CSE 440:
Introduction to HCI

# 10: Ketchup *(Catch-Up)*

April 25, 2024

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# Project Reminders

2f (ungraded) submitted yesterday

- Today: Crit on 2f

Due Tonight @ 8pm: 2f_rev

Due Monday @ 3pm: 2g

# Presentations

All 3 options will be offered (In-person, video, article)

- Specs for Video & Article will be posted over the weekend

For in person or video presentations:

- Only 2 people need to present
- Still expect that workload is evenly distributed!

Form will go out via email asking which option your group is doing

- Need answers by Monday @ 2g deadline

# Wrap-Up: More on Tasks

# A Common Issue

Tasks should represent underlying *objectives*

Tasks should be *completely disjoint from specific design features*

- If you can think of “obvious” designs that would support this goal: that’s fine!
- Key detail: there should be *multiple* possible designs that support this

# An Example: What's the Task?

Julia has very specific dietary preferences and likes to check the menu of a restaurant before going out. She said it makes it easier for her to know what she can actually order at that place (or find out if there's nothing available)

Proposed Task v1:

*Filter menu options on a restaurant's website based on dietary preferences*

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Proposed Task v1:

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Too design-specific!

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Julia has very specific dietary preferences and likes to check the menu of a restaurant before going out. She said it makes it easier for her to know what she can actually order at that place (or find out if there's nothing available)

Proposed Task v2:

*Identify what foods on a menu meet one's dietary preferences*

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Proposed Task v2:

*Identify what foods on a menu meet one's dietary preferences*

***Why?***

# An Example: What's the Task?

Julia has very specific dietary preferences and likes to check the menu of a restaurant before going out. She said it makes it easier for her to know what she can actually order at that place (or find out if there's nothing available)

Proposed Task v3:

*Determine if a restaurant has a menu appropriate for one's dietary preferences*

*OR*

*Alleviate stress of eating out by planning ahead of time*

# Going Forward with Tasks:

You are free to revise your tasks as you see fit!

If some of your tasks feel like they don't actually produce interesting designs: swap them out for something that *does!*

# Wrap-Up: Usability Testing

# Task Design is Important

The goal of a test is to figure out how a person interacts with an interface in the wild...

There are two possible explanations for why a test does not find significant problems:

- The interface does not have significant problems
- The test itself has significant problems

# Bad: Artificial Subgoals

People using the design “in the wild”
may not necessarily form these same subgoals

The task should give one top-level goal,
people should form their subgoals while pursuing this

> Now you want to choose the type of paper you want to print your document on. Lets imagine that Bin “B” has the paper you want to print your paper on, please complete this task.
>
> Now set the darkness of your copies to about 50% dark.
> After setting the darkness, you decide you want to print 2 sides of copies on two sides of paper. Please complete this task.

# Bad: Artificial Ordering

Without an artificial ordering of information or subgoals, people might not proceed in this order

The ordering might also be biased towards the layout of the interface, which would conceal any problems with finding the appropriate control

- Enter in 10 copies, with lightness set to 10%.
- Choose 1 sided to 2 sided, use paper source bin A.
- Cover sheet needed, using paper bin B for cover sheet.
- Set stapling feature on and collating on.
- Start printing.

# Bad: Changing the Task

The task is to make copies, and this happens to involve entering information in the copier interface

But this task description is a data entry task,
“Here is some information. Put it in the interface.”

- Make 23 copies
- With collate
- Cover sheets
- Default darkness
- 1 Sided-> 1 Sided

# Bad: Giving the Answers

Tells the person what terminology the interface uses, which they might not otherwise know

lighten = contrast, sorted = collated?

> You are a teacher and are trying to make 40 copies of a one-sided magazine article that is 10 pages long for your class tomorrow. Due to the large number of copies, you print the article double-sided, in other words 10 page article would be printed on 5 sheets of paper. Due to the high contrast of the article, you must lighten the copy, in other words change the contrast. You then want the copies to be collated and stapled.

# Good: Giving Context

Giving realistic context through scenarios can reduce the artificiality of the task

It's your first day in the office, starting a new job. You would like to make some copies of several documents that your boss gave you to browse through. Your colleague in the next cubicle tells you that you need an access code to make copies. The code is 5150. You walk over to the copy machine at the end of the hall and realize that it is not the Xerox copier that you are accustomed to...

Make 2 copies of the "Company Annual Report".

# Consider: Under-Specified Tasks

Many realistic goals are under-specified,
as people have only a general idea what they want

By under-specifying the task,
you can elicit realistic confusion and decision-making

> You just finished fixing up the old hot rod in the garage and now its time to sell her. Make a couple copies of the pictures you took to send into the used car sales magazines. It's ok that they're in black and white but maybe you should lighten them up a bit. Your account billing code is 5150.

# Task Design Summary

Task design is difficult and important

Poorly designed tasks mask interface failures

Have others help you “debug” them before testing

# Ethical Considerations in Usability Testing

Testing is stressful

- Can be distressing,
  leave people in tears

You have a responsibility to alleviate

- make voluntary with informed consent
- avoid pressure to participate
- let them know they can stop at any time
- stress that you are testing the system, not them
- make collected data as anonymous as possible

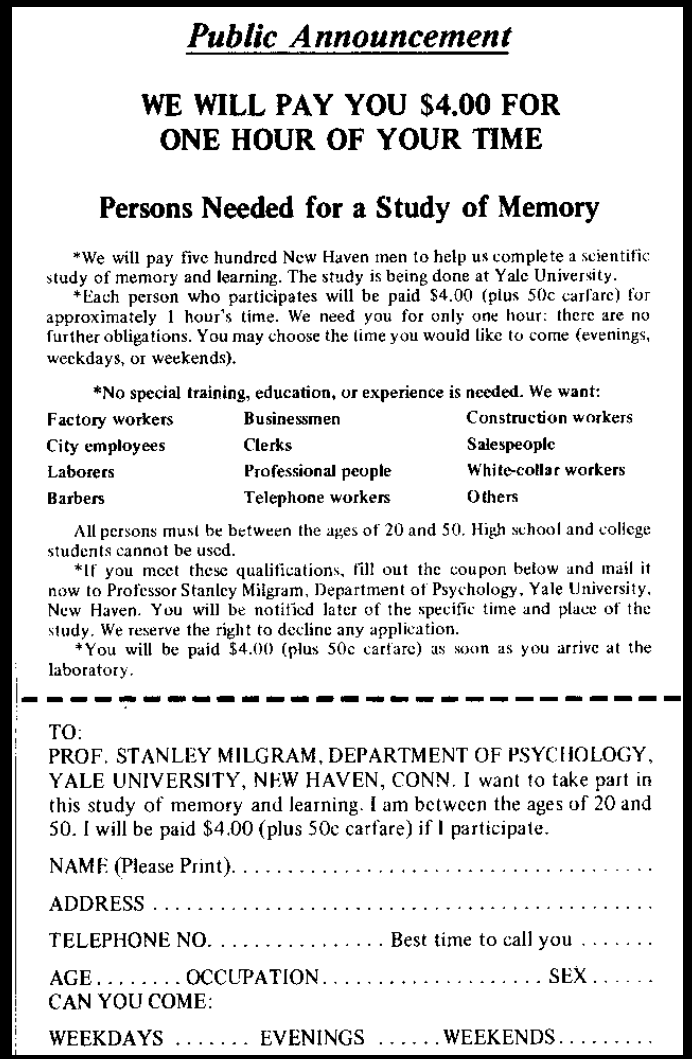
# Human Subjects Approvals

Research requires human subjects review of process

This does not formally apply to your design work

But understand why we
do this and check yourself

Companies are judged
in the eye of the public



***Public Announcement***

**WE WILL PAY YOU $4.00 FOR ONE HOUR OF YOUR TIME**

**Persons Needed for a Study of Memory**

*We will pay five hundred New Haven men to help us complete a scientific study of memory and learning. The study is being done at Yale University.

*Each person who participates will be paid $4.00 (plus 50c carfare) for approximately 1 hour's time. We need you for only one hour: there are no further obligations. You may choose the time you would like to come (evenings, weekdays, or weekends).

***No special training, education, or experience is needed. We want:**

| | | |
|---|---|---|
| Factory workers | Businessmen | Construction workers |
| City employees | Clerks | Salespeople |
| Laborers | Professional people | White-collar workers |
| Barbers | Telephone workers | Others |

All persons must be between the ages of 20 and 50. High school and college students cannot be used.

*If you meet these qualifications, fill out the coupon below and mail it now to Professor Stanley Milgram, Department of Psychology, Yale University, New Haven. You will be notified later of the specific time and place of the study. We reserve the right to decline any application.

*You will be paid $4.00 (plus 50c carfare) as soon as you arrive at the laboratory.

TO:
PROF. STANLEY MILGRAM, DEPARTMENT OF PSYCHOLOGY, YALE UNIVERSITY, NEW HAVEN, CONN. I want to take part in this study of memory and learning. I am between the ages of 20 and 50. I will be paid $4.00 (plus 50c carfare) if I participate.

NAME (Please Print). . . . . .

ADDRESS . . . . . .

TELEPHONE NO. . . . . Best time to call you . . . . . .

AGE . . . . . OCCUPATION . . . . . SEX . . . . . .
CAN YOU COME:

WEEKDAYS . . . . . EVENINGS . . . . . WEEKENDS . . . . . .

# A Fine Line: “Deception” in Testing

Sometimes we *think* we need to keep secrets from the tester about what’s “really going on”

Usually, lying to the tester only brings pain

- VERY quick way to lose trust / rapport with a tester
- Testers are way smarter than most engineers/designers care to concede

In **SOME** cases, this is fine:

- Wizard of Oz methods
- Studies about unconscious biases
- Extending “social grace” for critique

# “Wizard of Oz” Methods

Technique to allow testing and
iterative improvement of interfaces not yet implemented

- Human simulation of necessary functionality
- Paper prototyping is a simple example

Other methods more explored in research

- HCI interest credited to
  Gould et al, 1983
  “Composing Letters with
  a Simulated Listening Typewriter”

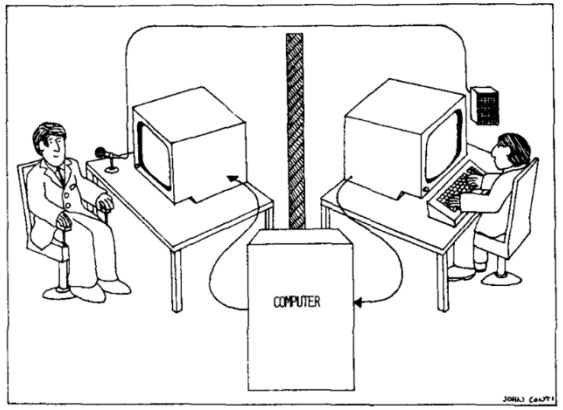
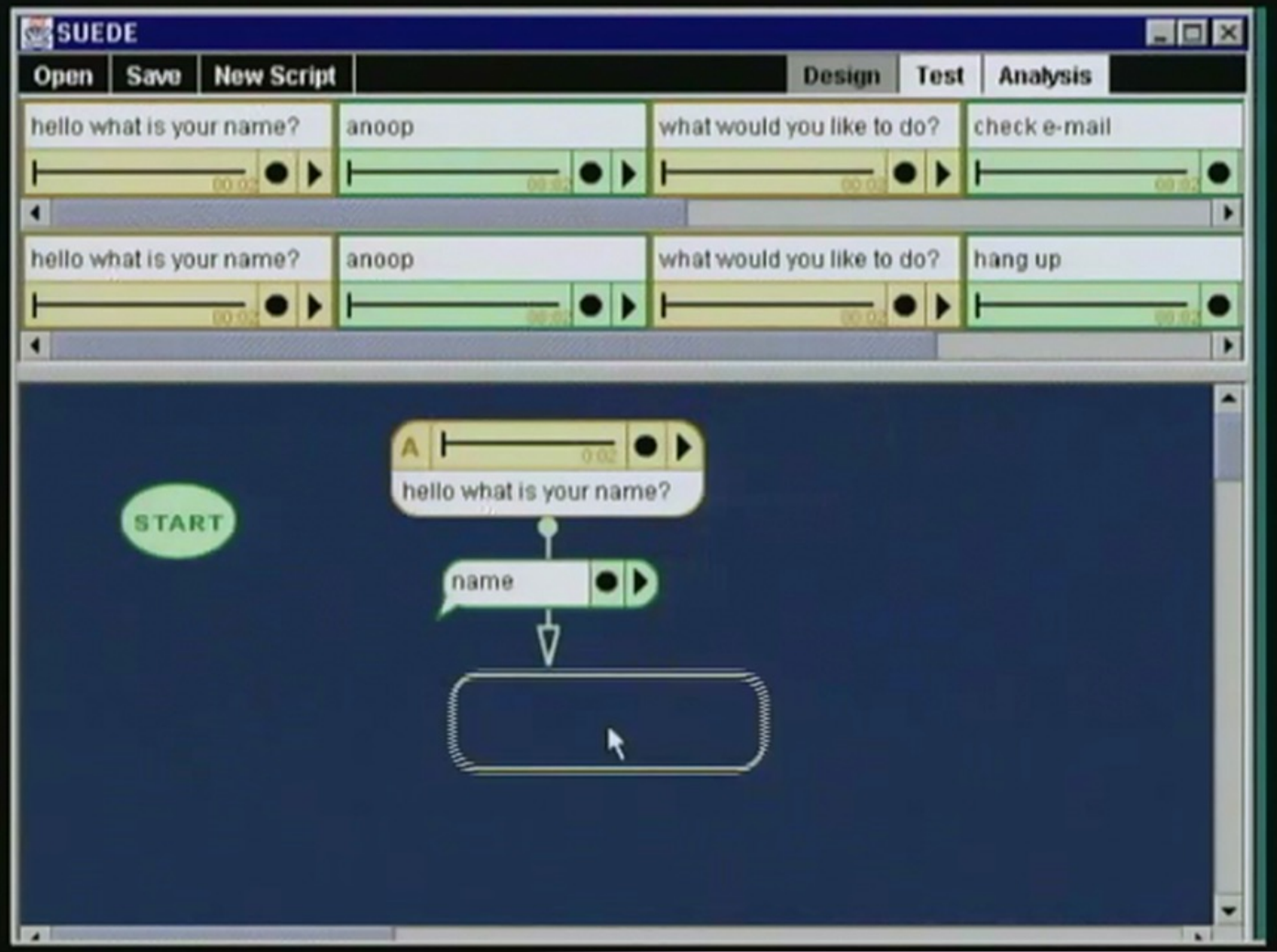


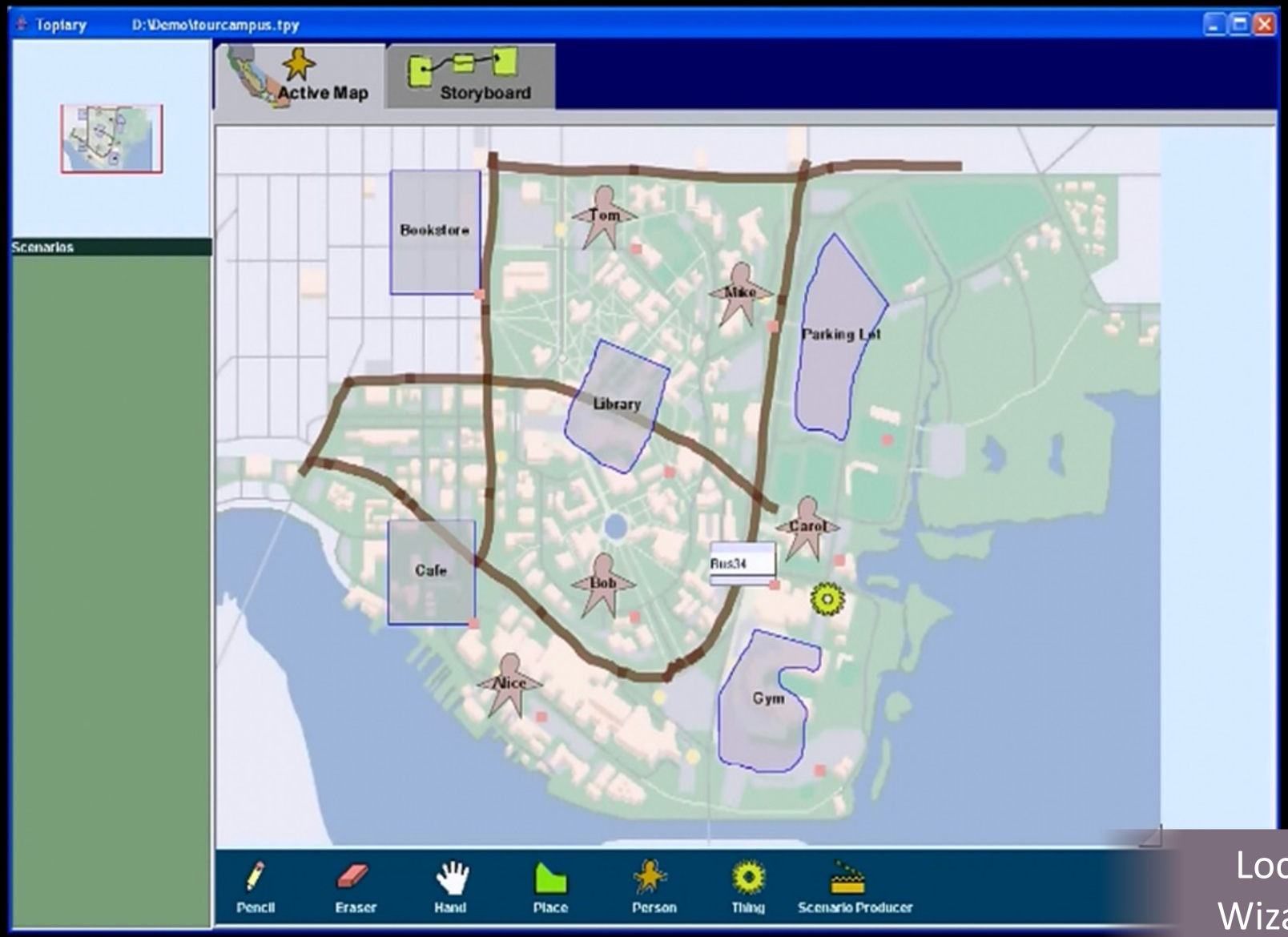

FIGURE 1. Schematic of the Experimental Setup.

