VRIJE UNIVERSITEIT BRUSSEL

Next Generation User Interfaces

Interaction Design

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Interaction Design (IxD)

> *Interaction design addresses the design of interactive products to support the way people communicate and interact in their everyday and working lives.*
>
> Y. Rogers, H. Sharp and J. Preece, *Interaction Design: Beyond Human-Computer Interaction*

- In order to design a product we first need some requirements
  - whom to ask about the requirements?
  - will users know what they want or need?
  - users are unlikely to be able to envision what is possible
    - where to get ideas for *innovative products*?
- *user-centred design* involves users throughout the process

Interaction Design (IxD) …

- Reduce negative aspects
  - frustration
  - annoyance
- Design products that are *easy to learn*, *effective to use* and provide an *enjoyable user experience*

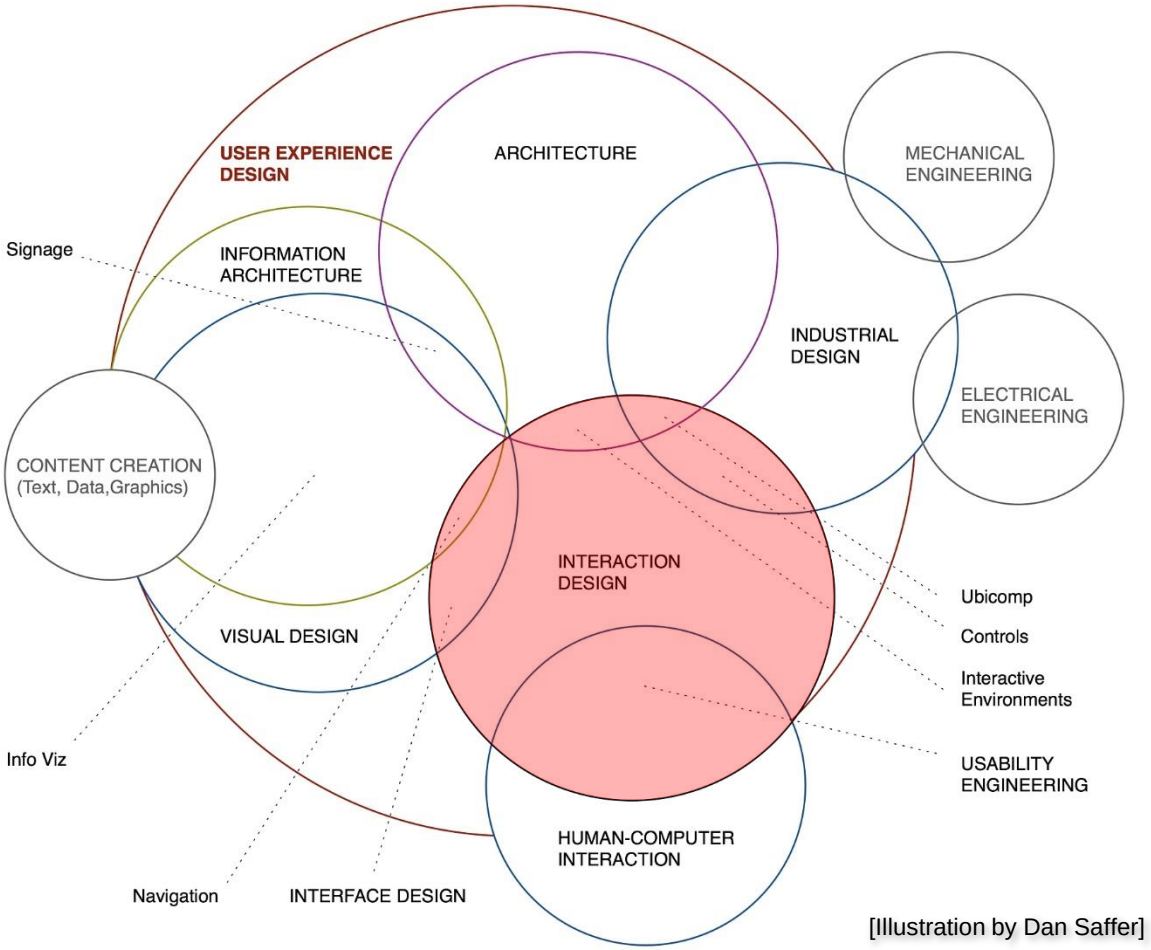
What to Design

- *Who (user)* is going to use an interactive product, *how (task)* are they going to be used and *where (context)*?
- We further have to understand the activities people are doing while using the products
- How to optimise a user's interactions with a system, environment or product to support and extend their activities in *effective*, *useful* and *usable* ways?
  - take into account *what people are good and bad at*
  - what might help people with the way they currently do things
  - *listen* to what people want and *get them involved in the design*
  - use established *user-based techniques* during the design process

