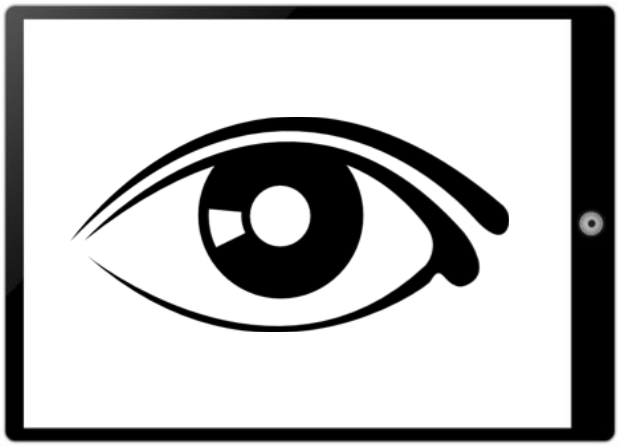
HUMAN-MACHINE INTERACTION (HMI)

Seminars

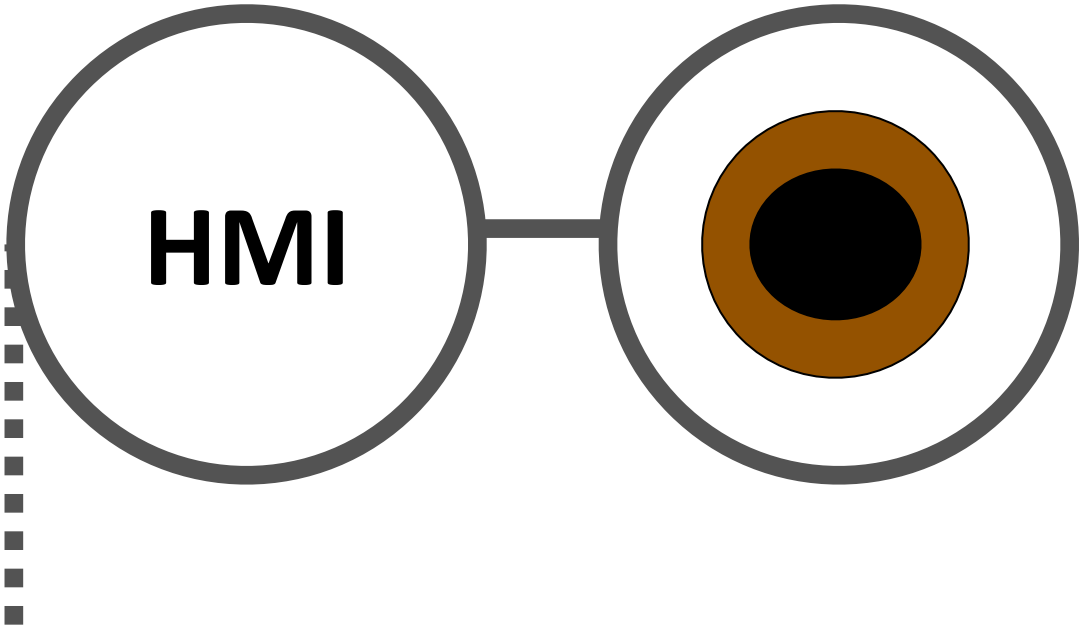
Lecturer and assistant

Rosella Gennari

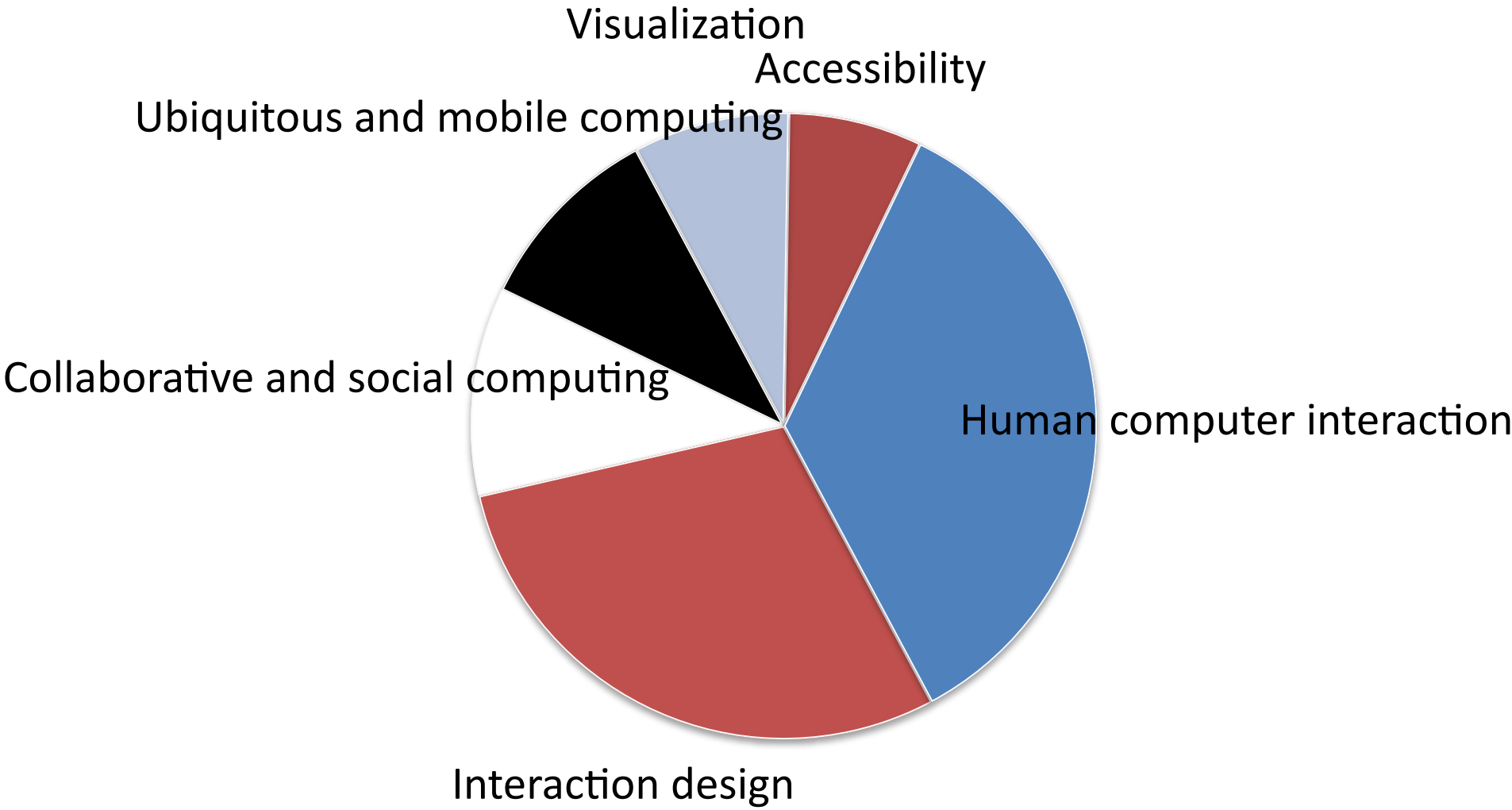
www.inf.unibz.it/~gennari/shmi.html



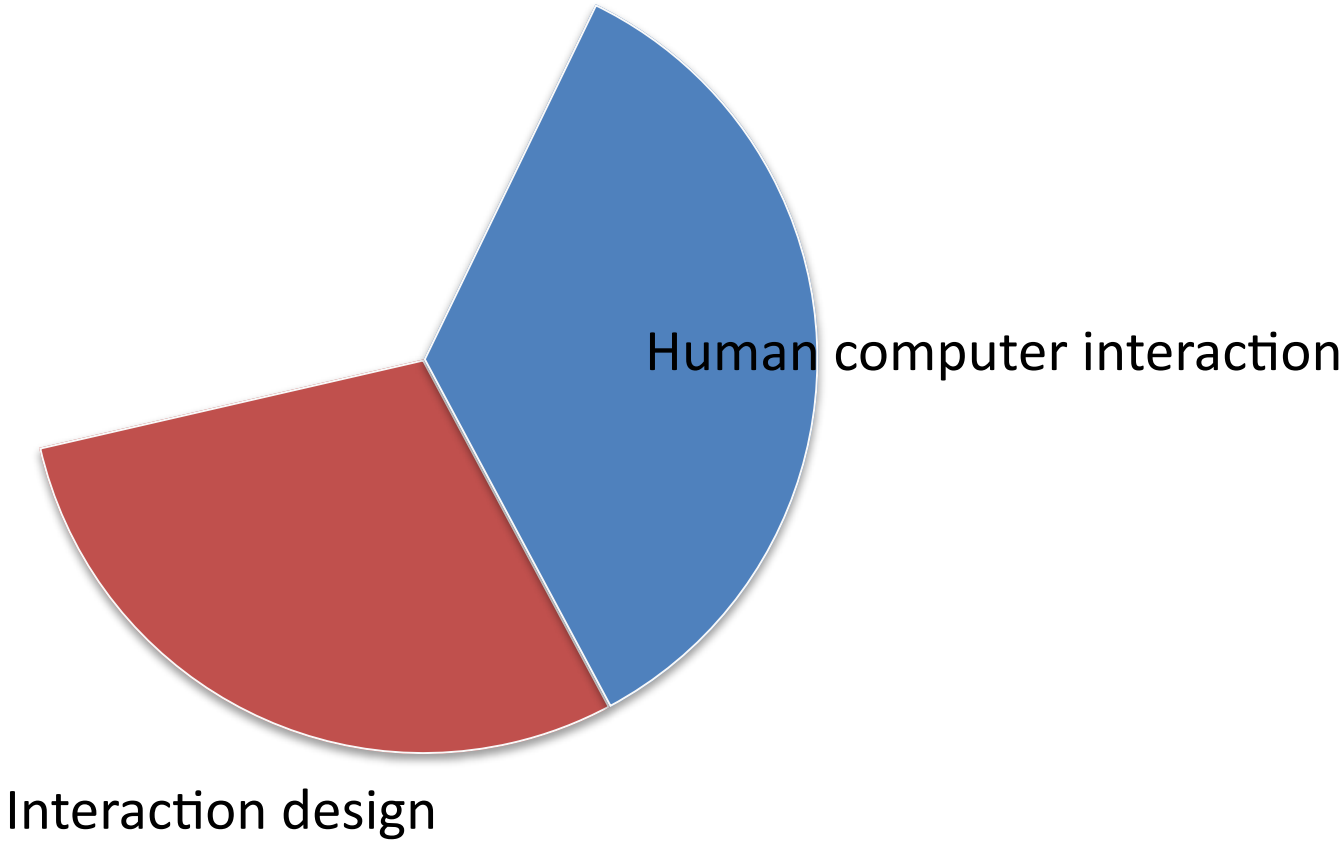
COURSE VIEW ON



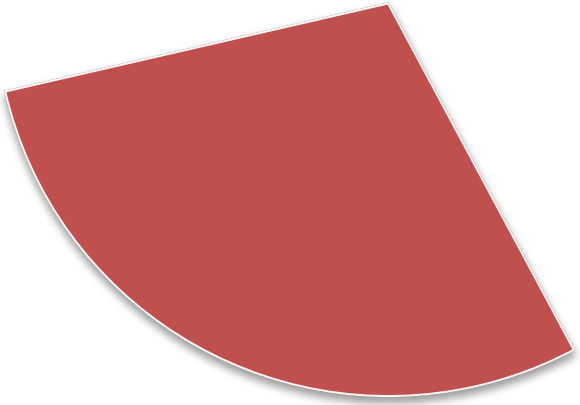
LARGER VIEW: HUMAN CENTRED COMPUTING



THE VIEW IN THIS COURSE



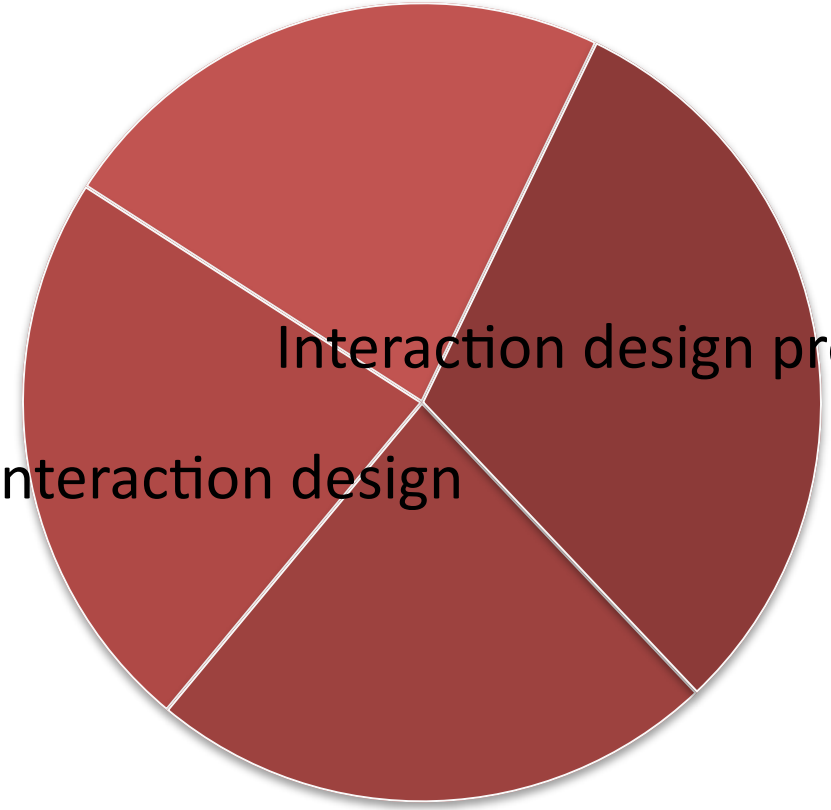
SPECIFIC VIEW: INTERACTION DESIGN