# SUEDE




Low-Fidelity Is Not Just About Ink, Wizard of Oz for Speech

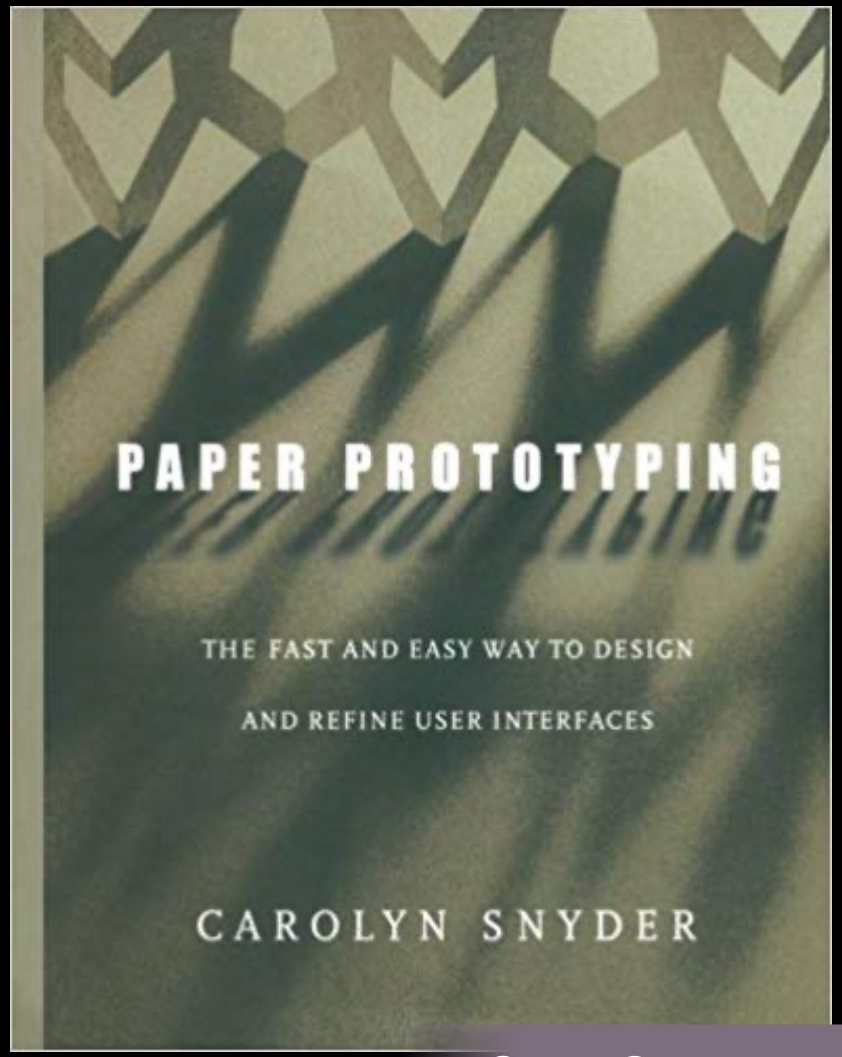
# Topiary




Location-Based Designs, Wizard of Oz for Location

# Additional Reading

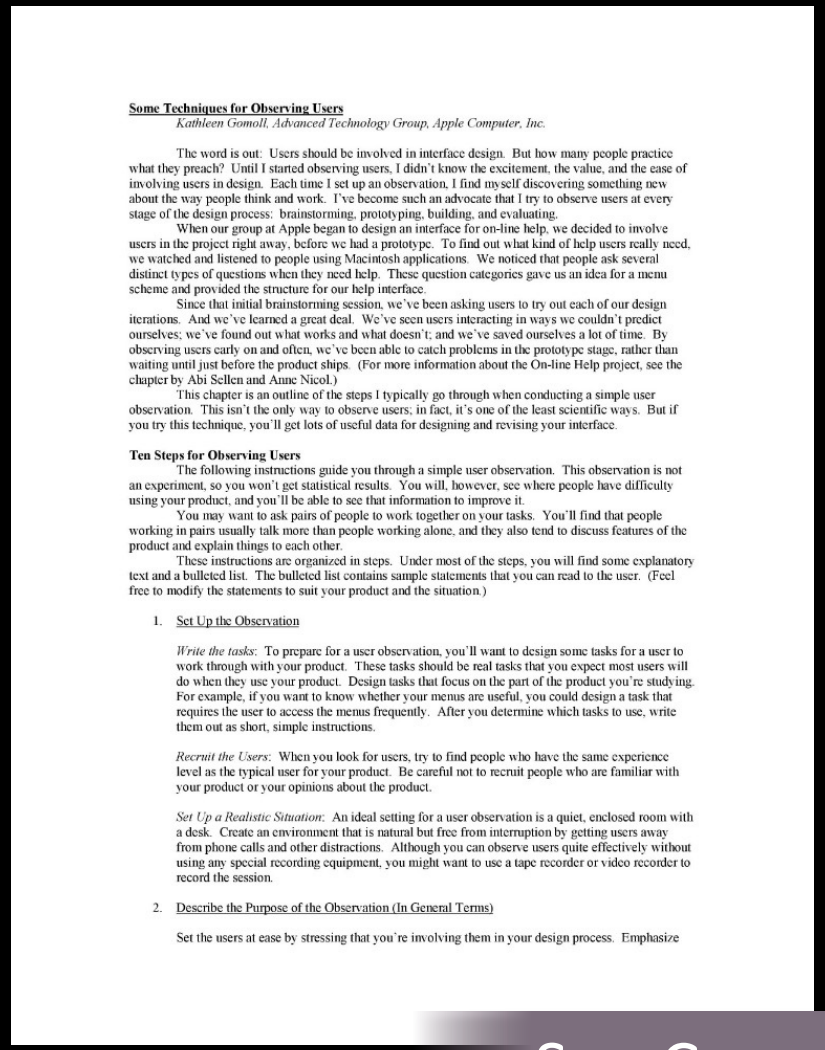
Chapter 8 is a practical introduction to usability testing




See Canvas Resources

# Additional Reading

Checklist for a usability session



**Some Techniques for Observing Users**

*Kathleen Gomoll, Advanced Technology Group, Apple Computer, Inc.*

The word is out: Users should be involved in interface design. But how many people practice what they preach? Until I started observing users, I didn't know the excitement, the value, and the ease of involving users in design. Each time I set up an observation, I find myself discovering something new about the way people think and work. I've become such an advocate that I try to observe users at every stage of the design process: brainstorming, prototyping, building, and evaluating.

When our group at Apple began to design an interface for on-line help, we decided to involve users in the project right away, before we had a prototype. To find out what kind of help users really need, we watched and listened to people using Macintosh applications. We noticed that people ask several distinct types of questions when they need help. These question categories gave us an idea for a menu scheme and provided the structure for our help interface.

Since that initial brainstorming session, we've been asking users to try out each of our design iterations. And we've learned a great deal. We've seen users interacting in ways we couldn't predict ourselves; we've found out what works and what doesn't; and we've saved ourselves a lot of time. By observing users early on and often, we've been able to catch problems in the prototype stage, rather than waiting until just before the product ships. (For more information about the On-line Help project, see the chapter by Abi Sellen and Anne Nicol.)

This chapter is an outline of the steps I typically go through when conducting a simple user observation. This isn't the only way to observe users; in fact, it's one of the least scientific ways. But if you try this technique, you'll get lots of useful data for designing and revising your interface.

**Ten Steps for Observing Users**

The following instructions guide you through a simple user observation. This observation is not an experiment, so you won't get statistical results. You will, however, see where people have difficulty using your product, and you'll be able to see that information to improve it.

You may want to ask pairs of people to work together on your tasks. You'll find that people working in pairs usually talk more than people working alone, and they also tend to discuss features of the product and explain things to each other.

These instructions are organized in steps. Under most of the steps, you will find some explanatory text and a bulleted list. The bulleted list contains sample statements that you can read to the user. (Feel free to modify the statements to suit your product and the situation.)

1. Set Up the Observation

   *Write the tasks*: To prepare for a user observation, you'll want to design some tasks for a user to work through with your product. These tasks should be real tasks that you expect most users will do when they use your product. Design tasks that focus on the part of the product you're studying. For example, if you want to know whether your menus are useful, you could design a task that requires the user to access the menus frequently. After you determine which tasks to use, write them out as short, simple instructions.

   *Recruit the Users*: When you look for users, try to find people who have the same experience level as the typical user for your product. Be careful not to recruit people who are familiar with your product or your opinions about the product.

   *Set Up a Realistic Situation*: An ideal setting for a user observation is a quiet, enclosed room with a desk. Create an environment that is natural but free from interruption by getting users away from phone calls and other distractions. Although you can observe users quite effectively without using any special recording equipment, you might want to use a tape recorder or video recorder to record the session.

2. Describe the Purpose of the Observation (In General Terms)

   Set the users at ease by stressing that you're involving them in your design process. Emphasize

See Canvas Resources

# Wrap-Up: Models

# Model Human Processor Operation

## Recognize-Act Cycle of the Cognitive Processor

On each cycle, contents in working memory initiate actions associatively linked in long-term memory

Actions modify the contents of working memory

## Discrimination Principle

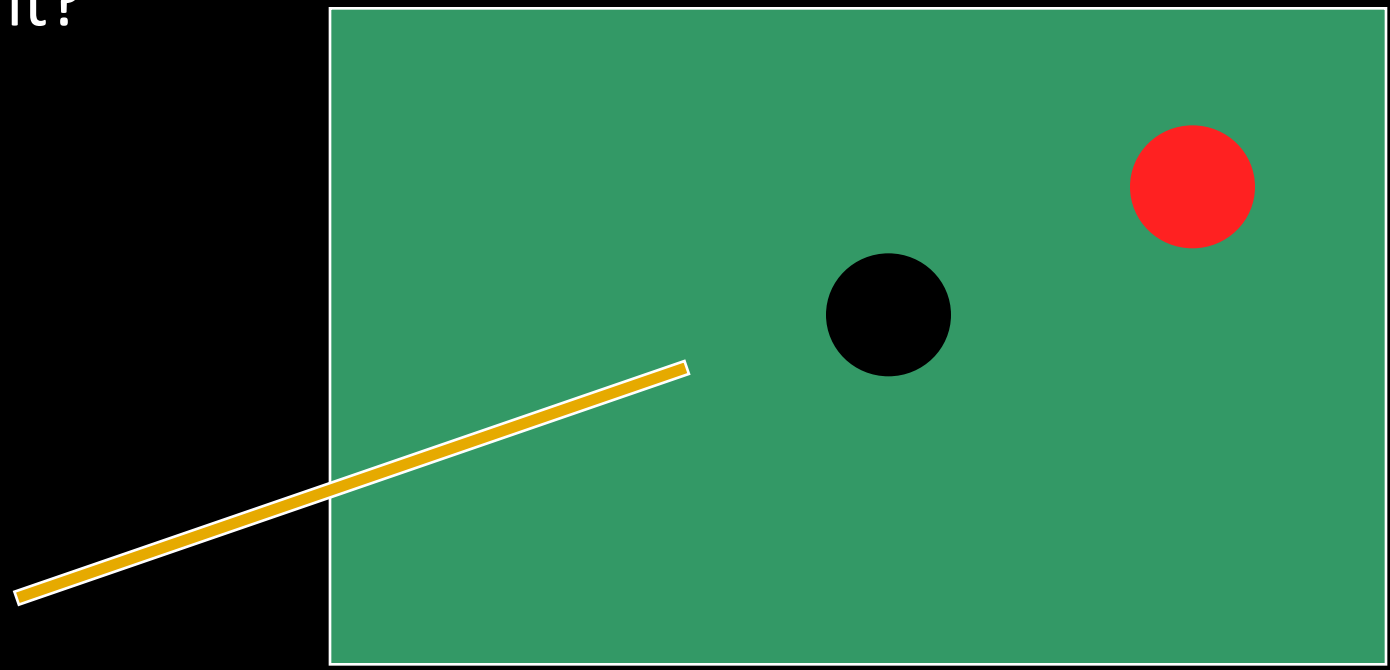
Retrieval is determined by candidates that exist in memory relative to retrieval cues

Interference created by strongly activated chunks

See also: Freudian slips

# Perceptual Causality

How soon must the red ball move after cue ball collides with it?



# Perceptual Causality

Stimuli that occur within one cycle of the perceptual processor fuse into a single concept

Requirement

- If you want to create the perception of causality, then you need to be sufficiently responsive

Caution

- Two stimuli intended to be distinct can fuse if the first event appears to cause the other

# Models from Different Perspectives

Some example models of human performance

Visual System

Model Human Processor

**Fitts's Law**

Gestalt Principles

Biological Model

Higher-Level Model

Model by Analogy

Predict Interpretation

# Fitts's Law (1954)

Models time to acquire targets in aimed movement

- Reaching for a control in a cockpit
- Moving across a dashboard
- Pulling defective items from a conveyor belt
- Clicking on icons using a mouse

Very powerful, widely used

- Holds for many circumstances (e.g., under water)
- Allows for comparison among different experiments
- Used both to measure and to predict

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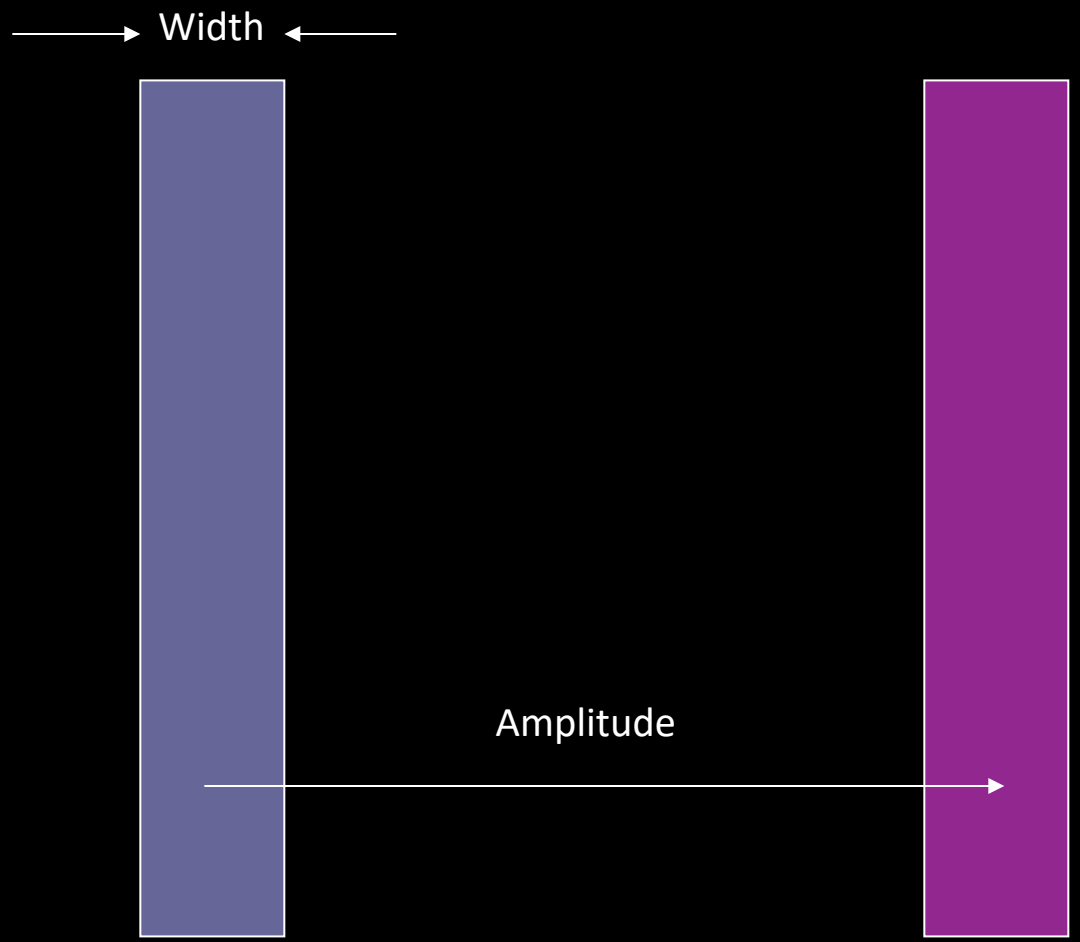
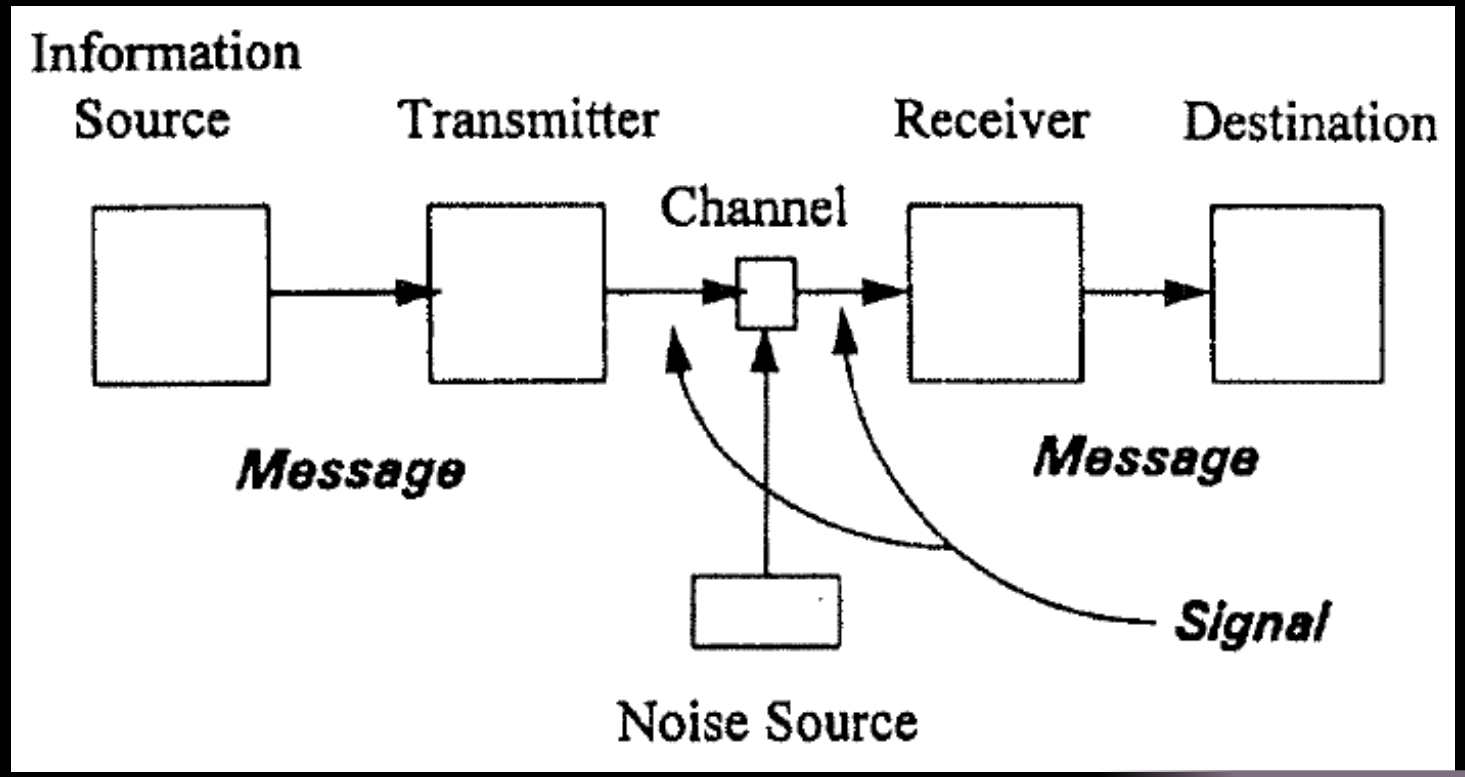
Most people say Fitts' Law,
but I was taught this by a "James"

