

Graphic Design and Gestalt Principles

CSI 60: User Interfaces
Maneesh Agrawala



Keepin' it Real: Pushing the Desktop Metaphor with Physics, Piles and the Pen [Agrawala 06]

VIDEO

LoFi Prototype (due today)

Identify project mission statement

Create low-fidelity prototype that supports 3 tasks

- 1 easy, 1 moderate, 1 difficult task as found in the last assignment

Test the prototype with target users

- No one from this class
- Not your friends

Upcoming Schedule

- Midterm next Tuesday March 18
 - Review next lecture
- Interactive Prototype + Presentations (due Apr 1)
 - First working implementation
 - Can include Wizard of Oz parts where justified
- Andy Ko – HCI Faculty Candidate
 - 4pm tomorrow – Soda 306

Review: Managing Participants

- Testing is distressing
- Treat participants with respect
 - Follow human subjects protocol
 - Obtain informed consent
 - Make sure experiment is ethical



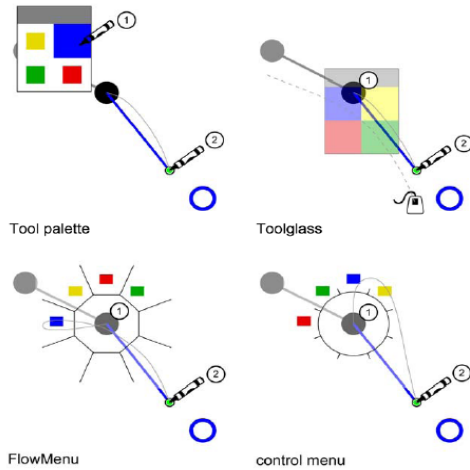
Review: Why Quantitative Studies

Repeatable, reliable evaluation of interface elements

To control properly, usually limited to low-level issues

- Menu selection method A faster than method B

Review: Menu Selection

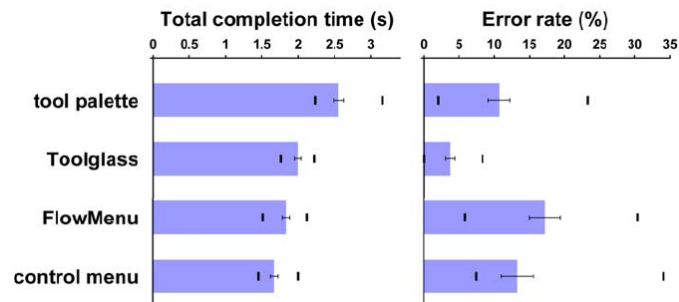


[Guimbretiere et al. 03]

Review: Statistical Analysis

Compute central tendencies (descriptive summary statistics) for each independent variable

- Mean
- Standard deviation



Review: Are the Results Meaningful?

Hypothesis testing

- **Hypothesis:** Manipulation of IV effects DV in some way
- **Null hypothesis:** Manipulation of IV has no effect on DV
- Null hypothesis assumed true unless statistics allow us to reject it

Statistical significance (p value)

- Likelihood results due to chance variation (i.e. null hyp. is true)
- $p < 0.05$ usually considered significant (Sometimes $p < 0.01$)
 - Means that $< 5\%$ chance that null hypothesis is true

Statistical tests

- T-test (1 factor, 2 levels)
- Correlation
- ANOVA (1 factor, > 2 levels, multiple factors)
- MANOVA (> 1 dependent variable)



Explaining Psychological Statistics
Barry H. Cohen

T-test

Compare means of 2 groups

- Null hypothesis: No difference between means

Assumptions

- Samples are normally distributed
 - Very robust in practice
- Population variances are equal (between subjects tests)
 - Reasonably robust for differing variances
- Individual observations in samples are independent
 - Extremely important!

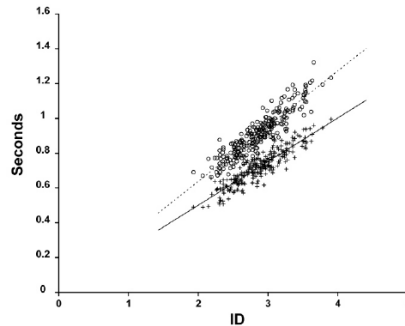
Correlation

Measure extent to which two variables are related

- Does not imply cause and effect
 - Example: Ice cream eating and drowning
- Need a large enough sample size

Regression

- Compute the “best fit”
 - linear
 - logistic
 - ...



