

Master in Computer Science and Engineering
Sapienza Università di Roma

Human-Computer Interaction

A.A. 2019/2020

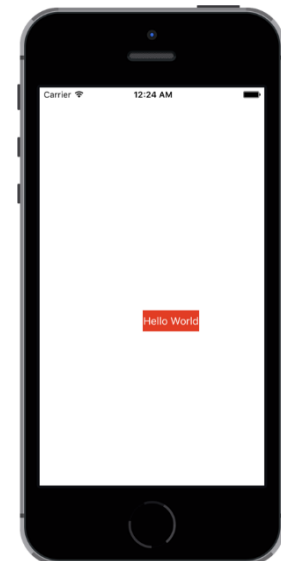
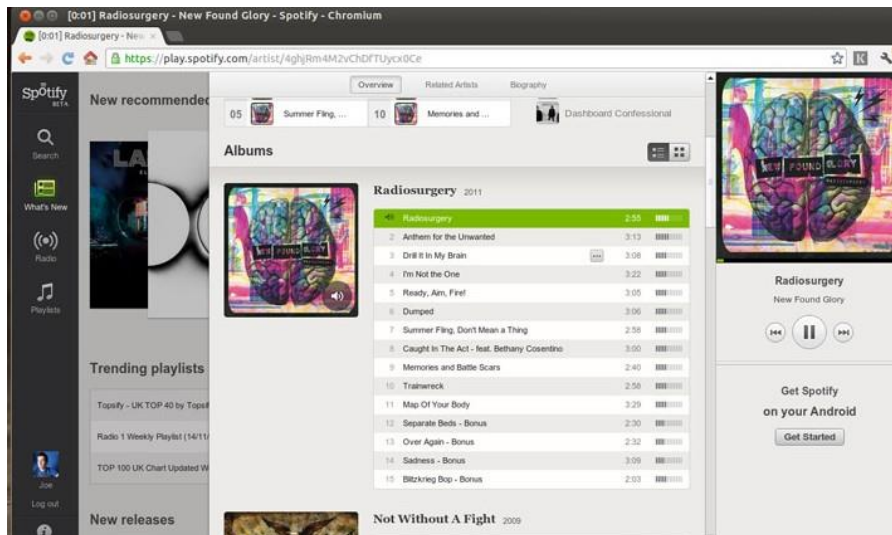
Designing Mobile Interfaces

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Going Mobile

- ▶ **Great and successful user interfaces for mobile devices are created, never ported** [Brian Fling, Mobile Design and Development]
- ▶ When design a user interface for a mobile platform, a designer faces **challenges** that s/he does not encounter during the design of a traditional user interface for desktop applications.



Challenges of mobile design

▶ Tiny screen sizes

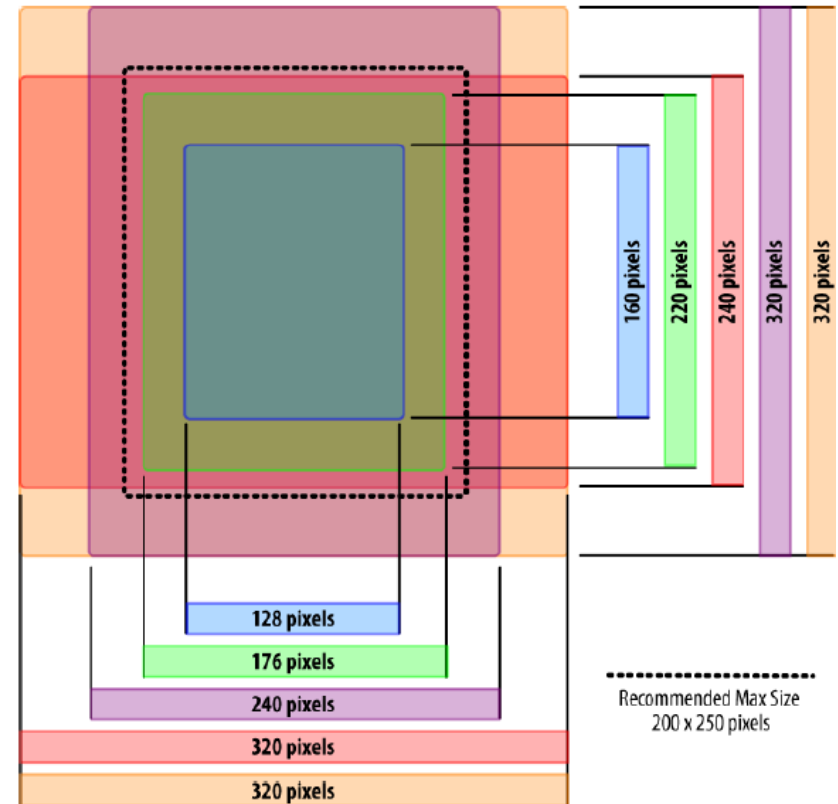
- ▶ Mobile devices **don't offer much space** to present information or choices.
- ▶ There are no sidebars, images that don't do anything, or long lists of links. **Need to strip the design down to its essence!**

▶ Variable screen widths

- ▶ It's **hard** to make a design that **works well on several different screens**.
- ▶ Scrolling down a mobile page is not terribly onerous, but **a design needs to use the screen width intelligently**.

▶ Dynamic physical environments

- ▶ Mobile devices are **used in all kinds of places**: outside in the bright sun, in dark theaters, in conference rooms, cars, etc.
- ▶ A good design takes care of the **ambient light differences**.



Challenges of mobile design

▶ Touch screens

- ▶ The majority of mobile applications comes from devices providing **touch screens**. It's hard to touch small targets accurately with fingers.
- ▶ A good design makes **links and buttons large enough to hit easily**.

▶ Difficulty of typing text

- ▶ It is uncomfortable to type long text on a touch and small screen.
- ▶ A good design makes **typing unnecessary or very limited**.

▶ Limited user attention

- ▶ Most of the time, mobile users **do not spend lots of time/attention** on a mobile app.
- ▶ Users look at interface design **while doing other things** - walking, riding in a vehicle, talking with other people, sitting in a meeting.
- ▶ Occasionally a mobile user will focus her full attention on the device, such as when playing a game, but he won't do it as often as someone sitting at a keyboard will.
- ▶ A good design takes care of **distracted users**.

3 Recipes to design usable mobile interfaces

1. Leverage on design guidelines and mobile patterns

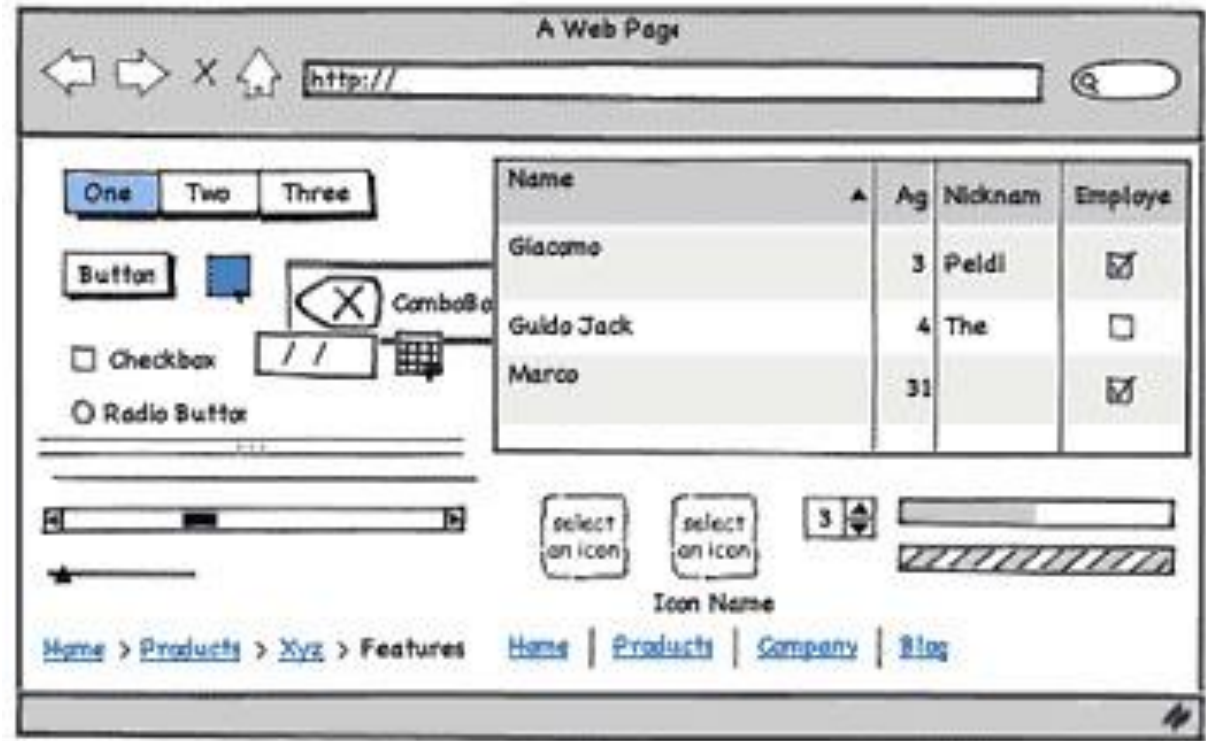
2. Invest on the first time user experience

- ▶ The **user's first impression** of a mobile user interface is fundamental.
- ▶ Even if you have the best design, the best code, and the best back-end service, if the user can not figure out how to use it, she will fail - and so will your interface.

3. Use Prototyping

- ▶ Use of advanced tools for **designing mockups** of mobile user interfaces and **interactions of mobile experiences**.

Balsamiq Wireframes



Balsamiq Wireframes



- ▶ Download Balsamiq Wireframes from the following link:
 - <https://balsamiq.com/download/>
 - Install the “trial” version of the software.
 - Insert the following credentials for an extended trial until 31/12/2020 (menu ‘Help’ -> ‘Register’)
 - License key:
 - ❖ Human-ComputerInteraction2020|Qc0reJxzCncxiQ+p8SjNTczTdc7PLSgtSS1S8MwDkonJJZn5eQpGBkY GNYZmBmYWpkYWBIAAANoPEEo=
 - Register the software (button ‘Register’)

Please keep in mind that this extended trial license can be used just by the students, of the HCI course, and must not be posted publicly.

Design Guidelines

- ▶ One of the central problems of a User-Centered Design (UCD) process is ***how to provide designers*** with the ***ability*** to ***determine the usability consequences*** of their design decisions.
- ▶ The majority of design rules for interactive systems are suggestive and **general guidelines**.
- ▶ Several books and technical reports contain huge catalogs of guidelines.
 - ▶ **Abstract guidelines** applicable during early life-cycle activities
 - ▶ **Detailed guidelines** (style guides) applicable during later life-cycle activities
- ▶ Different collections (Shneiderman's 8 golden rules, Norman's 7 principles)
- ▶ Understanding justification for guidelines helps in resolving **conflicts**.