Who Is Involved in Interaction Design

- Often carried out in *multidisciplinary teams*
  - engineers, designers, programmers, users, psychologists, …
  - more ideas as well as more creative and original designs
- Communication between people with different backgrounds might be an issue
- Nowadays companies often seek help from interaction design consultants
  - Cooper, Nielsen Norman Group, IDEO, …

Interaction Design Disciplines



[Illustration by Dan Saffer]

Good and Poor Design

- Voice mail example
- Possible interaction
  - After picking up the handset we get *"beep, beep, beep, there is a message"*
  - As written in the instructions we type '41' and get the answer *"You have reached the Hilton Brussels City voice message centre. Please enter the room number for which you would like to leave a message."*
  - After waiting and checking the instructions again we press *, enter our room number and press # to get the answer *"You have reached the mailbox for room 106. To leave a message type in your password."*
  - We type in our room number again and the system replies *"Please enter the room number again and then your password."*

```
1.  Touch 41.
2.  Touch *, your room number
    and #.
```

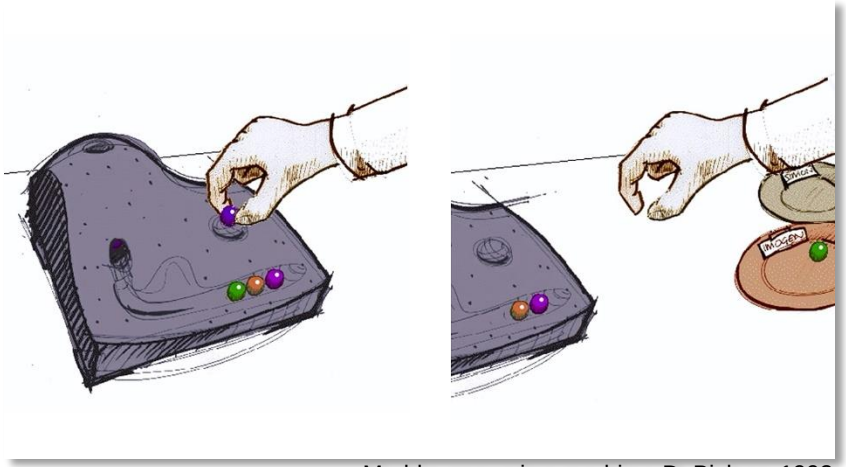
Instructions to listen to voice messages

Good and Poor Design …

- What is the problem with this voice mail system?
  - confusing
  - takes too many steps to do basic tasks
  - difficult to use
  - not possible to see at a glace how many messages have been left
  - instructions are partially provided by the system and partially by the instructions card
  - …