ANOVA

Single factor analysis of variance (ANOVA)

- Compare means for 3 or more levels of a single independent variable

Multi-Way Analysis of variance (n-Way ANOVA)

- Compare more than one independent variable
- Can find interactions between independent variables

Repeated measures analysis of variance (RM-ANOVA)

- Use when > 1 observation per subject (within subjects expt.)

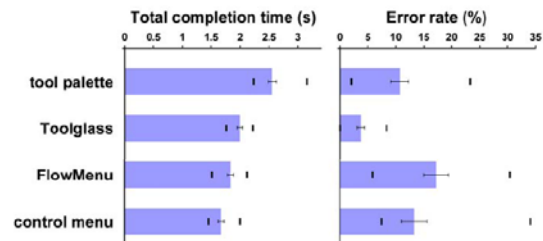
Multi-variate analysis of variance (MANOVA)

- Compare between more than one dependent var.

ANOVA tests whether means differ, but does not tell us which means differ – for this we must perform pairwise t-tests

Which should we use for the menu selection example?

Menu Selection Example



RM-ANOVA → means for completion times were significantly different
($F(3,33) = 73.4, p < .0005$)

- Tool palette significantly slower than others ($p < .0001$ in all cases)
- Control menu faster than FlowMenu but not sig ($p = .2$)
- FlowMenu faster than Toolglass ($p < .01$)
- Control menu faster than Toolglass ($p < .0005$)

Separate analysis for error rates

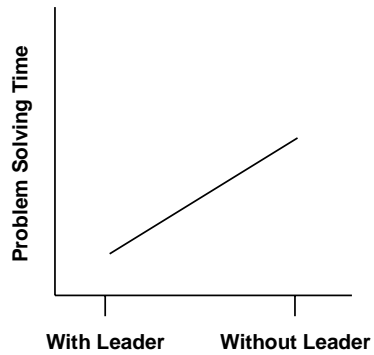
Interactions

Multiple IVs effect DV non-additively

Example of Interactions

Group problem solving

- Independent variable: Leadership

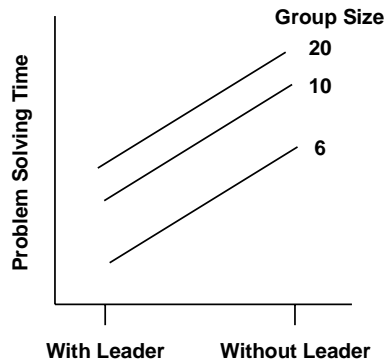


[from Martin 04]

Example of Interactions

Group problem solving

- Independent variable: Leadership
- Independent variable: Group size

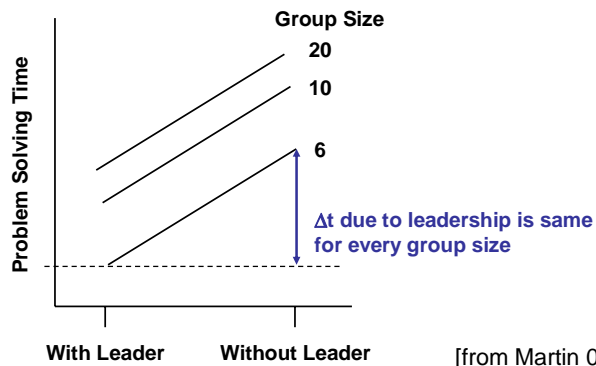


[from Martin 04]

Example of Interactions

Group problem solving

- Change in time due to leadership is same regardless of group size

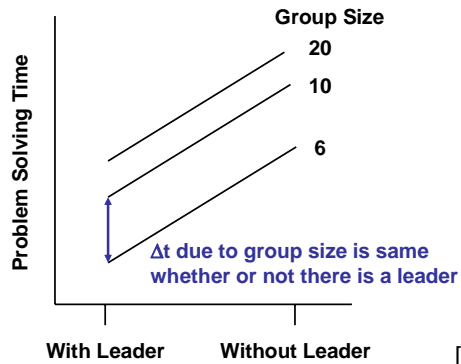


[from Martin 04]

Example of Interactions

Group problem solving

- Change in time due to leadership is same regardless of group size
- Change in time due to group size is same regardless of leadership
- Independent variables **do not** interact

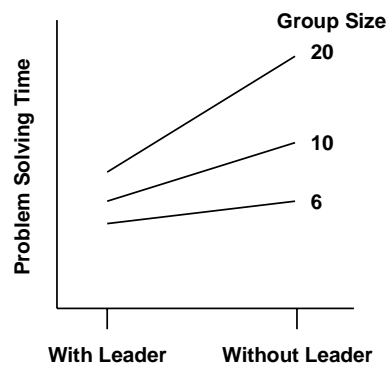


[from Martin 04]

Example of Interactions

Multiple IVs effect DV non-additively

- Change in time due to leadership differs with changes in group size
- Independent variables **do** interact



[from Martin 04]

Draw Conclusions

What is the scope of the finding?