Interaction design

SPECIFIC VIEW: INTERACTION DESIGN

Systems and tools for interaction design

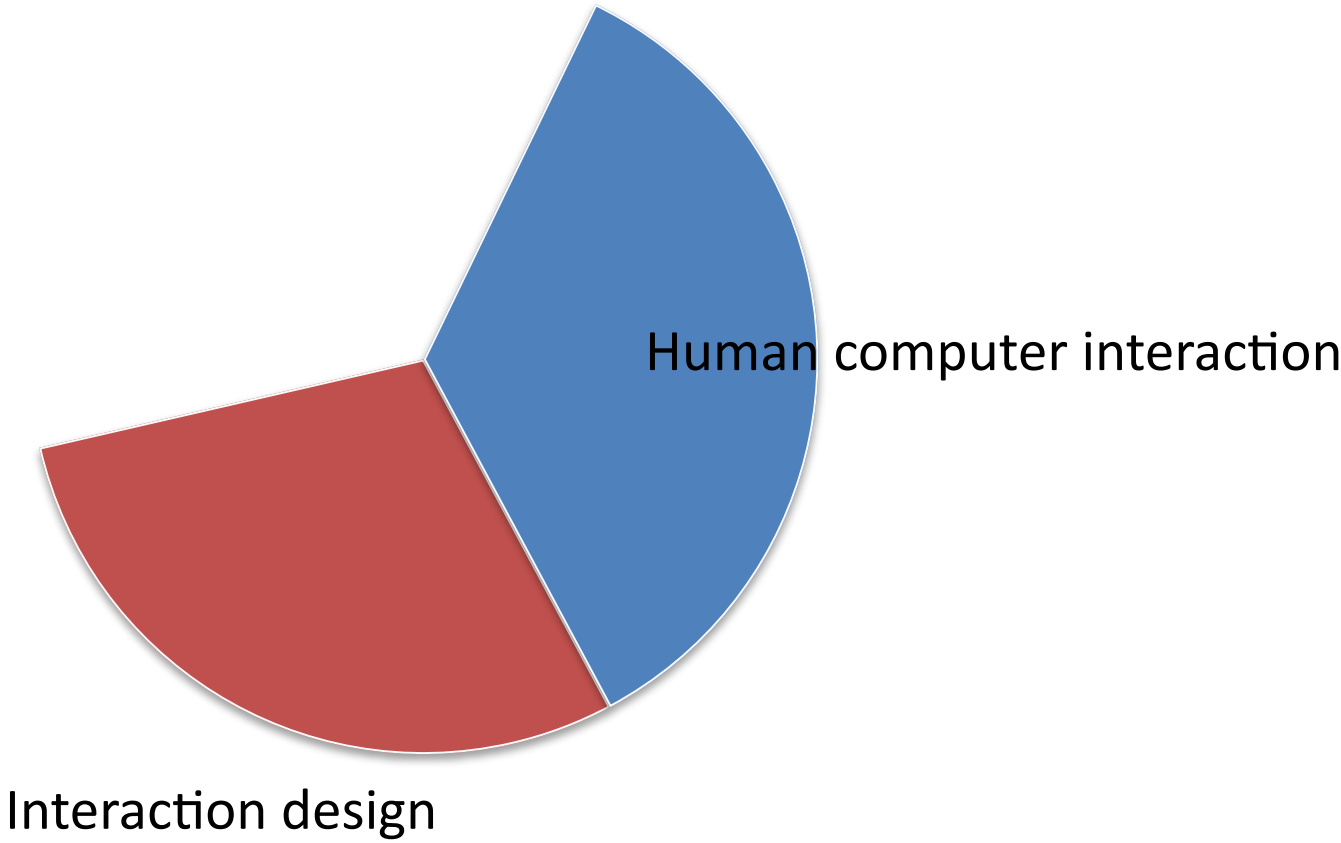


Interaction design process and methods

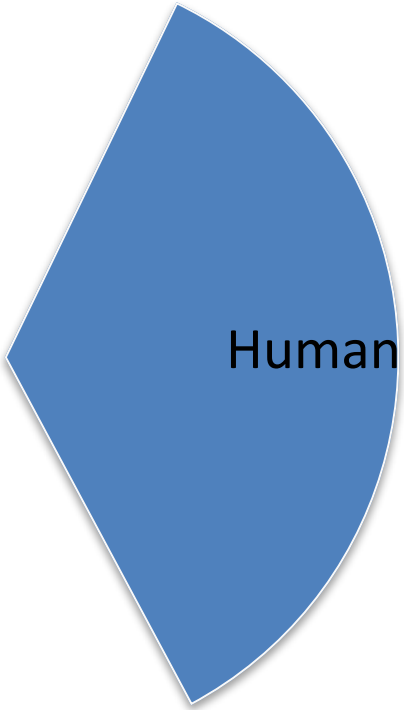
Empirical studies in interaction design

Interaction design theory, concepts and paradigms

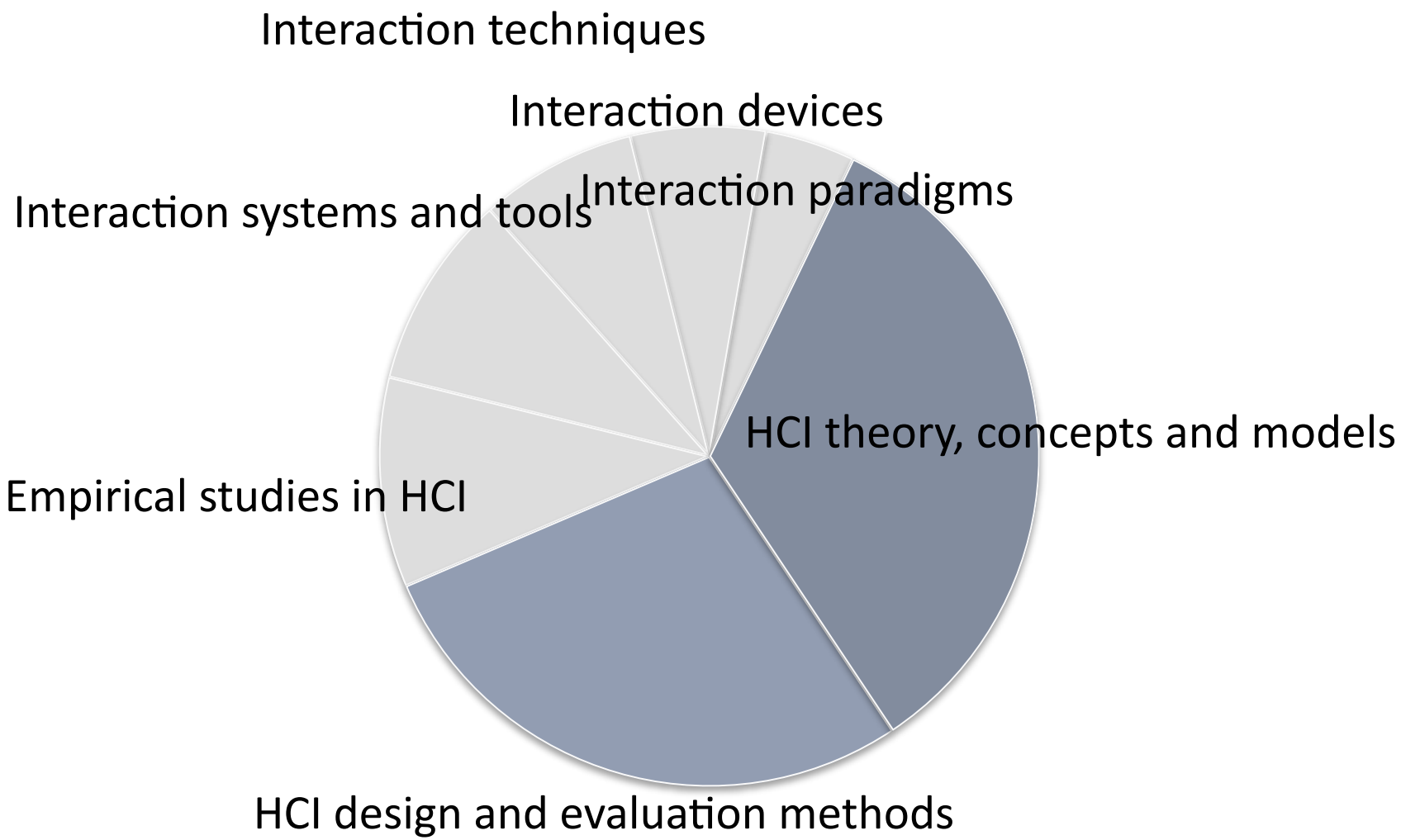
SPECIFIC VIEW: HUMAN COMPUTER INTERACTION



SPECIFIC VIEW: HUMAN COMPUTER INTERACTION



SPECIFIC VIEW: HUMAN COMPUTER INTERACTION



WHY DO WE NEED HMI?

