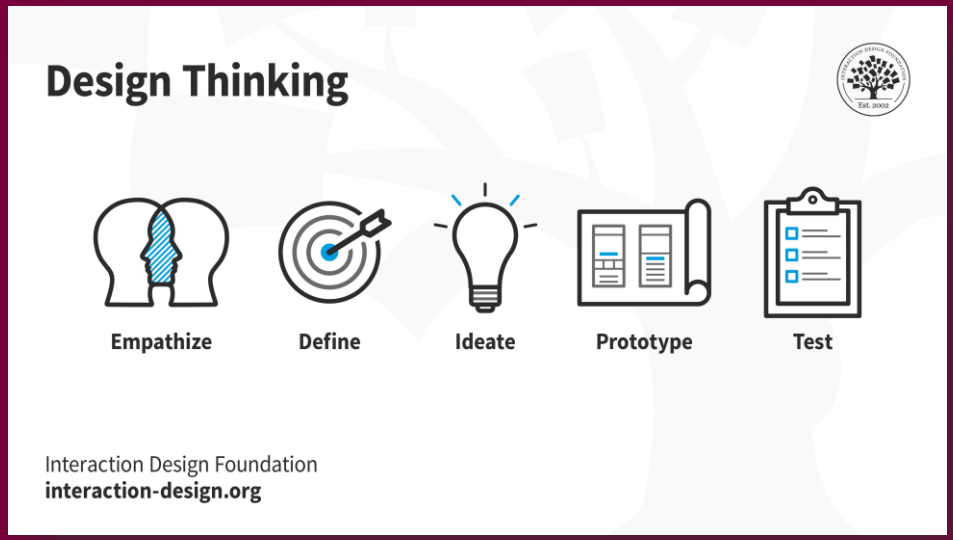


Introduction
User-Centered Design
Design Thinking

Human-Computer Interaction
Lecture 1
dr Kristina Lapin

User experience design is normally applied to websites and software
to make them easy to use and
overall **allow a person to complete the task they set out to do**.

The best way to think about UX is
more like product design than
traditional graphic design, that is
what you create has to work first and foremost.

Jon Dodd, The Ukdomain, August 2019

Outline

- Introduction
- Evolution of HCI
- The nature of interactive systems design
- The four processes involved in design:
  - understanding, design, envisionment, evaluation
- Course requirements

Introduction

- The Interdisciplinary Design Science of Human-Computer Interaction (HCI) combines knowledge and methods associated with professionals including:
  - Psychologists
    - incl. Experimental, Educational, Social and Industrial Psychologists
  - Computer Scientists
  - Instructional and Graphic Designers
  - Technical Writers
  - Human Factors and Ergonomics Experts
  - User experience designers
  - Anthropologists and Sociologists

Human-Computer Interaction (HCI)

- HCI is a multidisciplinary field of study focusing on the **design of computer technology** and, in particular, **the interaction between humans (the users) and computers.**
- While initially concerned with computers, HCI has since expanded to cover almost all forms of information technology design.

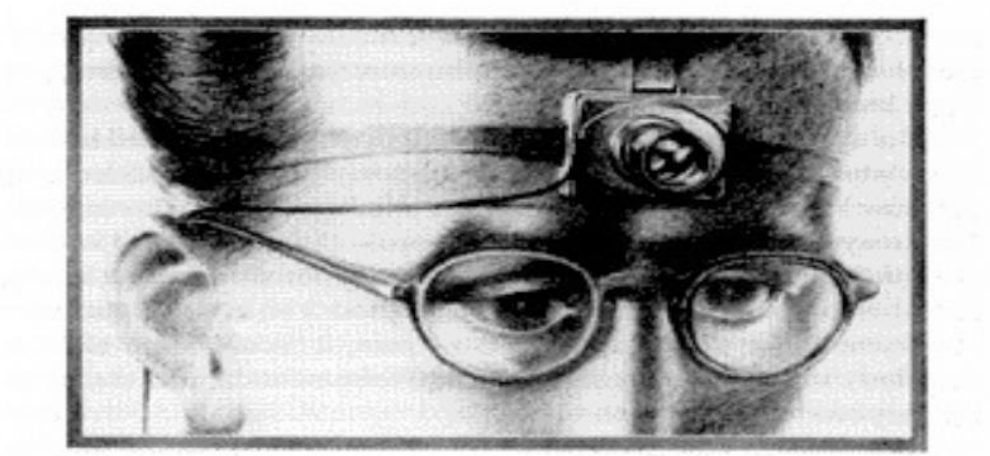
Vilnius
University

Evolution of HCI

Vannevar Bush “As We May Think”

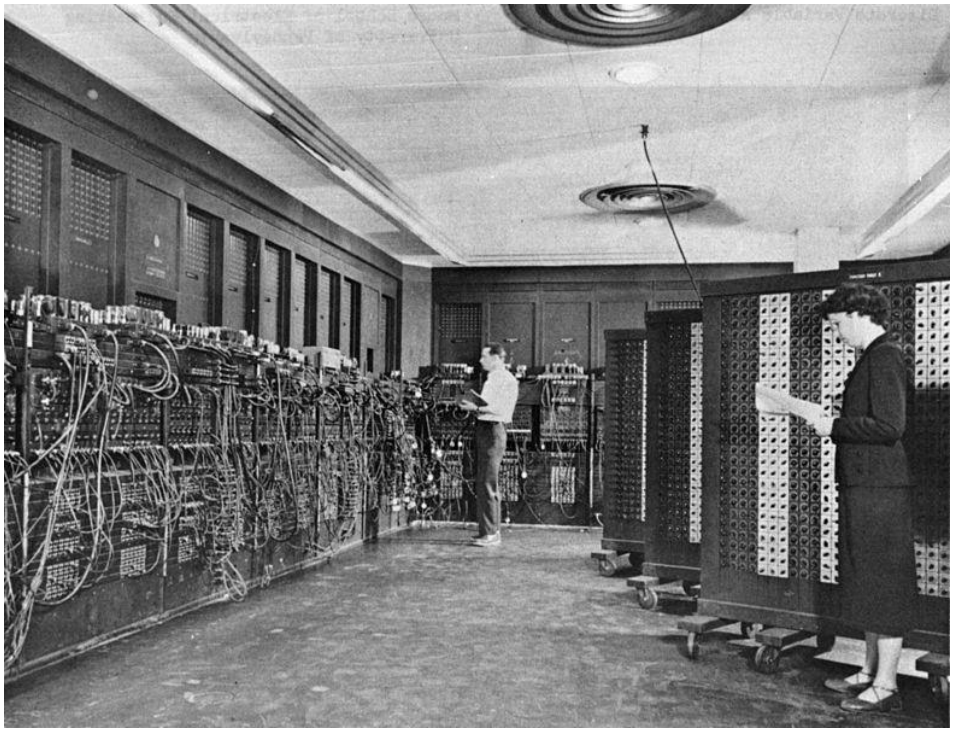
- The Atlantic Monthly, 1945.
- Memex: analog of hypertext

1890–1974



A scientist of the future records experiments with a tiny camera fitted with universal-focus lens. The small square in the eyeglass at the left sights the object (*LIFE* 19(11), p. 112).

ENIAC, 1946
Electronic Numerical Integrator And Computer

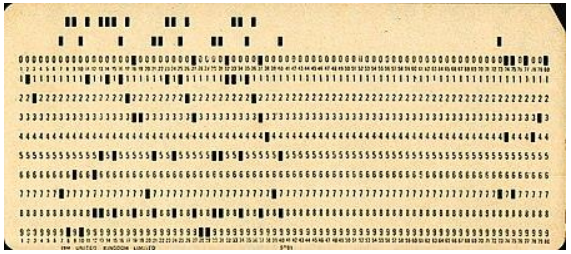


http://en.wikipedia.org/wiki/File:Eniac.jpg

Grace Hopper – the inventor of compiler

- Compiler has facilitated programming
- A-0: Arithmetic Language version 0; 1951-1952
- COBOL, 1959

First interactive screens



1960-ties:

- Data stored in paper tape or cards with holes punched in them.
- Cards were sent to the computer centre, data was processed, and results printed.
- Joseph C.R. Licklider: the first screens and cathode ray tubes (CRT)

Direct interaction with a screen

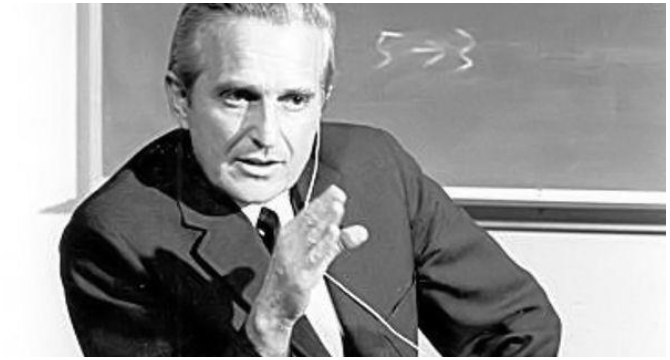
- Ivan Sutherland (MIT), Sketchpad, 1962:

It could draw both horizontal and vertical lines and combine them into figures and shapes. Figures could be copied, moved, rotated, or resized, retaining their basic properties.

