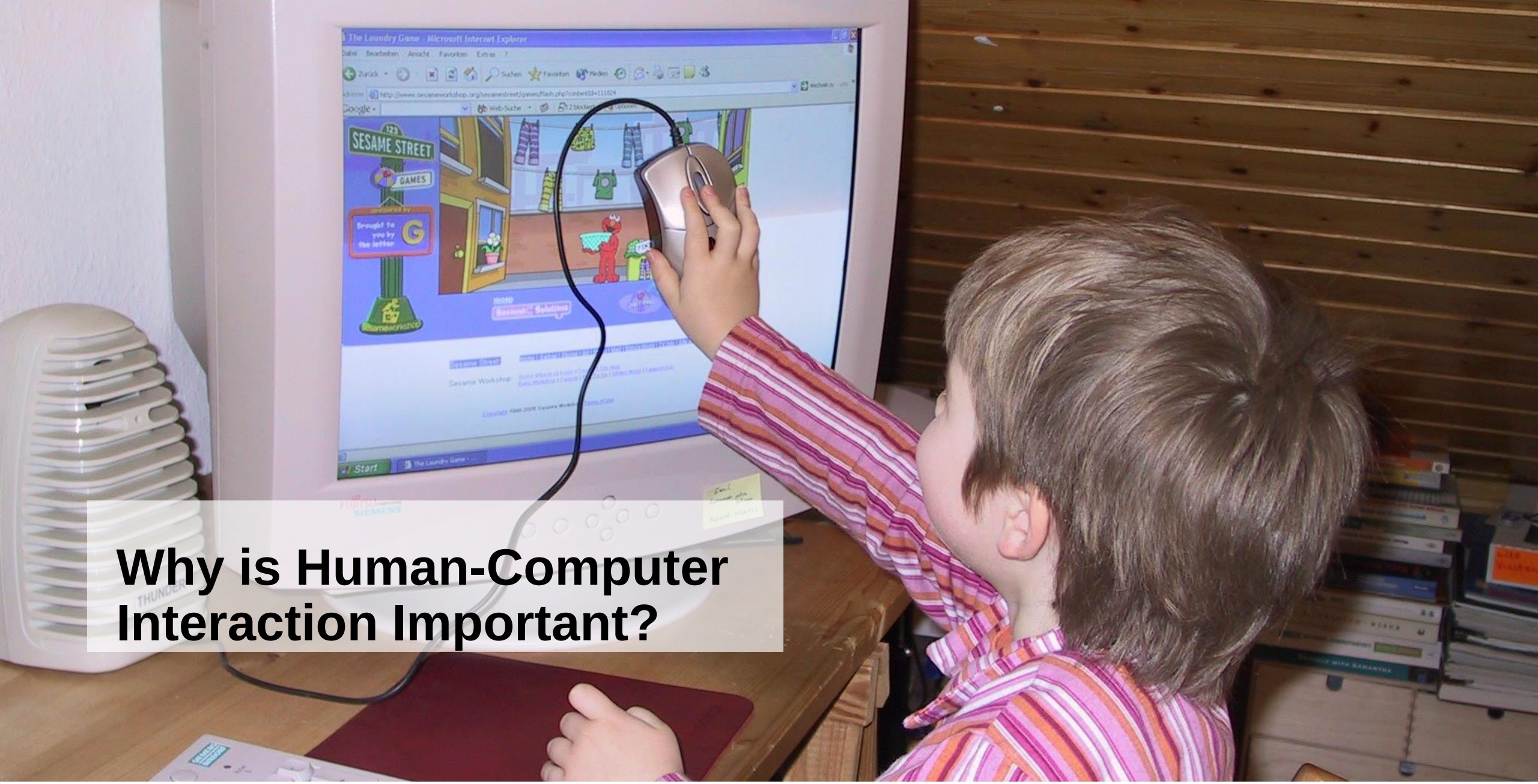


Why is Human-Computer Interaction Important?

Learning Goals

- Understand …
  - how user interfaces impacts our interaction and relationship with (digital) technologies
  - why interaction is relevant from different perspectives (user, companies)
  - why designing interaction is becoming more relevant as technology advances
- Be able to …
  - explain the economic implications of bad usability
  - sketch a user interface and discuss different aspects
  - explain why interaction is a visible innovation

Human-Computer Interaction

How does Human-Computer Interaction impact us?

- **It determines how we use (digital) products.**
- For examples it impacts…
  - what we can do with products and services,
  - how easy or hard it is to work with a software,
  - how quickly you can learn to use a system, or
  - how safe a product is.

- It is central to how we feel and what we experience while interacting with digital technologies.

Let‘s start with a discussion

Pause the video an write 5 points for each question!

- Why is it important that a (digital) product is ease to use?
- .
- .
- .
- .
- .

- What does it mean that a product is usable?
- .
- .
- .
- .
- .

Why is Usability Important?

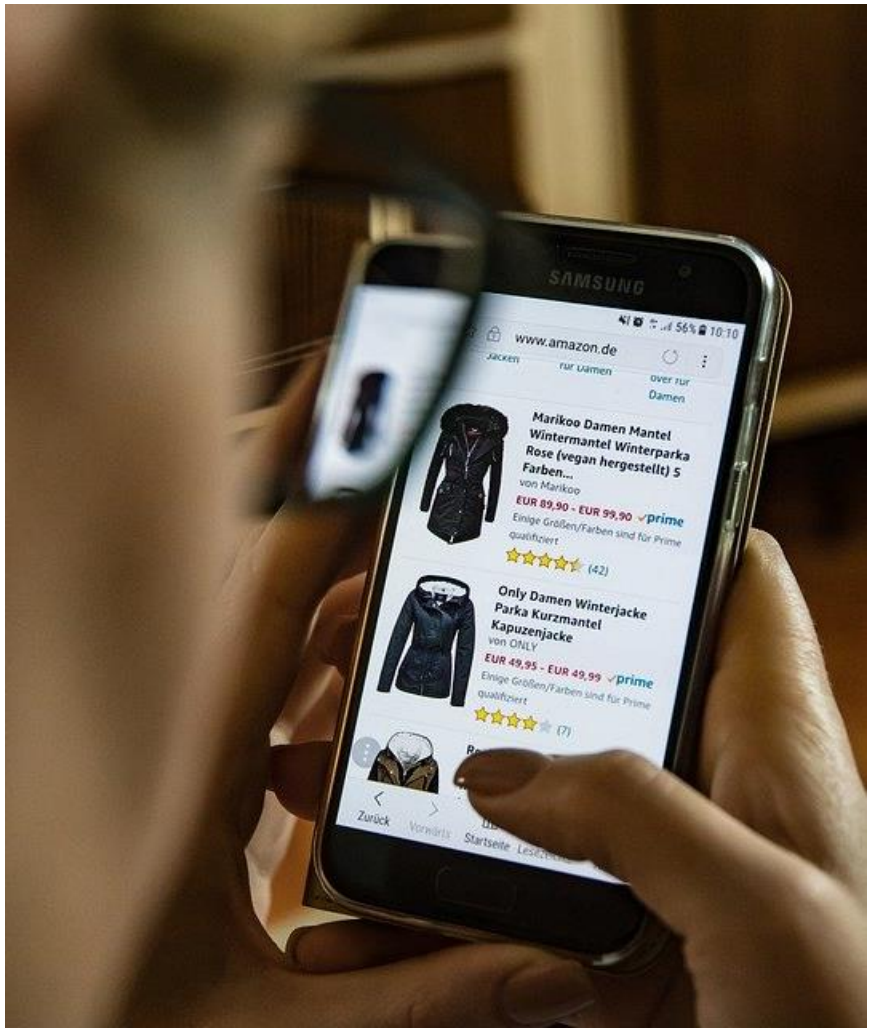
Products that are easy to use a good for business.

- Improving usability can
  - increase productivity of users,
  - reduce costs (support, efficiency),
  - increase sales/revenue (web shop),
  - enhance customer loyalty, or
  - win new customers.
- Case studies that show the benefit of usability
- Usability is often considered as sign of quality
- Usability gives a competitive advantage.

Why Focus on User and Interaction?

How to discriminate your product or service?

- Traditionally product discrimination is by functionality and price
- Why should a customer pick you, if competitors offer very similar functions (e.g. messaging services) at similar prices (e.g. payed by advertising)?
  - Your product is easier to use?
  - You get your tasks done faster?
  - You have more fun doing what you want to do?



Why Focus on User and Interaction?

Trends that make Human-Computer interaction more important

- It becomes harder to discriminate by technology
- Availability of bandwidth, storage and processing
- New input and output technologies
- Computing becomes part of many traditional devices
- Willingness for training or learning applications decreases
- Life-style technologies are more and more digital
- Broad and diverse user groups
- Majority of user are not interested in the technology

- New understanding of computing
  - The old question: What can computers do?
  - The new question: What can humans do with computers?
  - Book by Ben Shneiderman: Leonardo's Laptop

B. Shneiderman. Leonardo's Laptop: Human Needs and the New Computing Technologies. 2002.

Economic dimension of Usability?

Importance in the Context of WWW, Apps and New Media?

- User Interface is often the central discriminating factor
- Often the same product/service is sold at very similar prices
- Competition is very close (just another App, browser tab, …)
- Comparison is easily possible

- Examples: Online-Shop
  - Users who cannot find the product in the shop cannot buy it
  - Users who can fill in the payment form are not going to buy
  - Users who worry if the item fits them are less likely to buy
  - Typically a direct correlation between usability and sales

- “Bad Usability is Like a Leaky Pipe”
  https://90percentofeverything.com/2006/11/13/bad-usability-is-like-a-leaky-pipe/


OX ST.
Christmas is calling
TOPSHOP
50%
TOPSHOP
TOPMAN
ROAD AHEAD CLOSED

Concerns in Human-Computer Interaction

Science, Engineering, and Design Aspects

- The joint performance of tasks by humans and machines
- The structure of communication between humans and machines
- Human capabilities to use machines (including the learnability of interfaces)
- Engineering concerns that arise in designing and building interfaces
- The process of specification, design, and implementation of interfaces
- Design trade-offs
- Algorithms and programming of the user interface itself

Example: Sketch an Interface

How would a user interface that includes both functions look like?
Make sketches for 2 alternative interfaces.

```
String translate(int fromLanguage, int toLanguage, String str)
// translate is a function that takes a word (str)
// the word is from a specific language (fromLanguage) and it
// translates it into a word into another language (toLanguage)
// Example: wordInSpanish = convert(1, 3, "Haus")
// fromLanguage is the language the word is from, toLanguage
// ist die target language (1=German, 2=English, 3=Spanish)

float convert(int fromCurrency, int toCurrency, float amount)
// convert is a function that takes a number (amount) of a specific
// currency (fromCurrency) and it converts it into a number
// (toCurrency) representing the amount in the target currency
// Example: myDollar = convert(6, 7, 19.23)
// fromCurrency ist initlal curreny and toCurrency is the target
// currency (6=Euro, 7=US Dollar, 8=Britisches Pfund)
```

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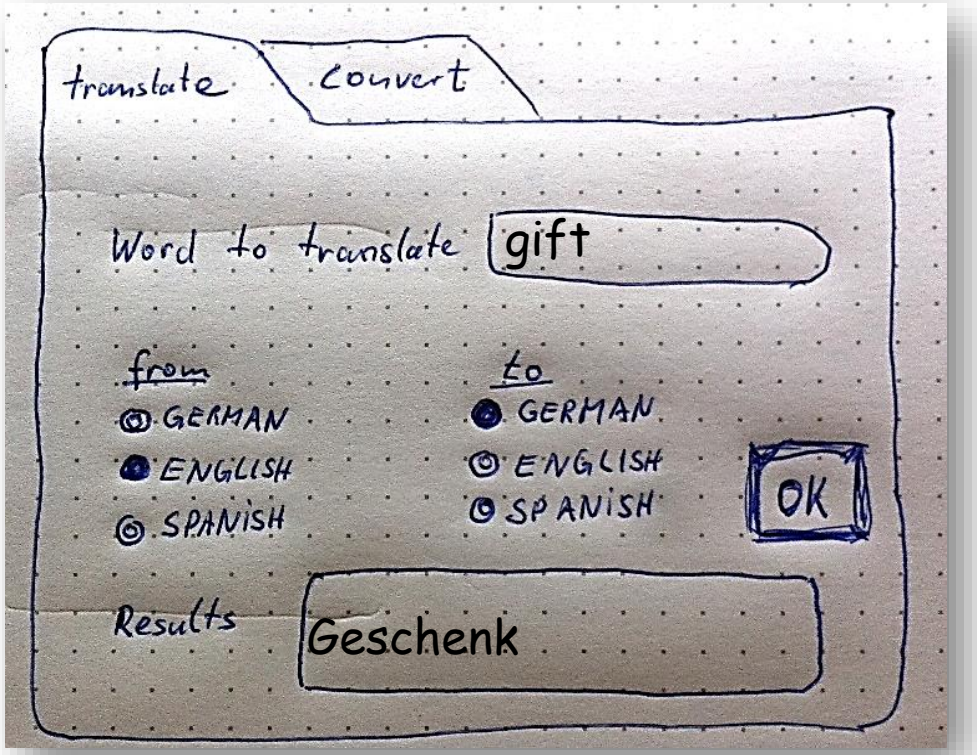

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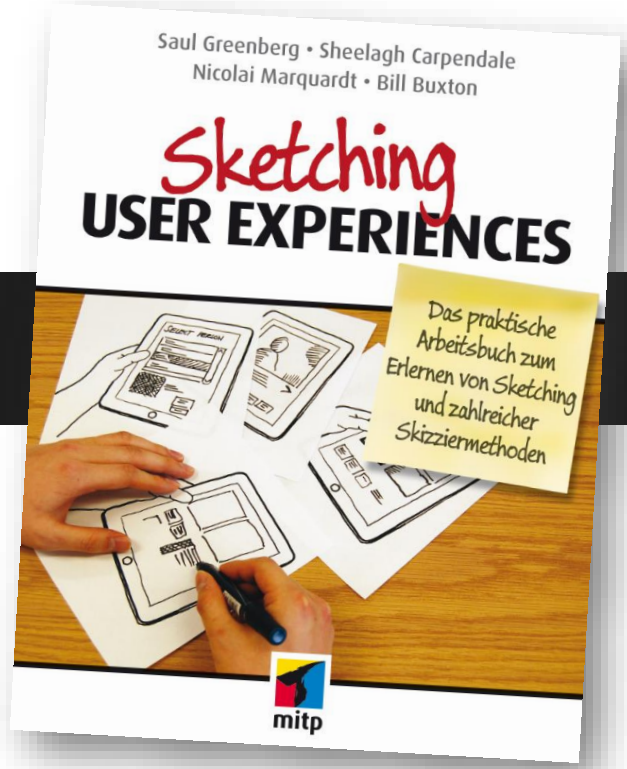

https://www.mitp.de/IT-WEB/Software-Entwicklung/Sketching-User-Experiences.html

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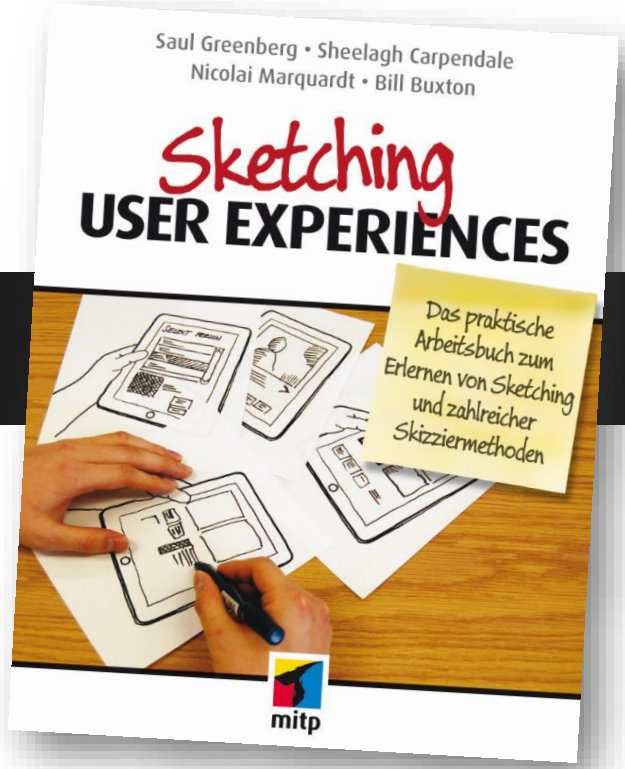


https://www.mitp.de/IT-WEB/Software-Entwicklung/Sketching-User-Experiences.html

It is NOT Only About the User Interface!

Experience includes the overall product and service

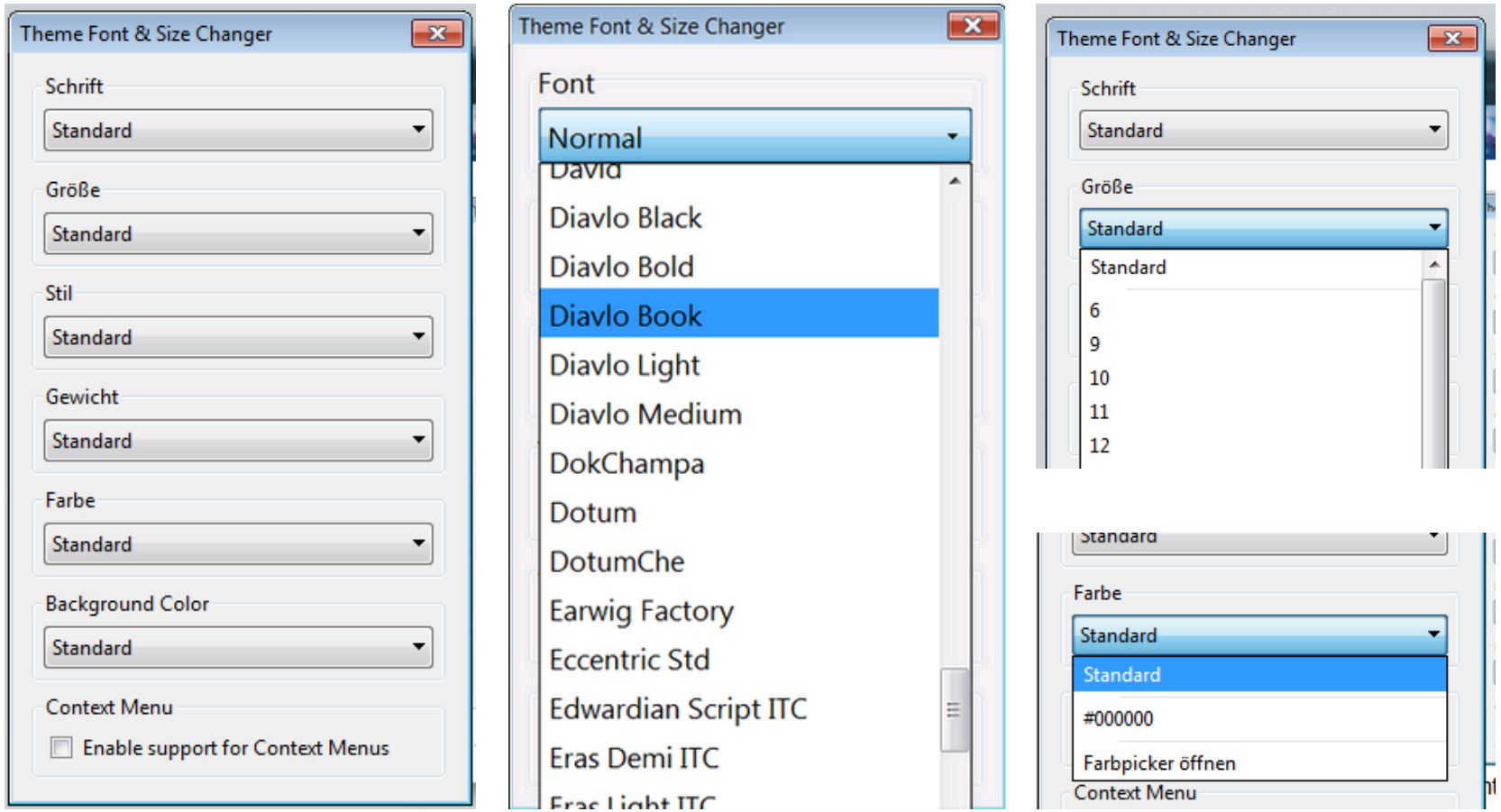
Human-Computer Interaction
…it is about visible innovation

What is your Solution?

