



# User Interface, User Interaction and Product Design

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## UI guidelines in Android

The screenshot shows the 'Android Design' website. On the left is a navigation menu with categories: GET STARTED (expanded), Creative Vision, Design Principles, UI Overview, STYLE, PATTERNS, BUILDING BLOCKS, DOWNLOADS, and DEVELOPERS. The main content area is titled 'Creative Vision' and features a large image of the Android home screen with icons for People, Gmail, and Calendar. Below the image, there is a paragraph of text about the Ice Cream Sandwich (Android 4.0) design changes.

Android Design

GET STARTED ^ Creative Vision < PREVIOUS NEXT >

Creative Vision

Design Principles

UI Overview

STYLE v

PATTERNS v

BUILDING BLOCKS v

DOWNLOADS

DEVELOPERS

Ice Cream Sandwich (Android 4.0) marks a major milestone for Android design. We touched nearly every pixel of the system as we expanded the new design approaches introduced in Honeycomb tablets to all types of mobile devices. Starting with the most basic elements, we introduced a new font, Roboto, designed for high-resolution displays. Other big changes include framework-level action bars on phones and support for new phones without physical buttons.

We focused the design work with three overarching goals for our core apps and the system at large. As you design apps to work with Android, consider these goals:

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<http://developer.android.com/design/>

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# More Resources from iOS world

Apple Developer | Discover | Design | Develop | Distribute | Support | Account

## iOS Human Interface Guidelines

The world's most advanced mobile OS offers everything you need to design beautiful, engaging apps that radiate power and simplicity.

**Overview**

- Design Principles
- What's New in iOS 10
- Interface Essentials
- Interaction
- Features
- Visual Design
- Graphics
- UI Bars
- UI Views
- UI Controls
- Extensions
- Technologies
- Resources

As an app designer, you have the opportunity to deliver an extraordinary product that rises to the top of the App Store charts. To do so, you'll need to meet high expectations for quality and functionality.

Three primary themes differentiate iOS from other platforms:

- Clarity.** Throughout the system, text is legible at every size, icons are precise and lucid, adornments are subtle and appropriate, and a sharpened focus on functionality motivates the design. Negative space, color, fonts, graphics, and interface elements subtly highlight important content and convey interactivity.
- Deference.** Fluid motion and a crisp, beautiful interface help people understand and

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# UI Design

## Flat Design- Material Design

**iOS7**

**Windows 8**

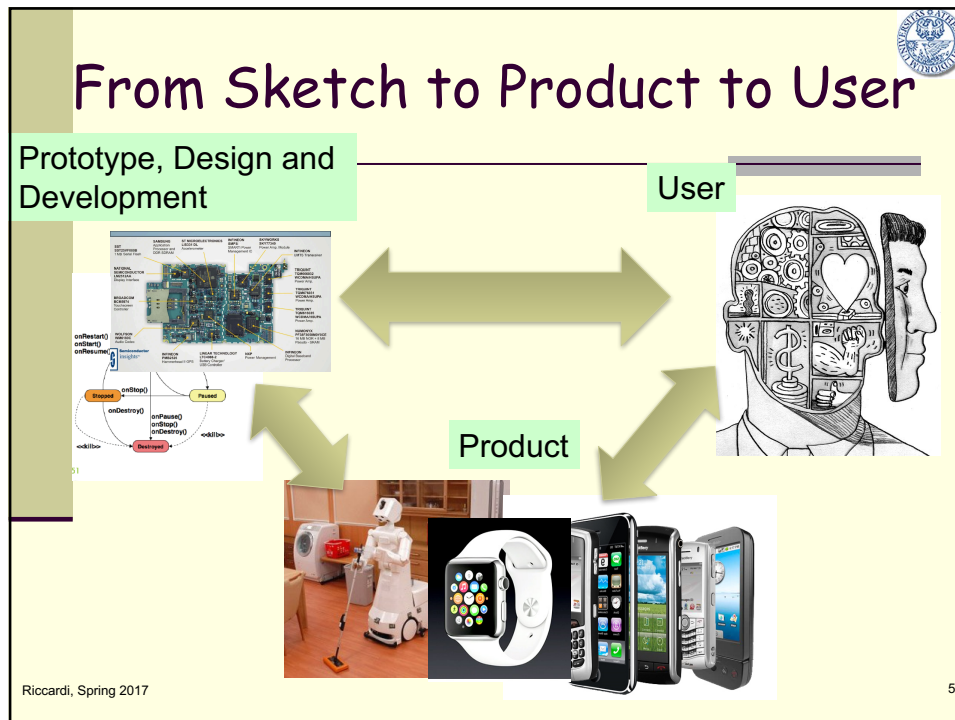
**Android**

Android uses a new design metaphor inspired by paper and ink that provides a reassuring sense of familiarity. Visit the [material design](#) site for more resources.

- > Introducing material design
- > Downloads for designers
- > Articles

**MATERIAL DESIGN**

- Animation
- Style
- Layout
- Components
- Patterns
- Usability



## On Terminology

- UI may be implemented via a **GraphicalUI** or **VoiceUI** or **MultimodalUI**
- That is where it starts!
- That is when the human-machine **interaction** and **experience** can be grounded into actions as simple as:
  - Clicks, Swipes, Gestures, Typing, Spoken Words
  - In order to **accomplish** or **support** a user task ("Compose an email")
- It applies to designing dyadic interaction as well as more complex n-ary systems.

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## Why User Interface/Interaction Design



- In a typical mid-large SW project the UI designer function should be present
- In small project teams ( people < 2-3 ) might not be available.
- He/She a minority whereas the team is mostly made of programmers/managers
- It is important that programmers know what UI design is about.
  - Better Communicate SW system development team.
- Programmers might turn into UI designers!

