User Interface design

POLITECNICO DI TORINO 1859 1906

SoftEng http://softeng.polito.it

Or, Usability

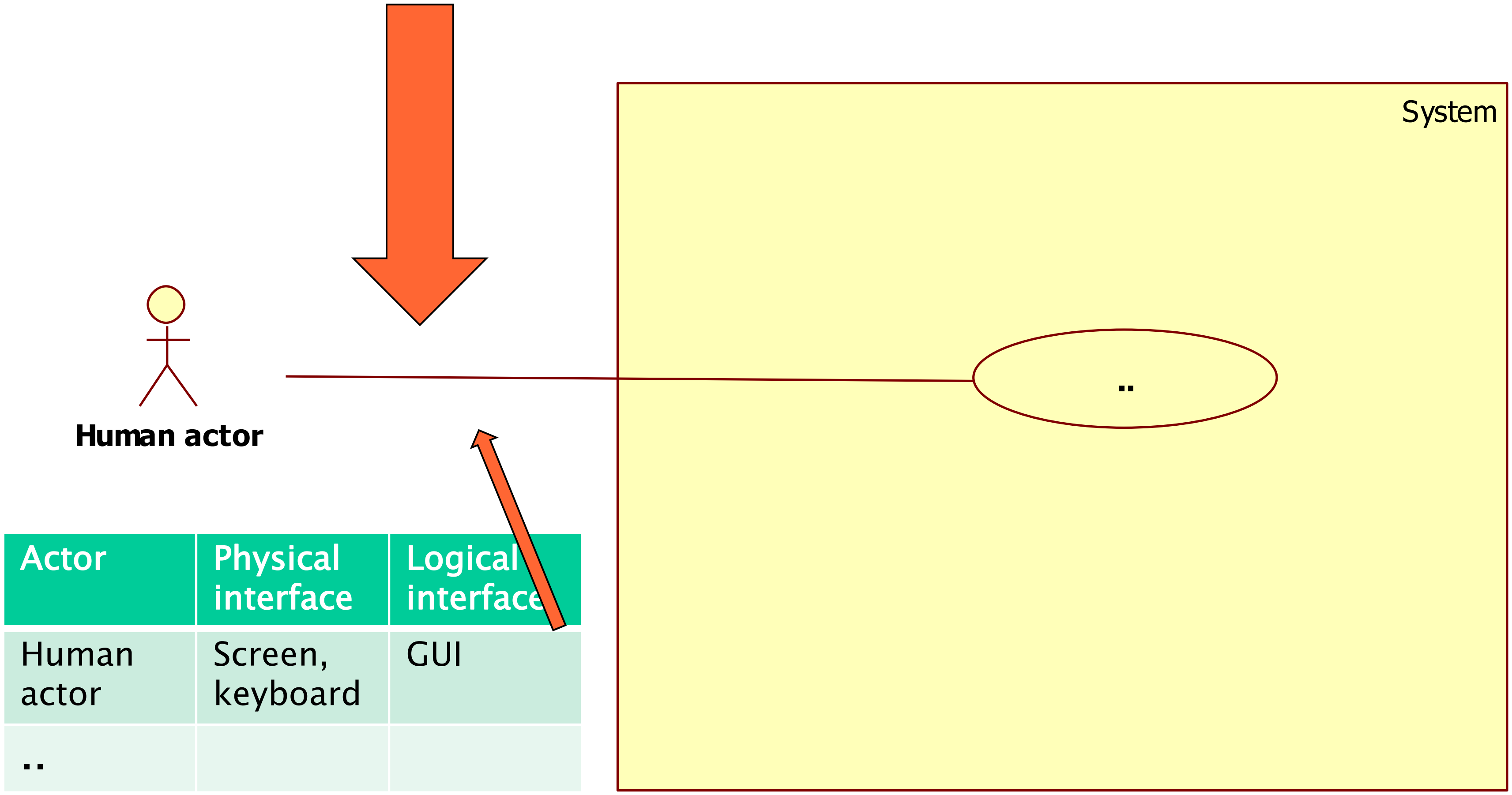
(NF requirement)

For more

- 02JSKOV Human Computer Interaction
- Prof. Corno

- When human actors are involved, designing the User Interface (often Graphical User Interface) is a key design choice
- We assume that RE activity has been completed
  - (in practice RE and UI design may overlap)

(G) UI



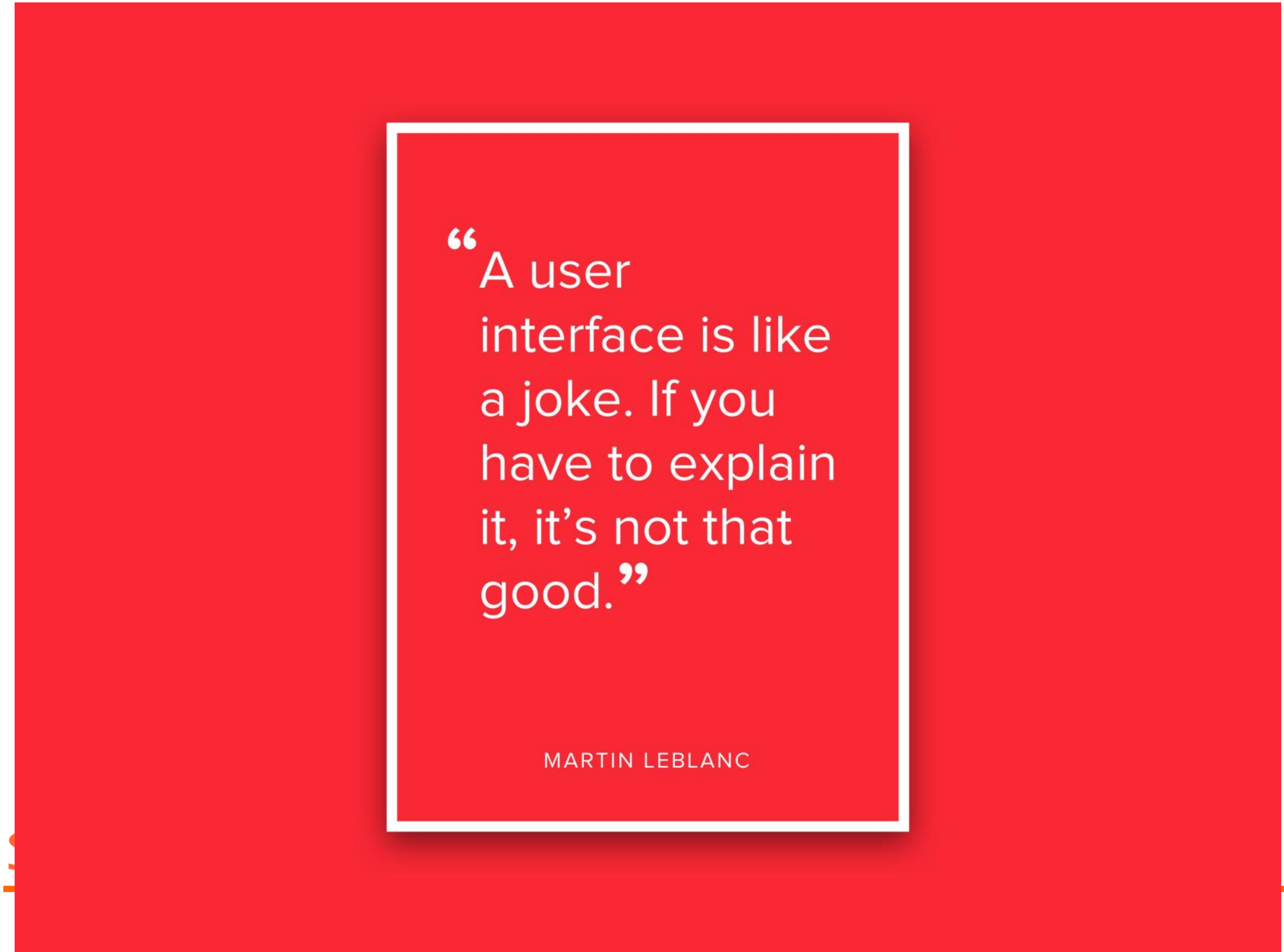
Actor	Physical interface	Logical interface
Human actor	Screen, keyboard	GUI
..		

Key message #1

Experimentation

- The UI should be experimented with the end users

Key message #2

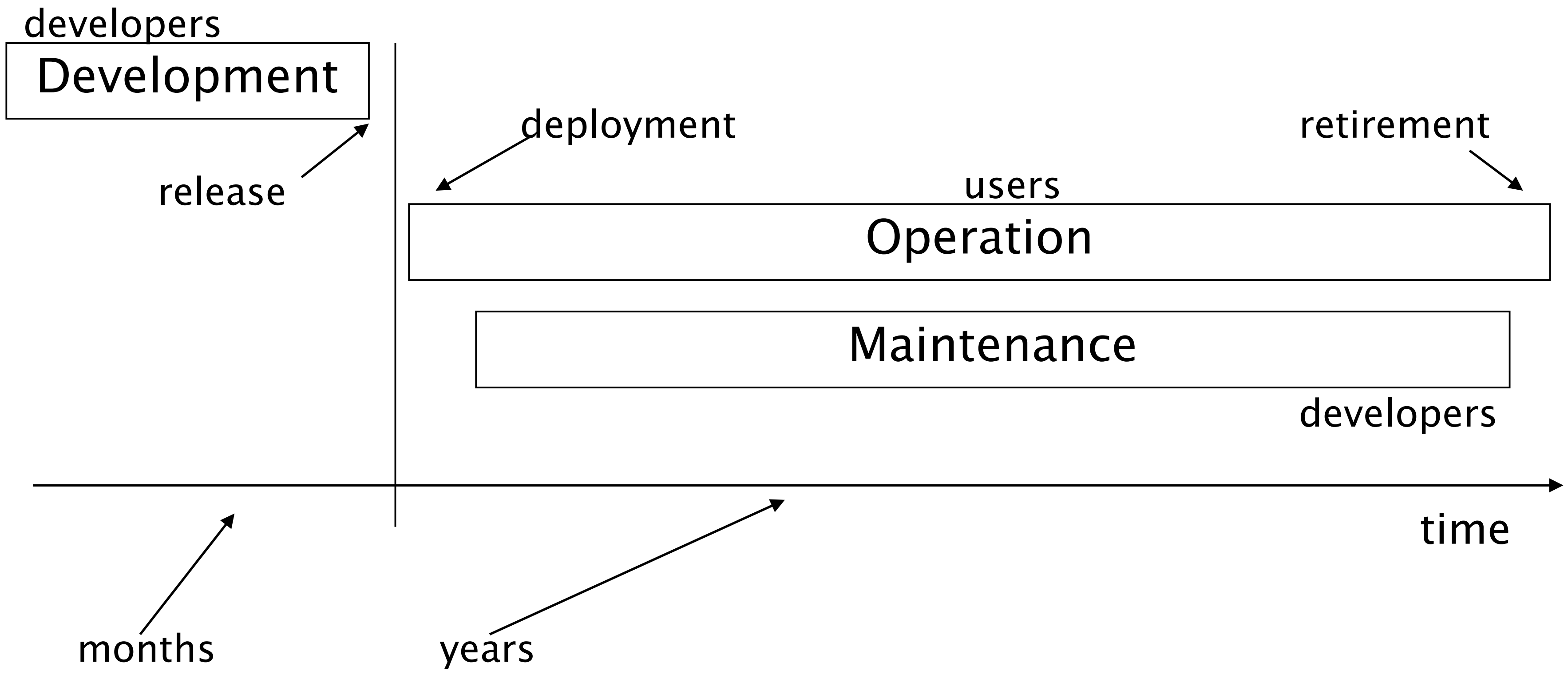


“A user interface is like a joke. If you have to explain it, it’s not that good.”