- Problems and challenges in Human-Computer Interaction
  - often not seen as problem before there is a solution
  - if problems are identified, they are typically easy to understand by non-experts
- Solutions in Human-Computer Interaction
  - once a solution is there, people will generally not remember that there was a problem
  - good and in particular great solutions (if found) often appear obvious (once they are there)
- The step from problem to solution is however not trivial (but this is often forgotten, once there is a solution)

Example: Selection/Menu for Fonts

Is there a Problem? How to improve it?



https://addons.mozilla.org/en-US/firefox/addon/theme-font-size-changer/

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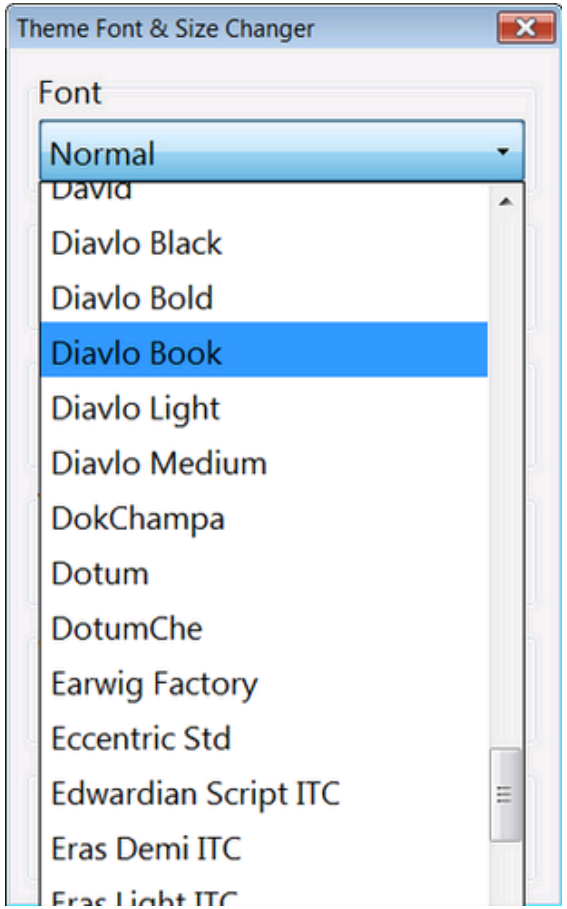

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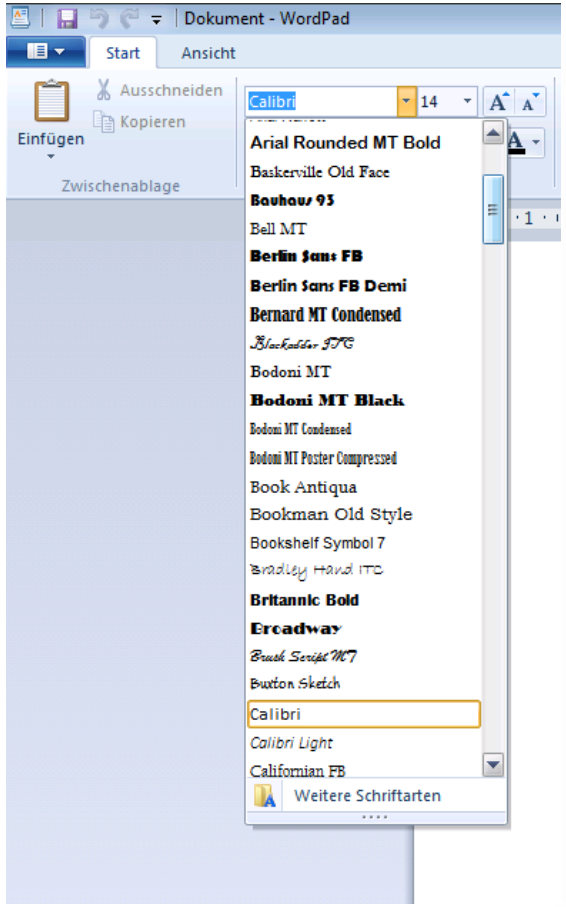
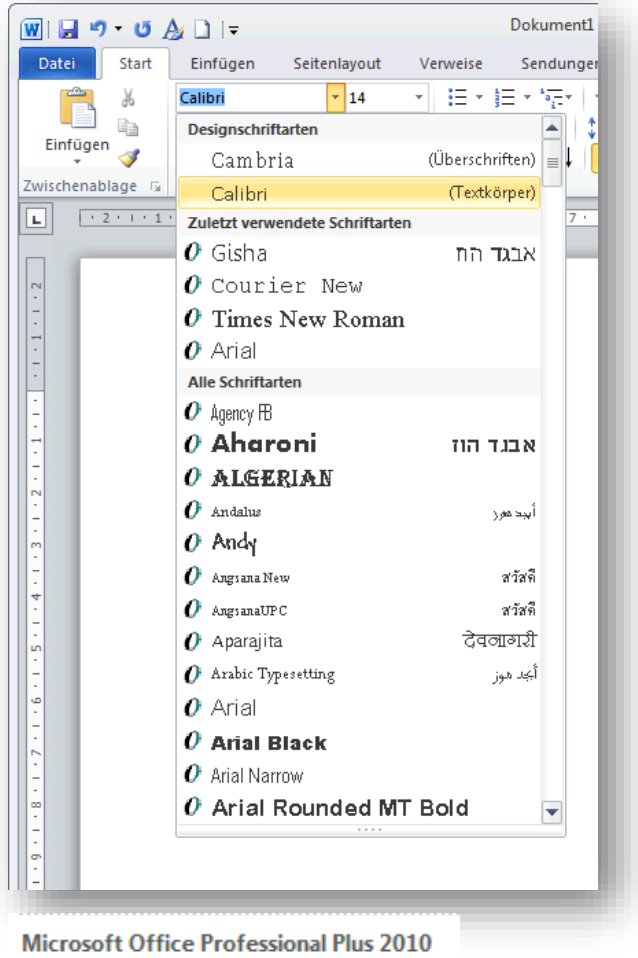


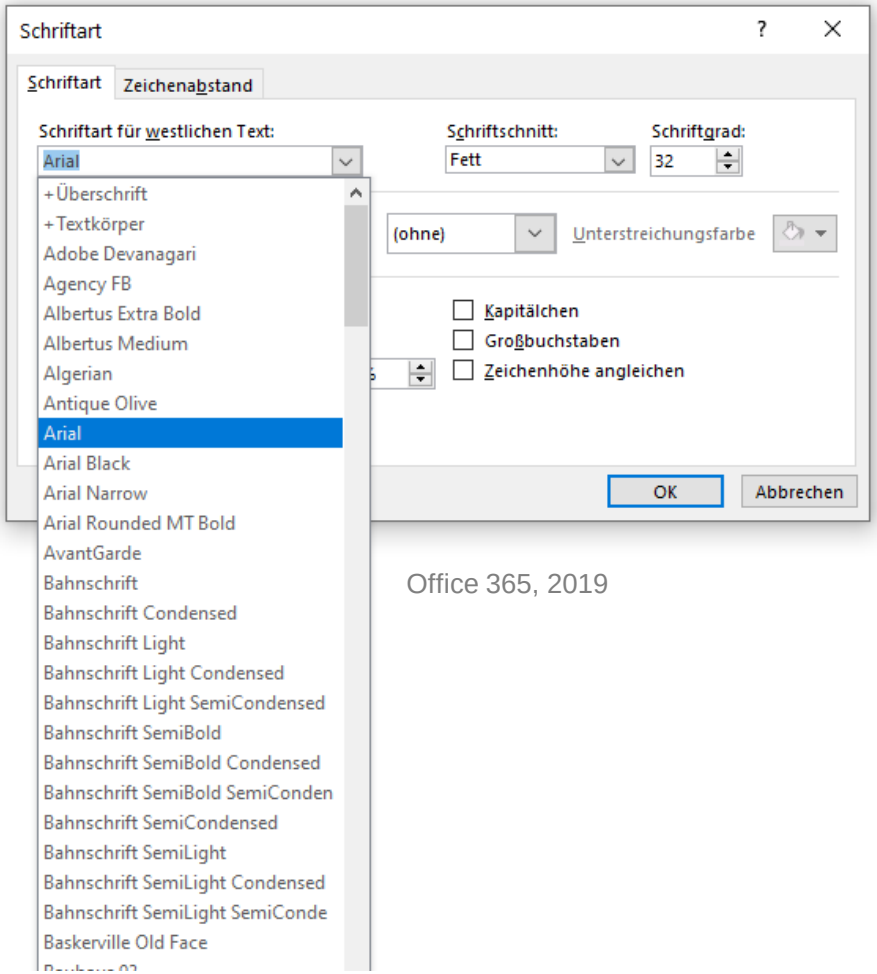
WordPad/Win7



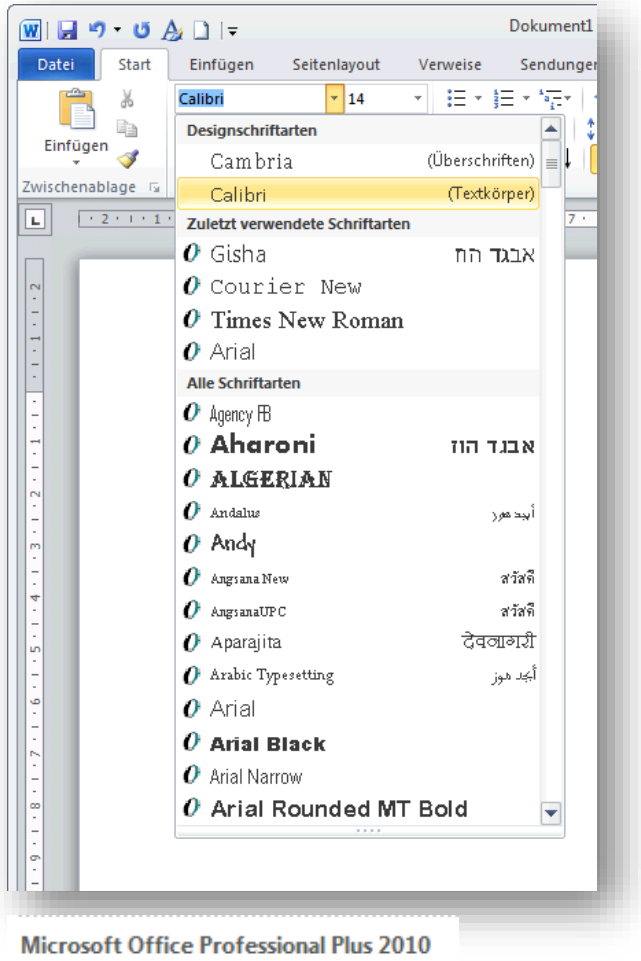
Microsoft Office Professional Plus 2010

Example: Selection/Menu for Fonts

What is the next step for the Office 365 Dialog Box?



Office 365, 2019



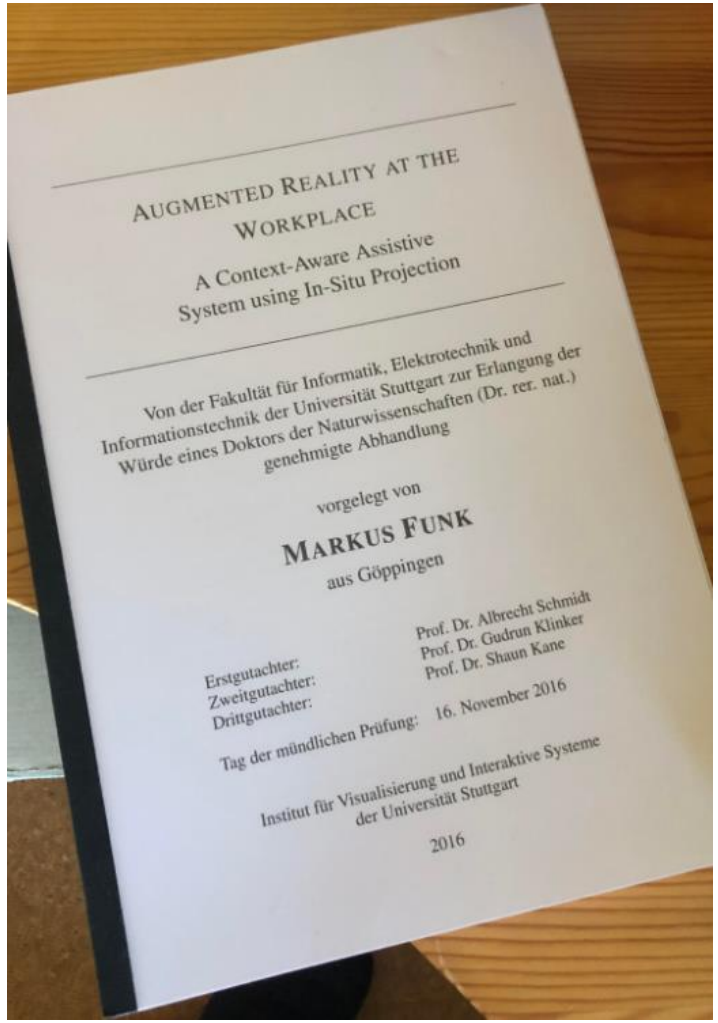
Microsoft Office Professional Plus 2010

Discussion: How long does it take to write a Thesis or a Book?

On a PC vs. on a Phone

- Assume the following
  - the book has 40.000 words
  - typing speed for physical keyboard is 40 words per minute
  - typing speed for phone keyboard is 15 words per minute

- Does this calculation make sense?
- What are we missing here?
- What is different when we write a text message?



Summary

The interface between the user and the information has become most critical for creating effective, efficient and pleasant systems.

- Interface and interaction design defines how we can use devices, services, and applications.
- The interface and interaction design impacts the performance of the user.
- It is important to understand way people use a system as a tool to achieve their goals.
- Human-computer interaction is relevant as it becomes harder to differentiate products based on features.
- Good usability is economically important.
- Sketching user interfaces and discussing design options and trade-offs is important.
- Innovation in Human-Computer interaction is mostly visible.

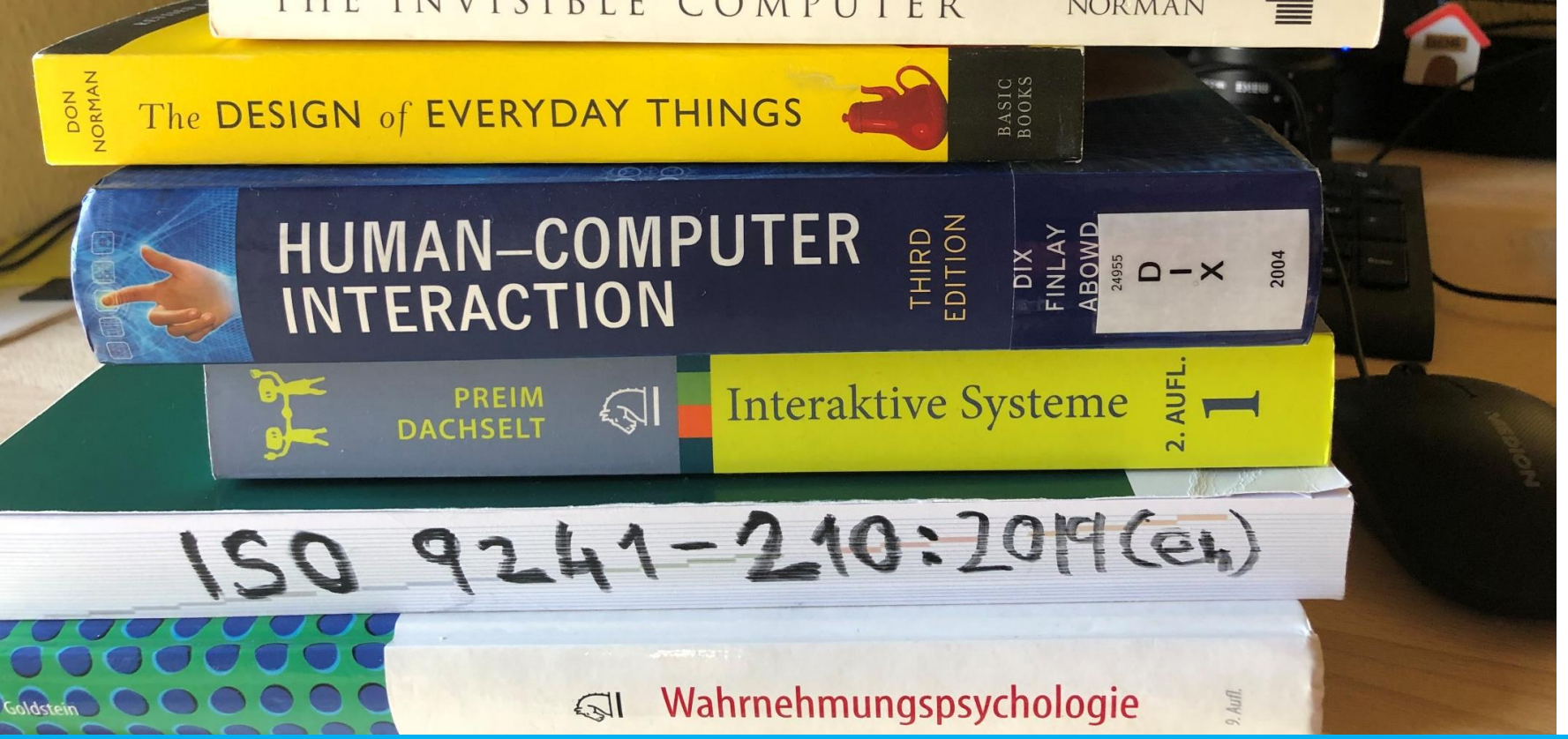
Did you understand this block?

Can you answer these questions?

- How does the user interface and interaction design impact the user? Give specific examples.
- Explain the economic benefits of a product that is easy to use in the context of a Web based shoe shop.
- What advantages can you expect if you improve the usability of an App or web page?
- Name some trends that make Human-Computer interaction more important.
- Sketch 2 alternative (and different) user interfaces for a world time clock app for a smart watch and discuss the advantages and disadvantages of the designs
- Explain with the example of a font menu the improvement of interactive technologies.
- Give an example that highlights the statement “Problems in HCI are often not seen as problem before there is a solution.”

References

- B. Shneiderman (2002). Leonardo's Laptop: Human Needs and the New Computing Technologies.
  http://mitpress.mit.edu/main/feature/leonardoslaptop/index.html
- B. Buxton (2010). *Sketching user experiences: getting the design right and the right design*. Morgan Kaufmann.
- Harry Brignull (2006). Bad usability is like a leaky pipe.
  https://90percentofeverything.com/2006/11/13/bad-usability-is-like-a-leaky-pipe/



Noun [edit]

interaction (*countable and uncountable, plural* **interactions**)

1. The situation or occurrence in which two or more objects or events act upon one another to produce a new effect; the effect resulting from such a situation or occurrence. [quotations ▼]

   *Be aware of **interactions** between different medications.*

2. A conversation or exchange between people.

   *I enjoyed the **interaction** with a bunch of like-minded people.*

Terminology - Basics

Learning Goals

- Understand …
  - technical terms that are central to human computer interaction,.
  - descriptions and texts that use these terms,
  - what user interface design is.
- Be able to explain technical terms, e.g.
  - Human-Computer Interaction,
  - Interactive Systems,
  - User Interface, or
  - Utility, Usability, Likeability.
- Know definitions relevant to HCI

Human-Computer Interaction

Definition

- “Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them” (definition in the ACM SIGCHI Curricula for HCI, 1992)

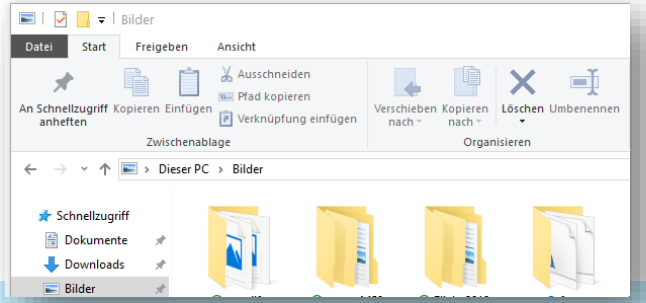
- A pragmatic computer science view point:
  How to enable interaction between one or more humans and one or more computational devices and with data.