# Reciprocal Point-Select Task



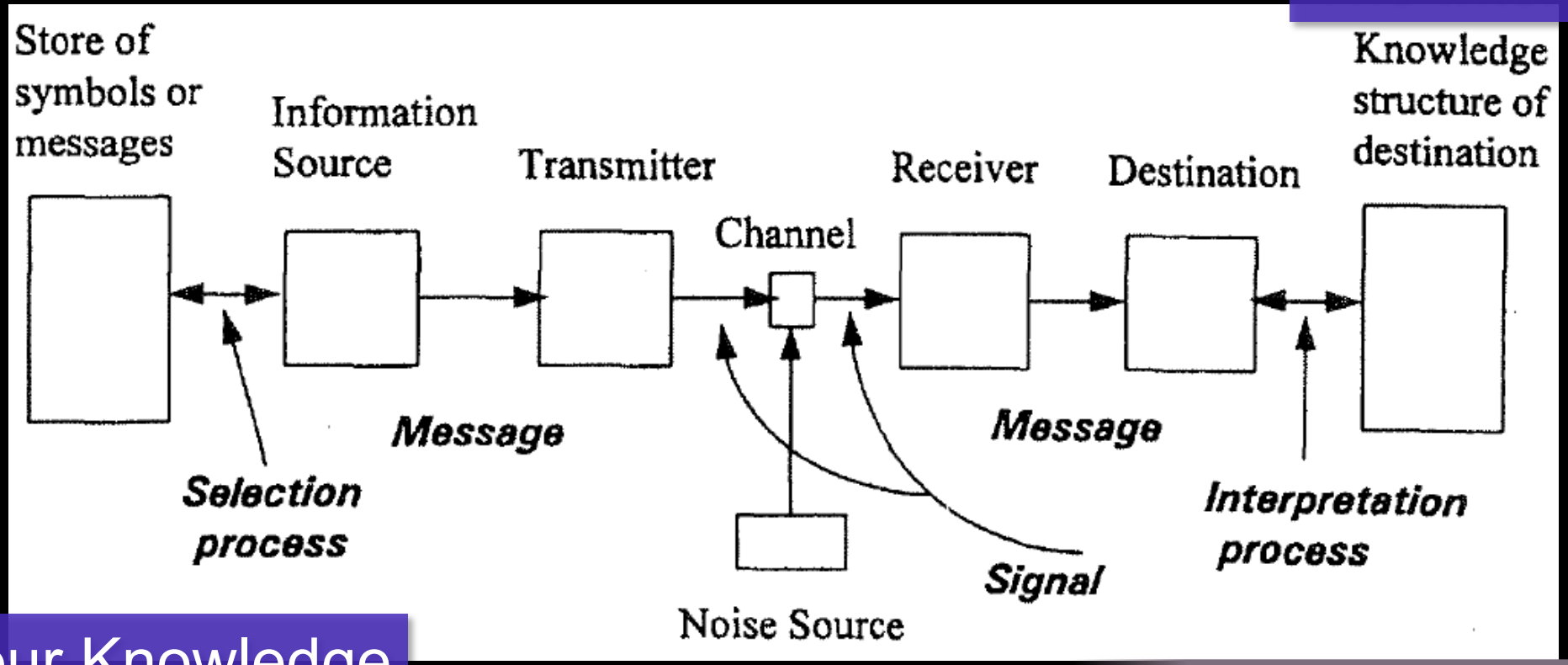
# Model by Analogy




Analogy to Information Transmission
Shannon and Weaver, 1959

# Model by Analogy

The Interface




Your Knowledge

Analogy to Information Transmission
Shannon and Weaver, 1959

# Fitts's Law

MT = a + b log2(A / W + 1)

What kind of equation does this remind you of?

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MT = a + b log2(A / W + 1)

What kind of equation does this remind you of?

y = mx + b

MT = a + bx, where x = log2(A / W + 1)

x is called the Index of Difficulty (ID)

As "A" goes up, ID goes up

As "W" goes up, ID goes down

# Index of Difficulty (ID)

log2(A / W + 1)

Fitts's Law claims that the time to acquire a target increases linearly with the log of the ratio of the movement distance (A) to target width (W)

Why is it significant that it is a ratio?

# Index of Difficulty (ID)

log2(A / W + 1)

- Fitts's Law claims that the time to acquire a target increases linearly with the log of the ratio of the movement distance (A) to target width (W)

Why is it significant that it is a ratio?

- Units of A and W don't matter
- Allows comparison across experiments

ID units typically in "bits"

- Because of association with information capacity and somewhat arbitrary use of base-2 logarithm

# “Beating” Fitts’s law

It is the law, right?

MT = a + b log2(A / W + 1)

So how can we reduce movement time?

Reduce A

Increase W

# Fitts's Law Related Techniques

Put targets closer together

Make targets bigger

Make cursor bigger

- Area cursors
- Bubble cursor

Use impenetrable edges

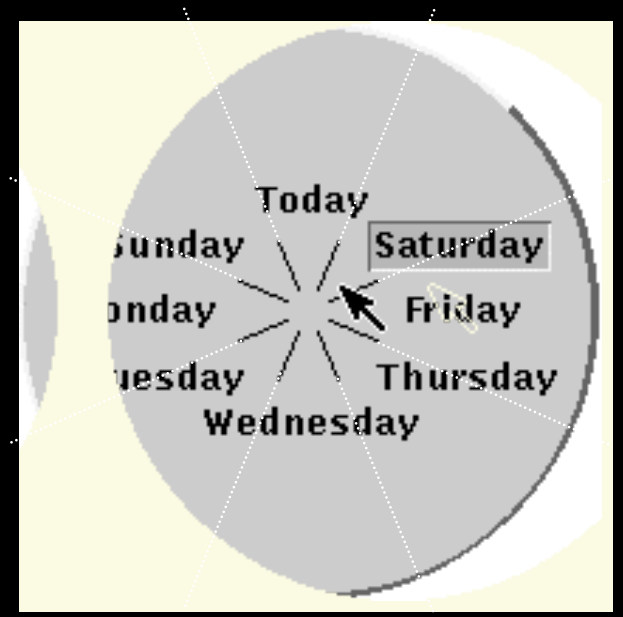
# Fitts's Law Examples

Which will be faster on average?

Pop-up Linear Menu

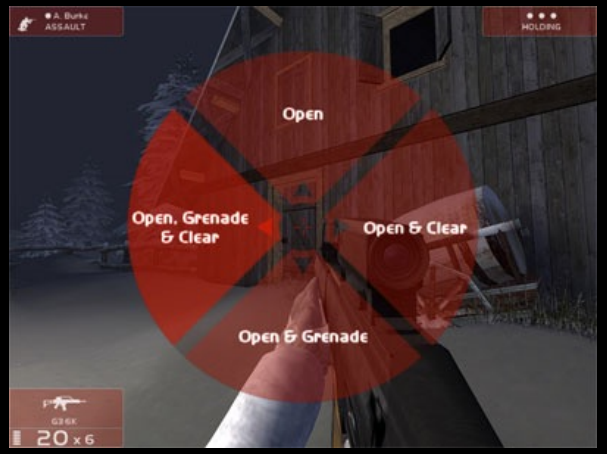
| Today |
| --- |
| Sunday |
| Monday |
| Tuesday |
| Wednesday |
| Thursday |
| Friday |
| Saturday |

Pop-up Pie Menu

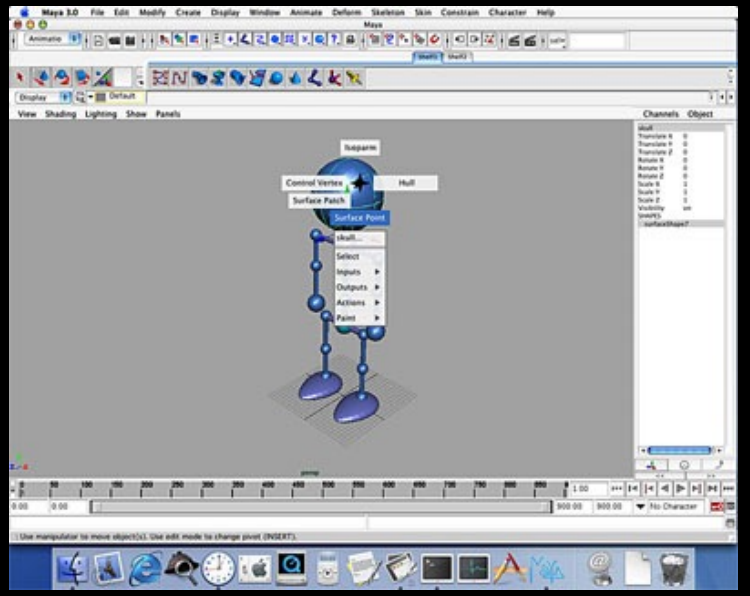


# Pie Menus in Use


The Sims




Rainbow 6



Maya

# Fitts's Law Examples

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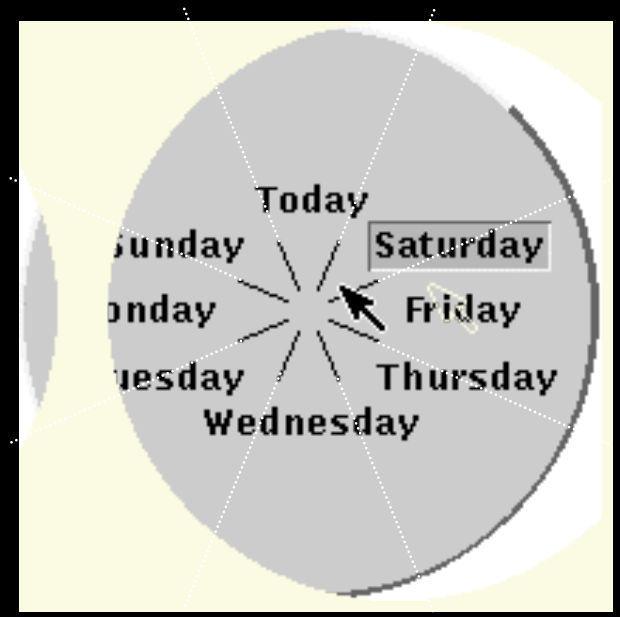
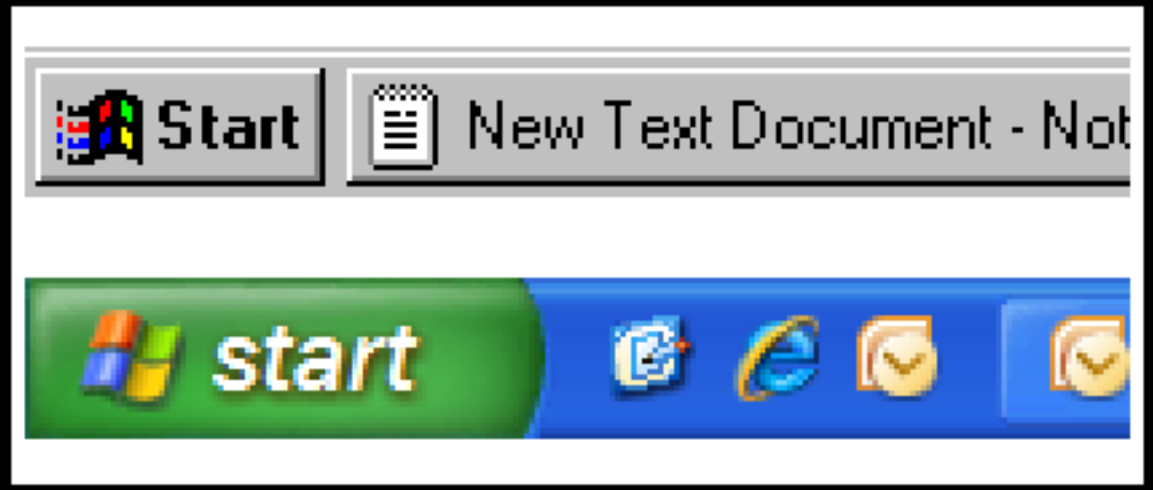



What about adaptive menus?

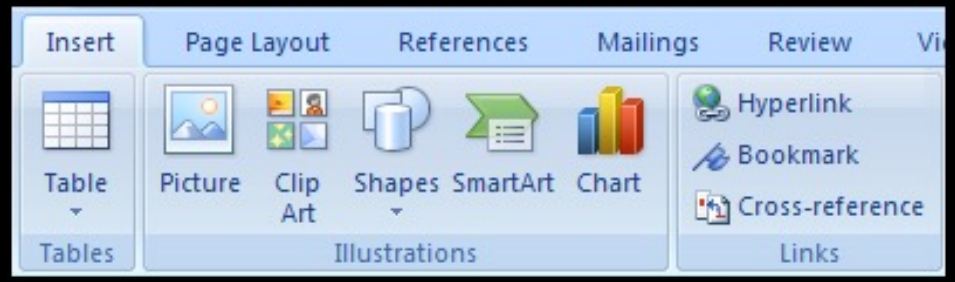
# Fitts's Law in Windowing



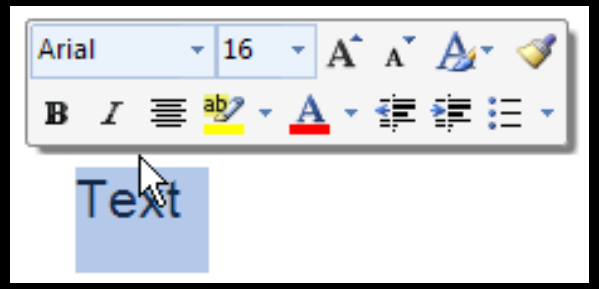

Windows 95: Missed by a pixel
Windows XP: Good to the last drop


Macintosh Menu

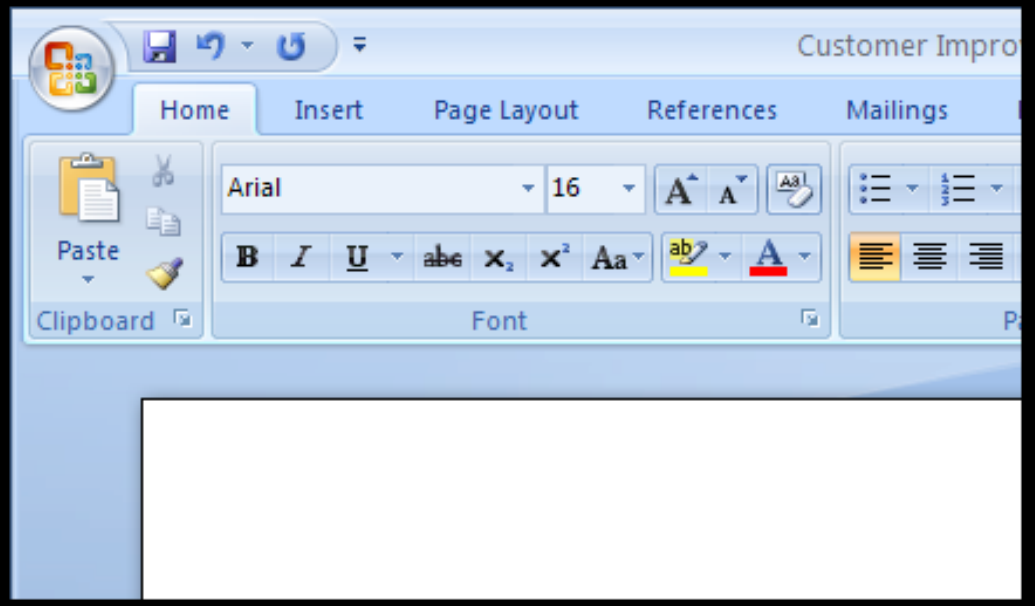
# Fitts's Law in MS Office 2007




Larger, labeled controls
can be clicked more quickly




Mini toolbar is close to the cursor




Magic Corner:
Office Button in the upper-left corner

# Bubble Cursor

Grossman and Balakrishnan, 2005

# Bubble Cursor

Grossman and Balakrishnan, 2005

# Bubble Cursor with Prefab

Dixon et al, 2012

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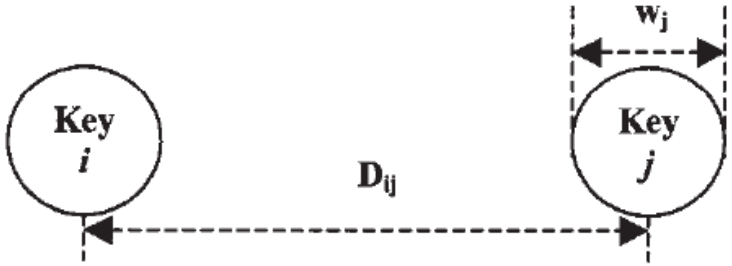
Dixon et al, 2012