USABILITY

USER EXPERIENCE

https://www.youtube.com/watch?v=PJ1O4sVICrY

HMI LEADING IDEAS

- context

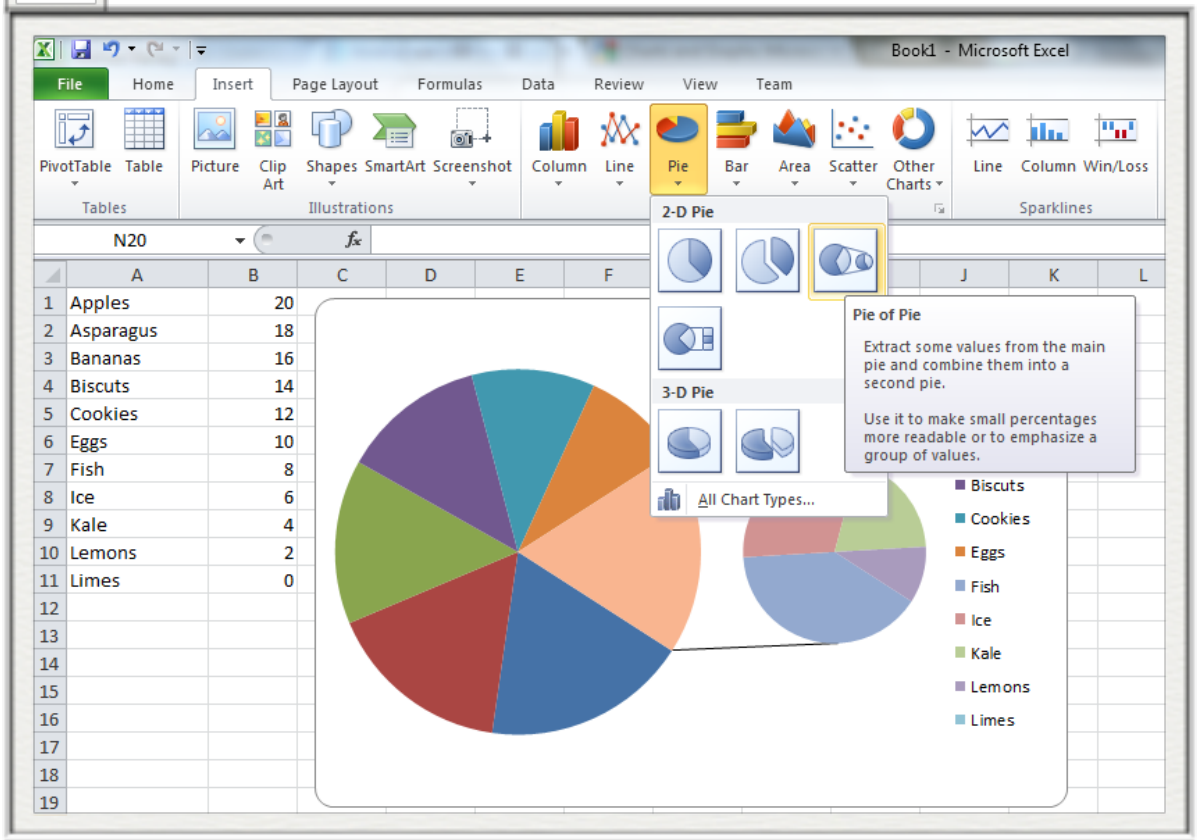
HMI design vs SW engineering

Wall-E / HMI

Eve / software

Once upon a time…

pc



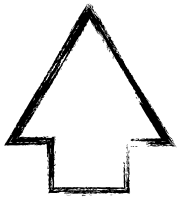
No **app** version of excel can **create pie charts** as simply as a pc excel!

Eve takes up the challenge: she wishes to develop a prototype of such an **app**…

And now…

…what will Wall-E recommend Eve?

"How can I create an interactive product that people will be **able** and **willing** to use?"

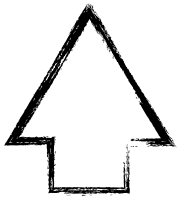


"Employ HMI experts: HMI is the science and craft of designing a **usable** interactive product that enhances the **experience** of people who use it in a given environment, for a given goal"

And now…

…what will Wall-E answer Eve?

"Why should I know the `people', environment and people's goal for the product?!"



"That is the **context of use** of the product—its potential users, their goal and tasks with the product and environment in which they will use it. Let me show why the context matters in designing interactive products…"

Everyday life

- Healthcare:
- Traffic
- **Everyday life**

…for **people**

Everyday life

- Healthcare:
- Traffic
- **Everyday life**

…for **people**

Everyday life

- Healthcare:
- Traffic
- **Everyday life**

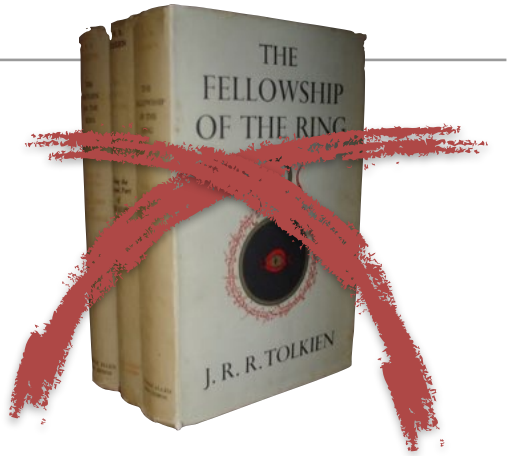
…in a given
environment

Everyday life

- Healthcare:
- Traffic
- **Everyday life**

…in a given **environment**

Everyday life



- Healthcare:
- Traffic
- **Everyday life**

…for a given
goal

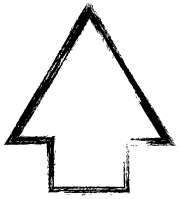
HMI LEADING IDEAS

- context
- design

And now…

…what will Wall-E tell Eve?

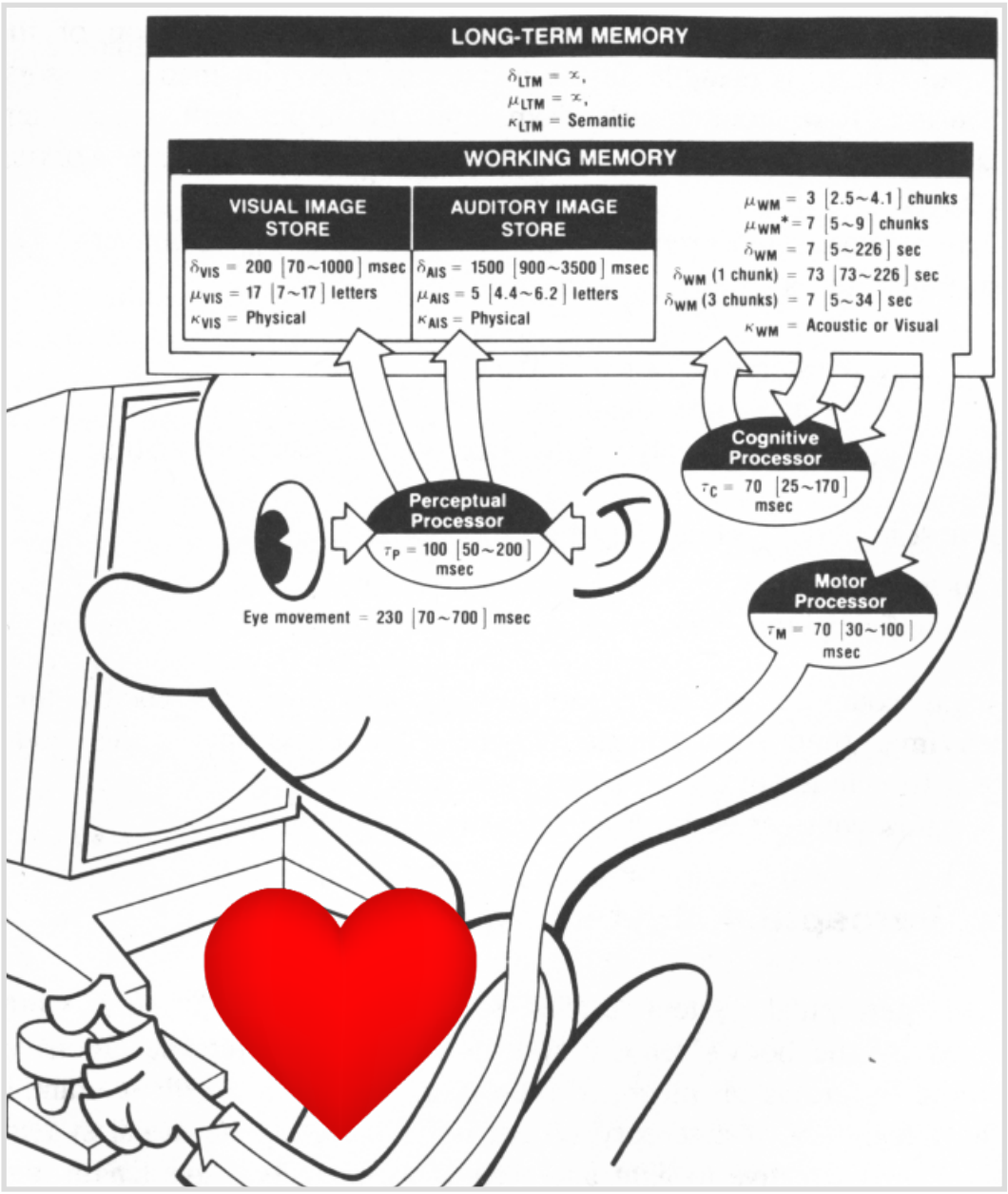
"I have got the context, and now let's design…"



"Hold on! We have to adhere to **design** and **prototyping principles, patterns and models…** and what motivates them"

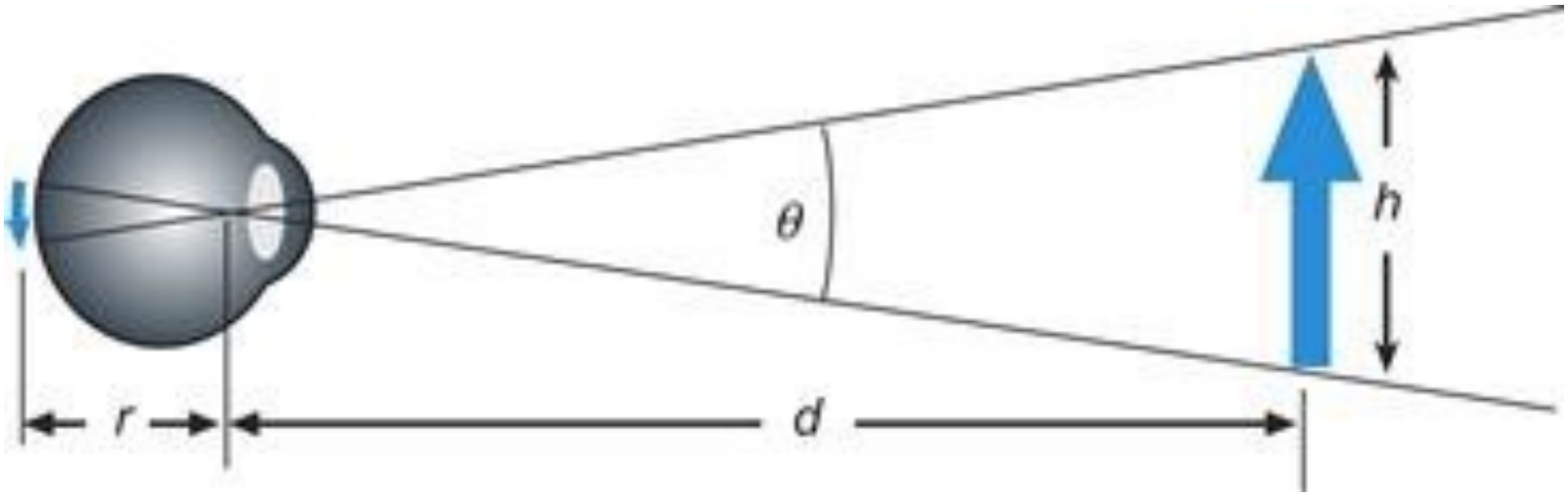
Design takes brains, senses and motors!