Shneiderman's 8 Golden Rules

- They provide a **convenient summary** of the key principles of interface design
- They need to be **interpreted** for each new situation
- Intended to be used during **design** can also be applied to the **evaluation**



Shneiderman's 8 Golden Rules

1. Strive for **consistency**
(action sequences, terminology, command use...)
2. Enable frequent users to use **shortcuts**
(to perform familiar actions more quickly)
3. Offer informative **feedback**
(for every user action, at an appropriate level)
4. Design dialogs to yield **closure**
(let the user know when they have completed a task)



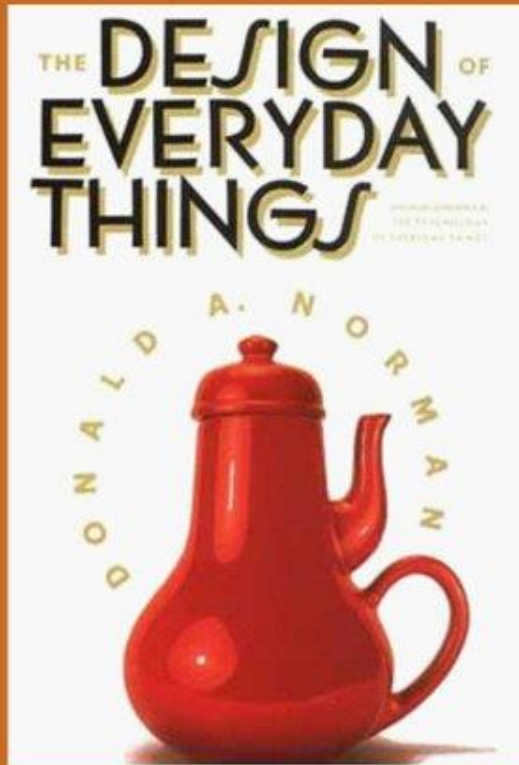
Shneiderman's 8 Golden Rules

- 5. Offer **error prevention** and **simple error handling**
(clear instruction to recovery)
- 6. Permit easy **reversal** of actions
(to relieve anxiety and encourage exploration)
- 7. Support **internal locus of control**
(the user is in control of the system)
- 8. Reduce **short-term memory load**
(keeping display simple,
providing time for learning
action sequences..)



Design golden rules

Norman's 7 principles



Transforming Difficult Tasks into Simple Ones

In his classic book "The Design of Everyday Things" (La caffettiera del masochista) Donald Norman summarize user-centered design in seven principles

Design golden rules

Norman's 7 principles

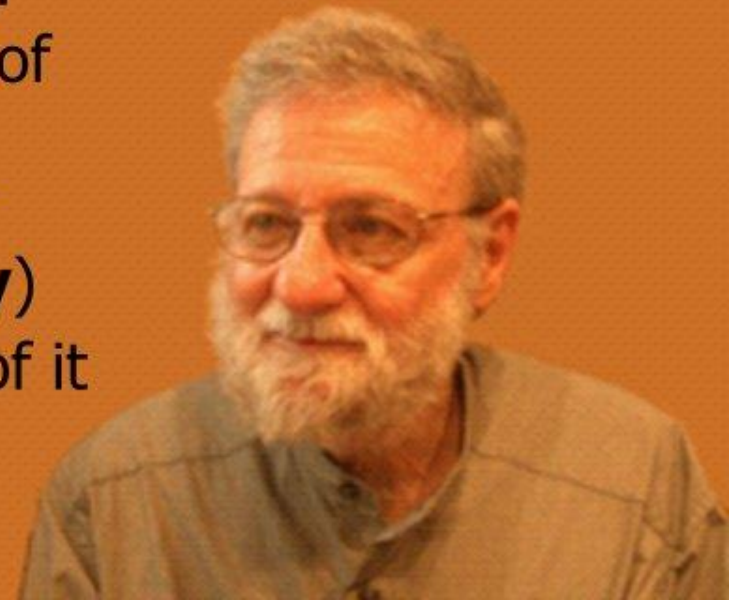
1. Use both **knowledge in the world** and knowledge **in the head**.

Provide the necessary knowledge within the environment.
Support the user in building a proper **mental model**

2. **Simplify** the **structure** of tasks

Avoid **excessive memory load**:

- **mental aids** (to keep track of stages in complicated tasks)
- more information and better feedback (using **technology**)
- **automate** the task or part of it
- **change** (simplify) **the nature** of the task



Example: change the nature of the task
(using velcro)



Design golden rules

Norman's 7 principles

3. Make things **visible**..

..so that people know **what is possible** and **how to do** them. People should know **what is currently going** on and what to do next

4. Get the **mapping** right

Make sure that the user can
determine the relationships

intentions ▶ possible actions

actions ▶ their effects on the system



Weak mapping



Good mapping: larger ► more valuable



Design golden rules

Norman's 7 principles

5. Exploit the **power of constraints**, both natural and artificial

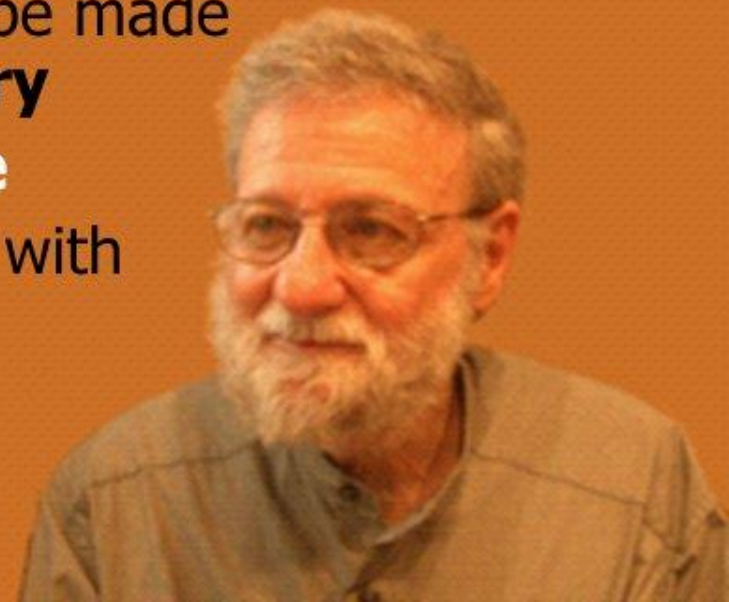
Constraints force the user to perform **only** the **right action** in the **right way** (e.g. puzzle)

6. Design for **error**

Assume that any error that can be made will be made Design for **recovery**

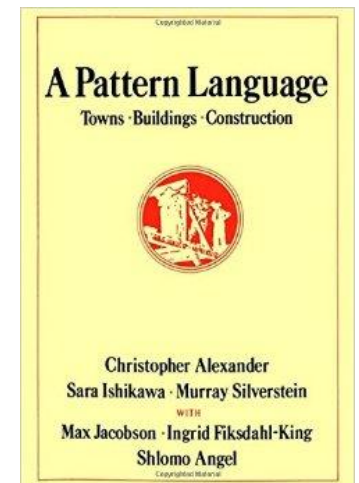
7. When all else fails, **standardize**

Standardization is a way to deal with things that cannot be designed without **arbitrary mappings** (e.g. car driving controls)



Design Patterns

- ▶ One way to approach UI design is to **learn from examples** that have proven to be **successful** in the past.
- ▶ **Design Patterns** are **solutions** to a **recurrent problem** within a **specific application domain**.
 - ▶ They allow to **capture** and **reuse** the **knowledge** of what made a system – or paradigm – successful and apply it again in new situations.
- ▶ Christopher Alexander, an Austrian-born architect, initiated the pattern concept in 1977 by describing 253 design patterns to common problems in architecture in his seminal book: *A Pattern Language: Towns, Buildings, Construction*.



A Design Pattern (in architecture)

Pattern 159: Light on two sides of every room

- ▶ **Problem:** People, when they have a choice, will always gravitate to those rooms which have light on two sides, and leave the rooms which are lit only from one side unused and empty.
- ▶ **Pattern:** *Locate each room so that it has outdoor space outside it on at least two sides, and then place windows in these outdoor walls so that natural light falls into every room from more than one direction.*



Solution is only **partially specified**.
No further details are provided!
*Where the windows should be located?
At what angle they should be
to each other?*

The pattern implementation depends on
the context and designer's creativity.

Design Rules

HCI design patterns

Characteristics of patterns

- capture design **practice** not theory
- capture the **essential** common properties of good examples of design
- represent design knowledge at varying levels: social, organisational, conceptual, detailed
- can express what is humane in interface design
- are **intuitive** and **readable** and can therefore be used for **communication** between all stakeholders

Ingredients for usable mobile design

- ▶ Information Architecture

- ▶ The **organization** and **structure** of data within an informational space. In other words, how the users will get to information or perform tasks within an application.

- ▶ Interface Design

- ▶ The **design of the visual paradigms** from which the user will assess meaning and direction given the information presented to her/him.

- ▶ Interaction Design

- ▶ The **design of how the user can participate with the information present**, either in a direct or indirect way, meaning how the user will interact with the application to create a more meaningful experience and accomplish her/his goals.

- ▶ Information Design

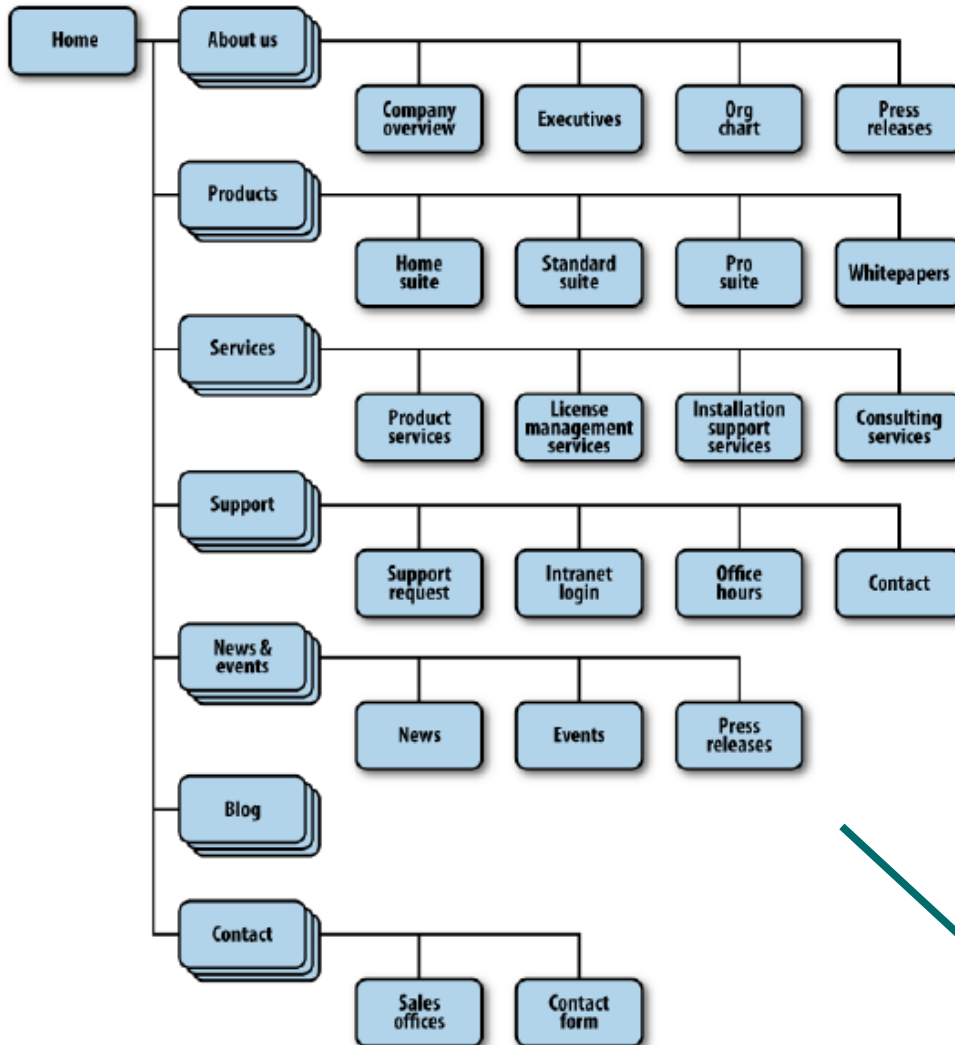
- ▶ The **visual layout** of information presented to the users.