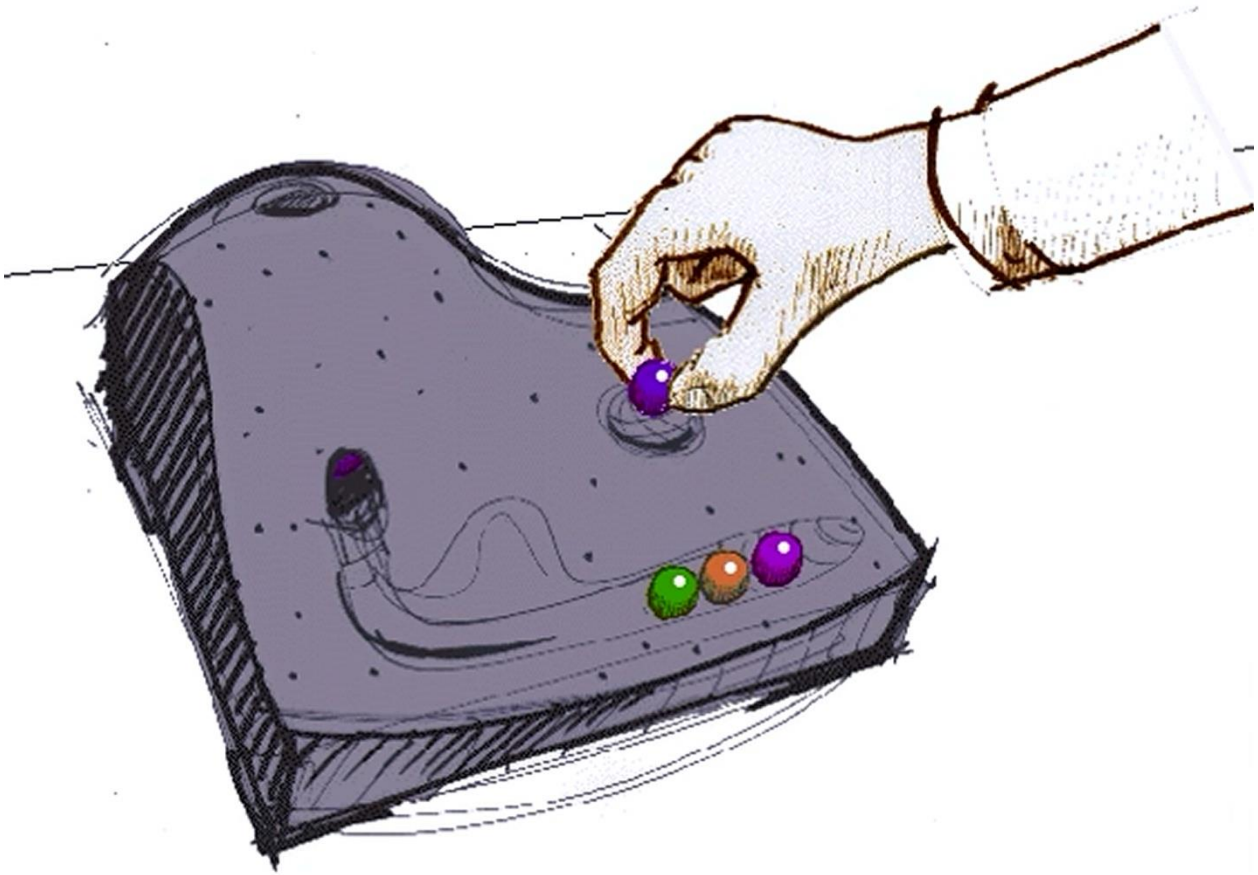
Good and Poor Design …

- Marble answering machine
  - incoming messages repre-sented by physical marbles
- Differences
  - familiar physical objects show the number of messages
  - *aesthetically pleasing* and *enjoyable to use*
  - *one-step actions* to perform a task
  - simple but elegant design with less functionality
  - anyone can listen to any of the messages
- Might not be robust enough to be used in public space
  - *important to take into account where a product is going to be used*



Marble answering machine, D. Bishop, 1992

Marble Answering Machine



Good and Poor Design

- Remote control example
- Multiple remote controls
  - each control looks and works differently
  - often many small, multi-coloured and double-labelled buttons
  - difficult to find the right buttons even for simplest tasks

- Is it better to *converge* to a single universal control or have multiple *specialised* one?

Good and Poor Design …

- TiVo remote control
  - large and clearly labelled buttons
  - logically arranged buttons
  - remote nicely fits into hand
  - good use of colours and cartoon icons making it easy to identify them

TiVo remote control

- Why is the TiVo remote control more usable than others?
  - TiVo followed a *user-centred design process*
  - potential users involved in the design process
  - avoids “buttonitis” trap by offering only the essential functionality on the remote and the rest via on-screen menus

Usability Goals

- *Effectiveness*
  - how good is the product at doing what it is supposed to do
  - question: *"Is the product capable of allowing people to learn, carry out their work efficiently, access the information they need, or buy the goods they want?"*
- *Efficiency*
  - how well does the product support the user in carrying out their tasks
  - question: *"Once users have learned how to use a product to carry out their tasks, can they sustain a high level of productivity?"*

Usability Goals …

- *Safety*
  - protect the user from dangerous conditions and undesirable situations
  - prevent users from making serious errors by mistake
    - do not place a `quit` or `delete` command next to a `save` command in a menu
    - asks for a confirmation for “dangerous” commands
  - provide different ways to recover from errors
    - offer some `undo` functionality
  - question: *“What is the range of errors that are possible using the product and what measures are there to permit users to recover from them?”*

Usability Goals …

- *Utility*
  - does the product provide the right kind of functionality
  - question: *"Does the product provide an appropriate set of functions that will enable users to carry out all their tasks in the way they want to do them?"*
- *Learnability*
  - how easy is it to learn to use the system
  - question: *"Is it possible for the user to work out how to use the product by exploring the interface and trying out certain actions? How hard will it be to learn the whole set of functions in this way?"*

