



# Ubiquitous Human-Computer Interaction

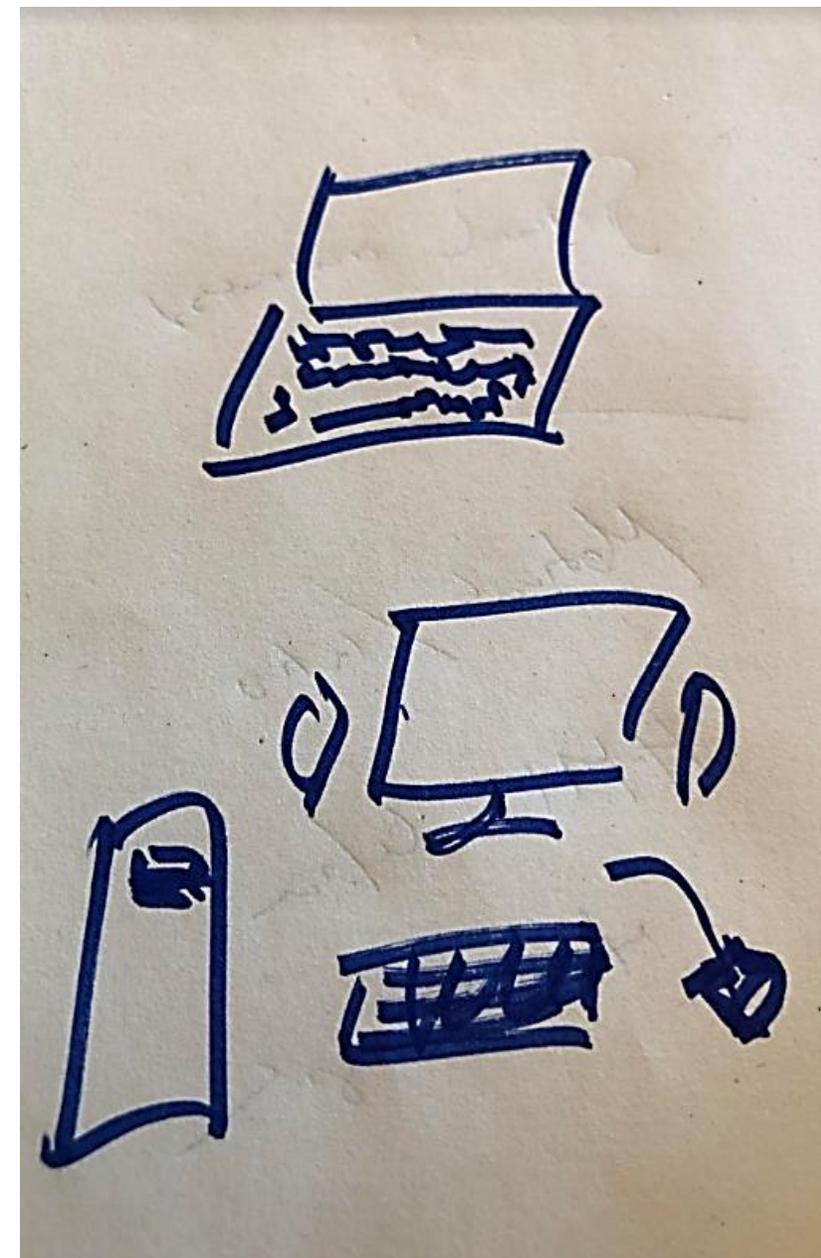
# Learning Goals

- 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?