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## Lecture Plan

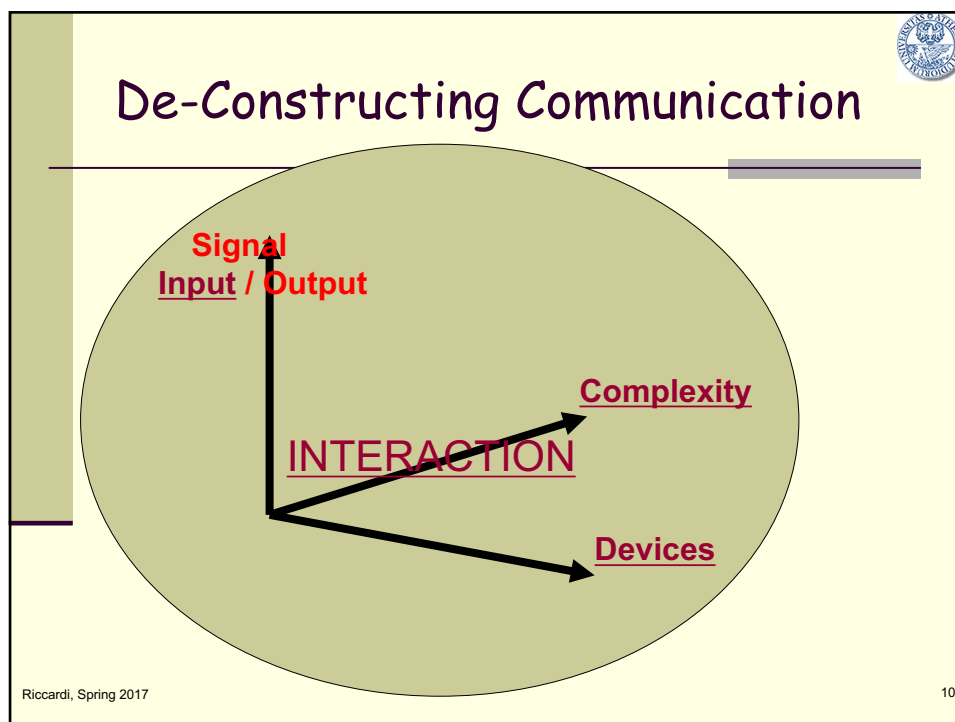
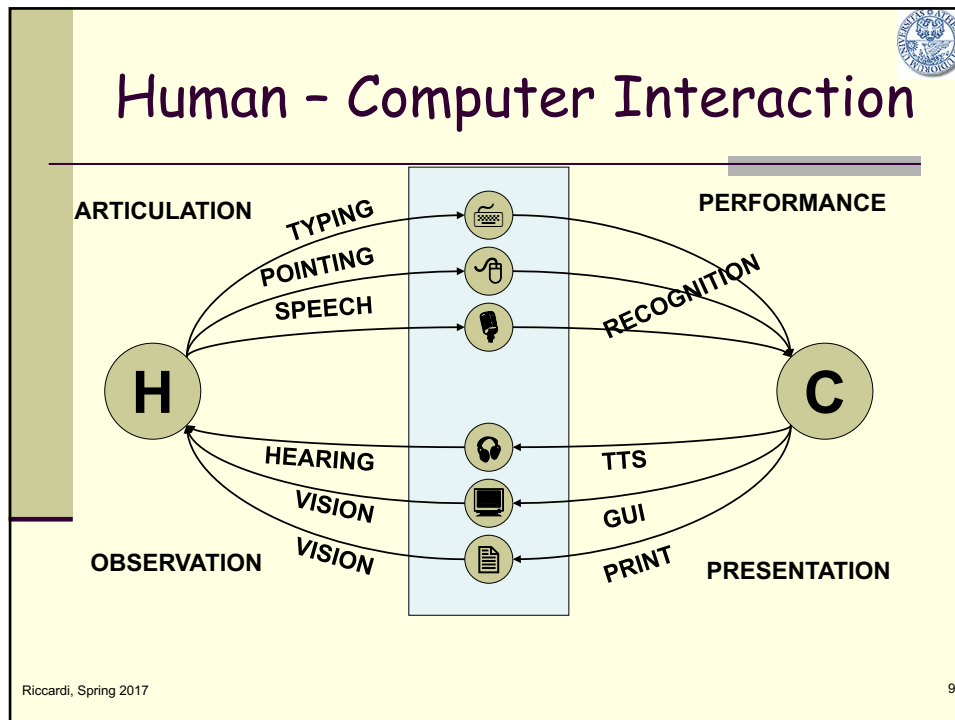



- 1st Part
  - User Interface Design
    - Principles ( applicable to Human-Machine Interaction Systems )
    - Psychological and Cognitive Motivations
- 2° Part (March 29 )
  - User Interaction guidelines
  - App Design Process
  - Examples

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# Human Computer Interaction

- Device
  - Input Device: Mouse, Keyboard, Joystick, Audio, ..
  - Output: Speakers, Screen (Virtual Reality Goggles)
- Interface
  - WIMP (Windows, Icons, Menus & Pointers) [Xerox '70s]
- Human-Machine Interaction
  - Multimodal ( Speech, Text, Gestures, Haptics, Sensors )

## HCI Goals

- U<sup>3</sup>: Useful & Usable & Used
- Fun
- Esthetics

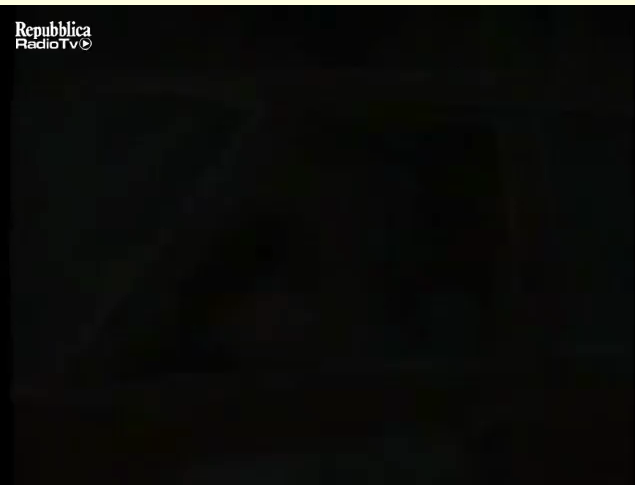
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# Demo

## Mobile Phone 1990

 Useful  
 Usable  
 Used



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## User Interface Design

- **Educated ART**
  - Human Interaction Understanding
  - Creativity and Expression (*Skeumorphisms vs Flat design*)
- Based on
  - Science (Cognitive, Psychology)
  - Engineering
- Goal of Designing interactive systems based on requirements
  - SW, HW
  - Interaction System (User, Machine)

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## Bridge Design and Engineering (0)

- Many solutions to the problem of  
 " **Design and Build a bridge**  
**from point A to B, that can**  
**carry car/truck traffic,**  
**pedestrians, be stable in**  
**super-windy conditions,**  
**earthquakes etc.."**

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## Bridge Design and Engineering (1)



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## Bridge Design and Engineering (2)



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## Artifact may require

- Engineering (Technology & Systems)
- Science (Cognitive, Psychology..)
- Aesthetics universals
- User/Social acceptance
- The end-product will be a mix of all of the above to reach a point equilibrium = solution
- **Solution is Not unique!**

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## Inventing Objects

1963  
Hugo Gernsback  
Teleglasses



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# The Evolution of the Mouse

1967-2015



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Slide Show ▶

Ormai fuori produzione, il Washable mouse di Belkin poteva essere lavato con acqua senza temere per i circuiti elettronici

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Slide Show ▶

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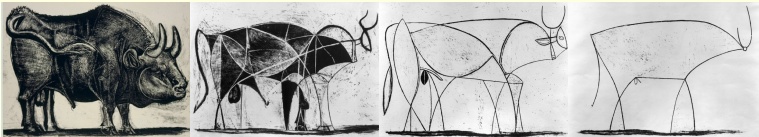


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## Function $\leftrightarrow$ Aesthetics

Picasso Bull Images



Apple Mouse over time



1985      1992      2005      2009

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## The design of the TV remote

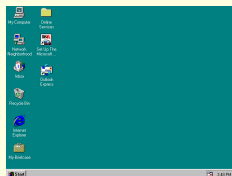


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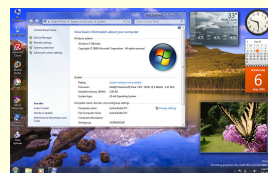
25