Usability Goals …

- *Memorability*
  - how easy is it to remember how to use a system once it has been learned
    - meaningful icons, command names and options
  - important for infrequently used products
  - question: *"What kinds of interface support have been provided to help users remember how to carry out tasks, especially for products and operations they use infrequently?"*

User Experience (UX)

- *How does a product behave and how is it used by people in the real world*
  - how do people feel
  - pleasure and satisfaction when using, holding, opening, …
- We cannot design a user experience but only *design for a user experience*
  - usability
  - aesthetics
  - content
  - look and feel as well as sensual and emotional appeal
- No unifying theory but *conceptual frameworks*, *verified design methods*, *guidelines* and *research findings*

User Experience Goals

Desirable aspects

- satisfying
- enjoyable
- engaging
- pleasurable
- exciting
- entertaining
- helpful
- motivating
- challenging
- supporting creativity
- fun
- rewarding
- …

Undesirable aspects

- boring
- frustrating
- making one feel guilty
- annoying
- childish
- unpleasant
- patronising
- making one feel stupid
- gimmicky
- …

- User experience goals are less objective than usability goals

3 Ways Good Design Makes You Happy

Design Principles

- Principles derived from theory-based knowledge, experience and common sense
- *Visibility*
  - visible functions ensure that a user knows what to do next
    - voice mail system vs. marble answering machine
  - non-visible functions might be harder to use
    - sensor-enabled faucets
    - sensor-enabled lights
    - ...

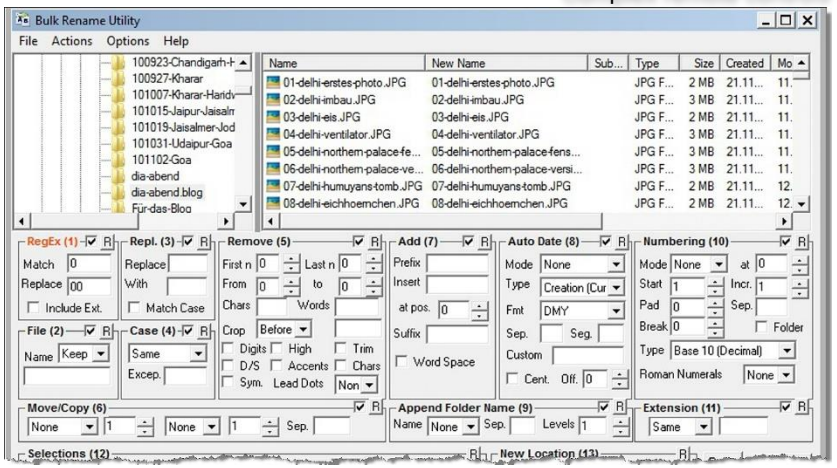
Design Principles …

- *Simplicity*
  - balance offered features vs. ease of use (usability)
  - do not oversimplify by eliminating necessary features
    - *"users want complexity"* (Don Norman)

Complex remote controls

"In anything at all, perfection is finally attained not when there is no longer anything to add, but when there is no longer anything to take away."

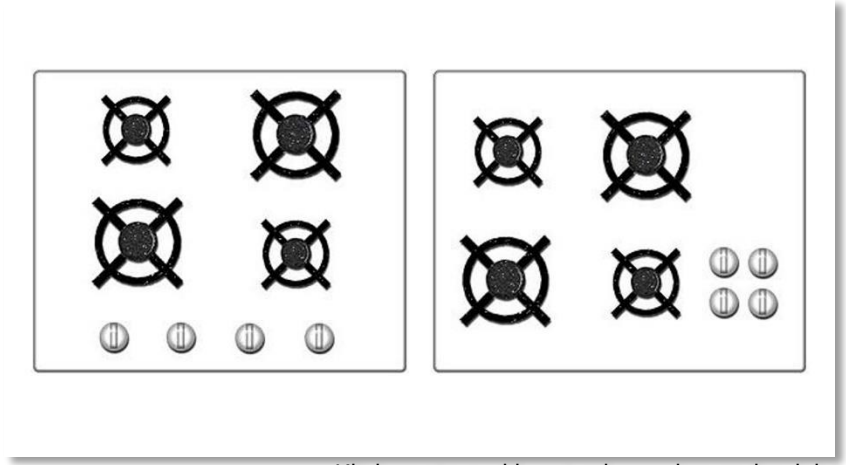
Antoine de Saint Exupéry



Design Principles …

- *Mapping*
  - *natural mapping* makes it easy to understand which control will perform which action
  - *"If a design depends upon labels, it may be faulty. Labels are important and often necessary, but the appropriate use of natural mappings can minimise the need for them. Wherever labels seem necessary, consider another design."*

