- Wrong Metaphors

MacOS:  
File Delete vs. Disk Eject





Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

Summary

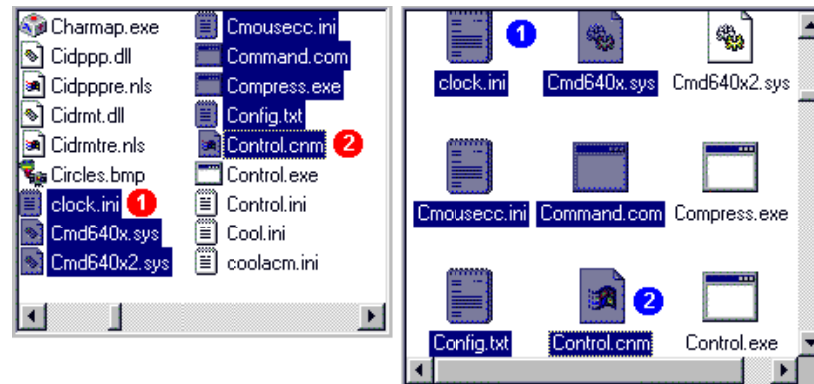
## Hall of Shame

- Inconsistency

Windows95:  
"My Computer" Window



Selections in different views





Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

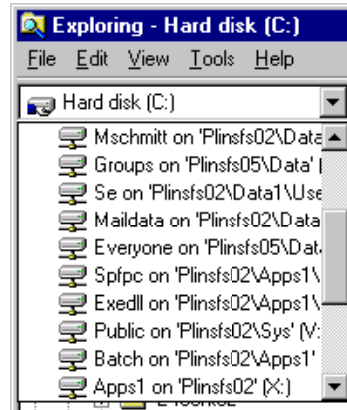
Examples

Summary

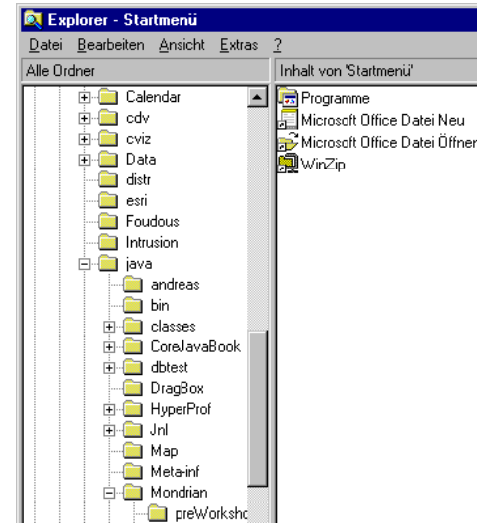
## Hall of Shame

- "Stupidity"

Windows Explorer:  
Selecting Drives



Directories





Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

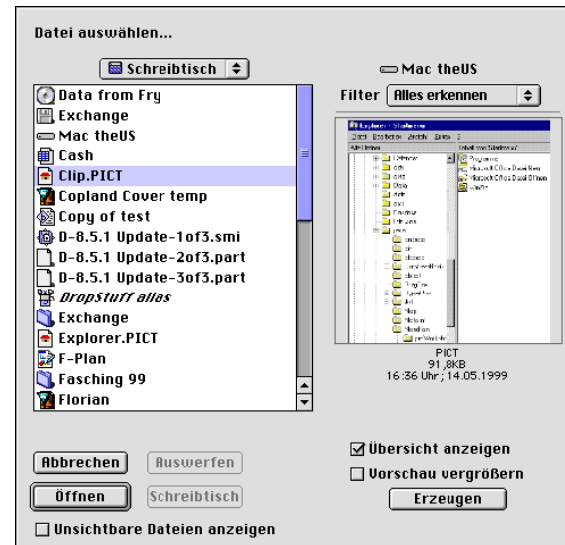
Summary

## Hall of Fame

- Most Recently Used (MRU)



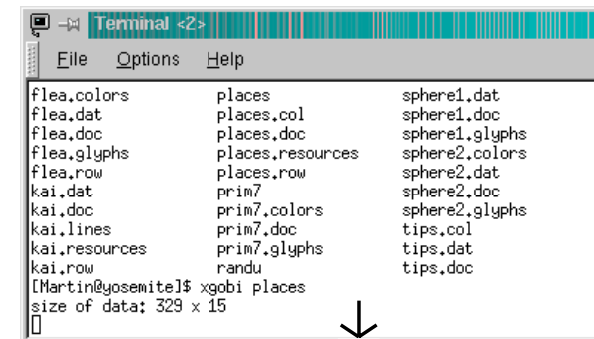
- Previews



- Tooltips



- Cues





Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

Summary

## Reasons For Failure

- The designer's intuition relies on a sample of one

Implementer's Model    vs.    User's Model  
System View            vs.    Task View