# 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.

### Author Keywords

Touch Interaction; Tangible Interaction; Life Logging; Quantified Self

### ACM Classification 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>

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# Many things become computational artifacts

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

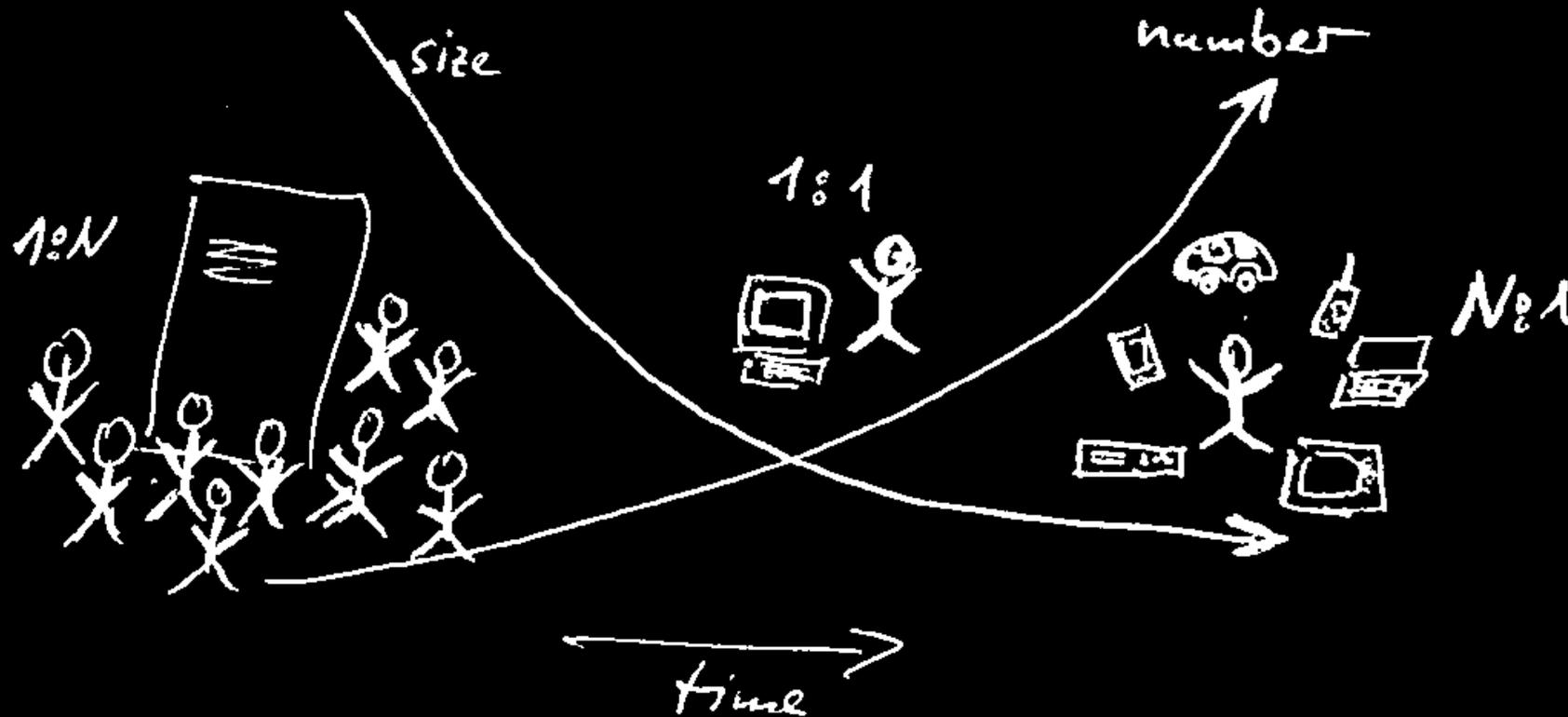
- **Mini Exercise:**

- 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](https://monoskop.org/images/2/2c/Gibson_James_J_1977_The_Theory_of_Affordances.pdf)