Seat adjustment in a Mercedes-Benz

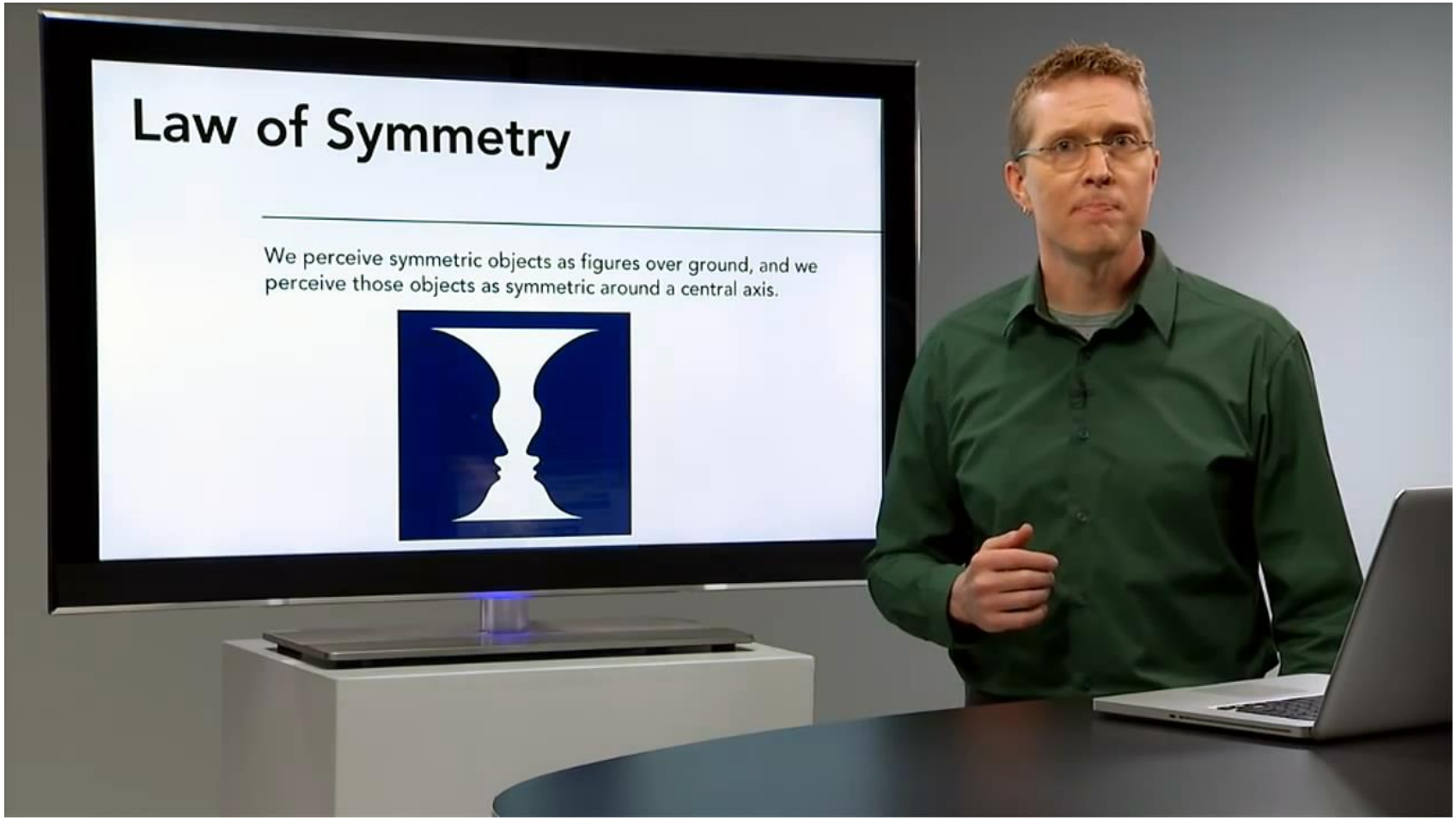


Kitchen stove with natural mapping on the right

Design Principles …

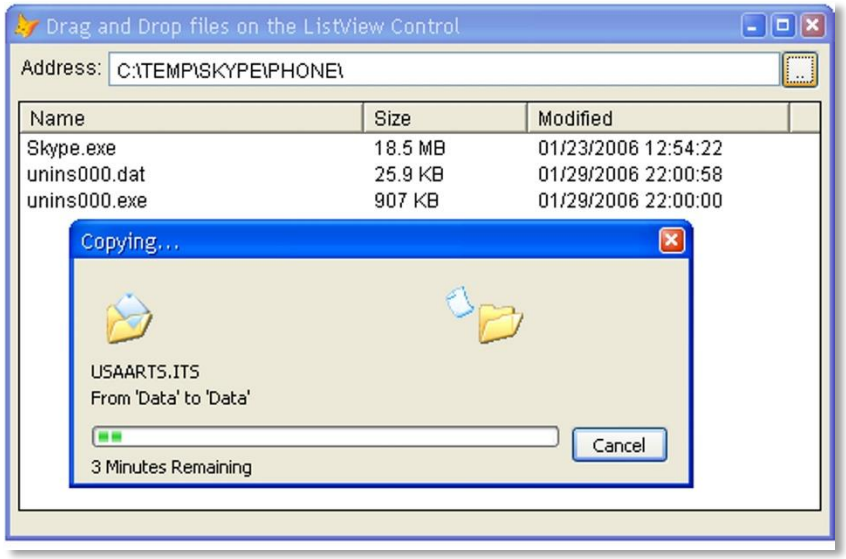
- *Gestalt Principles*
  - *law of proximity*
    - objects that are near each other in space or time are perceived as belonging together
  - *law of similarity*
    - objects with similar attributes are perceived as belonging together
  - *law of closure*
    - objects are perceived as a whole even if they are not complete
  - …

Gestalt Principles



Design Principles …

- *Feedback*
  - provide feedback about what action has been done, which allows users to continue with their activity
    - audio, tactile, verbal, visual or a combination of these feedback



Design Principles …

- *Consistency*
  - follow certain rules and use similar elements to achieve similar tasks
  - consistent interfaces are easier to learn and use
- *No Surprises*
  - messages should not pop-up as a surprise during some tasks
    - e.g. *"your battery is now fully charged"*
  - avoid timeouts
    - timeouts are evil
- *Dialogues instead of Monologues*
  - after the user gets an answer from the system there might be some further interaction
    - e.g. car route planner

Design Principles …

- *Affordance*
  - an affordance of an object tells us something (gives us a clue) about *how to use the object*
  - physical objects offer *real affordances* which do not have to be learned
  - screen-based interfaces offer *perceived affordances* which are learned conventions
- There might be some trade-offs between design principles when using multiple of them

Understanding the Problem Space

- Identification of usability and user experience goals as a prerequisite
- Make *underlying assumptions* and *claims* explicit
  - e.g. people will want to watch TV on their mobile phones
- Articulation of the problem space is typically done as a *team effort*
- Time-consuming process but reduces the chance of *incorrect assumptions* and *unsupported claims* creeping into a design solution
- Good understanding of the problem space helps in *conceptualising the design space* (blueprint)

Interaction Types

- Instructing
  - user *issues instructions* to a system