# Fitts's Law and Keyboard Layout

Zhai et. al (2002) pose stylus keyboard layout as an optimization of all key pairs, weighted by language frequency

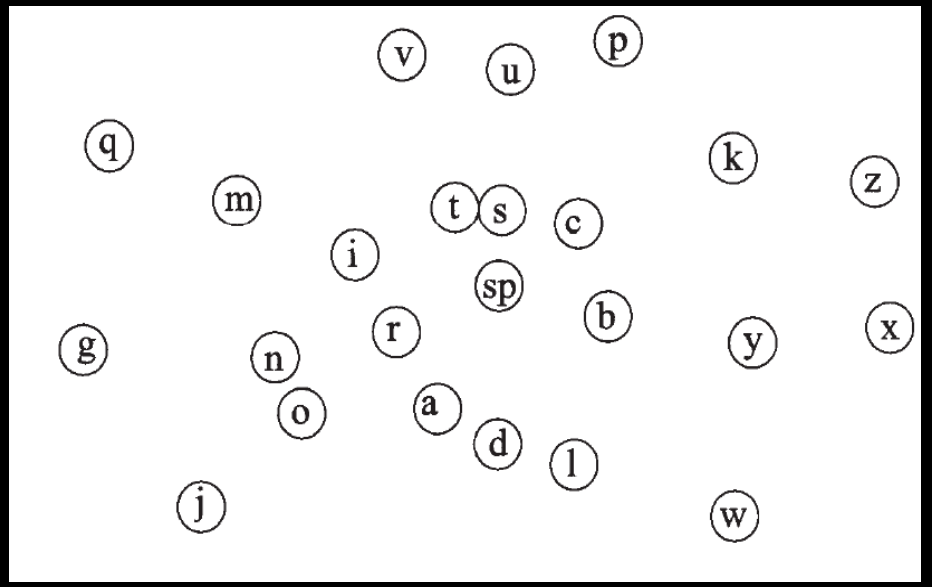


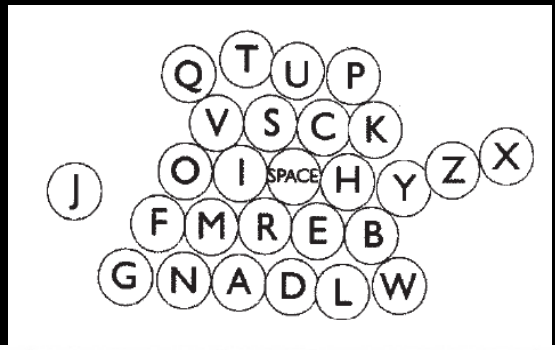

$$MT = a + b\log_2\left(\frac{D_{ij}}{W_j} + 1\right),$$

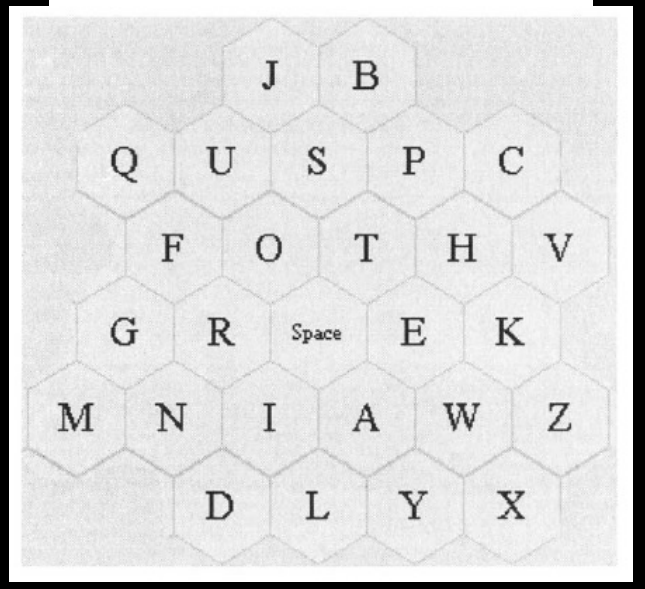
$$t = \sum_{i=1}^{27}\sum_{j=1}^{27} P_{ij}\left[log_2\left(\frac{D_{ij}}{W_j} + 1\right)\right],$$

# Metropolis Keyboard

Random walk minimizing scoring function



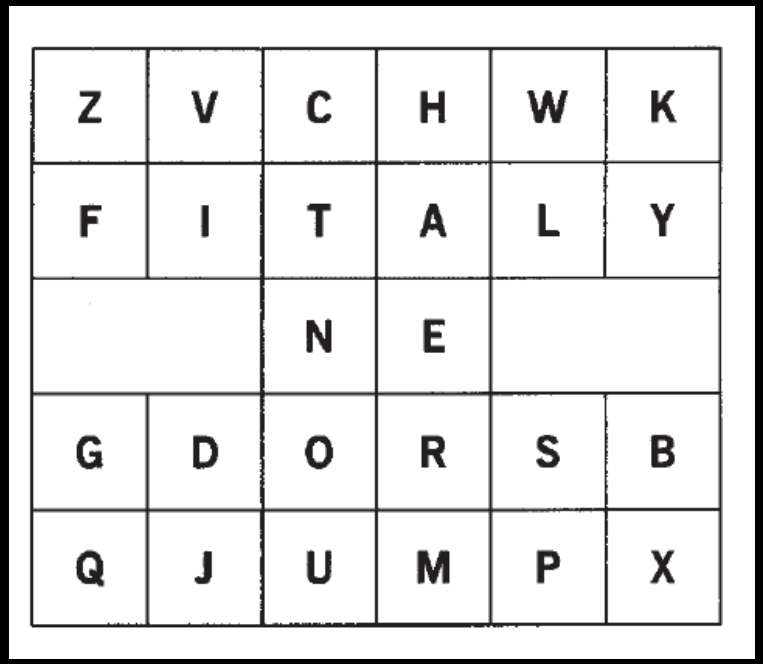



# Considering Multiple Space Keys

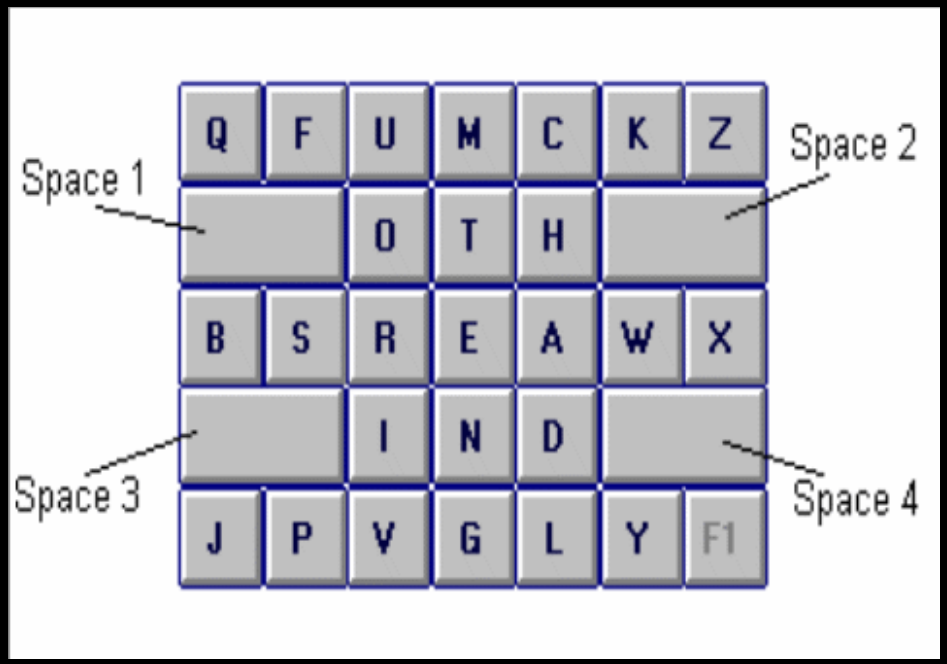
## FITALY Keyboard

Textware Solutions




## OPTI Keyboard

MacKenzie and Zhang 1999



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Textware Solutions

| | | | | | |
|---|---|---|---|---|---|
| Z | V | C | H | W | K |
| F | I | T | A | L | Y |
| | | N | E | | |
| G | D | O | R | S | B |
| Q | J | U | M | P | X |

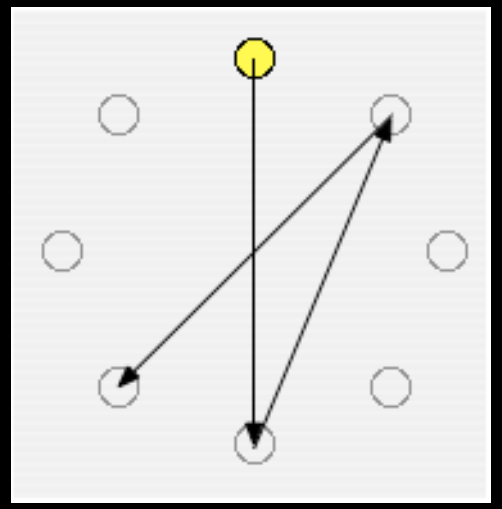
## OPTI Keyboard

MacKenzie and Zhang 1999

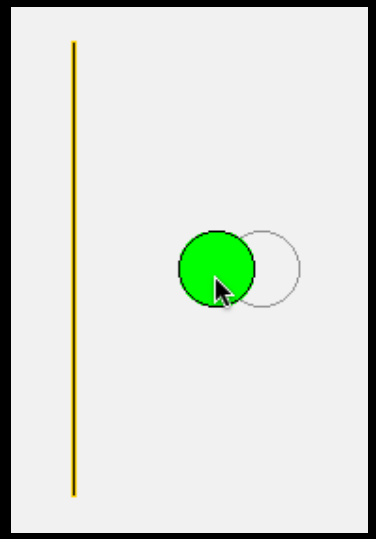

Correct choice of space key becomes important
Requires planning head to be optimal