- Does the experiment reflect real use?
 - External validity
 - Ecological validity
- Are there other parameters at play?
 - Internal validity

Summary

Quantitative evaluations

- Repeatable, reliable evaluation of interface elements
- To control properly, usually limited to low-level issues
 - Menu selection method A faster than method B

Pros/Cons

- Objective measurements
 - Good internal validity → repeatability
- But, real-world implications may be difficult to foresee
- Significant results doesn't imply real-world importance
 - 3.05s versus 3.00s for menu selection

Topics

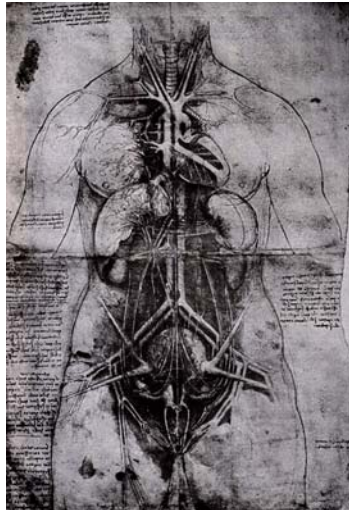
- Graphic design
- Simplicity and elegance
- Color
- Gestalt principles
- Grid-based design

Graphic Design

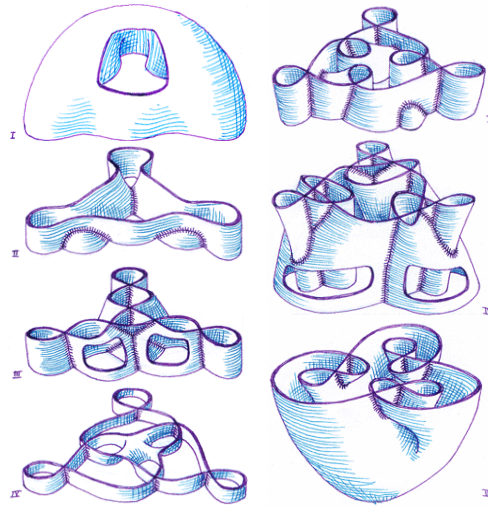
Design is about Communication



Design is about Communication



Principal organs & vasculature
[Leonardo da Vinci ca. 1490]



Strange immersion of torus in 3-space
[Curtis 92]

Design is about Form and Function

- Form – good designs should be a pleasure to use
- Function – good design supports users' tasks



3 Principles of Modern Design

Form follows function



3 Principles of Modern Design

Economy of form - limited vocabulary - minimalism



3 Principles of Modern Design

Integrity of materials



3 Principles of Modern Design

Integrity of materials – not just a modern principle



Shaker Furniture

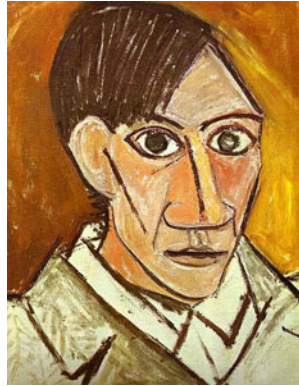


Wood Veneer

Steal Good Design Ideas

“Good artists borrow (from other artists), but great artists steal !” - Pablo Picasso

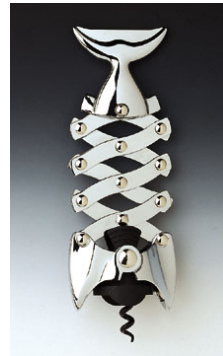
Compelling visual design takes practice and experience –a natural part of which is study and critique of other’s work



Simplicity and Elegance

Simplicity

Simple, *minimalist*, designs are usually the most effective



Elegance

Reduction: Only include essential elements

Regularization: Use one set of shapes, colors, forms etc.