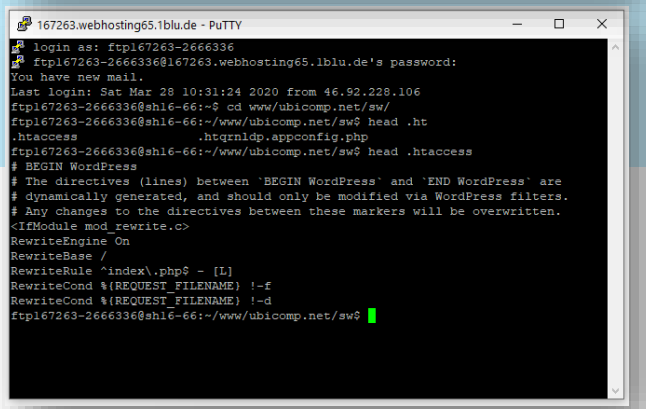
Thomas T. Hewett, Ronald Baecker, Stuart Card, Tom Carey, Jean Gasen, Marilyn Mantei, Gary Perlman, Gary Strong, and William Verplank. 1992. ACM SIGCHI Curricula for Human-Computer Interaction. Technical Report. Association for Computing Machinery, New York, NY, USA.

Interactive Systems

Definition and Examples

- An Interactive System is a computational system that allows users to interact in real-time[1]. Interactions receive instant feedback visible to the user.
- Interactive computing is used in a similar way, with a focus that is less on the systems aspect.
- Examples
  - Graphical user interfaces, such as Windows 10 or MacOS
  - Mobile devices, such as an Android phone
  - gaming consoles, such as Xbox with Kinect or Nintendo Switch
  - Ticket vending machines, such as the DB-ticket machine
  - Command line interfaces, such as an SSH console





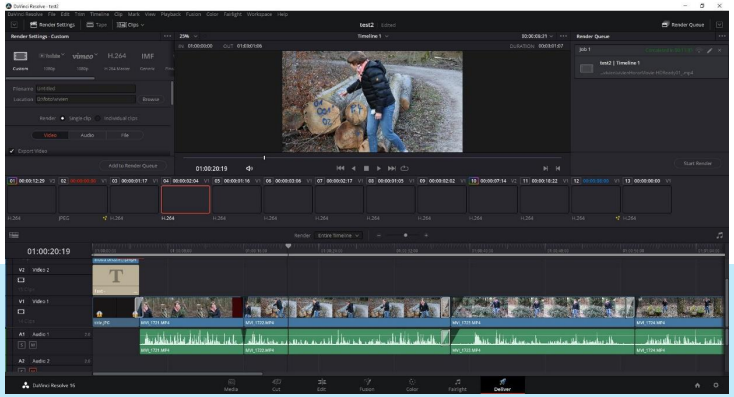
[1] *The term 'real-time' refers here to system responses that are in a time range where users perceive a instant answer. Practically this is typically under 100ms, see https://www.nngroup.com/articles/powers-of-10-time-scales-in-ux/*

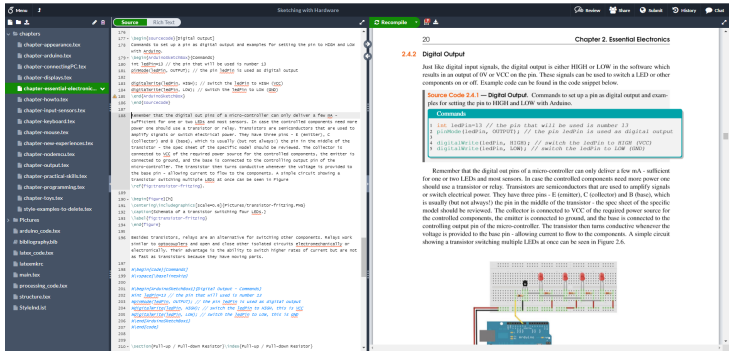
What is an Interactive Systems?

Mini-Exercise

- Which of the following devices and applications can be considered an interactive System? *
  - Why can they be considered an interactive systems?
  - Why may they be not considered an interactive system?

- Discuss one of the following
  - Professional video editing tool
  - Electronic signage at the railway station
  - Latex text processing system
  - 3D printer

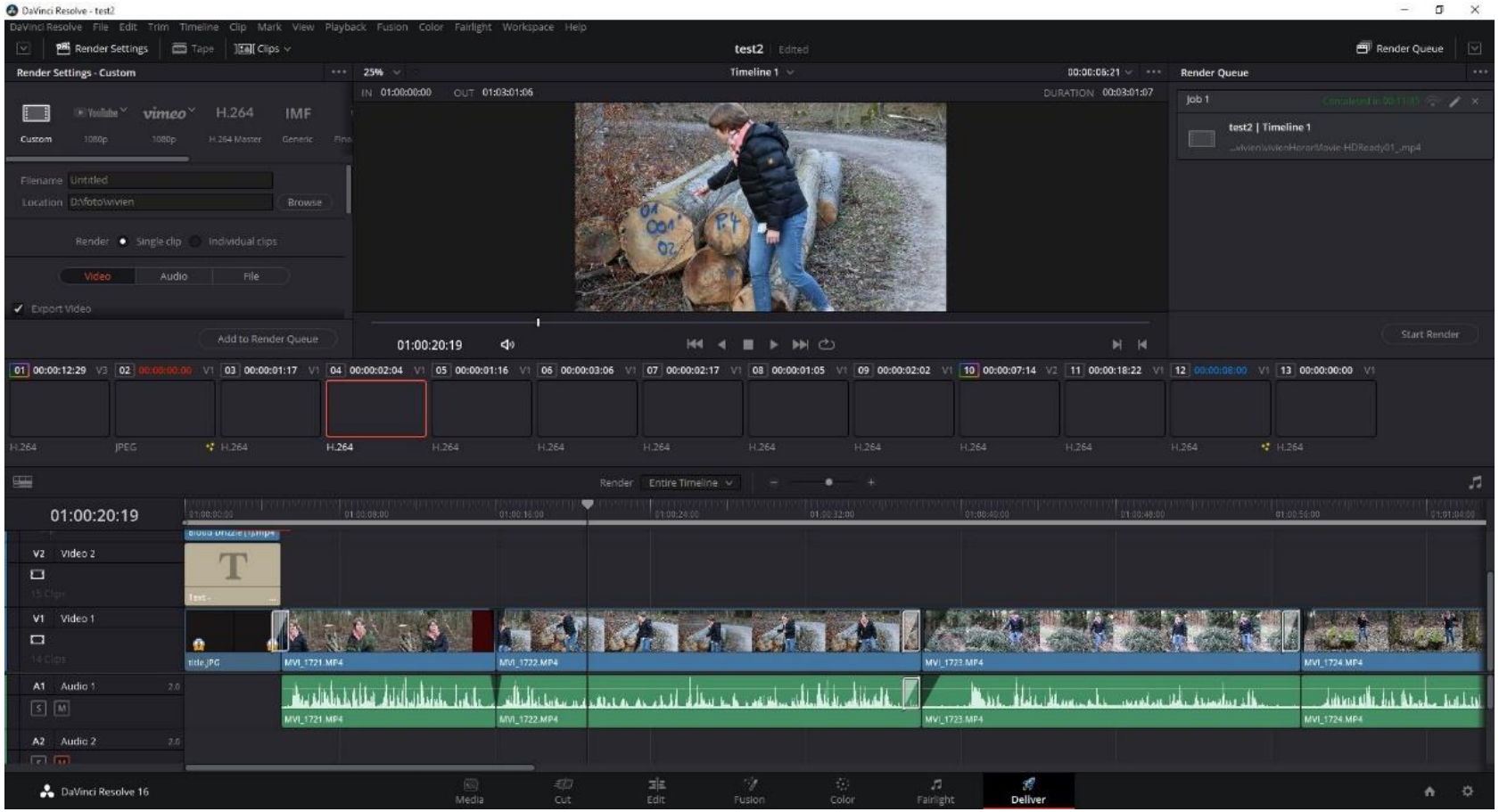




* *There may be not 'yes' or 'no' answer. Consider different aspects and think how the design impacts whether or not this is perceived as an interactive system.*

What is an Interactive Systems?

Mini-Exercise

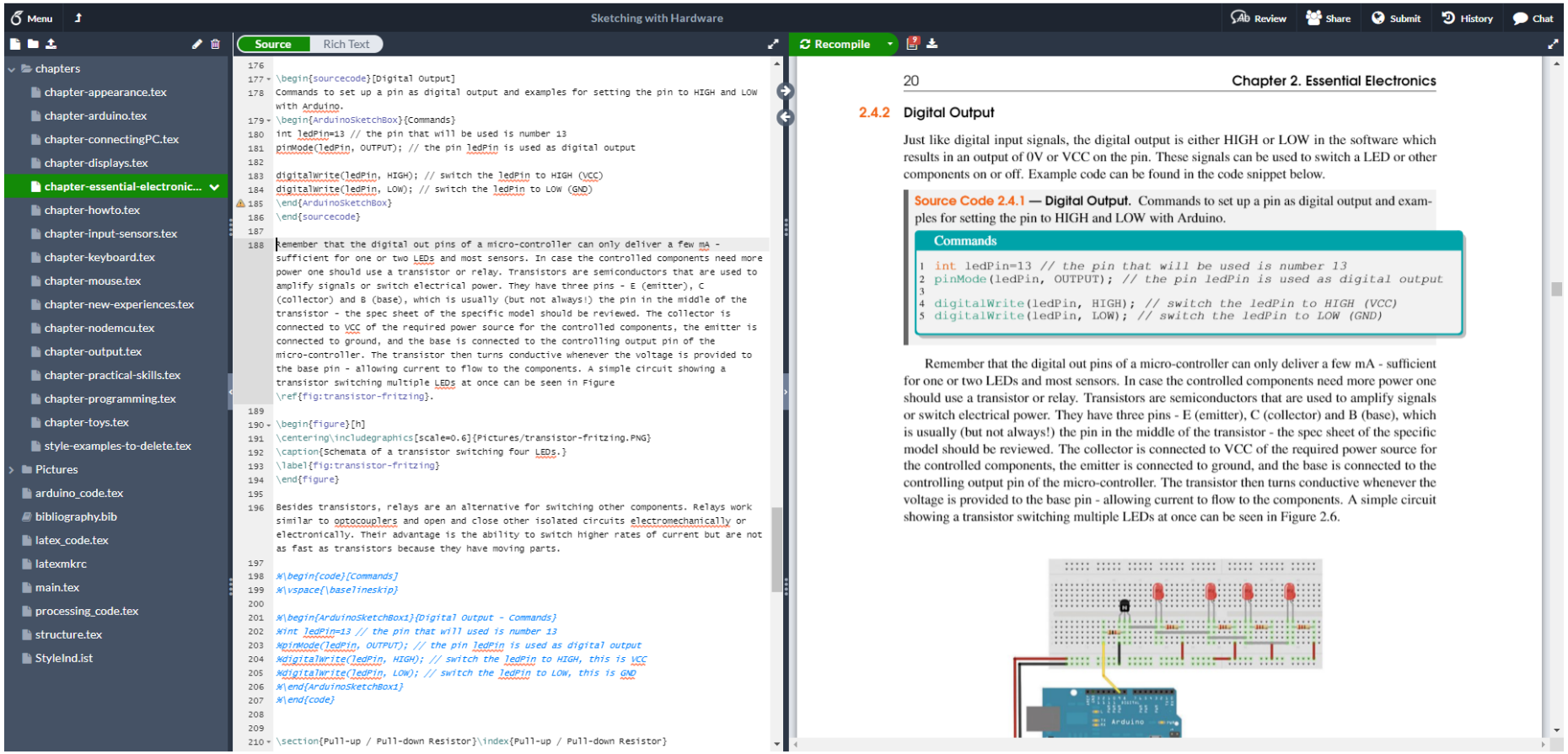


What is an Interactive Systems?

Mini-Exercise

What is an Interactive Systems?

Mini-Exercise



User Interface[1]

Definition

- The part of a system where a user can interact with a system, device or application.
- The user interfaces can support input, output or both.
- User interfaces are not restricted to digital technologies or interactive systems
- Similar terms:
  - Human-computer interface (HCI)
  - Man-machine interface (MMI) or Human-Machine-Interface (HMI)
- Examples:
  - Graphical user interface (GUI) on a web page
  - Voice user interface in a smart speaker (e.g. Alexa)
  - Buttons, switches, wheels and levers in a cockpit

[1] *in German Benutzungsschnittstelle or Benutzerschnittstelle.*

User, Interactive System, and User Interface

Definitions according to ISO 9241-210:2019(en)

- User: “person who interacts with a system, product or service”
- Context of Use: “ combination of users, goals and tasks, resources, and environment”
- Interactive System: “combination of hardware and/or software and/or services and/or people that users interact with in order to achieve specific goals”
- User Interface: “all components of an interactive system (software or hardware) that provide information and controls for the user to accomplish specific tasks with the interactive system”

https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-2:v1:en

User Interface Design and Interaction Design

Definition

- **User Interface Design** refers to the conception and design of the **user interface**, including the choice of **modalities**, selection of **interface elements** and their **placement** in the interface.

- **Interaction Design:**
  - Preece, Rogers and Sharp (2002): “Designing interactive products to support people in their everyday and working lives.”
    Jennifer Preece, Yvonne Rogers, Helen Sharp (2002) Interaction Design, ISBN: 0471492787, http://www.id-book.com/, Chapter 9
  - Winograd (1997): “The design of spaces for human communication and interaction.”
    Winograd, T. (1997). From computing machinery to interaction design. In Denning, P., & Metcalfe, R. (Eds.), Beyond calculation: The next fifty years of computing, 149-162. Springer-Verlag. http://hci.stanford.edu/~winograd/acm97.html.

Interaction Design vs. User Experience Design

Definition

- “**Interaction Design** (IxD) is the design of interactive products and services in which a designer’s focus goes beyond the item in development to **include the way users will interact with it**.” https://www.interaction-design.org/literature/topics/interaction-design
- **User Experience Design** describes the more holistic approach in **designing the experience a person will encounter** when interacting with a devices, system or application. It considers the user interface design in the broader context of use.

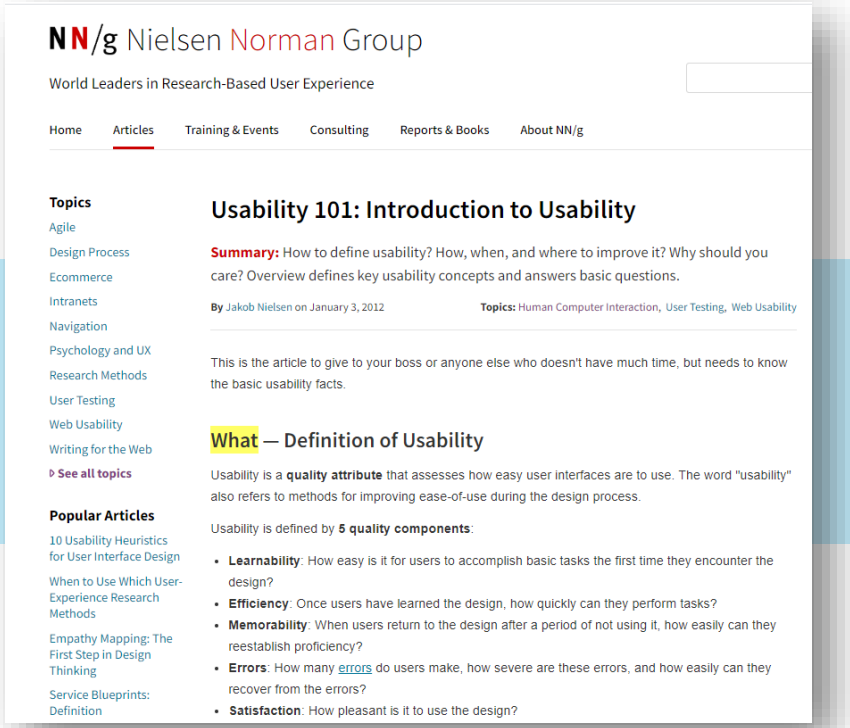
Utility, Usability, Likeability

- **Utility**
  a product can be used to reach a certain goal or to perform a certain task. This is essential!
- **Usability**
  relates to the question of quality and efficiency. E.g. how well does a product support the user to reach a certain goal or to perform a certain task.
- **Likeability**
  this may be related to utility and usability but not necessarily. People may like a product for any other reason…

What is Usability
A definition by Jakob Nielson

Usability 101 by Jakob Nielson

- “Usability is a quality attribute that assesses how easy user interfaces are to use. The word ‘usability’ also refers to methods for improving ease-of-use during the design process.”

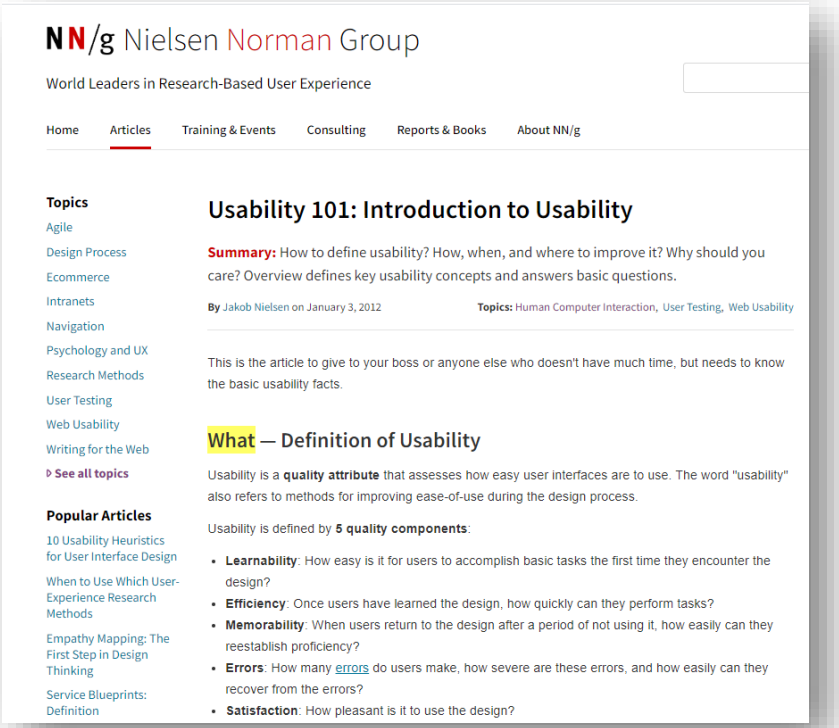


Jakob Nielsen's Alertbox, August 25, 2003: Usability 101: Introduction to Usability
https://www.nngroup.com/articles/usability-101-introduction-to-usability/

Usability has five quality components

Usability 101 by Jakob Nielson

- **Learnability**: How easy is it for users to accomplish basic tasks the first time they encounter the design?
- **Efficiency**: Once users have learned the design, how quickly can they perform tasks?
- **Memorability**: When users return to the design after a period of not using it, how easily can they reestablish proficiency?
- **Errors**: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- **Satisfaction**: How pleasant is it to use the design?



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Usability, User Experience and Human-Centred Design

Definitions according to ISO 9241-210:2019(en)

- Usability: “extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”
- User Experience: “user’s perceptions and responses that result from the use and/or anticipated use of a system, product or service”
- Human-Centred Design: “approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques”

https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-2:v1:en

Did you understand this block?

Can you answer these questions?

