User interview with Melanie

Meeting Tags	User Interviews
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Research Questions

- Is the presented prototype easy to understand of what you can do to control our device?
- Does the terminology make sense?
- Is everything that we provide sufficient enough to record experiments with it?
- Which style should the application follow? (after presenting mood boards and colour schemes)

▼ Interview Script

Interview Script

Introduction

- Doing a user interview, helps us to find out what and how we want to design things early in the creation of a new product
- We ask questions, not directly about you or to test you, but rather to gain insights for our design process
- If you don’t know how to answer a question let us know, we’re here to help you guide through the process, if you don’t want to answer a question that’s also fine, just let us know

Warm Up

- Tell us about yourself

    - What do you do as your job or hobby?
        - Go into more detail to ask about the context and connection to IDUN
        - Why doing research, what fascinated them?
    - What is the greatest pain at your current job/hobby? OR with what the person has mentioned in context and connection to IDUN?
        - Go more into detail and find out the WHY
    - What are you currently researching if they’re allowed to talk about it?
- Have you heard of brain-machine interfaces – what is a brain-machine interface?
    - Can you describe what a brain-machine interface is and how it works?
    - Have you ever worked with or thought of working with a brain-machine interface?
    - Do you have a research use case in research for a brain-machine interface?
- Have you worked with EEG before?
    - If yes, which systems from which brands?
    - What was the best EEG system you worked with and why?
    - What was the worst EEG system you worked with and why?
- Do you know the benefits of a mobile EEG system?
- What do you think is a benefit of an in-ear EEG system that is fully mobile?

Context

At IDUN, we are building an EEG system that can read your brain's signals in real time. We are not the first to do this, others have been doing it for many decades. The difference between our product and others on the market is the form factor. Our EEG device is the size and shape of a normal in-ear headphone such as Apple Airpods. Compared to e.g. a state of the art system in 2022 our device has similar signal qualities and impedance values in a form-factor which has the potential to be mainstream and the setup speed that is not comparable to any other EEG systems as of today (show some charts).

Our goal is not to develop the headphones themselves (building the brand, marketing, packaging design, etc.), but to integrate our technology (hardware as well as software) into existing headphones. And why? Because we want to be able to incorporate a fully mobile, unobtrusive and therefore mainstream-ready EEG sensor in a form factor that allows hours of measurements during everyday activities. No laboratory environment or special setup is required. Developers and researchers should then be able to interact with the brain data, for example in the form of classified outputs via an API.

- **To give you some examples of what's possible and will soon be possible in the near future:**
    - The users general focus in a range from 1–10
    - The users tiredness in a range from 1–10
    - How long, well and in which stages the user slept
    - Where the user is looking at (top right, bottom left, centre up, centre down etc.)
    - If the user is squeezing their eyes together or not or blinking and how long is blinking
    - If the user is hearing sounds in certain frequencies or what for profiles the user is able to hear
    - If the user is eating something, talking or chewing something hard of soft
    - If the user is hungry, tired, asleep, bored etc.
    - Raw data or filtered data that removes artefacts automatically already in real-time
- More things will be possible soon. Before we continue we want to hear how you feel when you hear what's possible with our device?
- Do you have any concerns about our device and application?
- We will give you two examples of what is possible to build with our device:
    - A music app that recommends music based on your mood: if you're tired it will show you two auto-generated playlists; one that makes you more awake and one that helps you fall asleep. Same with being focus, bored etc. You can replace the music playlist with basically any recommendation engine you could think of. (show example slides)

    - Another more complex idea: A user is wearing a AR/VR device and you track where the user is looking at in the 3D world and based on the focal point of the users attention you increase the volume of the source and decrease surrounding sounds (also known as the cocktail party effect). (show example slides)
- What are your thoughts when you heard these two ideas?
    - Ask more questions so that the user elaborates
- Next to using our app for creating applications it should also enable researchers to setup and record experiments, possibly experiments that need to be recorded outside of the lab. here is where your experience comes into play.
- How do you proceed when you create your own experiment?
    - Here is an example experiment: Resting state experiment: person looks at a cross and does nothing for one minute, to find out if you can identify some brain health related diseases or just to measure activity in different brain regions under resting conditions. OR oddball paradigm – How would you proceed to create such an experiment?
        - What tools (hardware and software) are you using?
            - Why are you using these tools?
        - What software are you using? Why are you using this software?
        - What are pain points of these tools etc?

- What are you doing after you recorded the data set of one experiment/one participant? Let us walk through it.
    - How are you ensuring the data quality of the recorded data?
    - How are you visualising the data? MATLAB, Excel, some other tool?
    - How are you processing (pre-, post-) the recorded data?
    - What are pain points in that process?
    - Why are you using these tools?
    - What tools are amazing to help you in that regard?
        - Where are you creating your own tool?

- Where did you learn these tools, softwares etc?
- Where are you storing that data?
  - How do you ensure user privacy and data protection for the recorded data?
  - How do you collect the consent for the recorded data from the participants?