HMI **design** is rooted in psychology of interaction



Why psychology of interaction matters

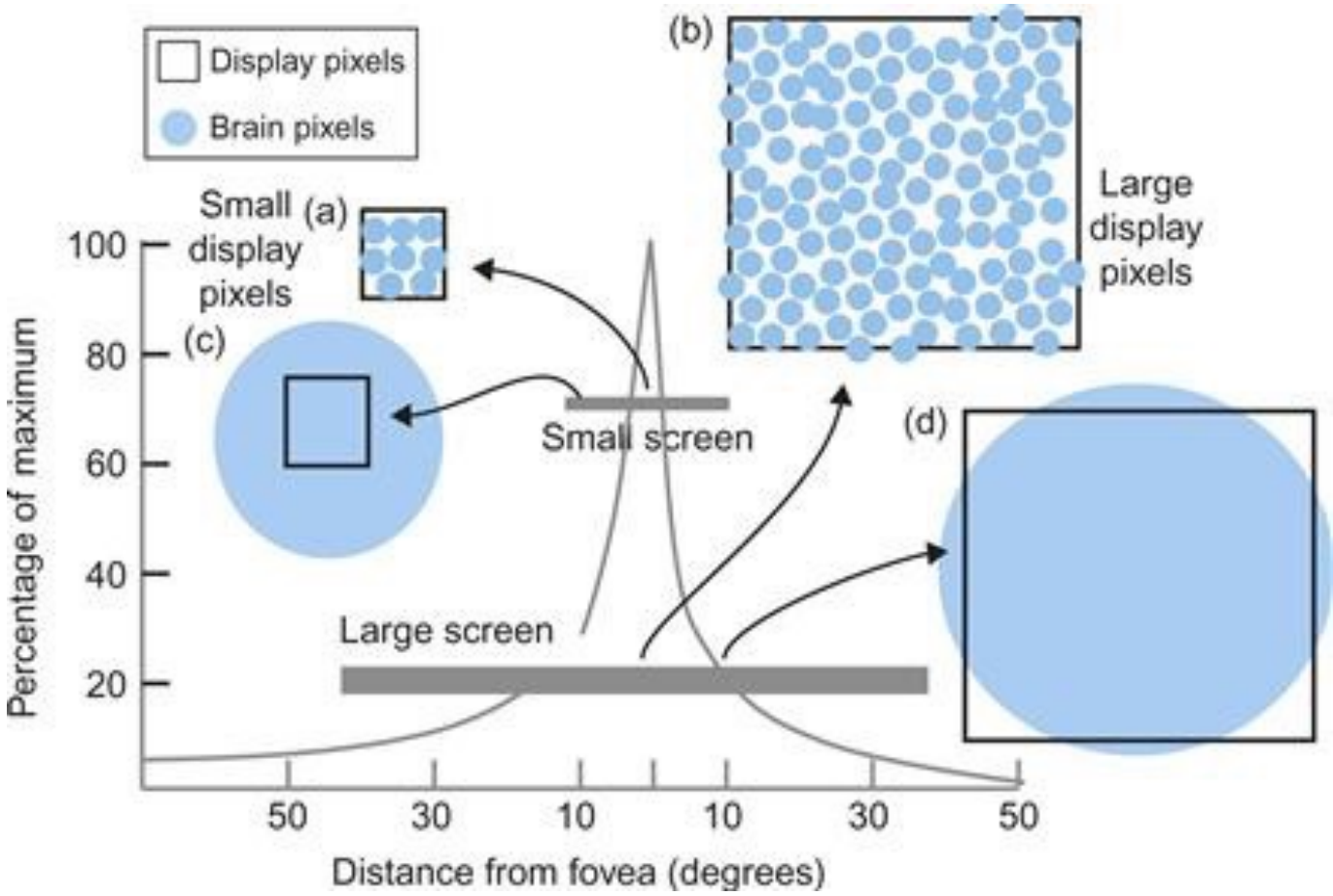
$d = h / 2 \tan(\vartheta/2)$



Position your screen accordingly!

From Ware, C. (2012). Information Visualization, 3rd Edition

Why psychology of interaction matters



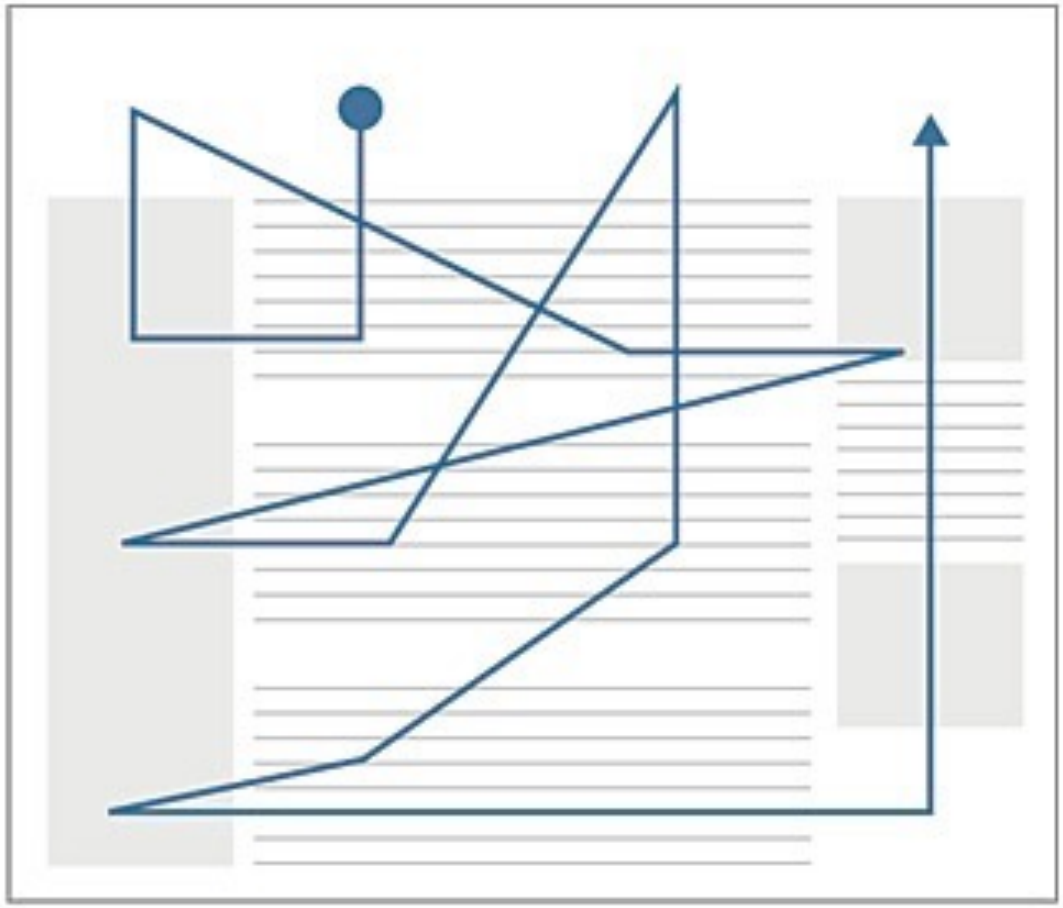
Plan information for different screens accordingly!

From Ware, C. (2012). Information Visualization, 3rd Edition

Why psychology of interaction matters

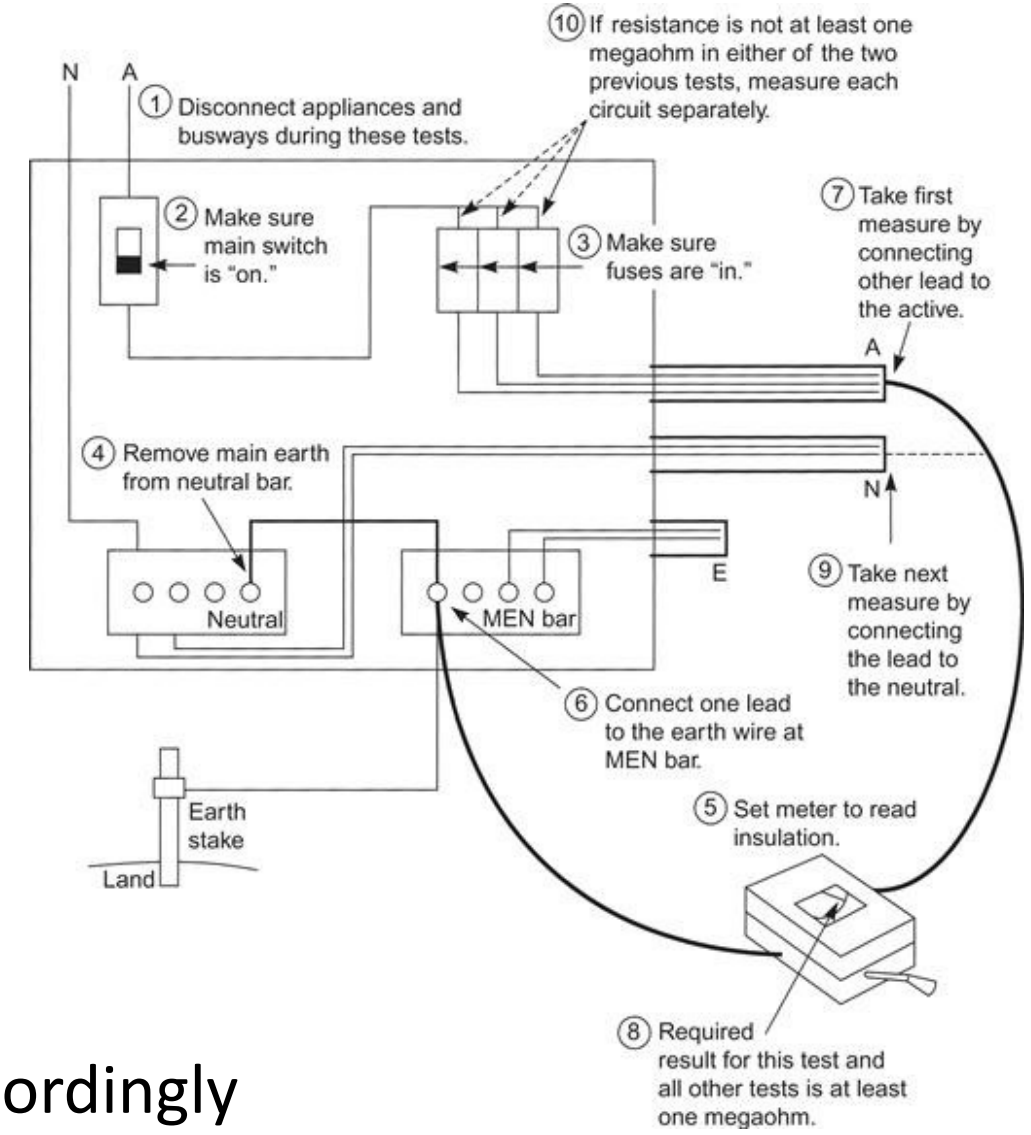
Visitors start their scanning fixing the upper left of the page and moving eyes as indicated

Position your website logo accordingly!