## GUI design: Microsoft OS

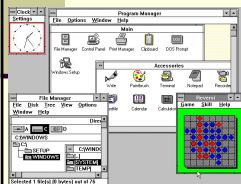
Windows 95



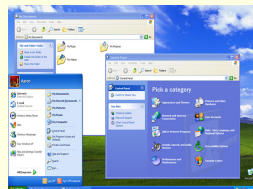
Windows 7



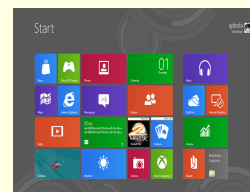
Windows 3.0



Windows XP



Windows 8



1990

1995

2001

2009

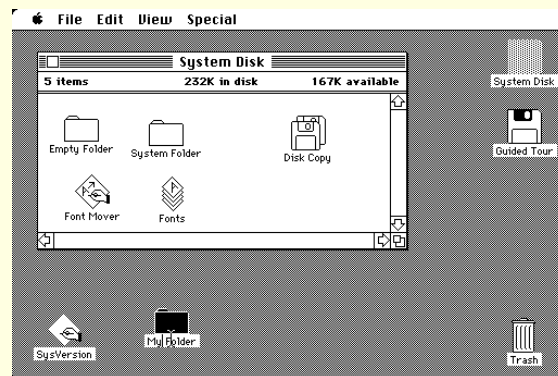
2012

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# GUI design: Apple OS

1984 - 1.0



1984

1995

2001

2009

2012

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# GUI design: Apple OS

1997-8.0



1984

1995

2001

2009

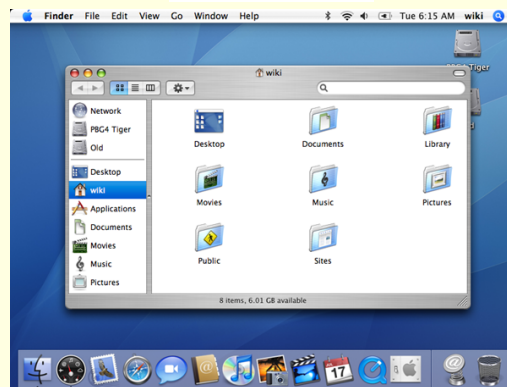
2012

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## GUI design: Apple OS

2005-10.4



1984

1995

2001

2009

2012

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## GUI design: Apple OS

2013 - 10.9



1984

1995

2001

2009

2012

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## Putting the **USERS** in the Design of UI

- Engineering of Bridge Building
  - DOES not need people to evaluate the solution!
- In HCI systems, users are part of it.
  - They are needed to study and evaluate
- Usability Testing
  - Limited by the number of users and delay btw prototype and final engineered solution

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## A word of advice from **S. Jobs:**



"You can't just ask customers what they want and then try to give that to them. By the time you get it built, they'll want something new."



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## OR Just Ask Your Users/Customers

CNET › Tech Industry › Tell Twitter's CEO what you want from him in 2017

### Tell Twitter's CEO what you want from him in 2017

Jack Dorsey puts out an open call for suggestions, using the hashtag #Twitter2017. It seems people are hankering to edit their tweets.

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## UI Design Principles

- They guide towards optimal equilibrium of requirements
- Do not provide analytical solution
- Should allow to avoid errors in early phases
  - System, User Requirements, Prototyping
- And not to rediscover each time dos and donts
  - "color blindness"
- They may be **Ambiguous and Contradictory**
- Goal to **UNDERSTAND** the motivations of such principles so to **GUIDED** in executive decisions.

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## Guidelines - A

(Shneiderman 1987)



- **Strive for Consistency**
- Cater to Universal Usability
- **Offer Informative Feedback**
- Design Task Flows to yield closure
- Prevent Errors
- Permit Easy Reversal of Actions
- Make Users feel They are in Control
- **Minimize Short-Term Memory Load**

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## Guidelines - B

(Nielsen and Molich 1990)



- Consistency and Standards
- Visibility of System Status
- **Match between System and Real World**
- User Control and Freedom
- Error Prevention
- **Flexibility and Efficiency of Use**
- **Aesthetics and Minimalist Design**
- Help Users Recognize, Diagnose and Recover from Errors
- Provide Online Documentation and Help

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## Psychological and Cognitive Motivations

- Intro
- Principles ( Design Rules )
- Foundations
  - Perception
  - Vision
  - Attention
  - Memory
  - Task Execution

Reference for the lectures : “**Designing with the mind in mind**”, Jeff Johnson

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## What they do come from?

- They are motivated by human cognitive and perception processes
- Science on how people
  - Perceive
  - Learn
  - Remember
  - Reason
  - Ground Intentions into Actions

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## What they do come from?

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  - Reason
  - Ground Intentions into Actions

## Perception

- Perception is the process of interpreting signals being collected by our sense organs into our nervous system.

Hearing (Hair Cells),

Sight (Retina)

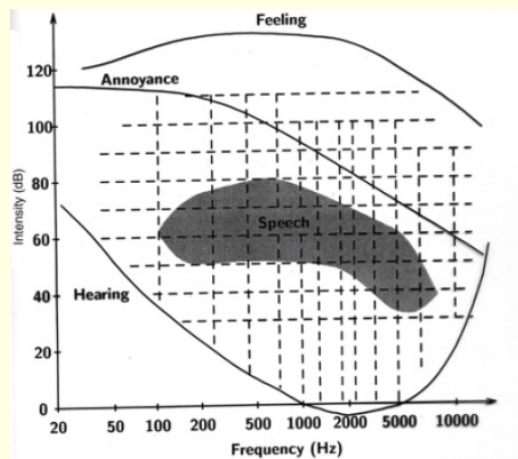
Smell (Olfactory Receptors)

Taste (Taste buds)

Touch (Neural Receptors)



## Speech Perception Limits



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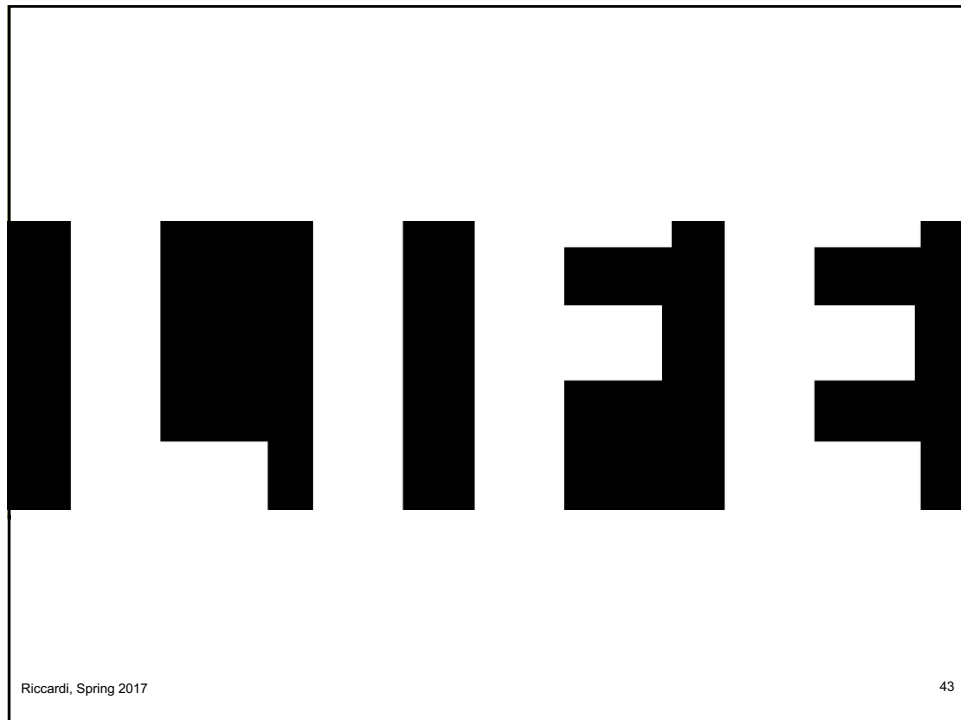
41