## 3

### The Theory of Affordances<sup>1</sup>

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

<sup>1</sup>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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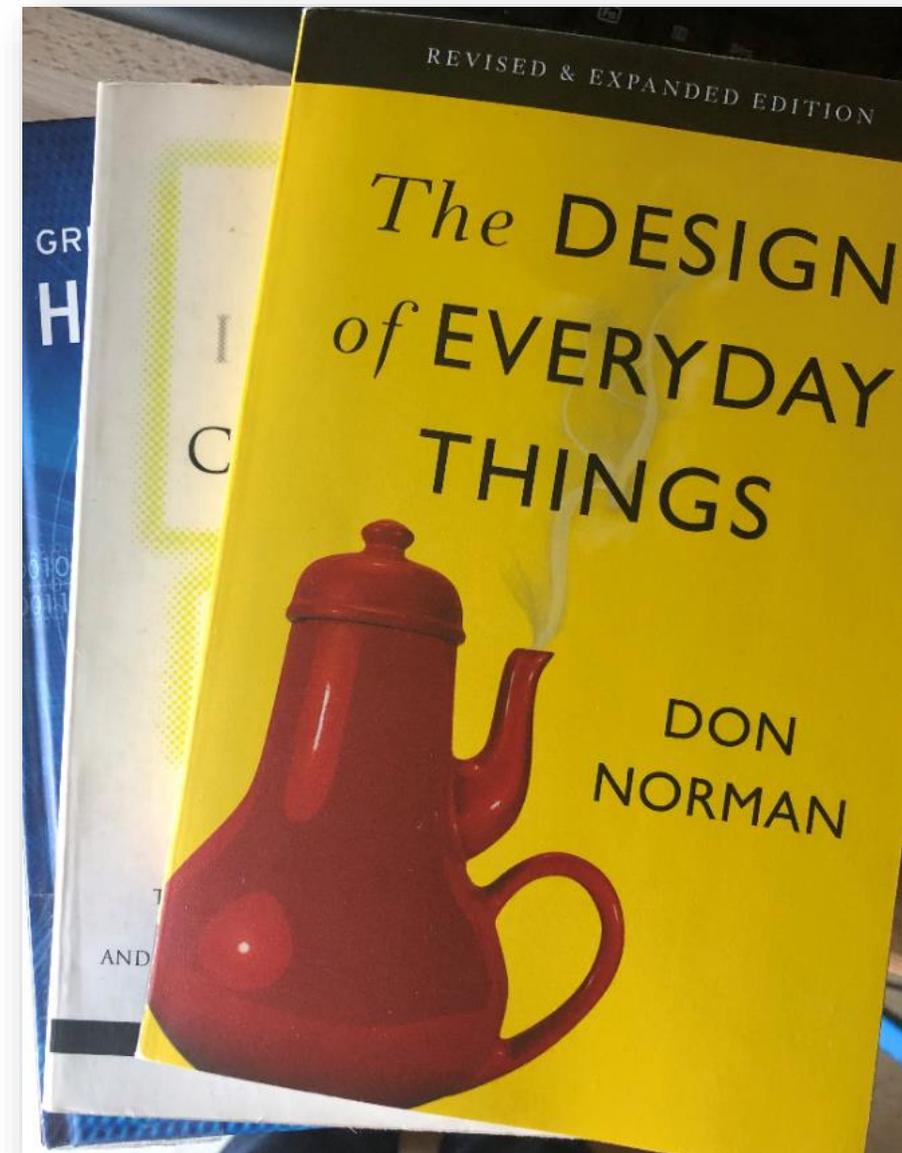
# Term: Affordance and Perceived Affordance

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/](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/](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?