  - typing commands, selecting menu options, …
- Conversing
  - user having a *two-way communication/conversion* with the system
    - e.g. ticket booking or help systems
  - used to find out specific kinds of information
- Manipulating
  - in *direct manipulation* digital objects are designed so that they can be interacted in a similar way as physical objects in the real world
- Exploring
  - explore environment by *exploiting knowledge on how to navigate* through existing spaces

Four Approaches to Interaction Design

- User-centred design (UCD)
  - user knows best and is the only guide to the designer
  - designer translates user needs into a design solution
- Activity-centred design (ACD)
  - focus on the behaviour surrounding a particular task
  - less about the user's goals but about the tasks forming part of particular activity
- Systems design
  - system (people, computers, objects …) is the centre of attention and the user's role is to set the goal of the system
- Genius design
  - relies solely on the experience and creativity of the designer
  - the user's role is to validate the design

Dan Saffer, 2009

Importance of User Involvement

- Before user-centred design was used, developers defined requirements based on
  - talking to their managers
  - talking to people playing the role of users (proxy users)
  - their own judgement
- User involvement during the development guarantees that user activities are taken into account
- Makes sure that the user expectations about a new product are realistic (*expectation management*)
  - pre-release versions and hands-on demonstration also help in shaping the expectations

Importance of User Involvement …

- Users who are involved feel that they have contributed to the development and are more likely to support a product's use (sense of *ownership*)
- Different degrees of user involvement
  - full-time for the duration of the whole project
  - full-time for a limited time
  - part-time for the duration of the whole project
  - part-time for a limited time
- Another possibility is to combine regular newsletters with workshops
- Customer support and error reporting systems after product release

How Much User Involvement?