- Input: light pen
- Output: cathode ray tube

http://www.youtube.com/watch?v=USyoT_Ha_bA

Computer mouse



- Douglas Engelbart, 1968
- Demonstrated the interaction using the mouse at The Mother of All Demos.
- Main research goal: augment human intellect

https://www.youtube.com/watch?v=yJDv-zdhzMY

1970-ties: people at the centre

- Earlier: **technology** at the focus of design
  - batch interaction
  - command line interfaces
- Alan Kay: **people** at the center of design
  - Dynabook: concept of laptop
  - Object-oriented programming, SmallTalk

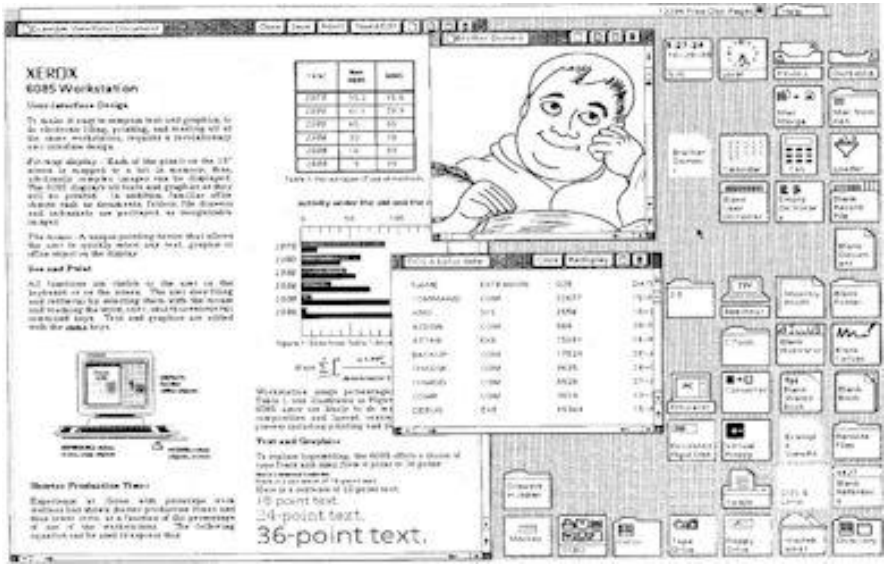
Alan Kay holds the mockup of Dynabook

Graphical user interface

- XEROX STAR, 1974

(Apple commercialized in 1984)

- Office metaphor
  - windows, icons, folders
  - Ethernet network,
  - file server,
  - print server,
  - email
- Runs on microcomputers



XEROX STAR demo: http://www.youtube.com/watch?v=Cn4vC80Pv6Q

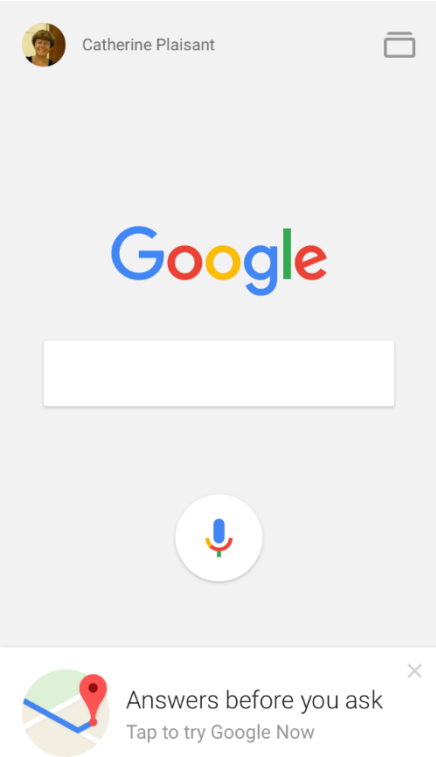
1990-ties: multimedia

- Hypertext: invented by Ted Nelson in 1965.
  - The 1st commercial hypertext system system was Apple's HyperCard in 1987.
- World Wide Web revolutionized the process of transmitting and sharing files in 1990-ties.
  - Pictures, movies, music, text and even live video links were available to everyone
- 1993: Mark Weizer, ubiquitous computing
  - Mobile devices and available Internet

Variety of technologies

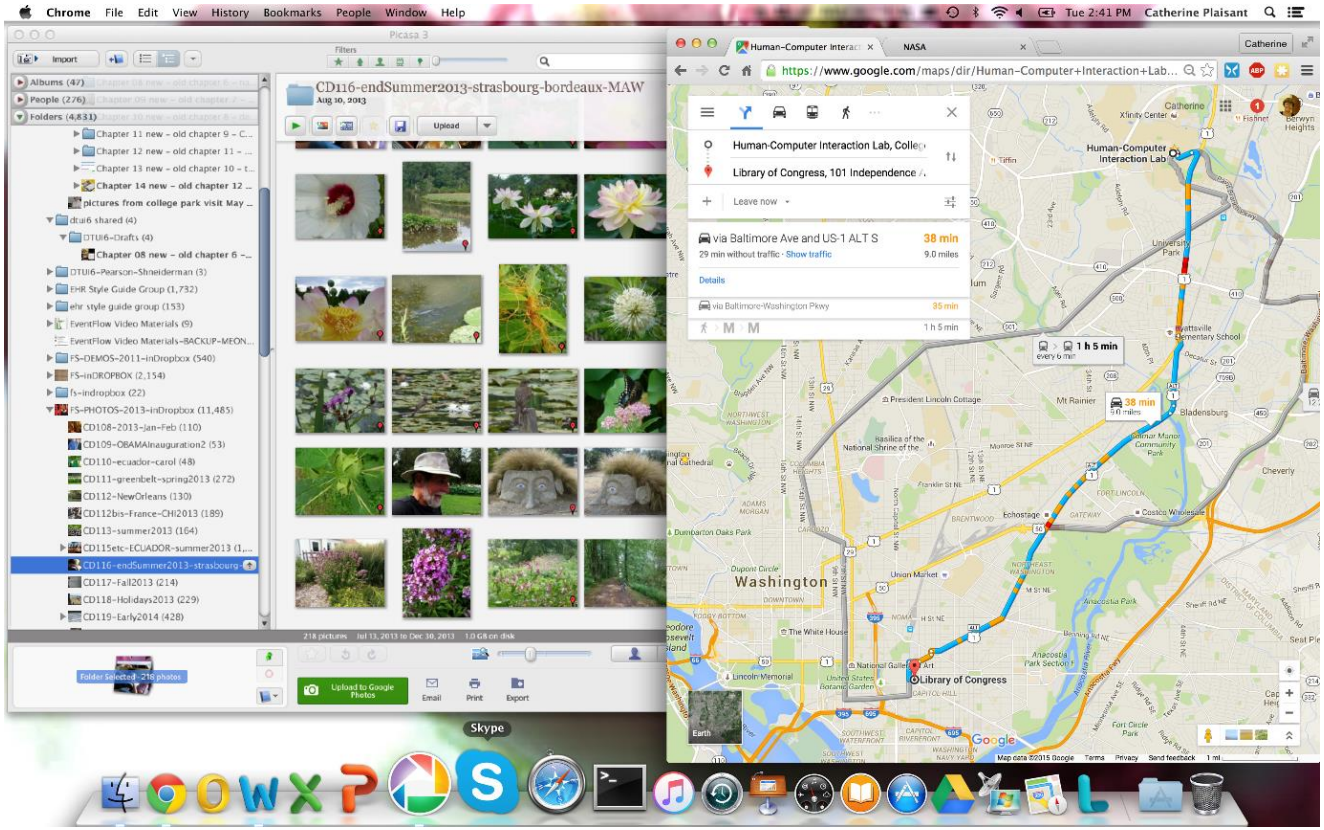
Vilnius University

Smart phones have high quality displays, provide fast Internet connections, include many sensors and support a huge variety of applications



Desktop computer software

Vilnius University

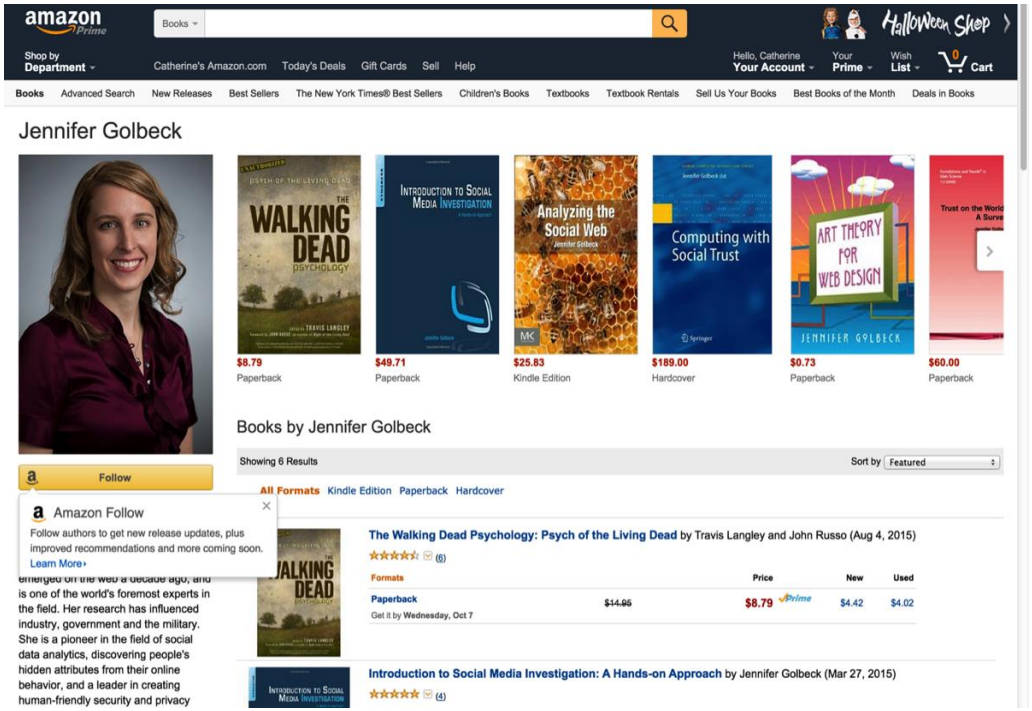


The bottom of the screen also shows the Dock, a menu of frequently accessed items whose icons grow larger on mouse-over