## Perception is biased by

- **Past** : Experience or prior information

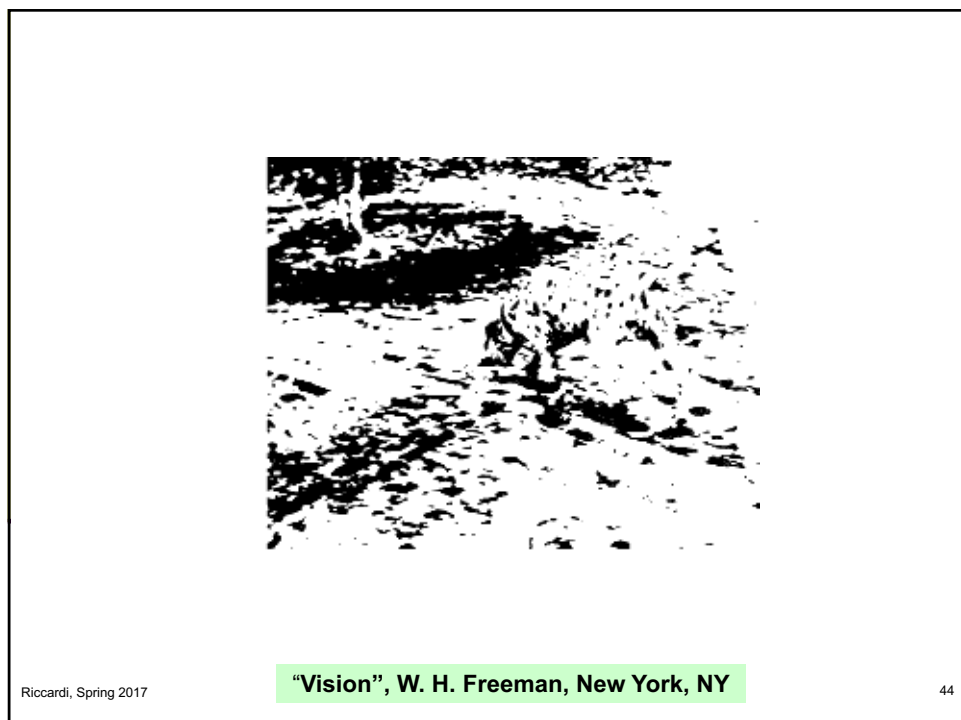
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"Vision", W. H. Freeman, New York, NY

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## ATM Transaction

---

Select Account


Checking 1

Checking 2

...

**BACK** **NEXT**

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## ATM Transaction (cont.d)

---

What would you like to do?


Withdrawal

Transfer

...

**BACK** **NEXT**

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ATM Transaction (cont.d)


Please Confirm Amount

200 \$?

No OK

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This slide shows a confirmation screen for an ATM transaction. The title is "ATM Transaction (cont.d)". The main text asks the user to "Please Confirm Amount" and displays "200 \$?". At the bottom, there are two orange buttons with blue text: "No" on the left and "OK" on the right. A small circular logo is in the top right corner. The footer contains "Riccardi, Spring 2017" and the slide number "47".



ATM Transaction

Printed receipt ?

OK DONE

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This slide shows a screen for the final step of an ATM transaction. The title is "ATM Transaction". The main text asks "Printed receipt ?". At the bottom, there are two orange buttons with blue text: "OK" on the left and "DONE" on the right. A small circular logo is in the top right corner. The footer contains "Riccardi, Spring 2017" and the slide number "48".

## Perception is biased by

- **Past** : Experience or prior information
- **Present** : Current Context
  - Also from concurrent signals from different sensorial information ( sight & hearing)
  - Influence/Reinforce each other (e.g. lip reading)

## Language is Ambiguous

Quanti significati ha la parola banco ?:

- Giorgio e Luca erano compagni di banco
  - Senso → **Mobile**
- Il direttore del banco di Napoli
  - Senso → **Istituzione di credito**
- Il nuovo test sara' il banco di prova
  - Senso → **Test**
- .....**Banco** ottico
- .....

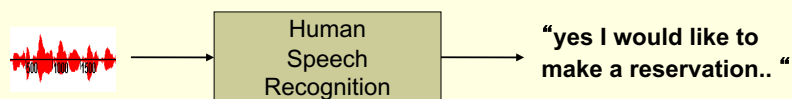
## Perception is biased by




- **Past** : Experience or prior information
- **Present** : Current Context
- **Future** : Our Goals
  - Our goals may filter our perception
    - “Look for your red car in the stadium parking lot” → all red cars will pop up!
  - Example of goal oriented information over web
  - Ignoring information ≠ Do not notice information

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## “Cocktail Party Problem”



- Human Perception Experiment
- Multiple audio sources
- Humans can “adaptively” **separate** a specific sound source
- Cocktail Party Problem
  - Audio sample 1 source 
  - Audio sample 2 source 
  - Audio sample 3 source 

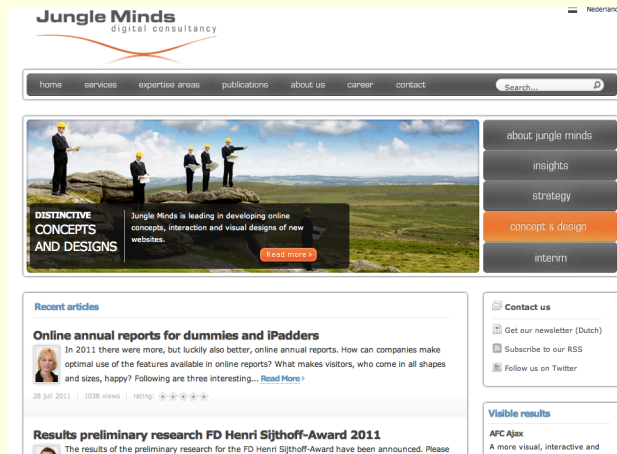
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# Influencing where we look

## Observing, Measuring and Evaluating

EyeTracker



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# Influencing where we look

## Observing, Measuring and Evaluating

EyeTracker



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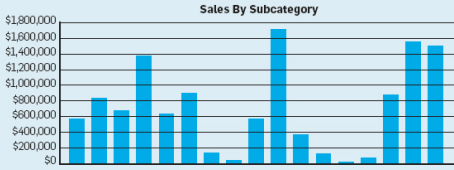
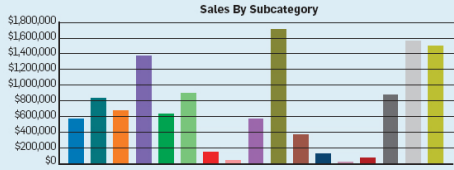
54

# Influencing where we look

Overuse of Colors

EyeTracker

Observing, Measuring and Evaluating

(a) (b)

P. Bera, "How Colors in Business Dashboards Affect Users' Decision Making", Proc. Communications of ACM, Vol. 59 No. 4, Pages 50-57, April 2016.