Leverage: Use elements in multiple roles (i.e. scrollbar)

Benefit: Approachability



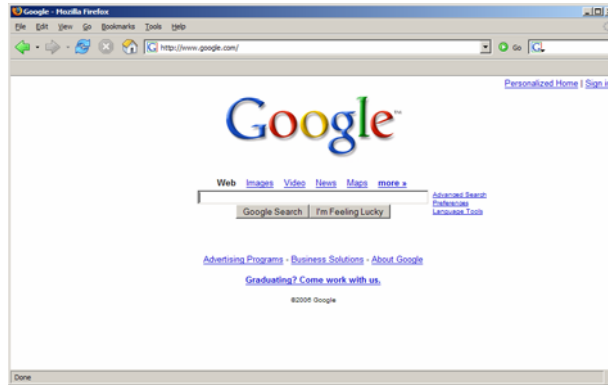
Visual elements rapidly understood - invite further exploration

Benefit: Recognizability



Less visual clutter makes it easier to recognize what is there

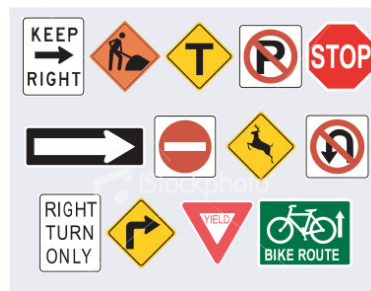
Benefit: Immediacy



Eye is immediately drawn to important visual elements
– Details that remain are more prominent

Unity

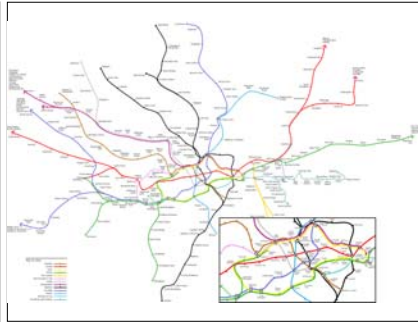
One path to simplicity & elegance is through unifying themes:
– Forms, colors, components with like qualities



Refinement



London Underground [Beck 33]



Geographic version of map

Draw viewers' attention to essential information

- Straigten subway lines to emphasize sequence of stops

Fitness

Match design to capabilities of technology and user

**The Quick Brown
Fox Jumps Over
The Lazy Dog.**

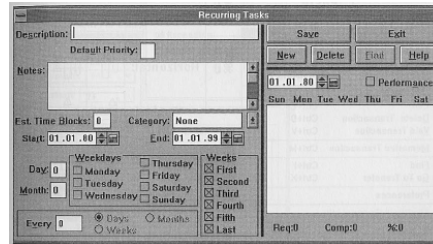
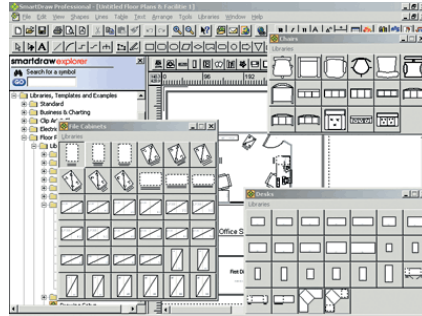
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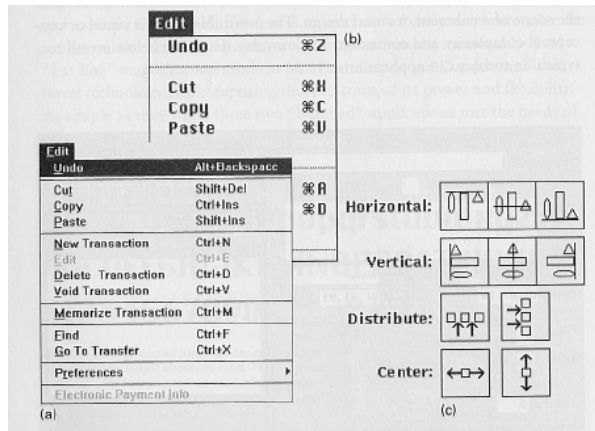
Chicago screen font designed for early low-res Macintosh display

- Thick verticals ensure visibility after applying 50% gray pattern
- Used as default font 1984-1997

