

# Graphical Screen Design

## CRAP

(Contrast, repetition, alignment, proximity)

## Grids

An essential tool for graphical design

## Other important graphical screen design concepts

Visual consistency

Visual relationships

Visual organization

Legibility and readability

Appropriate imagery

Navigational cues

Familiar idioms

James Tam

## The Squint Test

Used to determine what stands out or what elements appear to belong together



James Tam

# CRAP: An Important Tool For Graphical Screen Design

## Contrast

- Make different things even more different
- Brings out dominant elements & mute lesser elements

## Repetition

- Consistency
- Repeat conventions throughout the interface to tie elements together

## Alignment

- Visually associate related elements by lining them up

## Proximity

- Group related elements
- Separate unrelated elements

James Tam

## Contrasting Contrast

### Laura Mathews

1953 Kevalk Drive  
Santa Rosa, California 95405  
707-507-1254

#### Related Skills

Excellent working knowledge of laboratory tests and their significance in oncology care through working in a clinical laboratory, reinforced while providing patient care. Assisted with bone marrow biopsy and aspiration, lumbar puncture, paracentesis, thoracentesis, and intrathecal chemotherapy administration. Promoted self-care skills and adaptation of the client to their disease and particular treatment program.

Extensive experience with at-home care of sick and cancer patients, including IV line maintenance, pain management, understanding of medicare reimbursement and social service referrals.

#### Education

1990 Associate in Science Nursing, High Honors  
Santa Rosa Junior College, Santa Rosa, California

#### Experience

1992-present Registered Nurse for Home Health Plus, Visit Division. At-home care of patients with multiple health problems, sick, and cancer patients.

1990-present Registered Nurse for Memorial Hospital Oncology Unit, Santa Rosa, California. Managed the care of 4-5 oncology patients. Assumed lead nurse responsibilities. Assisted with new RN orientation. Assisted with procedures administered chemotherapy, assessed for side effects of chemotherapy and disease process.

1985-1986 Nurse's Aide for Mendocino Coast District Hospital, Fort Bragg, California. Assisted with patient care in Med-Surg and Obstetrical settings.

1985-1986 Lab Assistant for Mendocino Coast District Hospital, Fort Bragg, California. Computer skills while inputting data, cultured lab specimens.

#### Personal Statement

Previous work experience in a fast-paced, high-stress environment has fine-tuned my organizational skills. My experiences have made me comfortable with oncology patients and their families. Supervisors value my organizational skills, eagerness to learn and assume responsibilities, and my dedication to my job.

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From "The Non-Designers Design book by Robin Williams

James Tam

## Repetition



From "The Non-Designers Design book by Robin Williams

James Tam

## Alignment



From "The Non-Designers Design book by Robin Williams

James Tam

# Proximity

CD ROMs  
 CD ROMs  
 Children's CDs  
 Educational CDs  
 Entertainment CDs  
 Laser discs  
 Educational  
 Early learning  
 Language arts  
 Science  
 Math  
 Teacher Tools  
 Books  
 Teacher tools  
 Videos  
 Hardware &  
 Accessories  
 Cables  
 Input devices  
 Mass storage  
 Memory  
 Modems  
 Printers & supplies  
 Video and sound

**CD ROMs**  
 CD ROMs  
 Children's CDs  
 Educational CDs  
 Entertainment CDs  
 Laser discs

**Educational**  
 Early learning  
 Language arts  
 Science  
 Math

**Teacher Tools**  
 Books  
 Teacher tools  
 Videos

**Hardware & Accessories**  
 Cables  
 Input devices  
 Mass storage  
 Memory  
 Modems  
 Printers & supplies  
 Video and sound

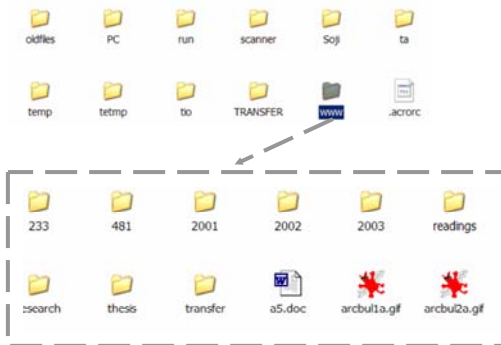
From "The Non-Designers Design book by Robin Williams

James Tam

# Graphical Design

**Must account for:**

- A comprehensible mental image
  - Metaphor (known <-> unknown)
- Appropriate organization of data, functions, tasks and roles
  - Cognitive model (how do I think it works)



Dilbert © United Features Syndicate

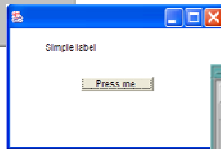
James Tam

## Graphical Design (2)

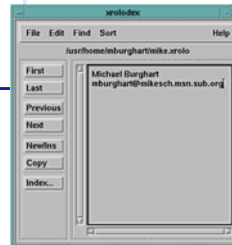
- Quality appearance characteristics
  - The “look”
- Effective interaction sequencing
  - The “feel”



Classic Windows



Windows XP



Motif

James Tam

## Components of Visible Language

### Layout

- Formats, proportions, and grids

scarves: 10.75

hats: 5.43

### Typography

- Typefaces and typesetting

**bold** serif      fixed  
*italic* sans-serif    variable

### Imagery

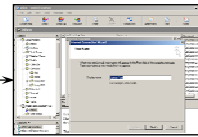
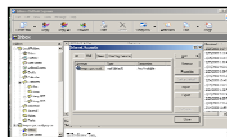
- Signs, icons, symbols; concrete to abstract



**BOOZE!**

### Sequencing

- How the interface unfolds



James Tam

## Components Of Visible Language (2)

### Visual identity

- Unique appearance



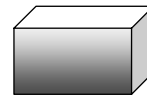
### Animation

- Dynamics of display



### Color and Texture

- Convey complex information and pictorial reality



James Tam

## Grids

### Horizontal and vertical lines to locate window components

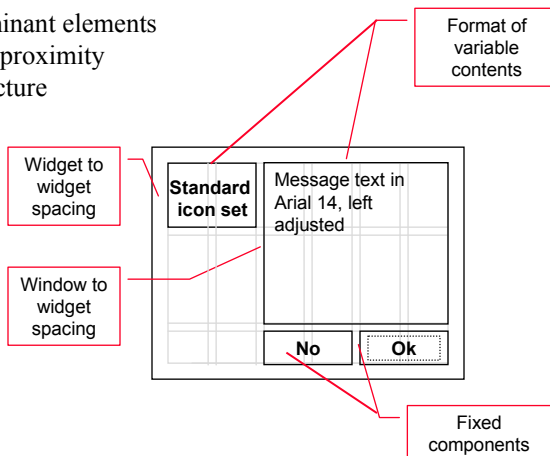
- Aligns related components

### Organizes the display:

- Contrast to bring out dominant elements
- Grouping of elements by proximity
- Show organizational structure
- Alignment