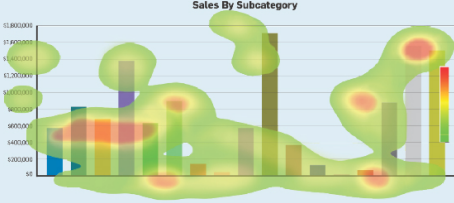
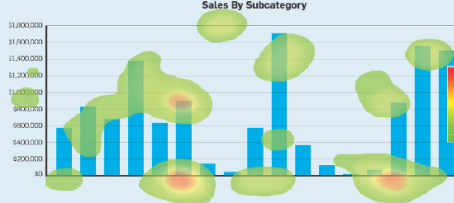
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# Influencing where we look

Overuse of Colors

EyeTracker

Observing, Measuring and Evaluating

(a) (b)

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# Perception

- Perception is biased by prior conditions, experience, expectations.
  - The bias maybe random ( not controlled ) or managed.
- Not only Bottom-up Processing!
  - Selective Attention Test

# Take Away Guidelines

## Perception

- **Avoid Ambiguity**
  - Requires effort
- **Be Consistent**
  - Exploit or Take into account users' past experience (e.g. Apple watch ) and expectations
- **Understand users' goals**
  - Either be explicit
  - Or Implicitly track them

# The Gestalt Theory

## Visual Perception



- *Gestalt* = Shape or Figure
- Psychologists proposed in 20<sup>th</sup> century to explain how visual perception works
- Supported now by neurophysiological experiments
- Descriptive framework
- Support for graphic and user interface design

# The Gestalt Theory

## Visual Perception



It identifies rules/principles  
human visual perception  
groups tokens together

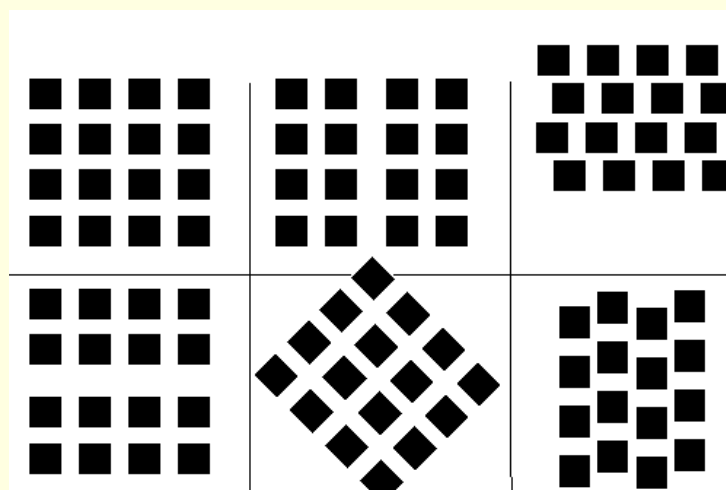
## Rules

- Proximity
- Similarity
- Continuity
- Closure
- Symmetry
- Figure/Ground

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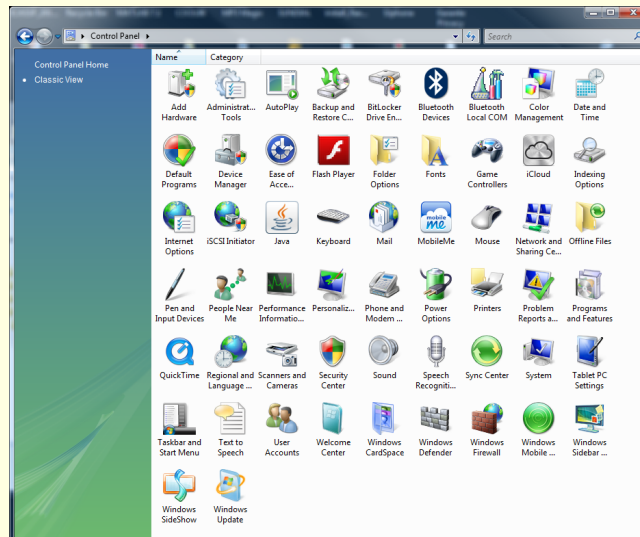
## Proximity (1)



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## Proximity (2)



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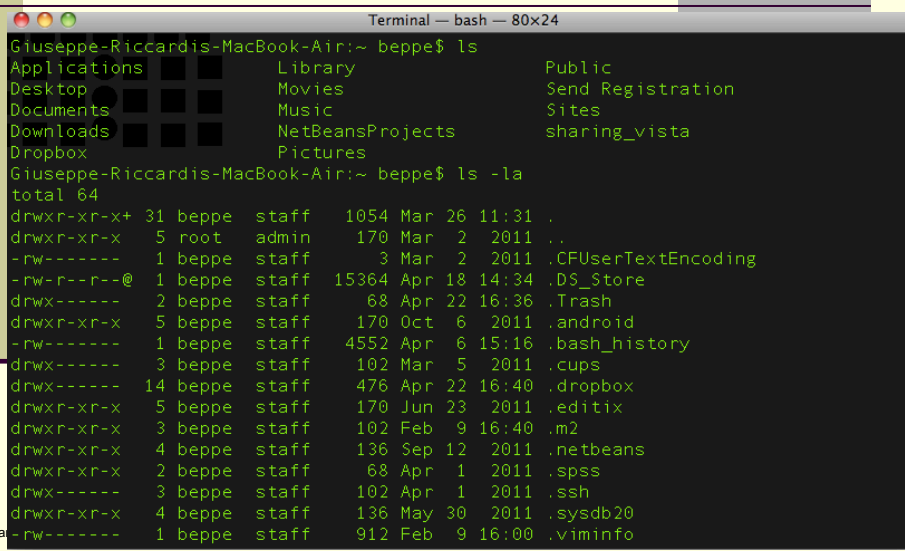
## Proximity (3)



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## Proximity (4)



