Topic 1: (no coding) Designing Devices with Sensory Substitution

We humans are inherently multisensory beings. Vision, Sound, Smell, Taste, Touch and Proprioception form a coherent representation of our body and our environment and yet, we are also capable to live and act if one or multiple senses are missing! A part of the solution is sensory substitution, the ability to replace the functions of one sensory system by the functions of another. Think of people with no vision that can read using touch information (braille) or even locate objects using sound. Think of deaf people that can communicate using sign language.

Sensory substitution does not only work when a sense is completely lost. Also healthy people are capable of learning information transmitted via a new input stream!

Task 1

Your task is to get a familiar with what is possible and then come up with a device for sensory substitution that is intended for market release. You are completely free to decide which sense is to be substituted and in what way or which area to target with your device. You might think of protheses, exoskeletons, robots or every-day-life devices such as your smartphone, of rehabilitation, work support, or casual quality of life improvements. Whatever you come up with, keep the following questions in mind:

- What is the benefit of your product?
- How useful is the device for users in their everyday lives?
- Does the user need extensive training, or is the device intuitive to use?
- Is the target user group large enough/is it profitable enough for a potential investor to consider manufacturing/selling your product?
- Is there scientific backing for your device?
- What are the current findings, and what has been proven to work so far?

Task 2

In the next step, design your own experiment or series of experiments to test how well your product works. This may include smaller pilot studies, but also several full-scale experiments that test different combinations of conditions. What's important is that the experiment or experimental series must be thorough enough to potentially convince investors of your product!
For each experiment, develop:

- A research question
- Hypotheses
- The experimental design (the procedure of the experiment, as well as the setup – e.g. what measurement tools will be used, etc.)
- Parameters to evaluate your research question

Getting Started

You can start by having a look at the small selection of literature on sensory substitution that is provided. From there you should expand your literature research according to your envisioned design.

Recommended Prerequisites

- Creativity