- Describe a pragmatic computer science view point of the concept human-computer interaction.
- How can you characterize an interactive system?
- Discuss: is a video editor an interactive system?
- What is a user interface? What are similar terms? Provide Examples?
- Which ISO standard is central for human-computer interaction?
- Explain the terms utility, usability, an likeability and how they relate.
- What are the 5 quality components for usability according to Jakob Nielson?

References

- Thomas T. Hewett, Ronald Baecker, Stuart Card, Tom Carey, Jean Gasen, Marilyn Mantei, Gary Perlman, Gary Strong, and William Verplank. 1992. ACM SIGCHI Curricula for Human-Computer Interaction. Technical Report. Association for Computing Machinery, New York, NY, USA.
- Standard, ISO 9241:210 https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-2:v1:en
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Terminology - UX

Learning Goals

- Understand …
  - terms related to user experience and interaction design,
  - descriptions and texts that use these terms.
- Be able to explain technical terms, e.g.
  - Interaction design dimensions according to G. Crampton Smith
  - User experience and user experience design
  - Experience economy

Computers are increasingly defining people's experiences in the real world

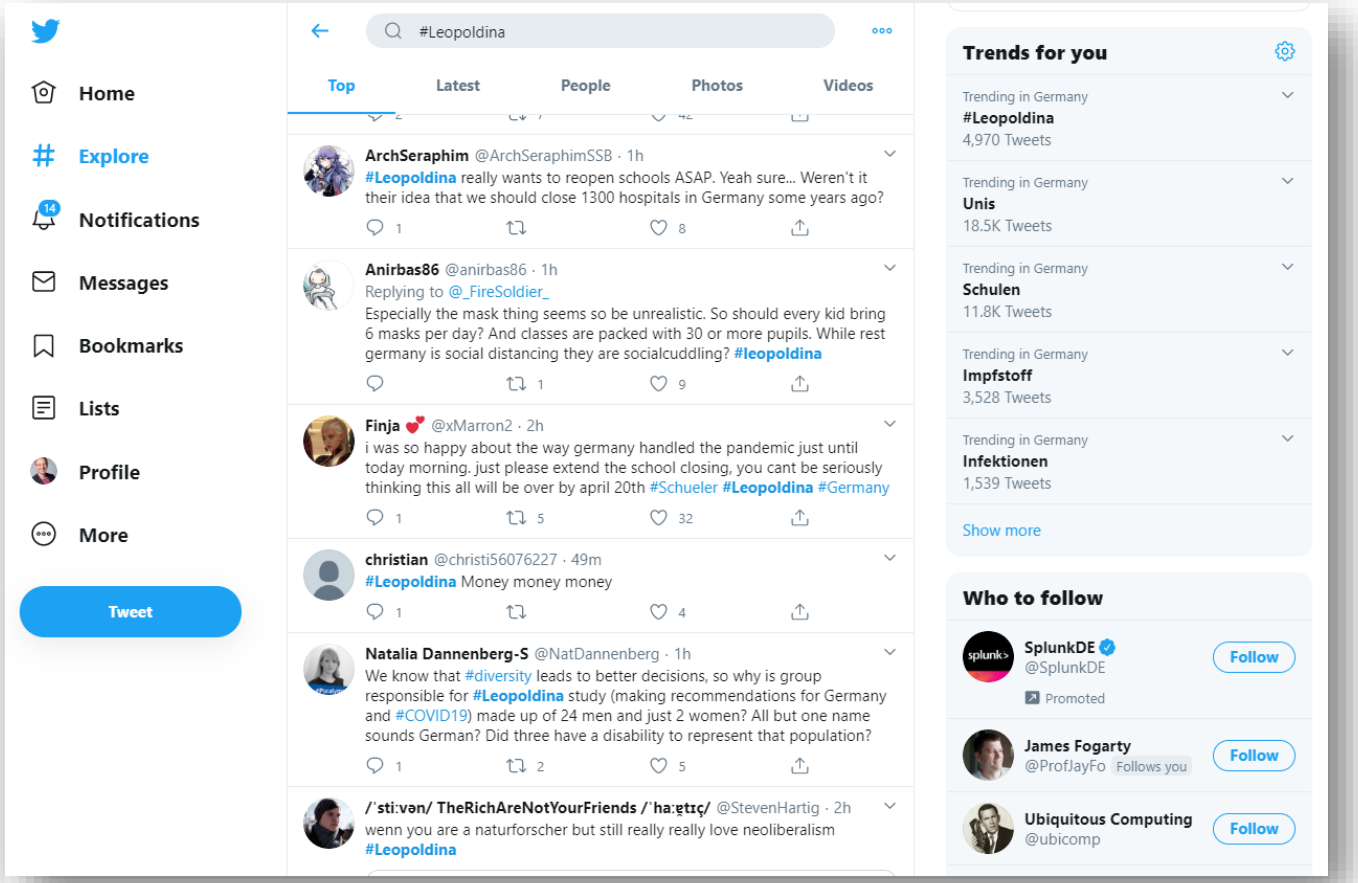

Photo by Jurvetson (CC BY 2.0)
http://www.flickr.com/photos/jurvetson/22226826/

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- **User Interface Design** refers to the conception and design of the **user interface**, including the choice of **modalities**, selection of **interface elements** and their **placement** in the interface.
- "**Interaction Design** (IxD) is the design of interactive products and services in which a designer's focus goes beyond the item in development to **include the way users will interact with it**." https://www.interaction-design.org/literature/topics/interaction-design
- **User Experience Design** describes the more holistic approach in **designing the experience a person will encounter** when interacting with a devices, system or application. It considers the user interface design in the broader context of use.

The Languages/Dimensions of Interaction Design

Gillian Crampton Smith in “What is Interaction Design”

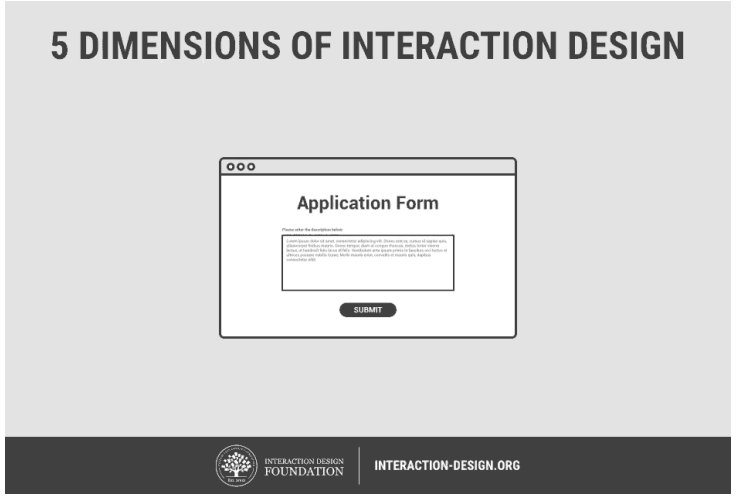
- “1-D includes **words** and poetry. […]
- The 2-D languages that interaction design can borrow from include **painting**, typography, diagrams, and icons. […]
- 3-D languages are those of **physical**, sculptural form. […] If something has a handle, for example, we know we are meant to grab it […]
- The fourth dimension is **time**. The 4-D languages include sound, film, and animation.”

Foreword “What is Interaction Design?”. Interview with Gillian Crampton Smith. Moggridge, Bill, and Bill Atkinson. *Designing interactions*. Vol. 17. Cambridge, MA: MIT press, 2007. page xvii

The 5 Dimensions of Interaction Design

by Yu Siang Teo
https://www.interaction-design.org/literature/article/what-is-interaction-design

- Originally by Gillian Crampton Smith (4 dimensions); Kevin Silver added the fifth.
- 1D: Words should be meaningful and simple to understand.
- 2D: Visual representations supplement the words used to communicate information to users.
- 3D: Physical objects or space looks at what physical objects do users interact with the product (laptop, mouse, touchscreen, phones, etc.)? These all affect the interaction between the user and the product.
- 4D: Time refers to media that changes with time (e.g. animation, videos, sounds).
- 5D: **Behaviour** includes the mechanism of a product. How do users perform actions?



https://www.interaction-design.org/

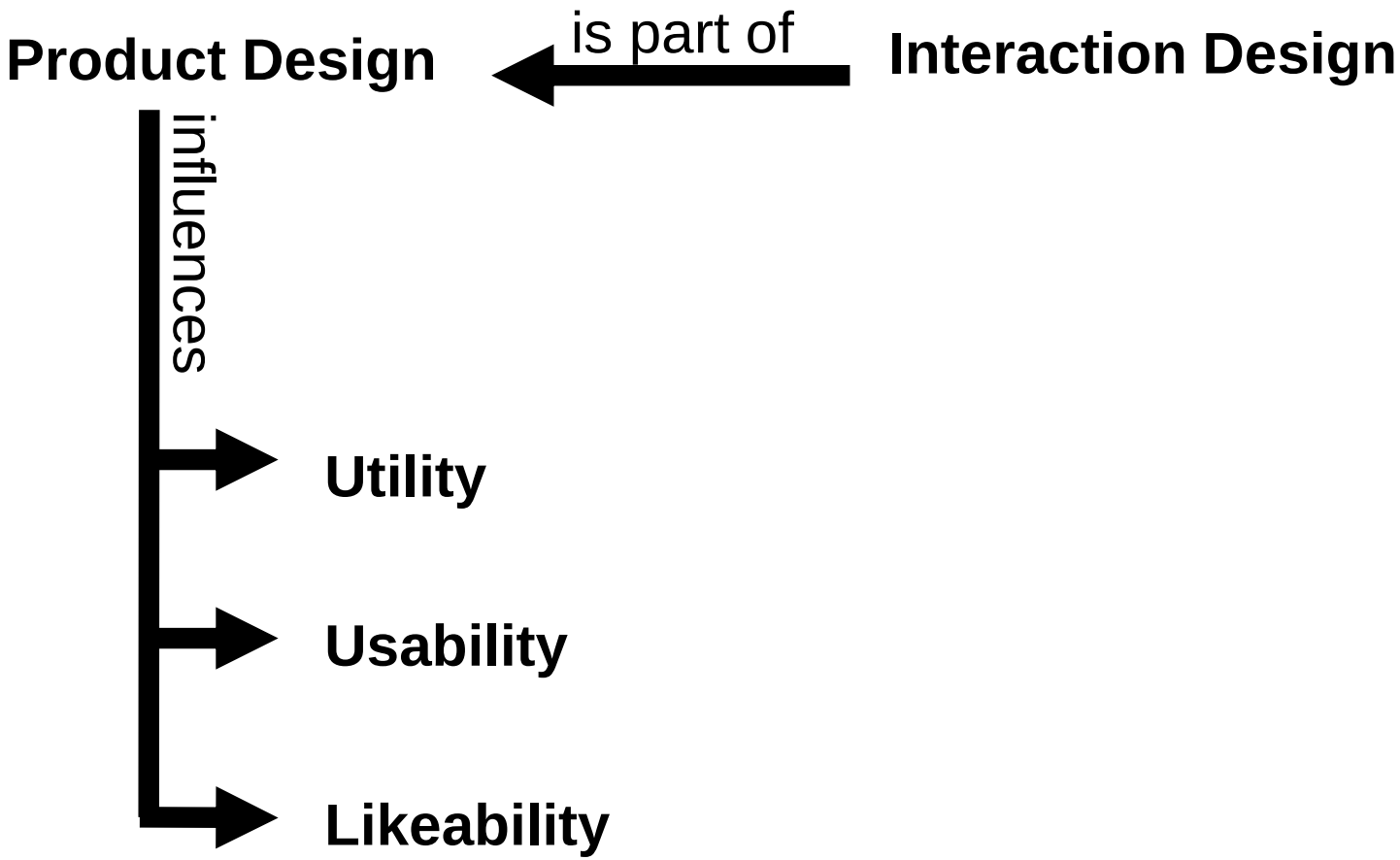
Fashion?

How long does an interface look new?
Is there a timeless interaction design?

Photo by Bcos47 (public domain)
http://en.wikipedia.org/wiki/File:IBM_Simon_Personal_Communicator.png

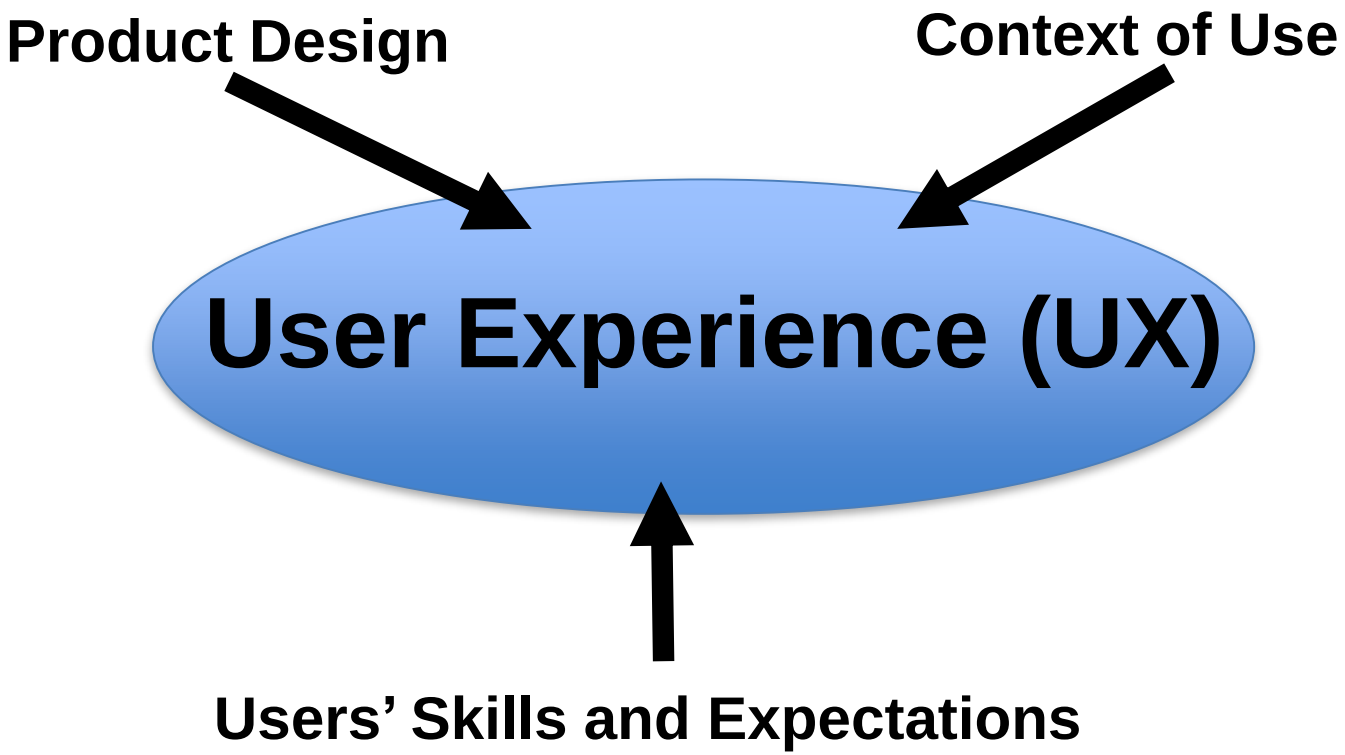
Aspects of Product Design

A simplistic view



Major Factors Influencing the User Experience

A simplistic view



One cannot
not *communicate*

Every behavior is a form of communication.

Mini-Exercise: Find out who made this statement and in what context?

One cannot
not *communicate*

Every behavior is a form of communication.

Mini-Exercise: Find out who made this statement and in what context?

- Paul Watzlawick
- Axioms of communication

https://www.paulwatzlawick.de/axiome.html

You cannot
not *create a*
User Experience

Every design will create a user experience.

Experiences are never “stand alone” they cannot be assessed in “isolation”

User Experience is contextualized

Foxconn Workers on Strike Over iPhone 5 Demands, Labor Group Says

By Lauren Indvik | Mashable – Fri, Oct 5, 2012

Email | Recommend 7 | Tweet 9 | Share 4 | +1 0 | Print

RELATED CONTENT

apple foxconn

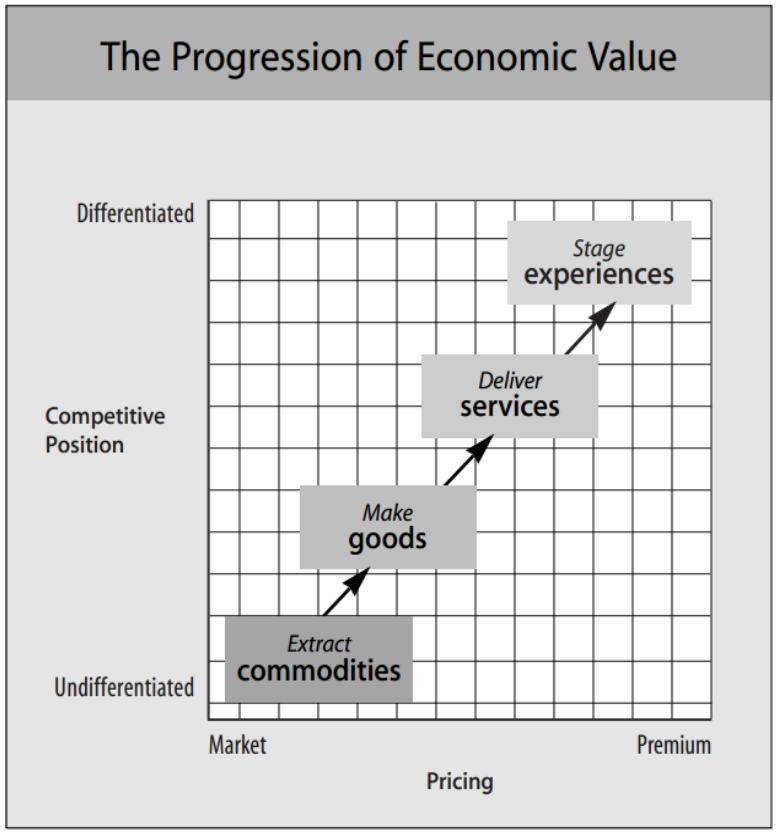
Some 3,000 to 4,000 production workers at Foxconn's Zhengzhou factory went on strike Friday afternoon, according to an alert sent out Friday by China Labor Watch, a not-for-profit, U.S.-based watchdog for Chinese workers' rights.

[More from Mashable: Apple Experts: Stop Comparing Tim Cook to Steve Jobs]

Production was halted as workers -- primarily quality control inspectors -- protested against a series of escalating demands. According to the group, Apple and Foxconn "raised strict quality demands on workers, including indentations standards of 0.02mm and demands related to scratches on frames and back covers" on iPhone 5 devices. When workers failed to meet the new standards, friction between quality control inspectors and workers came to a head, in some cases escalating to physical violence. Several workers were hospitalized, CLW said.

Experience Economy

An Economic Perspective on UX



Pine, B. Joseph, and James H. Gilmore. "Welcome to the experience economy." Harvard business review 76 (1998): 97-105. https://hbr.org/1998/07/welcome-to-the-experience-economy

Technology inevitably alters our perception of reality

Image from: http://www.cs.nott.ac.uk/~jqm/?p=501
Marshall, Joe, et al. "The gas mask: a probe for exploring fearsome interactions." CHI'11 Extended Abstracts on Human Factors in Computing Systems. ACM, 2011.

Figure 1. Gas Mask and Respiration Monitor

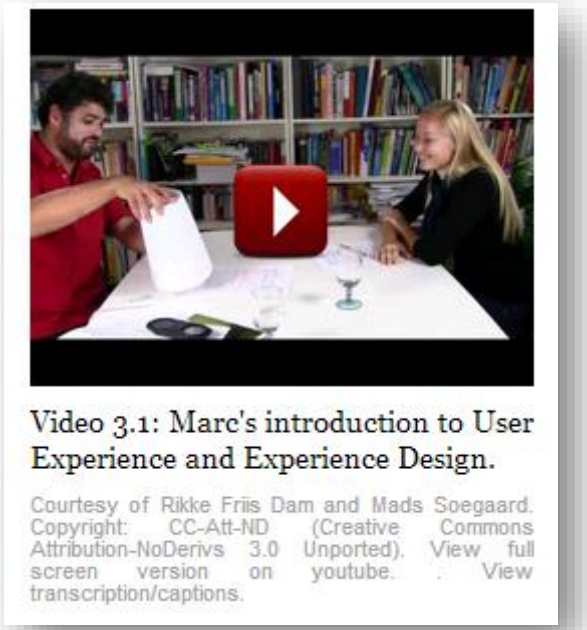
Did you understand this block?