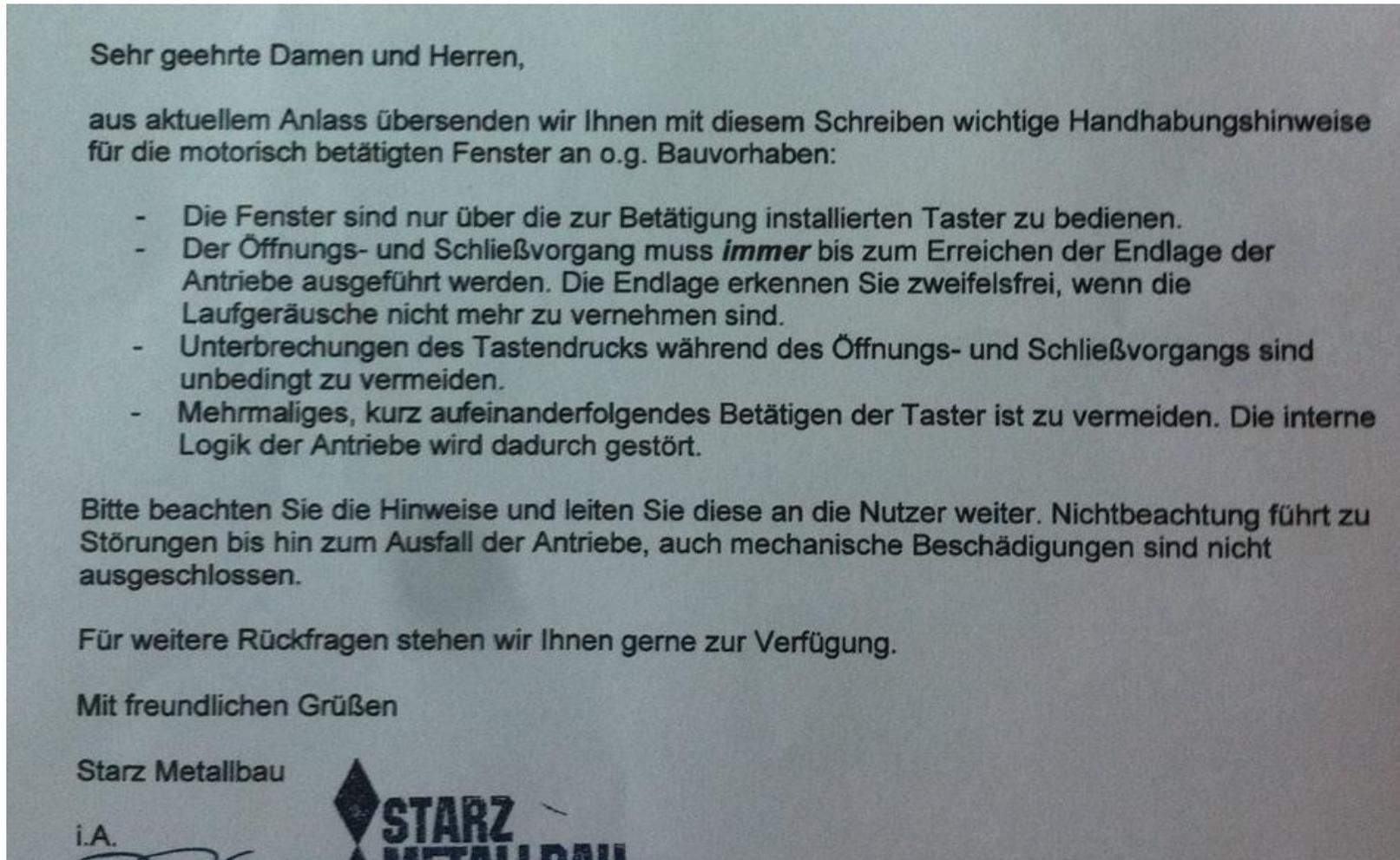
## Signs? Labels? A Tutorial?

- 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?