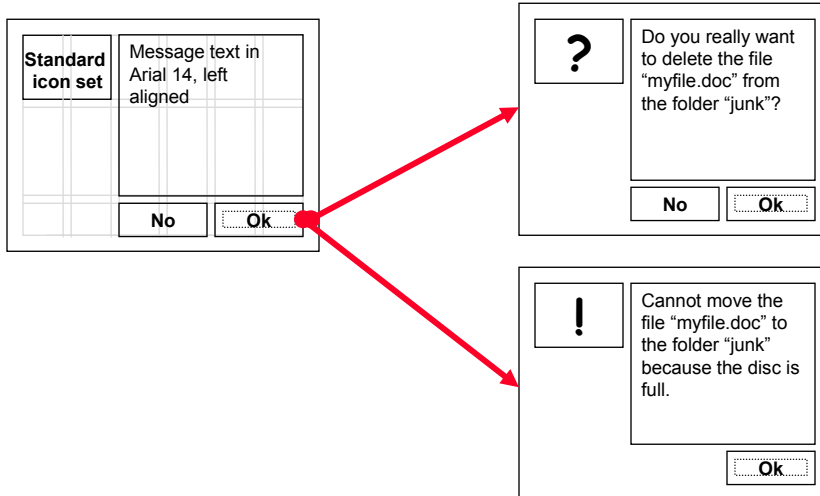
### Provides consistency

- Location
- Format
- Repetition
- Organization



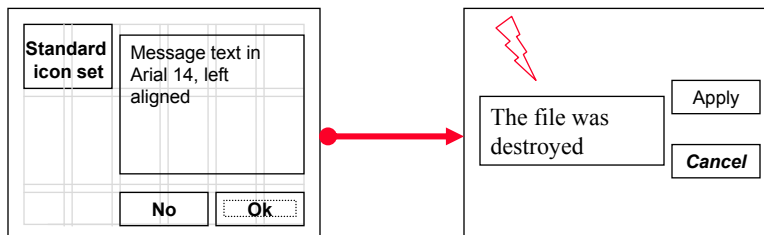
James Tam

## Using A Grid: Consistent



James Tam

## No Grid: Inconsistent



James Tam

## Another Grid Example

Two-level Hierarchy

- Indentation
- Contrast

Logic of organizational flow

Alignment connects visual elements in a sequence

Grouping by white space

James Tam

## Visual Consistency: Internal Consistency

- Unless there is a compelling reason all elements of the same program follow the same rules and conventions
- Application specific grids can be used to enforce this

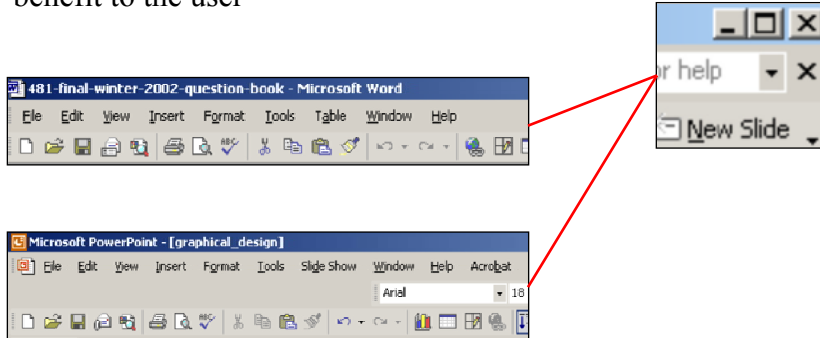
Doh!

James Tam



## Visual Consistency: External Consistency

- Follow interface and platform style conventions
- Use grids that are platform (e.g., Windows) and widget (e.g., Java Swing) specific
- Deviate from these conventions only when there is a clear benefit to the user



James Tam

## External Consistency Violated

The screenshot displays a web interface for 'LIGANDFIT', a cancer research project. The interface is divided into several sections:

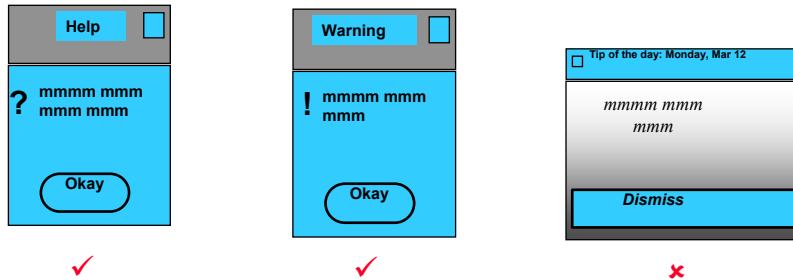
- Primary Task Information:** Displays the project name 'LIGANDFIT', the phase 'CANCER RESEARCH PROJECT, PHASE II', and a description: 'LigandFit helps scientists to characterize therapeutic targets and identify and assess drug candidates by performing automated docking of flexible ligands to a protein's binding site.' It also shows 'Task CPU Time: 3 hrs 7 mins 27 secs' and a 'Task Execution Progress' bar at 57%.
- Member Information:** Shows the member's name 'JimmyT', 'Total Points: 889891', and 'Total CPU Time: 5 years 132 days 15 h 25 m 23 s'. A link 'View your scores and rewards' is provided.
- Device Information:** Shows 'Overall Performance' with a score of 100, comparing the device to a 'High-end Desktop System'. Other metrics include Processor (100), Memory (185), Storage (185), and Network. A link 'View your device list' is provided.

The interface features a blue header and footer. The footer includes the 'UNITED DEVICES™' logo, the text 'Primary task is executing...', and a set of navigation icons. The overall design is clean and professional, but the layout and styling deviate from standard web conventions, illustrating external consistency violations.