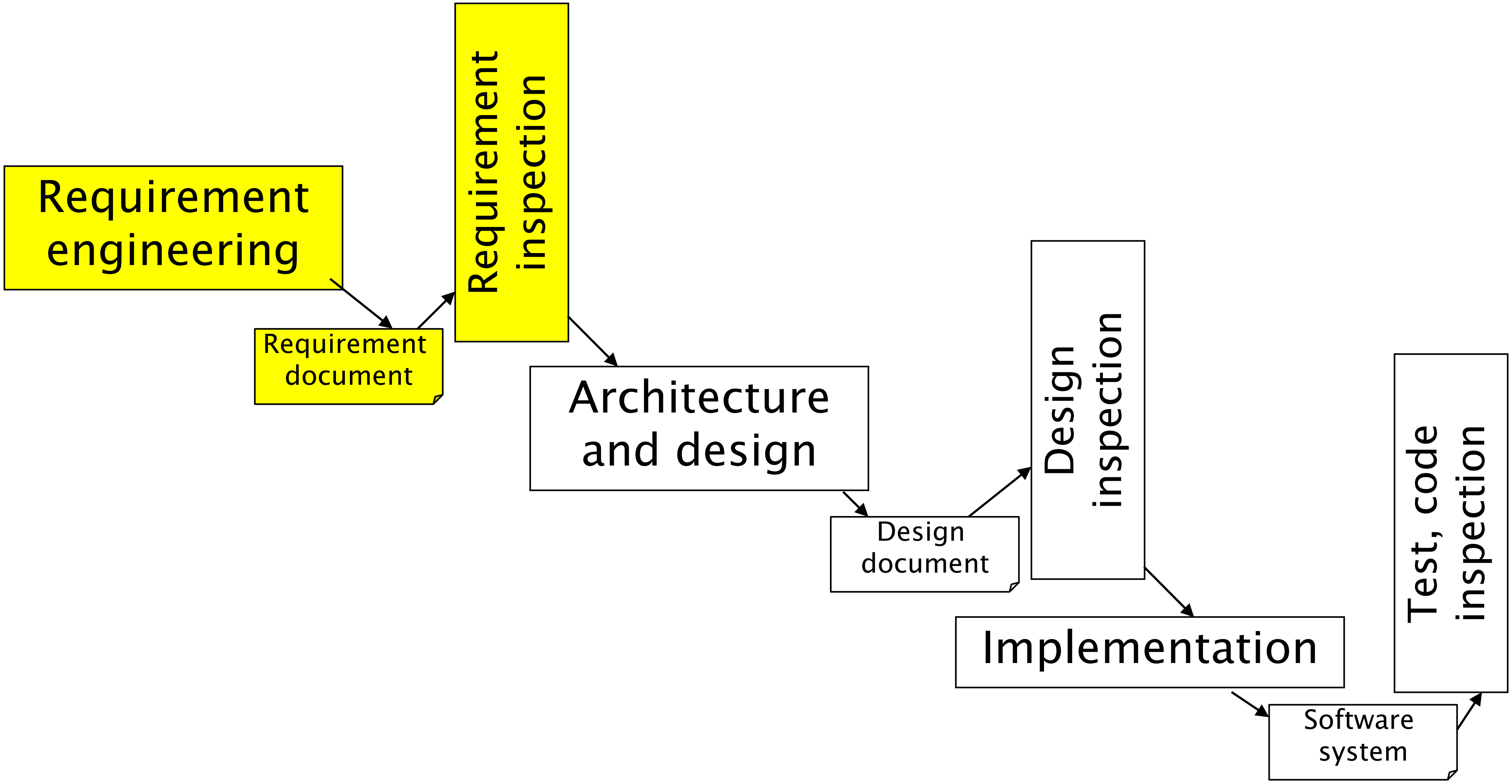
MARTIN LEBLANC

- Starting points are
  - Context diagrams, actors
  - Functional requirements
  - Use cases

The process – phases



The process – development



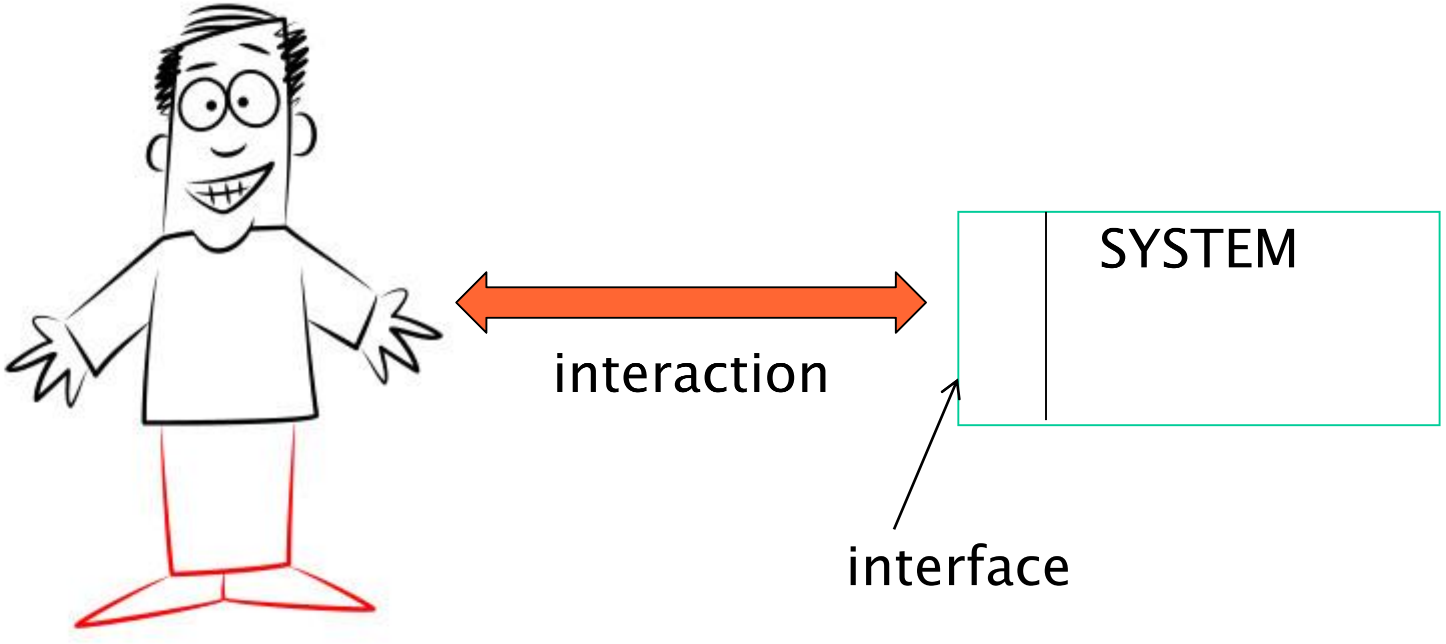
Configuration management

Project management

Context

- Software types
  - Embedded software
  - Mass market / consumer software
  - Enterprise software

Context

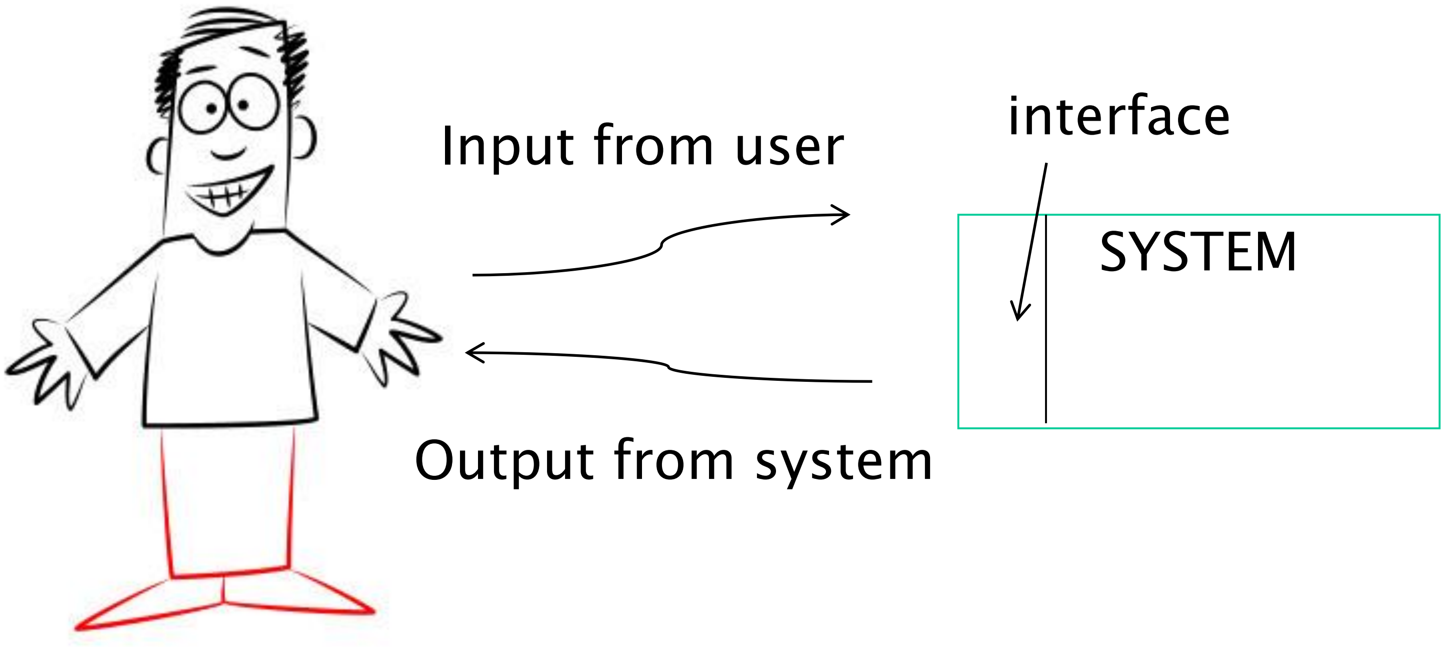


SYSTEM

interaction

interface

Interaction



Input from user

interface

SYSTEM

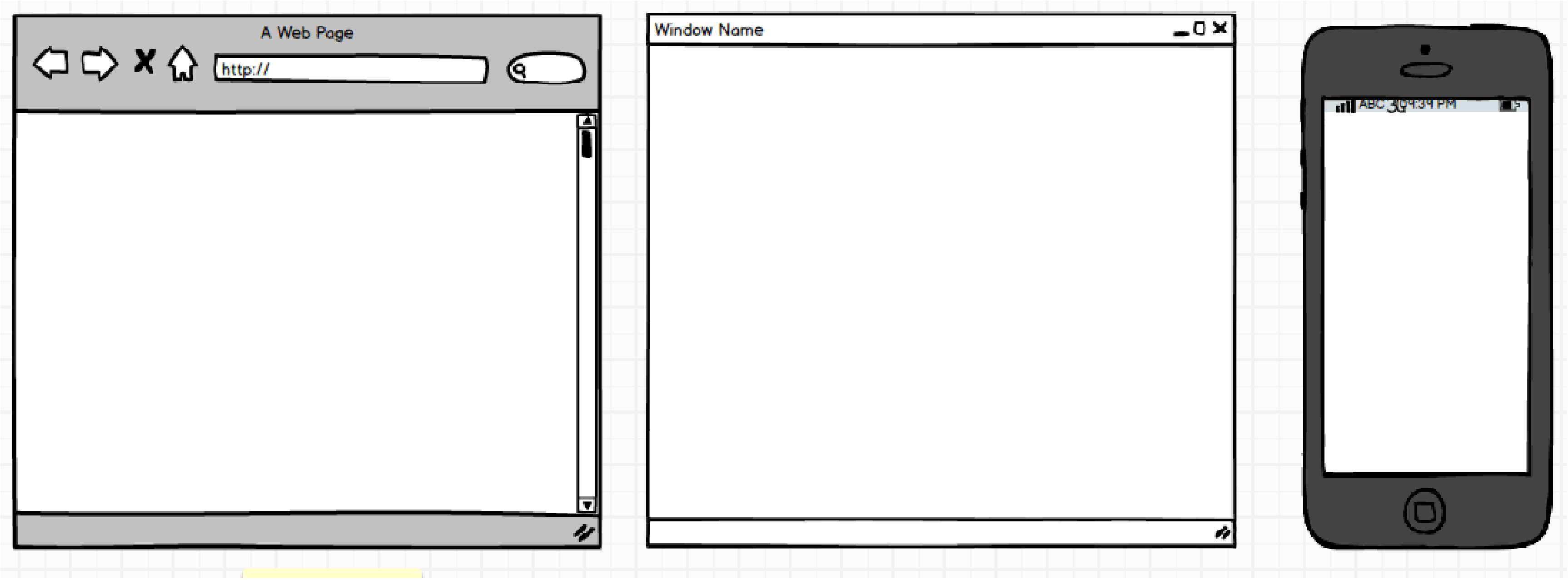
Output from system

Interaction means

User		System
Sight		Screen, printer, glasses, .
Hearing		Noise, music, voice synthesis
Touch		Glove
Hands		Keyboard, mouse, touchscreen, touchpad, glove
Voice		Voice recognition
Eyes		Eye tracking
Position, gesture		Gesture recognition