- Some studies have shown that too much user involvement can lead to problems
  - higher costs
  - less innovation
  - lower team effectiveness
  - over time, users develop more sophisticated ideas and they want to have them incorporated late in the project
  - users are less predictable and not aware of software development matters (e.g. asking for major late changes)
  - unnecessary conflicts and increased reworking
  - …

User-Centred Design Principles

1. *Early focus on users and tasks*
   - who will be the users
   - study the characteristics of users
2. *Empirical measurement*
   - identify specific usability and user experience goals
     - helps to chose between alternative designs
     - can be used to check the progress
   - sketches, description in natural language and prototypes help to observe and analyse the performance and reactions of users
3. *Iterative design*
   - problems identified in user testing are fixed and evaluated in a next iteration
     - iteration is particularly important when trying to innovate

Early Focus on Users and Tasks

- *Users' tasks and goals* are the *driving force*
  - technology informs design options and choices but user goals and tasks are the driving force
  - *"What technologies are available to provide better support for users' goals?"*
- *Users' behaviour and* context of use are *studied* and the system is designed to support them
  - design to support an activity with little understanding of the real work involved is likely to be incompatible with current practice
    - users do not like to deviate from their learned habits
- *Users' characteristics* are *captured* and designed for
  - take the cognitive and physical limitations of users into account and limit the mistakes they can make

Early Focus on Users and Tasks …

- *Users are consulted throughout the whole development*
  - respect users and take their input seriously into account
- *Design decisions* are *taken within the context of users, their work and their environment*
  - does not necessarily mean that users are actively involved in design decisions

Interaction Design Process

The interaction design process involves *four basic activities*

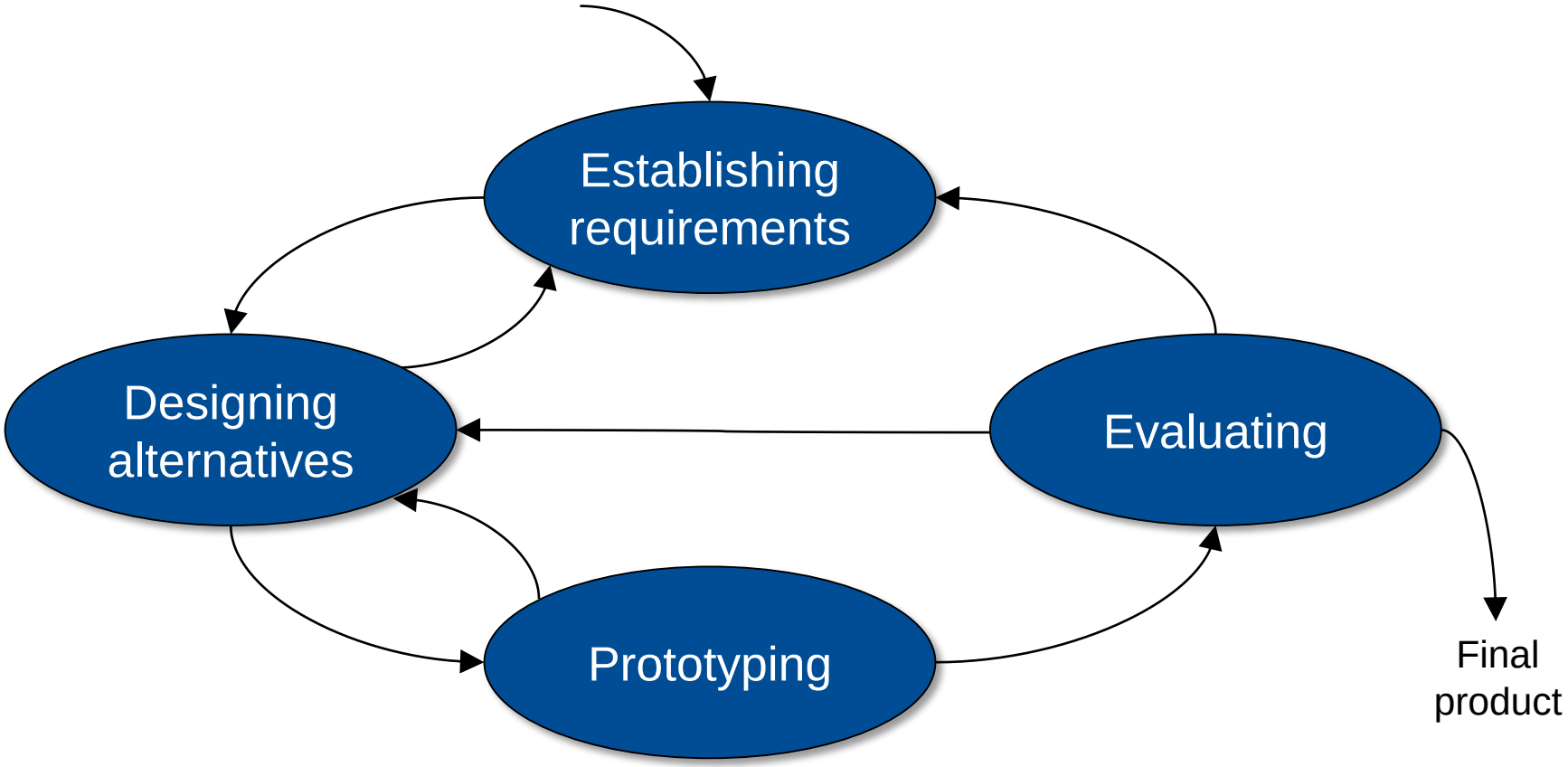
1. *Establishing requirements*
   - know target users and the required support
2. *Designing alternatives* that meet the requirements
   - conceptual design
   - physical design
3. *Prototyping* the alternative designs in order that they can be communicated and assessed
   - paper-based prototypes
   - software prototypes