The UD agent © United Devices: <http://www.grid.org/projects/cancer/>

James Tam

## A Tool For Ensuring Consistency: Mumble Text



James Tam

## Structure Is Difficult To Ascertain

sometimes be more a nuisance than a benefit. This was found to be the case in my own investigation of potential change display mechanisms summarized in Chapter 5 and published as Tam, McCaffrey, Maurer, and Greenberg (2000). During this study, many test participants expressed a desire for useful abstractions that combine rudimentary change information into one higher-level conceptual change. For example, one participant noted while watching the animated replay of a class name being shown, "...I don't need to see each and every character being typed just to see a name change!" Of course, care must be taken to make these abstractions understandable, e.g., by using already familiar representations or notations. This minimizes the cost of acquiring information while maximizing its benefits due to the added structure and organization.

Based upon my previous findings (to be discussed in Chapter 5), I add a third dimension, *persistence*, to Gutwin's classification. *Persistence* refers to how long the information is displayed (Figure 4.1 side pane). The display of information is *permanent* if it is always visible and *passing* if it only appears for a certain period. We noticed how study participants frequently complained when important information disappeared off the screen. Conversely, they also indicated that screen clutter might occur with the mechanisms that constantly displayed all changes. Thus, there's a need to classify change information according to how long it should stay visible.

With permanent persistence, the effort needed to find changes i.e., the acquisition cost is low because the information is always there. Ideally, a person merely has to shift their gaze over to see the information. Because people can become accustomed to the occurrence of workspace events, they can also ignore things that do not interest them and pay closer attention to things that are of interest (Gutwin 1997).

With passing persistence, information about changes is presented only for a limited duration. This is useful when the information applies only to a specific portion of the project (artifact or group of artifacts) being viewed, or when the change information otherwise becomes irrelevant. This is quite an important point for us. The matrix in Figure 4.1 suggests that these dimensions can be combined, giving eight possibilities. For example, a literal, situated and passing display of changes is depicted in Figure 4.2a. The figure shows an animation of a changed circle (by using a 'replay' technique) where the circle literally retraces the path that it took as it was moved. It is situated because the animation occurs in the same place that the change actually happened. The persistence is 'passing' because once an animation has replayed a change, the information is gone. Figure 4.2b shows two other examples within a concept map editor. The first illustrates the symbolic, situated and permanent octant, where color value (shades of gray) is used to indicate changed 'Jim' and 'Jack' nodes. Thus, it is symbolic because changes are mapped to a gray scale value, situated because the shading is applied directly to the node that was changed, and permanent because the color values are always on. Figure 4.2c also portrays an example of the symbolic, separate, and passing octant, where a person can raise a node's change details in a pop-up as a text description by mousing-over the node. Thus it is somewhat separate as the information appears outside the changed node, it is symbolic as it uses the text to describe the changes, and passing because the pop-up disappears when the person moves the mouse off the node (not quite on the node).

In summary, these three dimensions provide the designer with a means of classifying change information. I now turn to other display issues, where we need to represent the change information in an easily understood and readily accessible fashion.

James Tam

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## Structure Is Implied With White Space

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James Tam

## Relationships Between Screen Elements

- Using white space (negative proximity) vs. forcing an explicit onscreen structure (e.g., the use of bounding boxes)

### No structure

Mmmm:

Mmmm:

Mmmm:

Mmmm:

Mmmm:

x

### Explicit structure

Mmmm:

Mmmm:

Mmmm:

Mmmm:

Mmmm:

Mmmm:

x

### Implicit structure

Mmmm:

Mmmm:

Mmmm:

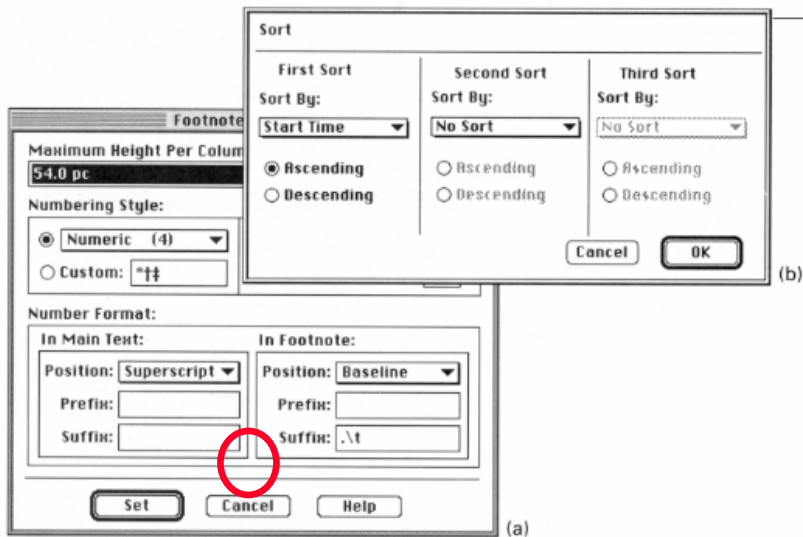
Mmmm:

Mmmm:

✓

James Tam

## Examples Of Explicit Structure



## What Are The Input Fields? What Is Output Only?

- Bad alignment
- Poor choice of colors to distinguish labels from editable fields

Form Title -- (appears above URL in most browsers and is used by 'www' search)		Background Color:
Q&D Software Development Order Desk		FFFBF0
Form Heading -- (appears at top of Web page in bold type)		
Q&D Software Development Order Desk		Text Color:
<input checked="" type="checkbox"/> Center		000080
E-Mail responses to (will not appear on)	Alternate (for mailto forms only)	Background Graphic
dversch@q-d.com		
Text to appear in Submit button	Text to appear in Reset button	<input type="radio"/> Mailto
Send Order	Clear Form	<input checked="" type="radio"/> CGI
Scrolling Status Bar Message (max length = 200 characters)		
****WebMania 1.5b with Image Map Wizard is here!****		
<< Prev Tab		Next Tab >>

Webforms

James Tam

## No Regard For Order And Organization

Advanced FAX Settings

Aptiva Communication Center

Speaker setting

On  On until connect  Off

Wait 45 seconds for connection

Retry after 60 seconds Number of retries 3

Resolution

Fine  Standard

Maximum transmit rate: 14400 bps

Paper size: Letter (8 1/2 x 11 in)

Use custom editor: xe C:\Phoenix\Fax\_inst.wii Browse...