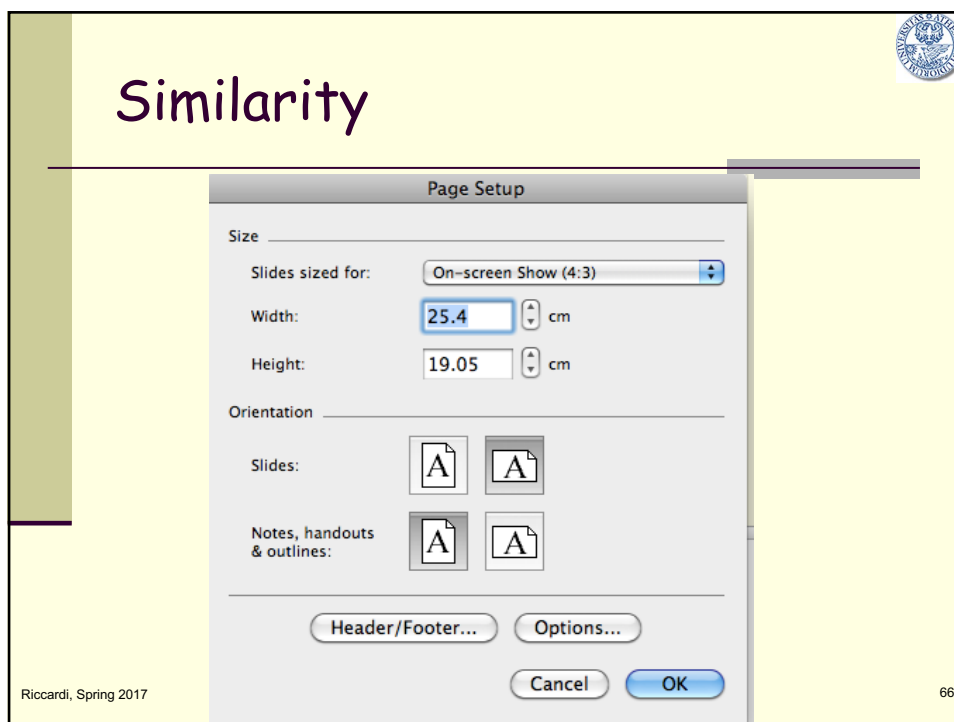
```

Giuseppe-Riccardis-MacBook-Air:~ beppe$ ls
Applications      Library           Public
Desktop           Movies            Send Registration
Documents         Music            Sites
Downloads        NetBeansProjects sharing_vista
Dropbox           Pictures


Giuseppe-Riccardis-MacBook-Air:~ beppe$ ls -la
total 64
drwxr-xr-x+ 31 beppe  staff   1054 Mar 26 11:31 .
drwxr-xr-x   5 root   admin   170 Mar  2  2011 ..
-rw-----  1 beppe  staff    3 Mar  2  2011 .CFUserTextEncoding
-rw-r--r--@  1 beppe  staff  15364 Apr 18 14:34 .DS_Store
drwx-----  2 beppe  staff    68 Apr 22 16:36 .Trash
drwxr-xr-x   5 beppe  staff   170 Oct  6  2011 .android
-rw-----  1 beppe  staff  4552 Apr  6 15:16 .bash_history
drwx-----  3 beppe  staff   102 Mar  5  2011 .cups
drwx----- 14 beppe  staff   476 Apr 22 16:40 .dropbox
drwxr-xr-x   5 beppe  staff   170 Jun 23  2011 .editix
drwxr-xr-x   3 beppe  staff   102 Feb  9 16:40 .m2
drwxr-xr-x   4 beppe  staff   136 Sep 12  2011 .netbeans
drwxr-xr-x   2 beppe  staff    68 Apr  1  2011 .spss
drwx-----  3 beppe  staff   102 Apr  1  2011 .ssh
drwxr-xr-x   4 beppe  staff   136 May 30  2011 .sysdb20
-rw-----  1 beppe  staff    912 Feb  9 16:00 .viminfo

```

## Similarity



## Continuity (1)




The graphic consists of a grid of blue and white horizontal bars. The bars are arranged in a way that creates a sense of depth and continuity, with some bars appearing to overlap or recede into the background. The overall effect is a complex, layered pattern that changes as the viewer's perspective shifts.

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## Continuity (2)

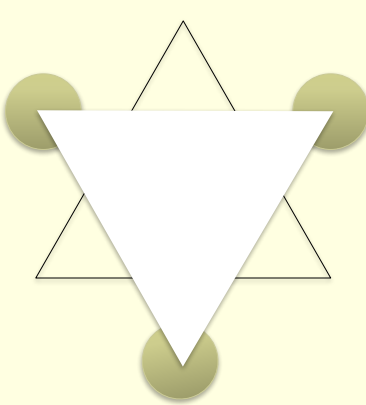


The image shows a vertical slider control, likely from a mobile device. It features a blue knob in the center of a vertical track. The track is white with a blue border. Above the track is a blue button with a white speaker icon. The entire control is set against a dark, textured background.

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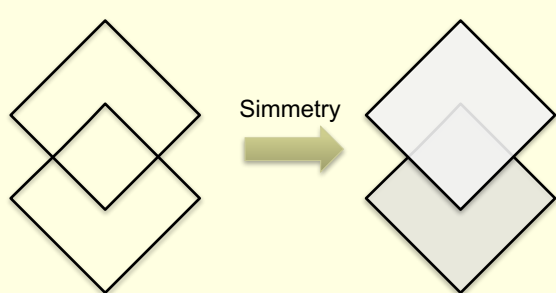
# Closure (1)



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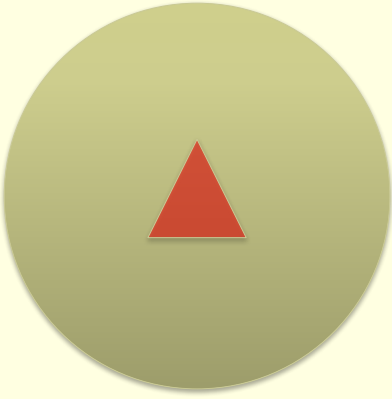
# Simmetry



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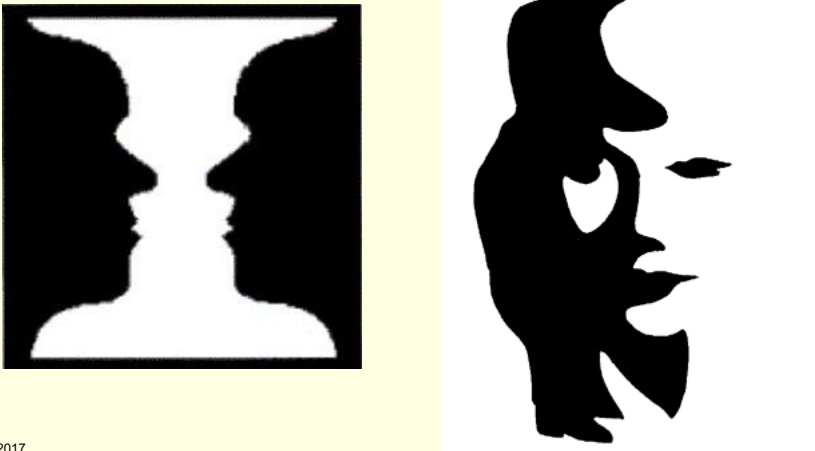
## Figure/Ground (1)



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## Figure/Ground (2)



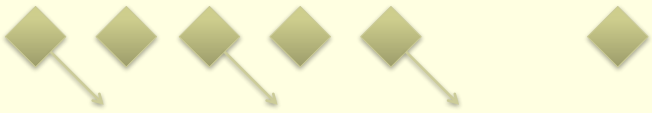
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# Common Fate


## Moving Objects



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# Closure-Symmetry-Continuity



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Cover of "Coherence in Thought and Action" book by Paul Thagard

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Signals & Interactive Systems

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## Guidelines - B

(Nielsen and Molich 1990)

- Consistency and Standards
- Visibility of System Status
- Match between System and Real World
- User Control and Freedom
- Error Prevention
- Flexibility and Efficiency of Use
- Aesthetics and Minimalist Design
- Help Users Recognize, Diagnose and Recover from Errors
- Provide Online Documentation and Help

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## Products, Services, Systems



- They serve a purpose, a task  
SOMEBODY may be interested!