# Using Motor Ability in Design

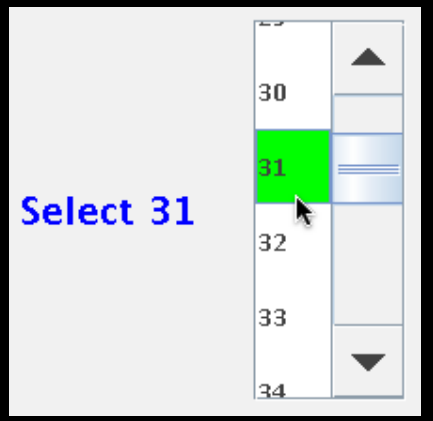
## Pointing



## Dragging



## List Selection



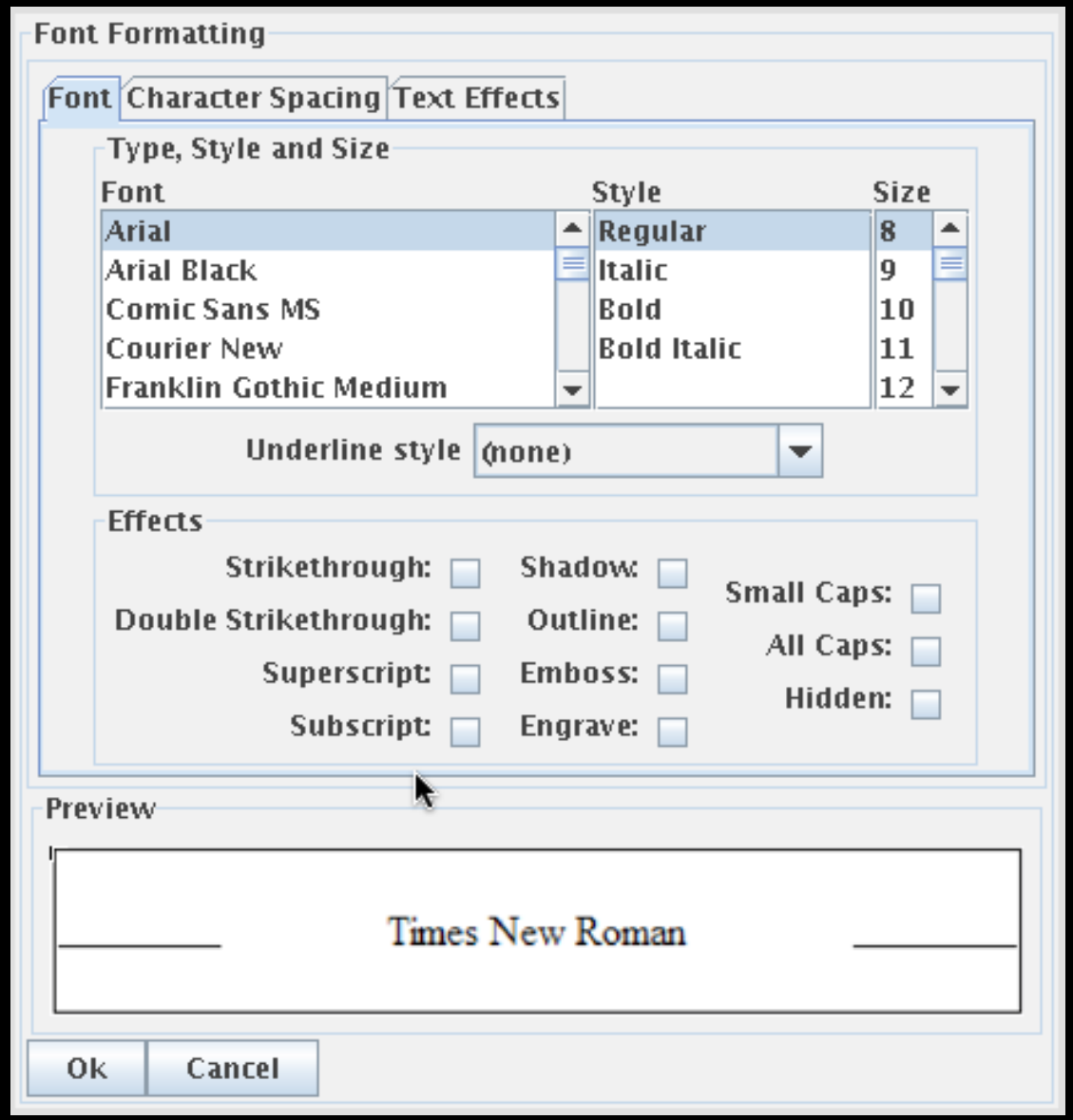

Gajos et al 2007

# Interface Generation As Optimization

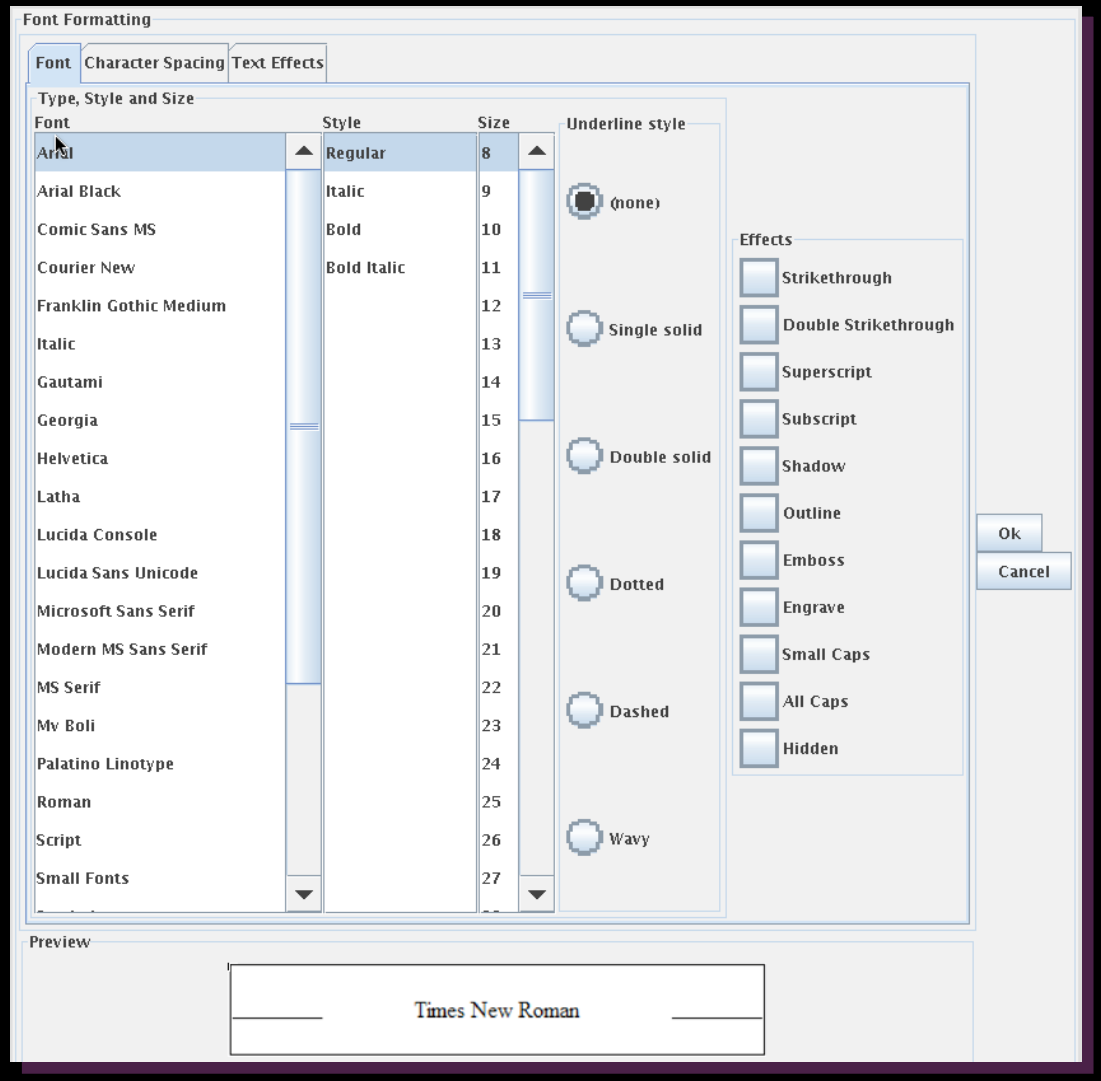
$( 

) = Estimated task completion time

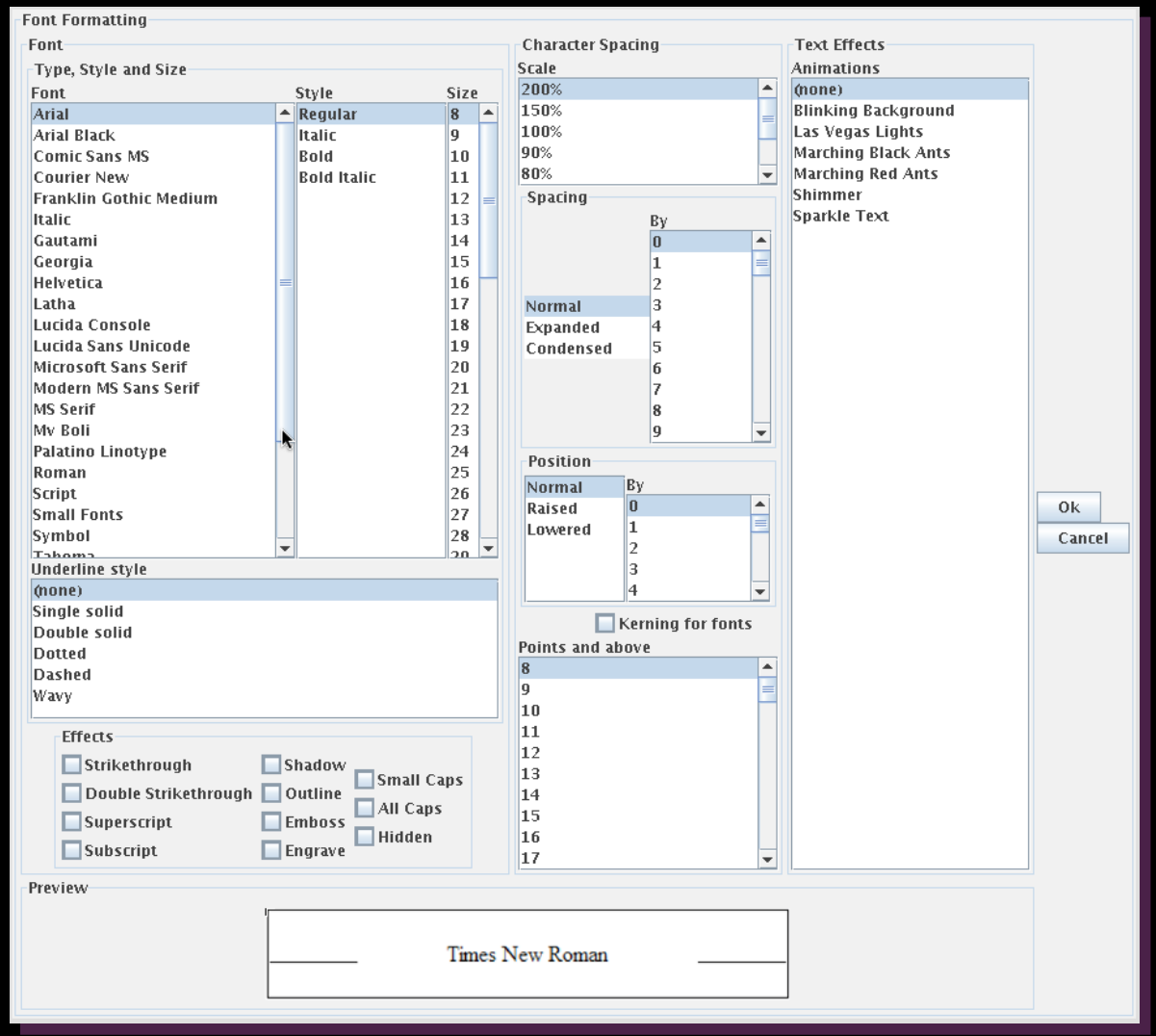
# Manufacturer Interface



# Custom Interface 1



# Custom Interface 2



# Fitts's Law Related Techniques

Gravity Fields

- Pointer gets close, gets "sucked in" to target

Sticky Icons

- When within target, pointer "sticks"

Constrained Motion

- Snapping,
  holding Shift to limit degrees of movement

Target Prediction

- Determine likely target,
  move it nearer or expand it

# Models from Different Perspectives

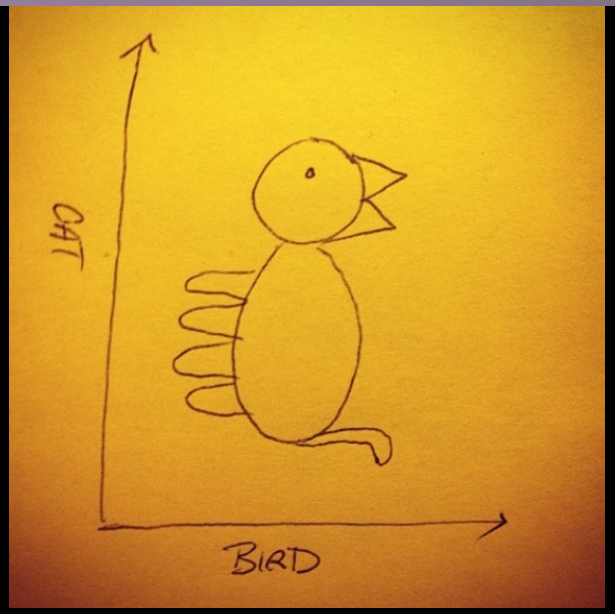
Some example models of human performance

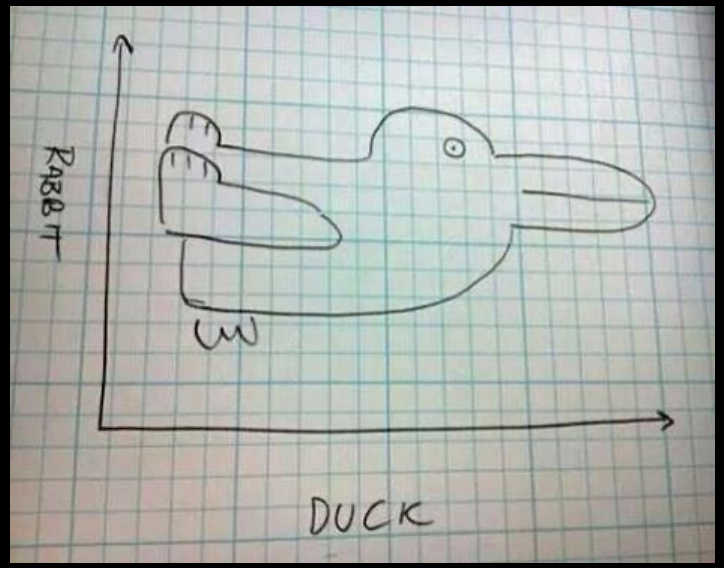
| | |
|---|---|
| Visual System | Biological Model |
| Model Human Processor | Higher-Level Model |
| Fitts's Law | Model by Analogy |
| **Gestalt Principles** | Predict Interpretation |

# Gestalt Psychology

Described loosely in the context of this lecture and associated work, not a real definition

Perception is neither bottom-up nor top-down, rather both inform the other as a whole