Save Cancel Help

IBM's Aptiva Communication Center

James Tam

## A Haphazard Layout

The screenshot shows a web form for 'xbugtool 2.0 Beta 2' with the following elements:

- Navigation:** Buttons for Load, Store, Submit, View, Print, Reset, Props, Gen. Help, and Update lists.
- Form Fields:** Bug ID, Category, Subcategory, Resp Mgr, State, Priority (1-5), Severity (1-5), Bug/Rfc (bug, rfc), and Responsible Engineer.
- Keywords:** A section with a 'Description' tab and sub-tabs for Work around, Suggested fix, Comments, and Public summary.
- State triggers:** A list of buttons including Evaluation, Commit to fix in rel., Fixed in releases, Integrated in releases, Verified in releases, Closed because, Incomplete because, Root cause, and Fix affects docs.
- Other Fields:** Duplicate of, Patch id, Interest list, See also (bugids), History, Submitter, Date, Generic SVR4 problem?, Dispatch operator, Evaluator, Commit operator, and Flux operator.

Haphazard layout from Mullet & Sano page 105

James Tam

## Repairing A Haphazard Layout

The screenshot shows a web form for 'Bugtool' with the following elements:

- Navigation:** Buttons for Report, View, Props, Help, Mode, Create, and Edit.
- Form Fields:** Bug ID, Type (Bug, RFE), Category (XView), Subcategory (Library), Release (1.0), Priority (1-5), Severity (1-5), States (Submitted), Synopsis, Keywords, Pub Summary, See also, and Interest List.
- Table:** A table with columns: Description, Work Around, Suggested Fix, Comments, and Evaluation.
- Root Cause:** A text field containing 'documentation-confusing'.
- Same as:** A section with fields for Resp Mgr, Resp Engr, Hook 1, and Hook 2.
- Flags:** Checkboxes for 'Fix Affects Documentation' and 'Generic SVR4 Problem'.

Repairing a haphazard layout from Mullet & Sano page 105

James Tam

# Spatial Tension

The screenshot shows a financial website with a navigation menu on the left and several content sections:

- News:** Last update 5:13 PM ET September 30, 1998. **Stocks sacked** - U.S. stocks were slammed for beefy losses Wednesday as investors, voicing extreme displeasure with Tuesday's minimal interest-rate cut by the Federal Reserve, dumped holdings across a broad swath. [FULL STORY](#)
- Today on Personal Finance:**
  - Home buying?** Prepare yourself with QuickenMortgage planning tools.
  - Stock of the Week:** Transaction Network Services.
- Financial Forums:**
  - Quicken Poll:** Would impeachment proceedings push the US into a recession?
- Personal Finance Q&A:**
  - Should I consolidate my debts?** [Click here for quick answers to your personal finance questions.](#)
- Mini Portfolio:** No alerts for your symbols. Default Portfolio table with columns for Symbol, Last, and Change.
 

Symbol	Last	Change
Nasdaq	1693.84	-40.21
Dow	7842.62	-237.90
S&P 500	1017.05	-31.97
FMAGX	97.52	-2.94
INTU	46.56	+0.06
AOL*	111.62	-5.75

 Updated: Wed, Sep 30, 17:54 EDT ET. Nasdaq data delayed at least 15 mins. Other data delayed at least 20 mins. \* = News, H/L = 52 wk high/low.
- Products & Promos:**
  - Quicken 99 is here!** **NEW**
  - Beyond.com** --The software center for all your business needs.
  - Sign up for our free**

The web site for Quicken: Web Centers/Personal Finance link

James Tam

# Spatial Tension

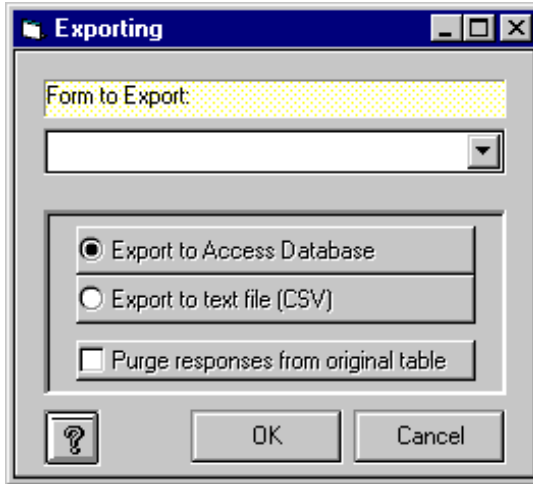
The screenshot displays a software interface with several key elements:

- PrintMonitor Window:** Shows a 'Printing' status for 'Picture 4' and a 'Waiting' area. It includes 'Cancel Printing' and 'Set Print' buttons, and a 'Printing Status' section.
- Preferences Dialog Box:** Contains various settings:
  - Snap to point
  - Transform pattern tiles
  - Scale line weight
  - Preview and print patterns
  - Show placed images
  - Split long paths on Save/Print
  - Constrain angle: 0°
  - Corner radius: 0.05 in
  - Cursor key distance: 0.014 in
  - Freehand tolerance: 2 pixels
  - Auto Trace over gap: 0 pixels
  - Output resolution: dpi
  - Artwork board options:
    - Tile imageable areas
    - Tile full pages
    - Single full page
  - Ruler units:
    - Centimeters
    - Inches
    - Picas/Points
- Icons:**
  - (a) Three arrow icons pointing right.
  - (b) Three arrow icons pointing right, with the first one highlighted.
  - (c) A vertical double-headed arrow icon.

Spatial Tension from Mullet & Sano page 72

James Tam

## Overuse Of 3D Makes The Layout Look Cluttered

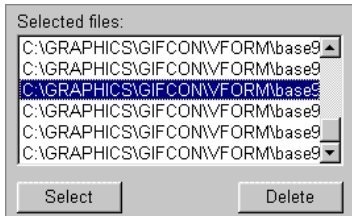


WebForms

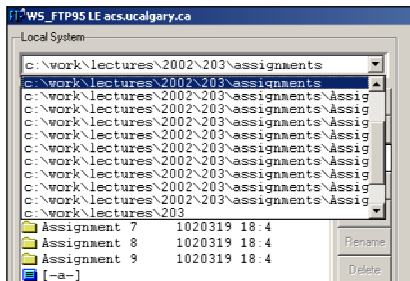
James Tam

## Relationships Between Screen Elements

- How do you choose when you cannot discriminate screen elements from each other?