Can you answer these questions?

- Gillian Crampton Smith proposes 4 dimensions of interaction design. What are they? Provide examples of user interfaces components
- Explain the term user experience and name major factors influencing it.
- Why is user experience relevant from an economical perspective?

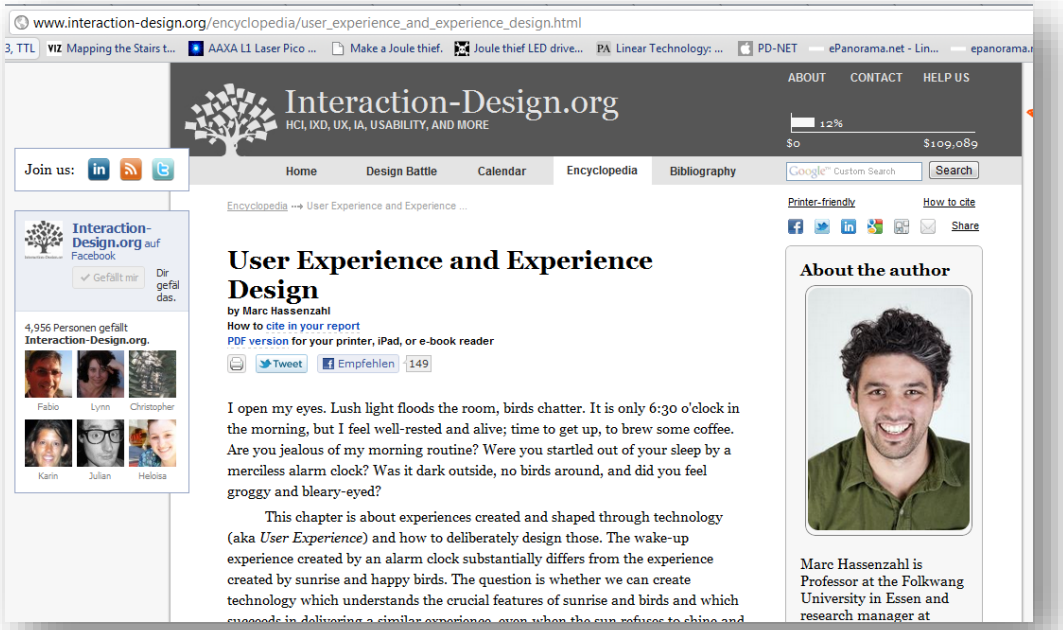
User Experience in Detail

Recommended Additional Material - read or watch



Video 3.1: Marc's introduction to User Experience and Experience Design.

Courtesy of Rikke Friis Dam and Mads Soegaard. Copyright: CC-Att-ND (Creative Commons Attribution-NoDerivs 3.0 Unported). View full screen version on youtube. . View transcription/captions.



Hassenzahl, Marc (2013): User Experience and Experience Design. In: Soegaard, Mads and Dam, Rikke Friis (eds.). "The Encyclopedia of Human-Computer Interaction, 2nd Ed.". Aarhus, Denmark: The Interaction Design Foundation. http://www.interaction-design.org/encyclopedia/user_experience_and_experience_design.html

Effie Lai-Chong Law, Virpi Roto, Marc Hassenzahl, Arnold P.O.S. Vermeeren, and Joke Kort. 2009. Understanding, scoping and defining user experience: a survey approach. In Proceedings of the 27th international conference on Human factors in computing systems(CHI '09). ACM, New York, NY, USA, 719-728. DOI=10.1145/1518701.1518813 http://doi.acm.org/10.1145/1518701.1518813

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- https://www.interaction-design.org/literature/article/what-is-interaction-design by Yu Siang Teo
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User Needs

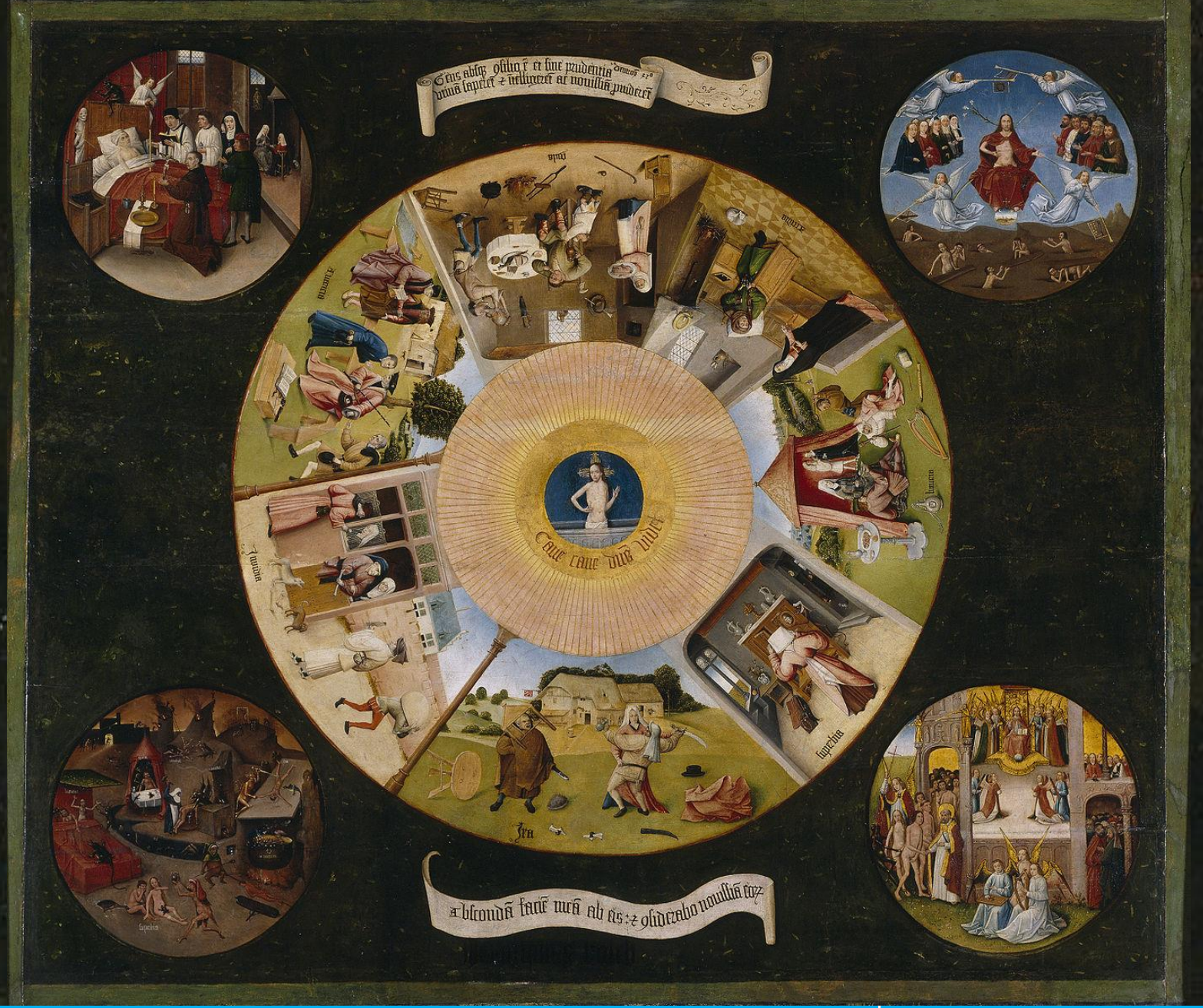


Image Source

Learning Goals

- Understand …
  - the complexity of user needs and the challenges to uncover them.
  - the relationship between user needs and technologies available.
  - how human needs impact the technologies we develop and how technologies influence needs
- Be able to explain …
  - the basics of Maslow's theory of motivation
  - the concept of the task-artifact cycle and give examples

User Needs

Ask the (potential) users?


https://www.youtube.com/watch?v=Pw9gaEiQAxY

User Needs

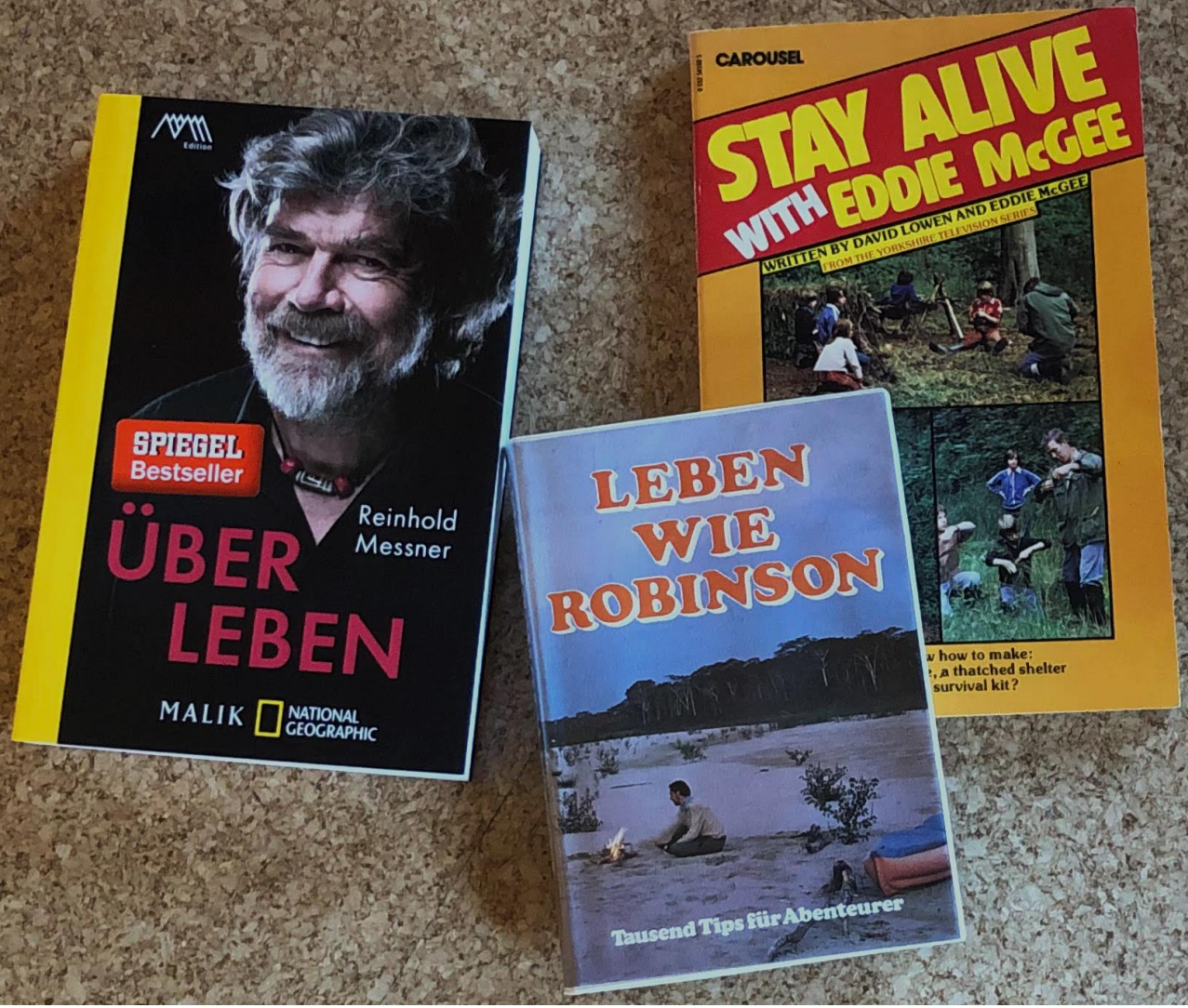
Ask the (potential) users?

User Needs
Current Technologies

Ask the (potential) users?

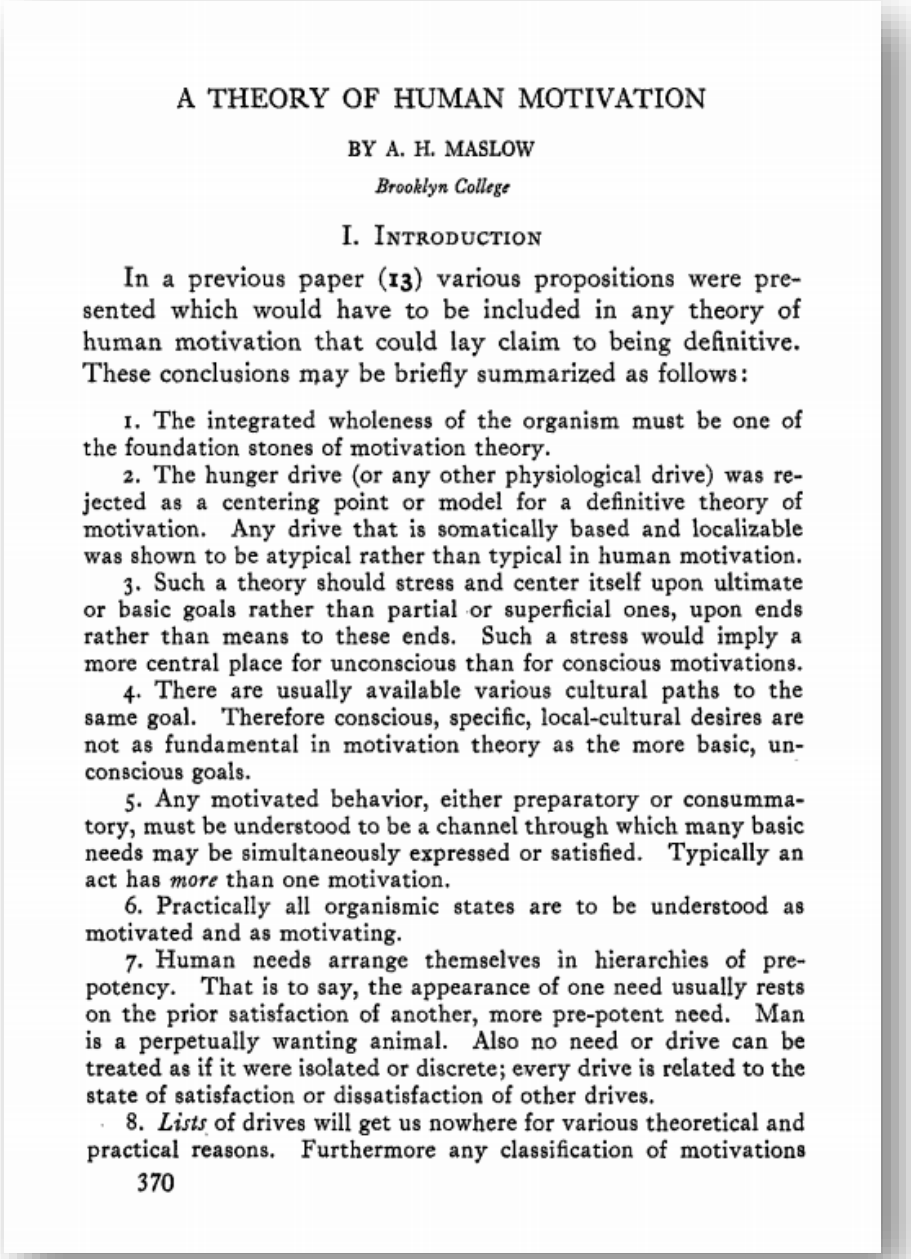
What do you need to survive?

- 3 Minutes
- 3 Days
- 3 Weeks



The Theory of Human Motivation

Maslow, A.H. (1943)



A THEORY OF HUMAN MOTIVATION

BY A. H. MASLOW

Brooklyn College

I. INTRODUCTION

In a previous paper (13) various propositions were presented which would have to be included in any theory of human motivation that could lay claim to being definitive. These conclusions may be briefly summarized as follows:

1. The integrated wholeness of the organism must be one of the foundation stones of motivation theory.
2. The hunger drive (or any other physiological drive) was rejected as a centering point or model for a definitive theory of motivation. Any drive that is somatically based and localizable was shown to be atypical rather than typical in human motivation.
3. Such a theory should stress and center itself upon ultimate or basic goals rather than partial or superficial ones, upon ends rather than means to these ends. Such a stress would imply a more central place for unconscious than for conscious motivations.
4. There are usually available various cultural paths to the same goal. Therefore conscious, specific, local-cultural desires are not as fundamental in motivation theory as the more basic, unconscious goals.
5. Any motivated behavior, either preparatory or consummatory, must be understood to be a channel through which many basic needs may be simultaneously expressed or satisfied. Typically an act has *more* than one motivation.
6. Practically all organismic states are to be understood as motivated and as motivating.
7. Human needs arrange themselves in hierarchies of pre-potency. That is to say, the appearance of one need usually rests on the prior satisfaction of another, more pre-potent need. Man is a perpetually wanting animal. Also no need or drive can be treated as if it were isolated or discrete; every drive is related to the state of satisfaction or dissatisfaction of other drives.
8. *Lists* of drives will get us nowhere for various theoretical and practical reasons. Furthermore any classification of motivations

370

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396. https://doi.org/10.1037/h0054346

Needs

Maslow, A.H. (1943)

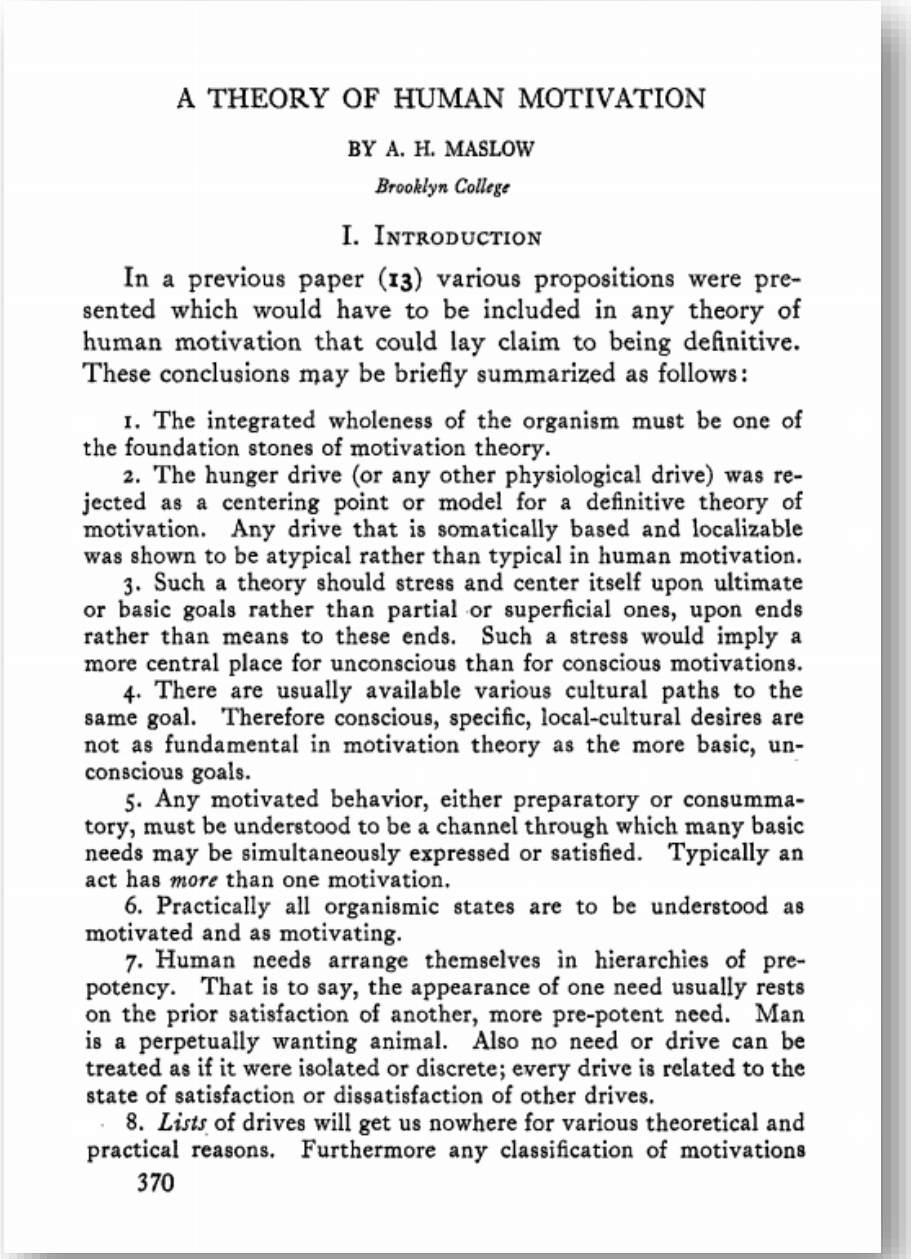
5) The Need for Self-Actualization.