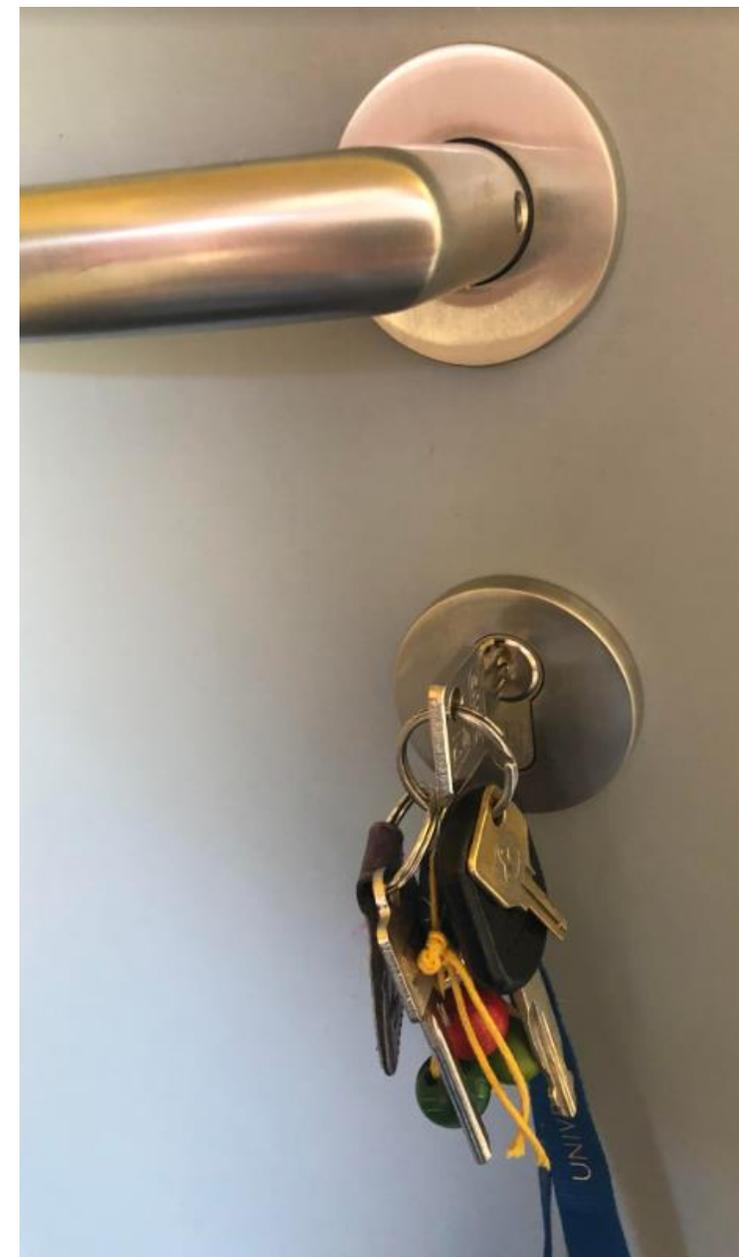
## A Letter that tells you how to use a window?



# 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 your design?
  - What are positive and negative aspects of your proposal?