GIF Construction Set



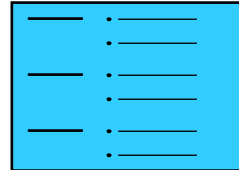
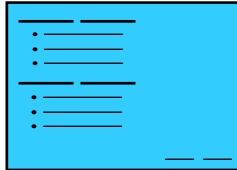
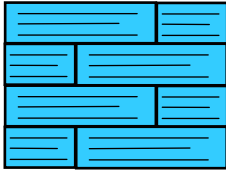
WS-FTP

James Tam



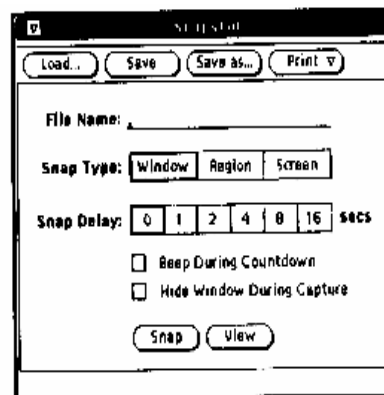
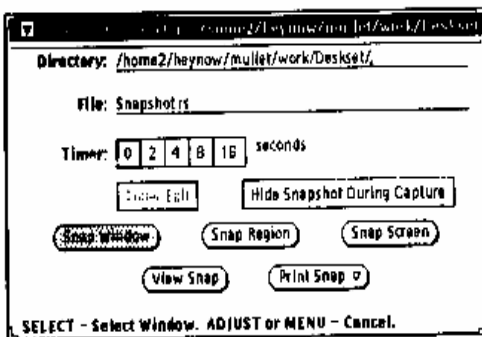
## Navigational Cues

- Provide initial focus
- Direct attention to important, secondary, or peripheral items as appropriate
- Assist in navigation through material

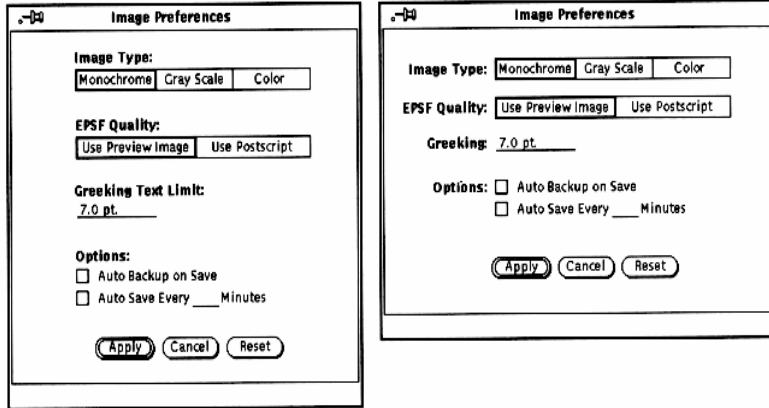


James Tam

## Re-Factoring An Interface



## The Importance Of Negative (White) Space

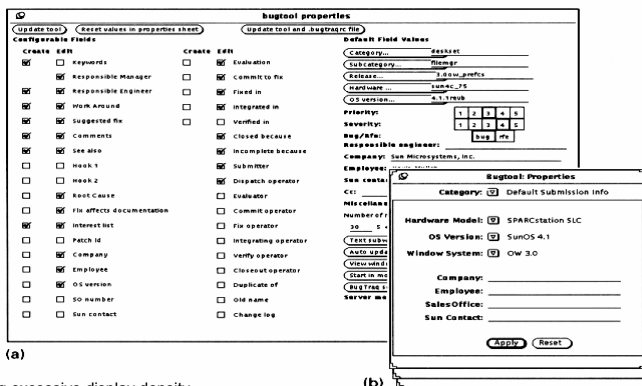


The importance of negative space from Mullet & Sano page 129

James Tam

## Economy Of Visual Elements

- Minimize number of controls
- Include only those that are necessary
  - Eliminate, or relegate others to secondary windows
- Minimize clutter
  - So information is not hidden

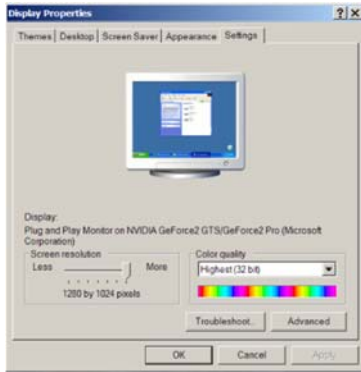


Repairing excessive display density from Mullet & Sano Page 111

James Tam

## Economy Of Visual Elements (Tabs)

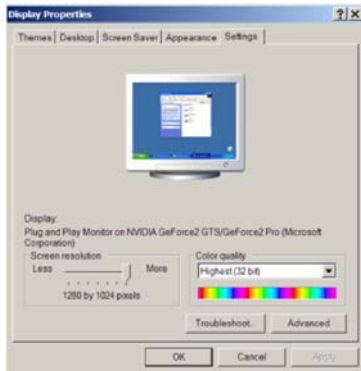
Excellent means for factoring related items



James Tam

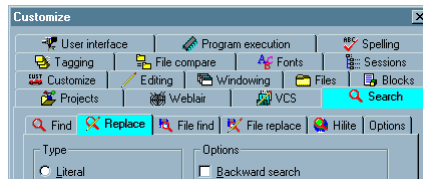
## Economy Of Visual Elements (Tabs)

Excellent means for factoring related items



Windows display properties tab

But it can be overdone



MultiEdit 8.0

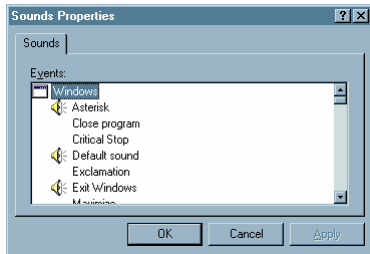


Website: Ottawa-Carleton Real Estate Board

James Tam

## Economy Of Visual Elements (Tabs): 2

The unnecessary use of a tab



Microsoft Windows

James Tam

## Legibility And Readability: Font Choice

*Whenever your local SMS Administrator sends you an actual software Package, the SMS Package Command Manager will appear (usually at network login time) displaying the available Package(s). The following screenshots display scenes similar to what you will see when you receive an actual SMS Package.*

*To start the demonstration, click the "OK" button.*

## Legibility And Readability: Capitalization

If you wish to add/change network information, please select one of the following options.