Context

- One application, many UIs



Web

Desktop

Mobile

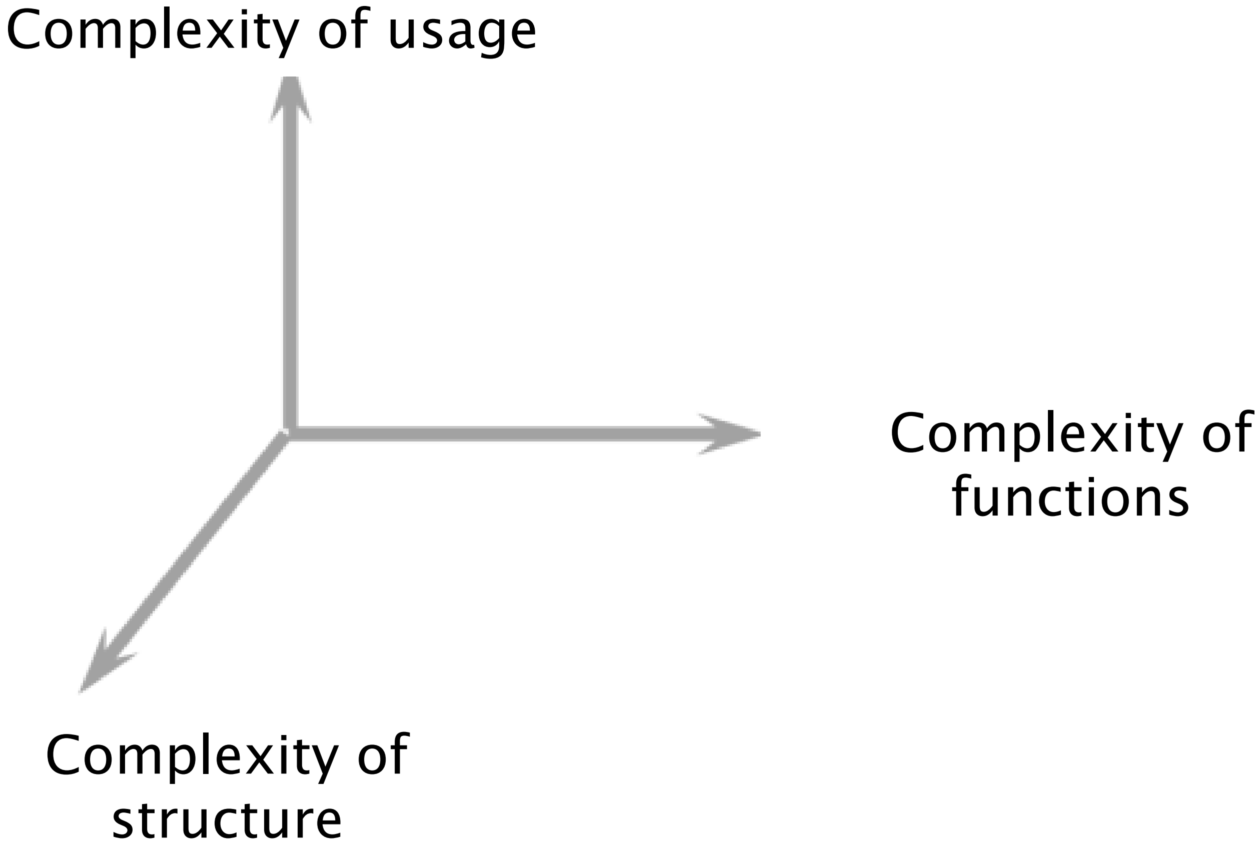
Context

- One application, many UIs

Tablet

Smartwatch

Principles – simplicity



Complexity of usage

Complexity of functions

Complexity of structure

Simplicity

- UI should be as simple, as allowed by complexity of structure, of functionality

Ex RVC

Ex RVC option 1

- Structure: mid complexity (10–100 components)
  - 4 sensors, 4 wheels, 5–6 engines, one processor, one battery
- Functionality: mid / high complexity
  - Clean: simple
  - Map space, navigate space: complex
- UI
  - On off switch, start button

Ex RVC option 2

- Structure: mid complexity (10-100 components)
  - Same as above +
  - Smartphone app
- Functionality: mid / high complexity
  - Same as in option 1 +
  - Plan cleaning
  - Show results of cleaning, show map
  - Manage multiple spaces and houses

Ex RVC option 2

- UI
  - Smartphone app with several windows for
    - Start stop
    - Plan cleaning
    - Show cleaning results
    - Manage multiple spaces
    - ..

Ex RVC

- UI becomes more complex as functionality (and structure) become more complex

- However, in any case UI should NOT be more complex than needed

Ex RVC

- Same functionality as in option 1
- Same structure as in option 1
- UI, only one button
  - Push 5 seconds, switch on
  - Push 3 times shortly, switch off
  - Push 2 times long, 2 times short, start cleaning

  - Better or worse UI?

Approaches

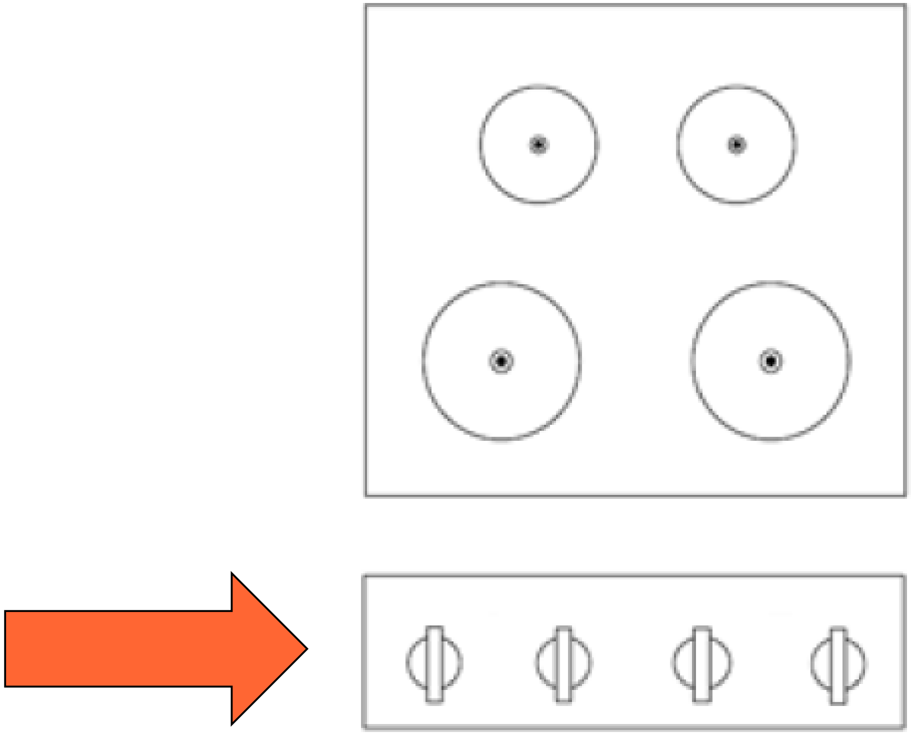
- Ergonomy
  - Safety, adaptability, comfort, usability,...
- Emotional design
  - Beyond ergonomy, the interaction (object) should cause positive emotions in the user
- User eXperience (UX)
  - Usability + feelings + emotions + values

Approaches

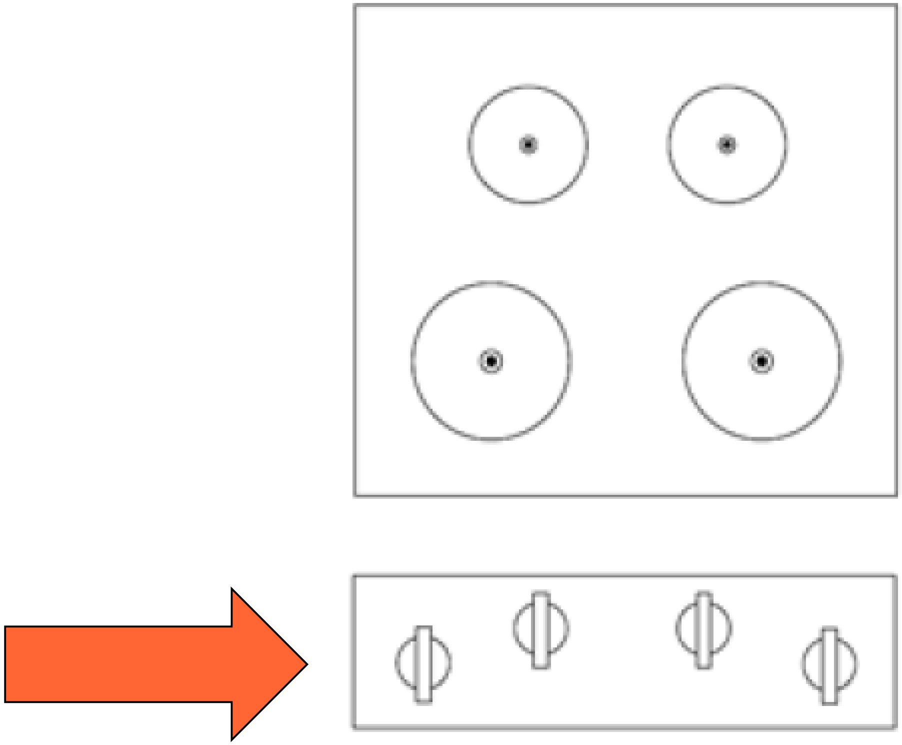
- Transparent technology
  - No emphasis on technology
- Feedback, user centered design
  - No decision based on personal opinions, but feedback from real users