# Gestalt Psychology

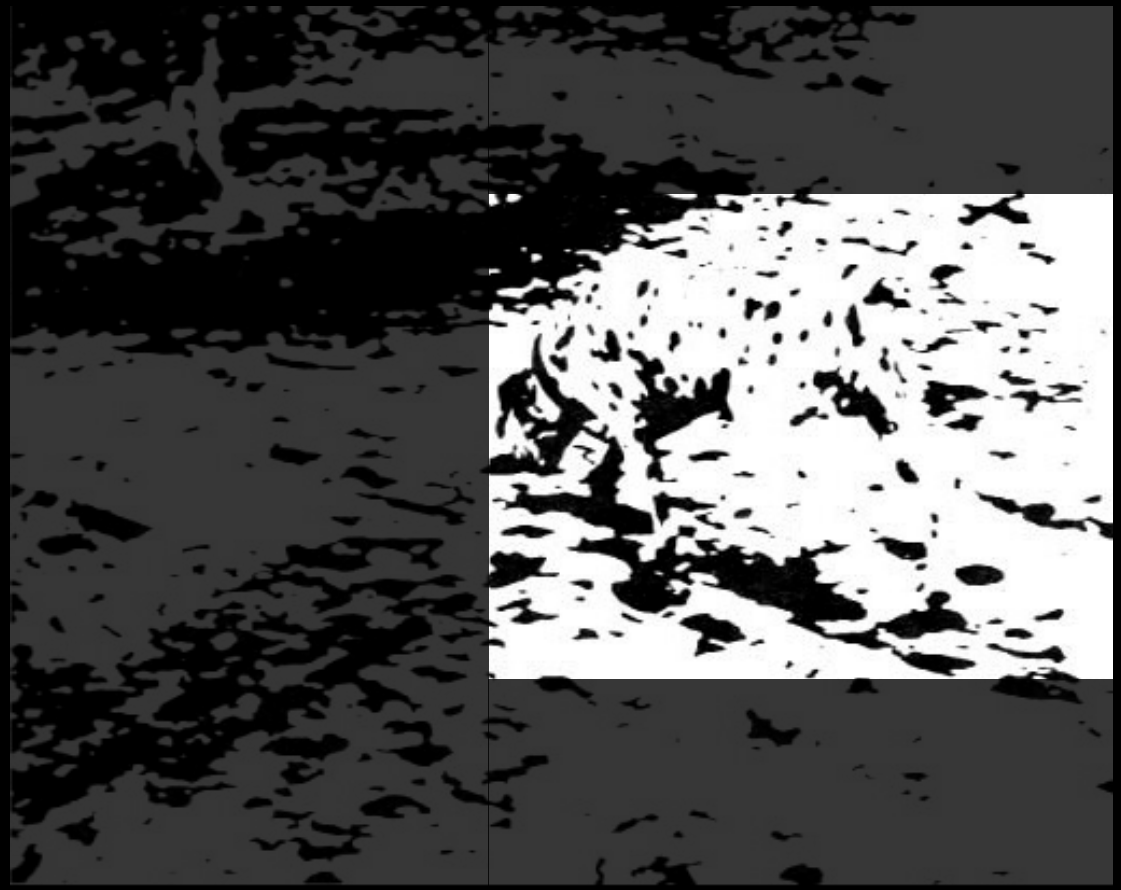
You can still see the dog…

# Gestalt Psychology

You can still see the dog…

# Gestalt Psychology

You can still see the dog…

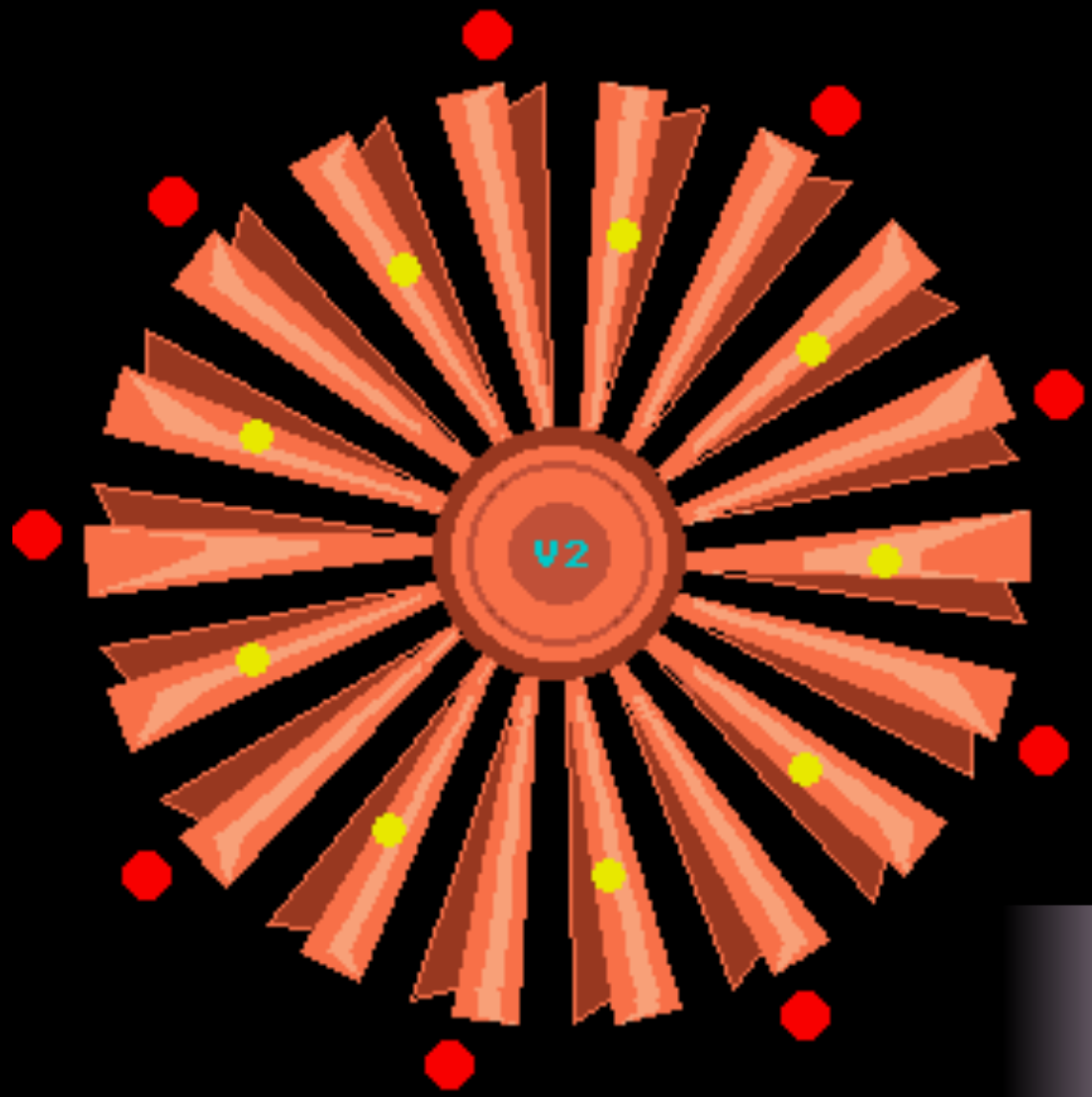


# Gestalt Psychology

You can still see the dog…

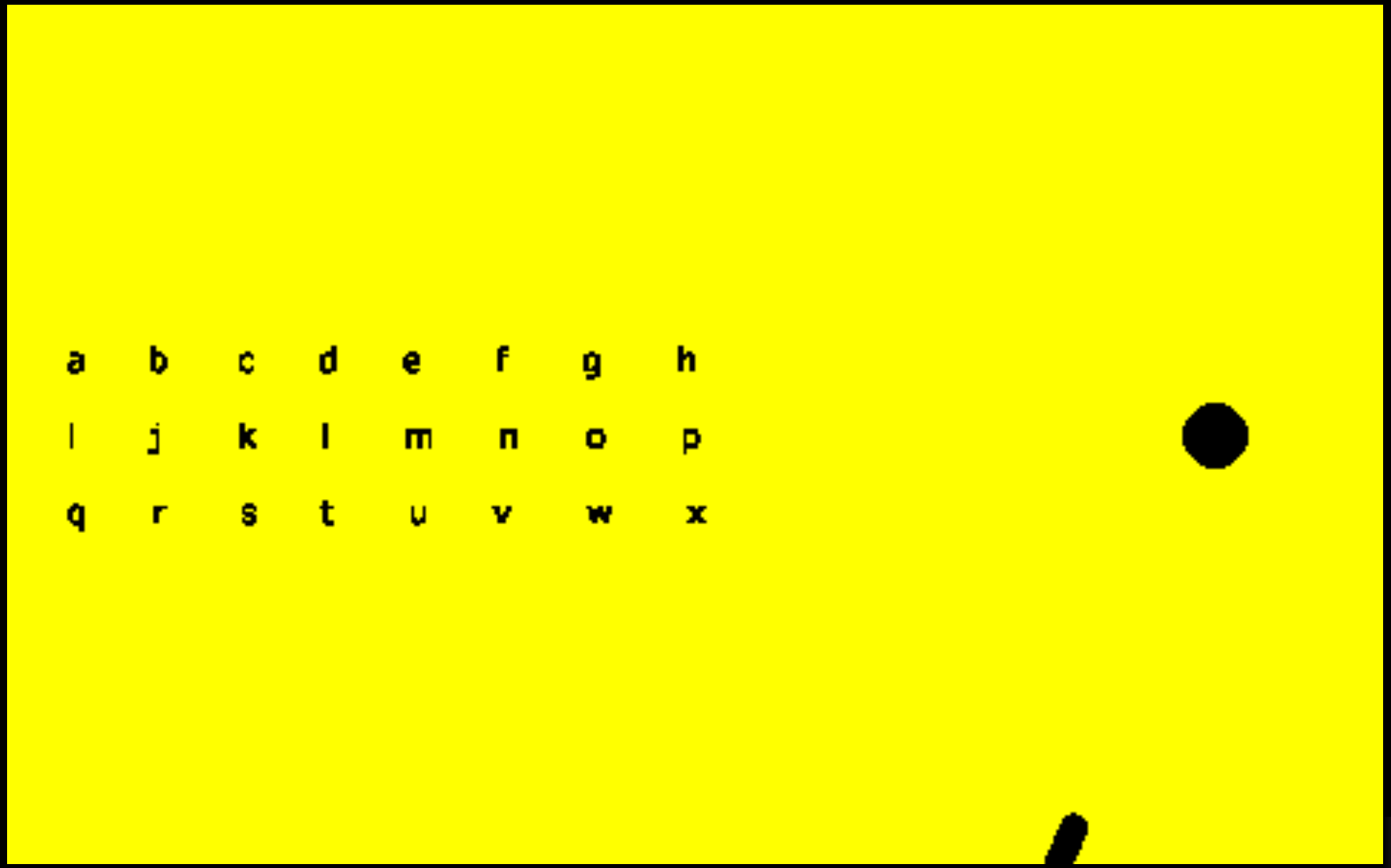
# Painful Image Warning

# Spinning Wheel



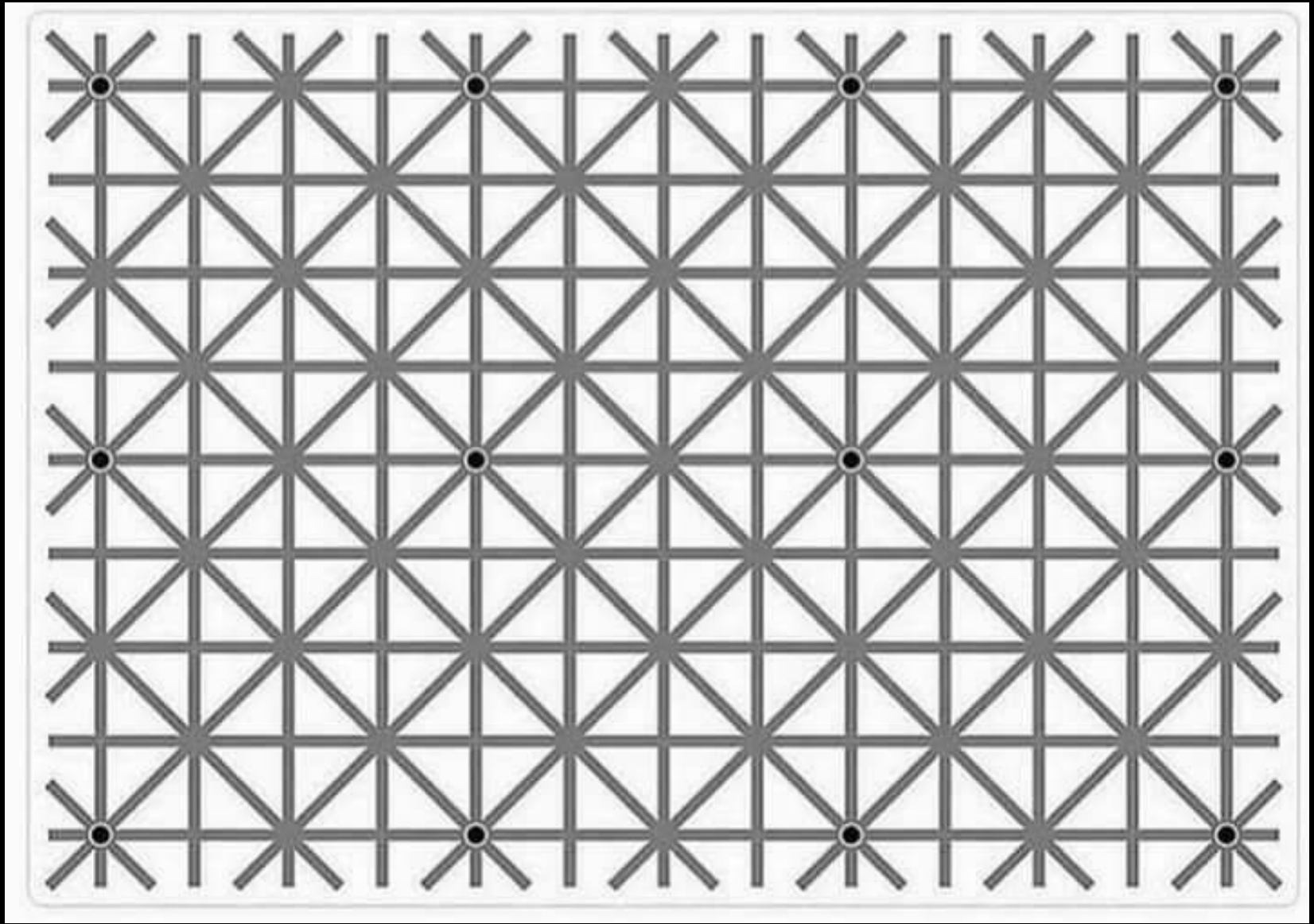

Follow the red dots vs
follow the yellow dots

# Blind Spot Interpolation

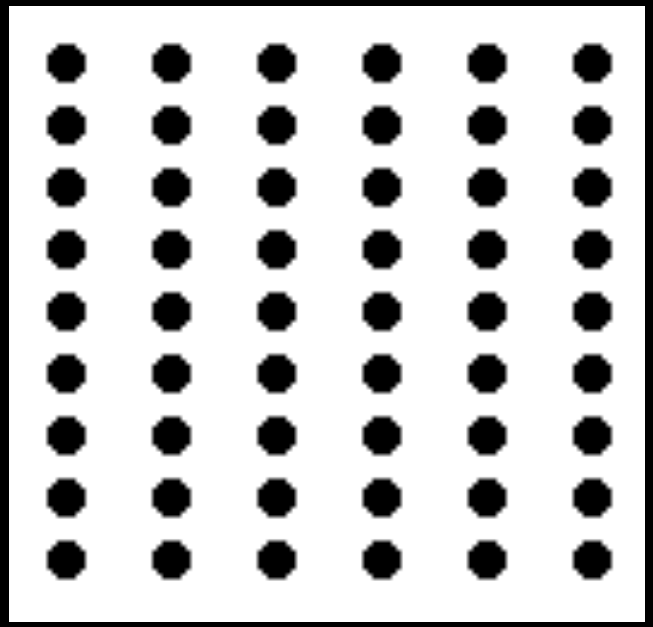


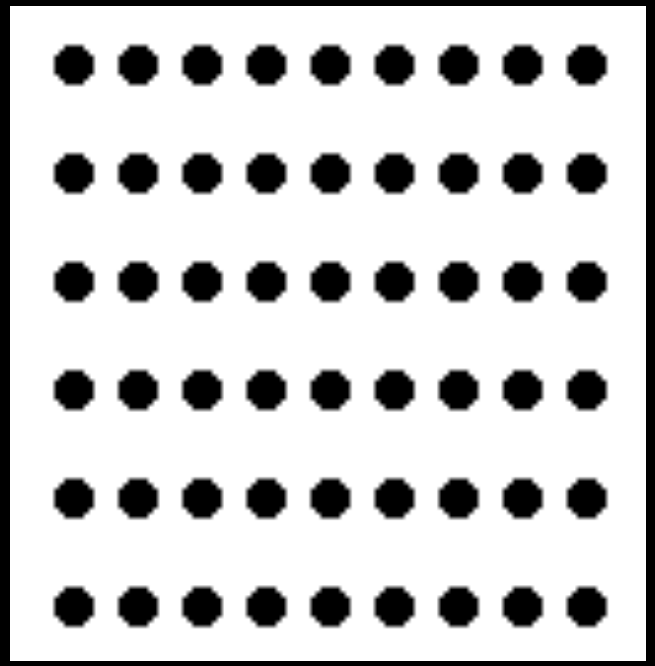

Use right eye, look at letters

# 12 Dots in this Image



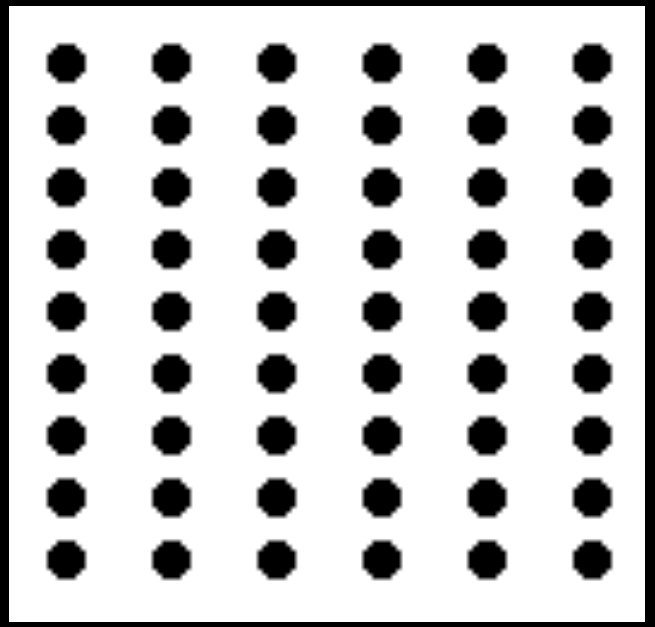
# Rows or columns?

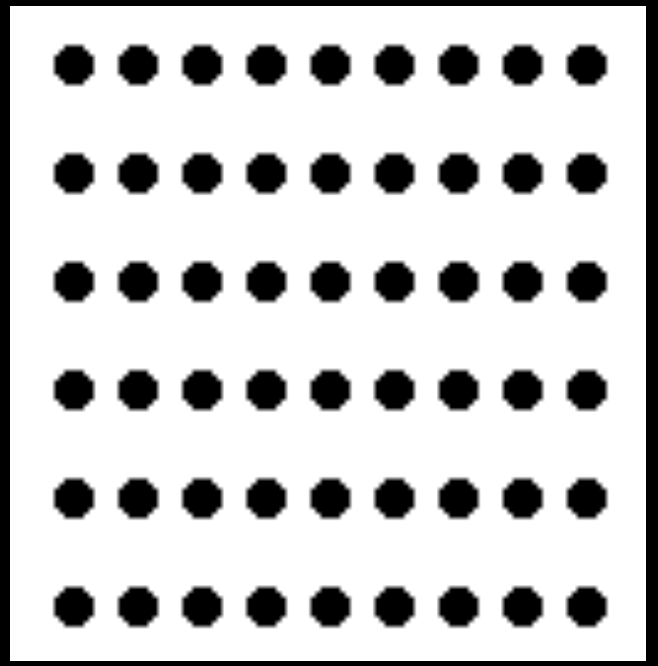




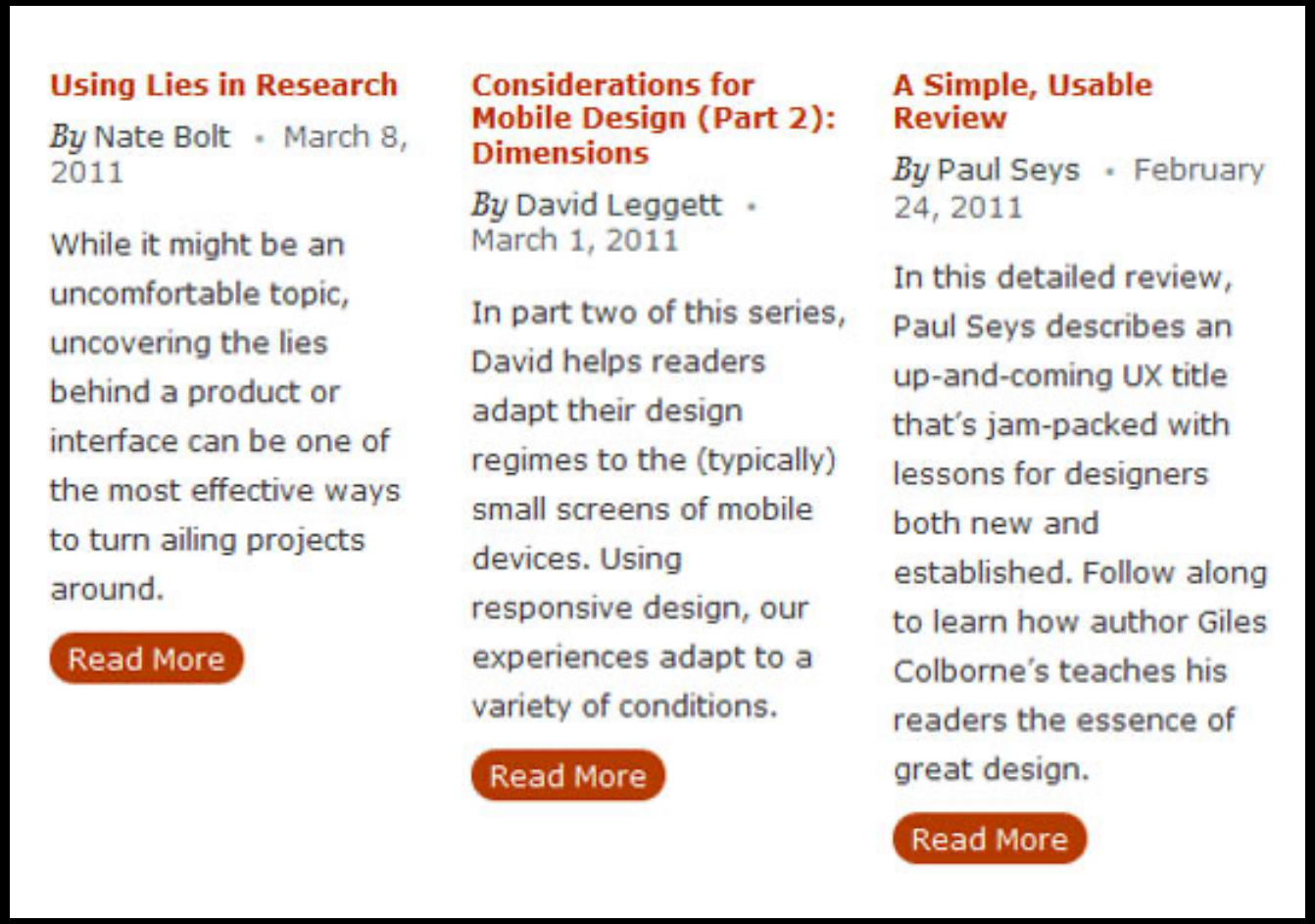
# Proximity

Objects close to each other form a group

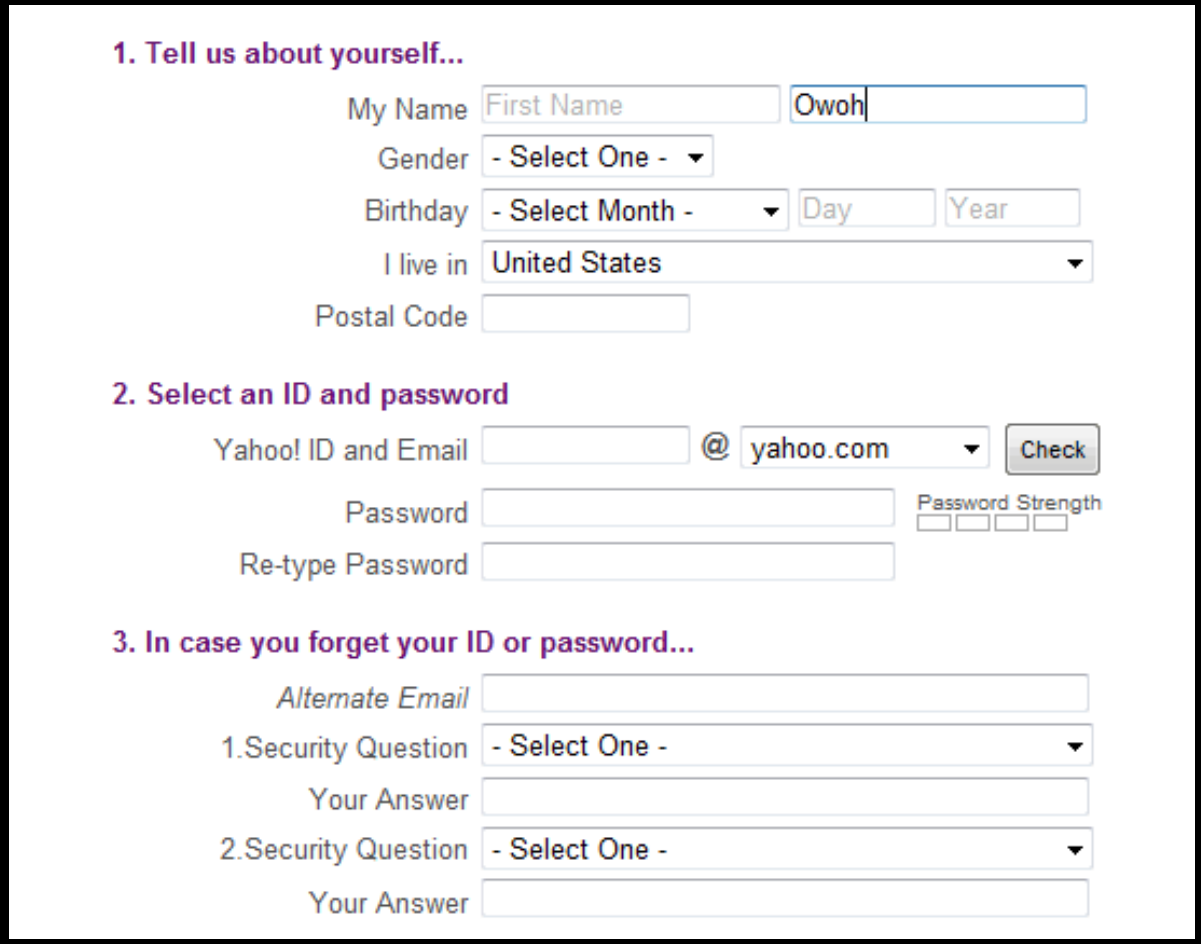




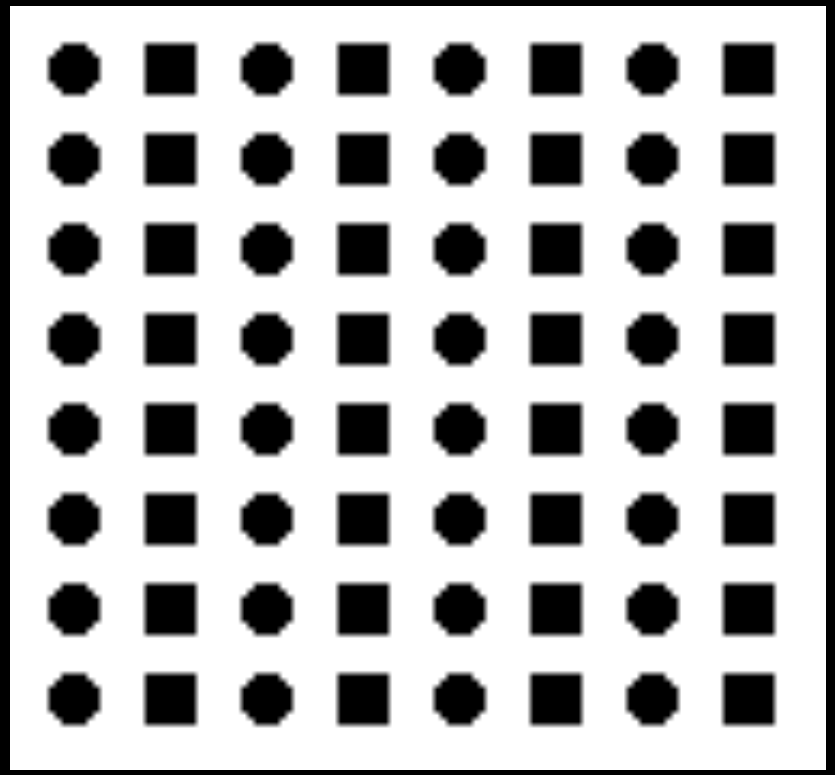
# Proximity


Using Lies in Research
By Nate Bolt • March 8, 2011
While it might be an uncomfortable topic, uncovering the lies behind a product or interface can be one of the most effective ways to turn ailing projects around.
Read More
Considerations for Mobile Design (Part 2): Dimensions
By David Leggett • March 1, 2011
In part two of this series, David helps readers adapt their design regimes to the (typically) small screens of mobile devices. Using responsive design, our experiences adapt to a variety of conditions.
Read More
A Simple, Usable Review
By Paul Seys • February 24, 2011
In this detailed review, Paul Seys describes an up-and-coming UX title that's jam-packed with lessons for designers both new and established. Follow along to learn how author Giles Colborne's teaches his readers the essence of great design.
Read More