- ▶ Mobile Design Patterns

Information Architecture

- ▶ Information architecture represents the **core** of the user experience.
- ▶ From a simple mobile website to an iPhone/Android application, the information architecture defines **how the information will be structured**.
 - ▶ A well-engineered product with good visual design **can still fail** because of **poor information architecture**.
 - ▶ The truly successful mobile products always have a **well thought** and **defined information architecture**.
- ▶ The first deliverable to define information architecture is the **site map**.
 - ▶ **Site maps** visually represent the **relationship of content to other content** and provide a map for how the user will **travel through the informational space**.

A bad site map for mobile

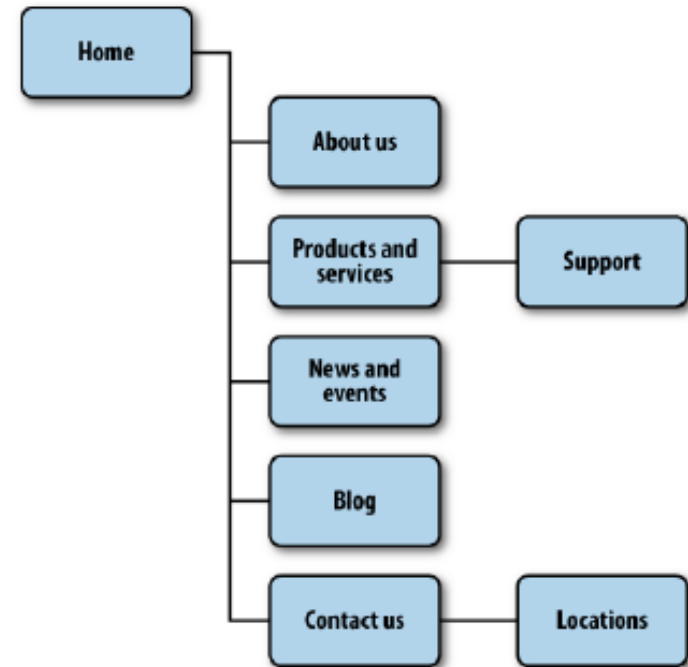


- ▶ **What risk is there to the users for making a wrong choice?**
- ▶ Imagine a road with a fork in it. We can go either left or right.
- ▶ The risk that we will make the **wrong choice** is only **50%**, meaning that we have a **better than good** chance that we will get to where we want to go.
- ▶ But imagine three roads. Our chances have dropped to **33%**.
- ▶ Four roads drop your chances to **25%**, and five roads takes you down to **20%**.
- ▶ The risks for making a wrong choice increase....

A bad mobile information architecture that was designed with desktop users in mind rather than mobile users
(14% of success).

Limit Opportunities for Mistakes

- ▶ In the mobile context, **tasks are short** and **users have limited time** to perform them.
- ▶ **Limit users' options:** A mobile information architecture should provide **5 navigation areas or less**.
 - ▶ The risks to make the wrong choice are minor.
- ▶ **Suggestion:** Make the path through the information you present **logical** and **easy to predict**.
 - ▶ put **markers** to let them where they are.
 - ▶ put a **back-button**.
 - ▶ *When mobile users select the wrong path, they should immediately click back to where they started and go down another path, eliminating the wrong choices to find the right ones.*



Interface Design

- ▶ **Interface design** analyzes the **visual layout** of content presented to a mobile user, and **how the user assesses meaning and direction** from it.
- ▶ The greatest challenge to creating a mobile design that works well on multiple screen sizes is **filling the width**.
- ▶ A traditional solution is the use of **vertical designs**.
 - ▶ The interface design is a **cascade of content** from top to bottom, similar to a newspaper.
 - ▶ The contextual information lives at the top.
 - ▶ The content consumes the majority of the screen.
 - ▶ Any exit points live at the bottom.
- ▶ For **content-heavy** sites and applications **this solution works**, since the width of mobile devices is almost the perfect readability, presenting not too many words per line of text.



Interface Design: Challenge

- ▶ The problem is when it is required to present a **large number of tasks** or **actions**.
 - ▶ The easiest and most compatible way is to present a stacked list of links or buttons, basically one action per line.
 - ▶ However, the presence of too many actions together quickly clutters the design...
- ▶ There exist some **design principles** to build effective visual layouts.

Axis

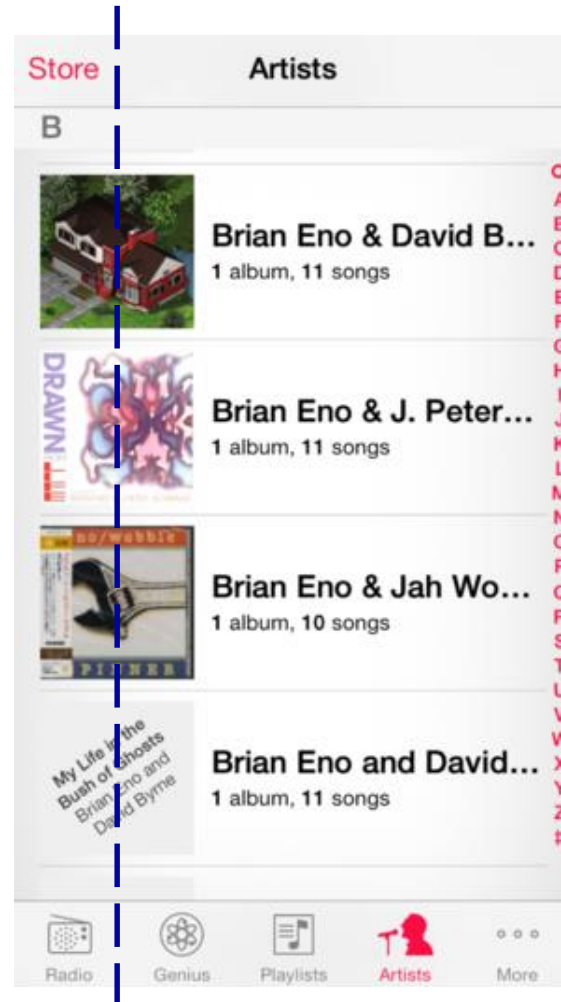
- ▶ Axis is the most basic and common information principle for organizing content.
- ▶ It consists of an **imaginary line** that is used to **align a group of elements** in an interface.
- ▶ When elements are arranged around an axis, **the design feels ordered**.
 - ▶ Users enjoy designs that are ordered because they feel more stable and comfortable.

	The BANGLES 3 albums, 4 songs
	Bon Iver 2 albums, 20 songs
	Bruno Mars 2 albums, 2 songs
	The Cardigans 1 album, 1 song
	Counting Crows 1 album, 14 songs
	The Cranberries 1 album, 2 songs
	The Fray 3 albums, 3 songs

Credits: Melissa Mandelbaum
<http://learndesignprinciples.com>

Example of Axis

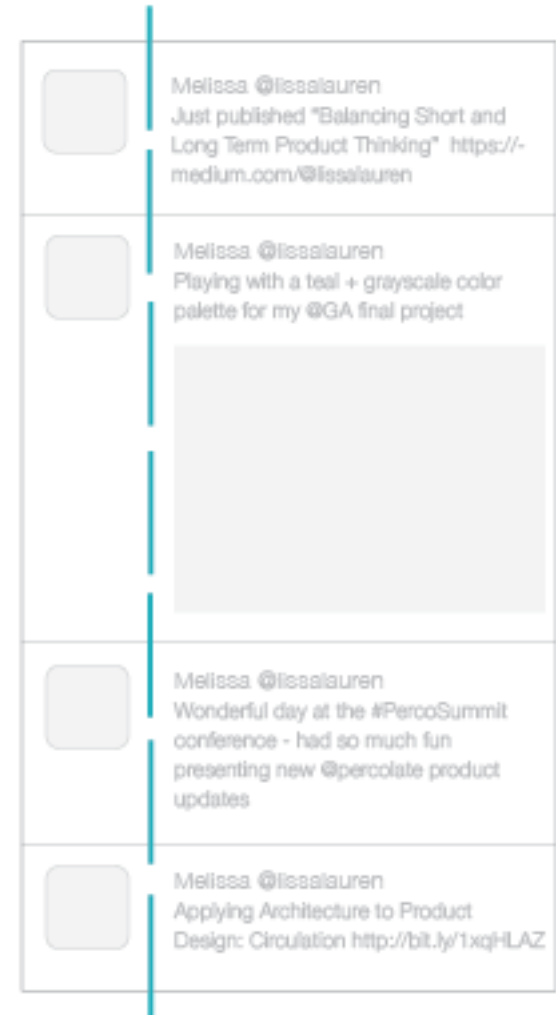
Albums list (iTunes in iOS).
A vertical axis neatly aligns album covers on the left side of the screen.



Axis Reinforcement

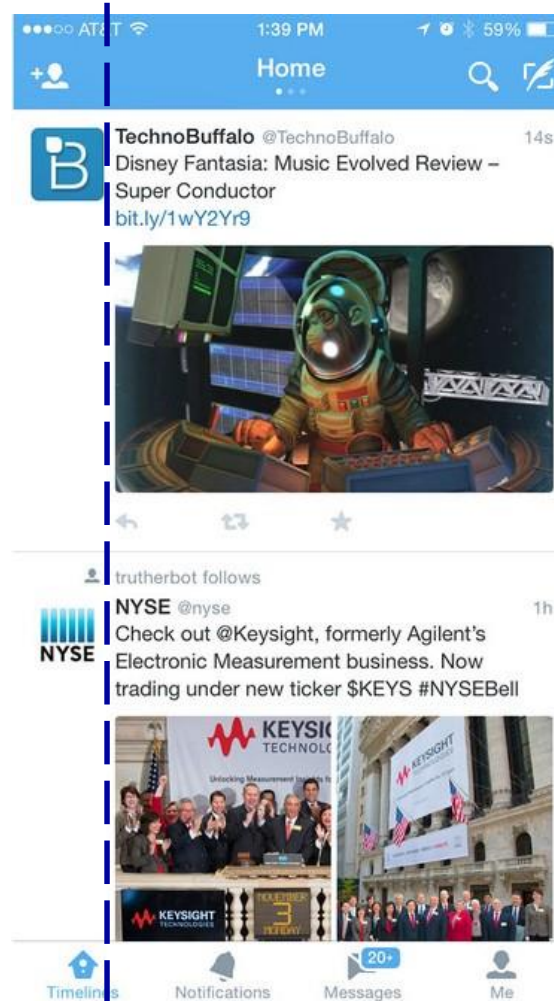
- ▶ Axis can be made more apparent if the **edges of surrounding elements are well defined.**
- ▶ A common example of this concept in architecture is a city street.
 - ▶ The city street is an axis that is reinforced by the buildings on both sides.
 - ▶ If a portion of the street is missing a building on one or both sides, the street's axis would not feel as strong.

