

# UI Design Process

EMEX Transnational Online Courses

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# User Interface Design

# Human-Centered Design – key principles

From ISO 9241-210:2010

- The design is based upon an explicit **understanding** of users, tasks and environments.
- Users are **involved** throughout design and development.
- The design is driven and refined by user-centered **evaluation**.
- The process is **iterative**.
- The design addresses the whole **user experience**.
- The design team includes **multidisciplinary** skills and perspectives.

# Form Follows Function

User interface (UI) designers can easily become UI-centric.  
→ Before rushing UI details, carefully consider the **purpose** and **functionality**.

- User's goals, needs
- Conceptual models: User's mental model <> design concept
- User's abilities and constraints
- Use context

From abstract to concrete:

**Activities** → **Tasks** → **Interactions (UI design)**

# Information Architecture

## Structure of the application

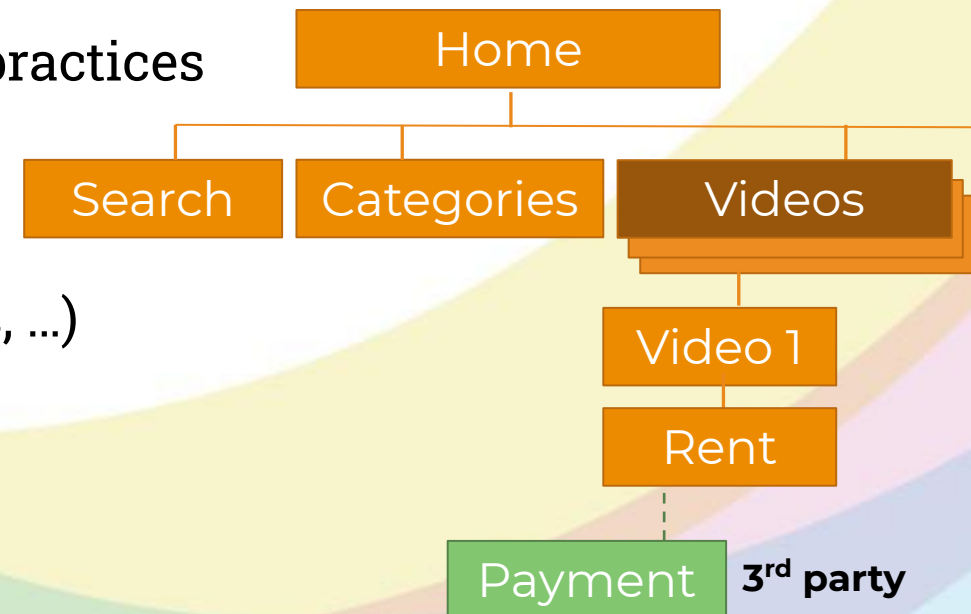
- Navigation and screen grouping
- Layout of each view/screen (**wireframe**)

### 1. Define

- Purpose, users & their needs, wishes, current practices
- Content (metadata, labeling)
- Structure & navigation
- Search mechanisms  
(search keywords, ask wizard, filter categories, ...)