Interaction Design Process

4. *Evaluating*

- determining the usability and acceptability
- observing or talking to users
- interviews or questionnaires

Interaction Design Lifecycle Model



Who are the Users?

- Involving the right users is crucial
- Different types of users
  - primary users
    - frequent hand-on users of the product
  - secondary users
    - occasional users or users who use the product through an intermediary
  - tertiary users
    - affected by the introduction of the product or influence its purchase
- Group of *stakeholders* for a product normally larger than the group thought of as users
- Difficult to find users for products that are a *new invention*

What are the Needs?

- People might not know what is possible (*un-dreamed-of requirements*)
  - cannot just ask *"what do you need?"*
- Understand characteristics and capabilities of users
  - what are they trying to achieve and how do they do it currently
  - would they achieve their goals more efficiently and have a more enjoyable experience?
- Useful to start by understanding similar behaviour that is already established
- Focus on *user's goals* and on *usability and user experience goals* is more promising than focusing on needs

Designing Alternatives

- Should not just stick to a solution that is “good enough” but also consider alternative solutions
- *Creativity of the designer* plays an important role
  - discussion with other designers
  - studying other designs
    - pay attention to copyrights and patent laws
  - solve new problems based on knowledge gained from solving previous similar problems
  - creativity workshops and brainstorming sessions

“The best way to get a good idea, is to get lots of ideas.”

Linus Pauling

TechBox, IDEO

- TechBox with interesting labelled objects and materials

Choose Among Alternative Designs

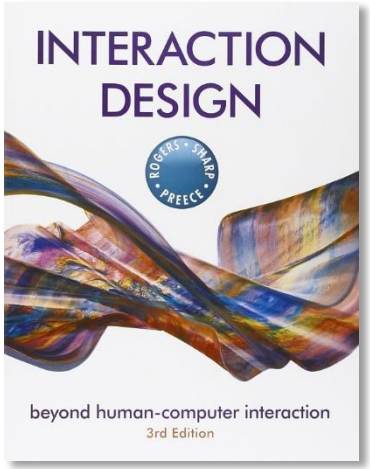
- Designs and potential solutions have to be communicated in a suitable form to other people
  - sketches, description in natural language, *prototypes*, …
- Design decisions based on the information collected about *users and their tasks*
- Decision also based on the *technical feasibility* of an idea
- Decide about
  - *externally visible* and measurable features
  - *internal characteristics* of the system
- Let users and stakeholders interact with the products
  - decide based on their experience, preferences and suggestions for improvements

Integrating IxD and Other Lifecycle Models

- Lifecycle models associated with other disciplines that contribute to interaction design
- Software engineering
  - "Human-Centred Software Engineering" (HCSE)
  - Agile Software Development as a promising attempt
    - eXtreme Programming (XP)
    - Scrum
    - …

Further Reading

- Major parts of this lecture are based on the book *Interaction Design: Beyond Human-Computer Interaction*
  - chapter 1
    - What is Interaction Design
  - chapter 2
    - Understanding and Conceptualising Interaction
  - chapter 9
    - The Process of Interaction Design



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Next Lecture

Requirements Analysis, Prototyping and Evaluation