4) The Esteem Needs

3) The Love Needs

2) The Safety Needs

1) The 'physiological' Needs



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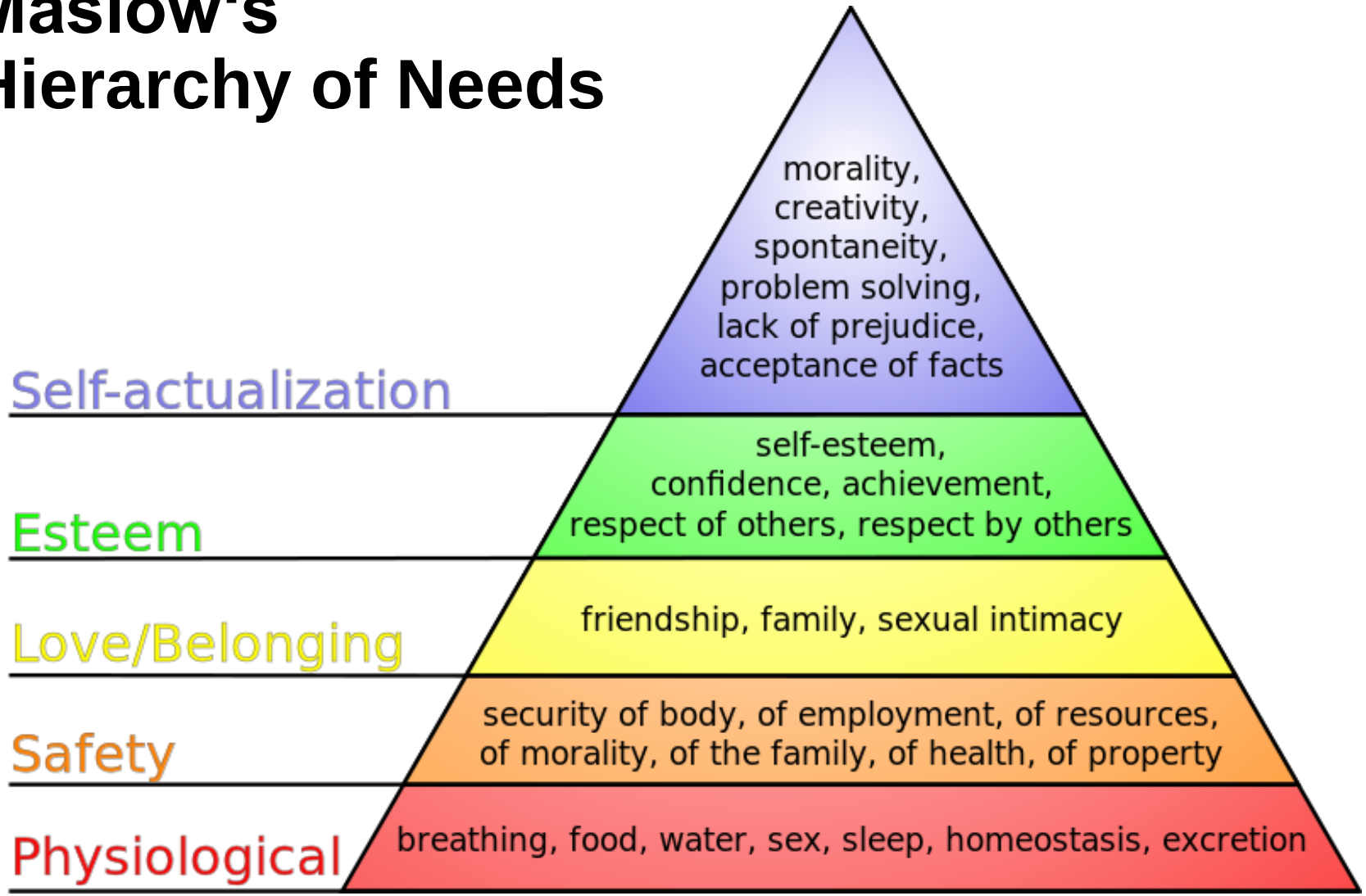
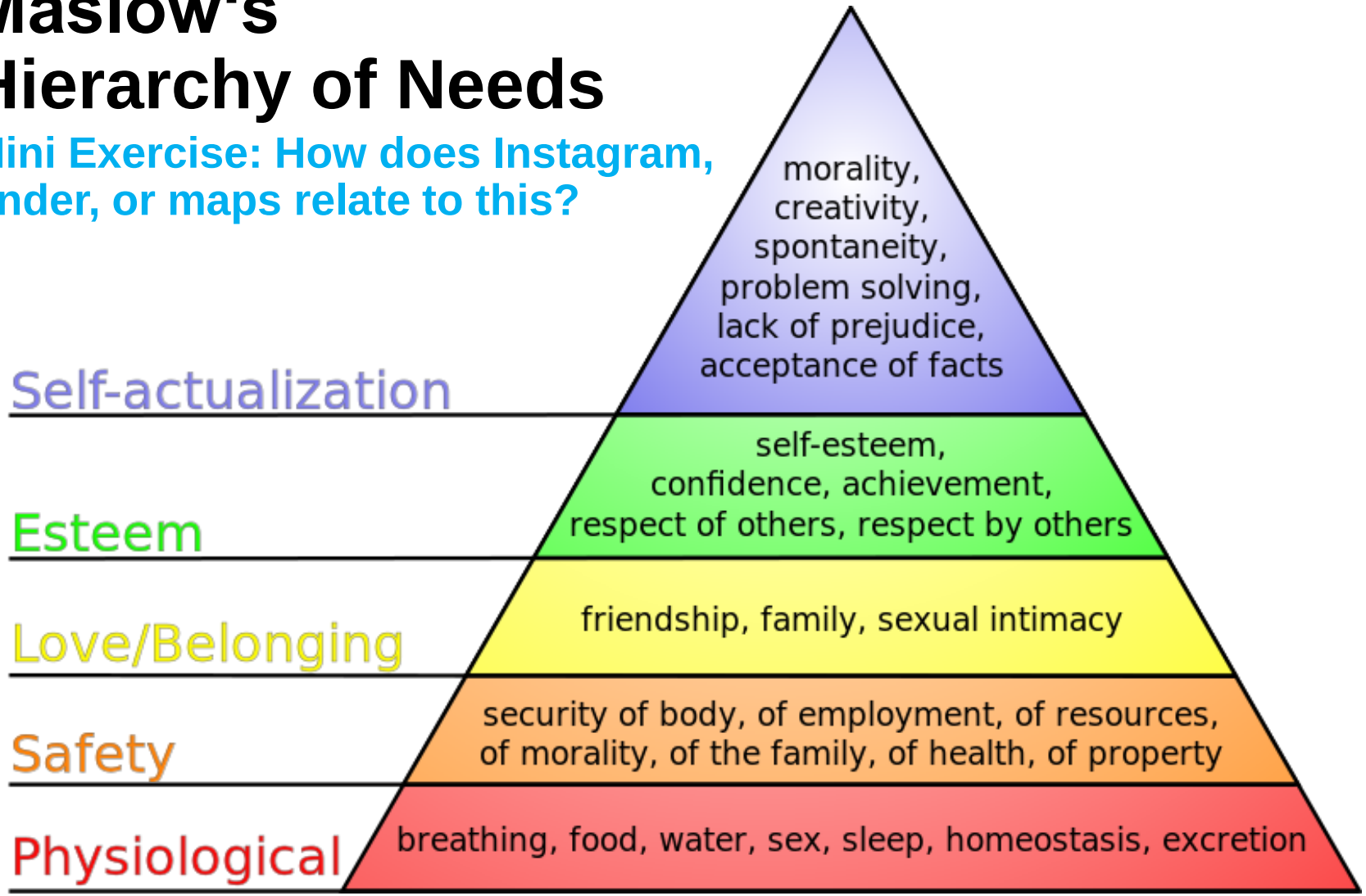
Maslow‘s Hierarchy of Needs



Maslow‘s Hierarchy of Needs

Mini Exercise: How does Instagram, tinder, or maps relate to this?



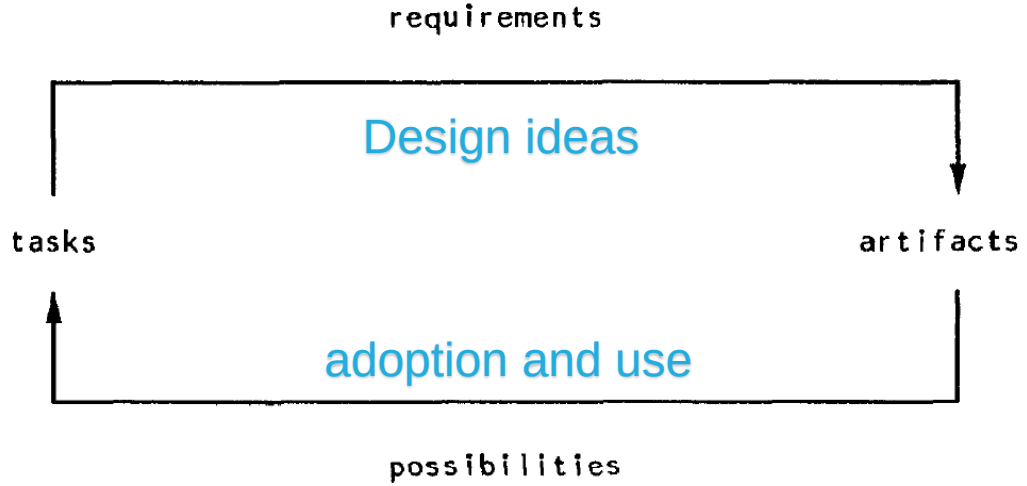
Hieronymus Bosch
The Seven Deadly Sins

Mini Exercise: How does Instagram, tinder, or maps relate to this?

Task-Artifact Cycle

John Carroll 1990

- Humans have needs and preferences
- Technologies are created to suit these needs
- As humans use the technologies needs and preferences change



John M. Carroll. 1990. Infinite detail and emulation in an ontologically minimized HCI. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '90). Association for Computing Machinery, New York, NY, USA, 321–328. DOI:https://doi.org/10.1145/97243.97303

INFINITE DETAIL AND EMULATION IN AN ONTOLOGICALLY MINIMIZED HCI

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P.O.Box 704
Yorktown Heights, NY 10598

ABSTRACT
By default, we attempt to define practical areas of technological endeavor as "applications." For example, the applied psychology of human-computer interaction has characteristically been defined in terms of the methods and concepts basic psychology can provide. This has not worked well. An alternative approach is to begin from a characterization of current practice, to take seriously the requirements of the domain of endeavor, and to define areas of "science" and "application" as possible and appropriate in that context.

KEYWORDS: ontology, theory, hermeneutics, interpretation, task-analysis, design rationale

One of the most appealing aspects of human-computer interaction (HCI), and also one of the most vexing, is the commitment — pursued energetically through the 1980s — to produce an intellectually rich applied psychology that could effectively support the design of usable computer equipment. Appealing chutzpah! The general case is that basic science provides uncertain and indirect support to practical endeavors [4, 20, 24, 29].

This ambitious project in HCI has unfortunately not succeeded, however, at least not yet. The most sustained, focussed and sophisticated attempts to develop explicit extensions of academic information processing psychology for HCI have had no discernible impact on design practice [8, 34]. Indeed, even the more mundane efforts to adapt the laboratory methods of experimental psychology have often foundered: to get clear and statistically strong results, too many investigators have been led to "discover," for example, that organized menus are better than disorganized menus [25].

The key problem is that both the concepts and the methods of basic psychology have been specialized for simple and abstract situations. Too much attention was paid to applying psychology and too little to understanding what it was that psychology was being applied to.

In this paper, I adopt a framework developed by Pat Wright, John Long and Phil Barnard for understanding applied psychology. I seek to develop this framework to address two difficult requirements in the HCI domain, that I call Infinite Detail and Emulation. The general thrust of my approach is to urge that we take seriously as *scientific* objects the objects that are of obvious practical importance in the everyday commerce of a domain (hence the term "ontologically minimized"). In HCI, the important objects are user tasks and designed artifacts. This approach meets the requirements that no other approach can, and because it is built out of the practical essence of the domain, it offers unique and direct leverage for the pragmatics of design as well.

INFORMATION FLOW

How can we do better at coordinating and integrating basic science with practical endeavor? An interesting line of thinking starts with Wright's [41] examination of the relationships between pure and applied work on text. She found "few points of contact" between psycholinguistics and design of text. She suggested an "information flow among researchers ... that starts with applied solutions to practical problems, continues through pure explanations of why these solutions are successful, and so enables the refinement of the original applied solutions."

John Long [27] and Phil Barnard [2] are developing a framework for understanding the activity in HCI as what amounts to an information flow in Wright's sense. (From my standpoint, it is convenient to collapse Long and Barnard's work, though they would clearly want to make distinctions). This is sketched in Figure 1 (based on figures from Long and Barnard). The key idea is that science provides a *representation* of the real world. To construct and to apply this representation, we must be able to map between it and the world. This mapping involves intermediary, or bridging representations, specialized for the intended domain of endeavor.

Task-Artifact Cycle

John Carroll 1990.

*"**Human activities** implicitly **articulate needs**, preferences and design visions. **Artifacts are designed in response**, but inevitably do more than merely respond. Through the course of their adoption and appropriation, **new designs provide new possibilities** for action and interaction. Ultimately, this activity articulates **further human needs**, preferences, and design visions."*

Carroll, John M. (2013): Human Computer Interaction - brief intro. In: Soegaard, Mads and Dam, Rikke Friis (eds.). "The Encyclopedia of Human-Computer Interaction, 2nd Ed.". Aarhus, Denmark: The Interaction Design Foundation. Available online at http://www.interaction-design.org/encyclopedia/human_computer_interaction_hci.html

Task-Artifact Cycle: Example Mobility

Need for transport → car → changed mobility behavior and town layouts

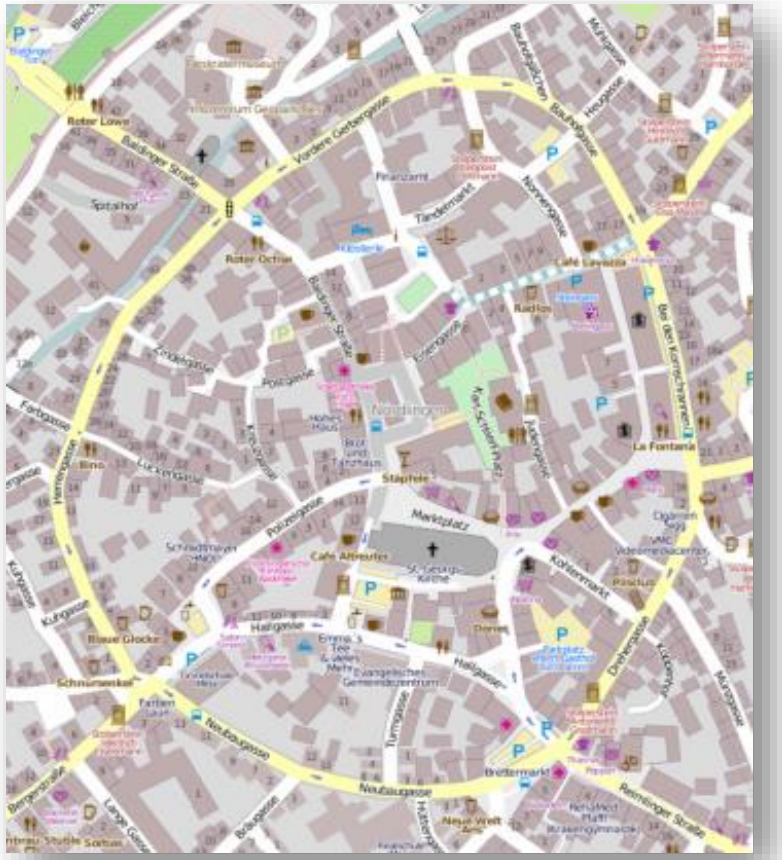


Image from OpenStreetMap:
http://www.openstreetmap.org/?lat=48.85154&lon=10.48856&zoom=17&layers=M

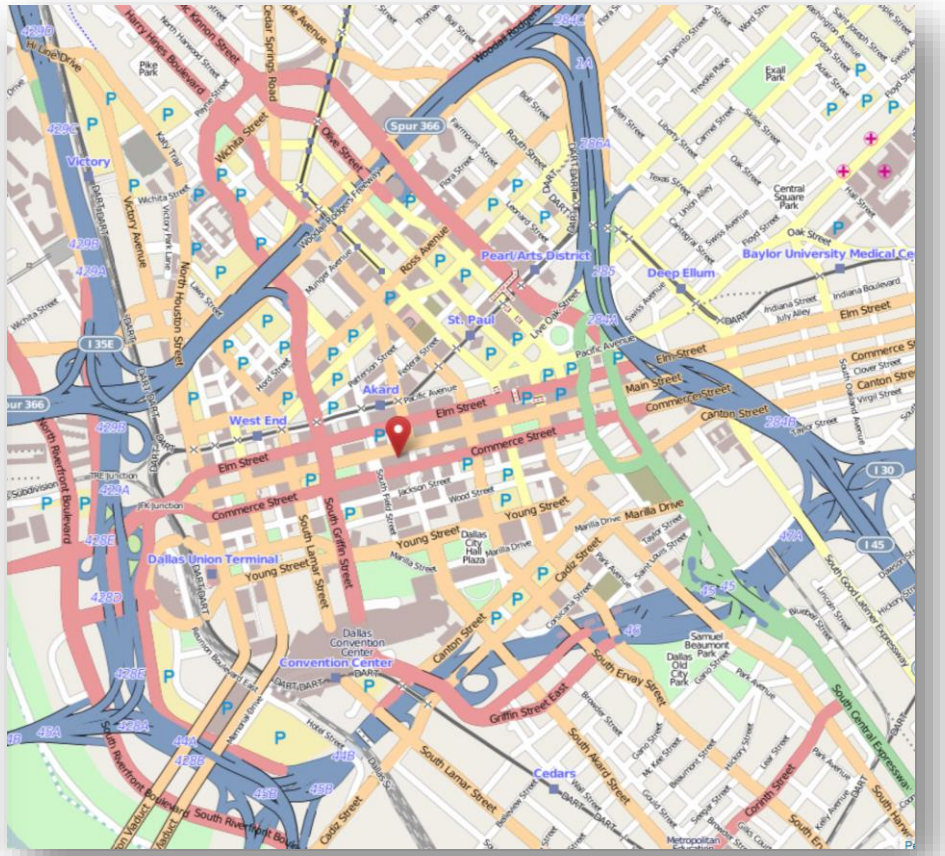


Image from OpenStreetMap:
http://www.openstreetmap.org/?lat=49.48761&lon=8.46736&zoom=16&layers=M

Task-Artifact Cycle

Mini Exercise: Mobile Phone

Desire to communicate

→ phone

→ changed social behavior

→ …

1. Explain the task-artifact cycle in the context of mobile telephony.
2. How did people meet in town 1990? An how in 2020? Discuss the impact beyond a single artifact.

