NeuroCampus – Inside Out:

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Kidmose's Ear-EEG Lab works on developing user-friendly and discrete EEG devices, enabling the use of brain monitoring in everyday life. This brings the potential of decoding auditory attention, using sleep patterns as disease biomarkers and generally expanding the possibilities of brain monitoring research.


Preben Kidmose. Photo: Karoline Klitgaard

Can you describe your research in a nutshell?
As an engineer, I work with technical sciences, more specifically within the field of neurotechnology. I find it intriguing to use my creativity and technical ingenuity in solving technical problems, and consider neurotechnology a perfect opportunity to do this while simultaneously helping to advance and help humanity.
In my lab, we strive to bring to brain monitoring from the labs into everyday life. In order to do this we develop small EEG-devices that fit into your ear (ear-EEG) meaning that they are more discrete, user-friendly and unobtrusive.

How did you end up where you are today?
When I graduated from DTU with a master and PhD in engineering and signal processing, I had no clear sense of direction for my future work. I got my first job at a hearing aid company. The least thing a hearing aid does is amplifying sound – instead it must compress information into a smaller dynamical range. Noise reduction is a crucial element in order to compress sound into a smaller dynamical range, and it requires that you know which information the individual wants to hear. The same sound stimuli could be both noise and the important signal depending what the individual attends to, and this attention cannot be inferred from the auditory signal alone. This led me to realize that we needed to develop a way of measuring and decoding auditory attention using brain monitoring.
After having worked with the auditory attention decoding as only a small side project for years, I got a position at the engineering department here at AU. Since then have had more time to focus on the auditory attention decoding and other possibilities of ear-EEG, and today I actually collaborate with the hearing company to achieve this goal.

What translational impact may your research have for people?
Our work with ear-EEG follows to main branches of research: The first line of research centers around audiology. As mentioned earlier, our ultimate goal in this area is to develop EEG-regulated hearing aids that can measure auditory attention via brain activity and thus reduce noise depending on to what the individual attends. While much is yet to be figured out in order to make this possible, we are already today able to improve hearing aids considerably using brain monitoring: For most people, hearing loss gradually worsens over time and for some it even fluctuates from day to day. This makes it a challenge to adjust the hearing aid appropriately. Connecting hearing aids to EEG allows us to measure the strength of the auditory signal at all times by monitoring the brain activity, and thus the hearing aids can automatically adjust to meet the requirements at that specific time.
Our second branch of research is more generally health orientated with a focus on sleep. The user-friendliness and unobtrusiveness of the ear-EEG, means that individuals can record their own sleep at home over long periods of time. These long-term recordings s are very valuable in order to detect small changes in sleep patterns, which can potentially be used a biomarkers for various psychiatric and neurodegenerative diseases.

What does a (local) strong neuroscience research network mean for you and your research?
I interact a lot with people from the less technical side of neuroscience. As engineers, we can can figure how to design all the technical elements that it takes to measure the signals, but the interpretation of the data and asking all the right questions in the first place requires collaboration with people with a different scientific background.
We collaborate with people from CFIN and IMC regarding using our brain monitoring techniques in large-scale synchrony studies. We also have a lot of collaboration in connecting with our sleep monitoring projects. This involves, among others, the clinicians in neurophysiology and the psychiatric department.

If you had unlimited resources to conduct a big, multidisciplinary neuroscience project, what would you like to do?
Our collaboration with CFIN (Center of Functionally Integrative Neuroscience) and IMC (Interacting Minds Center) evolves around the idea of conducting large-scale hyperscannings. Our ear-EEG devices are relatively cheap and can be put on by the individual itself, which brings the possibility of measuring synchronized brain activity from a lot of people at once in a unique situation such a during a goal at a football match. These unique events only happen once and thus requires averaging over subjects rather than trials. This would make it possible to explore more naturally occurring phenomena at group level. Hyperscannings would require many resources, but it is probably within reach.

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