Cooker

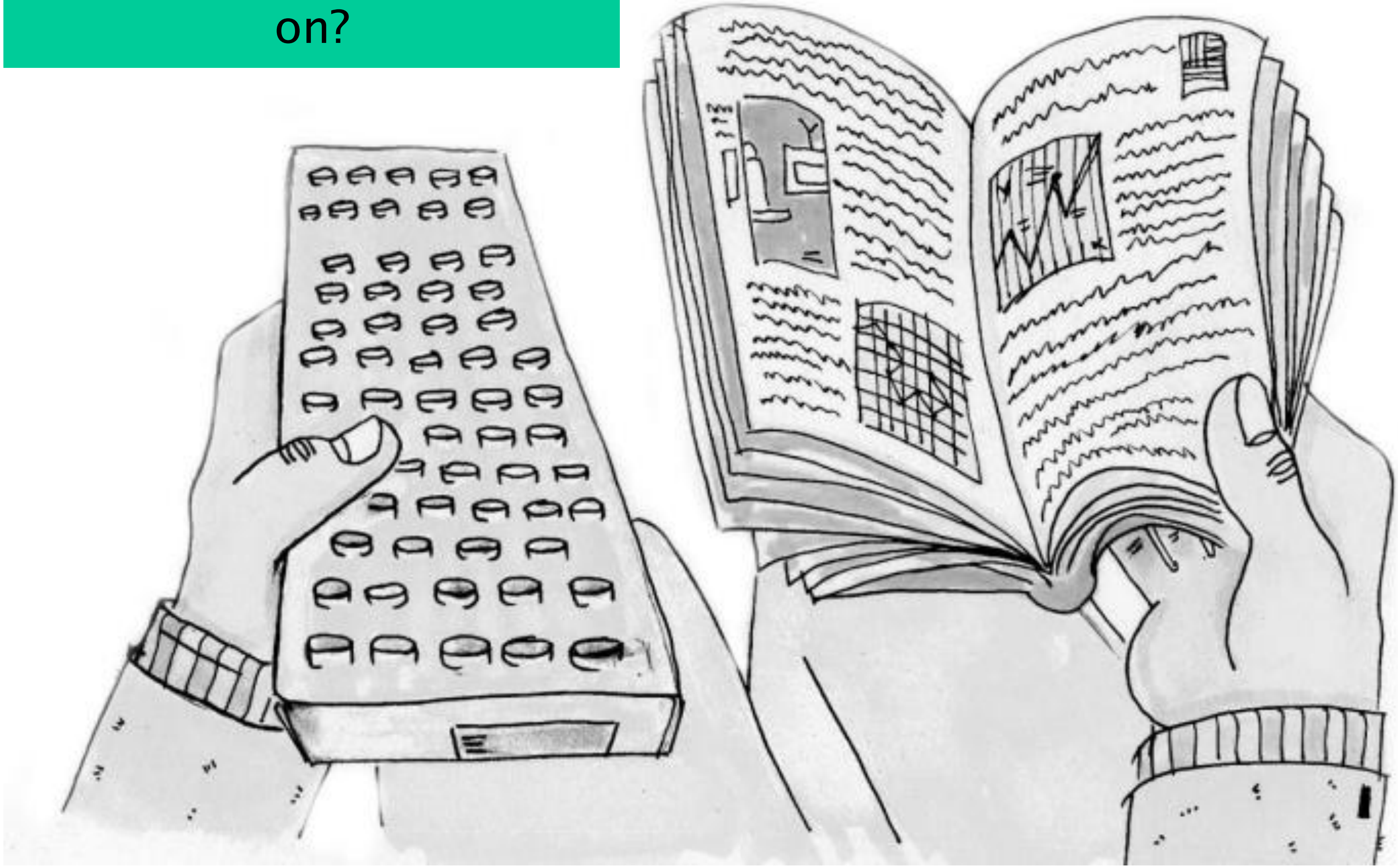
Cooker UI

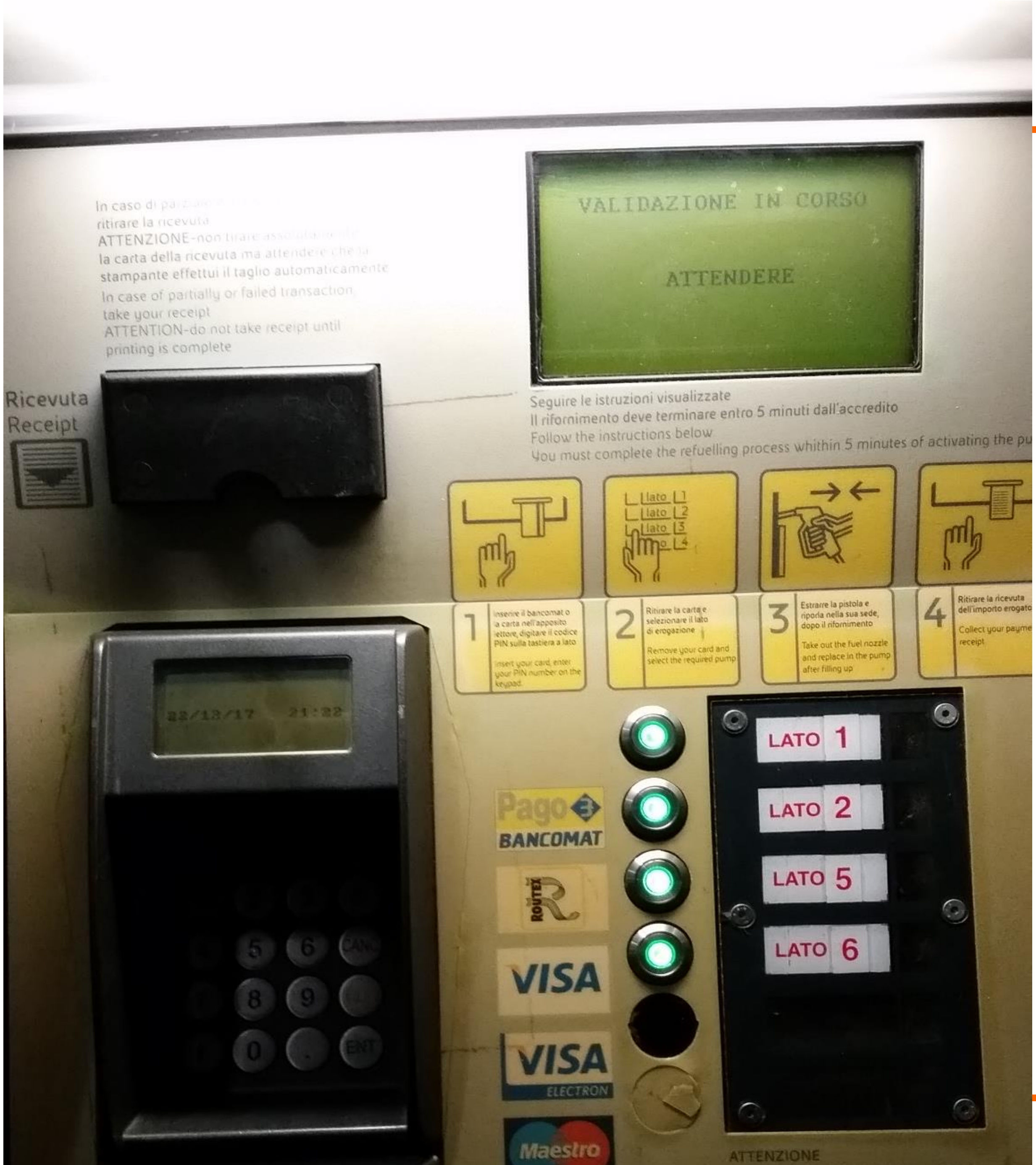


Cooker UI

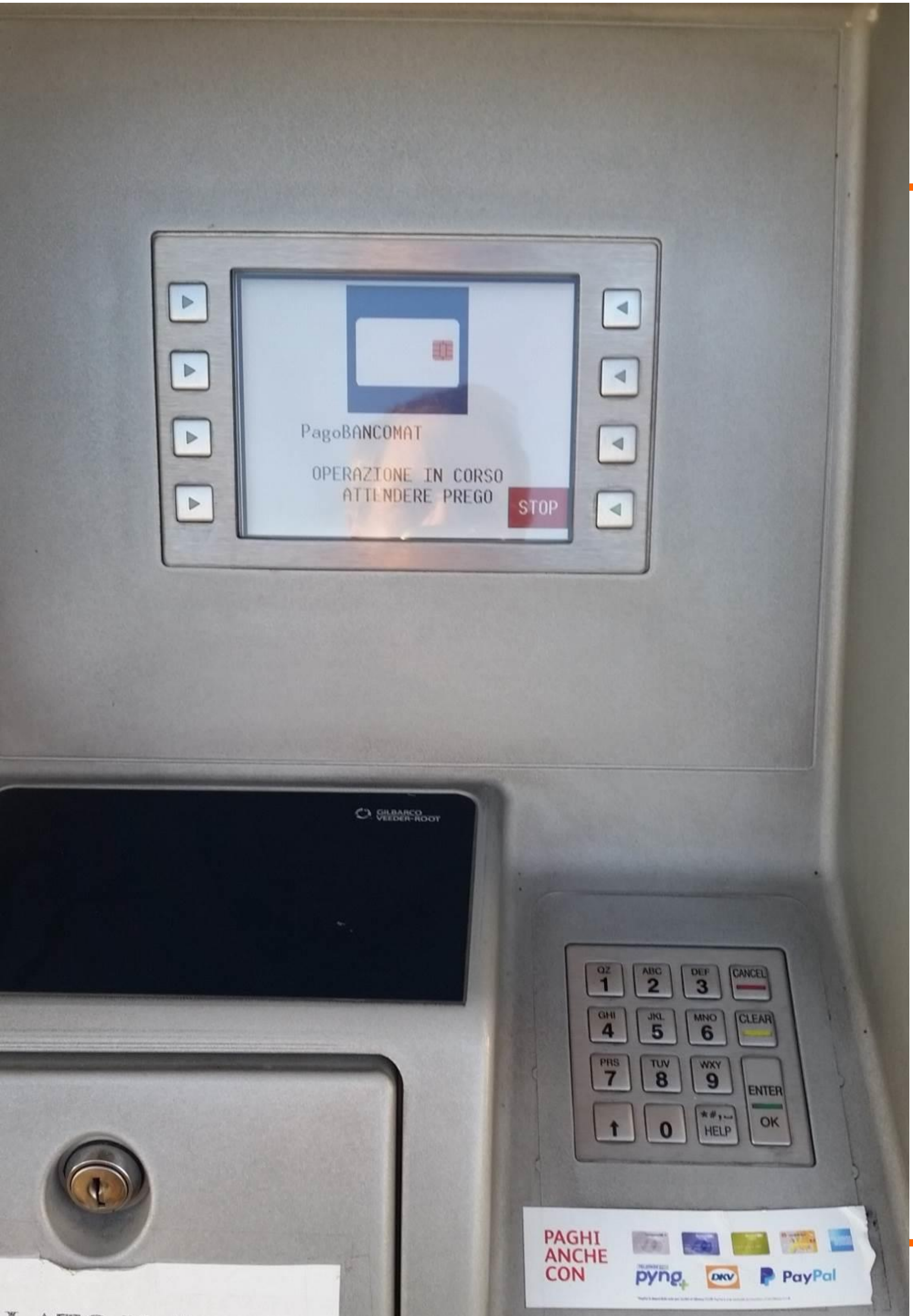


And, for turning the TV on?