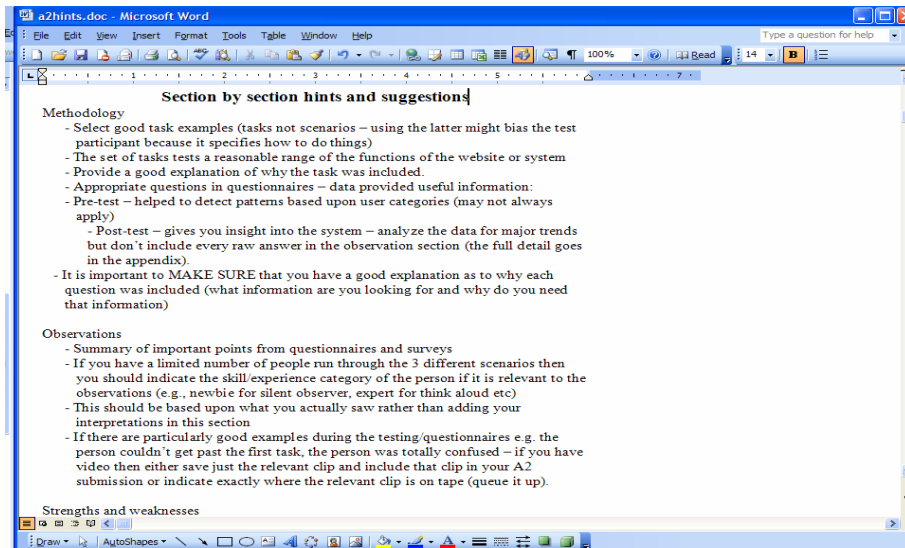
- I WANT TO CONNECT TO AN EXISTING TIME & CHAOS WORKGROUP OR MODIFY THE CONNECTION SETTINGS.
- I WANT TO BUILD A BRAND NEW WORKGROUP.

These choices must be really important, or are they?

## Legibility And Readability: Capitalization (2)

THIS IS AN EXAMPLE OF TEXT THAT IS SHOWN ALL IN CAPITAL LETTERS AS YOU CAN PROBABLY TELL, THE LACK OF VARIATION IN HEIGHT MAKES IT SOMEWHAT MORE DIFFICULT TO READ. THIS WHOLE PARAGRAPH JUST GOES ON AND ON WITHOUT SAYING ANYTHING SIGNIFICANT. THE OTHER SIDE EFFECT OF ALL CAPITALS IS THAT SOME PEOPLE THINK THAT IT IS THE TEXT EQUIVALENT OF SHOUTING AT SOMEONE. ALSO OTHER PEOPLE MAY THINK THAT IT IS MORE SIGNIFICANT BECAUSE IT IS ALL IN CAPITALS. THAT IS PROBABLY WHY SOME PEOPLE DO IT - IN ORDER TO GIVE THE IMPRESSION THAT THEIR MESSAGE IS REALLY IMPORTANT. BUT AS YOU HAVE PROBABLY ASCERTAINED (ASSUMING THAT YOU HAVE EVEN READ THIS FAR) THAT PUTTING TEXT ALL IN CAP'S IS SIMPLY TOO PAINFUL TO READ.

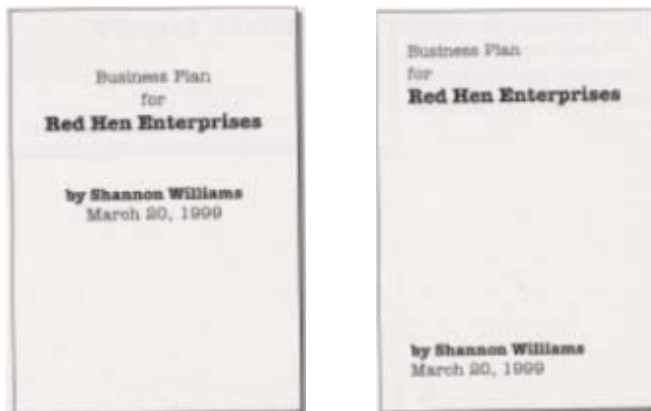
## Use Capitalization Sparingly



James Tam

## Center Alignment

- Some regard it as unprofessional and advocate against its use.
- It's described as being unprofessional looking and plain.

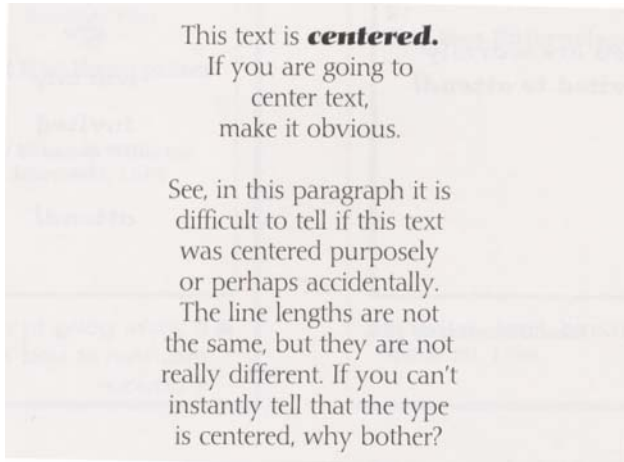




## Center Alignment



- **If you are employing it to provide contrast then make it obvious**



## Legibility And Readability

- Characters, symbols, graphical elements should be easily noticable and distinguishable

Text set in  
Helvetica

Text set in  
Times Roman



TEXT SET IN  
CAPITOLS

Text set in  
Braggadocio

Text set in  
Courier





## Legibility And Readability

### Proper use of typography

- 1-2 typographical effects (typeface or typography) - 3 max
  - Font types, normal, italics, bold, underline
- 1-3 fonts sizes max

Large

Medium  
Small

Large

Medium  
Small

### Readable

Design components to be inviting and attractive

Design components to be inviting and attractive



### Unreadable

Design components to be *inviting* and attractive

Design components to be **inviting** and *attractive*



James Tam

## Legibility And Readability

- Typesetting
  - Point size
  - Word and line spacing
  - Line length
  - Indentation
  - Color

### Readable

Design components to be inviting and attractive

Design components to be inviting and attractive



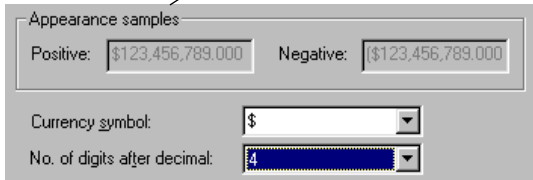
Unreadable: Design components to be easy to interpret and understand. Design components to be inviting and attractive



James Tam

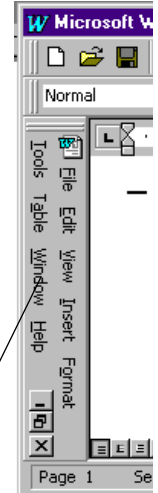
## Legibility And Readability

Grayed-out example text hard to read.  
Why not make it black?



