Chapter 3:

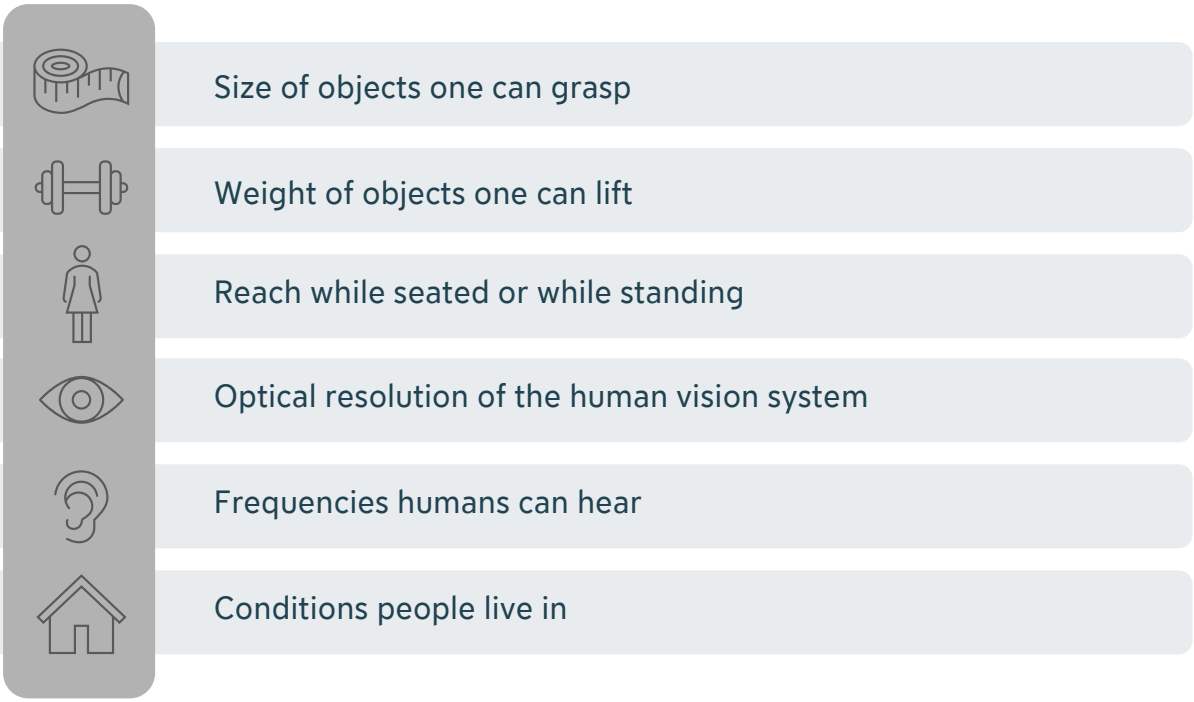
Humans – Excurse: Physiology

Overview

1. Examples for physiological limitations
2. Relation to Computer Science
3. Hand, Motions & DOF
4. Gesture Input vs. Physiology?

Examples for physiological limitations

On the one hand humans have a lot of abilities through their specific physiology but on the other hand also lots of examples where you have physiological limitations:



When you think about Bergkirchweih in Erlangen. You get 1l Maßkrug: For some people this is easy to grab and lift. However, there are lots of users that are actually not able to do that. The sheer size and weight of the objects makes it hard for specific groups to use it as it is supposed to.

Not everything that could be done technically can be used / perceived by humans.

Relation to Computer Science

Human physiology has also been explored in the context of computer science and HCI-related disciplines within the last decades. The possibilities and especially the limitations you just learned play an important role in the design and implementation of future interfaces. Existing devices and systems, that are intended for the interaction with a human have been widely investigated in research and industry.

If we wouldn't take the human physiology and human factors in general into account, people might not be able to use a certain device or might come up with suboptimal performance.

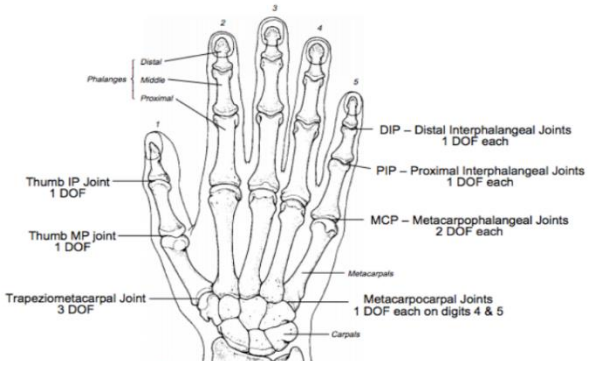
One example for this is the computer keyboard as you know it. For physiology experts it is completely clear that writing in the position you have with a normal keyboard is unhealthy and ergonomic keyboards have been designed to overcome this issue. When we take a look back in history to the invention of the keyboard, we find ourselves in the time of typewriters. Due to the functional principle, the keys were placed in the layout that can still be found on almost all keyboards today.