Internet systems

Vilnius University

The Amazon.com web site showing the books published by Jen Golbeck



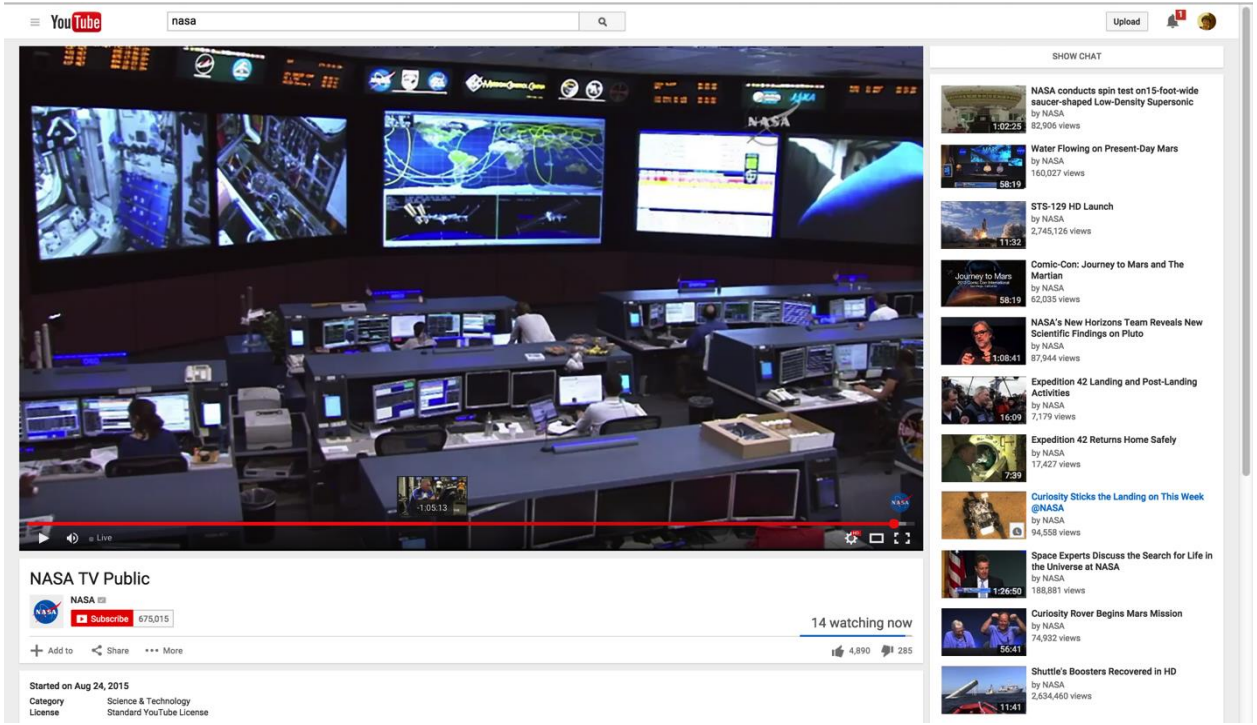
Facebook makes book and product recommendations based on a user's personal history with the site

http://www.amazon.com/

Streaming video

Vilnius University

YouTube showing a video showing NASA TV, and other available related videos on the side



The NASA video shows an example of control center with multiple large wall displays and workstations

Wearable computing

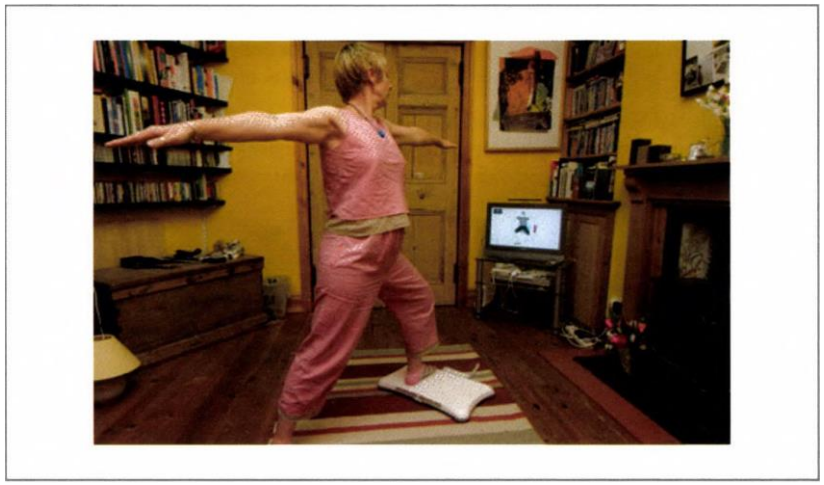
Vilnius University

Two children learn about the human body using a wearable, e-textile shirt displaying real-time visualizations of how the body working via “organs” with embedded LED lights and sound

Gesture interaction

Vilnius University

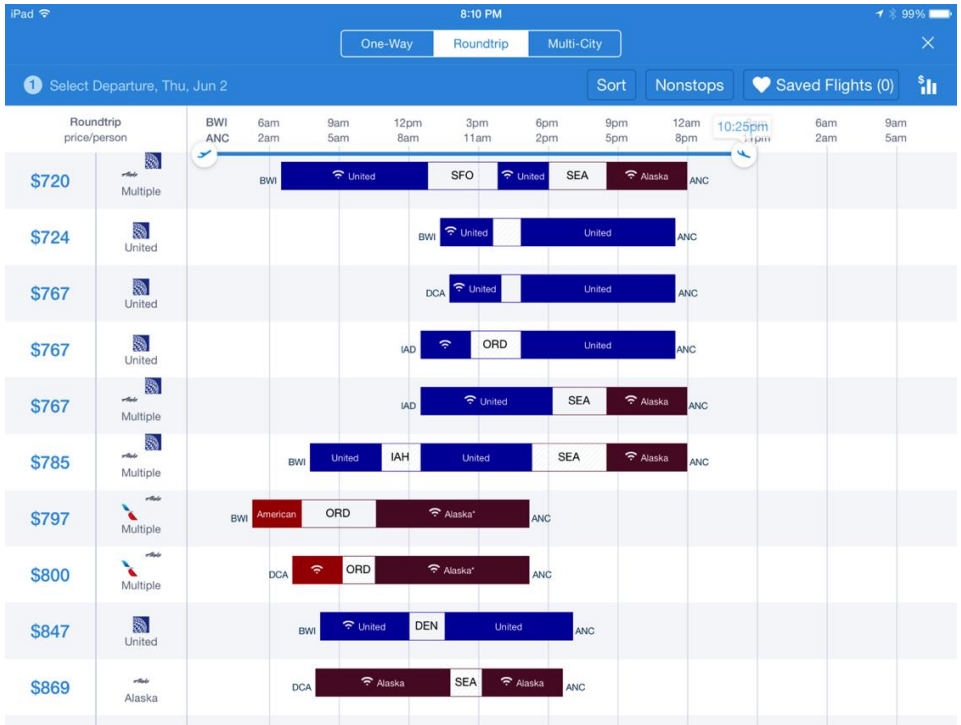
- A new games concept that used infrared sensors attached to a TV or other display device to track a wand that transmitted infra-red signals.
- The system could register movements that change the notion of games
- The next development: Microsoft Kinnect (2011)



Nintendo Wii (2007)

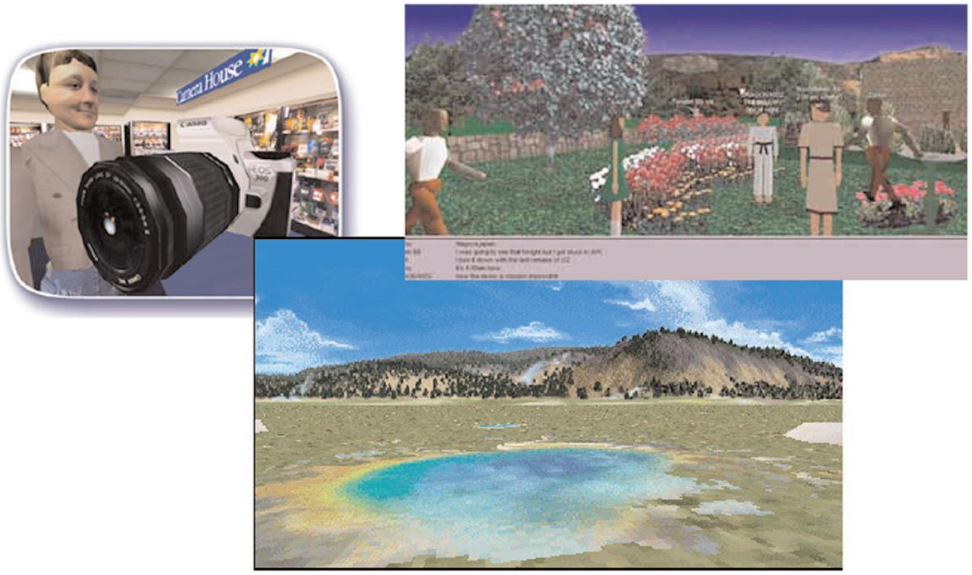
Tablet applications

The HIPMUNK travel search shows available flights visually as seen on a Apple iPad tablet



The slider at the top allows users to narrow down the results, e.g. here we see only the flights landing before 10:25 pm

Virtual reality



Virtual worlds

Vilnius University

Second life is a huge on-line community populated by animated virtual people (avatars). Consists of simulated islands with parks, buildings, etc. People create the avatars to represent themselves.

Ambient technologies

http://www.youtube.com/watch?v=2lXh2n0aPyw&feature=player_embedded#!

Domestic toy robot i Robo Q

- Moves freely around the house
- Reacts to voice commands,
- Monitors its surroundings with a surveillance camera and takes pictures
- Teaches children languages,
- Plays games,
- Provides the weather forecast, news and recipes.

Photographed at a robot exhibition in Seoul, South Korea.