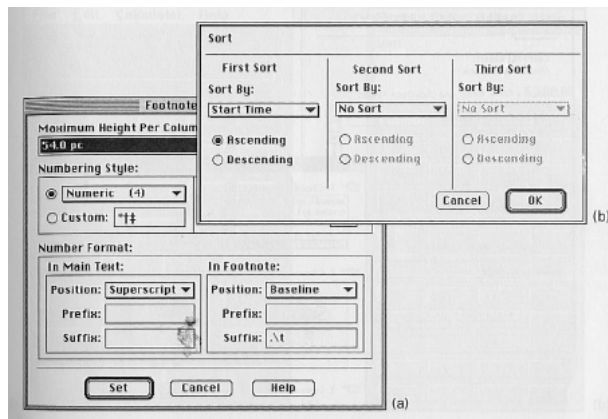
Mistakes: Clutter & Noise



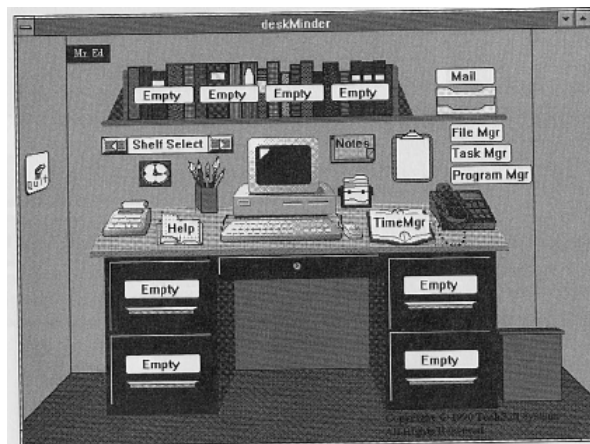
Mistakes: Interference



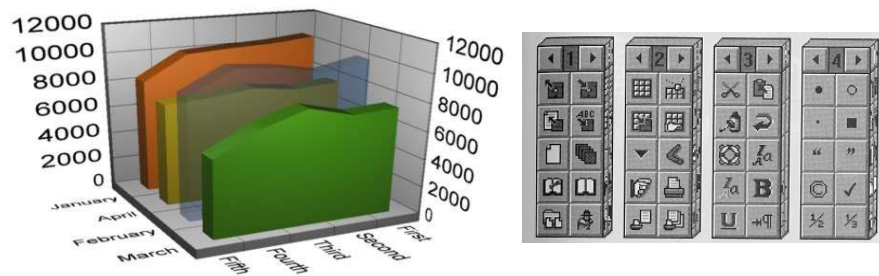
Mistakes: Too Much Explicit Structure



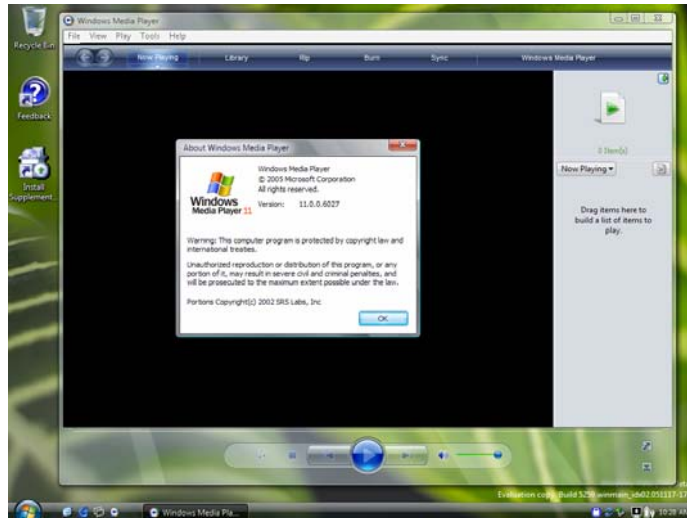
Mistakes: Belaboring the Obvious



Mistakes: Gratuitous use of 3D



Mistakes: Excessive Embellishment



Minimalists hate it, but sometimes users like embellishments (i.e. Apple's designs)