### 2. Sketch, evaluate and revise

### 3. Create a design blueprint

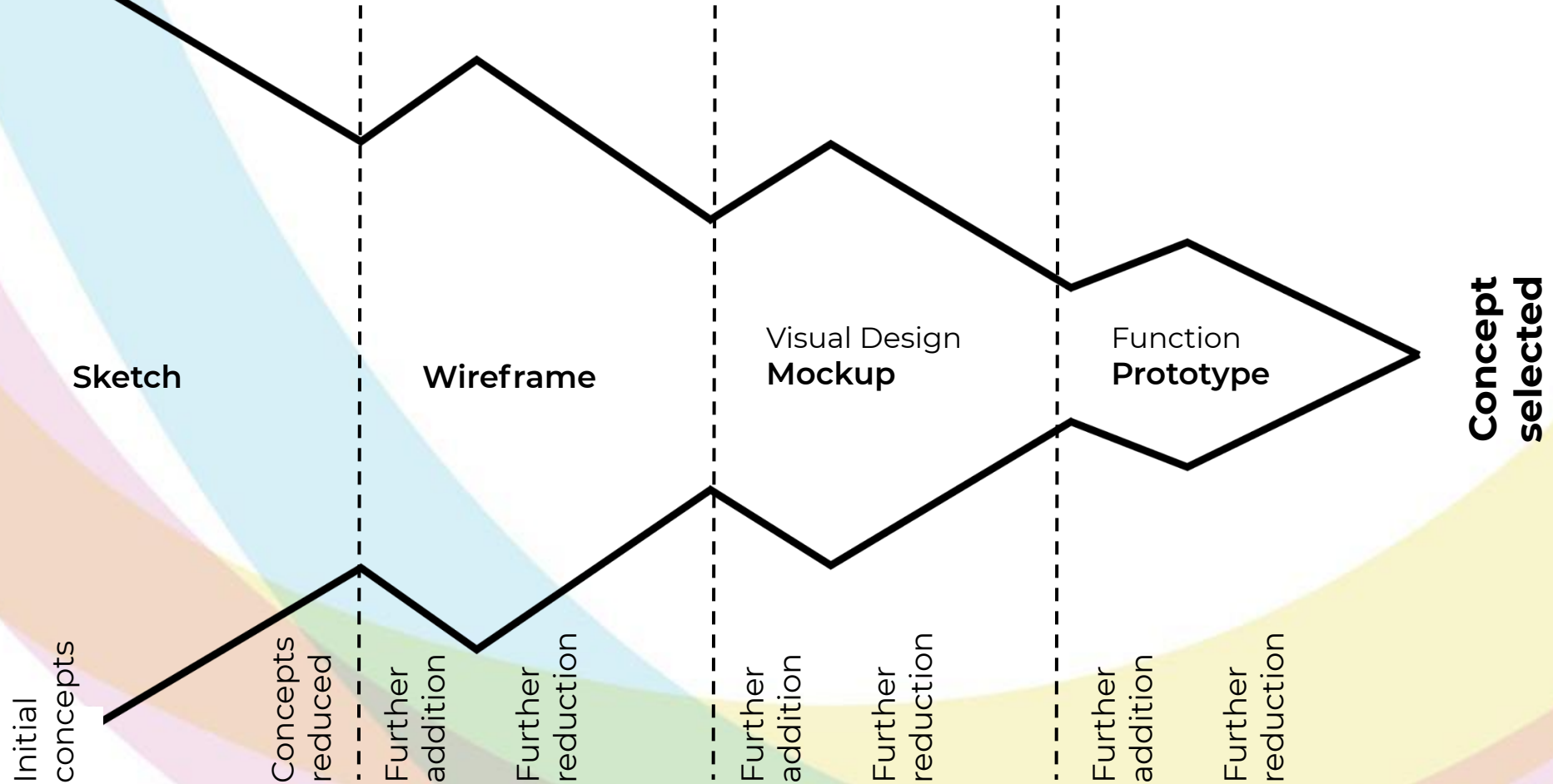


# Start with Sketching



# Design Process and Level of Detail

Concept generation





# Design Process and Level of Detail

- Quick and cheap
  - "Just enough" for communicating and evaluating ideas
  - Many alternative solutions easily
  - Low investment → easy to trash & re-design
  - Improve by iteration
- Does not bind thinking, free imagination
- Sketch draft does not give wrong impression
  - Doesn't look like a design (plan)
  - Rough drawing (vs. blueprint)