Various user interfaces

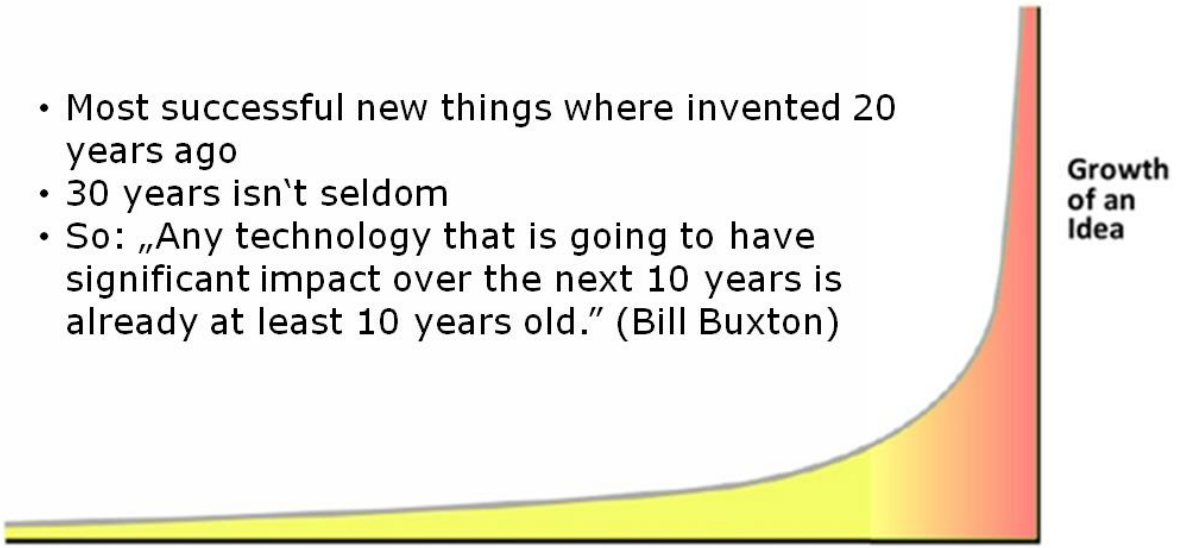
Vilnius University

What do the interfaces consist of?

Long nose of innovation, Bill Buxton

„Long Nose" of the S-Curve

- Most successful new things where invented 20 years ago
- 30 years isn't seldom
- So: „Any technology that is going to have significant impact over the next 10 years is already at least 10 years old." (Bill Buxton)



Long nose of innovation

- New products and ideas come from observing history and the evolution of the ecosystem.
- iPod took aesthetical inspiration from Dieter Rams' Braun T3 radio, produced in 1958.

Vilnius University

IT revolutions

1. PC: **1976** (Apple I)
2. Web: **1993** (Mosaic, the first GUI browser)
3. AI: **2023** (ChatGPT 4)

When will be the next?

(Jacob Nielsen on UX, 2024)

AI – the 3rd user interface paradigm

- Paradigm 1: Batch Processing
  ~ 1945, a complete workflow must be specified in advance.
- Paradigm 2: Command-Based Interaction
  ~1965, the user and the computer take turns, one command at a time.
- **Paradigm 3: Intent-Based Outcome Specification**
  - 2023, the user no longer tells the computer what to **do,** they tell what outcome they **want.**

(Nielsen 2023)

Decades of HCI development

Vilnius University

- 40–ties – vision, Vannevar Bush
- 50-ties – compilers, Grace Hoper
- 60-ties – Sketchpad, Ivan Sutherland
- 70-ties – Dynaburg, Alan Kay
- 80-ties – XEROX Star, microcomputers
- 90-ties – multimedia
- 2000-ties – mobiles
- 2010-ties – Ubiquitous computing
- 2020-ties – ?

Vilnius
University

The nature of Interactive system design

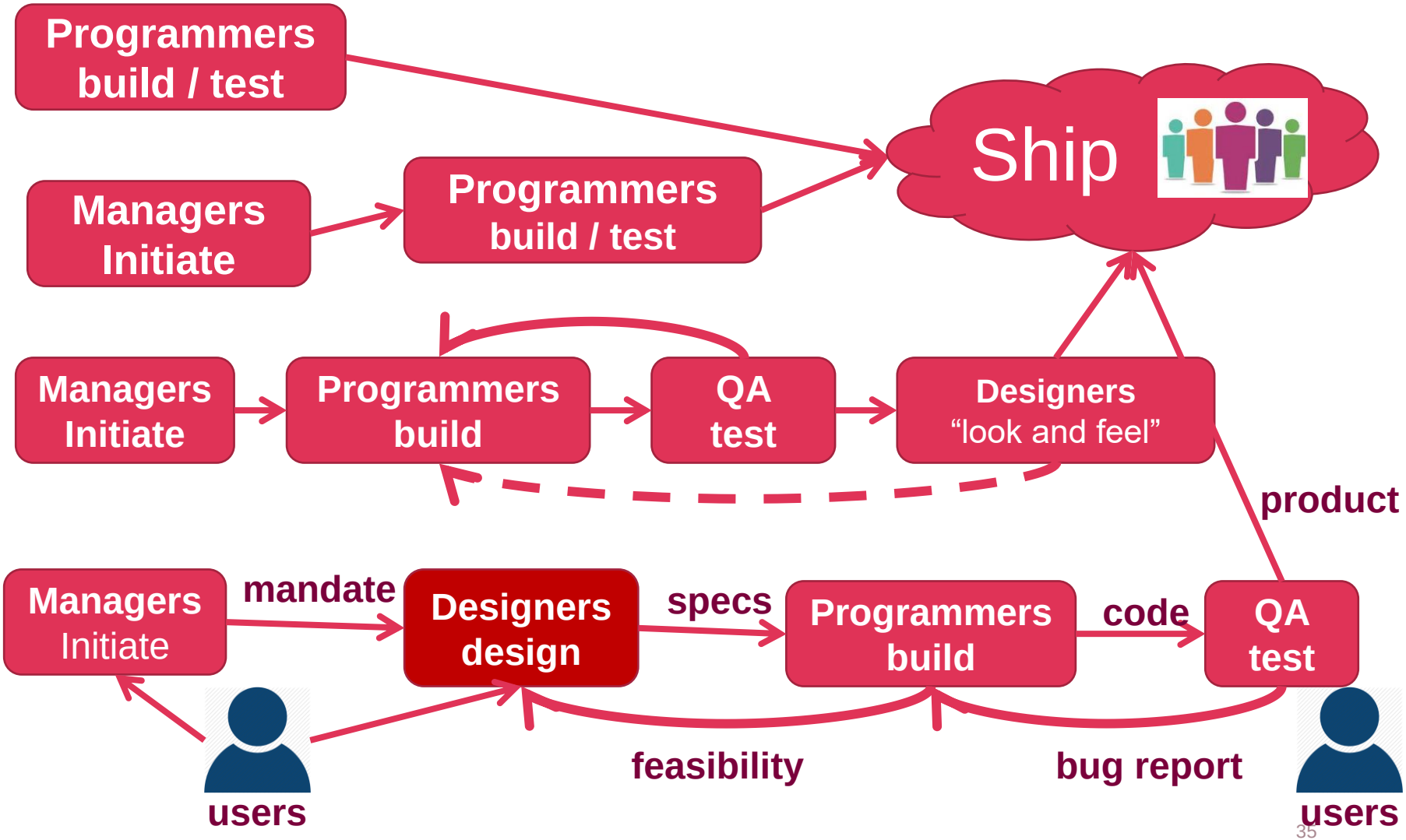
Vilnius University

Digital products …

- are rude
  - ask patronizing questions like “Are you sure”, “Do you really want”?
- require people to think like computers
- Why is so?
  - ignorance about users
  - conflicting interests
  - the lack of a process

The evolution of the software development process

Vilnius University



A successful product

Vilnius University

Desirable

Viable

Buildable

Designers

- User model: motivations, behaviors, attitudes
- Product design: design schedule, form and behavior spec

User effectiveness & Customer adoption

Management

- Business model
  - funding model
  - income/expense projections, etc
- Business plan
  - marketing plan
  - launch plan
  - distribution plan

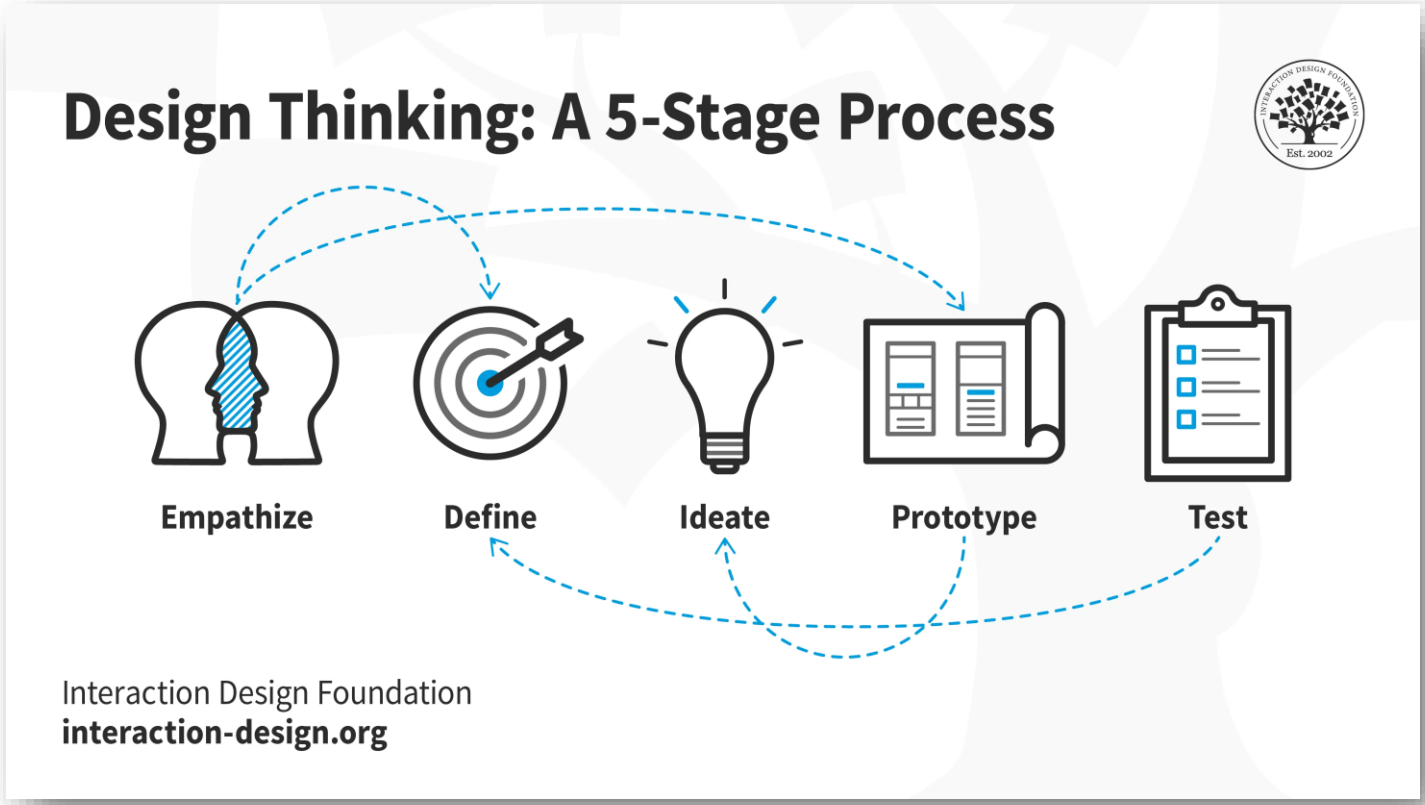
Sustainable business

Technologists

- Technologiy model
  - Core technologies
  - technology components
  - build vs. buy
- Technology plan
  - engineering schedule
  - engineering spec