- Tools do not make a concept

X11 and its Window Managers offer various widgets,  
but no guidelines for a desktop/application concept

KDE/Gnome try to define common desktop concepts

- Inconsistency

Similar things/tasks must look/behave similarly

- Bundling the GUI with the OS

Smalltalk and Oberon

- Backwards compatibility to insufficient GUIs



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Principles

Heuristics

Aesthetics

The Process

Do's and Don'ts

Examples

Summary

## Design Approaches

- Principles (by Norman)
  1. Use both knowledge in the world and knowledge in the head.
  2. Simplify the structure of tasks.
  3. Make things visible:  
bridge the gulfs of Execution and Evaluation.
  4. Get the mappings right.
  5. Exploit the power of constraints,  
both natural and artificial.
  6. Design for error.
  7. When all else fails, standardize.



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Principles

Heuristics

Aesthetics

The Process

Do's and Don'ts

Examples

Summary

## Design Approaches

- Heuristics (Nielsen and Molich)

- Visibility of system status

*The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.*

- Match between system and the real world

*The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.*

- User control and freedom

*Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.*

- Consistency and standards

*Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.*



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Principles

Heuristics

Aesthetics

The Process

Do's and Don'ts

Examples

Summary

– Error prevention

*Even better than good error messages is a careful design which prevents a problem from occurring in the first place.*

– Recognition rather than recall

*Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Reduce the users' memory load.*

– Flexibility and efficiency of use

*Accelerators – unseen by the novice user – may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.*

– Aesthetic and minimalist design

*Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.*

– Help users recognize, diagnose, and recover from errors

*Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.*



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Principles

Heuristics

Aesthetics

The Process

Do's and Don'ts

Examples

Summary

## Design Approaches

- Aesthetics

- Aesthetics

- not tangible, but obvious*
    - the right "look and feel"*

- Harmony

- comes along with consistency*

- Composition

- once the components are defined correctly,*
    - the program will build up more easily*

- benefit from object oriented design*



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

**Design Approaches**

Principles

Heuristics

Aesthetics

**The Process**

Do's and Don'ts

Examples

Summary

## Design Approaches

- The Process

- Early focus on users and tasks

- Study the attitudes and behaviors of users,  
and become familiar with the nature of their tasks*

- Empirical measurement

- Early in the development process, study the performance  
and reactions of the system's intended users using  
simulations and prototypes.*

- Study your GUI carefully

- Be sure you know all components and their correct use*

- Talk to colleagues

- "Maybe both of you are wrong!"*

- Iterative design

- Keep redesigning the system as long as user testing  
reveals problems.*



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

Summary

## Do's and Don'ts

Do ...

... talk to the user

... present and test prototypes

... iterate your design

... think in terms of tasks

... maximize consistency

... think in reusable objects

... conform to prevailing standards  
unless there is a good reason not to

...

Don't ...

... believe your intuition

... ignore the user's feedback

... be lazy

... think in terms of the system

... be satisfied with a local solution

... write code over and over again

... reinvent the wheel

...



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

DataDesk

MANET

Mondrian

XGobi

Summary

## DataDesk

non standard windows

function "hidden" behind cues

inconsistent behavior of selection tools

desktop concept

inconsistent color assignment

non standard forms

Linear Model

91 total cases of which 41 are missing

- Multivariate Tests:
- Overview p-values
- Results for Dependent Variable MPG
- Results for factor Cyl\*Cny
- Results for MPG and Cyl\*Cny
  - Coefficients
 

Level of Cyl*Cny	Coefficient	std. err.	t Ratio	prob
Germany,3				
Germany,4	0,1845	5,989	0,0308	0,9756
Germany,6	-2,708	4,485	-0,6038	0,5495
Germany,8				
Japan,3	-4,376	8,432	-0,5190	0,6067
Japan,4	1,668	4,302	0,3877	0,7004
Japan,6	2,708	4,485	0,6038	0,5495
Japan,8	0	0		
Other,3				
Other,4	-2,774	3,548	-0,7818	0,4391
Other,6	0	0		
Other,8				
USA,3				
USA,4	0,9216	2,188	0,4213	0,6759
USA,6	0	0		
USA,8	0	0		
  - Expected Cell Means
 