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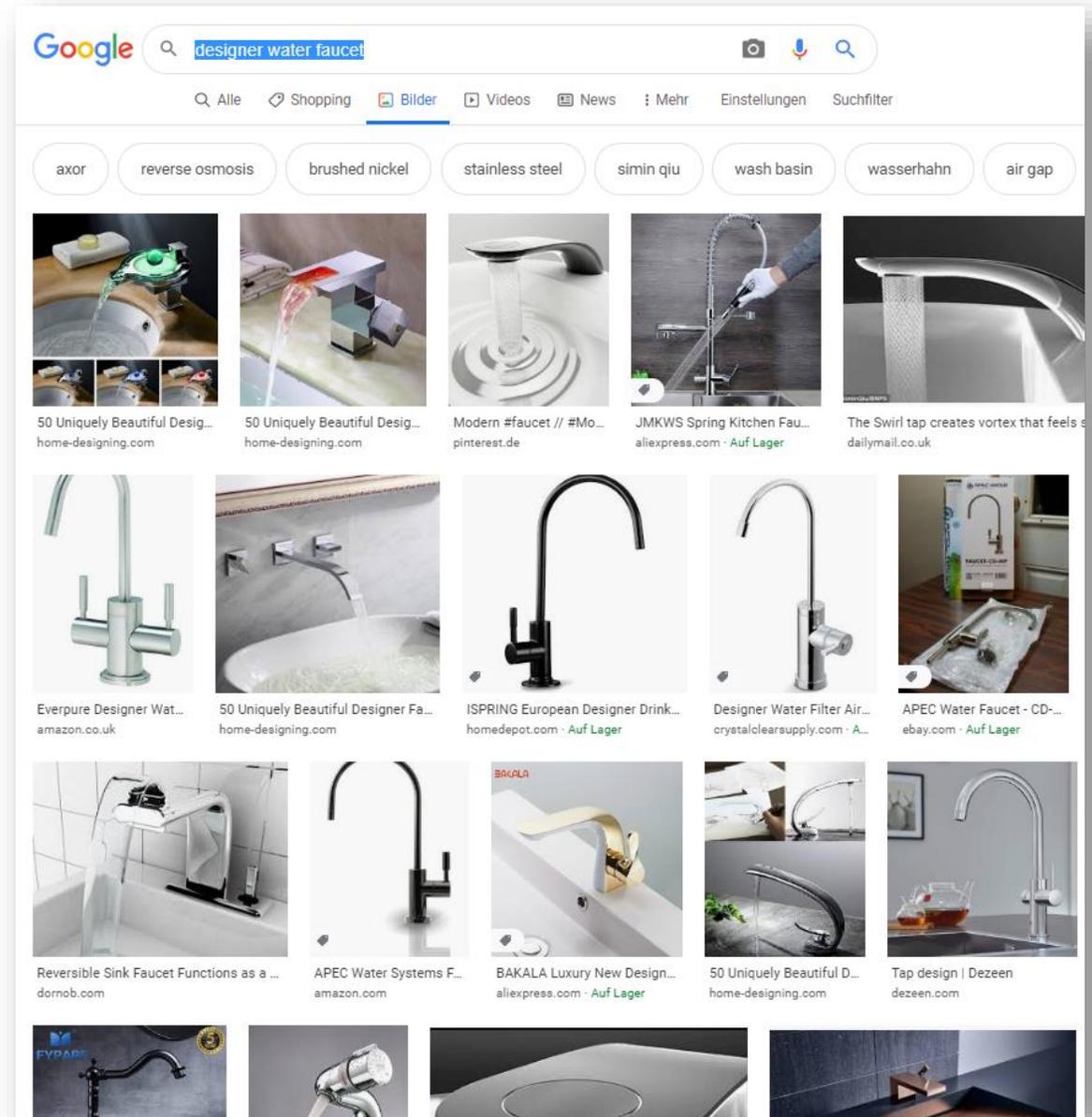


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# Examples: Affordance and Perceived Affordance