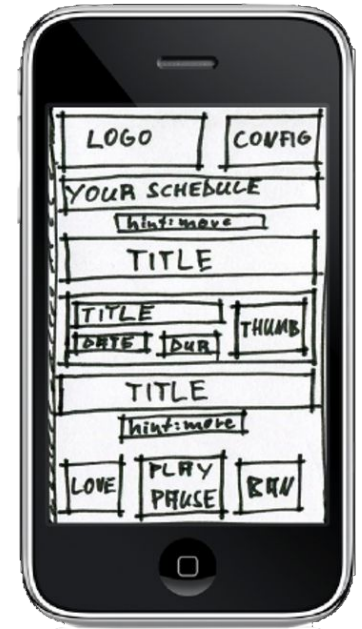
*"Sketching is a thinking aid"*

A good sketch reflects the level of **(in)completeness** of the idea in the designer's head.

# Wireframes

# Wireframes

- Page schematic, “screen blueprint”
- High-level description of the page template
- **Layout skeleton** that concretizes the UI design
- Defining **content** and **functions**
  - Abstract description of structural parts
  - Information, interaction, navigation
  - “page map”  
(information architecture of the screen)
- Does *NOT* define the visual appearance
- Current trend towards interactive wireframes

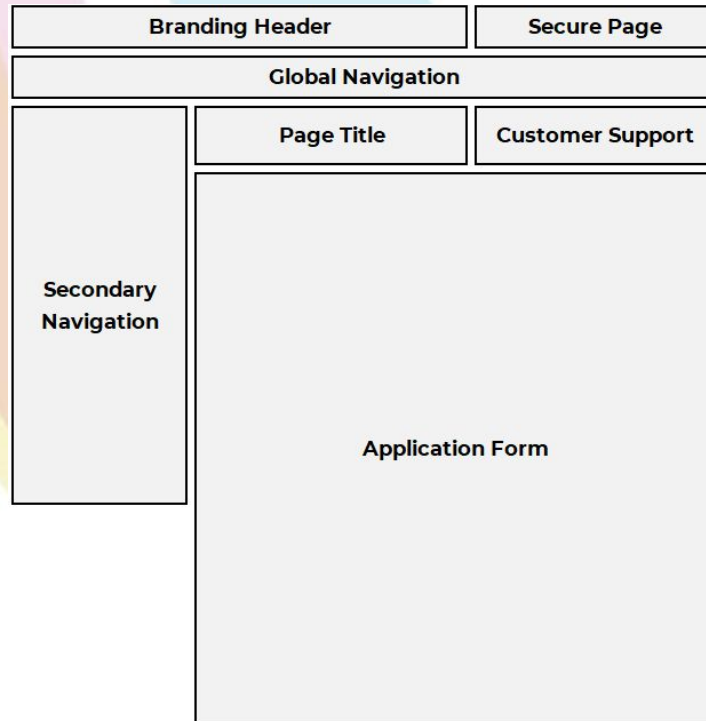


Scribble Layout



Wireframe Layout

# Wireframe Content



- From overview to details
  - Start with high-level general wireframe
  - Add sub-content wireframes
- No need to redesign a wheel
  - **Design guidelines:** E.g. Design guidelines for Android TV  
<https://designguidelines.withgoogle.com/android-tv/>
  - Exploit **design pattern** libraries & **conventions**  
E.g. <http://ui-patterns.com/patterns>
  - De-facto standards: E.g. common elements and their typical locations

# Practical exercise: Sketching wireframes

This exercise assumes you have an idea of an interactive TV application and its purpose on general level. Select one view (e.g. “home page”) for this exercise.

1. **List the main elements** (content & interactions) of the view.
2. **Each member** of the group sketches their own ideas of the UI wireframe. (Sketch it “**quick’n’dirty**”, feel free to sketch several versions.)
3. Review the sketches and **discuss** together within the group. (Note commonalities, need for improvements, best practices, etc.)
4. Create a **revised wireframe together**.