Why psychology of interaction matters

When textual information is integrated in diagrams there is a reduced need to store information temporarily for processing it



Draw your diagram accordingly

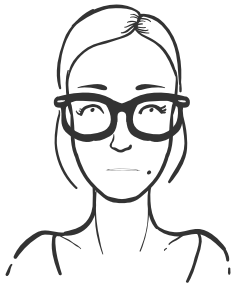
From Ware, C. (2012). Information Visualization, 3rd Edition

HMI LEADING IDEAS

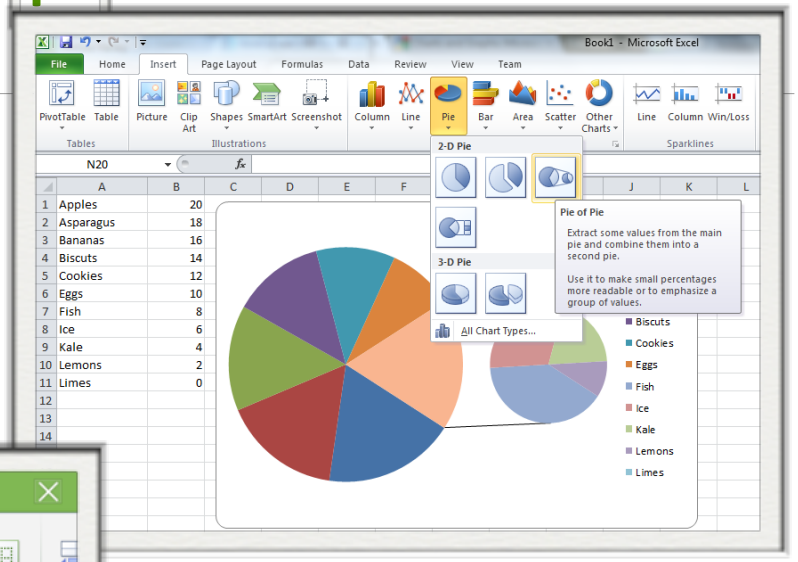
- context
- design
- evaluation

And now Eve wonders…

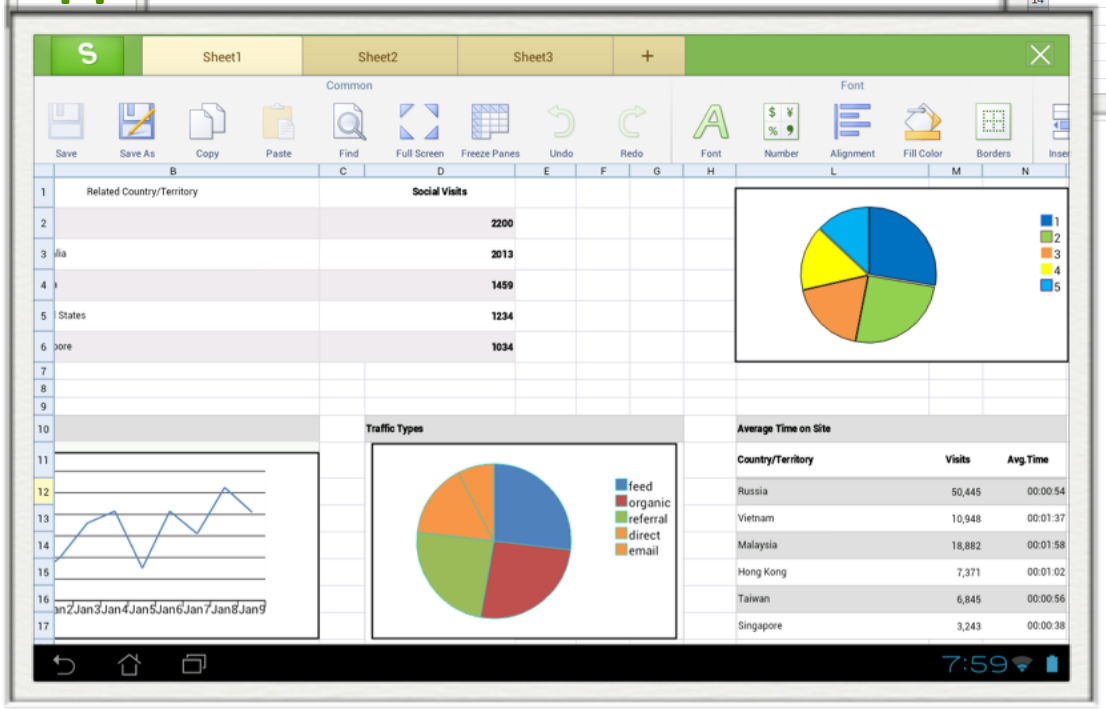
"Got a first prototype app. How can I assess its **usability**?"



pc



app



Wall-E answers:
"Test if **users** **succeed** in creating **pie-charts** on **tablets**"

In simple words…

Eve app is usable if:

the **usability** of an interactive product	**success** of
for **people** that use it	**app users**
for a given **goal**	in creating **pie-charts**
in a given **environment**	on **tablets**

Traditional usability evaluation

the **usability** of an interactive product
for **people** that use it
for a given **goal**
in a given **environment**

Is that all?

No: usability as user performance means, traditionally,

the product is **effective** to use, **efficient** to use, **safe** to use, **easy to learn,** with easy to **remember** functionalities

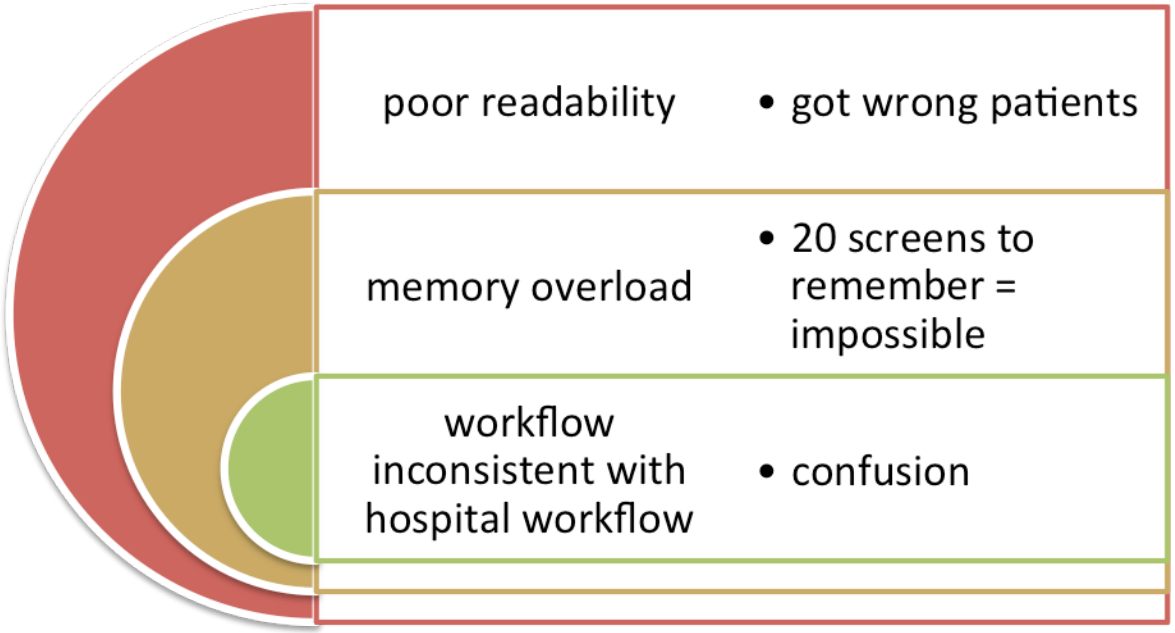
Usability as performance

Which is the more usable product?

See http://www.nngroup.com/articles/usability-101-introduction-to-usability/

A leap further: usability as qualitative issues

- **Healthcare (effectiveness & safety issues):**
  - Nielsen (2005) found 22 usability issues of automated hospital system, resulting into recommendations of wrong prescriptions (http://www.nngroup.com/articles/medical-usability/)



A bigger leap further: experience

- Nowadays HMI also evaluates the **user experience (UX)** with a product
  - "a person's **perceptions** and responses that result from the use or anticipated use of a product, system or service" (ISO 9241-210)
  - This kind of UX is often associated to flow, **emotions** and **aesthetics/beauty** (E.L.-C. et al., 2014)
  - and as such it may be difficult to generalise…

Experience “goals”