# Proximity

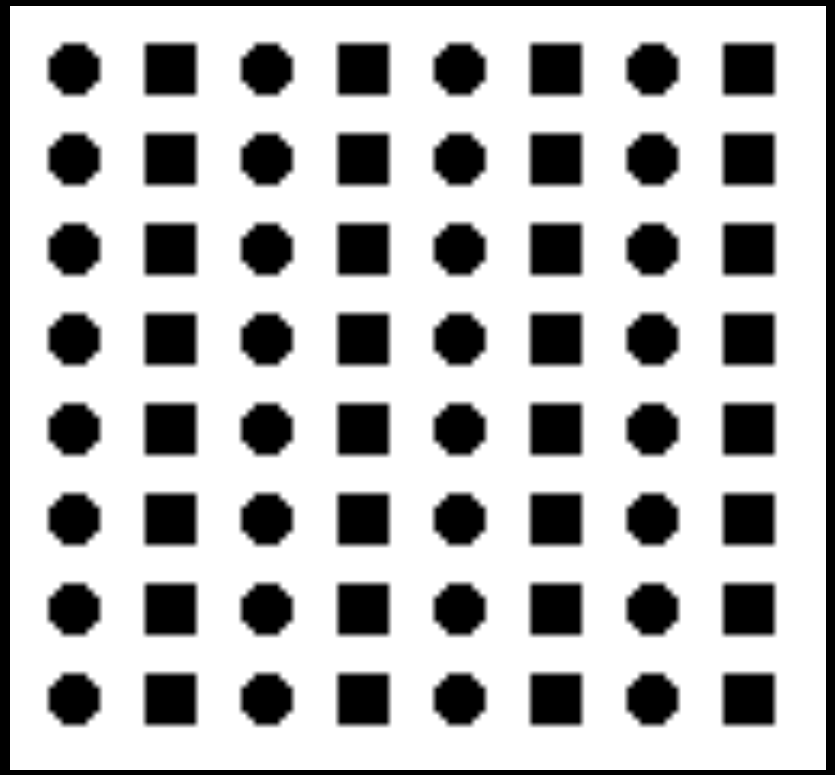

1. Tell us about yourself...
My Name
First Name
Owoh
Gender
- Select One -
Birthday
- Select Month -
Day
Year
I live in
United States
Postal Code
2. Select an ID and password
Yahoo! ID and Email
@
yahoo.com
Check
Password
Password Strength
Re-type Password
3. In case you forget your ID or password...
Alternate Email
1.Security Question
- Select One -
Your Answer
2.Security Question
- Select One -
Your Answer

# Rows or Columns?

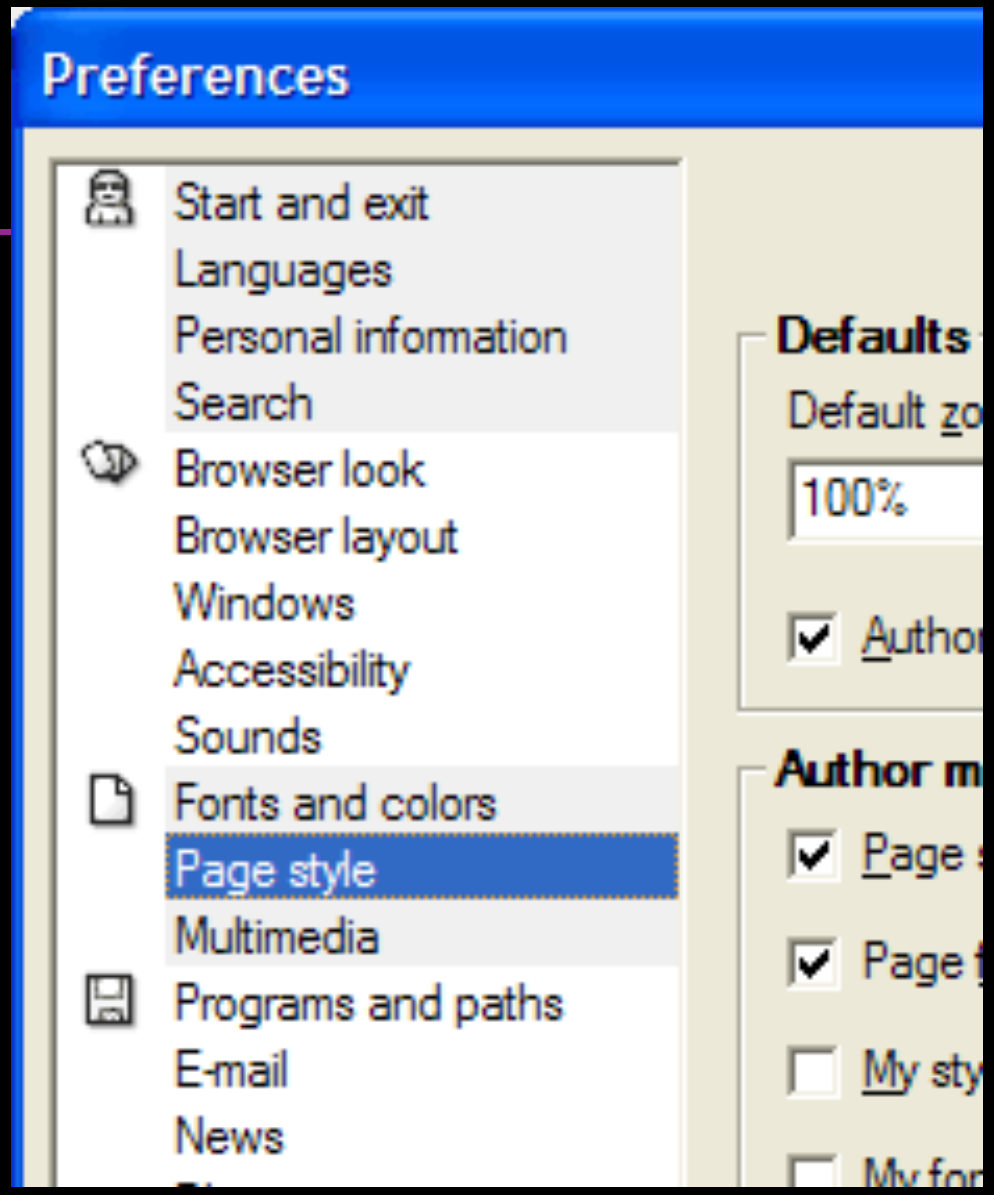


# Similarity

Objects that are similar form a group

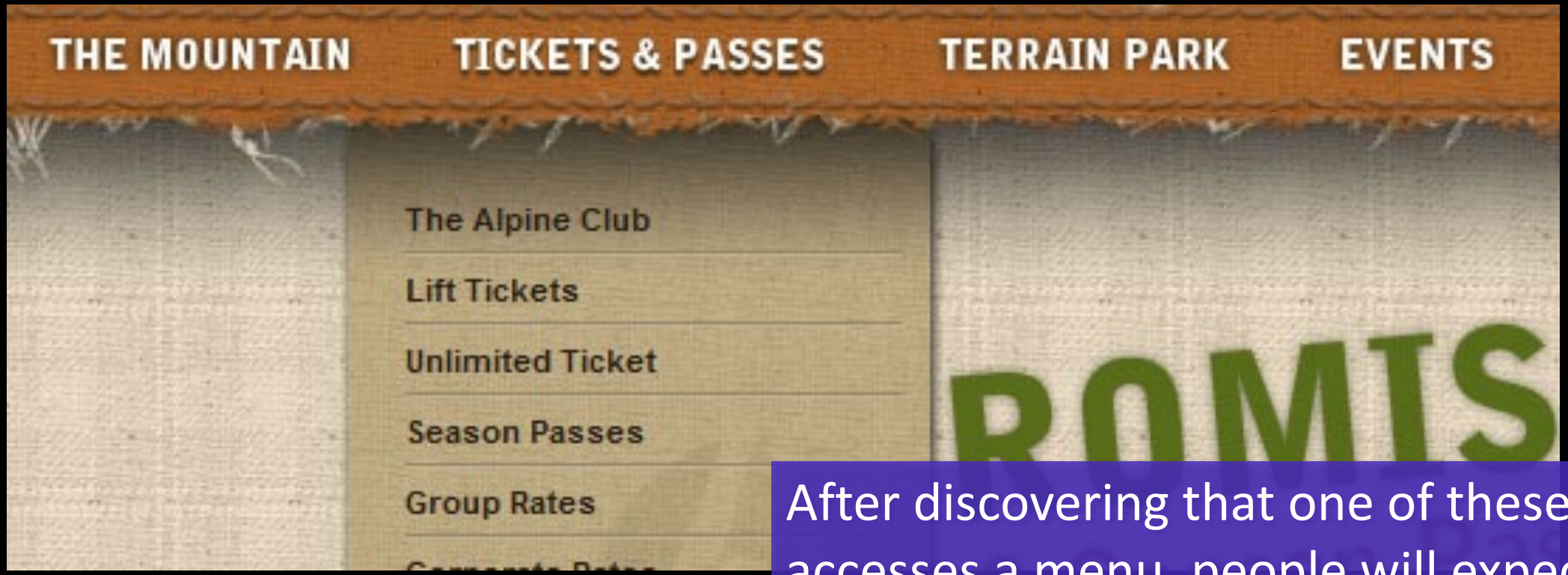


# Similarity


Preferences
Start and exit
Languages
Personal information
Search
Browser look
Browser layout
Windows
Accessibility
Sounds
Fonts and colors
Page style
Multimedia
Programs and paths
E-mail
News
Defaults
Default zo
100%
Author
Author m
Page
Page
My sty

# Proximity and Similarity

# Proximity and Similarity



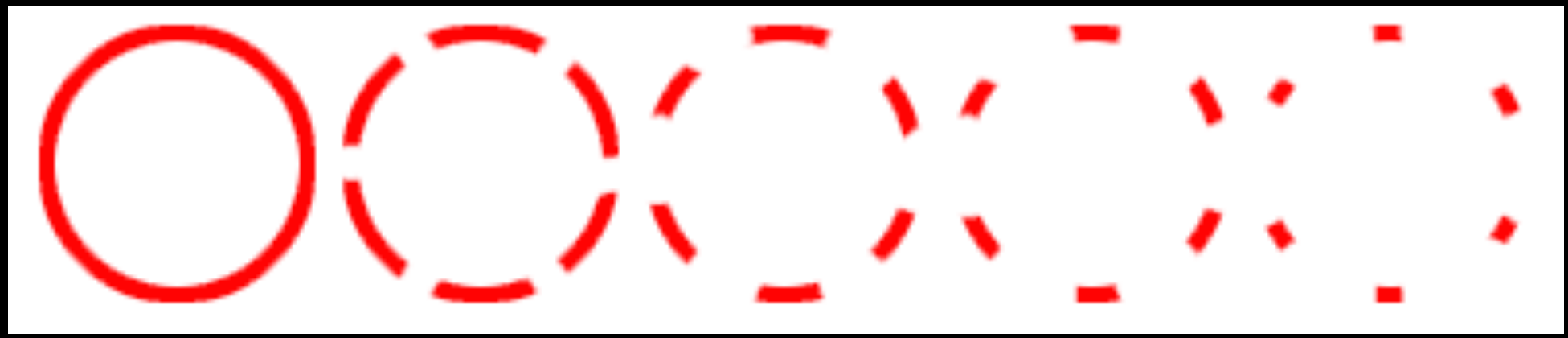

After discovering that one of these accesses a menu, people will expect they all access a menu. They are the same.

# How many circles?

# Closure

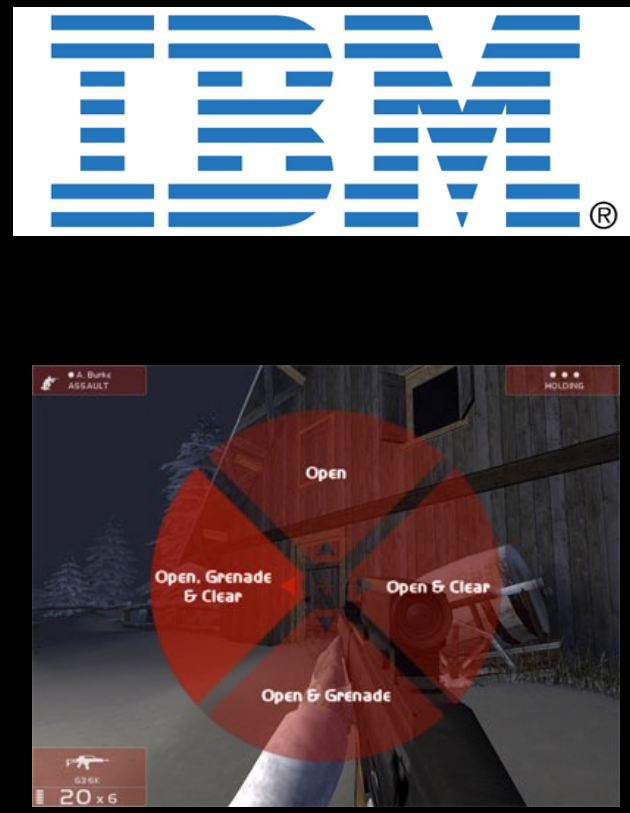
Even incomplete objects are perceived as whole

- Increases regularity of stimuli



# Closure


The Sims




Rainbow 6

# Symmetry

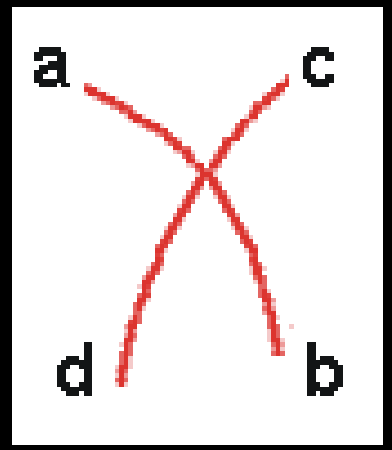
Objects are perceived as symmetrical and forming around a center point

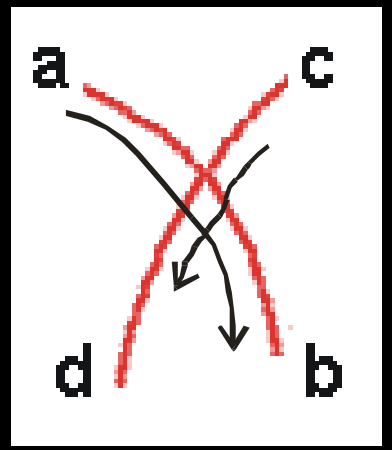

If you fight symmetry, be sure you have a reason

# Continuity

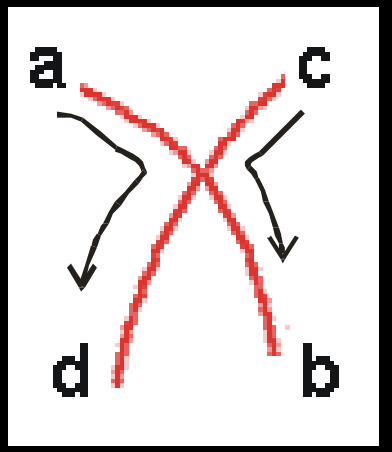
Objects perceived as grouped when they align