# Prototypes



# Prototypes

## Low-fidelity (paper prototype)

- Rough details, looks like a proto
- Fast, easy, cheap
- Encourages discussion (e.g. in focus groups)
- Not binding (fail early)
- Testing ideas and concepts
- Parallel design, comparing options
- Big trends
- Identifying and verifying requirements

...



## High-fidelity (interactive prototype)

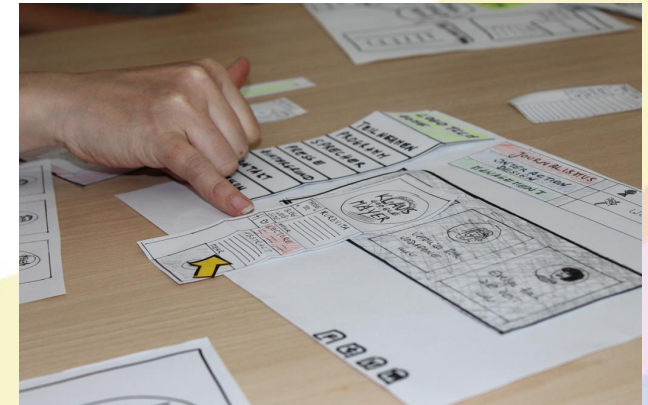
- Detailed, looks more finished
- Slower, more complex, costly
  - PPT, Axure, InVision, Flash, ...
- Demonstrating interaction
  - Sometimes high-fidelity only in essential parts
  - (proto~=product via iteration)
- Testing details
- Usability testing
- Selling the idea
- ...



# Paper prototypes

Perhaps the most common type of proto in HCI

- Intend to allow quickly testing UI and interaction solutions
- Demonstrates the structure of the UI and some basic interactions
- Can be done very quickly after doing sketches or wireframes
- Can be "rough" and hand-drawn, but readable
- Often covers most of the UI views
- Appear as something that is still being designed
  - "permission" for users to give critical feedback
- Quick and easy to change □ iterative



Example paper proto test: <https://www.youtube.com/watch?v=9wQkLthhHKA>

VR paper prototyping: <https://www.youtube.com/watch?v=4Zarx4Oqa4I>

# Examples of paper prototypes



See also:

<http://iwataasks.nintendo.com/interviews/#/wiiu/miiverse2/0/0>



# Guerrilla testing with paper protos

Quick, cheap, ad hoc, informal way to test you idea/concept/proto

How to:

1. Plan the test
2. Go to field and find users
3. Ask if they can spare *a few minutes* to test your idea/concept/proto and answer a few questions. Give intro to the proto & explain the procedure
4. Think-aloud may be useful, remember ethics (can quit anytime etc.)
5. Give them a few (earlier prepared) tasks to do (and explain/show the scenario if needed) Act as the Wizard-of-Oz, as needed.
6. Observe interaction (or discuss the concept). Note also time, keep your promise of a few minutes testing time!
7. Ask about experience
8. Analyze results

Gets quick impressions but can be risky, shallow and unreliable due to the on-the-fly nature.