DESIRABLE ASPECTS

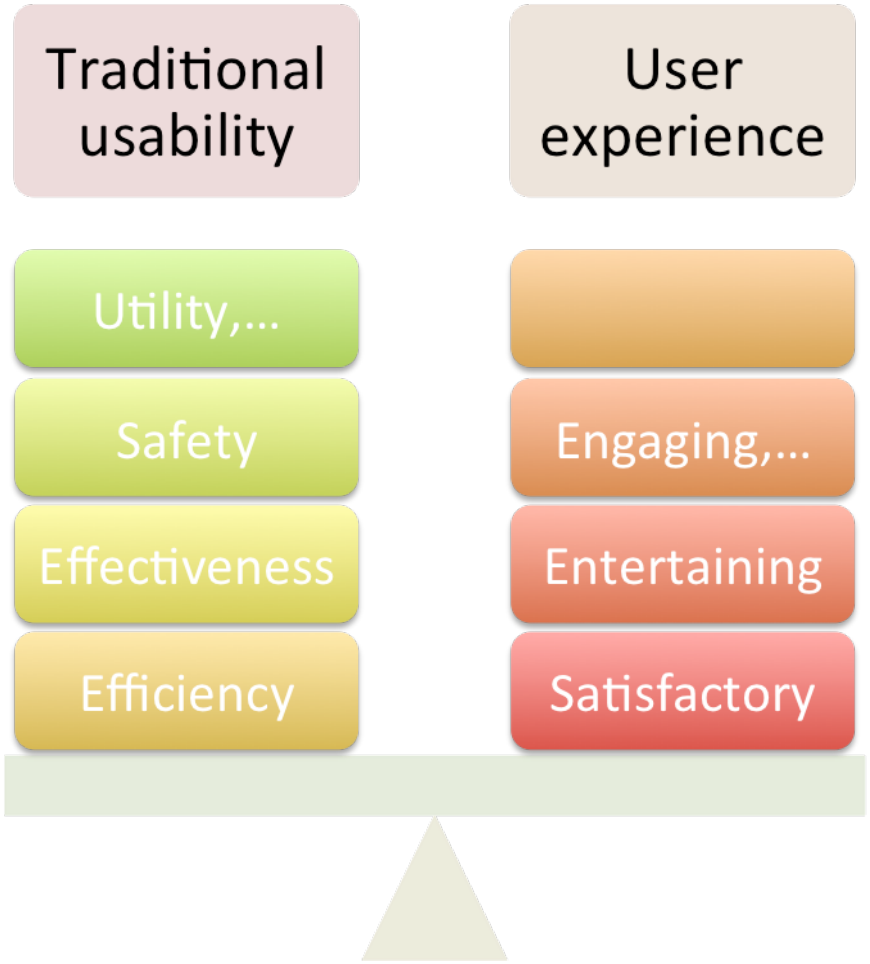
satisfying
enjoyable
engaging
pleasurable
exciting
cognitively stimulating
helpful
motivating
challenging
enhancing sociability
supporting creativity
fun
provocative
surprising
rewarding
emotionally fulfilling
entertaining

UNDESIRABLE ASPECTS

boring
frustrating
making one feel guilty
annoying
childish
unpleasant
patronizing
making one feel stupid
cutesy
gimmicky

It's a matter of balance

- How do usability goals **differ** from new user experience goals?
- Are there **trade-offs** between the two kinds of goals?
  - e.g., can a learning product be both effective and fun?
- How easy is it to **measure** usability versus user experience goals?



When the two meets…

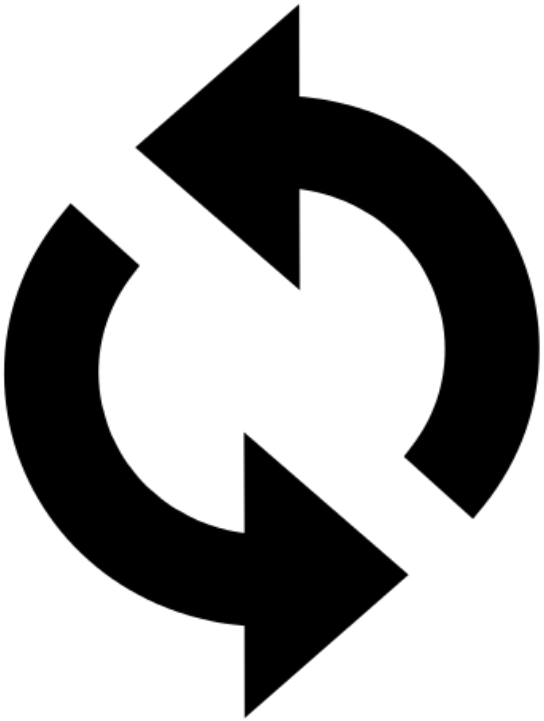
https://www.youtube.com/watch?v=PJ1O4sVICrY

The end?

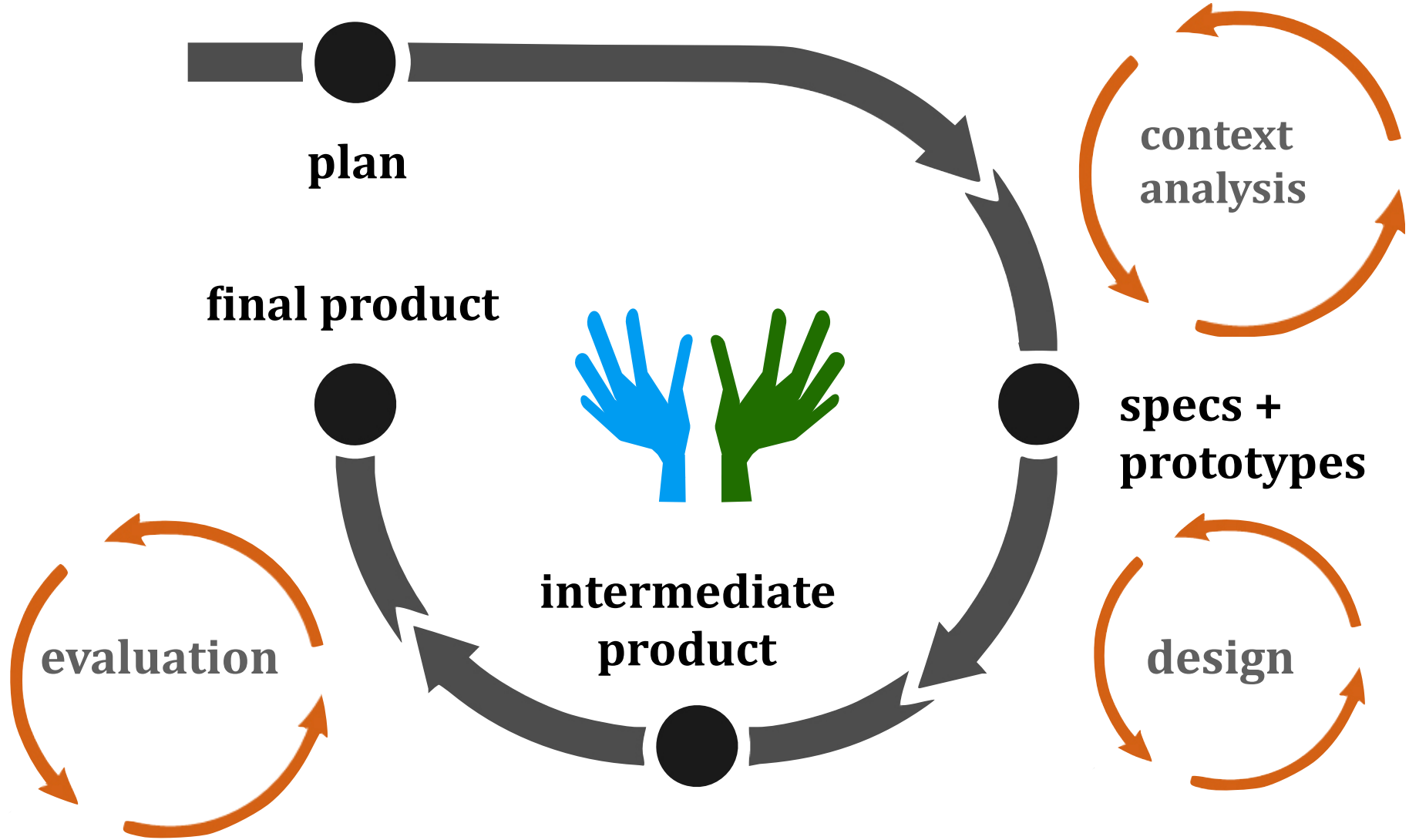
Thanks, now I now it will take time

Yap, it will take an entire course!

HMI STAGES AND COURSE STAGES



HMI stages and course plan



Based on UCD process diagram (© Tom Wellings)

COURSE PLAN: SPECS

- **Context** of use analysis: data gathering **methods**; data **models**
- **Design principles, patterns** and **models**, including task analysis for and from context scenarios
- **Prototyping** approaches
- **Evaluation** approaches, focussing on **small-scale** empirical studies for usability/user experience analysis
  - ➡ See also Research Methods
  - ➡ See also Statistical Methods
- HMI design **processes**

COURSE WEB PAGE AND RESOURCES

COURSE RESOURCES

Course web page:

- See http://www.inf.unibz.it/~gennari/shmi.html

Resources:

- **Slides** and material therein suggested
- **Textbooks:**
  - Designing for the Digital Age, Goodwin, A.
  - Measuring the User Experience, Tullis, T. & Albert, B.
- **Other books for selected material:**
  - See the above course web page

COURSE EDUCATIONAL CHOICES

- **Progression:** information is gradually presented, in chunks
- **Redundancy:** key information is redundantly presented
- **Multiple modalities**: slides mix text with lots of illustrations and examples; slides point to videos and articles; the course closely mixes practice (labs and verification questions) and theory (lectures)
- **Collaboration**: labs require group work

WHY?

COURSE EDUCATIONAL CHOICES

- **Progression**: to help you gain confidence
- **Redundancy**: to help you memorise information
- **Multiple modalities**: to adapt to your learning styles
- **Collaboration**: when you teach you learn best, when you learn you teach best…

COURSE LABS

- This year there are **8 labs**
- **Lab 1** is for ice-breaking and forming groups; **Lab 8** is for recapping or deepening specific subjects
- During **Labs 2—7**:
  - students work in **4-5 member teams** on the lab task;
  - each team hands in their resolution to a lab task **within 1 week from its assignment (strict)**, specifying **who has done what;**
  - each resolution is marked: 0.5 (passed)—0 (not passed);
  - each resolution comes with explanatory brief feedback.

FINAL WRITTEN EXAM

- The final written exam has:
  - verification questions, with points
  - transfer of knowledge questions and exercises, with points
- Without tackling tasks, you must gain ≥ **9 points** out of 12 to pass the final exam
- By passing lab tasks, you **can** have to gain ≥ **6 points** out of 12 to pass the final exam

OFFICE HOURS

- Time window: **Mon-Thu mornings** from 8:30 to 12:30
- Always **upon appointment**, better taken at the end of a lecture or lab (kindly, avoid email as much as possible; thank you)
- My office is at the 1st floor, right wing, Faculty of Computer Science, Piazza Domenicani 3, Bolzano

HMI: RELATIVES' VIEW

Image from: https://pixabay.com/en/family-tree-genealogy-295298/

COMPUTER SCIENCE (CS) & HMI

CS areas that are interrelated with HMI:

1. other **design**-oriented courses
   - requirements and design of software systems, software engineering, internet technologies
2. other **research**-oriented courses
   - research methods, mathematical methods for experimental science

OTHER FIELDS AND HMI

- Industrial design
  - Hardware design, ergonomics,…
- Visual design
  - Colour, typography,…
- Information design
  - Concepts or data for communication
- **HMI and Interaction Design**
  - In this course, any technology enhanced product interacting with people

WHAT IT TAKES TO DO HMI

- A multidisciplinary mind frame
- Good communication means
  - given that many people from different backgrounds are involved
  - bringing different perspective and ways of seeing and talking about things