## What they do come from?



- They are motivated by human cognitive and perception processes
- Science on how people
  - Perceive
  - Learn
  - Remember
  - Reason
  - Ground Intentions into Actions

## User Tasks

- A task is what a user
  - Does regularly during the day
    - "Drives to work", "Use cash for payments"
  - Does sometimes
    - "Go out for dinner"
  - Does rarely
    - "Buy a gift for his in-laws"
  - May be doing in the future
    - "Gone fishing"
  - Never thought of doing it
    - "Optimizing his gas/electric bill with AI"

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## Learning a Task

- Learning from scratch
  - Learning and recalling from experience
    - **Personal** Past experience → Learned Actions are easy to perform
- "Stay away from walking over the edge of a cliff"
- "Do not execute .exe files received from unknown recipients"
- "Facebook is good for making friends" (User 1)
- "Facebook is a waste of time" (User 2)

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# Learning from Experience

## Issues

- Learning from experience is in general difficult and requires resources ( attention, skills, background )!
- Too much or too little data to learn from or too many conclusions to draw
- Learning from **errors** may be painful but effective
- Credibility of the experience to learn from
  - Whose experience was that (brother vs friend..)
- (Over ) Generalization is used both by humans and machines and can undeniably lead to errors.

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# Learned actions easy to perform

- Many tasks may be performed routinely
  - "Riding a bike", "Driving a car", "Walking on the sidewalk", "Reading a Newspaper"...
  - For most part of the experience we do not consume any conscious resources ( attention or memory) (Schneider & Shiffrin 1977)
    - We automate how and when to change gears
    - We have learned from past experience
    - We pay attention to obstacle avoidance

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## Examples of Learned vs New Tasks



- "Recite letters of the alphabet A through P"
- "Recite letters of the alphabet from P to A"
- "Drive to work using your normal route"
- "Drive to work an unfamiliar one"
- "Spell out your telephone number"
- "Spell out your telephone number by grouping numbers by four"
- Write and post a letter at the post office
- Write and send an email (users age >50)

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## Take Away Guidelines



- Provide System status and Users' progress toward their goal
  - Relieve attention strain and minimize short-memory
- Guide users to goal
  - Consider one-time user or repeat-user experience
  - Expliciting needed information ( do not overload either)
- Let Computer do the "math"/"algorithm"
  - "Go the middle of the document"→ Solve it graphically

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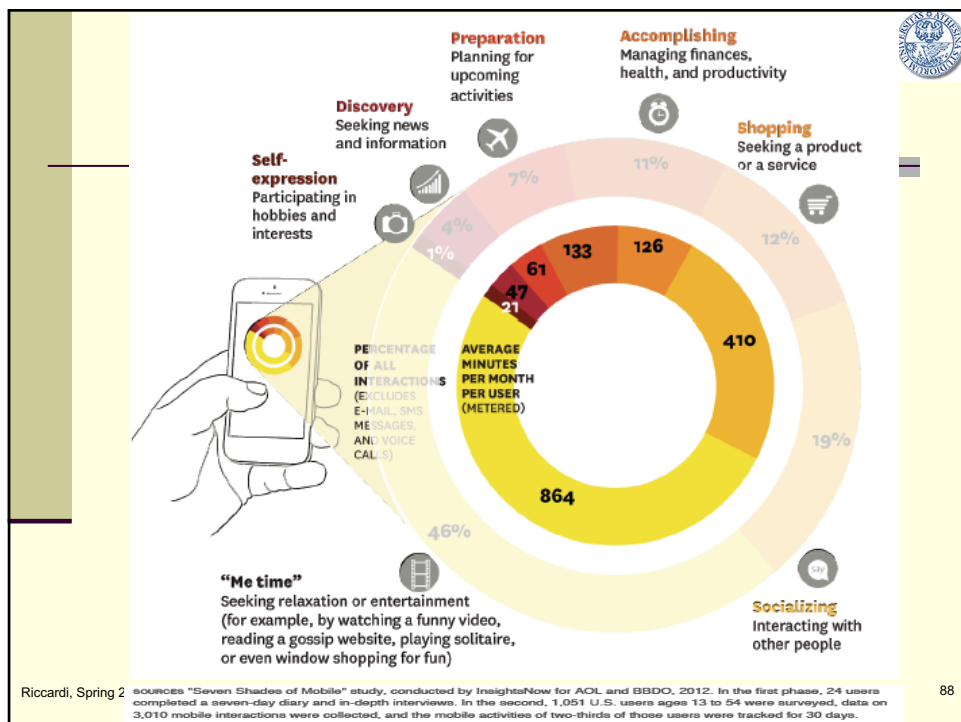
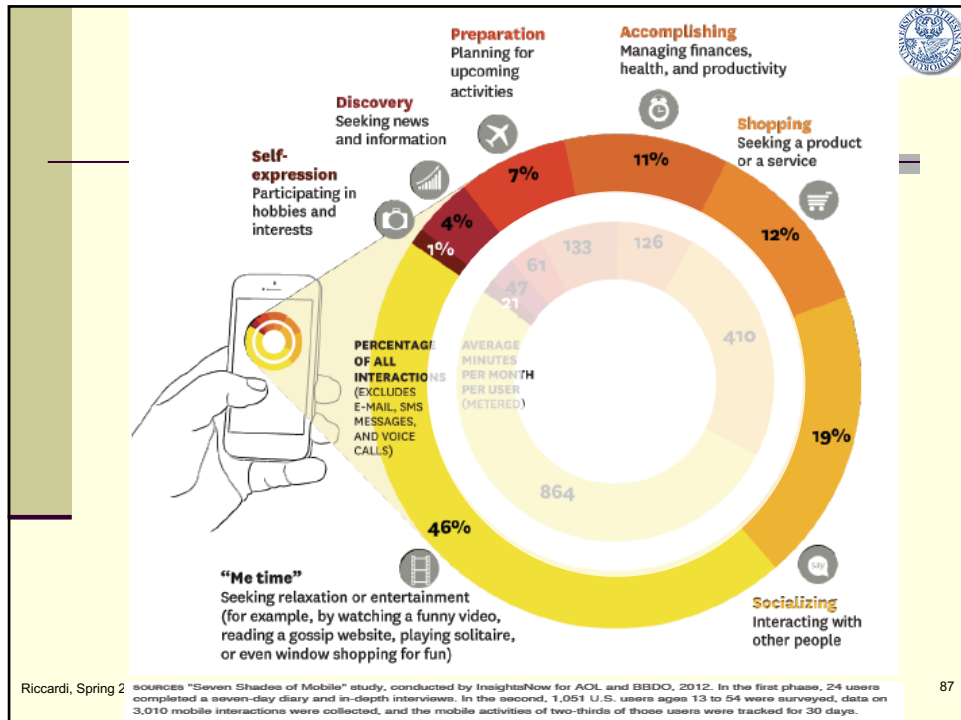
## Putting Together User Interface, User Interaction/Experience