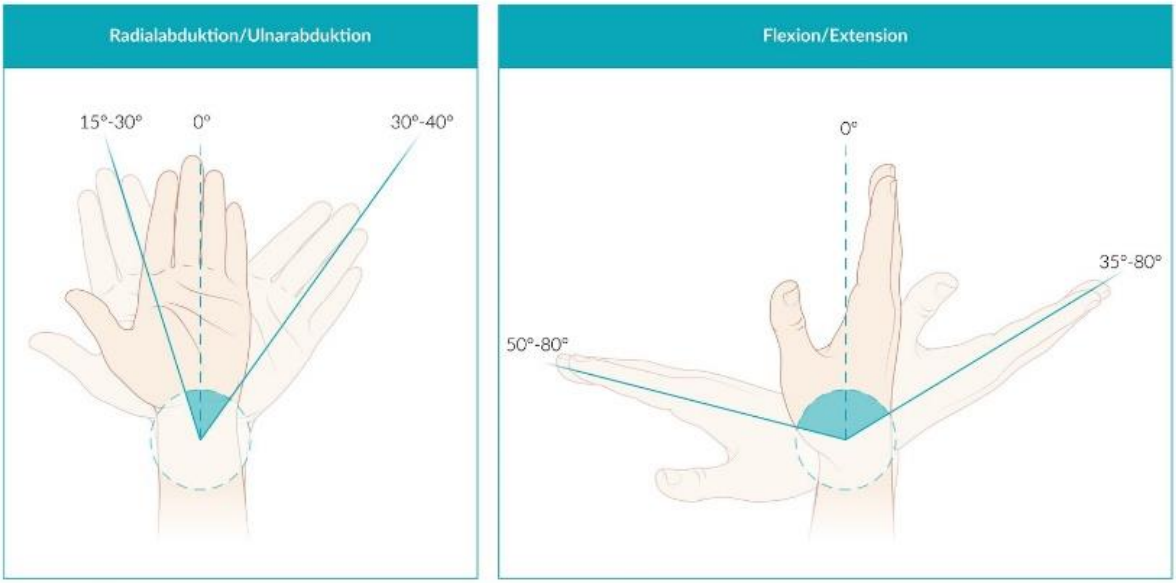
Today, of course, this is no longer necessary from a technical point of view, but no new design has been able to establish itself apart from some isolated solutions. Most people are used to type with the QWERTZ keyboard even though there might be more physiological and efficient ways for typing.

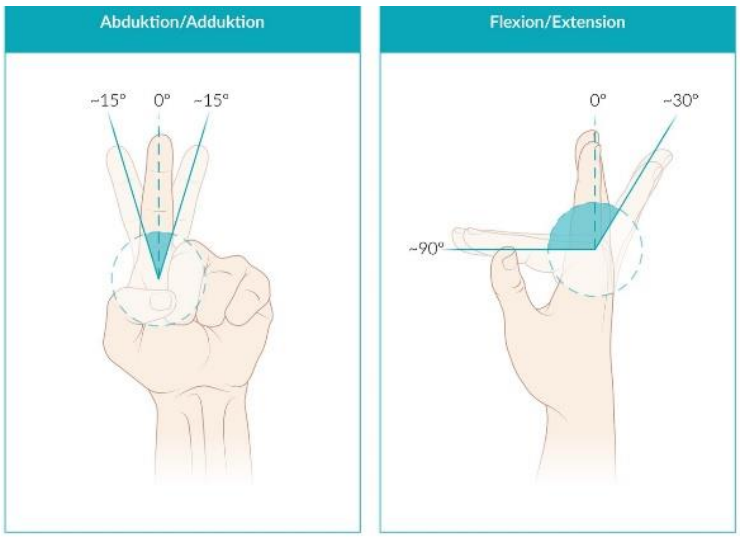
Hand, Motions and DOF

The human hand with its numerous bones, joints and muscles is an anatomically complex part of the human body. It consists of 17 active joints that provide 23 degrees of freedom (DOF) in total.

Both easy and difficult movements are depending on the musculoskeletal system behind the hand. This defines what can and cannot be realised by us and might also be different for individual people.







Imagine you want to recreate a human hand:
What would be good design choices for it?

Gesture Input vs Physiology?

In 2002 this was the vision of future user interfaces:

Video Link: https://www.youtube.com/watch?v=PJqbivkm0Ms

What do you think about this type of user interface?

- Is it feasible?
- What are advantages and disadvantages?

Jordan, Philipp & Auernheimer, Brent. (2015). Why HCI should care about Sci-Fi. https://www.researchgate.net/publication/307173212_Why_HCI_should_care_about_Sci-Fi

References

1. Goldstein, E. Bruce (2004). Cognitive Psychology: Connecting Mind, Research and Everyday Experience, ISBN: 0534577261
2. A. Maelicke (1990), Vom Reiz der Sinne, VCH
3. W. Spalteholz (1861), Hand-atlas of human anatomy
4. A. Vardy (1998), Articulated Human Hand Model with Inter-Joint Dependency Constraints. Computer Science 6752, Computer Graphics, Project Report, Pages 1-13
5. Hrabia, C. E., Wolf, K., & Wilhelm, M. (2013). Whole hand modeling using 8 wearable sensors: biomechanics for hand pose prediction. In Proceedings of the 4th Augmented Human International Conference (pp. 21-28). ACM.
6. Image Minority Report: https://www.insider.com/minority-report-interface-offices-2015-11
7. Jordan, Philipp & Auernheimer, Brent. (2015). Why HCI should care about Sci-Fi. https://www.researchgate.net/publication/307173212_Why_HCI_should_care_about_Sci-Fi