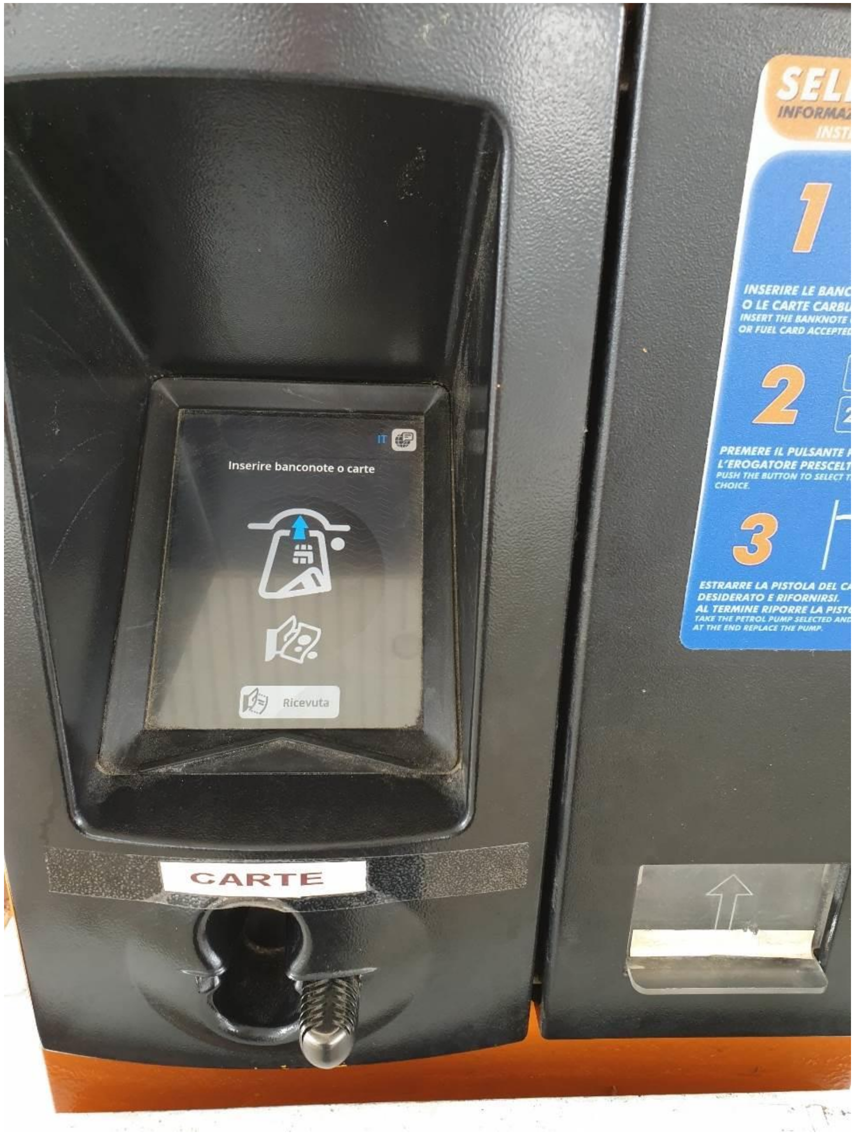

VALIDAZIONE IN CORSO
ATTENDERE
In caso di parziale [illegible] ritirare la ricevuta
ATTENZIONE-non tirare assolutamente la carta della ricevuta ma attendere che la stampante effettui il taglio automaticamente
In case of partially or failed transaction take your receipt
ATTENTION-do not take receipt until printing is complete
Ricevuta
Receipt
Seguire le istruzioni visualizzate
Il rifornimento deve terminare entro 5 minuti dall'accredito
Follow the instructions below
You must complete the refuelling process whithin 5 minutes of activating the pu
lato 1
lato 2
lato 3
lato 4
1
Inserire il bancomat o la carta nell'apposito lettore, digitare il codice PIN sulla tastiera a lato
Insert your card, enter your PIN number on the keypad
2
Ritirare la carta e selezionare il lato di erogazione
Remove your card and select the required pump
3
Estrarre la pistola e riporla nella sua sede, dopo il rifornimento
Take out the fuel nozzle and replace in the pump after filling up
4
Ritirare la ricevuta dell'importo erogato
Collect your payme receipt
22/12/17 21:22
5
6
CANC
8
9
0
ENT
Pago BANCOMAT
ROUTEX
VISA
VISA ELECTRON
Maestro
LATO 1
LATO 2
LATO 5
LATO 6
ATTENZIONE