Regional Preferences applet in Windows95

Text orientation makes it difficult to read



MS-Word James Tam

## Imagery

### Signs, icons, symbols

- Right choice within spectrum from concrete to abstract

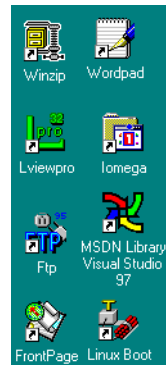


**BOOZE!**



### Icon design *very* hard

- Except for most familiar, always label them

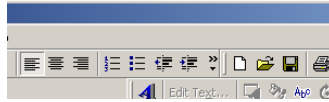


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## Imagery (Continued)

### **Image position and type should be related**

- Image “family”



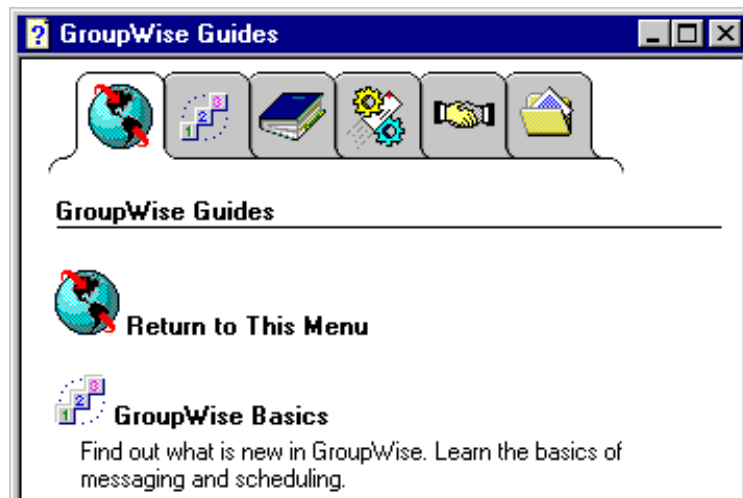
- Don't mix metaphors

### **Consistent and relevant image use**

- Not gratuitous
- Identifies situations, offerings...

James Tam

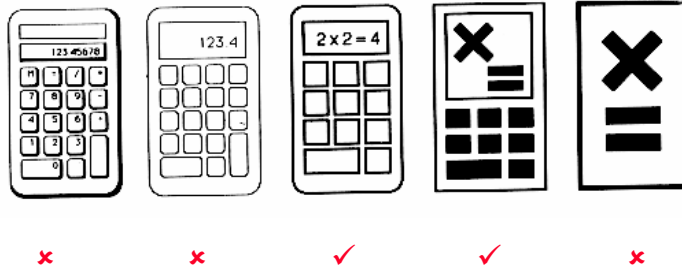
## Why Icon Design Is Hard: An Example



Novell GroupWise 5.1

James Tam

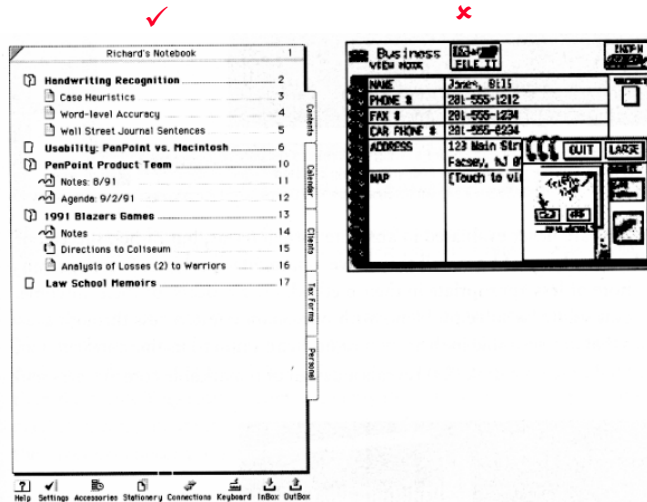
## Icon Design: Use The Appropriate Level Of Detail



Choosing levels of abstraction from Mullet & Sano Page 174

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## Interface Design: Use An Appropriate Level Of Detail



Refined vs excessive literal metaphors from Mullet & Sano page 25

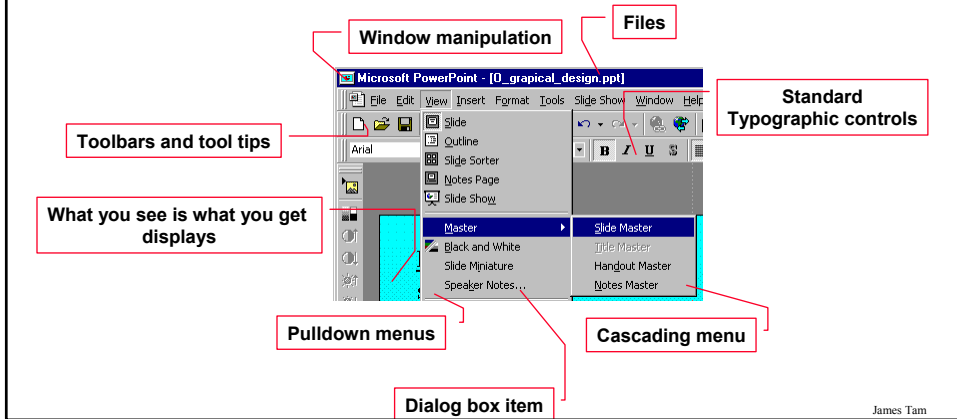
James Tam

# Idioms

## Familiar ways of using GUI components

- Appropriate for casual to expert users
- Builds upon computer literacy
- Must be applied carefully in walk up and use systems