Competitors/Examples

- Can you describe the best app for an EEG system that you've used before?
  - Can you describe why this example is amazing and what they're making differently?
- Can you describe the worst app for an EEG system that you've used before?
  - Can you describe why this example is bad and what they're making badly?
- What is the most complex EEG system or lab recording system that you've ever used?
  - Let the user elaborate
- Did you ever create code snippets on your own for experiments in a lab?
  - Let the user elaborate
  - **dig more into them**
  - how did you learn these things? course, bootcamp etc?

Prototype

We have designed a prototype of this web app to help people that want to use our device without the need to code/program. our aim is an easy-to-understand graphical user interface that helps people to understand how the device works, control the device and to record data/experiments. We want you to let it go through. We don't want you to break anything, and keep in mind that this is a prototype that is not 100% finished or thought through. If you have a question or something is unclear, let us know. We encourage you to think out loud about

what you are thinking as you go through the prototype. We have a few exercises for you to conduct and would like to go through them now.

These are the exercises:

- You bought a new device and want to use it for a simple audio stimuli recording, so letting various people ranging of different ages listen to a 40 Hz and a 90 Hz sound to see what the differences in neural responses are in terms of age. For that you need to register a newly bought pair of headphones on the web app's platform. Can you do that for us in the prototype?
- Now that you registered the device you want to quickly test if it works and if brain data goes through, so you want something like a livestream.
- Now that you're looking at the livestream you want to know if the quality is good of the device, so e.g. if the earphone sits correctly in the ear.
- Now in order to record a simple experiment with a possible test subject you want to create a 10 seconds recording and then have a look at the data afterwards. Can you do that for us?
    - Please now access the eye movement data
    - Now you want to visualise the data, how would you do that?
    - Now you want to download the data, how would you do that?
    - What would you usually do after you downloaded such data? What are the tools you're working in?
        - What are pain points or limitations of these tools you work in after downloading such data?
- Now you want to setup a recording template for the hearing threshold experiment that you can reuse with other people. You also want to be able to upload sounds that can be played during the experiments at certain points. How would you do that?
    - What do you think is very important for creating such recording data sets?
        - Mention maybe markers, timestamps, time synchronisation etc.

- Now you recorded 20 experiments with 20 participants. you also always recorded the pulse rate of the recorded people and want to compare them with the recorded brain data.
    - How would you normally proceed in a situation like this?
    - Did you know that you can also upload other data sets such as videos, heart rate etc. to our platform to easily visually compare them? Can you do that for us please.

Style and Moodboard

Thank you so much for helping us understand how your mind works. In order to conclude the design questions we present you with a few example designs and moodboards from other apps and/or competitors and you need to chose your favourites. Please keep in mind that we encourage you to think out aloud.

Conclusion

Thanks a lot for participating in our user interview session. You were very helpful and provided us with a lot of interesting insights. We will keep the provided information from you private and we will delete the recorded files in the next two weeks. You don’t need to do anything anymore. Do you have any questions?

▼ Notes

big struggle, big eeg system, gel, long time, especially for sleep research, in the university you need to go to the sleeping lab

especially in psychiatric/mental disorders to give the tools to do it by themselves
worried about the quality
working with muse, it’s not so nice, never will get the same quality

how would you setup an experiment to get insight?
- starts with recruiting, e.g. with epilepsy
- exclude people with mental disorders because of the pattern
- to do the eeg setup: at ETH big EEG setup with electrodes and gel, talking with them what the study will be about, explain a little
- always of taking care that people don’t scared of the syringes of the gel

- you get very close to people, 20 minutes very close
- important that they don’t move too much
- camera implementation when they were in the other room e.g. so that they don’t fall asleep
- lots of electrodes, 30 minutes at least until they’re ready
- always baseline recording in the beginning, big cross on the wall and they need to be relaxed, 2 minutes max with eyes open, 1 minute with eyes closed
- ERP experiment, record all the data, for maybe 30 minutes
- sign several confirmations before they collect the data

where do they collect the data?

cables of the embrain were very vulnerable, amplifiers suddenly turned off, lots of cleaning like a maniac to get the gel off, wash the hair
data is saved on local computer

what do you do to understand to achieve the goal of the experiment?

she was not able to see the evoked potential, separate data scientist

record data with timepoints? it’s not coded with psychypy, they used eeglab in matlab, raw data in the brain visualizer.

other study with commercial product (muse)

it is not the best quality with the muse headban, the muse company is not very helpful (support), there was a secondary software developed MindMonitor, easily visualize it and record as a CSV and upload to cloud, it’s quite easy, import CSV in matlab to visualise it, you can also visualize on the mind monitor page ⇒ which is really nice

do a time comparison with timestamps on the mindmonitor app

do you have established metrics or quality control?