- Two screens and two keyboards

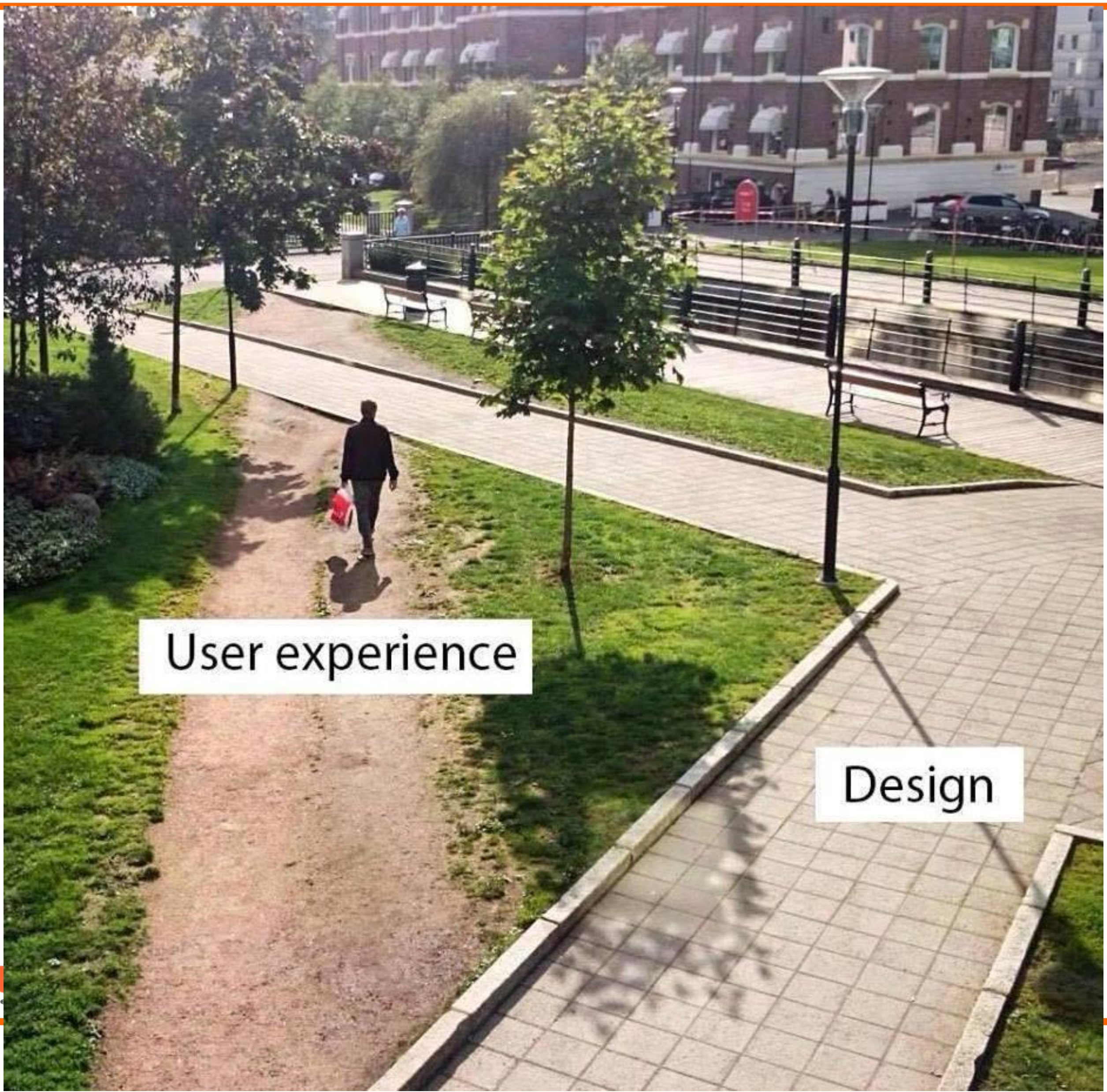


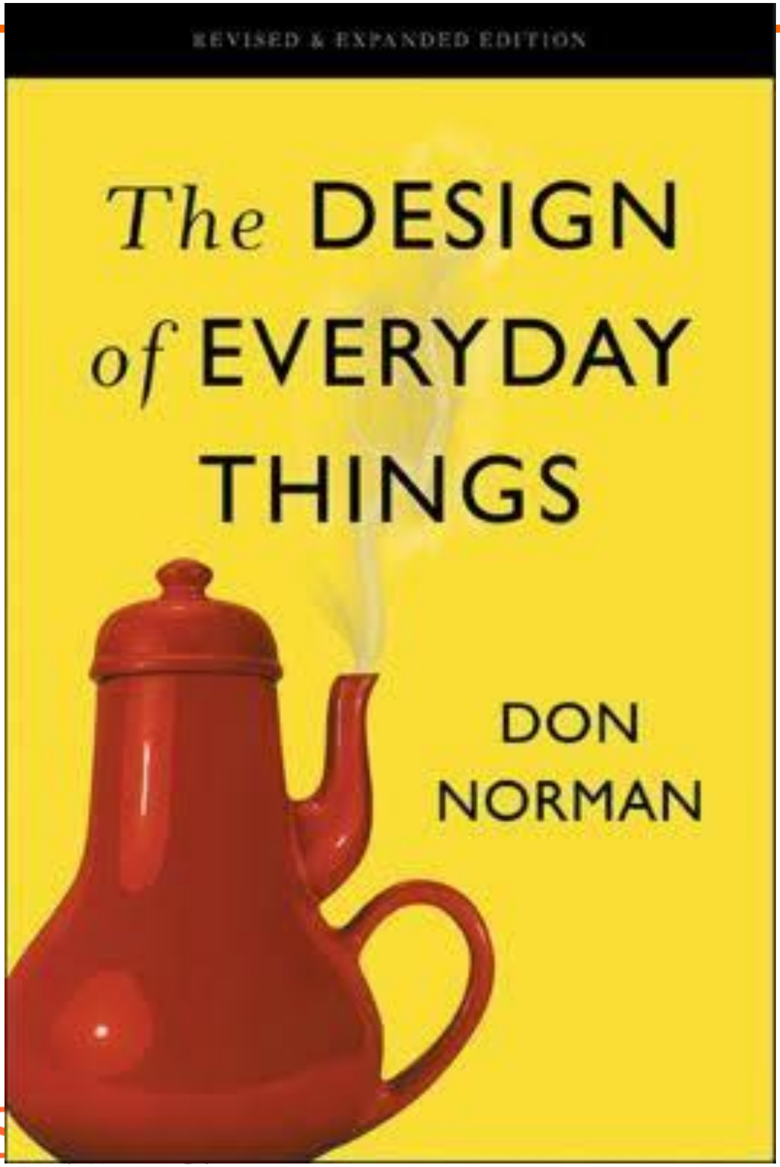
- One screen
- Keyboard + touchscreen

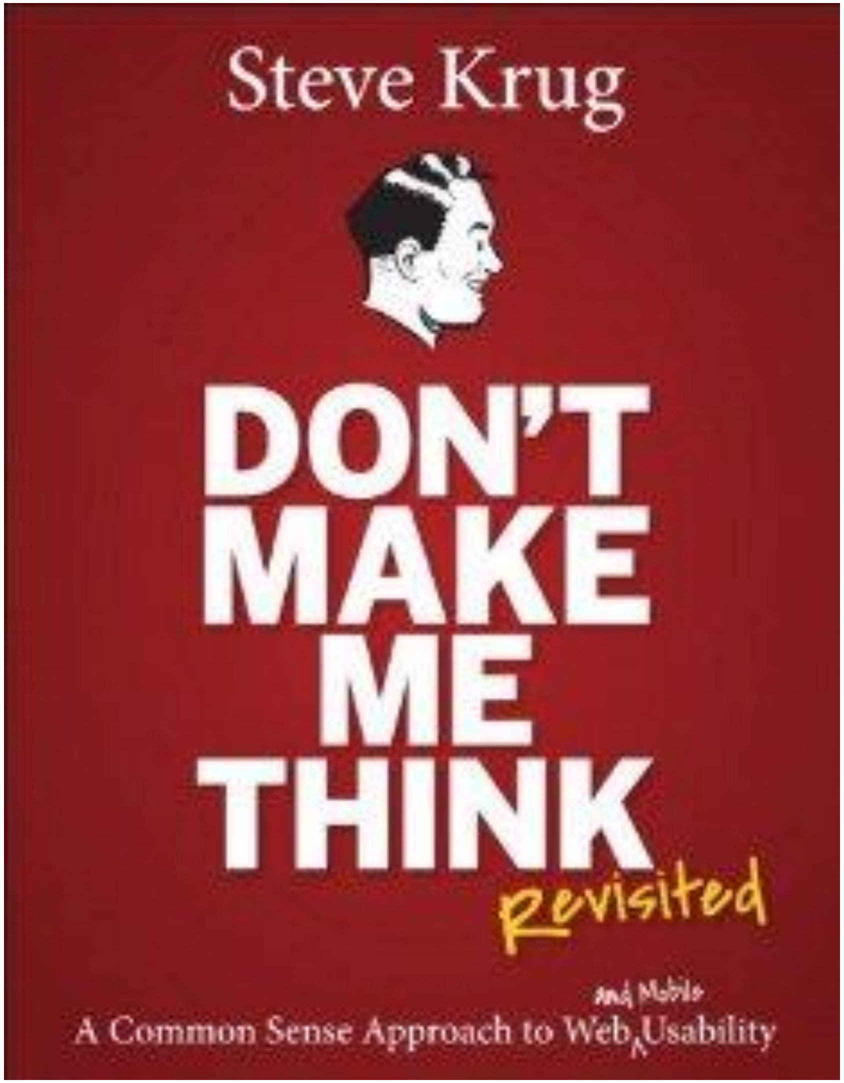
And finally..



- ONE SINGLE interaction point


User experience
Design


REVISED & EXPANDED EDITION
The DESIGN of EVERYDAY THINGS
DON NORMAN


Steve Krug
DON'T MAKE ME THINK
revisited
A Common Sense Approach to Web and Mobile Usability

User centered design

- Context: mass market product

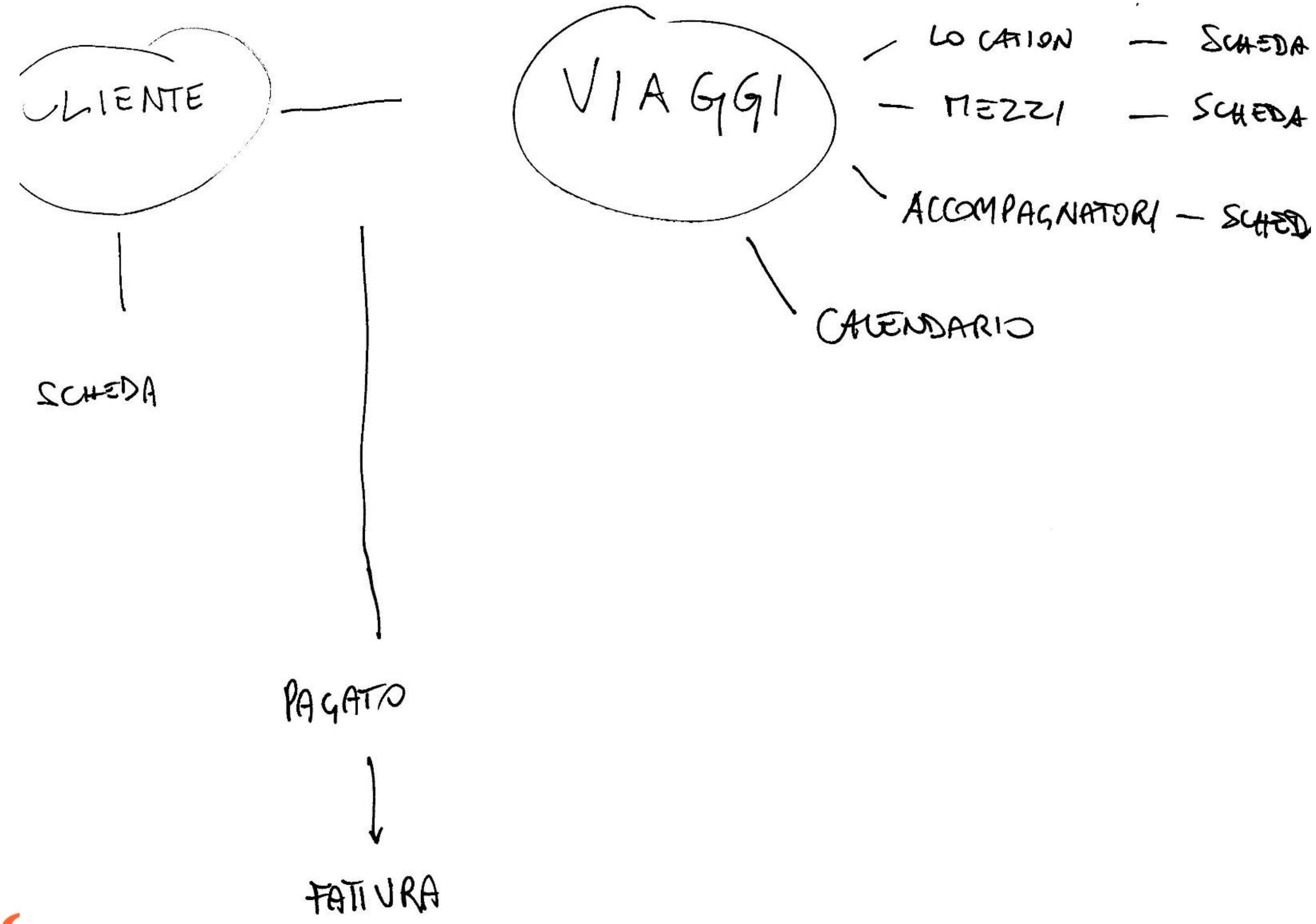
UCD process – techniques

Activity#	Activity	Techniques
1	Identify the users	Context diagram, personas / actors
2	Define requirements	Use cases, scenarios, functional requirements
3	Define system and interactions	Prototypes
4	In lab tests	Ethnographics, Interviews
5	In field tests	A/B testing Measurements

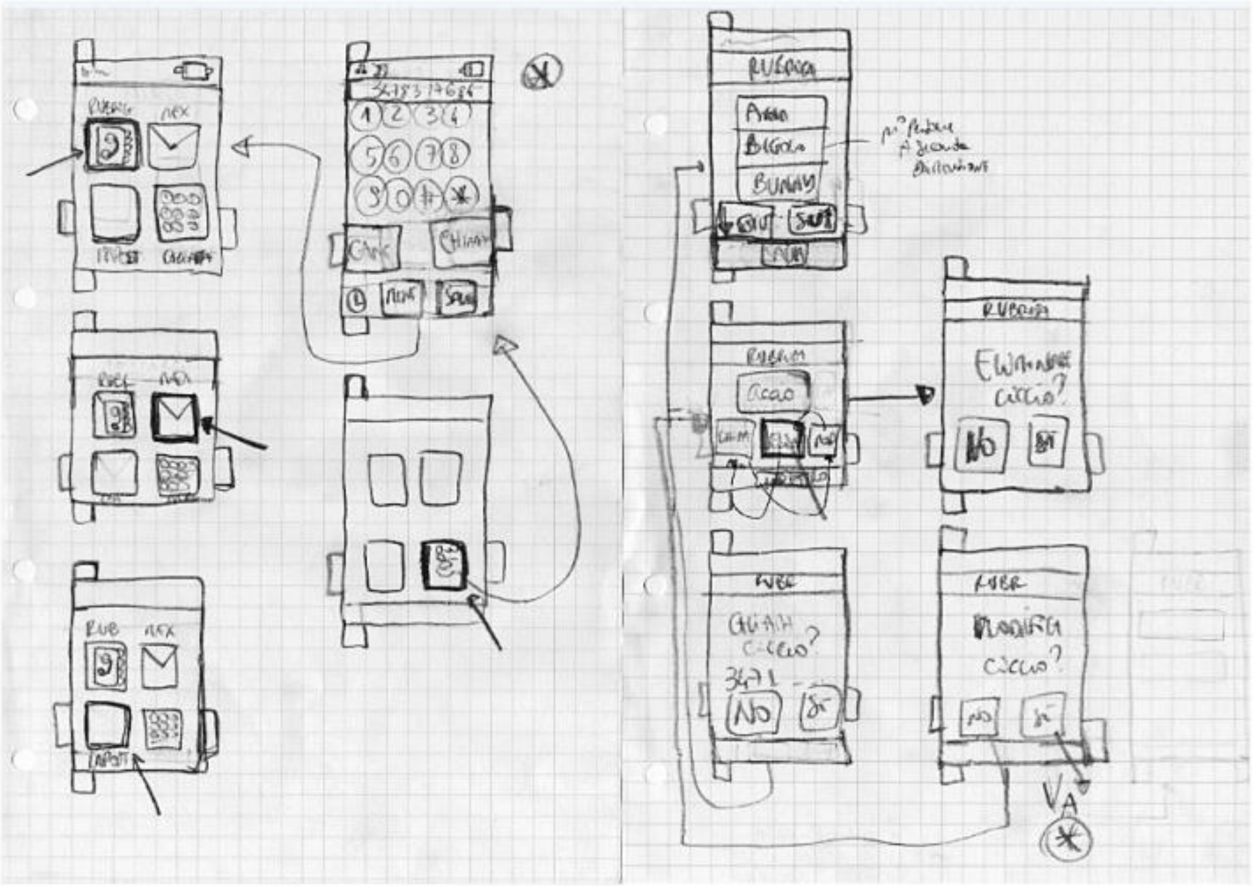
Prototypes

- Low fidelity
  - Paper / pencil, sketches, post its
- High fidelity
  - Computer executable mock ups
    - Aka Powerpoint
    - Aka Balsamiq
  - Actual GUIS
    - GUI Builders:
      - WindowBuilder (Eclipse, Java)
      - NetBeans Gui Builder (Net Beans)

Sketch


CLIENTE
SCHEDA
PAGATO
FATTURA
VIAGGI
LOCATION — SCHEDA
MEZZI — SCHEDA
ACCOMPAGNATORI — SCHED
CALENDARIO

Sketch / storyboard



Sketch

Feedback – low fi prototype

- Cognitive / ergonomy experts apply checklists / experience to identify possible issues

Feed back – hi fi prototype

- Selected users use the prototype in a lab
- Feedback via
  - Ethnographics
  - Interviews
  - Focus group

Ethnographics

- End users perform their usual activities, using prototype
- Researcher(s) observe(s) the behaviour of end users, and especially interaction with prototype
  - Researcher tries to be invisible as much as possible to avoid modify behaviour of users

Interviews

- End users use prototype
- After use, (a subset of users) is interviewed
  - Interview = set of predefined questions, with open or closed answers, about the prototype