Conflicting User Needs

Designers make value decisions

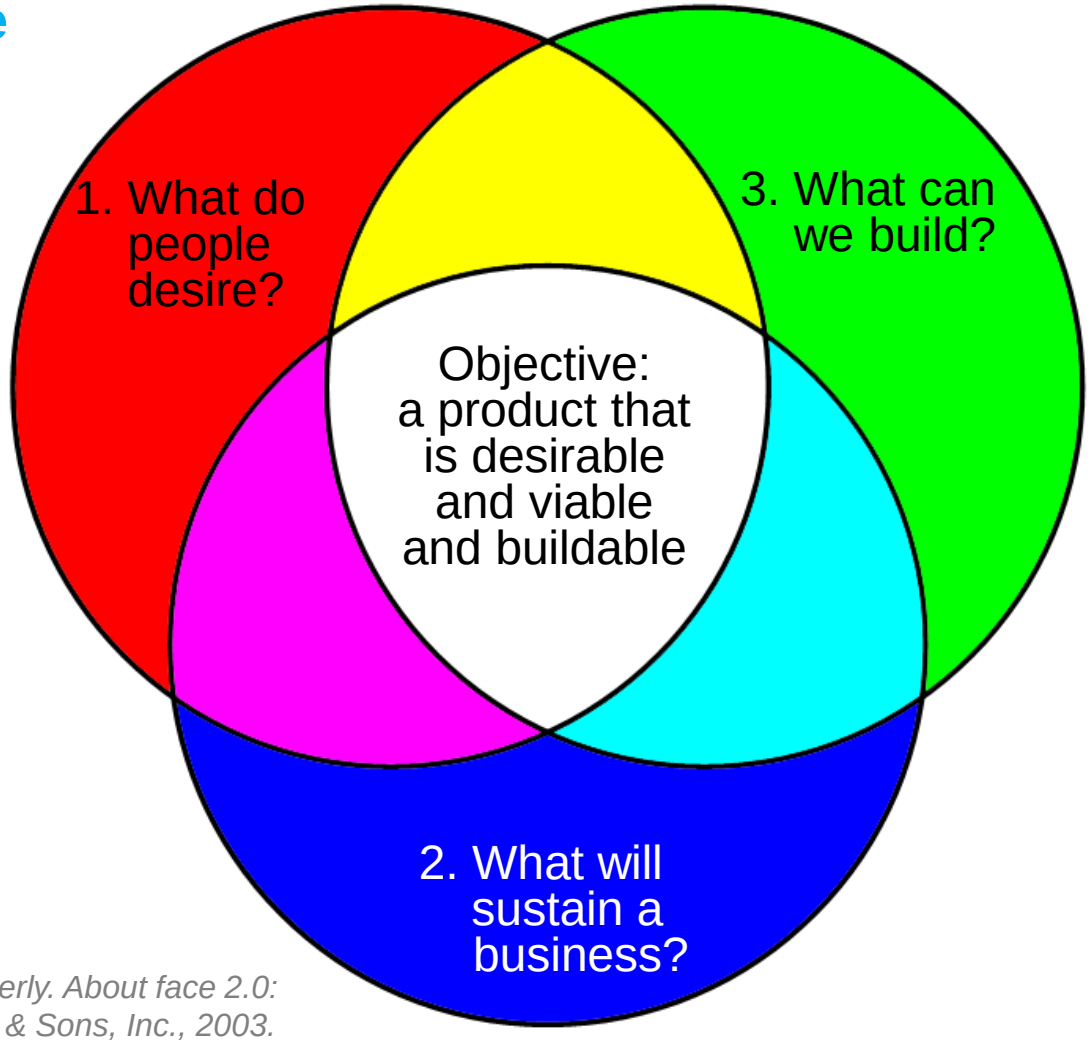
- User needs are a complex mix of (conflicting) needs
  - It is difficult to weight values against each other
  - Many values are not explicitly communicated

- Example – ask people about explicit values:
  - Should it be free of charge?
  - Should it be privacy preserving?
- Example – observe peoples implicit values:
  - Minimal effort in getting started and using it?
  - Using applications that are “sponsored” by ads
  - Social status of a technology (coolness factor)

The Bigger Picture
Building Successful Digital Products

It is not only about what the users want!

- Tension
  - different objectives
  - different design goals
- Context of a product design



Cooper, Alan, Robert Reimann, and Hugh Dubberly. About face 2.0: The essentials of interaction design. John Wiley & Sons, Inc., 2003.

Summary

- Asking the user is not sufficient to reveal user needs.
- Humans have a basic set of needs.
- Maslow states a hierarchy of needs (physiological needs, safety needs, love needs, esteem needs, Need for Self-Actualization).
- The task-artifact cycle describes how humans use the technologies changes needs.
- In real world scenarios it is likely that user needs are conflicting.
- Understanding user needs is essential, but this is not sufficient to create a successful product.

Did you understand this block?

Can you answer these questions?

- Sketch the task-artifact cycle according to Carroll et al.
- How does this insight impact methods in human computer interaction?
- Give one real example that is explained by the task-artifact-Cycle.
- Name the levels in Maslow’s hierarchy of human needs.
- Relate 3 widely use software products or web services to specific levels and explain this in one sentence each.
- How do user needs fit into Alan Cooper’s concept for “Building Successful Digital Products”.

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- Alan Cooper, Robert Reimann, and Hugh Dubberly (2003): About face 2.0: The essentials of interaction design. John Wiley & Sons, Inc.

Ubiquitous Human-Computer Interaction

Learning Goals

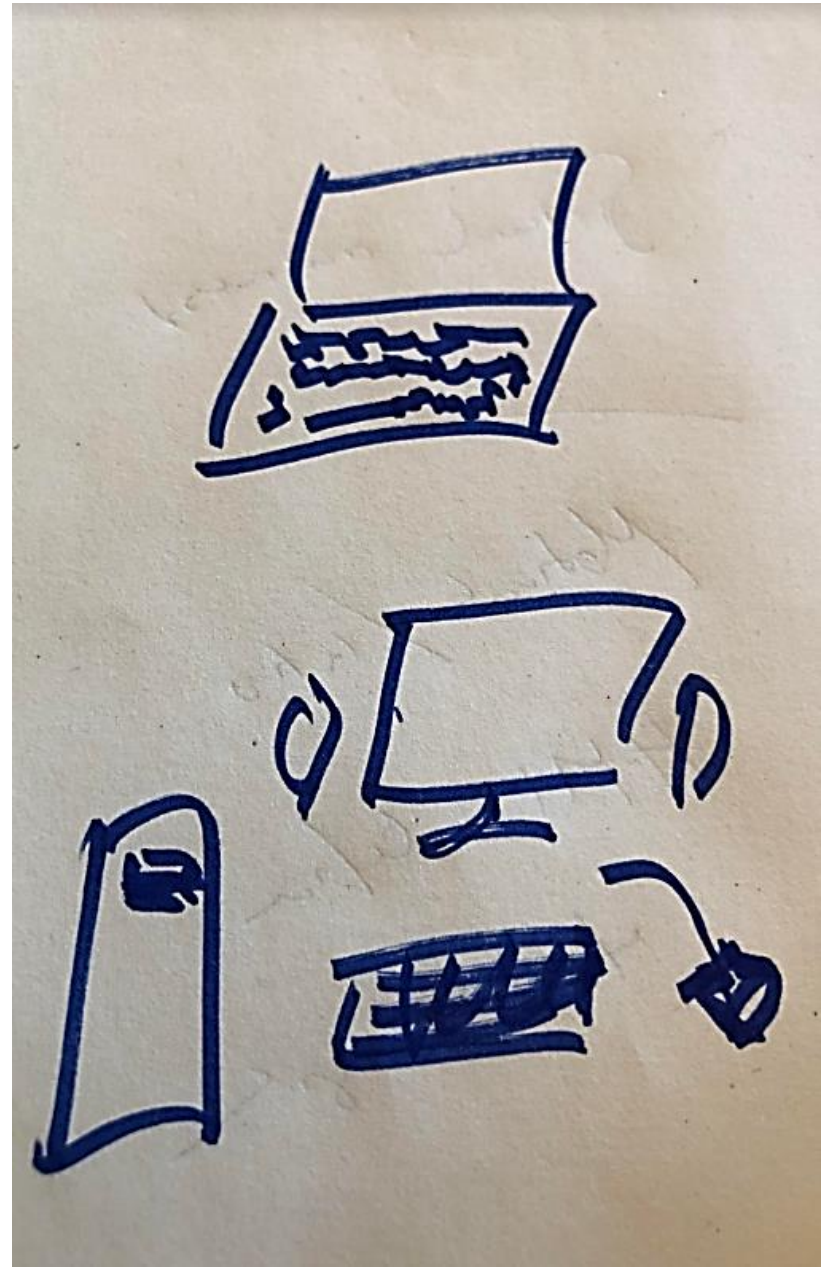
- Understand …
  - that human-computer interaction is relevant to a variety of technology developments
  - How the design of physical and digital objects makes them easy or hard to use
  - That what limits us in building new applications and services
- Be able to explain …
  - why the interaction design for digital product is more challenging than for mechanical ones
  - The term affordance and perceived affordance and give examples

Mini-Exercise: Draw a Computer

Pause the video a sketch a computer?

- How did your first computer look like?
- How does your current computer look like?

- Pick a computer and draw a sketch!



How many computers have you interacted with?

What is a computer anyway?

How many computers have you interacted with?

What is a computer anyway?

- What other things are you interacting with today?

Paula Zuccotti (2015). Every Thing We Touch: A 24-Hour Inventory of Our Lives: Our Days and Lives in Objects. Viking. UK.

What do you interact with?

You Can Touch This: Eleven Years and 258218 Images of Objects

Figure 1: All objects touched by Alberto Frigo in January 2004, 2009 and 2014. Every line shows the images of the touched objects for one day. Please use the magnifying functionality of your PDF reader to take a closer look at the photos.

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DOI: http://dx.doi.org/10.1145/2851581.2892575

Abstract

Touch has become a central input modality for a wide variety of interactive devices, most of our mobile devices are operated using touch. In addition to interacting with digital artifacts, people touch and interact with many other objects in their daily lives. We provide a unique photo dataset containing all touched objects over the last 11 years. All photos were contributed by Alberto Frigo, who was involved early on in the "Quantified Self" movement. He takes photos of every object he touches with his dominant hand. We analyzed the 258,218 images with respect to the types objects, their distribution, and related activities.

Author Keywords

Touch Interaction; Tangible Interaction; Life Logging; Quantified Self

ACM Classi cation Keywords

H.5.2. [User Interfaces]: Haptic I/O

Introduction & Context

Touch interaction is heavily studied in the area of human-computer interaction (HCI). From research in the area of tangible computing [8, 10] to research enriching touch as an input modality [3, 20], the topic has gained growing importance in the field. In addition to using touch to interact with the digital world, like a computer mouse or a smartphone,

Nina Runge, Johannes Schöning, Rainer Malaka, and Alberto Frigo. 2016. You Can Touch This: Eleven Years and 258218 Images of Objects. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (CHI EA '16). ACM, New York, NY, USA, 541-552. DOI: https://doi.org/10.1145/2851581.2892575

What do you interact with?

You Can Touch This: Eleven Years and 258218 Images of Objects

Figure 1: All objects touched by Alberto Frigo in January 2004, 2009 and 2014. Every line shows the images of the touched objects for one day. Please use the magnifying functionality of your PDF reader to take a closer look at the photos.

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Abstract

Touch has become a central input modality for a wide variety of interactive devices, most of our mobile devices are operated using touch. In addition to interacting with digital artifacts, people touch and interact with many other objects in their daily lives. We provide a unique photo dataset containing all touched objects over the last 11 years. All photos were contributed by Alberto Frigo, who was involved early on in the "Quantified Self" movement. He takes photos of every object he touches with his dominant hand. We analyzed the 258,218 images with respect to the types objects, their distribution, and related activities.

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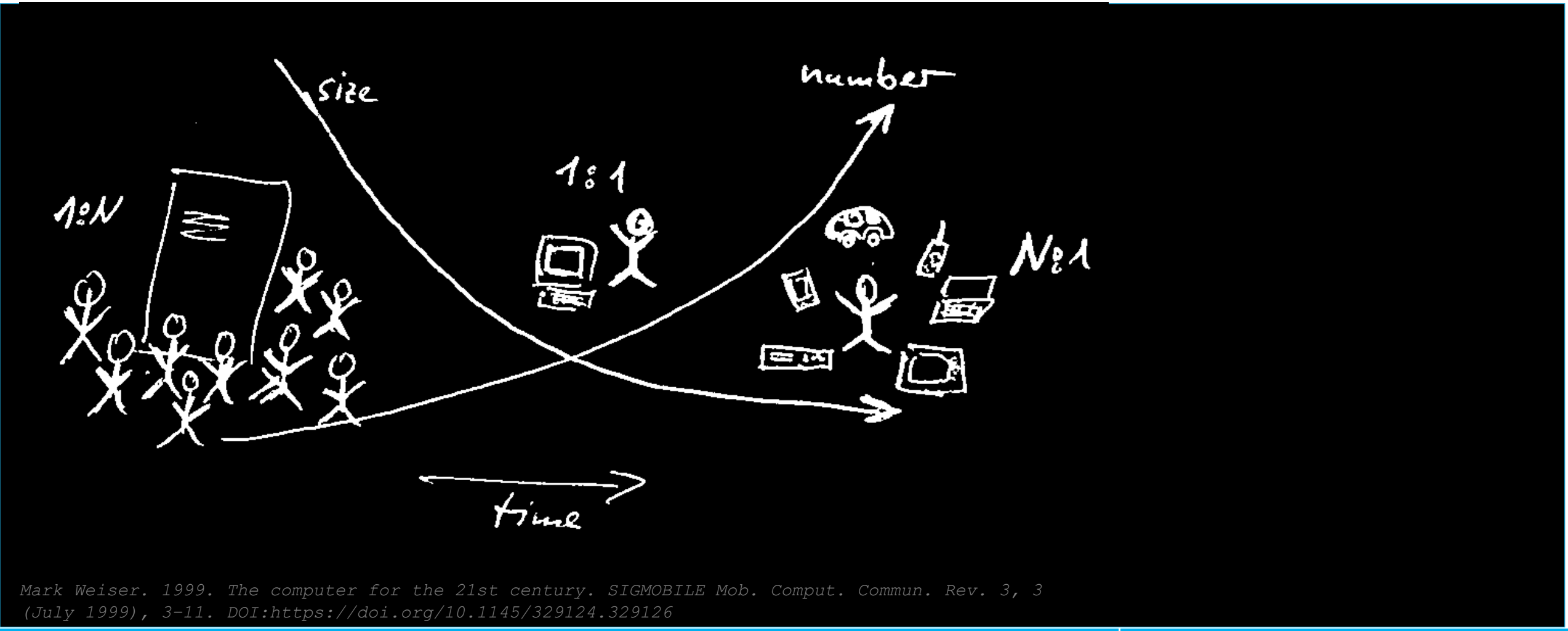
Many things become computational artifacts

How many of things you use will be “computers” in 2050?

- **Mini Exercise:**
  - Think of 10 things you have or use today that have become a computational device in the last 20 year?
  - Think of 10 things you have or use today that may become a computational device in the next 30 year? (Start with things that already now use power…)

Ubiquitous Computing



Mark Weiser. 1999. The computer for the 21st century. SIGMOBILE Mob. Comput. Commun. Rev. 3, 3 (July 1999), 3-11. DOI:https://doi.org/10.1145/329124.329126

What is different when you design interaction for digital artifacts?

Observable Mechanical Constraints vs. Endless Digital Design Opportunities

Curse of freedom?

- How can you tell the function from observation?

Mini-Exercise: What vandalism would you expect?

What vandalism does each design afford?

wood

glass

stone

Term: Affordance

(in German: Angebotscharakter, Aufforderungscharakter)

Origin in Psychology, Gibson 1977

"A fruit says 'Eat me'; water says 'Drink me'; thunder says 'Fear me'…"

THE ORIGIN OF THE CONCEPT OF AFFORDANCES

The Gestalt psychologists recognized that the meaning or value of a thing seems to be perceived just as immediately as its color. The value is clear on the face of it, as we say, and thus it has a *physiognomic* quality in the way that the emotions of a man appear *on his face.* To quote from the *Principles of Gestalt Psychology* (Koffka, 1935): "Each things says what it is . . . a fruit says 'Eat me'; water says 'Drink me'; thunder says 'Fear me'; and woman says 'Love me' [p. 7]." These values are a vivid and essential feature of the experience itself. Koffka did not believe that a meaning of this sort could be explained as a pale context of memory images or an unconscious set of response tendencies. The postbox "invites" the mailing of a letter, the handle "wants to be grasped," and things "tell us what to do with them [p. 353]." Hence they had what Koffka called "demand character."

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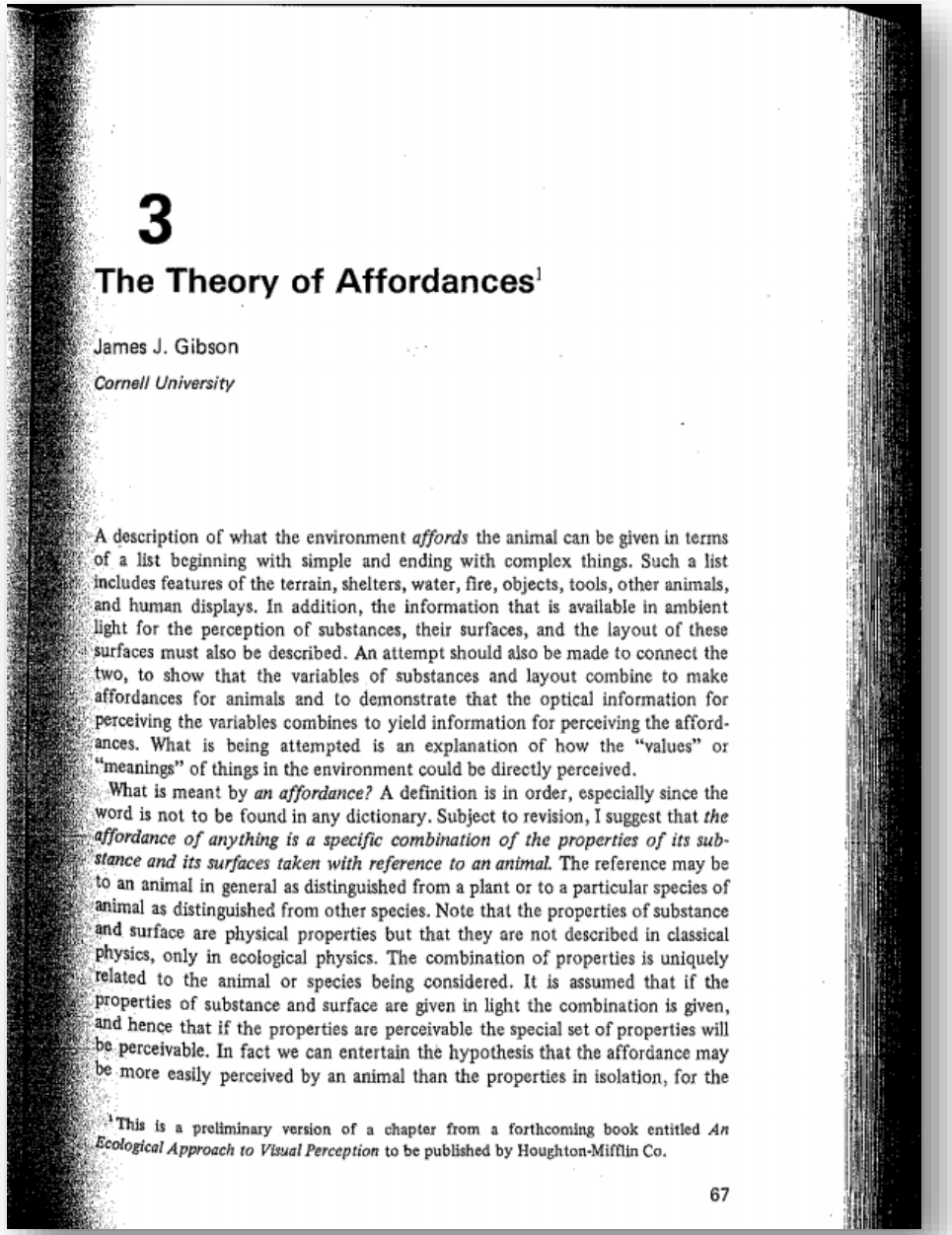
Gibson, James J. "The theory of affordances." *Hilldale, USA* 1.2 (1977).
https://monoskop.org/images/2/2c/Gibson_James_J_1977_The_Theory_of_Affordances.pdf



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The Theory of Affordances[1]

James J. Gibson

Cornell University

A description of what the environment *affords* the animal can be given in terms of a list beginning with simple and ending with complex things. Such a list includes features of the terrain, shelters, water, fire, objects, tools, other animals, and human displays. In addition, the information that is available in ambient light for the perception of substances, their surfaces, and the layout of these surfaces must also be described. An attempt should also be made to connect the two, to show that the variables of substances and layout combine to make affordances for animals and to demonstrate that the optical information for perceiving the variables combines to yield information for perceiving the affordances. What is being attempted is an explanation of how the "values" or "meanings" of things in the environment could be directly perceived.