Level of Cyl*Cny	Expected Cell Mean	Cell Count
Germany,3		0
Germany,4	25	1
Germany,6	17,00	1

Interaction Plot of MPG by Cyl\*Cny

MPG/Wgt Plot

MPG

Weight

Cylinders Bar Chart

Cylinders



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

DataDesk

MANET

Mondrian

XGobi

Summary

# MANET

cursor indicates selection mode

indicator of missing information

no desktop or session concept

cue indicating plot options

tracking of selection steps

consistent interrogation

File Edit Plots Windows Groups Utilities statistics Hilfe

Polygon : state

Midwest

Variables:

- ID
- name of county
- state
- area of county
- total population
- Population density
- Total white population
- Dot: % white

weight is: state

2

IL IN WI OH MI

OH  
86.36/20.14 (%)



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

DataDesk

MANET

Mondrian

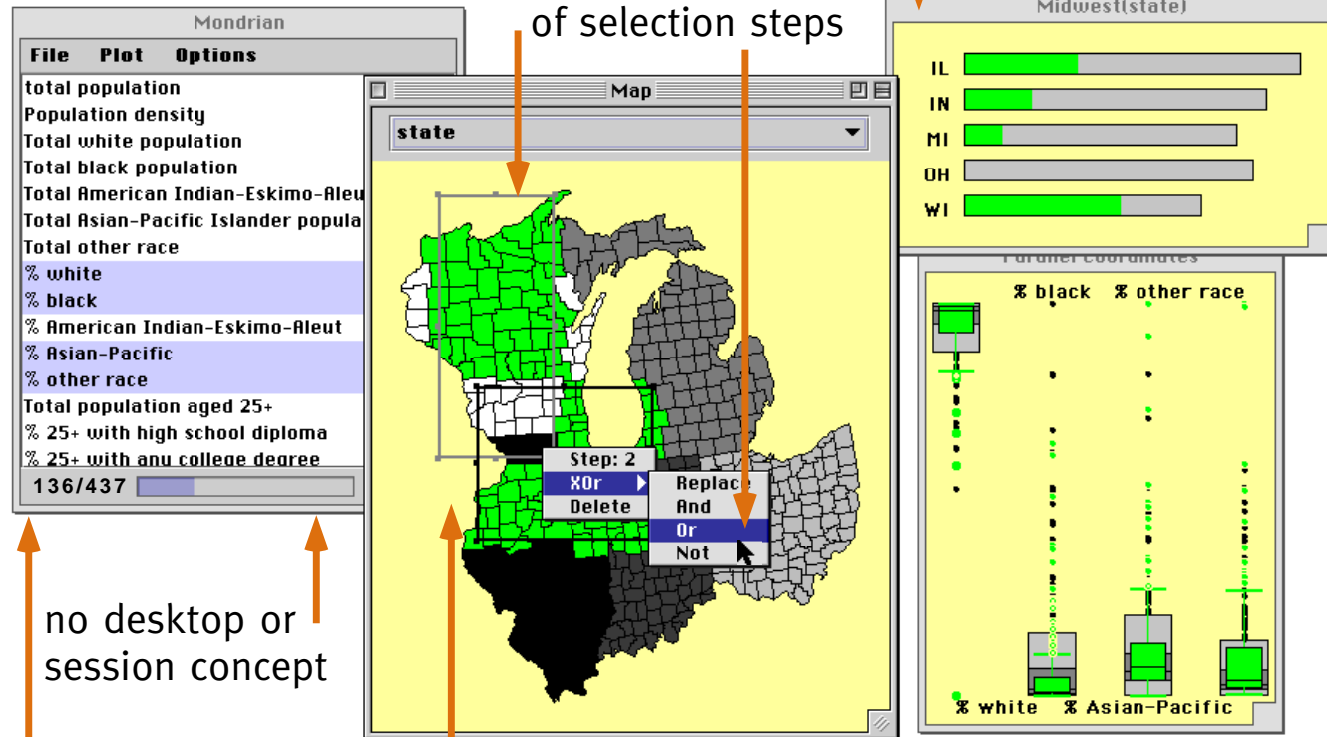
XGobi

Summary

# Mondrian

platform independent  
Swing (JAVA) interface

advanced tracking  
of selection steps



no desktop or  
session concept

visibility of selection  
proportion

multiple selections  