pre-processing to look if it has too many artefacts, the band doesn’t fit well, not very nice for women e.g. she says, some artefacts because people move around, doesn’t look that bad, but not overwhelming

notch filter at 40hz, timestamps, 250 sampling rate (which is not that bad for a commercial product)

any minimum requirements for a commercial product such as the muse: no idea if it worked, they just did it and measured “it”, definitely more alpha, alpha experiment eyes opened and eyes closed

is raw data critical? would like to have classifiers that say something, complains about slowness of process and also matlab in pre-processing

data security; requirements for the data?
need to be stored in the USZ cloud, grey zone because she recorded from the muse because she used her phone, data is never associated with the name of the subject

anonymising data feature? she would like it, every admin task that can be taken away might be useful

naming templates is a great thing!

muse is not expensive, 7k maximum budget for her study, she saw some studies with the muse that gave her confidence to use it instead of using gold standard

a surgeon cannot wear a EEG cap during a surgery and also no cables, they can do that with a muse, they do VR robotic surgery to test it there in a pre-study

muse has a movement recorder “accelerometer” can see when they move more or not, this is very very helpful, they will compare time frequencies

everything after raw data is better she says, they’re always moving in the surgery, the more information you get without extra effort would be better

do you work with ML?

not yet, still at the pre-processing, using algorithms by mindmonitor
would be nice to have an output with less interpretation without any extra steps, do basic statistics (on our tool?)

simplified key tests to quickly validate

best experience with an eeg system:

she knows just brainvisualizer, feels like in the 90s, no light that says it’s recording, she prefers mindmonitor because it’s super easy

worst experience?

worst was technical issues with brain products, middle of the study, huge process, weird noise and you can’t do anything, happened frequently

happens a lot to forget to record the data

different electrodes are visualised in brainvisualiser, not more sophisticated

they also test eye movements and blinks before do a recording, clenching the teeth (biocalibration before conducting the experiments)

little bit of scripting to experience in eeglab, she doesn’t like programming that much, focusing on frequency bands in matlab, easy plots to visualise the data

very basic matlab intro in uni, doing some basic loops and viz’s, she knew eeg lab a bit, but cao explained most of it, cao helped a lot with the scripts

no experience in algorithm development

any experience of visual code editor?

no experience

is she interested in it?

would be very interesting to have such a visual editor, would make a lot of sense to her
check mindmonitor website, a school kid can understand it – she says good ux design in the mindmonitor app

what is the ideal eeg system for her?

no need for a huge setup, no gel, uncomfortable for the participants
when it comes to data: skip all the manual steps for preprocessing, cleaning etc.
skip some tasks that she has to skip in matlab, visualize it immediately
some people disagrees on some standards in terms of brainwaves, less artefacts

what are the worst artefacts for you?
clinching the teeth is a problem, see the tension in the signal, chewing guns, they will soon remove the artefacts

at some day having an alogirthm during the game for the surgeons, and some are not – to see this correctly with an algorithm

neurofeedback games look boring and from the 90s, she says its a shame people are not interested in investing time, quite expensive, to have to look at a butterfly going through a tunnel

duolingo people don't give up, include something exciting into psychotheraphy

refocusing and defocusing in the games, mostly visually

you can watch movies, if you're not focused, the sound goes away, most famous is the gaming part, go with a jetski through the ocean

always get reallife feedback, uually 30 sessions to see an impact for the psychotheraphy

work a lot with surveys connected to the psychitherphy evaluation, person to person valuation

guardian might be useful for people to know their mental state e.g. taking ritalin or drinking coffee → lots of stats and therefore lots of information from the API?

Data had to be sent directly to the USZ server to save the data, there was no possiblility to save data on her mac laptop, and the laptop can not be used in the surgical theater, but the phone was fine. The Muse has a heart rate sensor and breathing, but somehow it didn't work and she had to buy a new belt to track the breathing.

Has to use the Mind mobile app since Muse doesn't allow you to access the raw data on her own and to extract it. the Muse app is neurofeedback style, focus and audio stimulation.

If you had a value for focus from the app, would it be fine? Yes, no problem, but she needed to do everything on her own with the data and the app. How is she

sure it was done correctly? She doesn’t have the change to control it, but the software and process in the lab is validated, so it is trusted.

Normally she would look at peer-reviewed validation of data and devices. If the software gives a classified output but has no validation, would she try it? Yes, is there’s no other way. Sometimes you have to be the first to try something.
Why Muse?

- They have good marketing, and mentioned in the news, NY Times, Guardian, maybe a bit superficial and they have published some papers, in her budget, easy to use, great battery life for longer gaming sessions. Other EEGs were quite expensive or strange devices on Amazon. Good PR, publications. ECUs.
    - But their software is shit and provide no support
    - Her colleagues had no negative reaction, were wondering if it would work well, does it have the right quality, only 4 electrodes
- Why trust the mind mobile software?
    - Because there was no other choice, it’s easy to record on the phone, no other option.

Battery life

- 8 hours is very nice, most devices struggle if the battery life is less than 20%, sometimes hard to charge devices in between tests. 5 hours is also very nice. One round of games was about 20 minutes per round and 3 rounds per participants, so it added up quickly to 2 hours.

What’s our main goal? Context?

- We are currently working towards the next software design and release, figuring out opinions about things. getting a lot of insights to know and think in terms of features to work on.