Product delivery

Design thinking



Stages

Stage 1: Empathize—Research Your Users' Needs

Stage 2: Define—State Your Users' Needs and Problems

Stage 3: Ideate—Challenge Assumptions and Create Ideas

Stage 4: Prototype—Start to Create Solutions

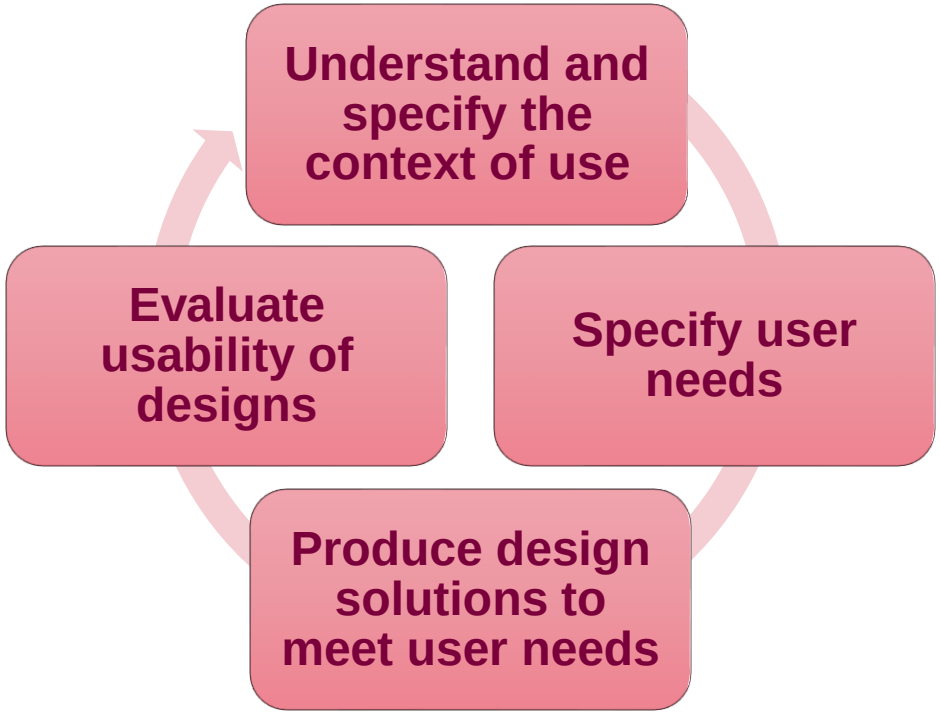
Stage 5: Test—Try Your Solutions Out

Design Frameworks

- **A core principle of design thinking – user-centered design**

- **User-centered design (UCD)**
  - Takes the needs, wants, and limitations of the actual end users into account during each phase of the design process
- **Participatory design (PD)**
  - Direct involvement of people in the collaborative design of the things and technologies they use
- **Agile interaction design**
  - Development methods for self-organizing, dynamic teams and that facilitate flexible, adaptive, and rapid development that is robust to changing requirements and needs

User-centered design
fine-tunes processes and iterations



Principles of user-centered design (UCD)

1. Early focus on users and tasks

   User's strength, limitations, preferences and expectations are taken into account when specifying which activities are carried out

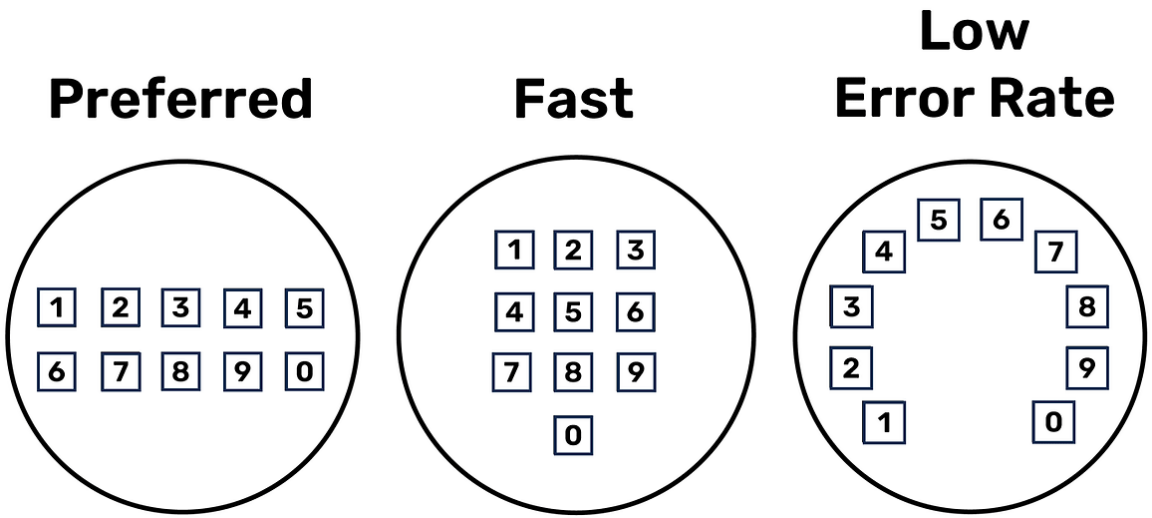
2. Empirical measurement

   Users' reactions and performance to scenarios, manuals, simulations & prototypes are observed, recorded and analysed

3. Iterative design

   Problems are found in user testing, fix them and carry out more tests

BUT:
Designing for users cannot be based solely on their stated preferences.



R. L. Deininger: "Human Factors Engineering Studies of the Design and Use of Pushbutton Telephone Sets."
Bell System Technical Journal July 1960

(Nielsen 2024)

Being human-centred

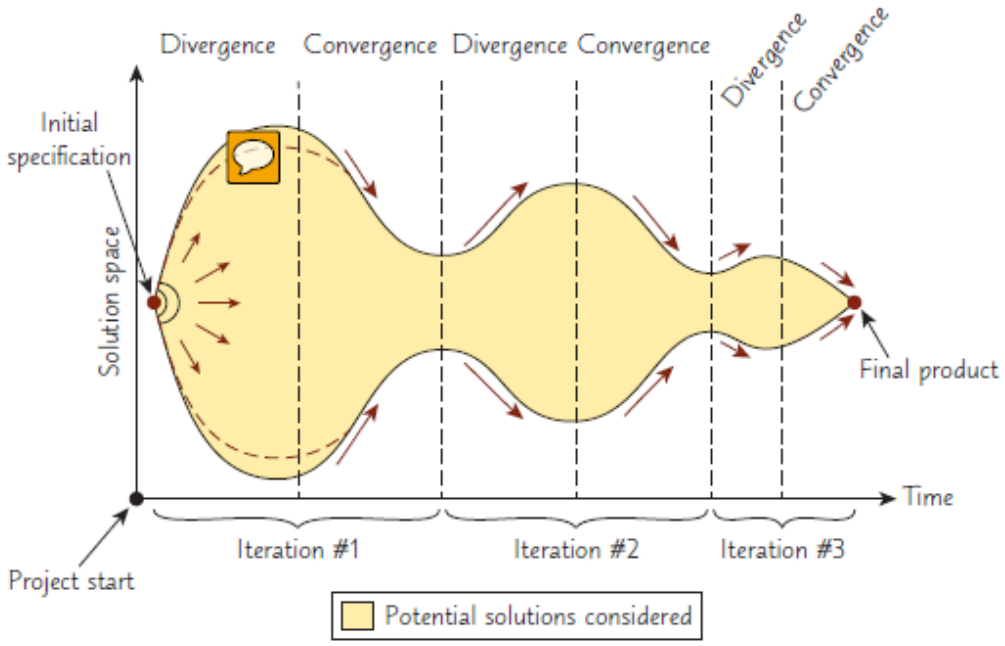
1. Thinking about what people want to do rather than what the technology can do
2. Designing new ways to connect people with people
3. Involving people in the design process
4. Designing for diversity

UCD Design Methods

- Practical building blocks that form the actual day-to-day activities in the design process
  - Ideation and creativity
  - Surveys, interviews and focus groups
  - Ethnographic observation
  - Scenario development and storyboarding
  - Prototyping

UCD Design Methods (concluded)