# Click Through Prototype Tools

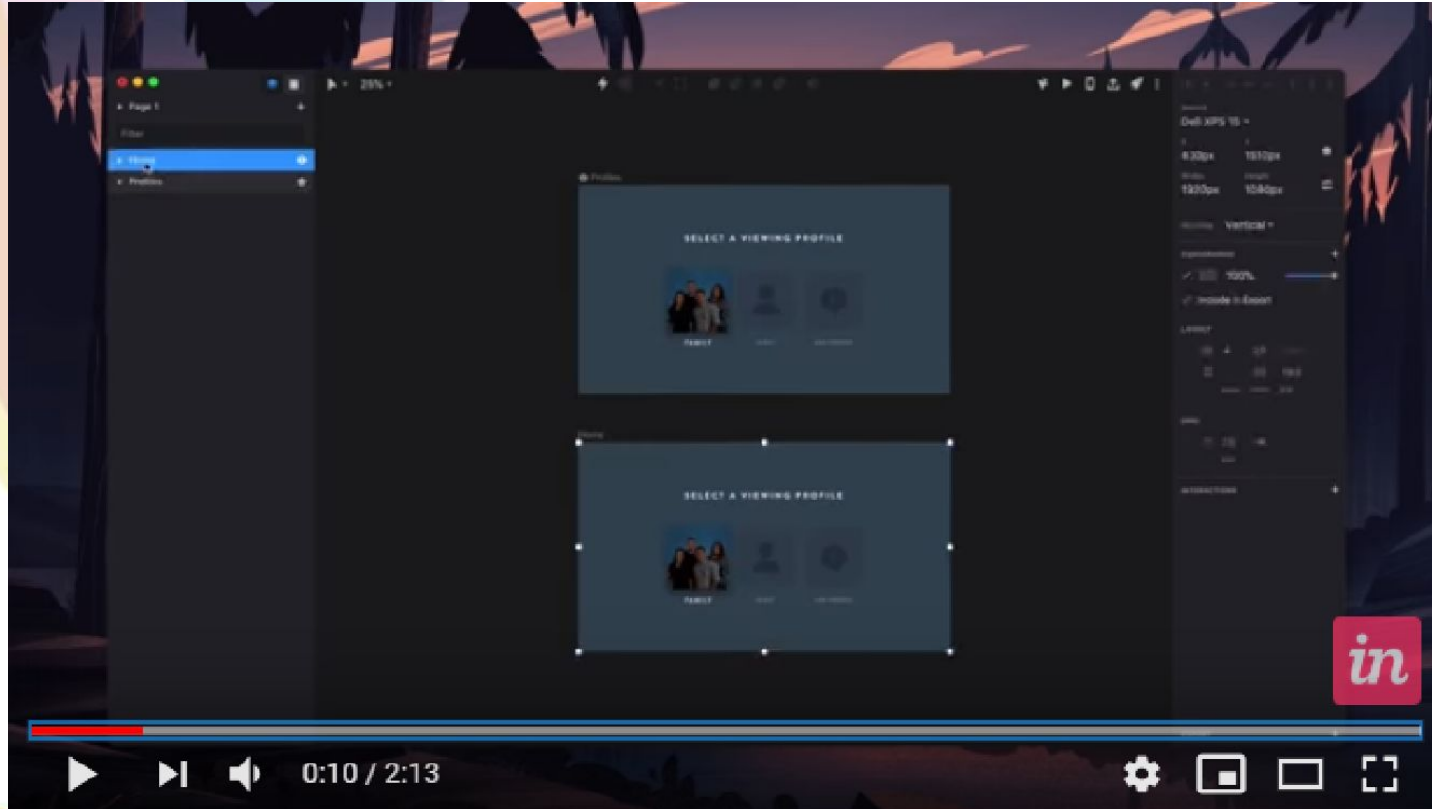
## Easy to create interactive prototypes:

- Build interactive wireframes
- Turn your sketches into click-through protos
- Sell your concept with cool (/realistic) looking prototypes

## Example tools

- **Balsamiq** Create interactive wireframes quickly and easily: <https://balsamiq.com/>.
- **Marvel POP** Transform your pen and paper ideas into an interactive iPhone or Android prototype: <https://marvelapp.com/pop/>.
- **InVision** Allows building low or high fidelity web or mobile prototypes and UI mockups. Just upload any graphics and make them interactive within a few minutes: <http://www.invisionapp.com/>.
- **Axure** Allows creating prototypes of websites and apps without coding: <http://www.axure.com/edu>

# Example: Smart TV interactive prototype



[InVision Studio Jams](#)  
[- Justin Jones, Smart TV](#)

# Don't forget interaction design principles

## Don Norman's Design Principles

(orig. 1983, revised 2013)

- **Affordance:** Communicating the purpose and use
- **Discoverability:** To know what can be done and how
- **Feedback:** What was done
- **Constraints:** Logical, semantical, physical, cultural
- **Mappings:** Relationship between controls
- **Conceptual model:** Explains how the product works
- **Signifier:** Symbol, sign, etc. to help in understanding the action

# Interactive TV and Second Screen Usage

Some notes and references



# Social Viewing

Watching TV, especially in a living room, is often a social situation:

- Several people are watching together or
- they can be co-located in the same living room but also in separate locations, sharing the experience via technology.