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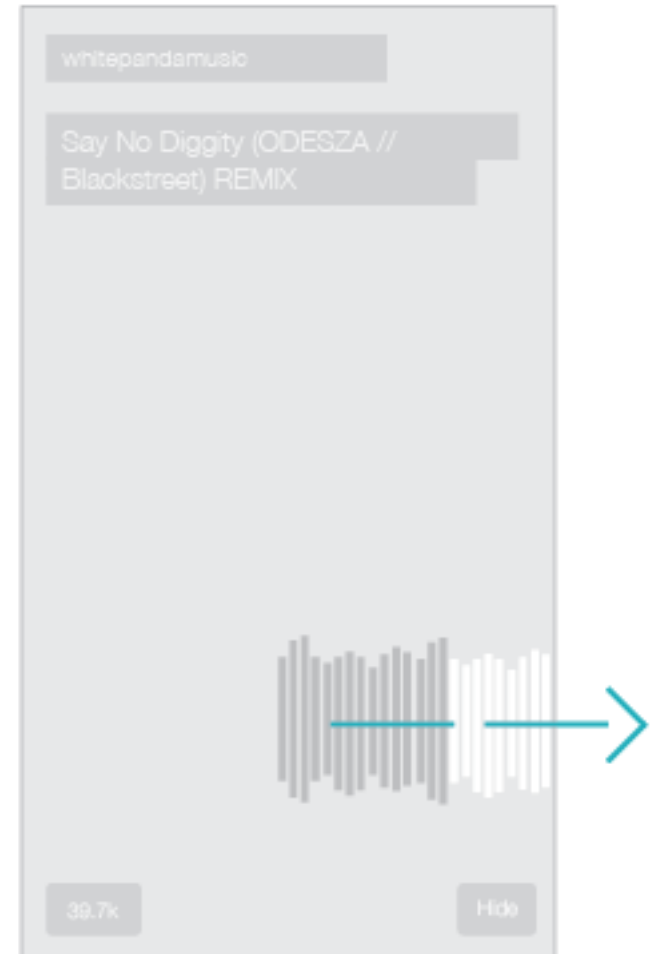
Example of Axis Reinforcement

Timeline in the **Twitter app (iOS)**.
A vertical axis helps to define a section for avatars on the left and a section for tweet content on the right.



Axis Movement

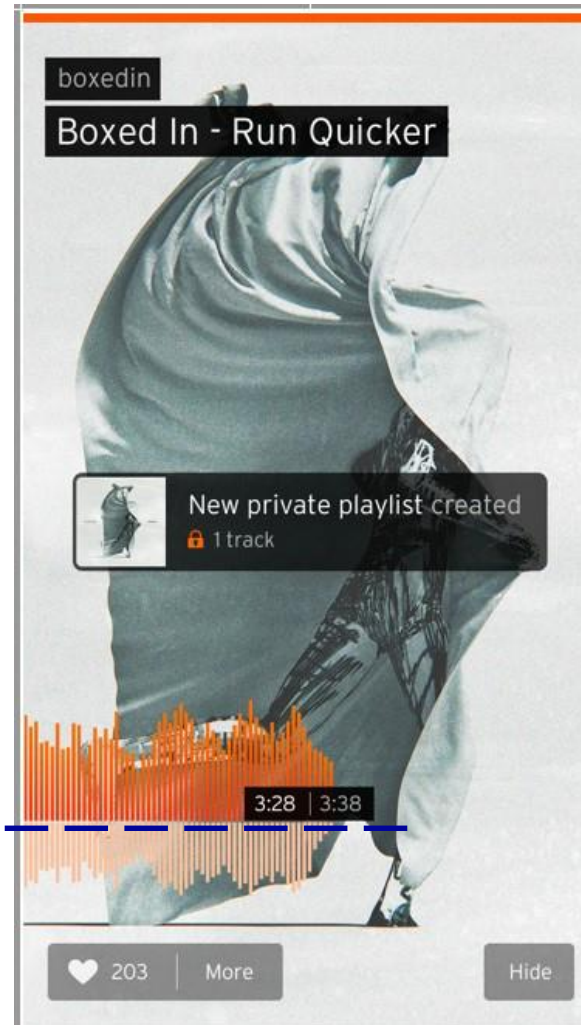
- ▶ When we encounter something linear, such as an axis, we naturally follow the line in a direction.
- ▶ Lines encourage **movement** and **interactions**.
- ▶ The direction of movement depends on the **end points**. A defined end point signals a place to start or stop.



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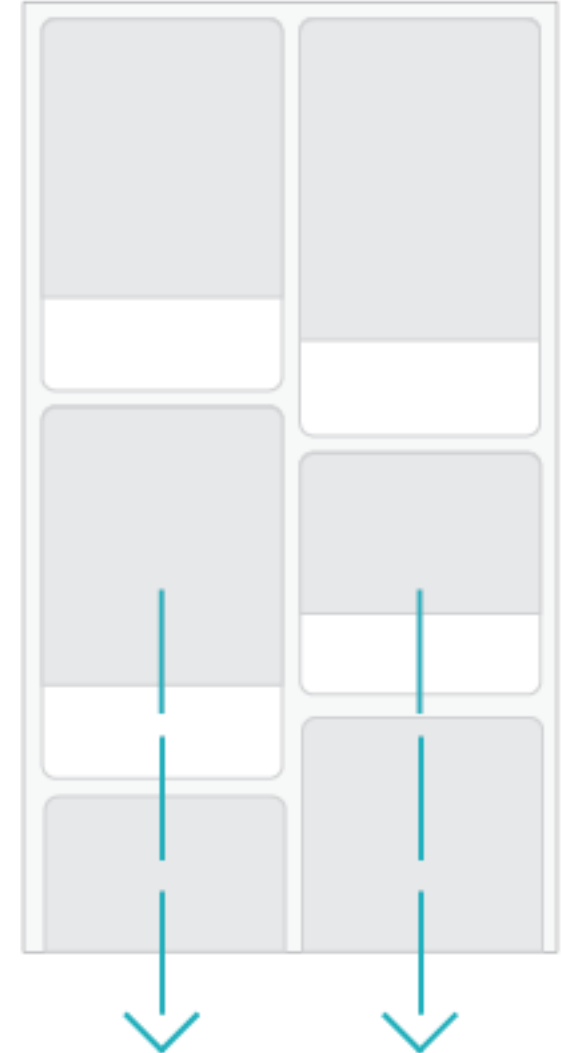
Example of Axis Movement

Music scrubber in the **SoundCloud app (iOS)**.
The scrubber is represented as a left-right axis,
and slide the scrubber to the right
until you reach the end of the song.



Infinite Axis

- ▶ If an **end point is undefined**, you will follow the axis until you reach something of interest or are tired of interacting with the axis.
- ▶ The concept of an undefined end point is realizable through **infinite scrolls**.



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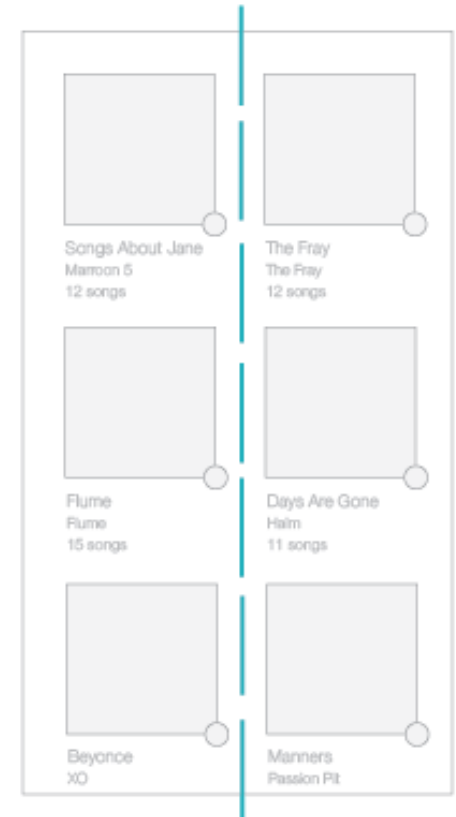
Example of Infinite Axis

The main feed of the **Pinterest app (iOS)**, encourages you to scroll down the page for as long as you're interested in viewing pins



Simmetry

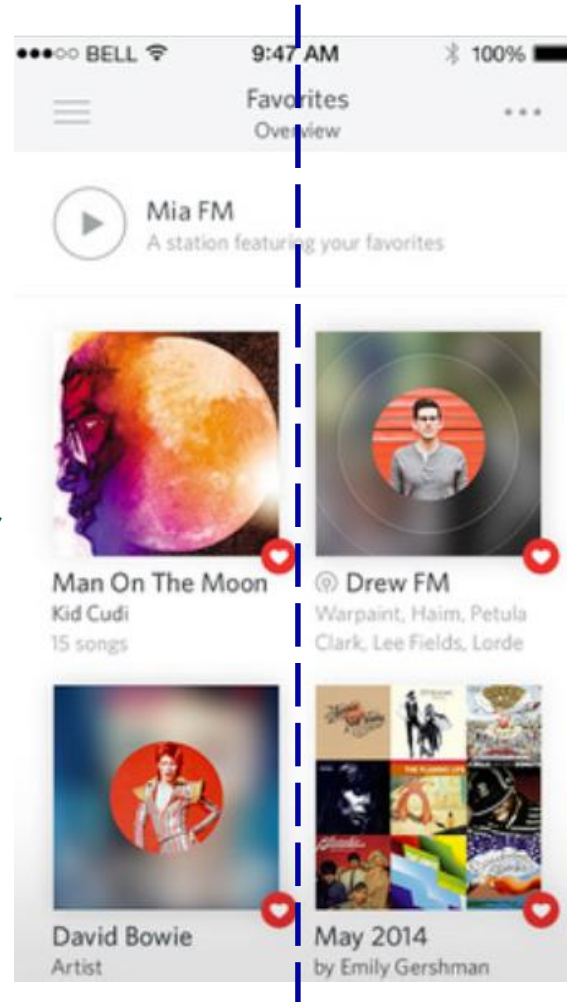
- ▶ Elements are arranged in the **same way on both sides of an axis**.
- ▶ **Perfect symmetry** is when elements are exactly the same on both sides.
- ▶ The design feels armonious and it is easy to read, both top-bottom and left-right.
- ▶ Conversely, if the arrangement of elements is different on both sides of an axis (**asimmetry**), the design is felt as unbalanced and uncomfortable.



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Example of Symmetry

Arrangement of music covers in the **Rdio app (iOS)**. Elements on both sides of the screen have the same format.