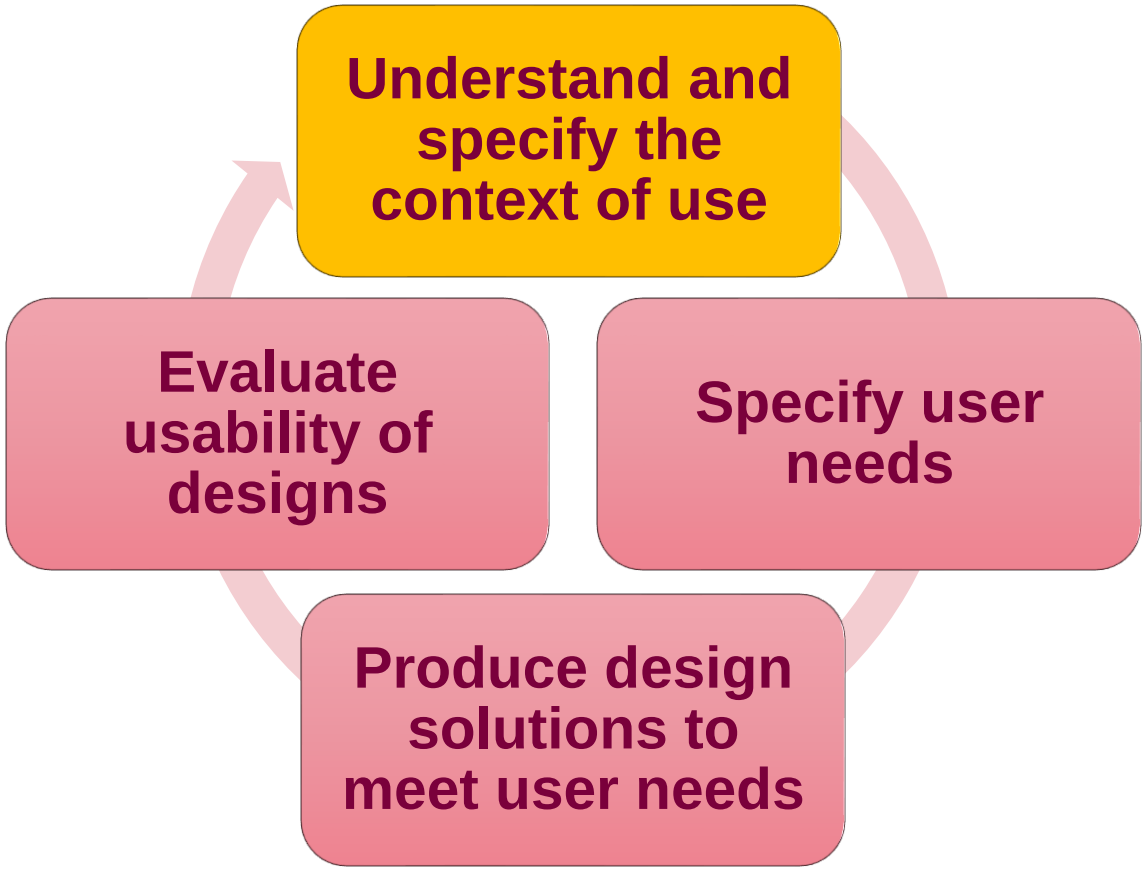
Vilnius University



- Illustration of how the solutions considered during a design process will grow (diverge) and shrink (converge) iteratively until it eventually fixates on a single point, the finished product
- This particular design process involves three iterations, but real processes may have more or fewer iterations.

User-centered Design (UCD) activities

Vilnius University



Problem statement

- Is a concise description of the problem that needs to be solved.
- Includes:
  1. **The background of a problem.**

     Which organization or department has the problem and what is the problem? Why has the problem arisen?
  2. **The people affected by the problem.**

     You should call out how the problem affects users
  3. **The impact of the problem on the organization.**

     If the problem is not fixed, what will be the effect on the organization? Reputational damage? Paying unavoidable costs?

Problem Statements in UX Discovery, **NN/g**

Problem statement: examples

- Each year, many applicants call the contact center seeking an update on their application. Applicants often spend a long time waiting to speak to an agent. Because contact-center staff members lack access to case information, they are unable to answer queries from applicants. This situation causes frustration for both applicants and customer-contact staff and represents an avoidable cost to the department.
- Users of our newspaper app often export content from our app, rather than sharing content through our app. This is a problem because target audiences are less likely to know that the content came from our app, leading to lower conversion rates. This is also a problem for app users, as exporting content is time-consuming and could lead to a decrease in app usage.

Understanding users' needs

- Taking into account
  - what people are good and bad at
  - what might help people in the way they currently do things
  - what might provide quality user experiences
- Listen to what people want and get them involved
- Use tried and tested user-centered methods

Stakeholders

- Individual or organization having a right, share, claim or interest in a system or in its possession of characteristics that meet their needs and expectations (ISO 9241-11:2018)
  - Note 1 to entry: Stakeholders can include: users, purchasers, systems owners or managers and people who are indirectly affected by the operation of a system, product or service.
  - Note 2 to entry: Different stakeholders can have different needs, requirements or expectations.

Identifying stakeholders

Vilnius University

- **Primary** users
  - Who is directly and frequently use the system?
- **Secondary** users
  - Who is occasionally involved?
  - Who is involved via somebody else?
  - Who manage direct users? Will they need statistics of the managed processes?
  - Who will receive output from the product? (indirect user)
- **Indirect (tertiary) users, business owners, managers**
  - Who will influence a purchase decision?
  - Who will benefit from introducing the system?
- **Competitors:** maybe people use competitor's tools now and you are going to provide them the better solution?
- **Development and maintenance team**
  - **Who** will develop and maintain the developed system?

Business goals vs user goals

Vilnius University

Business goals

- What is the business reason for this site?
- How is the business going to determine whether the site is a success?

Example: grow the business by getting more new users to adopt the offered service

User goals

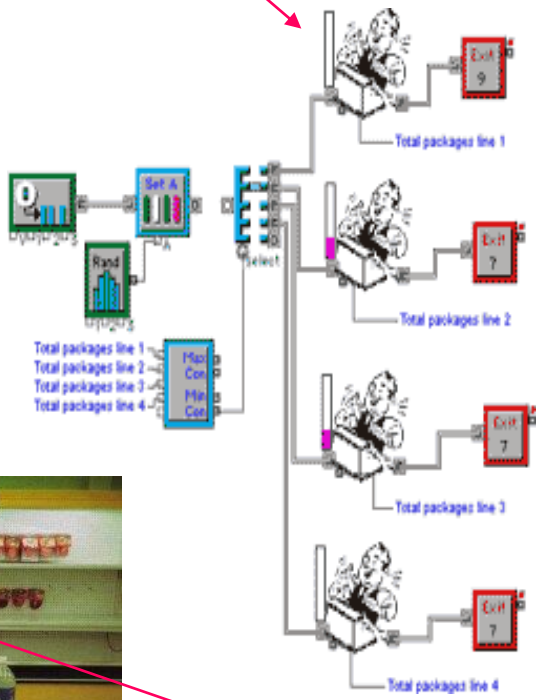
- What **will** users **do** with a system?
- Why will users come to your site?
  - To be entertained?
  - To get work done?
  - To learn something?
  - To create something?
  - To interact with other people?
  - To avoid having to talk to sales people?

Who are the stakeholders?