Supporting social elements in interactive TV is important.

Viewers may interact directly but including support for it in the applications is valuable. The support can enable/help:

- communication
- negotiation
- collaboration
- competition

Program genre effects socialization: news, soap, quiz and sport suit real time socialization while most other genres suit more asynchronous communication. (Geerts, Cesar, Bulterman. 2008)

# Second Screen

Second screen interactions are common today, viewers use their own mobile devices while watching TV. Second screen content can be:

- Irrelevant to TV content
- Generic web browsing, a viewer can, e.g., look for background information about the viewed topic
- Using social media to make viewing social, e.g., follow content related tags on Twitter
- Using a **companion app** which is designed specifically for the content viewed
  - these apps may include social viewing features
  - content is often synchronized across screens, requirements of the synchronization precisions have been studied
- Companions apps may be designed by third parties as well, e.g., to help critical viewing (Feltwell et al. 2017)

Still, most of this type of interactions happen before or after the actual viewing (Bentley, 2017)

# Second Screen

Having a second screen splits attention.

Design of the second screen content and interaction can help managing attention (and perhaps even the big screen content can be adjusted).

In addition to screens, also print media etc. is utilized while watching TV.



# References

Timothy Neate, Matt Jones, and Michael Evans. 2017. Cross-device media: a review of second screening and multi-device television. *Personal Ubiquitous Comput.* 21, 2 (April 2017), 391-405. DOI: <https://doi.org/10.1007/s00779-017-1016-2>

Edward Anstead, Steve Benford, and Robert J. Houghton. 2014. Many-screen viewing: evaluating an olympics companion application. In *Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video (TVX '14)*. ACM, New York, NY, USA, 103-110. DOI: <https://doi.org/10.1145/2602299.2602304>

David Geerts, Rinze Leenheer, Dirk De Grooff, Joost Negenman, and Susanne Heijstraten. 2014. In front of and behind the second screen: viewer and producer perspectives on a companion app. In *Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video (TVX '14)*. ACM, New York, NY, USA, 95-102. DOI: <https://doi.org/10.1145/2602299.2602312>

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Tom Feltwell, Gavin Wood, Kiel Long, Phillip Brooker, Tom Schofield, Ioannis Petridis, Julie Barnett, John Vines, and Shaun Lawson. 2017. "I've been manipulated!": Designing Second Screen Experiences for Critical Viewing of Reality TV. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 2252-2263. DOI: <https://doi.org/10.1145/3025453.3025833>

Rui Zhang, Ye Deng, and Lei Shi. 2017. User Research and Design for Live TV UX in China. In *Adjunct Publication of the 2017 ACM International Conference on Interactive Experiences for TV and Online Video (TVX '17 Adjunct)*. ACM, New York, NY, USA, 9-14. DOI: <https://doi.org/10.1145/3084289.3089916>

Mark McGill, John Williamson, and Stephen A. Brewster. 2015. It Takes Two (To Co-View): Collaborative Multi-View TV. In *Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video (TVX '15)*. ACM, New York, NY, USA, 23-32. DOI: <https://doi.org/10.1145/2745197.2745199>



# Evaluation

# Evaluation is integral to the design process

Evaluate throughout the iterative design process

- Check usability and UX goals, and collect user feedback when interacting with a design artifact
- Target can be a sketch, prototype, (component of) a product

Evaluation method depends on the goals of the study

- E.g. Predict or model user behavior (e.g. expert evaluations, modeling)
- E.g. Collect data from real use (e.g. usability tests, field user studies, log data)
- E.g. Collect users' opinions and reactions (e.g. interviews, surveys)
- E.g. Collect data from long-term use (e.g. diary studies, experience sampling)

# From evaluating ideas to testing designs

## Validating ideas or concepts

- Does the idea/concept meet the needs of the user (our intended target user group)
- Are we making the *right product*?