  - Ex: questionnaire at end of Polito course

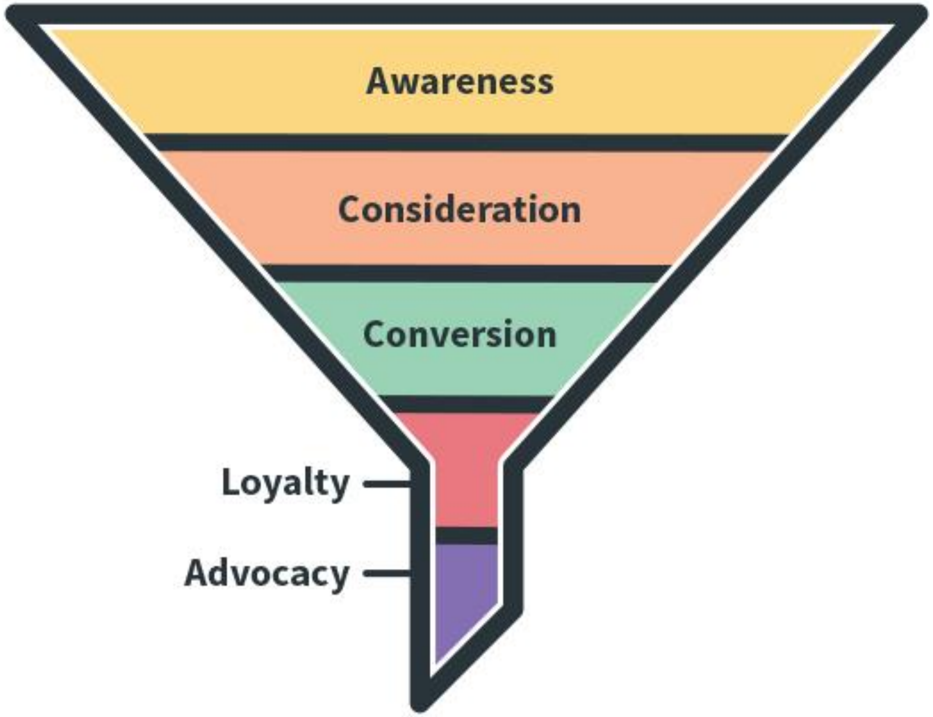
Focus group

- Users use prototype
- After use, they gather in a meeting, lead by a moderator
- Moderator invites users to express their opinions, ideas, suggestions
- Scribe takes notes, moderator draws conclusions

Feedback, final system

- Define and collect measures about
  - Usage of system (time spent on different pages / part of pages, errors)
  - Effect of system, conversion rate (ex rate from browse to purchase)

Marketing funnel

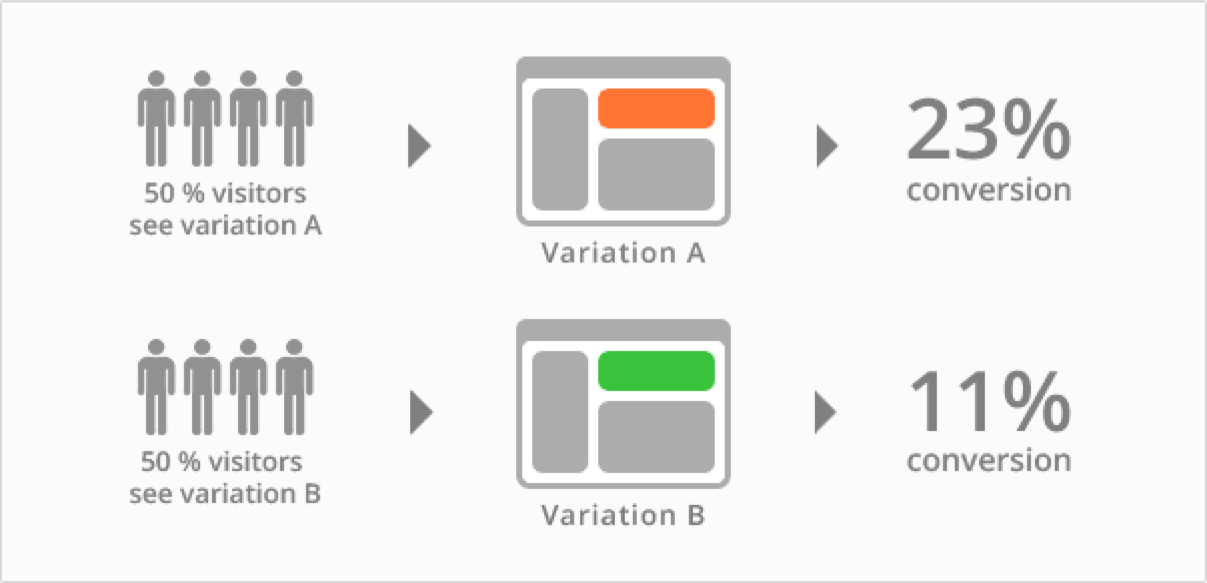


Conversion rate

- In general
  - From awareness of product / service
  - To customers purchasing
- On ecommerce website
  - From number of landing on web page per day by unique visitors
  - To number of purchases

Feedback

- A/B test

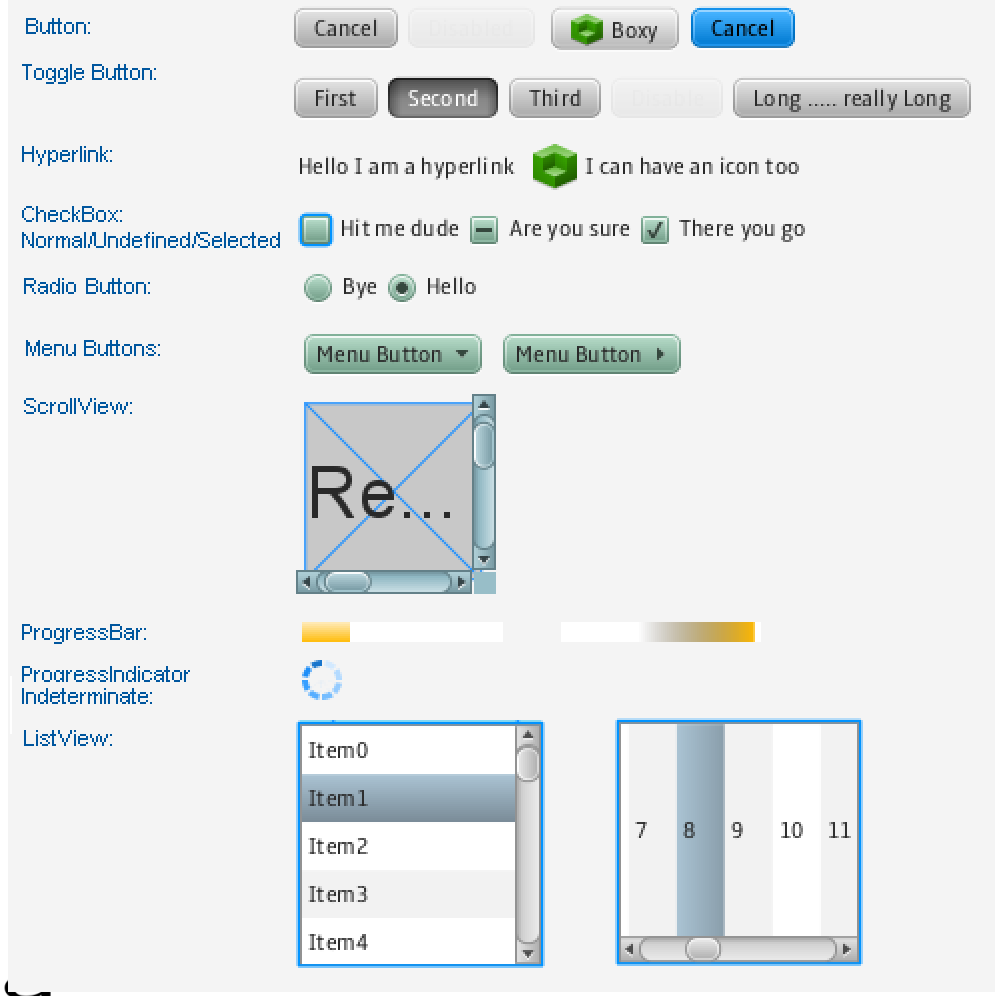


Designing the GUI

- Technical elements
- Usability guidelines

Technical elements

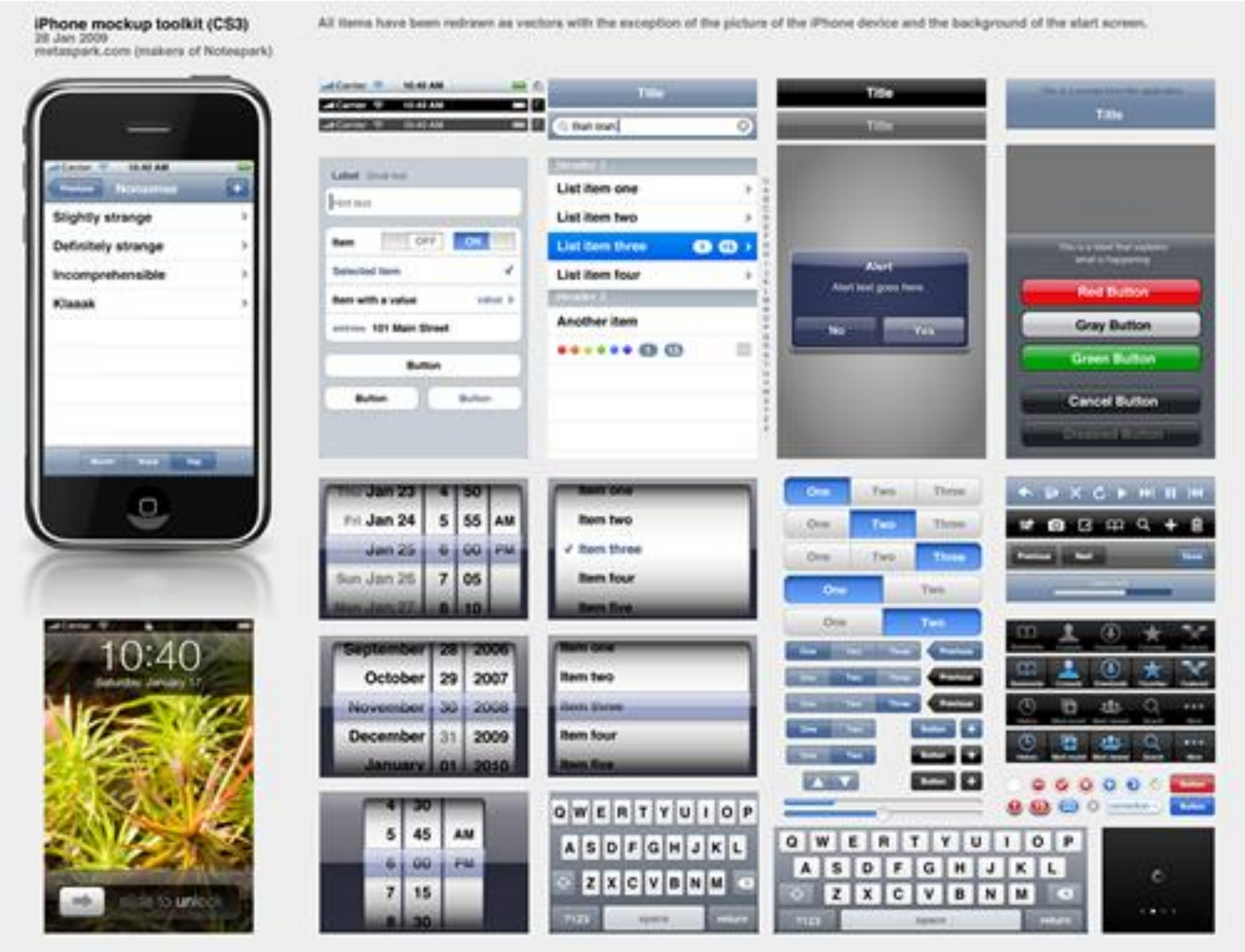
Java


Button:
Cancel
Disabled
Boxy
Cancel
Toggle Button:
First
Second
Third
Disable
Long ..... really Long
Hyperlink:
Hello I am a hyperlink
I can have an icon too
CheckBox:
Normal/Undefined/Selected
□ Hit me dude
Are you sure
☑ There you go
Radio Button:
○ Bye
● Hello
Menu Buttons:
Menu Button
Menu Button
ScrollView:
Re...
ProgressBar:
ProgressIndicator
Indeterminate:
ListView:
Item0
Item1
Item2
Item3
Item4
7
8
9
10
11