per window

consistent mapping of mouse and modifier keys for selection and alteration



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

DataDesk

MANET

Mondrian

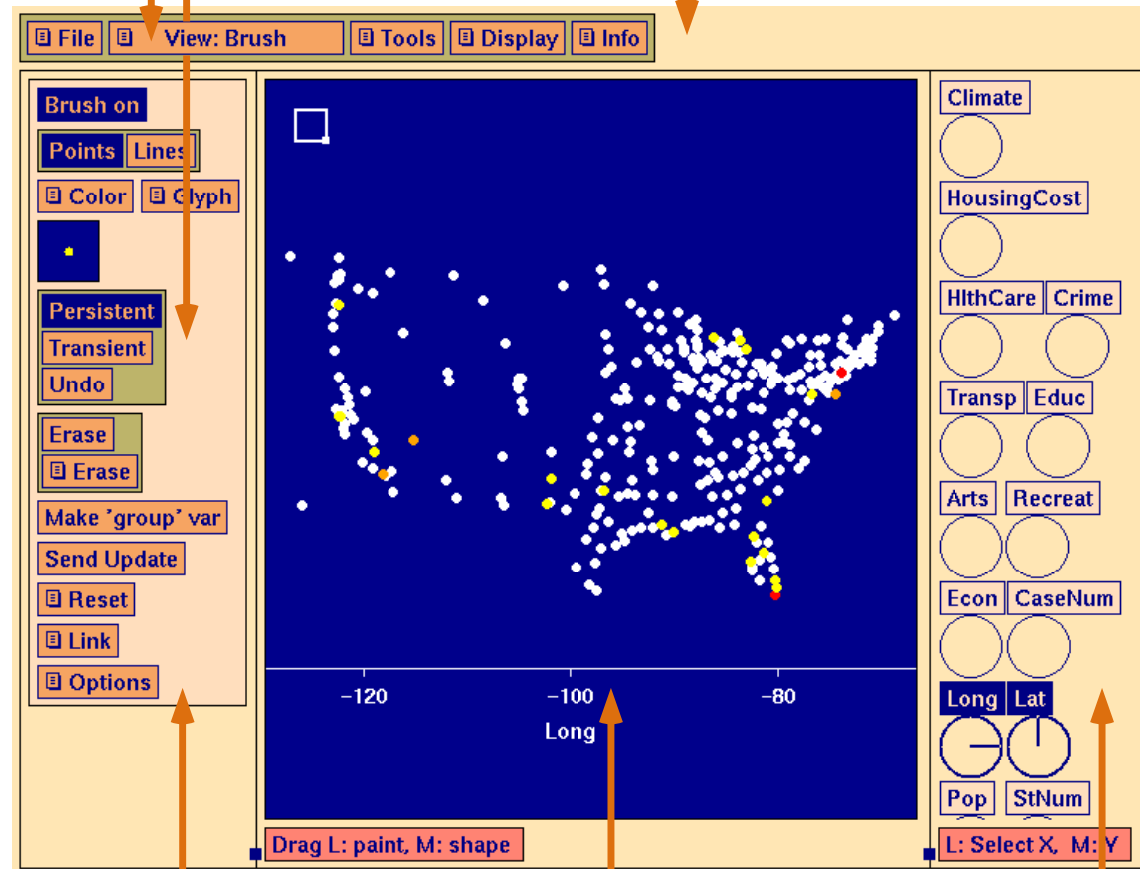
XGobi

Summary

XGobi

possible operations are constrained by current mode

old and non-standard interface toolkit



cluttered button list

only one window per XGobi

variable circles provide a lot of feedback



Outline

History of GUIs

Hall of Shame

Hall of Fame

Reasons for Failure

Design Approaches

Do's and Don'ts

Examples

Summary

## Summary

- "Your best guess is not good enough"
- Complex tasks can not be performed with trivial controls
- Most interfaces are optimized for a specific task
- A "good enough" design might be the best we can achieve
- Most software is still far away from being "good enough"

## Resources

Donald A. Norman – "The Psychology of Everyday Things"

Jakob Nielsen – <http://www.useit.com>; (formerly SUN)

Isys Information Architects Inc. – <http://www.iarchitect.com>

Debby Swayne – AT&T Labs Research

Antony Unwin – University of Augsburg