Vilnius University

- Suppliers
- Local shop owners

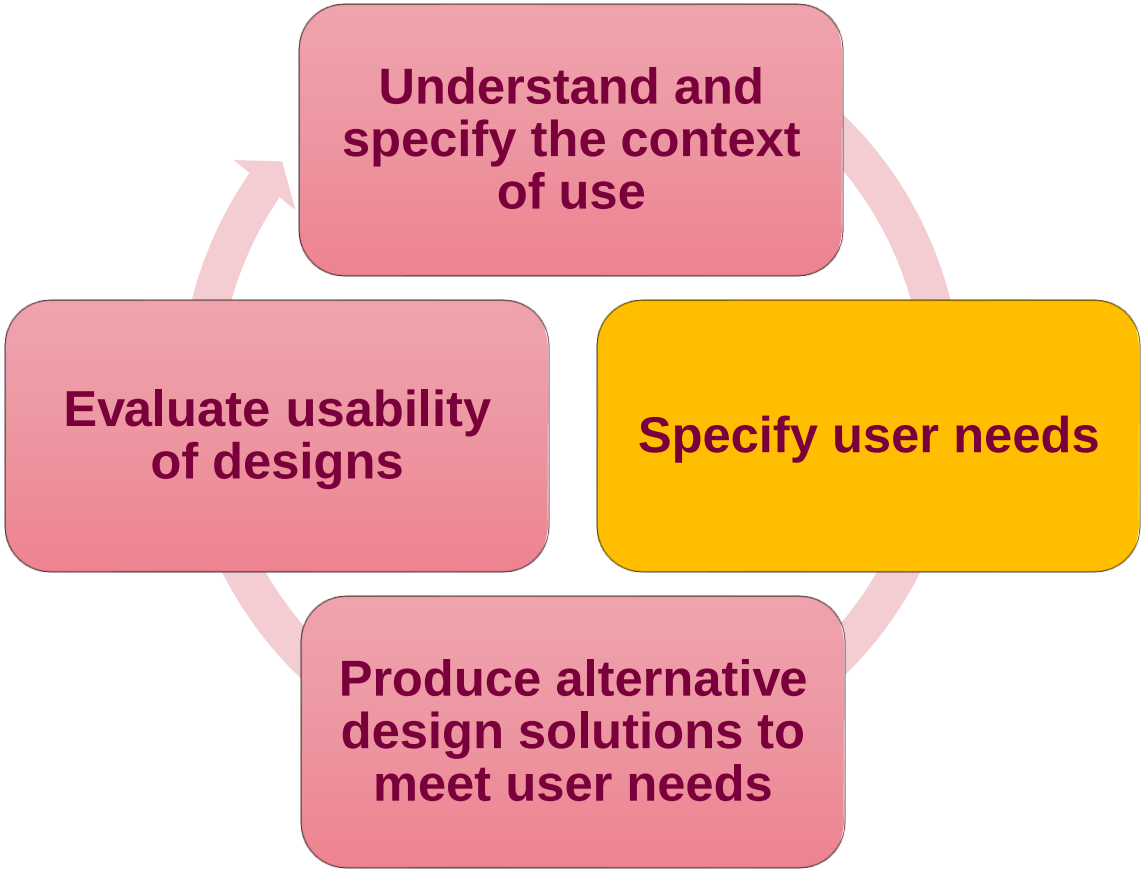
Check-out operators



Managers and owners

Customers

Specification of User needs



User need statement: a definition

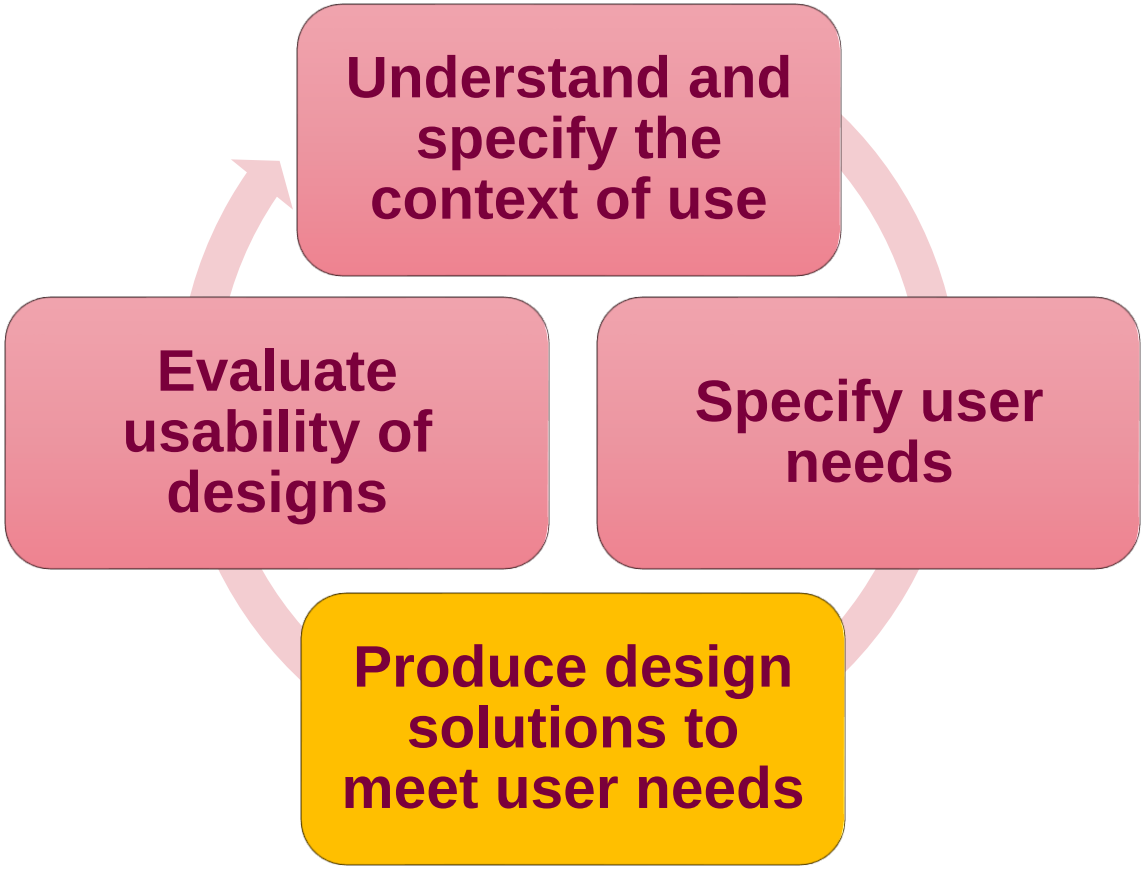
A **user need statement** is an actionable problem statement used to summarize

- who a particular user is,
- the user's need, and
- why the need is important to that user.

- It defines what you want to solve before you move on to generating potential solutions, in order to
  1) condense your perspective on the problem, and
  2) provide a metric for success to be used throughout the design thinking process.

Vilnius University

Produce alternative designs: conceptual and physical



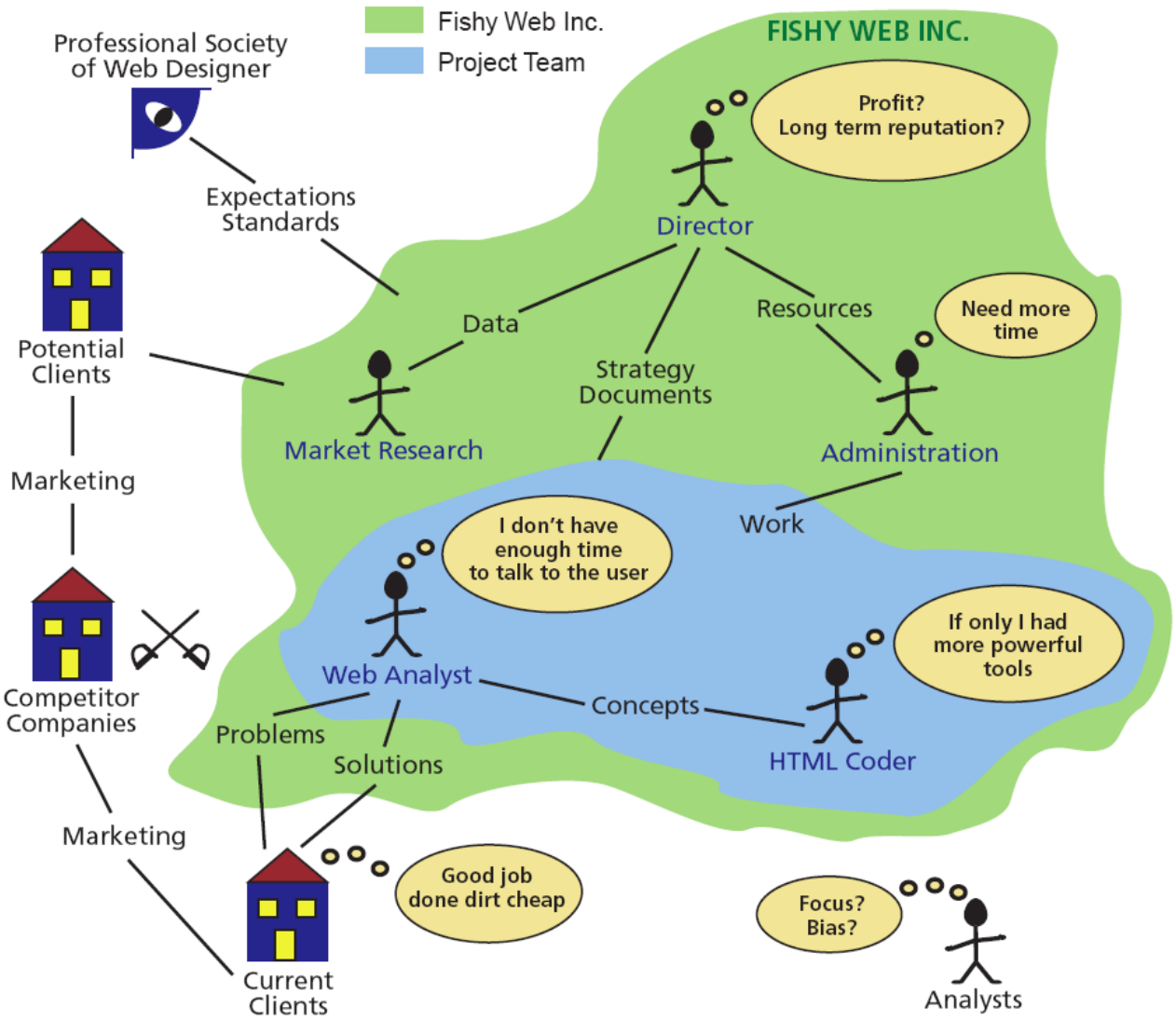
Conceptual design

- **What**?
  - what information and functions are needed by the user to achieve its goals using system
  - what someone will have to know to use the system.
- Clear conceptualization of a design solution and how that conceptualization will be communicated to people
  - User story, rich picture
  - Use-cases, entity-rellationship models
  - Site maps, navigation maps

Conceptualization of needs: rich picture

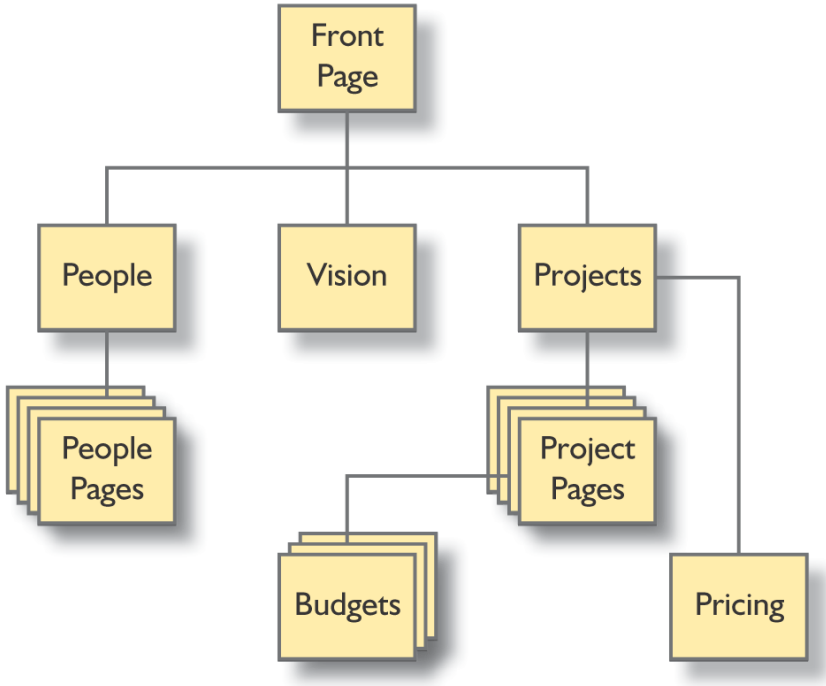
Vilnius University

Figure 2 Rich Picture of Web Design Consultancy



Navigation maps

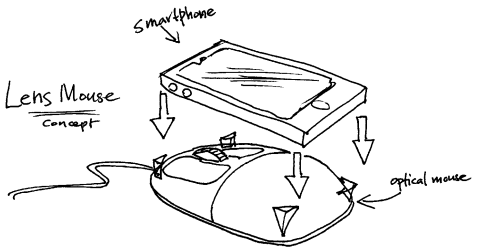
- Focus on how people move through the site or application
- Each page is a box or heading



Picture from Benyon

Physical design

- **How?**
  - how people will work: the look and the feel
  - structuring interactions into logical sequences
  - clarifying and presenting the allocation of functions and knowledge between people and devices.