## Verifying designs

- Do the utility and usability of the interface meet the design goals?
- Are we making the *product right*?



# Validating early ideas / concepts

- Storyboards → Can utilize rough sketches and wireframes
- Videos
- Mockups
- Low-fidelity prototypes
  - Paper prototypes
  - Interactive
- Wizard-of-Oz
- and more
  - lego prototypes, role-playing, ... or combined methods



**Iterative!**

# Evaluation of Usability and UX

- Consulting the usability experts
  - Heuristic evaluation – holistic reviews guided by heuristics
  - Walkthrough methods – focused investigations stepping through pre-planned scenario noting problems
- Testing involving users (or based on user data)
  - Usability testing – testing of the product/service with users
  - Experiments – controlled lab study
  - Also, e.g. A/B testing comparing designs, often including Analytics based on log data
- Evaluating user experience (“UX user studies”)
  - Focus on users’ emotional reactions and subjective experiences
  - Often in the real context of use, i.e. field studies, observations, diaries
  - Typically including methods to ask users, e.g. questionnaires, interviews

# Example Methods

# Heuristic evaluation

- Inspection based evaluation performed by usability experts
- Based on guidelines and checklists i.e. “heuristics”
  - E.g. Heuristic evaluation based on Nielsen’s heuristics, or, going through product specific checklists
  - Heuristics guide the evaluation: **Stimulate** thinking and help to **discover** and **analyze** problems
- Tries to predicts user reactions based on assumptions
  - Finds *potential* problems
  - Provides *recommendations* for improvements

# Most common: Nielsen's Heuristics

## Usability Heuristics for User Interface Design

1. Visibility of system status (Visibility)
2. Match between system and the real world (Familiarity (or match))
3. User control and freedom (Control)
4. Consistency and standards (Consistency)
5. Error prevention (Error prevention)
6. Recognition rather than recall (Recognition)
7. Flexibility and efficiency of use (Flexibility)
8. Aesthetic and minimalist design (Aesthetics (or minimalism))
9. Help users recognize, diagnose, and recover from errors (Error messages (or recover))
10. Help and documentation (Help)

# Heuristic evaluation – How to

- Select the appropriate list of heuristics suitable for your goal and user group
- Select and instruct evaluators (~ 3-4 evaluators produces best benefit)
  1. Each evaluator independently conducts the evaluation  
First to get overall feel, second round to focus on specific features
  2. Problems from all evaluators are combined and discussed  
A final common list is produced  
(often also including the expected severity of the foreseen problem)
- Findings and suggestions are reported
  - If possible, findings are discussed with the client in a feedback meeting



# Cognitive Walkthrough

- Focus on evaluating **learnability**
  - First time use, occasional users
  - E.g. ATM, coffee vending machine
- Experts utilize assumptions about user population, context of use, task details, while the walk through a pre-defined scenario
- Various versions developed over years, with different number of questions to ask (2-4)

→ Can be combined with  
heuristics  
(usability walkthrough)



# Cognitive Walkthrough – How to

1. Define tasks
2. Define steps for each task
3. Walk through step by step asking the following questions for each step (version by Spool 2018)
  - Will the correct action be sufficiently evident to the user?
  - Will the user notice that the correct action is available?
  - Will the user associate and interpret the response from the action correctly?

 → As the experts work through the scenario, they note problems.

# Usability Testing

Evaluating a product or service by testing it with **representative users**.