Example of Asimmetry

Although the left and right columns have the same width (Pinterest for iOS), **the height of elements in each column varies.**

This variance makes it difficult to scan from left-right. **Even the slightest bit of asymmetry can throw off the balance and comfort in a design.**



Hierarchy (by size, shape, placement)

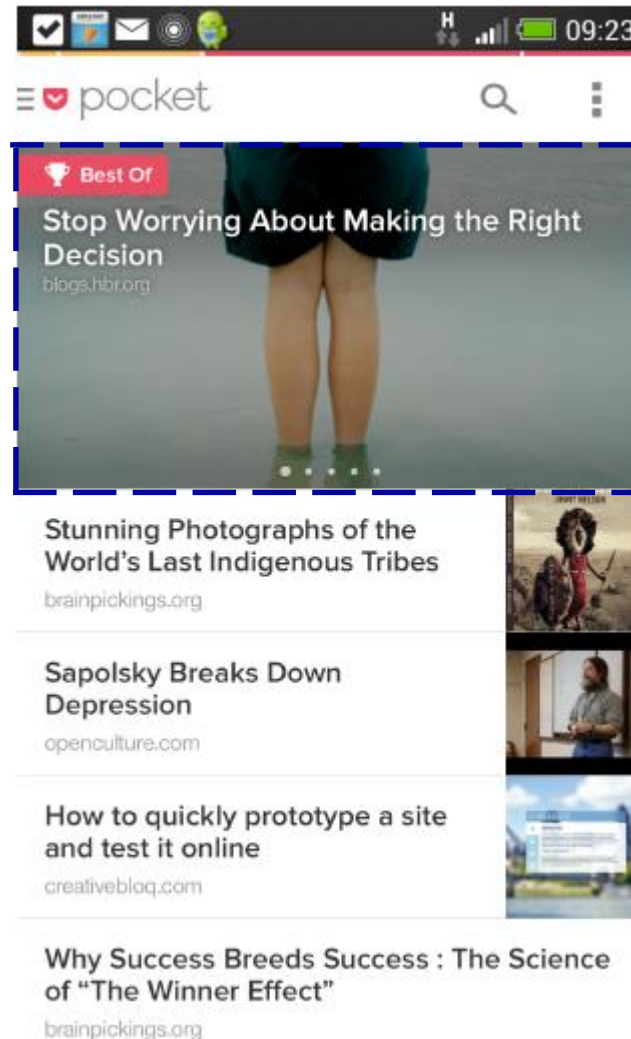
- ▶ Hierarchy is obtained when an element **appears more important** in comparison to other elements in a design.
- ▶ In **hierarchy by size** there is an element that is larger than the other elements in the interface.
- ▶ In general we look first at the **largest element**.
 - ▶ If there are five windows on the front of a building, and one is twice the size of the others, our attention will focus on the biggest window first.

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Our Values blog.peroolate.com	
Design Details itunes.apple.com	
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My New Book is called "How they	

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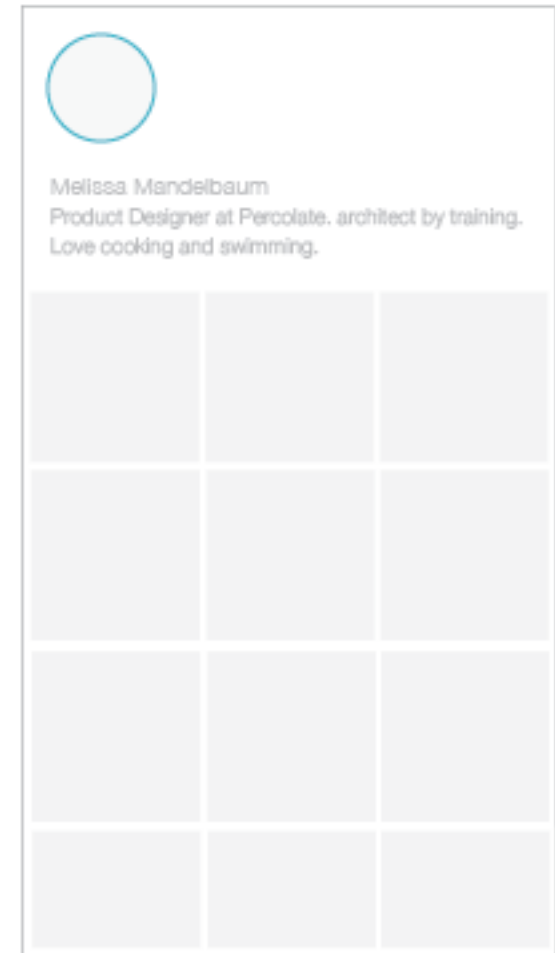
Example of Hierarchy by size

Article list in the **Pocket app (iOS)**.
The header article is featured at the top, with a larger picture. Due to its size, it catches our attention first.



Hierarchy by shape

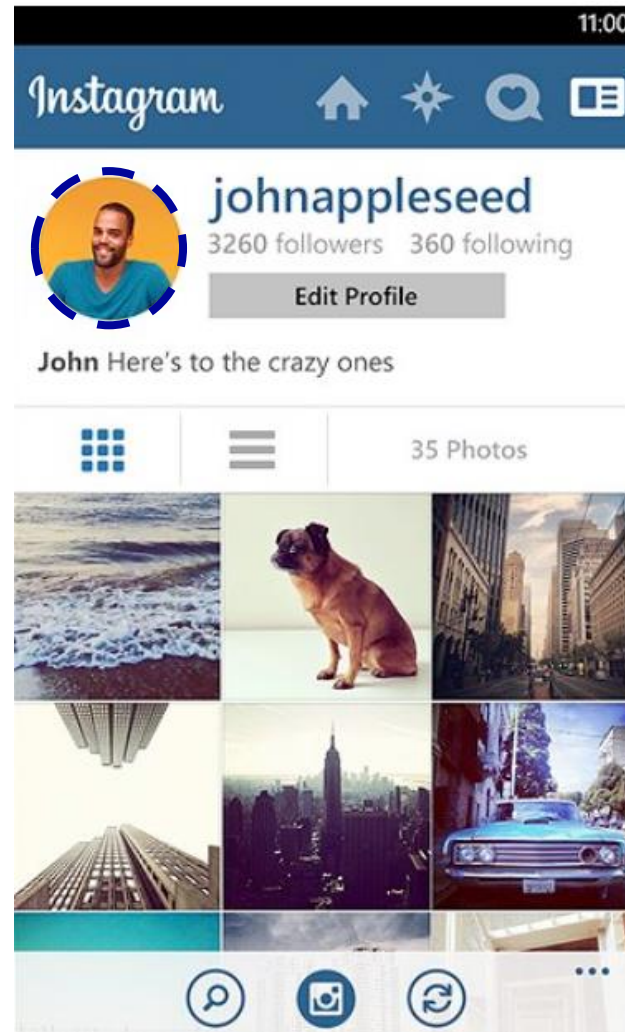
- ▶ Hierarchy can be also obtained when an element is **different** than other elements in an interface (**hierarchy by shape**).
- ▶ We naturally look first at the irregular shape in a design.
 - ▶ If there are five of the same windows and one door on the front of a building, our attention will focus on the door first.



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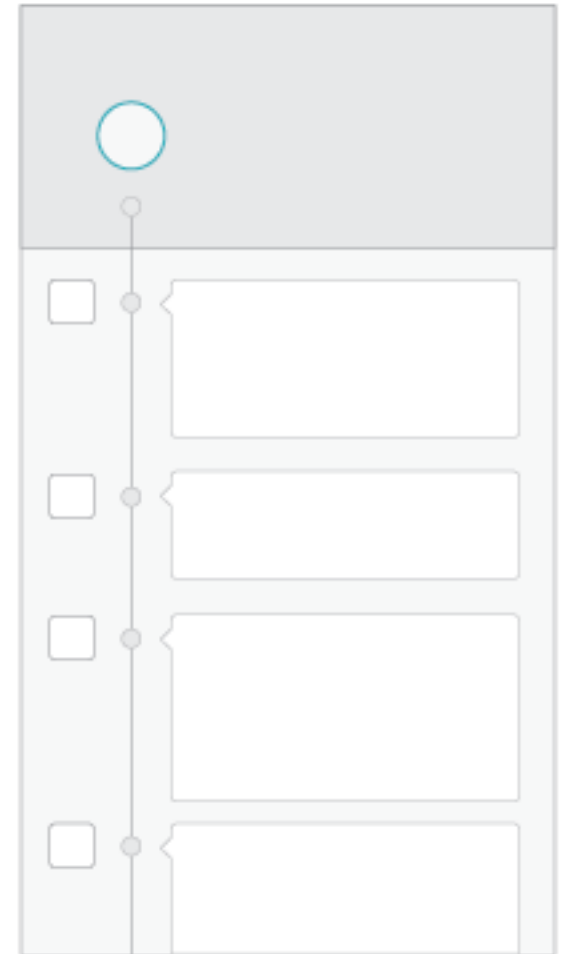
Example of Hierarchy by shape

Profile page in the **Instagram app (iOS)**.
The circular profile picture is distinctly different than the other elements.



Hierarchy by placement

- ▶ The end of an axis is naturally more hierarchical than points along the line (**hierarchy by placement**).
- ▶ We naturally look first at the start and stop of an axis.

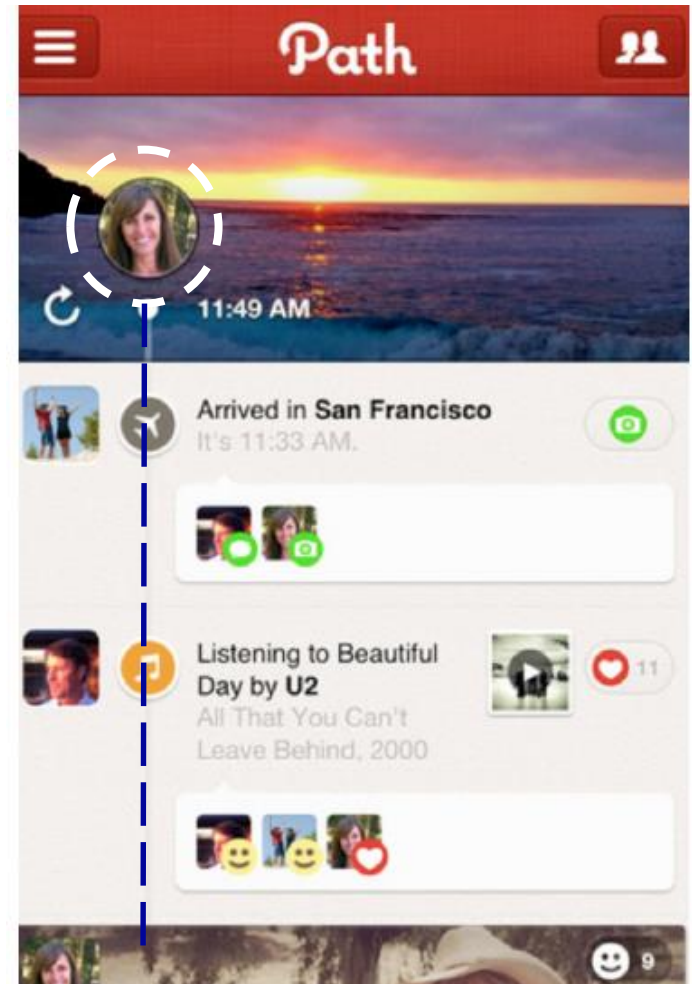


Credits: Melissa Mandelbaum
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Example of Hierarchy by placement

Timeline in the **Path app (iOS).**

The avatar is the starting point of a long axis, and therefore has a higher level of importance than the avatars on the left in the stream.