HMI: THE HISTORICAL VIEW

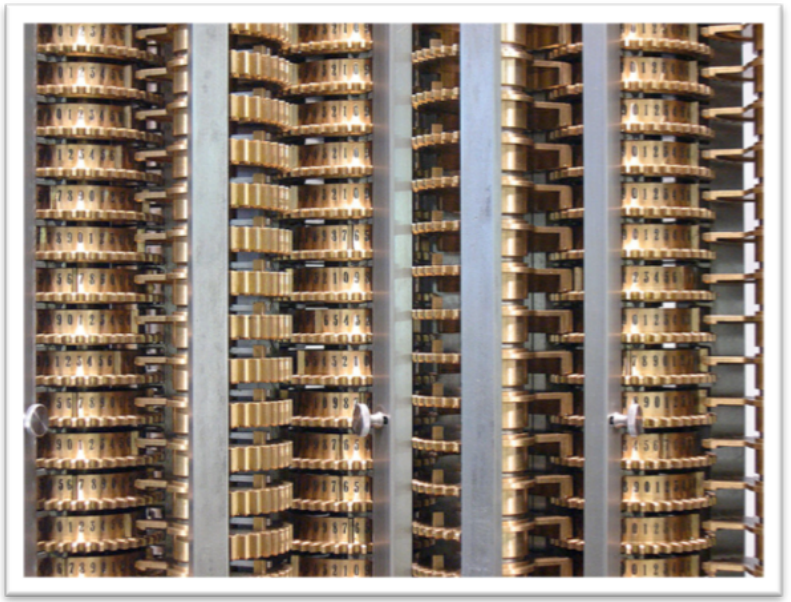
HMI Birth

- How does one separate HMI history from the broader scope of computing history in general?
- It's the point at which it became possible to draw a separation between the work that was done to serve the **needs of the machine**, and the work that was done solely to **meet the needs of the user**

Karen McGrane, 2012

The Mechanical Era (before 1945)

Users: scientists



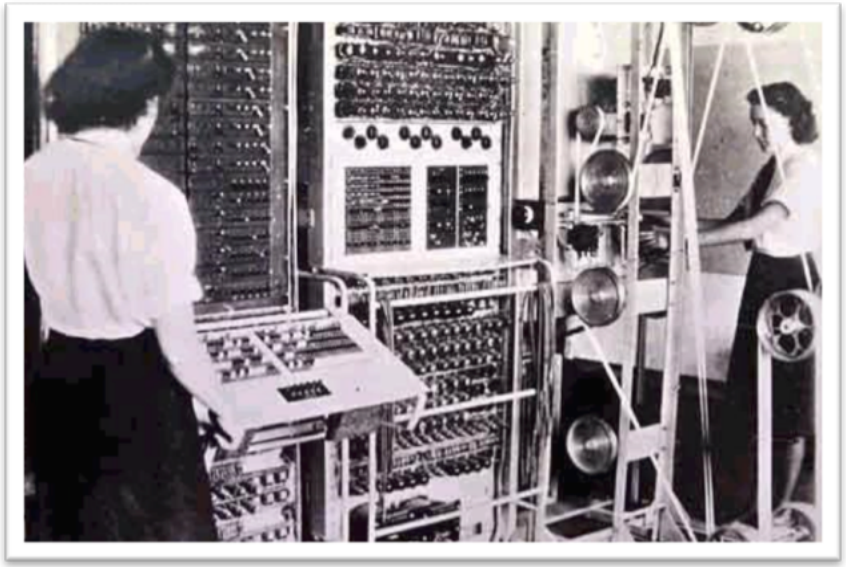
Interface: gears and cranks

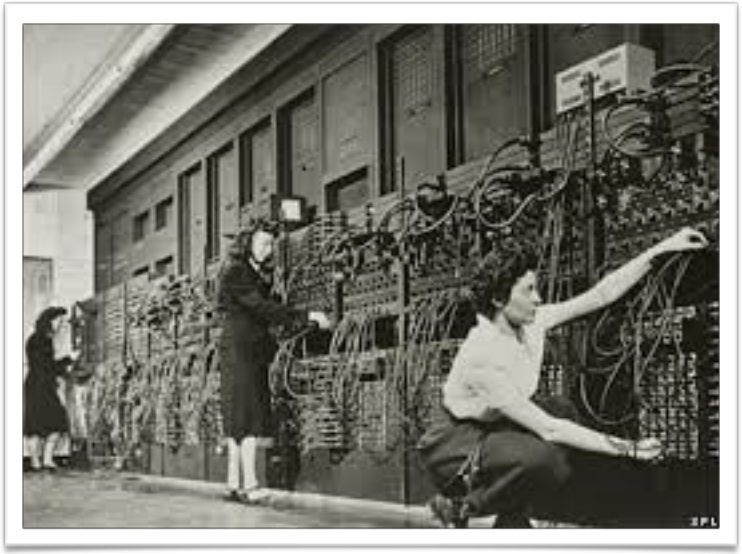
For what: arithmetics

Source: K., McGrane, 2012

The Electronic Era (around 1950's)

Users: programmers





For what: general-purpose high speed calculations

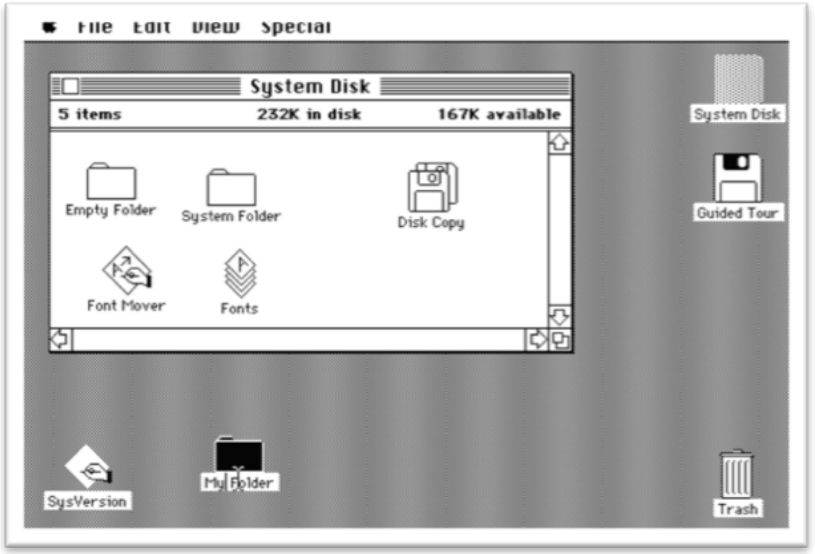
Interface: punch cards and tape or plugboards

ENIAC programmers: Kay McNulty, Betty Jennings, Betty Snyder, Marlyn Wescoff, Fran Bilas and Ruth Lichterman

Source: K., McGrane, 2012 and Wikipedia

The PC Era (around 1980's)

Users: common people



Interface: a GUI

For what: writing, drawing,…

Source: K., McGrane, 2012

The Mobile Era (around 2000's)

Users: common people

Interface: you know

For what: sharing user experience

Source: K., McGrane, 2012

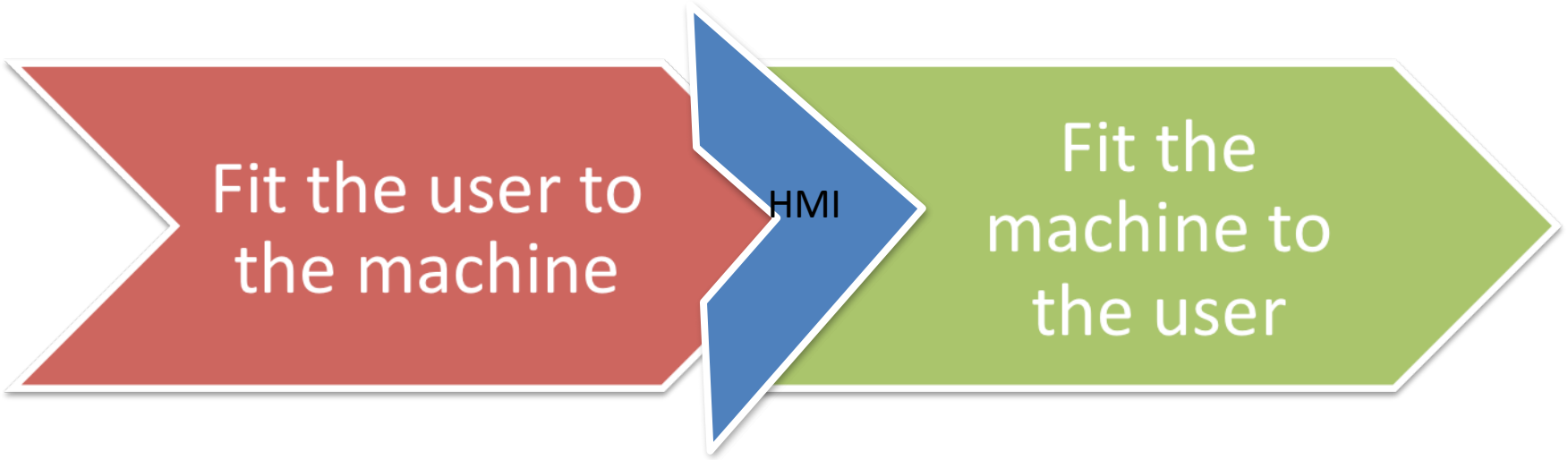
The Internet of Things Era (after 2010)