## Typical setup

- Participant & moderator (& observers)
- Product / service to test
- Test tasks
- Recording equipment (e.g. video camera, movable lab equipment)
- Supporting methods (e.g. think-aloud, eye tracking)
- After the test, questionnaires and/or an interview

# Usability testing – Procedure

- Plan the test (goals, participants, test environment, budget, schedule)
- Prepare materials (test tasks, forms, script, equipment)
- Pilot test!
- Conduct the tests
  - Inform & instruct the participant
  - Ask to fill in informed consent (and pre-test forms)
  - Run the test & observe
  - Post-test questionnaires, interview
  - Thank the participant!
- Analyze and report

# Measuring usability

To study the product's usability = “the extent to which a product can be used by specified users to achieve specific goals with **effectiveness**, **efficiency**, and **satisfaction**, in a specified context of use” ISO 9241-11

In a **usability test**, the focus is on:

- Effectiveness: e.g. task completion rate, accuracy
- Efficiency: e.g. time to complete tasks or recover from errors
- Satisfaction: e.g. subjective responses (questionnaire, interview)

# Example questionnaire: System Usability Scale (SUS)

- Widely used, validated measure
- Industry standard
- Can be used to complement tests and interviews
- Provides *summative* data about the usability of a product

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. .....

**Strongly disagree 1 / 2 / 3 / 4 / 5 Strongly agree**

See details e.g.: → [Usability.gov: System usability scale](https://www.usability.gov/system-usability-scale)



# Informal and longitudinal studies

- Informal user trials and observations can happen anywhere (sitting/standing next to the user)
  - field (e.g. user's workplace, user's home, bus stop, etc.)
  - remotely (e.g. via screen sharing and webcam)
  - (or in a laboratory where you have the equipment for screen capture and multiple simultaneous video recordings)
- Longer real-life user trials are impossible to observe (e.g. the user taking the test device home or installing an app on one's own device)
  - need other methods for data collection, e.g. cultural probes, (video) diaries, or experience sampling methods
    - Logging of use is sometimes impossible – and may be unethical; explicit consent is required if done

# Evaluating user experience

- How a person *feels* about a system
- Subjective, emotional, holistic
- Various methods
  - Self-reporting (e.g. questionnaires)
  - Observing (expressions)
  - Measuring in the lab (physiological reactions)
  - Field studies

→ See, e.g.: [AttrakDiff questionnaire](#)



# Example: Premo questionnaire tool

“A validated emotion measurement tool that gives insights into people’s nuanced feelings towards products, services and other stimuli.”

[premotool.com](http://premotool.com)

- Focus on users’ emotional reactions and subjective experiences.
- The product/system is shown to the user.
- In different stages of using the product, the **user is asked to define how strongly they feel** each of the 14 emotions.
- The tool can complement interviews and stimulate discussion.

# Experience sampling method (ESM)

Participants are asked to report their experiences, thoughts and activities in their everyday lives

- Reporting requests can be sent regularly at a certain time, randomly, or they can be triggered related to a participant's (user's) certain actions
- Requests and responses can be sent via a mobile device

## Strengths

- Method does not rely on participant's long-term memory (reduces recall bias)
- Provides insight into the influence of time on the research subject

## Weaknesses

- Requires longer commitment from participants
- Can interrupt participant's other activities

# Learn more

- Tullis & Albert (2013): Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics.
- Sauro & Lewis (2016): Quantifying the User Experience: Practical Statistics for User Research.
- Sharp, H., Rogers, Y., & Preece, J. (2019). Interaction design: beyond human-computer interaction (Fifth edition). Indianapolis, IN: Wiley.
- Norman, D. (2013). The design of everyday things (Revised and expanded edition). New York: Basic Books.

See also resources available online

- <https://www.interaction-design.org/literature>
- <https://www.nngroup.com/topic/heuristic-evaluation/>
- <https://www.nngroup.com/topic/user-testing/>
- [www.allaboutux.org](http://www.allaboutux.org)