Color

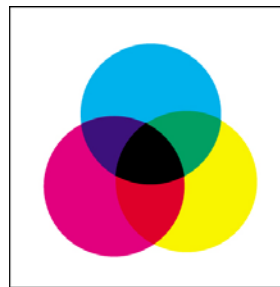
Color Spaces



RGB

Additive

Electronic Media



CMY

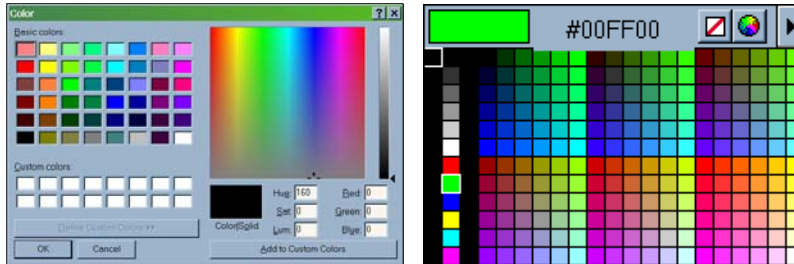
Subtractive

Printed Media

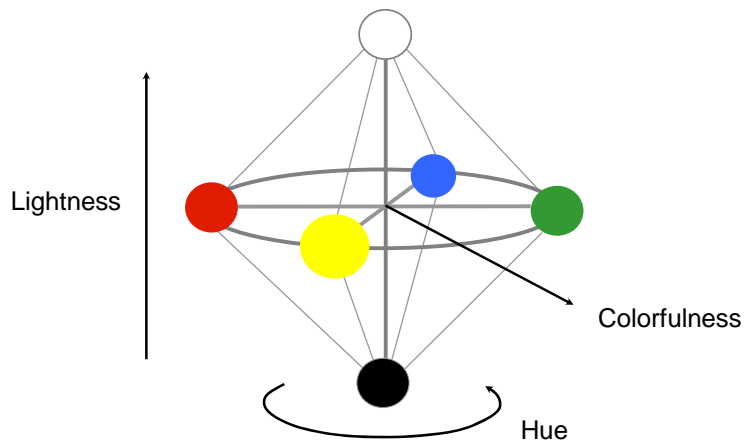
Parameters of color space driven by technology

Technology-Centered Colors

- Nice RGB Hex codes, “evenly” distributed
- But, lime green and hot pink?



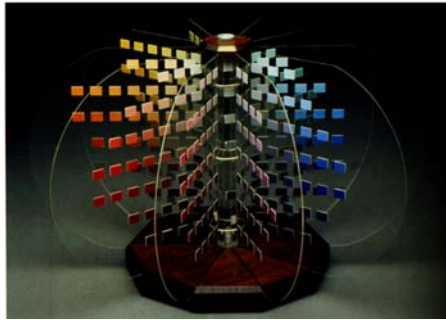
Perceptual Organization



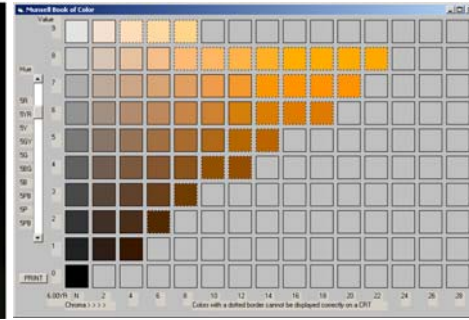
Parameters of color space driven by perception

Munsell Color Space

Perceptually uniform book of painted chips



Hue

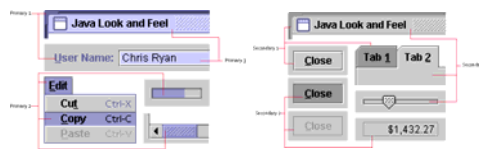


Chroma vs. Value

Munsell Color Utility: www.wallkillcolor.com

Tips for Picking Colors

- Use a small palette (6 color Java look and feel)



- Don't use all fully saturated colors



- Ensure good color contrast for text

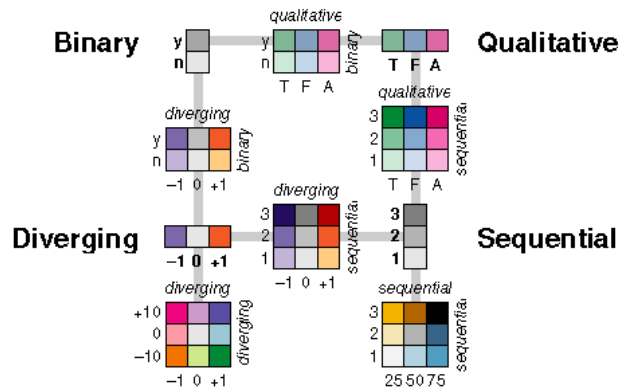


Let Someone Else Pick For You



Imhof, Cartographic Relief Projection

Let Someone Else Pick For You



ColorBrewer.org