What is meant by *an affordance?* A definition is in order, especially since the word is not to be found in any dictionary. Subject to revision, I suggest that *the affordance of anything is a specific combination of the properties of its substance and its surfaces taken with reference to an animal.* The reference may be to an animal in general as distinguished from a plant or to a particular species of animal as distinguished from other species. Note that the properties of substance and surface are physical properties but that they are not described in classical physics, only in ecological physics. The combination of properties is uniquely related to the animal or species being considered. It is assumed that if the properties of substance and surface are given in light the combination is given, and hence that if the properties are perceivable the special set of properties will be perceivable. In fact we can entertain the hypothesis that the affordance may be more easily perceived by an animal than the properties in isolation, for the

[1]This is a preliminary version of a chapter from a forthcoming book entitled *An Ecological Approach to Visual Perception* to be published by Houghton-Mifflin Co.

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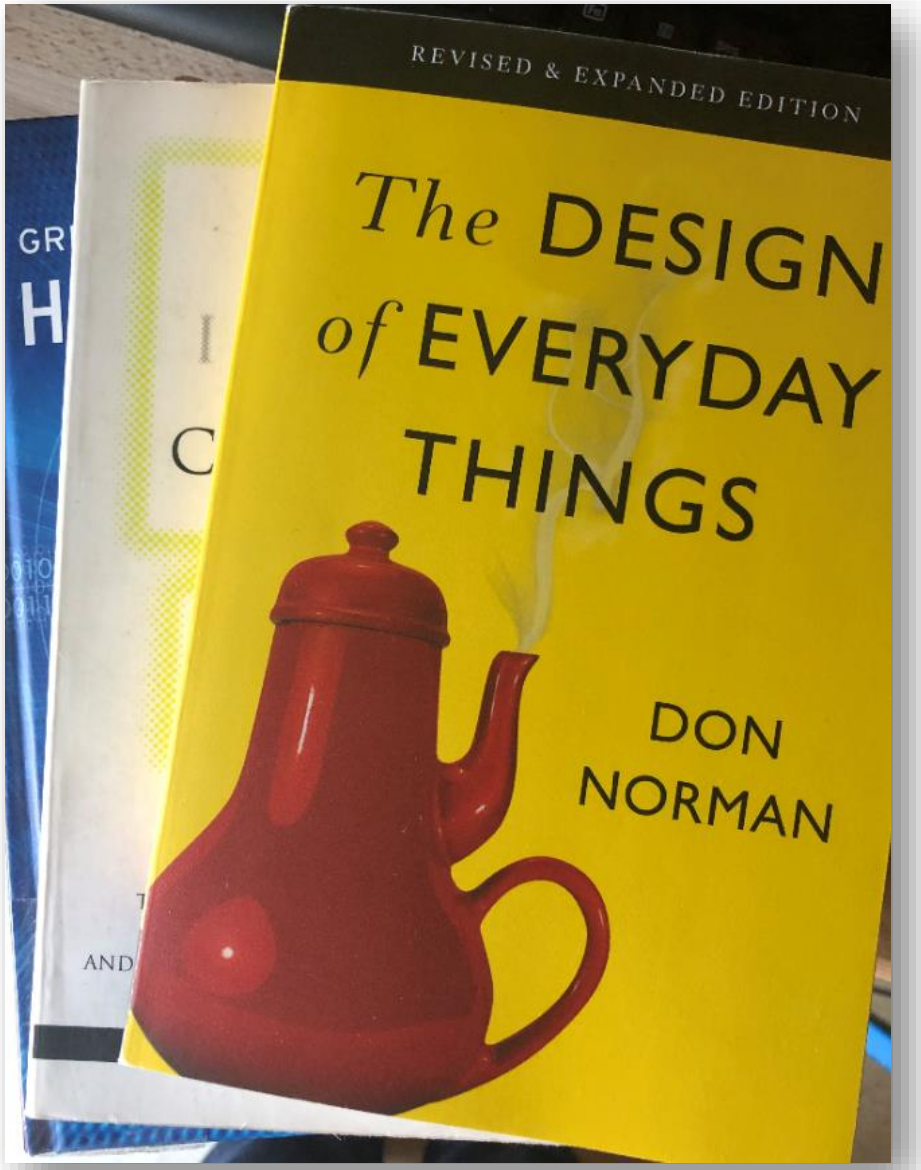
Term: Affordance and Perceived Affordance

Don Norman

- *“What the designer cares about is whether the user perceives that some action is possible (or in the case of perceived non-affordances, not possible).” Don Norman, https://jnd.org/affordances_and_design/*

- *When looking at an object you know how to use it*
- *The function and the opportunities for interaction follow from the design*



https://jnd.org/affordances_and_design/
Norman, D. A. (2013). The design of everyday things: Revised and expanded edition. New York: Doubleday.

How to tell the user how to use it?

Signs? Labels? A Tutorial?

- How to make things that are obvious to use?
- Is there something like an intuitive user interface?

How to tell the user how to use it?

A Letter that tells you how to use a window?

Sehr geehrte Damen und Herren,

aus aktuellem Anlass übersenden wir Ihnen mit diesem Schreiben wichtige Handhabungshinweise für die motorisch betätigten Fenster an o.g. Bauvorhaben:

- Die Fenster sind nur über die zur Betätigung installierten Taster zu bedienen.
- Der Öffnungs- und Schließvorgang muss ***immer*** bis zum Erreichen der Endlage der Antriebe ausgeführt werden. Die Endlage erkennen Sie zweifelsfrei, wenn die Laufgeräusche nicht mehr zu vernehmen sind.
- Unterbrechungen des Tastendrucks während des Öffnungs- und Schließvorgangs sind unbedingt zu vermeiden.
- Mehrmaliges, kurz aufeinanderfolgendes Betätigen der Taster ist zu vermeiden. Die interne Logik der Antriebe wird dadurch gestört.

Bitte beachten Sie die Hinweise und leiten Sie diese an die Nutzer weiter. Nichtbeachtung führt zu Störungen bis hin zum Ausfall der Antriebe, auch mechanische Beschädigungen sind nicht ausgeschlossen.

Für weitere Rückfragen stehen wir Ihnen gerne zur Verfügung.

Mit freundlichen Grüßen

Starz Metallbau

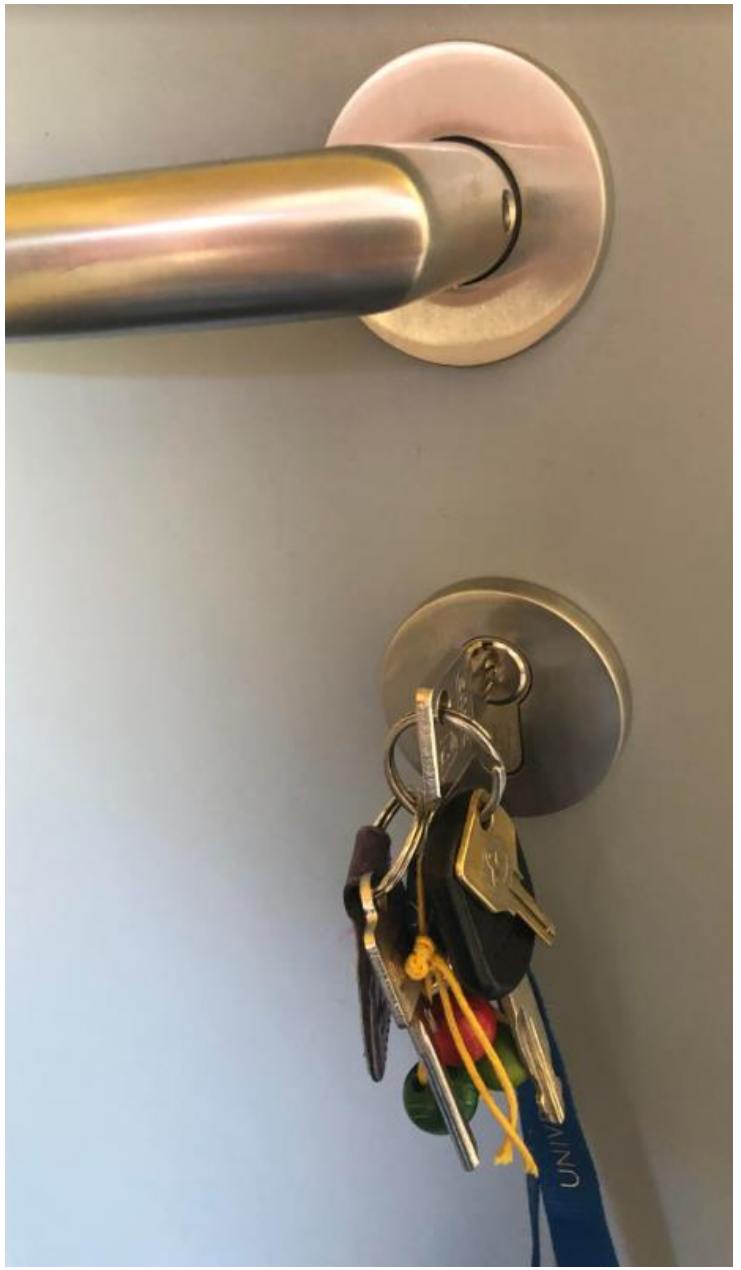
i.A.

STARZ METALLBAU

Design Task: Usable Security

What is your Solution?

- Scenario:
  - You have one lock to a room which holds equipment.
  - Room is shared by 20+ people from one department, who need to access it infrequently (typically every few weeks).
  - People from other departments should not get into the room.
  - Currently solution: there is one key that can be borrowed from the care taker and 5 out of the 20+ people have personal key to this room.
- Design a better solution.
  - You should replace old lock by something else.
  - What is you design?
  - What are positive and negative aspects of your proposal?



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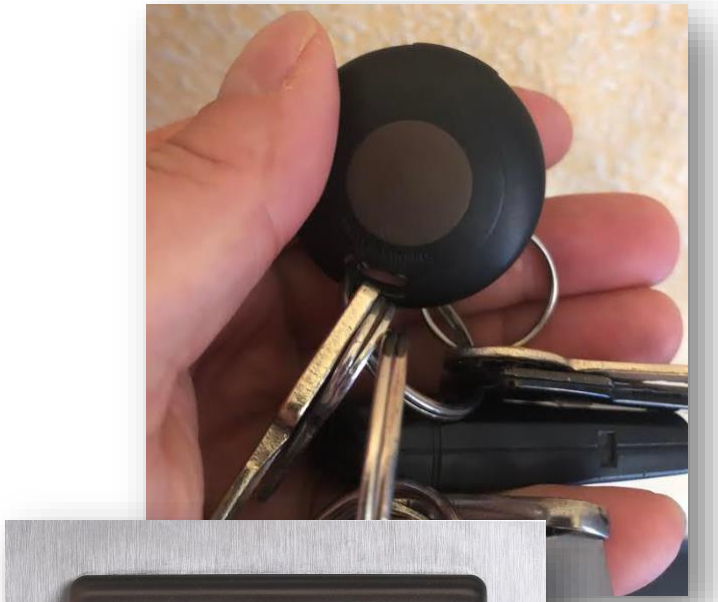


Photo by D4m1en, CC BY-SA 3.0
https://commons.wikimedia.org/w/index.php?curid=34336655

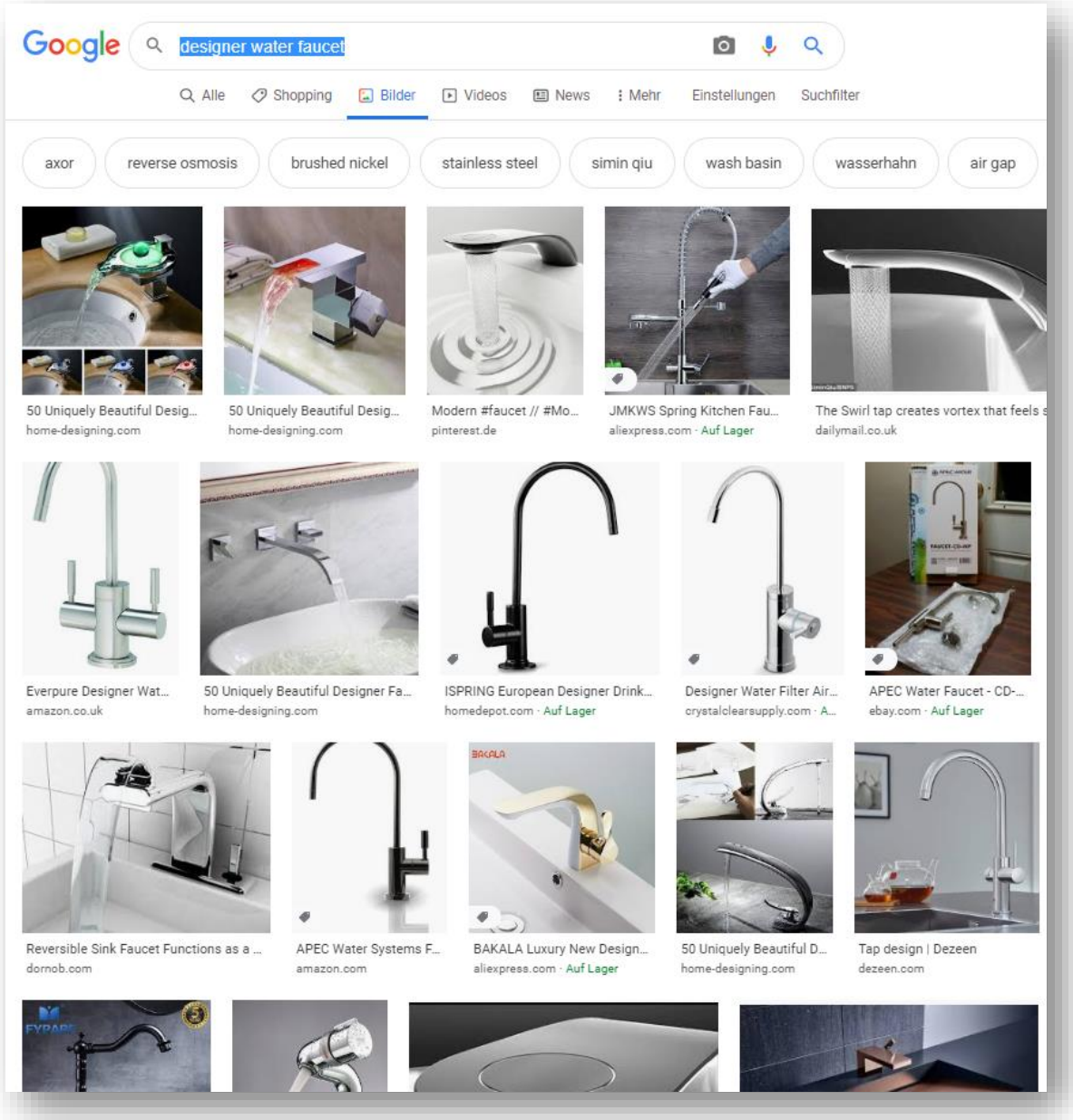
Examples: Affordance and Perceived Affordance

Door handles and water facets

- Perform a google image search for
  - designer water faucet

  and find examples of products where it is NOT clear how to use them.

- Why do people design things that are not obvious to use?

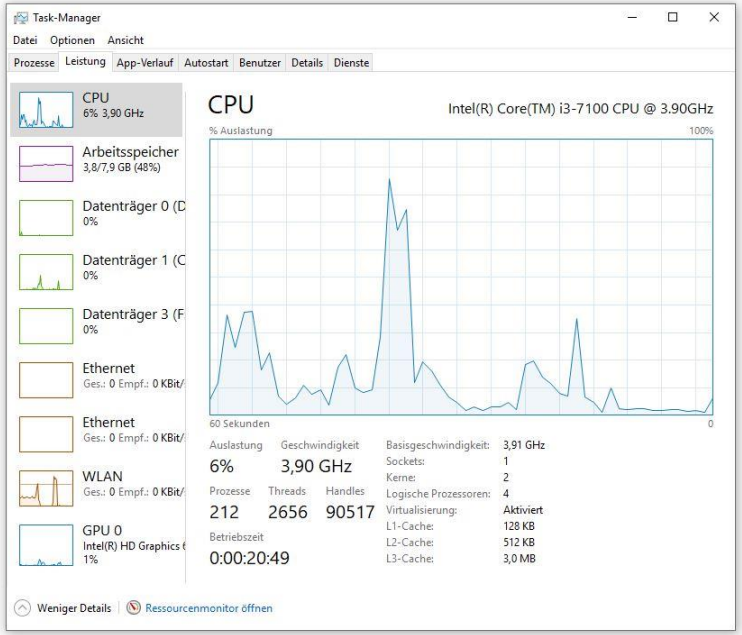


Limitations

What limits what applications you can build and use?

- Processing power? Network connectivity?
- Screen size? Keyboard input speed?
- Your creativity to think of something useful?

ThE cRaCkEr / CC BY-SA



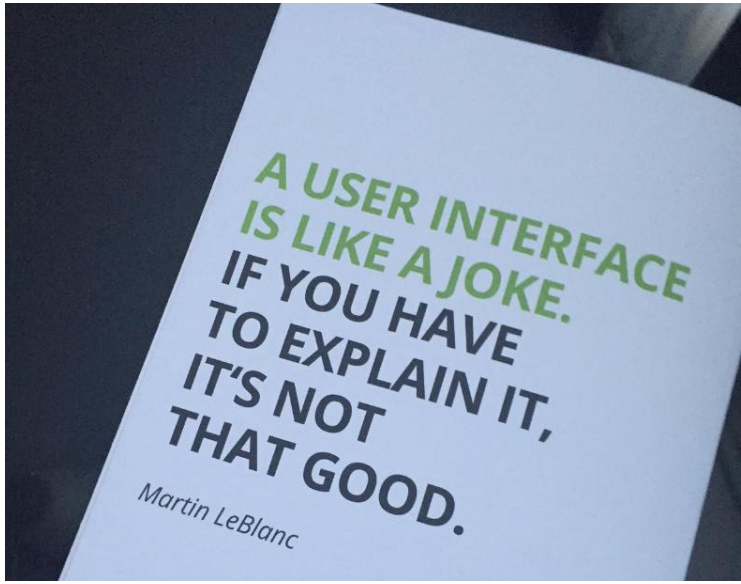
Summary

- Human-computer interaction is widely relevant to the development of interactive technologies
- The interaction and interface design determines how people can and will use an object, device or application
- The goal is to make a interface and interaction design that communicates how a things is used
- As constraints are remove when moving from mechanical to digital the interaction design plays a bigger role
- The terms affordance and perceived affordance describe how objects communicate how you can use them
- Designing objects requires to understand what perceived affordances are created.

Did you understand this block?

Can you answer these questions?

- Why is it harder to see how a digital artefact is used, compared to a mechanical one?
- Explain the term affordance according to Gibson.
- Explain the term perceived affordance according to Norman.
- Explain the quote "*A user interface is like a joke. If you have to explain it, it's not that good.*" with regard to the concept of affordance.
- Provide examples for a good design and for a bad design that can be explained with the concept of affordance.
- Take photos of 10 door handles and discuss the concept of affordance.



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