Rhythm

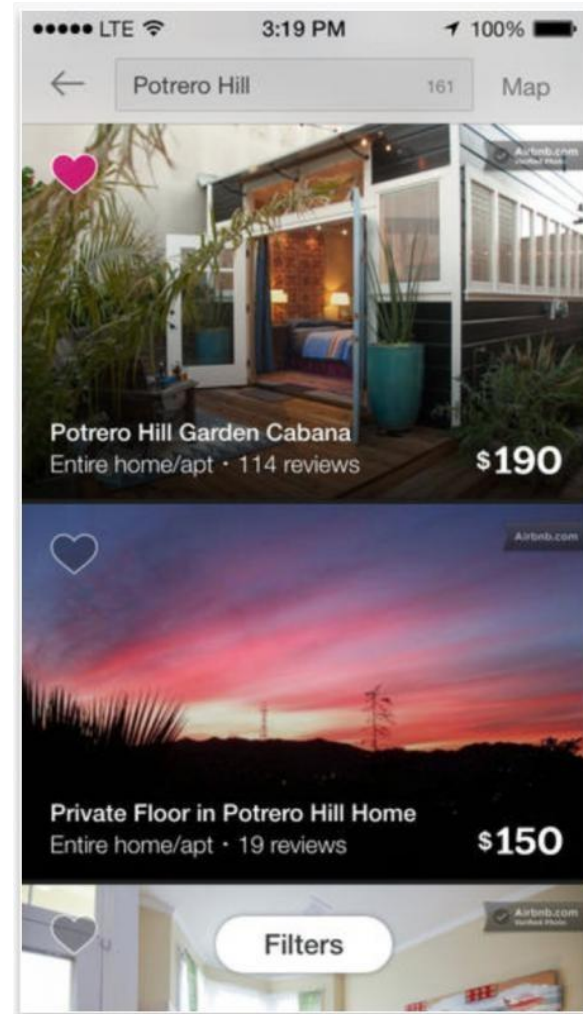
- ▶ Rhythm is the movement created by a **repeated pattern of forms**.
- ▶ When using an interface, you begin familiar with the rhythm and know exactly where to look for elements in the patterns.
- ▶ The best way to understand rhythm is to think of a song.
 - ▶ Songs have rhythm when a piece of the song repeats.
 - ▶ When listening to a song with good rhythm, we recognize the pattern and begin to expect the repeated piece of the song.

Credits: Melissa Mandelbaum
<http://learndesignprinciples.com>



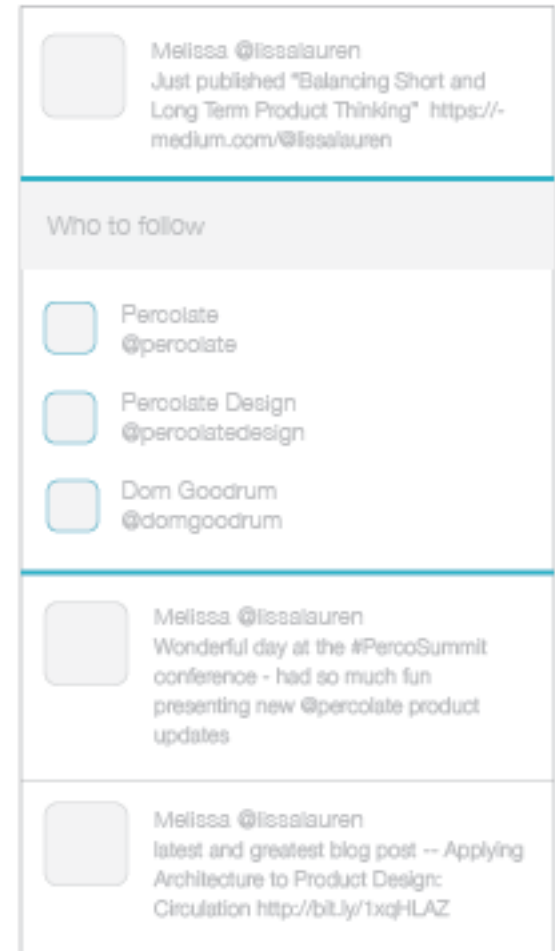
Example of Rythm

The feed in the **Airbnb app (for iOS)**.
When scanning the feed, the users already know
where the price, title, and features are placed.



Breaks

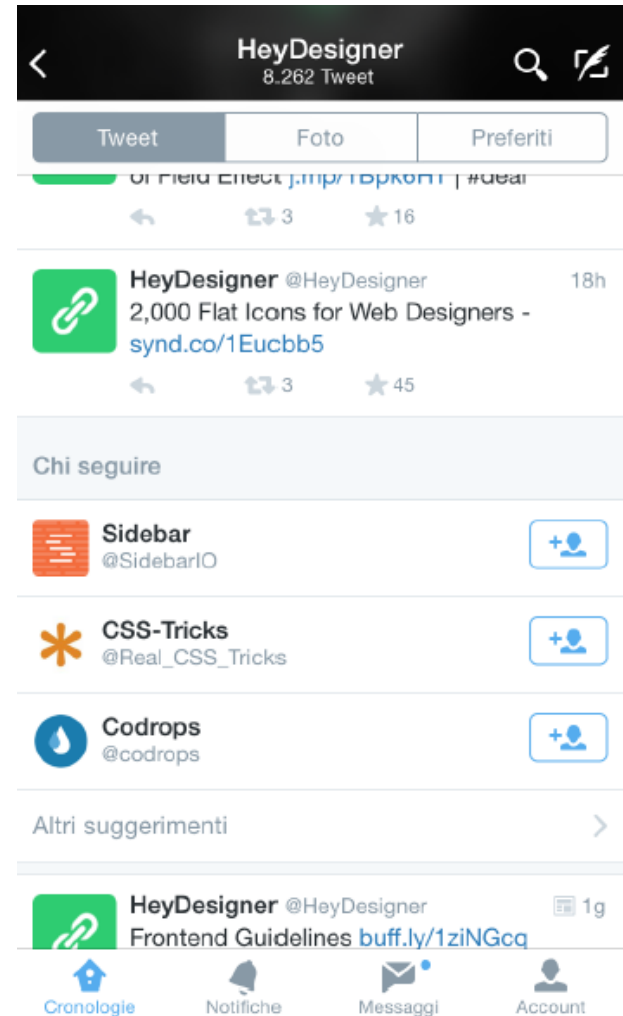
- ▶ A break in a repeated pattern gets more hierarchical.
- ▶ Think about a song.
 - ▶ When a song has a repeated rhythm and the rhythm is broken, something quite special usually happens.



Credits: Melissa Mandelbaum
<http://learndesignprinciples.com>

Example of Break

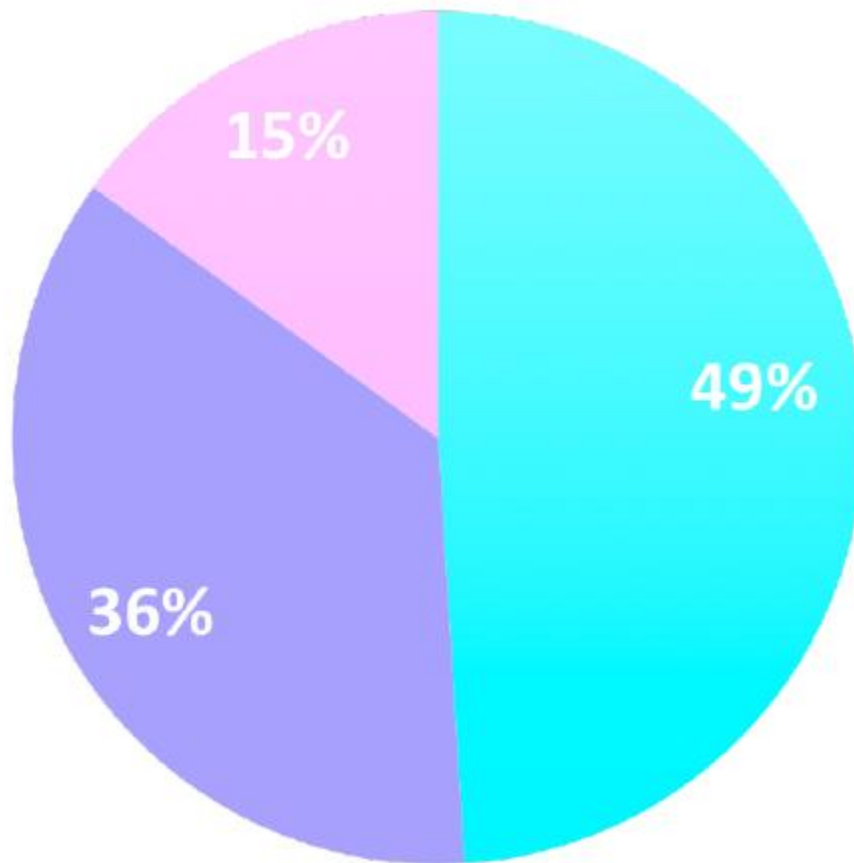
In the **Twitter app (iOS)**, the profile feed has a rhythm and is broken by a section with suggestions of people to follow. This break appears more hierarchical and is a good way of grabbing the user's attention.



Interaction Design

- ▶ Interaction design investigates the way people interact with their mobile devices.
- ▶ The **interaction** is any **direct** or **indirect** communication between a user and her/his mobile device.
 - ▶ **Direct interaction** involves a dialog with feedback and control throughout the whole performance of the task.
 - ▶ **Indirect interaction** may involve intelligent sensors controlling the environment.
- ▶ Three main *direct interaction paradigms* for mobile devices:
 - ▶ *single touch interaction*: the user literally points and clicks;
 - ▶ *multi touch interaction*: a user is allowed to perform gestures;
 - ▶ *Physical buttons and directional pads* to navigate to the desired location.
- ▶ Two *relevant issues* to tackle:
 - ▶ How do we hold mobile devices?
 - ▶ How do we communicate with a mobile device?

How do we hold mobile devices?