## Door handles and water facets

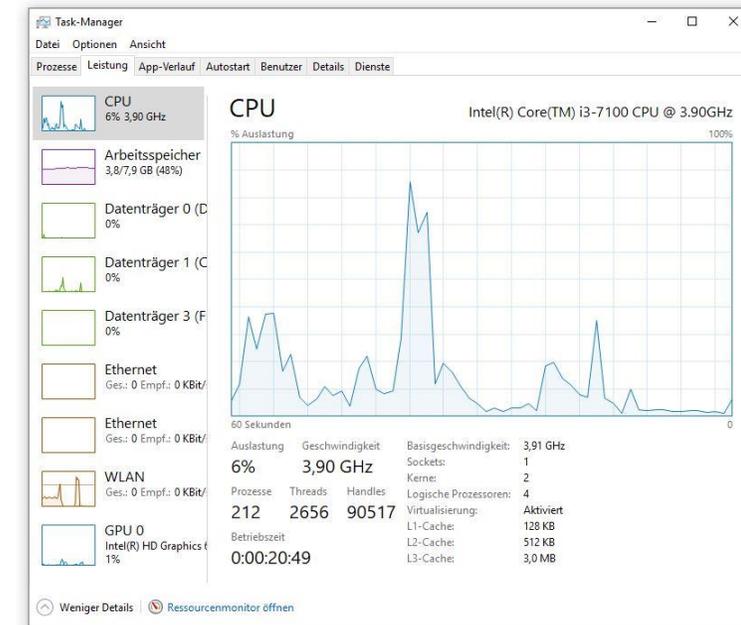
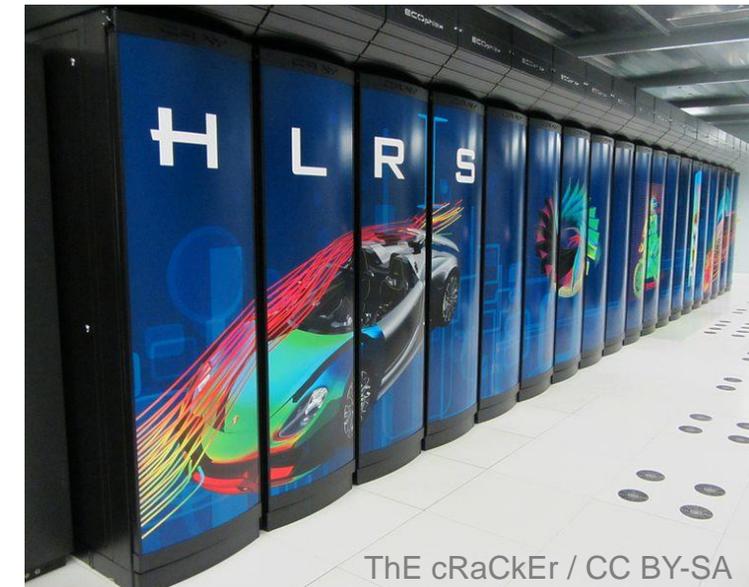
- Perform a google image search for
  - designer water faucetand find examples of products where it is NOT clear how to use them.
- Why do people design things that are not obvious to use?



# Limitations

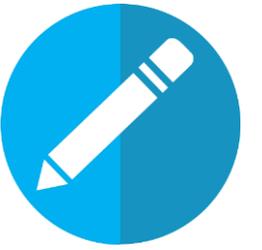
What limits what applications you can build and use?

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



# Summary

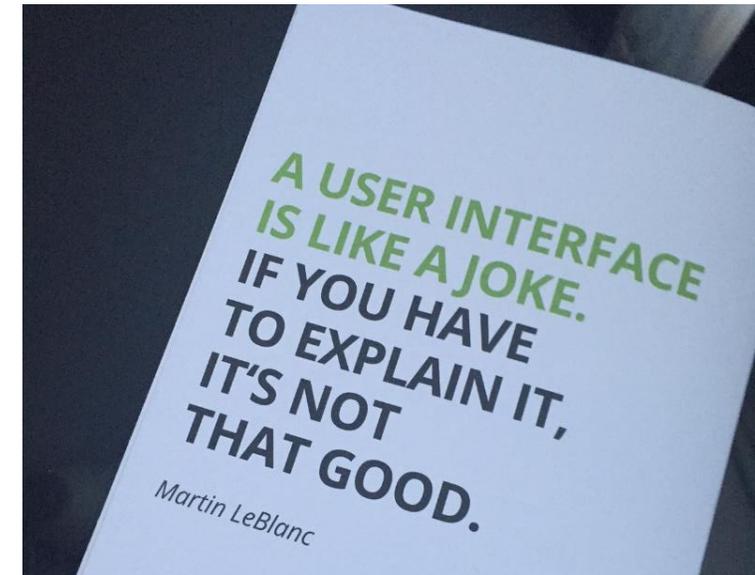
- Human-computer interaction is widely relevant to the development of interactive technologies
- The interaction and interface design determines how people can and will use an object, device or application
- The goal is to make a interface and interaction design that communicates how a things is used
- 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.



# References

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