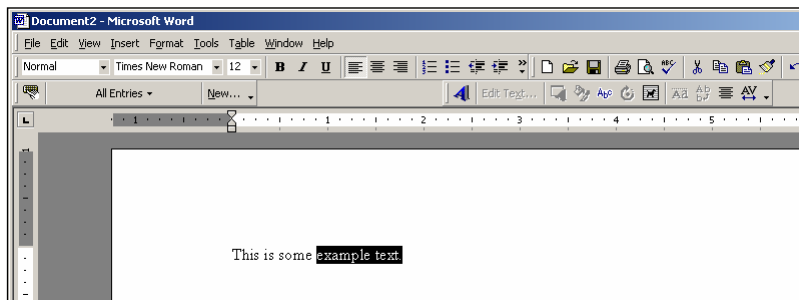
## Some examples



## How To Choose Between Widgets

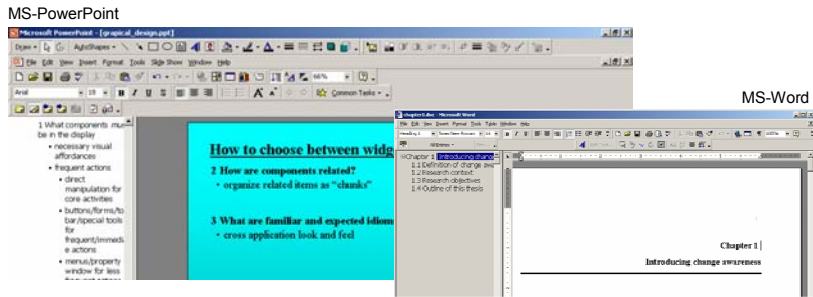
### 1) What components *must* be in the display

- Necessary visual affordances
- Frequent actions
  - Direct manipulation for core activities
  - Buttons/forms/toolbar/special tools for frequent/immediate actions
  - Menus/property window for less frequent actions
  - Secondary windows for rare actions



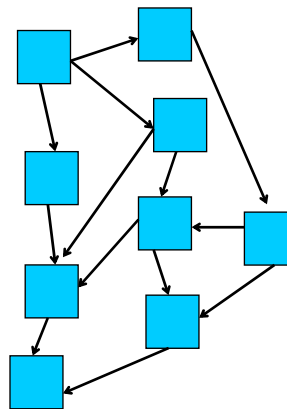
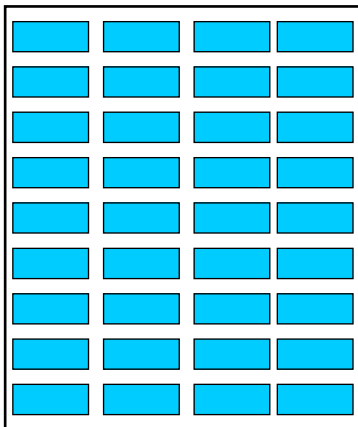
## How To Choose Between Widgets (Continued)

- 2) **How are components related?**
  - Organize related items as “chunks”
- 3) **What are familiar and expected idioms?**
  - Cross application look and feel



James Tam

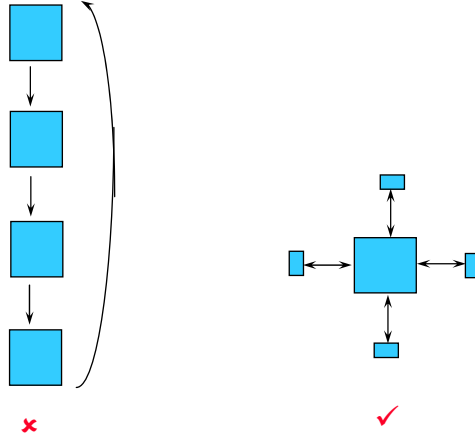
## Balance Between Too Many Controls On A Single Screen Vs. Too Many Screens



James Tam

## Widgets And Complexity

- How can window navigation and clutter be reduced?
  - Avoid long paths
  - Avoid deep hierarchies
  - Re-factor/combine functions



James Tam

## What You Now Know

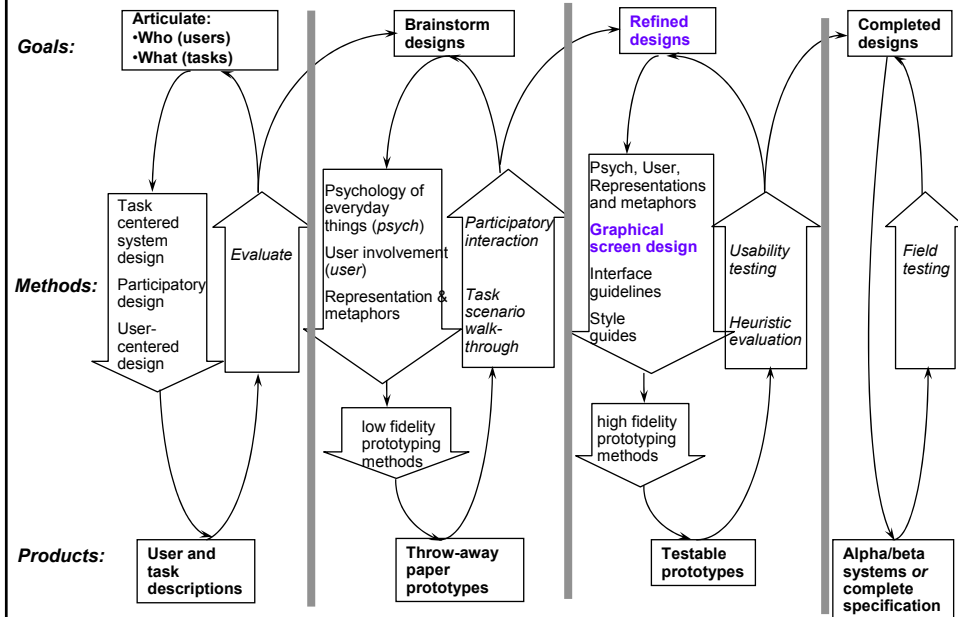
**Grids and C.R.A.P. are essential tools for graphical design**

**Important visual concepts include**

- Visual consistency
  - Repetition
- Visual organization
  - Contrast, alignment and navigational cues
- Visual relationships
  - Proximity and white space
- Familiar idioms
- Legibility and readability
  - Typography
- Appropriate imagery

James Tam

# Interface Design And Usability Engineering



This diagram is a variation of the one presented by Saul Greenberg

James Tam