- Remain distinct even with overlap
- Preferred over abrupt directional changes



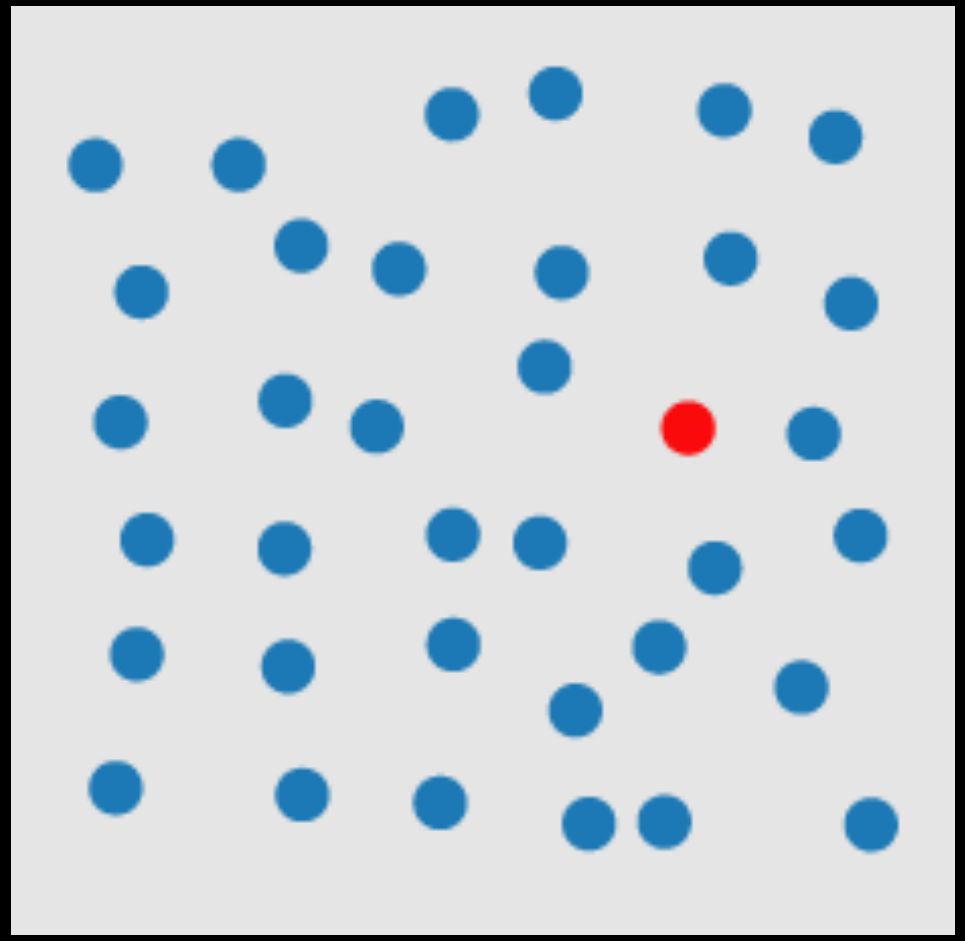




what most people see



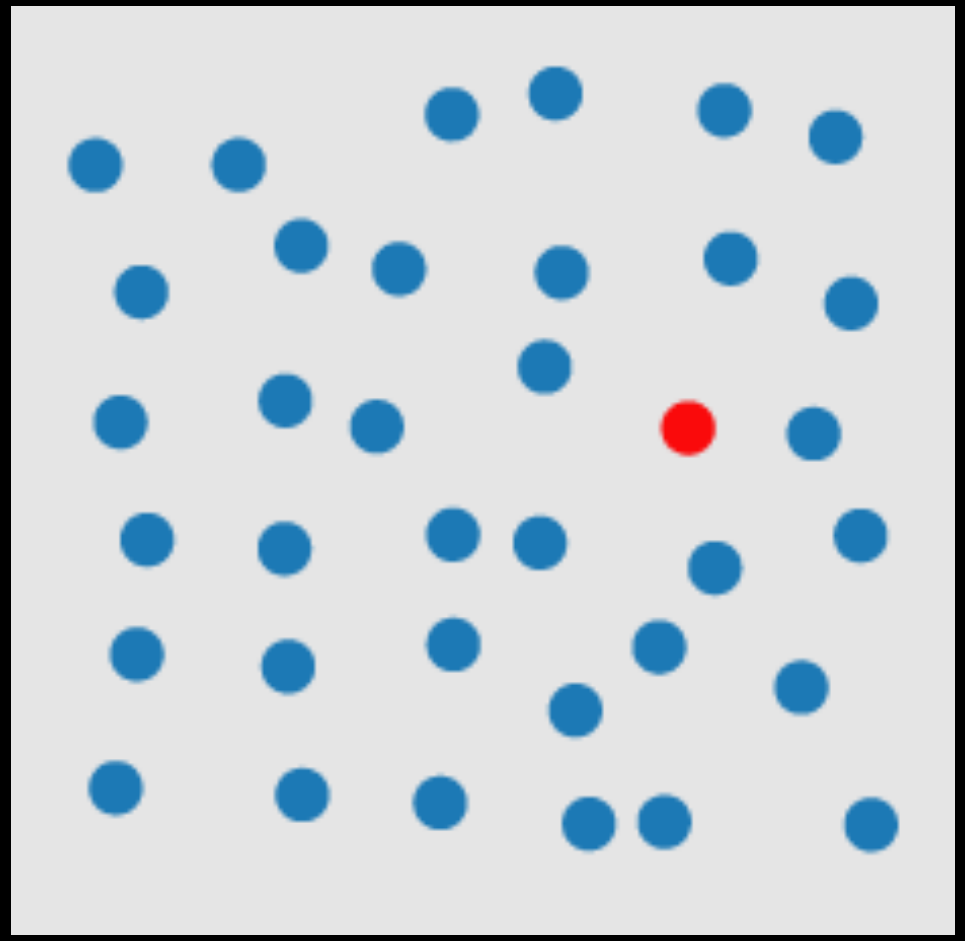

not this

# What's the question here?



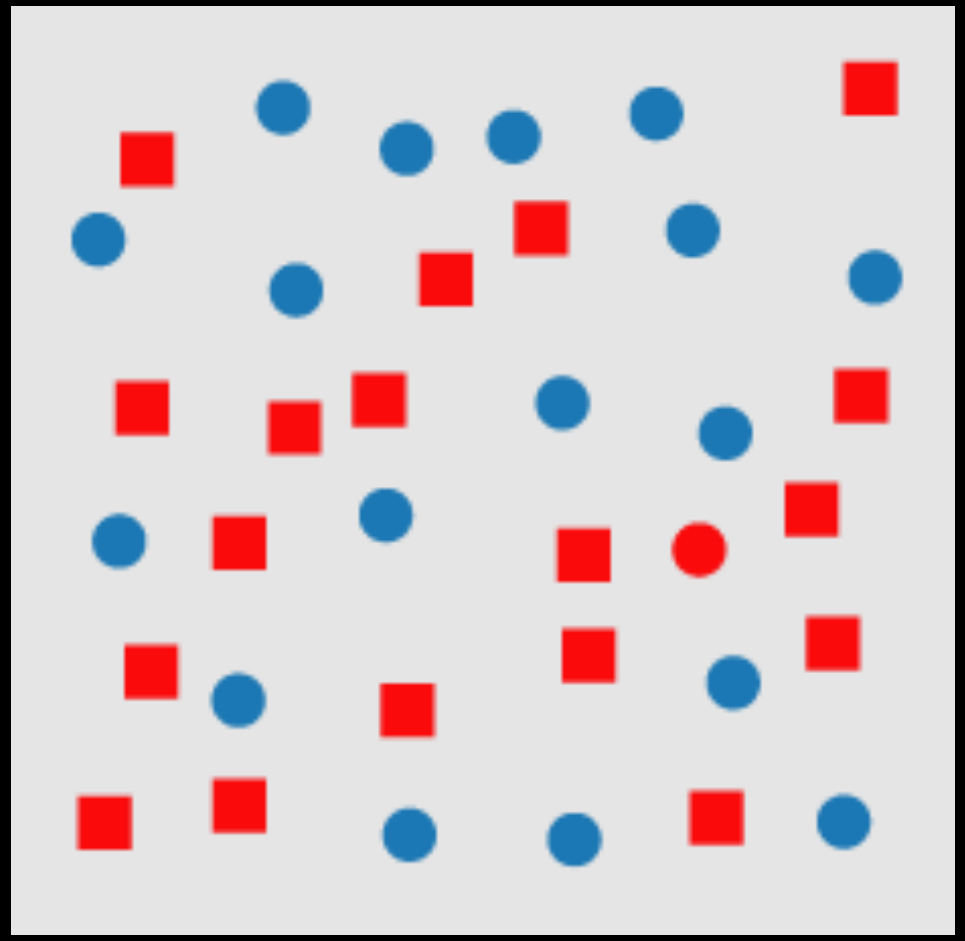
Mike Bostock

# No, I wasn't going to ask where the red circle is



Mike Bostock

# Pre-Attentive Processing



Mike Bostock

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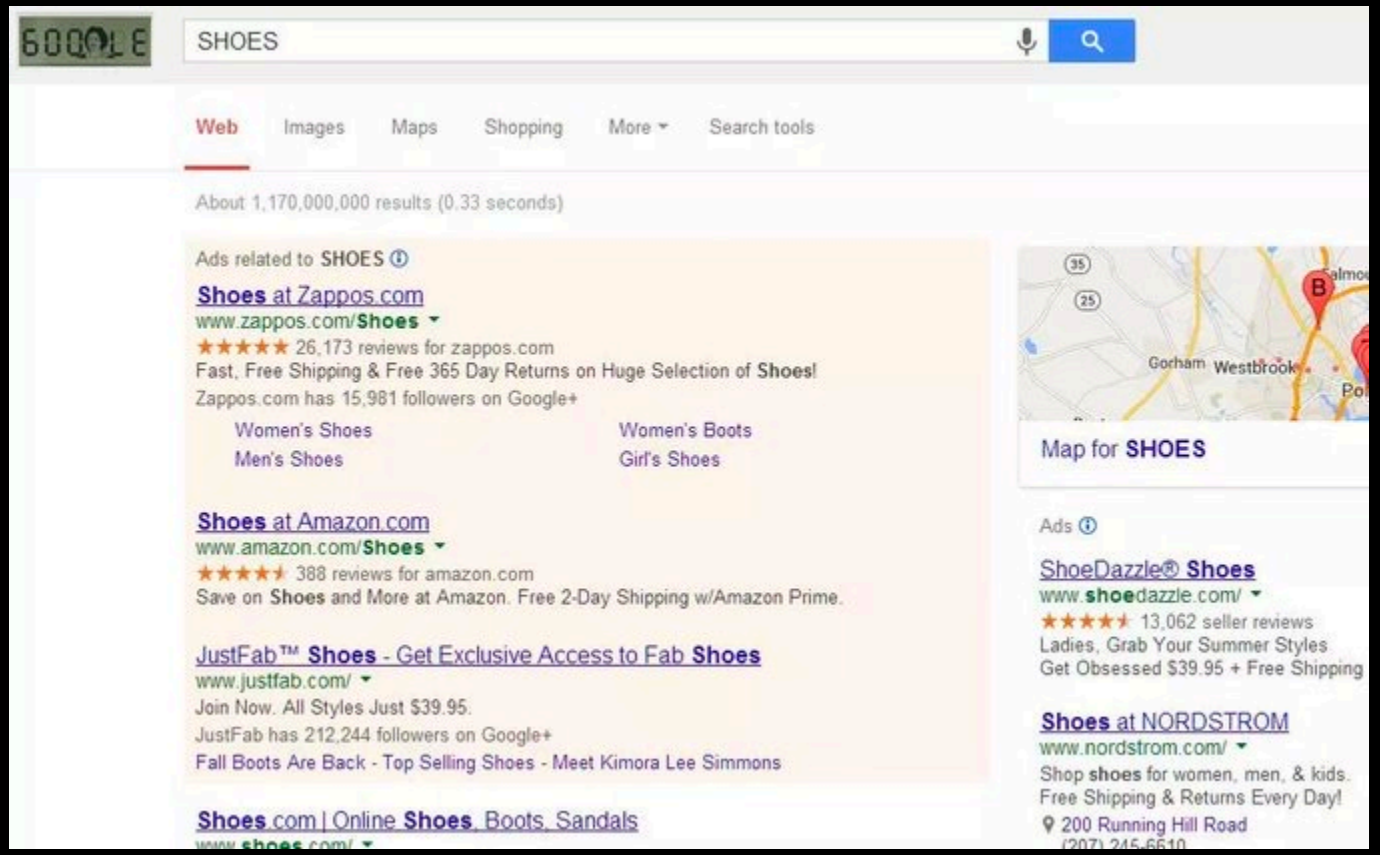


Mike Bostock

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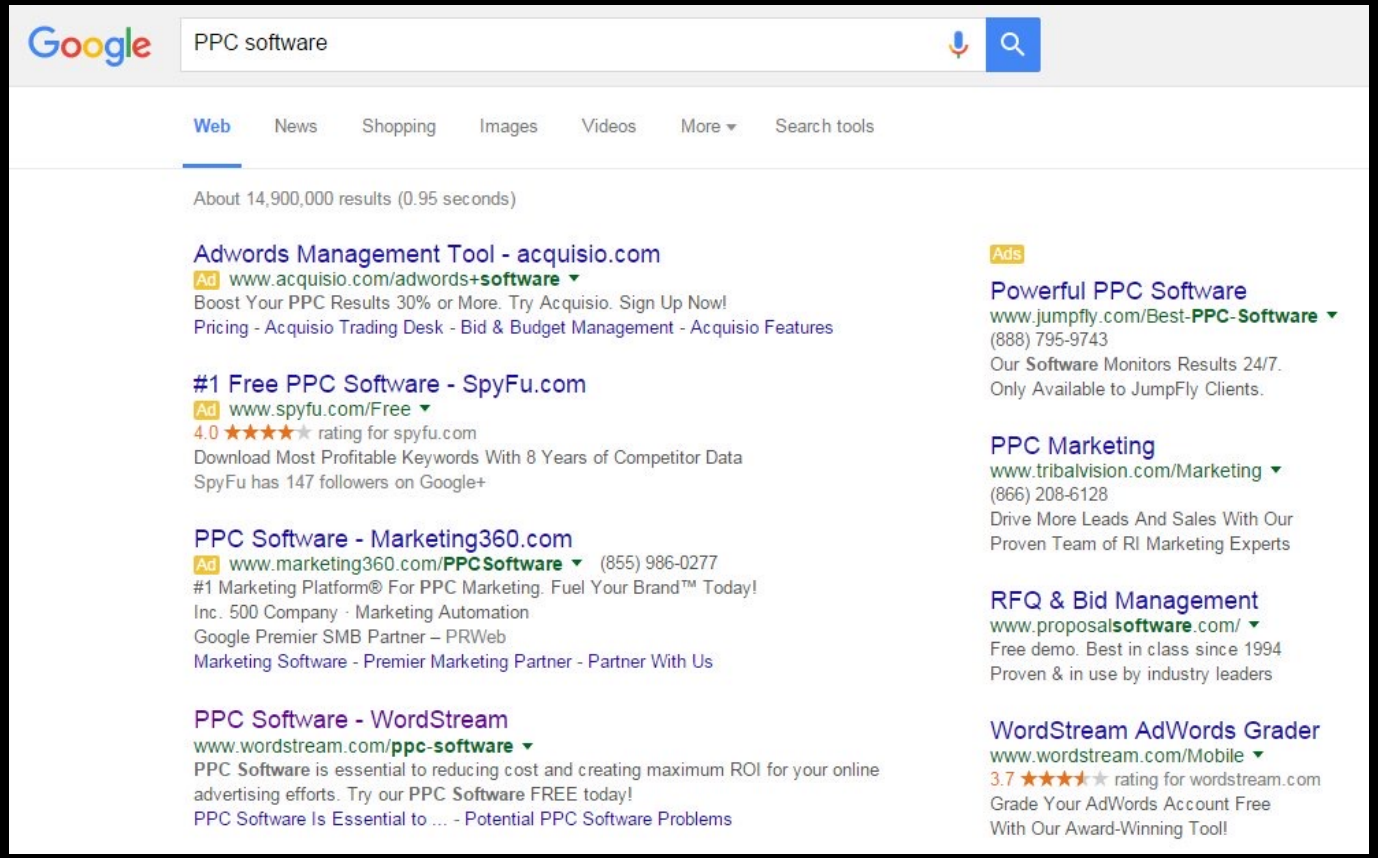


Mike Bostock

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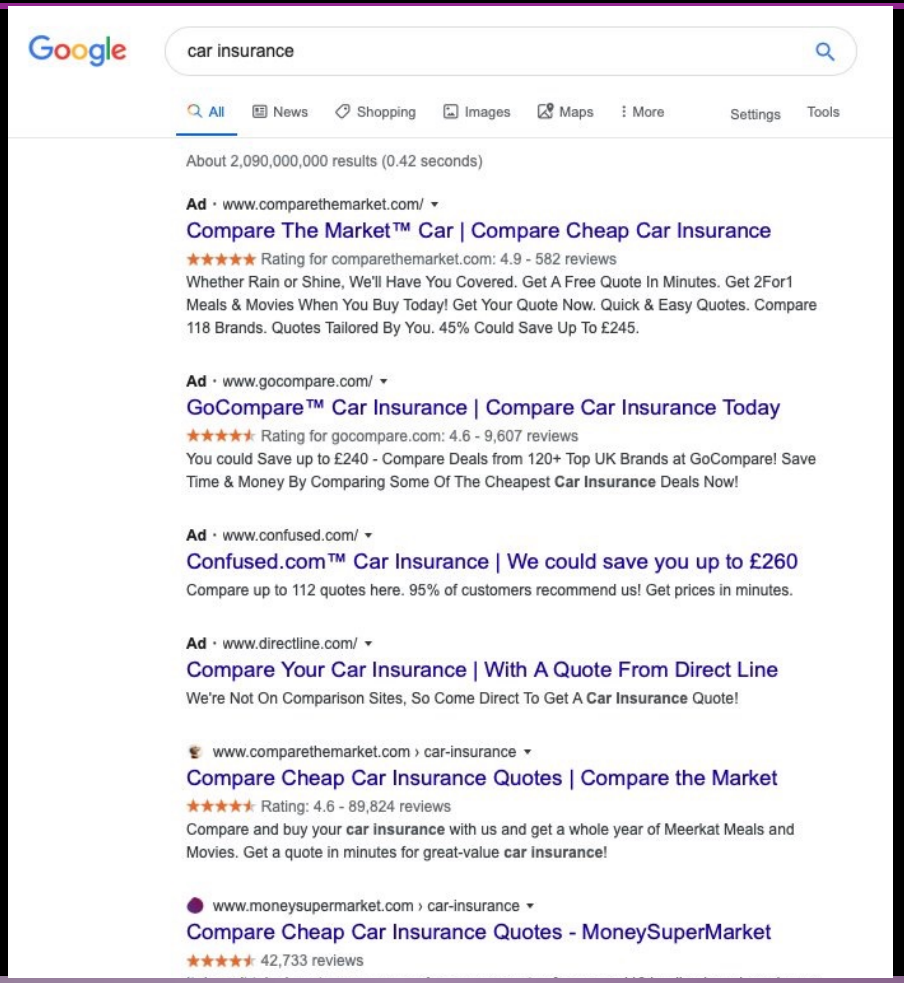


Mike Bostock

# Remaining Time: 2f Crit

# 2f Crit

Pair up with a group *not in your section!*

Guiding Questions:

- Are there Tasks (or DR insights) not presently supported in a design that would be interesting to incorporate?
- Could the Tasks be revised to broaden the Designs?
- Are the designs meaningfully distinct from each other? Can we push them farther in separate directions to explore the space more?

CSE 440:
Introduction to HCI

# 10: Catch-Up

April 25, 2024

Jesse J. Martinez | Avery Mack | Simona Liao