Android

Widget
320 x 100
4 x 1
Widget
160 x 200
2 x 2
Widget
80 x 100
1 x 1
Widget
240 x 300
3 x 3
Menu List
List w/ Arrow
List w/ Item
List w/ Bottom
Checkbox Active
Checkbox
Radio Active
Radio
Spinner Selector
Input Box
Active Input Box
Button
Cancel
Portrait
9:38 AM
Landscape
9:38 AM
marlin mobile
user experience / performance / optimization
Android 1.6 UX Stencil
Created by: Marlin Mobile
Follow us on Twitter @MarlinUX
Version 1.1

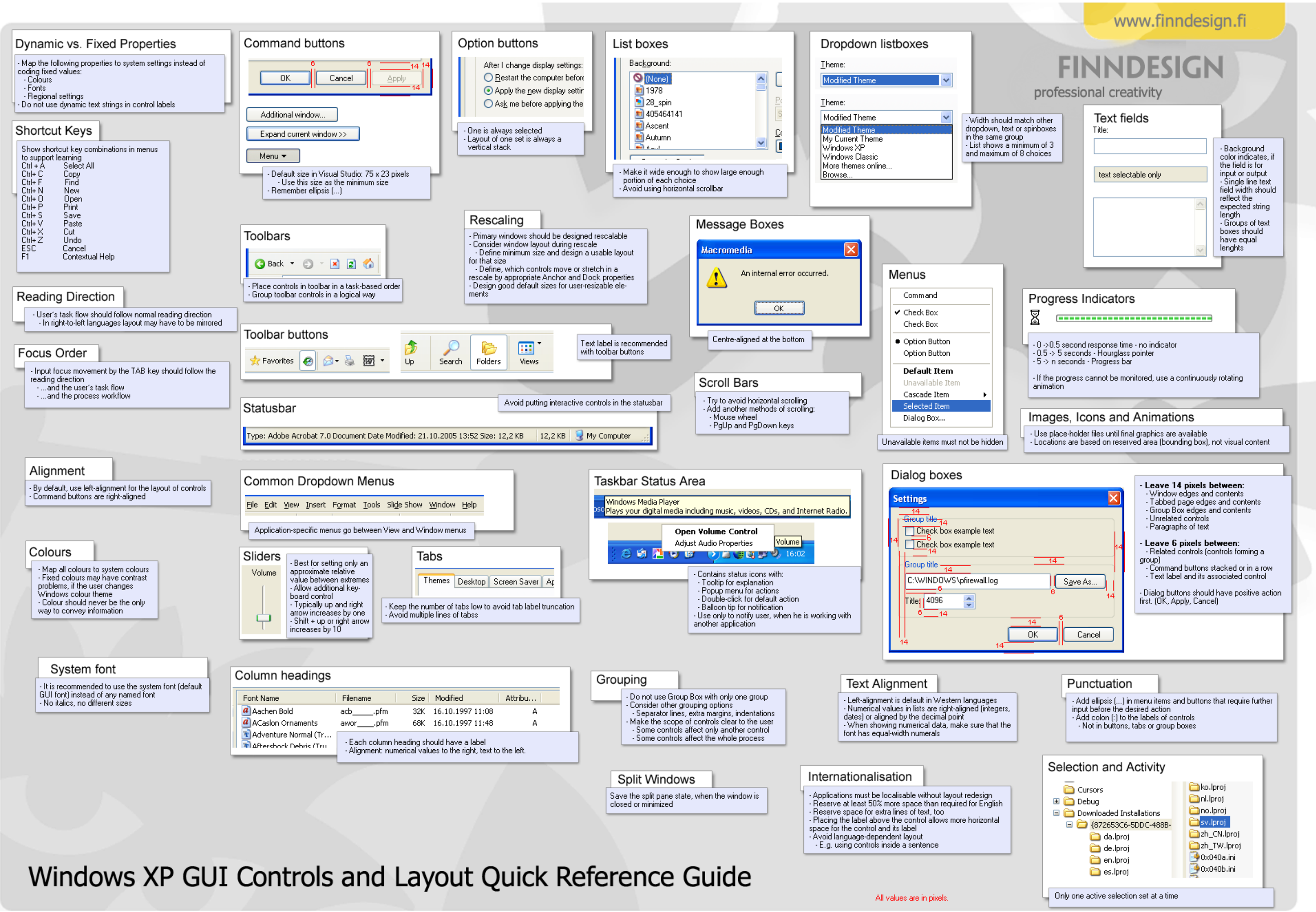
IOS



iPhone mockup toolkit (CS3)
28 Jan 2009
metaspark.com (makers of Notespark)

All items have been redrawn as vectors with the exception of the picture of the iPhone device and the background of the start screen.

Windows



Dynamic vs. Fixed Properties

- Map the following properties to system settings instead of coding fixed values:
  - Colours
  - Fonts
  - Regional settings
- Do not use dynamic text strings in control labels

Shortcut Keys

Show shortcut key combinations in menus to support learning

Ctrl + A	Select All
Ctrl+ C	Copy
Ctrl+ F	Find
Ctrl+ N	New
Ctrl+ O	Open
Ctrl+ P	Print
Ctrl+ S	Save
Ctrl+ V	Paste
Ctrl+ X	Cut
Ctrl+ Z	Undo
ESC	Cancel
F1	Contextual Help

Reading Direction

- User's task flow should follow normal reading direction
  - In right-to-left languages layout may have to be mirrored

Focus Order

- Input focus movement by the TAB key should follow the reading direction
  - ...and the user's task flow
  - ...and the process workflow

Alignment

- By default, use left-alignment for the layout of controls
- Command buttons are right-aligned

Colours

- Map all colours to system colours
- Fixed colours may have contrast problems, if the user changes Windows colour theme
- Colour should never be the only way to convey information

System font

- It is recommended to use the system font (default GUI font) instead of any named font
- No italics, no different sizes

Command buttons

- Default size in Visual Studio: 75 x 23 pixels
  - Use this size as the minimum size
- Remember ellipsis (...)

Toolbars

- Place controls in toolbar in a task-based order
- Group toolbar controls in a logical way

Toolbar buttons

Text label is recommended with toolbar buttons

Statusbar

Type: Adobe Acrobat 7.0 Document Date Modified: 21.10.2005 13:52 Size: 12,2 KB | 12,2 KB | My Computer

Avoid putting interactive controls in the statusbar

Common Dropdown Menus

Application-specific menus go between View and Window menus

Sliders

- Best for setting only an approximate relative value between extremes
- Allow additional keyboard control
- Typically up and right arrow increases by one
- Shift + up or right arrow increases by 10

Tabs

- Keep the number of tabs low to avoid tab label truncation
- Avoid multiple lines of tabss

Column headings

Font Name	Filename	Size	Modified	Attribu...
Aachen Bold	acb_____.pfm	32K	16.10.1997 11:08	A
ACaslon Ornaments	awor____.pfm	68K	16.10.1997 11:48	A
Adventure Normal (Tr...				
Aftershock Debris (Tru				

- Each column heading should have a label
- Alignment: numerical values to the right, text to the left.

Option buttons

- One is always selected
- Layout of one set is always a vertical stack

Rescaling

- Primary windows should be designed rescalable
- Consider window layout during rescale
  - Define minimum size and design a usable layout for that size
  - Define, which controls move or stretch in a rescale by appropriate Anchor and Dock properties
- Design good default sizes for user-resizable elements

List boxes

- Make it wide enough to show large enough portion of each choice
- Avoid using horizontal scrollbar

Message Boxes

An internal error occurred.

Centre-aligned at the bottom

Scroll Bars

- Try to avoid horizontal scrolling
- Add another methods of scrolling:
  - Mouse wheel
  - PgUp and PgDown keys

Taskbar Status Area

Windows Media Player
Plays your digital media including music, videos, CDs, and Internet Radio.

- Contains status icons with:
  - Tooltip for explanation
  - Popup menu for actions
  - Double-click for default action
  - Balloon tip for notification
- Use only to notify user, when he is working with another application

Grouping

- Do not use Group Box with only one group
- Consider other grouping options
  - Separator lines, extra margins, indentations
- Make the scope of controls clear to the user
  - Some controls affect only another control
  - Some controls affect the whole process

Split Windows

Save the split pane state, when the window is closed or minimized

Dropdown listboxes

- Width should match other dropdown, text or spinboxes in the same group
- List shows a minimum of 3 and maximum of 8 choices

Menus

Unavailable items must not be hidden

Text fields

- Background color indicates, if the field is for input or output
- Single line text field width should reflect the expected string length
- Groups of text boxes should have equal lenghts

Progress Indicators

- 0 ->0.5 second response time - no indicator
- 0.5 -> 5 seconds - Hourglass pointer
- 5 -> n seconds - Progress bar

- If the progress cannot be monitored, use a continuously rotating animation

Images, Icons and Animations

- Use place-holder files until final graphics are available
- Locations are based on reserved area (bounding box), not visual content

Dialog boxes

C:\WINDOWS\pfirewall.log

- **Leave 14 pixels between:**
  - Window edges and contents
  - Tabbed page edges and contents
  - Group Box edges and contents
  - Unrelated controls
  - Paragraphs of text
- **Leave 6 pixels between:**
  - Related controls (controls forming a group)
  - Command buttons stacked or in a row
  - Text label and its associated control
- Dialog buttons should have positive action first. (OK, Apply, Cancel)

Text Alignment

- Left-alignment is default in Western languages
- Numerical values in lists are right-aligned (integers, dates) or aligned by the decimal point
- When showing numerical data, make sure that the font has equal-width numerals

Internationalisation

- Applications must be localisable without layout redesign
- Reserve at least 50% more space than required for English
- Reserve space for extra lines of text, too
- Placing the label above the control allows more horizontal space for the control and its label
- Avoid language-dependent layout
  - E.g. using controls inside a sentence

Punctuation

- Add ellipsis (...) in menu items and buttons that require further input before the desired action
- Add colon (:) to the labels of controls
  - Not in buttons, tabs or group boxes

Selection and Activity

Only one active selection set at a time

Windows XP GUI Controls and Layout Quick Reference Guide

All values are in pixels.

Issue

- Portability of the GUI
  - Redevelop GUI for each environment
  - Cross platform compilers
    - Ex Xamarin, Cordova, Flutter, ..
  - Cross platform GUI
    - Browser

Usability guidelines

- Have same style and format in all pages
- Do not ask same info twice
- Give feedback
    - When button clicked, when text inserted, when processing
- Make interactive objects obvious
    - Large buttons, blinking, ..

Usability guidelines

- Consider default values in input fields
- Clear success / error messages
- Show clearly navigation hierarchy
  - Use breadcrump trails

Usability guidelines

- Simplicity /readability
  - Min number of pages
  - Min number of colors / fonts
  - Font min size
  - N elements in page
  - N pages
- Use conventions
  - Logo at top left
  - Click on logo brings to home
  - Links change color when mouse hovers
  - Next / back always in the same place

Summary

- In mass market products User interaction is key
- User centered design
  - Focuses on user feedback
  - Using several techniques in a defined process
- Key message: UI design must be validated with users
  - Never assume you did it right