One Handed



Cradled



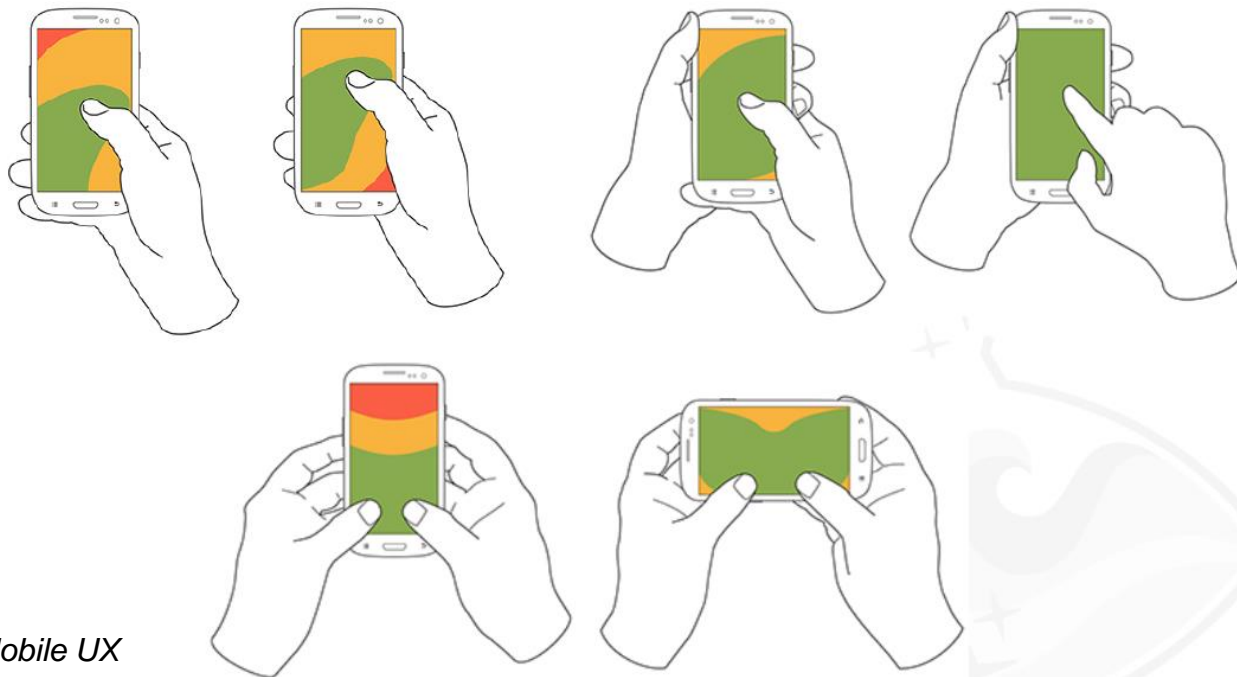
Two Handed



Credits: Emilia Ciardi – The 10 Golden Rules of Mobile UX

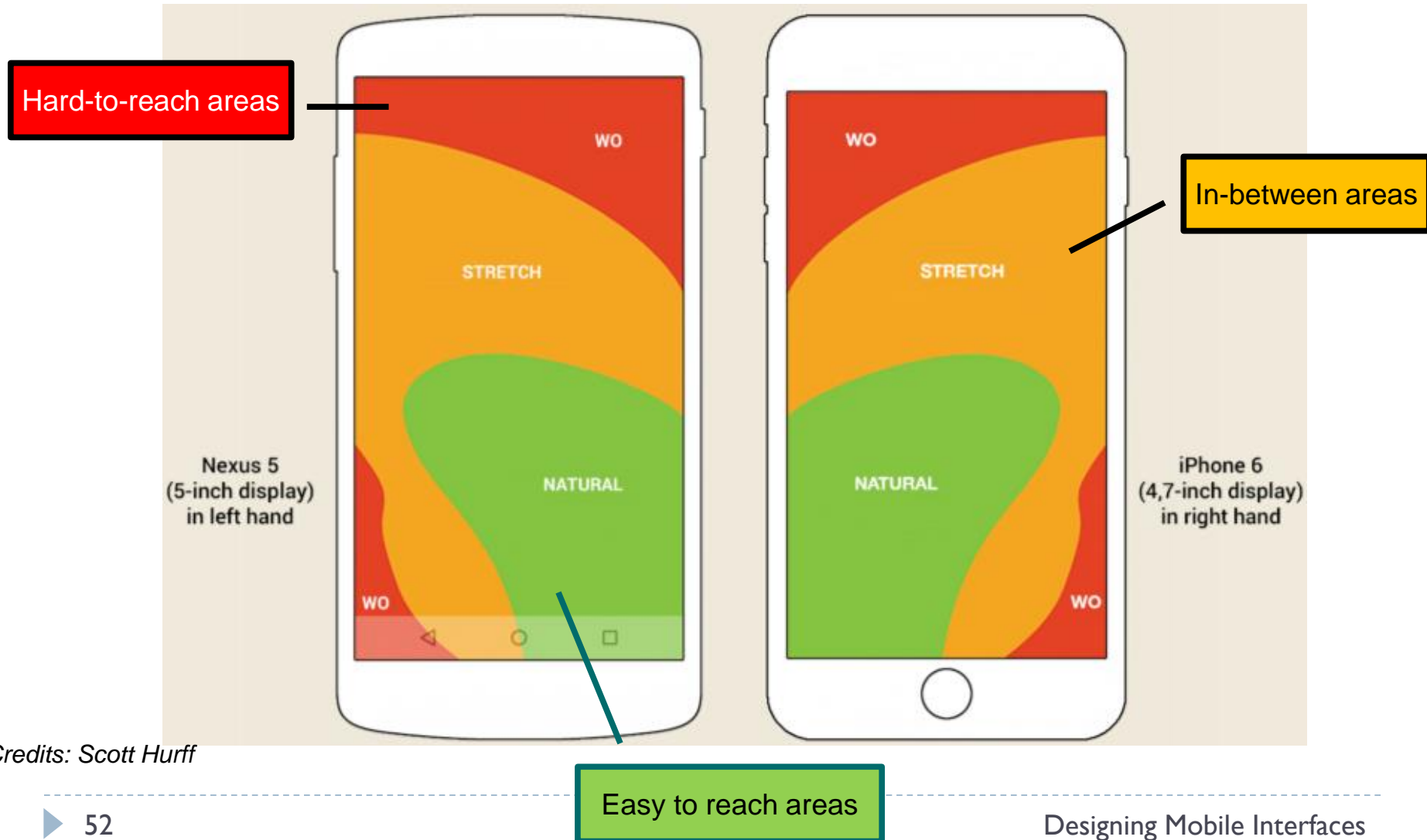
The Thumb Zone

- ▶ In his 2011 book “Designing Mobile Interfaces”, Steven Hoober coined the term “**The Thumb Zone**”, “***the most comfortable area for touch with one-handed use***”.
- ▶ With 49% of users holding their phones in one hand, and using it with one thumb, this “mythical zone” is highly relevant for mobile designers.



Credits: Emilia Ciardi
The 10 Golden Rules of Mobile UX

The Thumb Zone

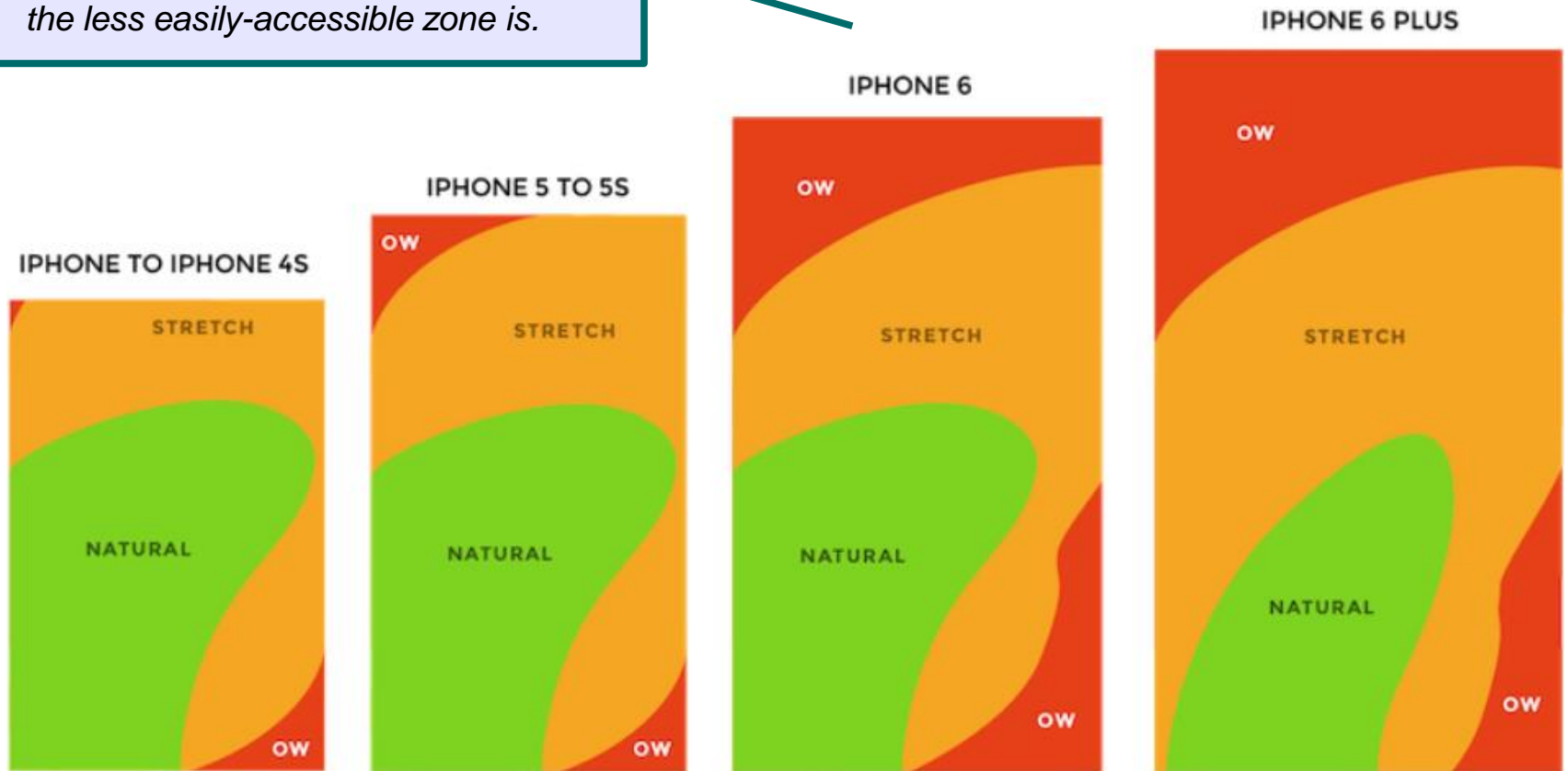


Credits: Scott Hurff

The Thumb Zone evolution

Screen sizes are going to **keep expanding**.

*The bigger the display is,
the less easily-accessible zone is.*



Credits: Scott Hurff

Place relevant content within the thumb's reach

- ▶ **Important content needs to be aimed towards the thumb**, to where it is natural for the thumb to be.
- ▶ Stretch areas are in reach but can be considered a relegation area for less important touch interaction.
- ▶ Hard-to-reach areas should be avoided. The user can see them, but would rather not touch it.



Touch interaction and gestures

Single & multi-touch gestures enable **predefined motions and actions** to interact with the device and software.



Drag item



Flick finger



Tap



Tap and hold



Nudge



Pinch



Spread



Slide finger

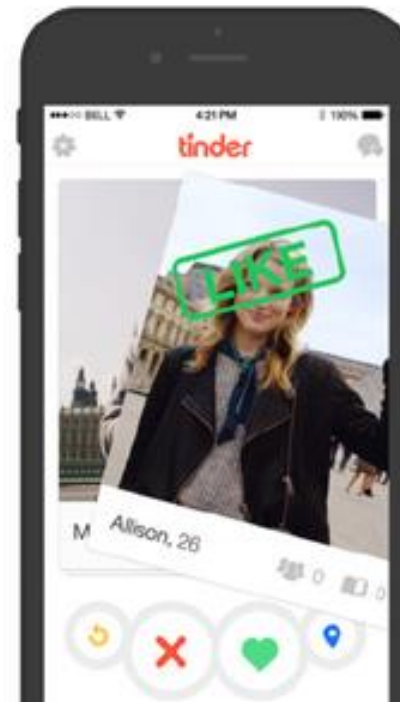
*Credits: Ivano Malavolta
User-centred design*