Users: common people

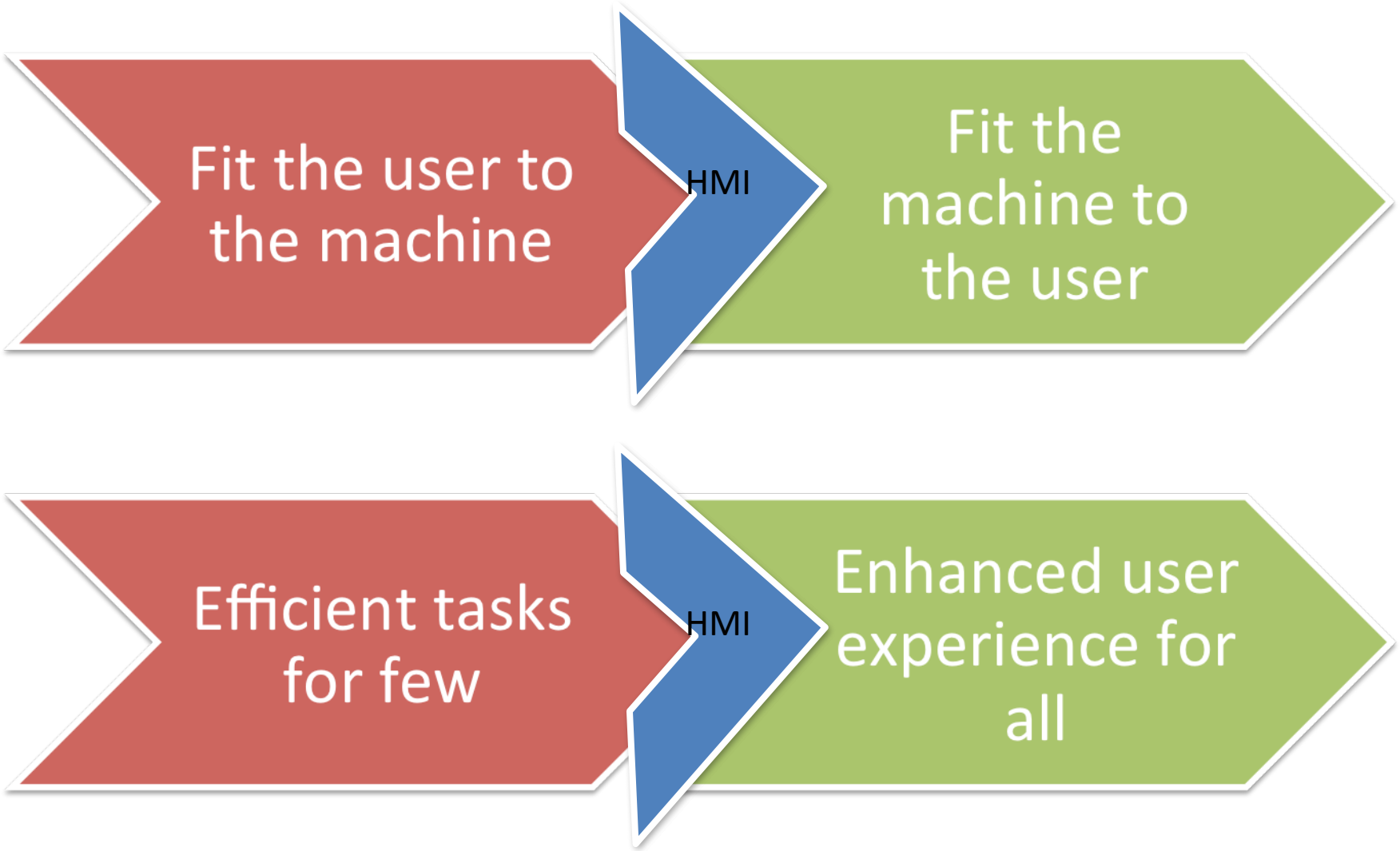
Interface: any smart object

For what: smart experience

Birth



Birth


Fit the user to the machine
HMI
Fit the machine to the user
Efficient tasks for few
HMI
Enhanced user experience for all

SUMMARY

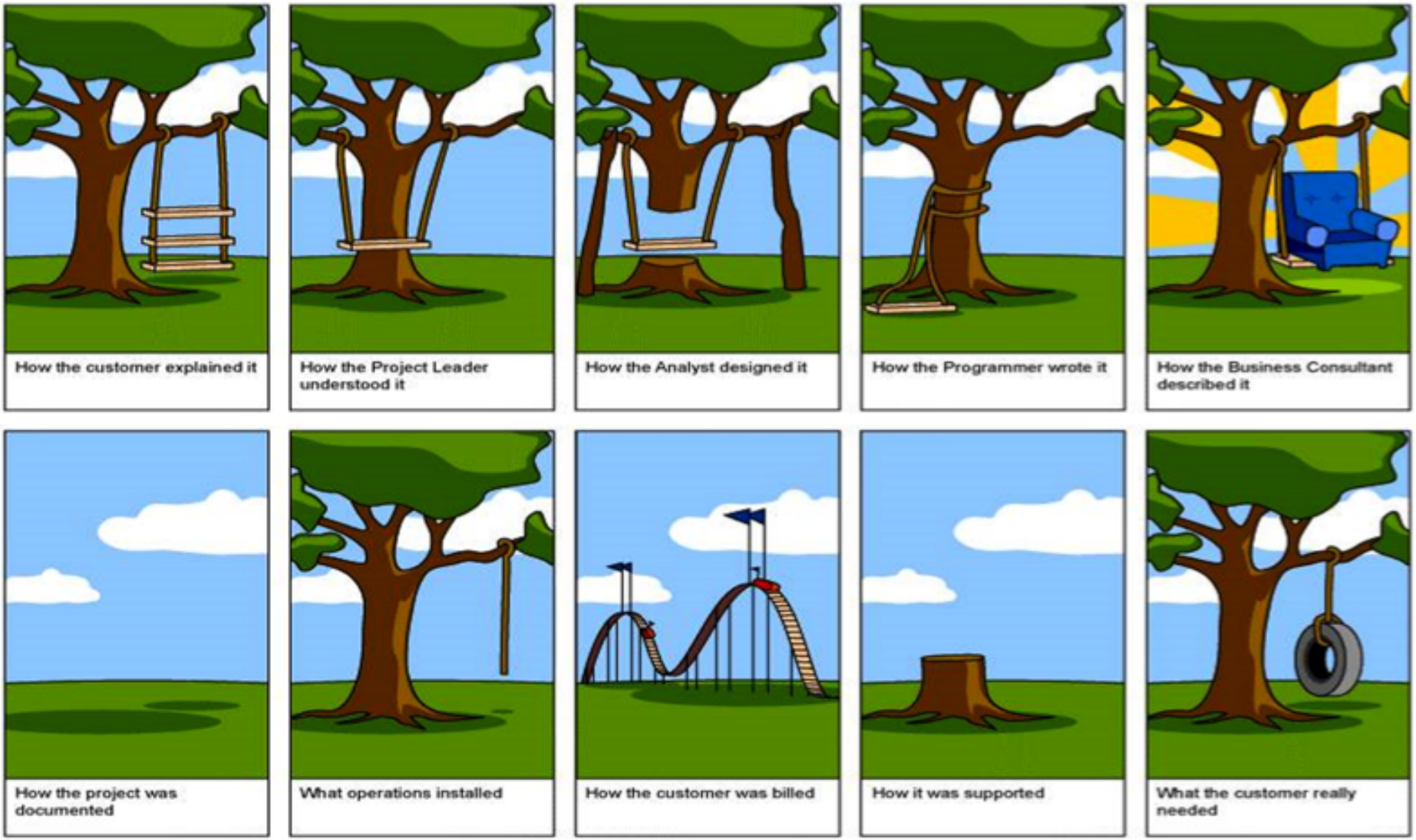
Summary

- HMI leading **ideas**
- HMI main **stages**
  - context analysis for UX requirements
  - design and prototyping: roots are in psychology
  - evaluation:
    - traditional usability: quantitative and qualitative
    - user experience
- HMI and other **fields**
- Interaction design and HMI **history**
- **Organization** of this course

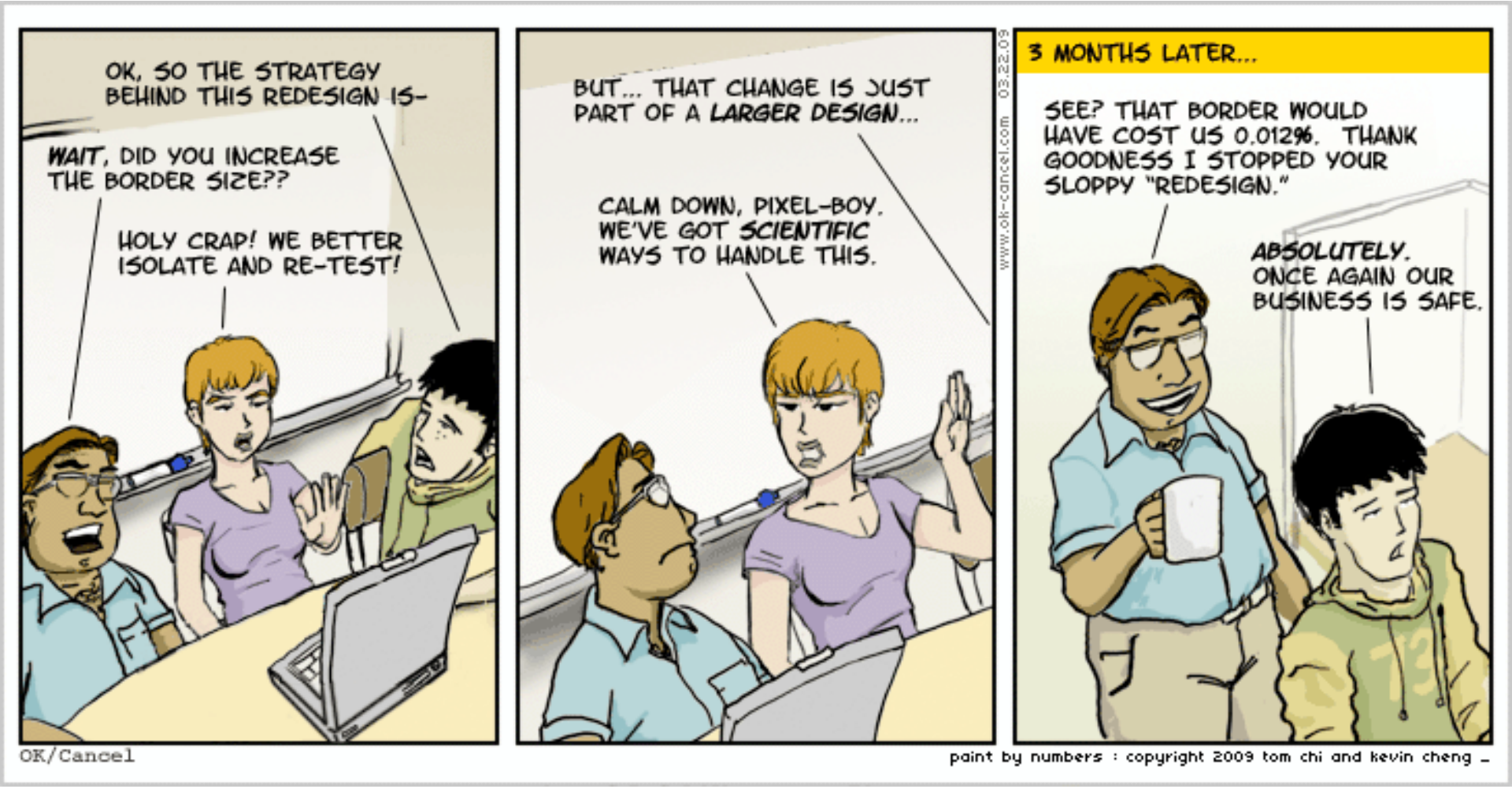
Resources for this lecture

- Chapters 1 and bits of 9 of the following book: Sharp, Rogers, Preece. Interaction Design. Available as Safari Tech book
- Slides at the course web sites
- Further suggested readings:
  - Effie Lai-Chong Law, Paul van Schaik, Virpi Roto (2014). Attitudes towards user experience (UX) measurement. International Journal of Human-Computer Studies, 526-541
  - http://karenmcgrane.com/2010/01/04/what-is-interaction-design-history/
  - TED talk by G. Dyson on the birth of the computer http://www.ted.com/talks/george_dyson_at_the_birth_of_the_computer.html
  - ENIAC video (from K. Wagner post)

Why users matter…



… with compromises :-)



VERIFY!

Verification & transfer-of-knowledge questions

1. This course focuses on: (1) visualisation techniques; (2) ubiquitous and mobile computing; (3) interaction design
2. A recommender system is usable if: (1) it presents several choices to its users; (2) it presents the user choices that users like; (3) it presents choices that enable users to make their intended decisions
3. A recommender system enhances the user's experience if: (1) it presents a number of choices to its users; (2) it presents the user choices that users like; (3) it presents choices that enable users to make their intended decisions
4. List examples of environment constraints for ATM displays (imagine!)