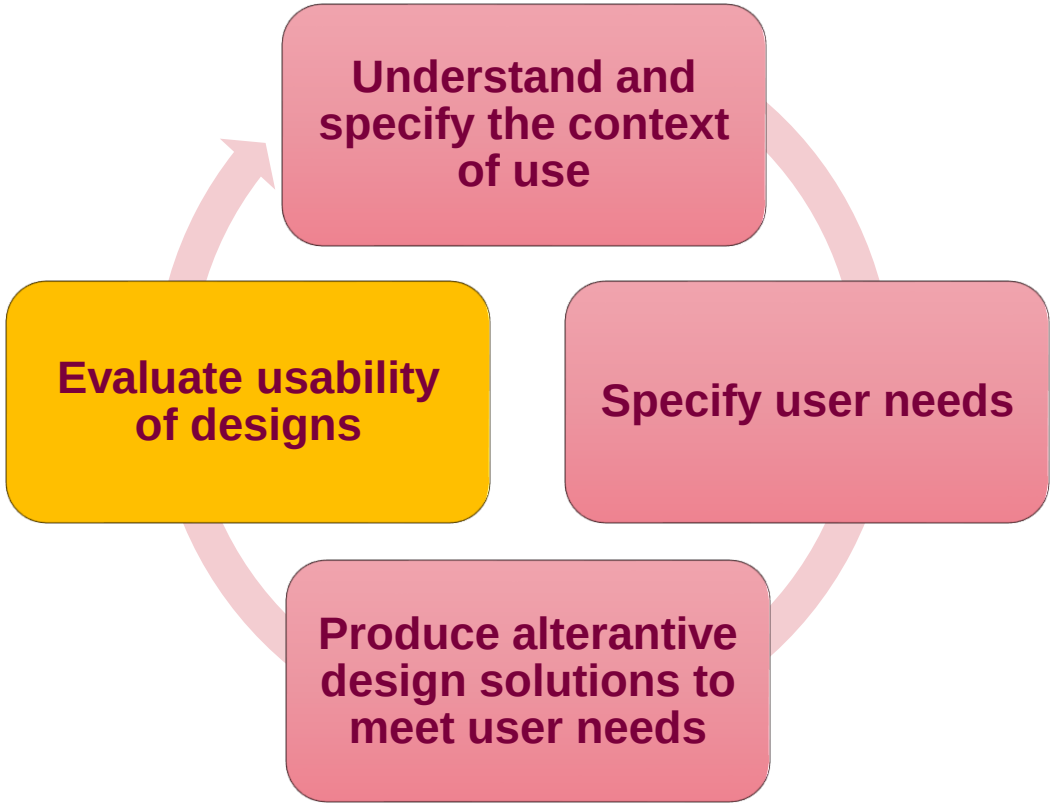


Prototyping

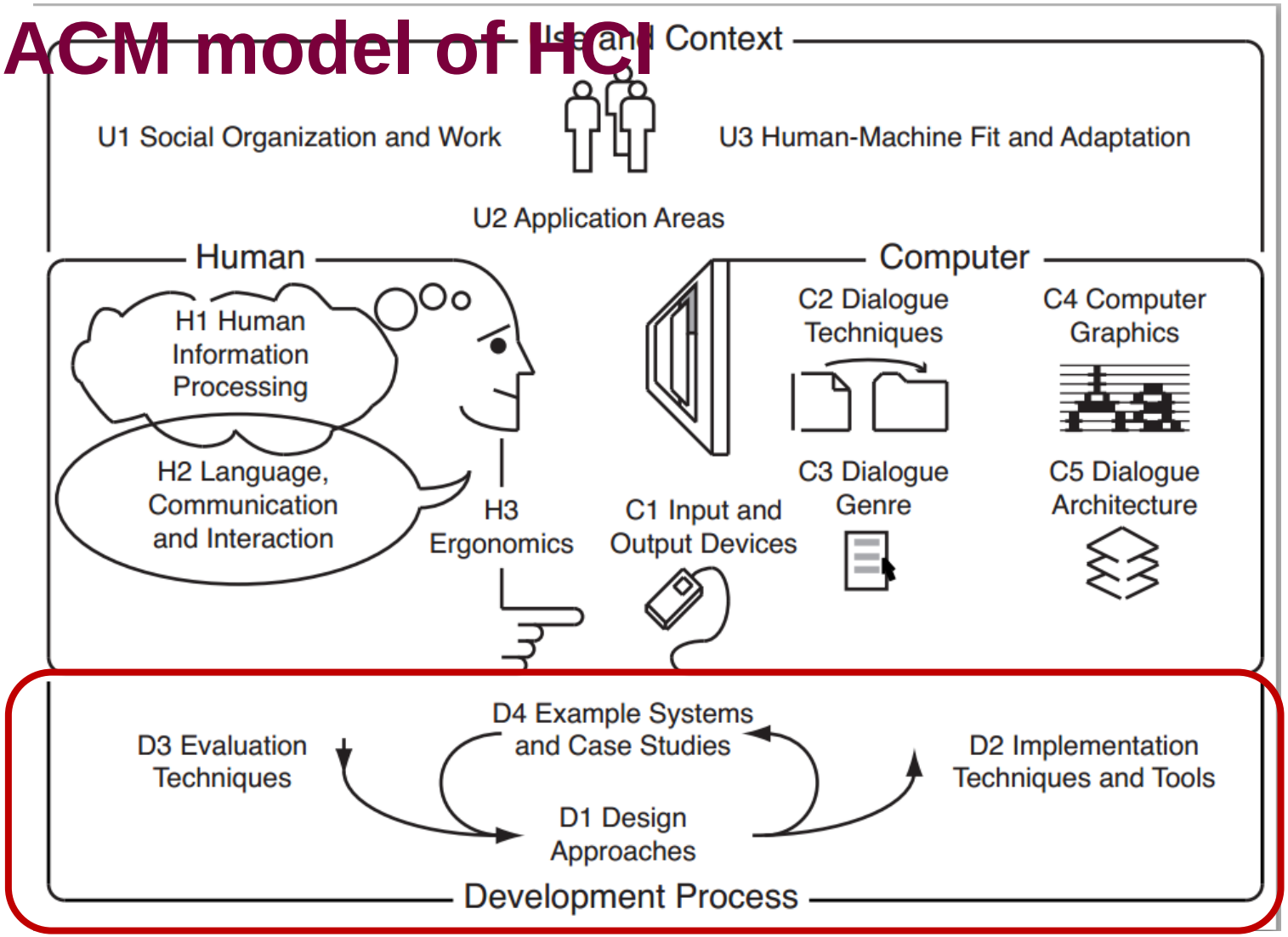
- **Low-fidelity prototypes** are generally created by sketching, using post-it notes, or cutting and gluing pieces of paper together (paper mockups)
- **Medium-fidelity prototypes** are often called *wireframes*, and provide some standardized elements (such as buttons, menus, and text fields), even if potentially drawn in a sketchy fashion, and has some basic navigation functionality
- **High-fidelity prototypes** look almost like the final product and may have some rudimentary computational capabilities; however, the prototype is typically not complete and may not be fully functional

Evaluate usability of designs

- Analytical evaluations
- Field studies
- Testing with users



ACM model of HCI



Course requirements

Vilnius University

- 5 assignments (group project) – 50%
  - Required participation in 3 presentations
    - 2 weeks delay reduces a grade by 10%
    - 3 and more weeks delay reduces grade by 20%
- Lecture tests – 5%
- Reviews of peer deliverable – 5%
  - Upload delay eliminates from reviewing
- Exam – 40%
  - **3 assignments are required to be allowed to take an exam**

Skills of interactive systems designer

Vilnius University

- **Study** and **understand**
  - **the activities** and **aspirations of people** and
  - **the contexts** within which some technology is useful and
  - **generate requirements** for technologies
- Know the possibilities offered by technologies
- Research and design technological solutions
  - that fit in with people, the activities they want to undertake and the contexts in which those activities occur
- Evaluate alternative designs and iterate
  - do more research and more design until a solution is arrived at

„Some students (typically the less technical) like it very much; some students (typically the more technical) find it troubling and "irrelevant". Both sorts can find it challenging."*

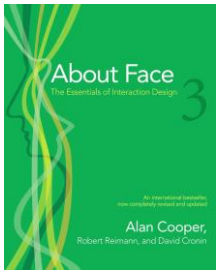
Sally Fincher, Michael Kölling
Human-Computer Interaction, University of Kent
United Kingdom

* - *Human Computer Interaction*

Bibliography

Vilnius University

- Jennifer Preece, Yvonne Rogers, Helen Sharp (2017). **Interaction design: beyond human-computer interaction**. John Wiley & Sons (MIF Library)
- **Ergonomics of human-system interaction** - Part 210: Human centred design for interactive systems (ISO 9241-210:2010)
- Alan Cooper, Reimann Robert, Dave Croni. **About face 3: the essentials of interaction design**. Wiley, 2007 (MIF Library)
  - chapter 1. Goal-directed design
- Maria Rosala, Problem Statements in UX Discovery, NN/g, 2021
- Jacob Nielsen. **10 Foundational Insights for UX.** UX Tigers, 2024
- Jacob Nielsen on UX. Join the AI Revolution Now, or Forever Regret Missing Out, August 2024
- Jacob Nielsen, AI Is First New UI Paradigm in 60 Years, UX Tigers, 2023



Additional reading

- Donald A. Norman. **The Design of Everyday Things**. Basic Books; Reprint edition (September 17, 2002), 272 pages
  - Excellent introduction to HCI