Flick Gesture

Tinder shows you
interesting people nearby

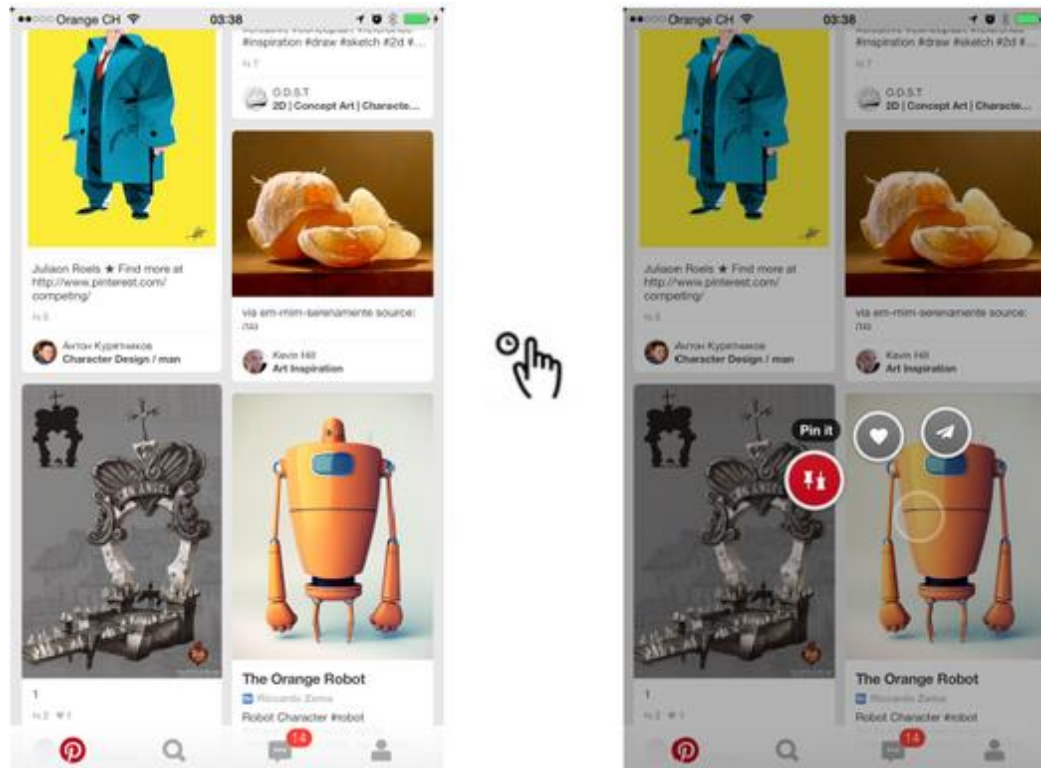


Anonymously like
or pass each person



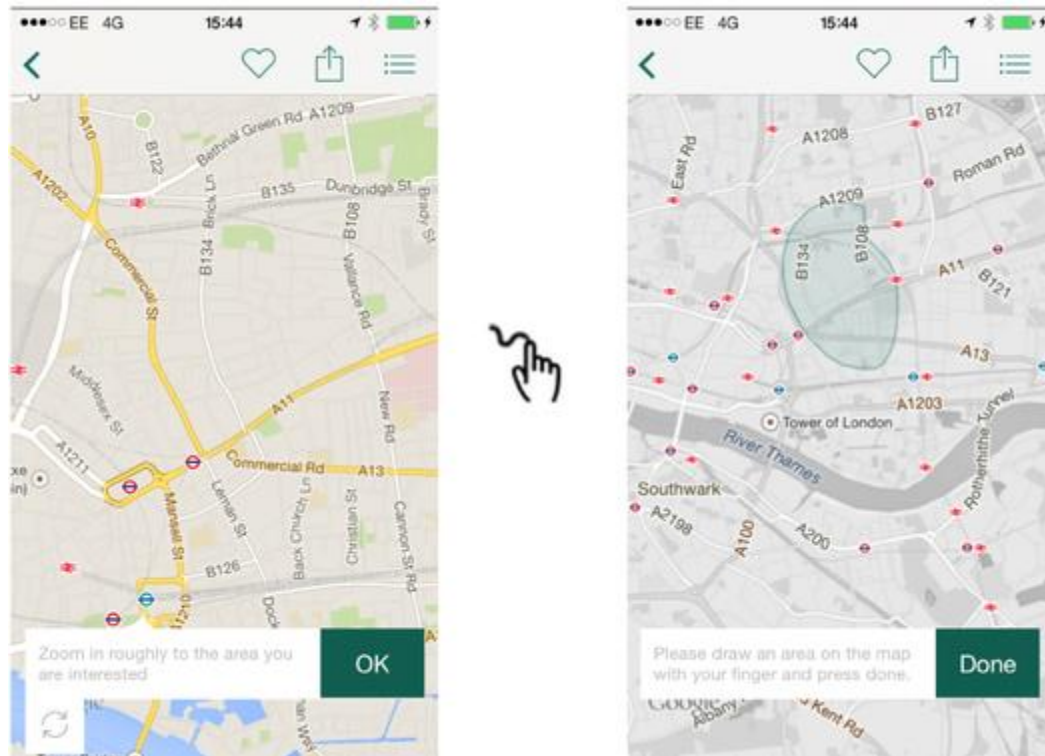
*Credits: Emilia Ciardi
The 10 Golden Rules of Mobile UX*

Tap & Hold Gesture



*Credits: Emilia Ciardi
The 10 Golden Rules of Mobile UX*

Draw Gesture



Credits: Emilia Ciardi
The 10 Golden Rules of Mobile UX

Embrace gestures with attention

1. Users expect that gestures work the same, regardless of the app they're currently running!
2. Use gestures if the context they are used in feels natural!
3. Make sure users will find them!
 - ▶ Draw attention to the part of the UI where the gesture is active – *maybe it could pulse the first time to signify it is interactive!*
 - ▶ Perform an animation that hints to the type of gesture !
 - ▶ If you don't think users will figure out your gestures easily, don't overload them with too many help hints all at once, instead reveal them over time

Minimize the Effort Required for User Input

Suggestion: Inputting information takes time and attention, **minimize it!**

- ▶ If your app asks users a lot of input data, you have to revise your design.
- ▶ Balance any request for input by users with what you offer them in return
- ▶ Get information from the OS, when appropriate.
 - ▶ for example: contacts, address, events in the calendar...
- ▶ Use auto-completion in text fields whenever possible



Information Design

- ▶ It concerns the **visual layout** of information presented to the users. Three main aspects to consider:
- ▶ Design for “fat fingers”. Make your links and buttons large enough to hit easily
 - ▶ at a minimum, make important hit targets at least 1 cm on each side, and put some space between them.
- ▶ Design for distracted users.
 - ▶ Make the task sequences easy, quick, and reentrant, so that mistakes are easily corrected.
 - ▶ And make everything self-explanatory.
- ▶ Think about colors and typography. And think about motion.

Colors psychology

- ▶ Users react to different colors differently, since colors **evoke emotions**.
- ▶ Thinking about the emotions that colors evoke in people is an **important aspect** of mobile design.
 - ▶ Note what some of the different colors can mean in different cultures.

BLU

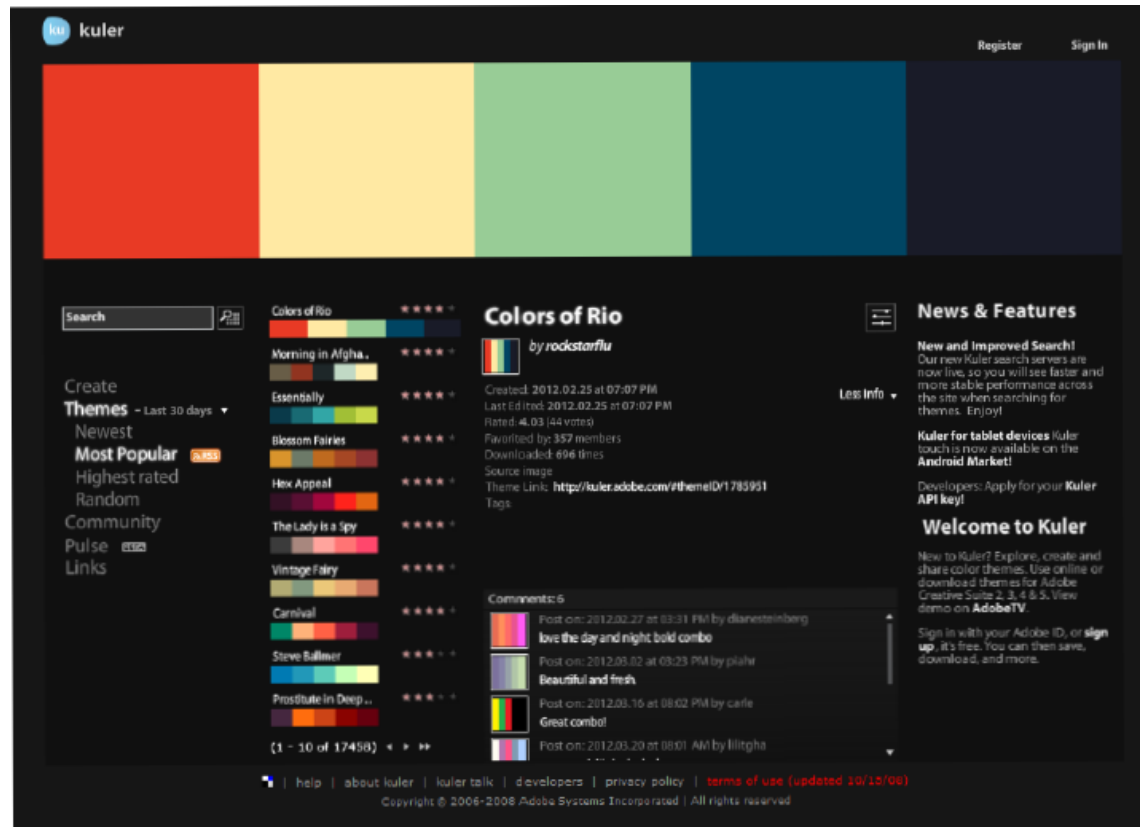
productiveness, interiors, skies, peace, unity, harmony, tranquility, calmness, trust, coolness, confidence, conservatism, water, ice, loyalty, dependability, cleanliness, technology...

RED

Passion, strength, energy, fire, sex, love, excitement, speed, heat, arrogance, ambition, leadership, masculinity, power, danger, gaudiness, blood, war, anger, revolution, radicalism, aggression, respect, martyrs, conservatism (U.S. politics), wealth (China), and marriage (India)...

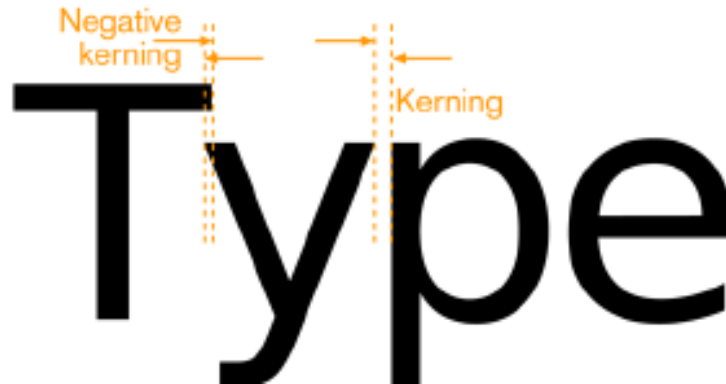
Colors Palette

- ▶ Choose a **predefined number of colors** to be used in a mobile app.



Typography

- ▶ Typography is about:
 - ▶ selection of the correct font
 - ▶ understanding sizes
 - ▶ applying conventional design methodologies (size, shape, contrast, color, position, space, etc.)



*Credits: Ivano Malavolta
User-centred design*

Readability Guidelines

1. Use a high-contrast typeface

- ▶ Devices are usually used outdoor

ABCDEFGH
NOPQRST
abcdefghijklm

Poor
Contrast

2. Use the right typeface (font)

Pretty but too fancy and unreadable!

TOO NARROW TOO NARROW

Credits: Ivano Malavolta
User-centred design

Readability Guidelines

3. Provide decent leading (space between two lines)



4. Leave space on the right and left of each line
5. Do not crowd the screen
6. Generously utilize headings
 - ▶ Divide the content into paragraphs
7. Use short paragraphs
 - ▶ 2-3 sentences at most

*Credits: Ivano Malavolta
User-centred design*

Bibliography

1. J. Tidwell: *Designing Interfaces*, 2nd Edition (2010)
2. B. Fling: *Mobile Design and Development* (2009)
3. S. Hooper, E. Berkman: *Designing Mobile Interfaces* (2011)