- The production process of an App.
- Conceptualizing
- Designing
- Prototyping
- Refining
- Evaluating
- **Your App.**

## Why People Really use Mobile Phones ?










## 12 Myths of Mobile App Design

Over the years (2005 A. Marcus and adapted)

- Users want power and aesthetics. Features are everything
- What we really need is a Swiss army knife
- 3G is the future!
- Focus groups and other traditional market analysis tools are the best way to determine user needs
- If it works in New York, it will work anywhere
- The killer app will be games, --er, no, I mean, nightlife, or gps.... uh...
- Mobile devices will essentially be phones, organizers, or combinations with maybe music/video added on
- The industry is converging on a UI standard
- Highly usable systems are just around the corner
- One dominating operating system will dominate
- Mobile devices will be free-or nearly free
- Advanced data-oriented services are just around the corner

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## The App Concept

The story begins

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- At the office during a meeting
- At home, with my kids
- On Vacation with my friends
- 24/7
- A teacher with 1-10 grades students in class
- Recruiter on face-to-face interviews

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## APP concept: Create a Story

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I want to easily create a shopping list easily, quickly and share it with my family.

I want my camera to tell me when is the best timing/lighting for me to shoot a picture


I want to check how much exercise while I go to work, do sports and share it with my doctor

I want to plan my next summer vacation in the countryside and select from friends' advices and social websites

I want to know where is the cheapest gas station wherever I am considering the mileage to reach it.

I want to monitor and improve my mnemonic skills

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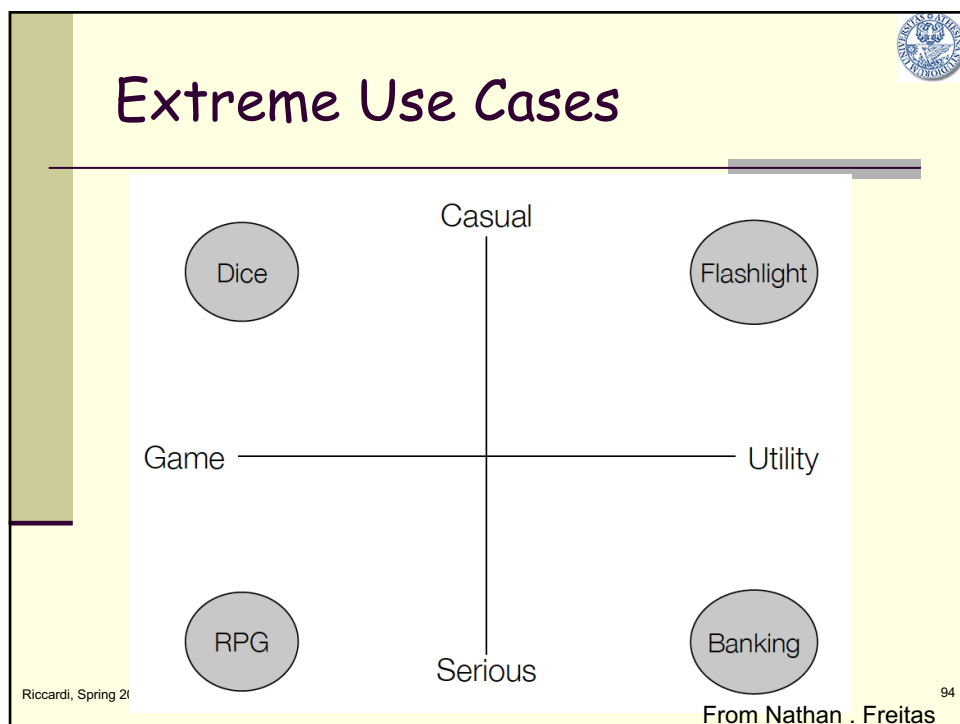
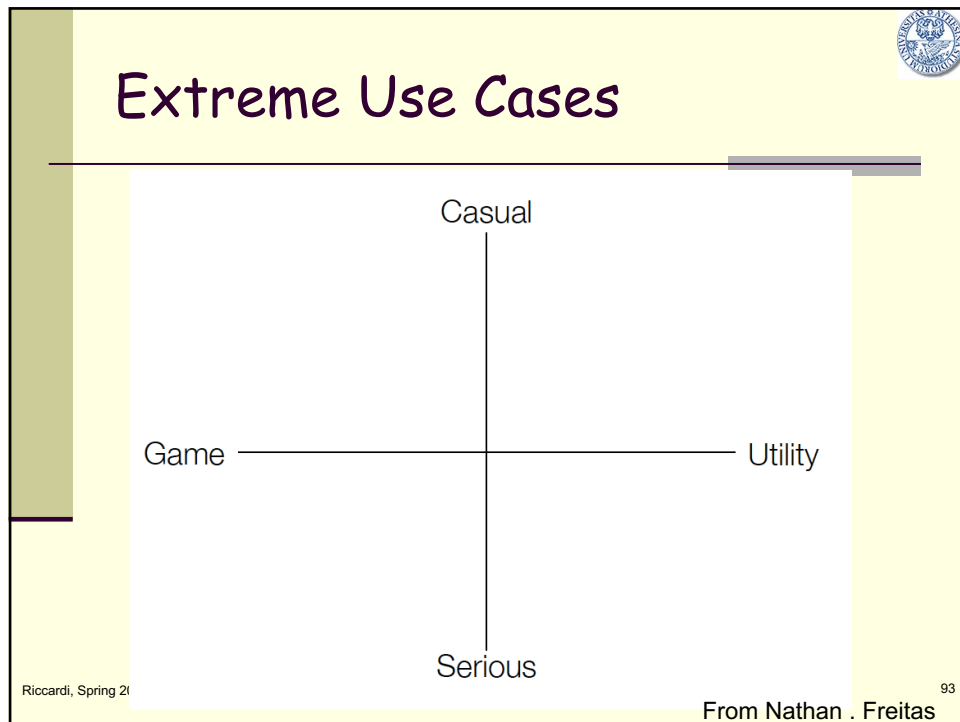


## Extreme Use Cases

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- 60 SECONDS use case
  - Soccer match scores, weather, stock quotes..
- 60 MINUTES use case
  - Video watching, Reading (emails) , Writing (blogs) , making dinner plans..

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## App Design Process

1. Create an Application **Concept-Story**
2. Identify **Your** User-Group
3. List All the **Features** App may support
4. Filter the Feature List Through the User-Group Definition
5. Review
6. Prototype
7. Iterate
8. EVALUATE ( may happen at the end of step 6)

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## Example

- "Help People Shop for Groceries"
- Features: **Creating**List, **Getting**Related**Recipes**, **Getting**Coupons,...
- Who needs it?: **Penny**Pinching, **Gourmet**, **Busy**Mom, **Single** people
- Filter the Feature List by choosing target audience: **Thrifty** People
- Prototype, Iterate
- EVALUATE! : **Y**ourself, **F**riends, **G**roup of **P**otential **U**sers

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