

Transkription Interview 7

1 I: so, let's start.
2 TN: mhm
3 I: um, my first question is, um, how have you been in contact with, uh, BCIs before? in which way.. like, have you
4 conducted studies,
5 //TN: mhm//
6 I: or have you even participated by yourself?
7 TN: yeah, so I participated of course, and I also conducted studies,
8 //I: uh-huh//
9 TN: and like, in the very beginning we just had the one electrode BCI that I showed you, this Neurosky one in our lab in
10 [city] when I was doing my Master's and
11 //I: mhm//
12 TN: that's where I first knew that this thing exists.
13 I: yeah
14 TN: and um, yeah, then I.. started my PhD and I, uh, also took part in a s-in like.. several studies with like, uh, high-end
15 BCIs, uh, in [city]
16 I: "high end," what does this mean?
17 TN: like, the medical ones
18 I: ah, okay, high end, uh-huh.
19 TN: or, um (Pause) and like, in the course of my PhD, I'm just using the consumer BCIs to, um, (?) for EEG and, uh, to
20 collect data and like do stuff like emotion recognition
21 //I: mhm//
22 TN: or um.. SSVEP for control. yeah, stuff like that.
23 I: and what's the topic of your uh PhD thesis, like, or-d-it's connected to BCI, or?
24 TN: very, very, very good question (laughs)
25 I: (laughs)
26 TN: so the.. um.. in the PhD, I'm not only using BCIs, I'm also using other physiological sensors, like heart rate,
27 breathing rate,
28 //I: mhm//
29 TN: maybe eyetracking sometimes.. stuff like that, to, um.. like, infer cognitive states,
30 //I: mhm//
31 TN: and use this in applications, and most of those applications have to do with communication between people or
32 multip-multiple people at the same time.
33 //I: mhm//
34 TN: so like um, large-scale.. like, for example, one project was fitting every uh person in the room with a.. single
35 electrode BCI like the Neurosky one
36 //I: mhm//
37 TN: during a presentation and uh showing the presenter how the audience are concentrating in his presentation.
38 //I: ahh//
39 TN: of course, not every person alone because that's-
40 I: (laughs)
41 TN: not ethical
42 I: right, yeah
43 TN: but rather, like an average of all the people in the audience so that the presenter can know if the people are losing
44 interest, if he should stop, give a break,
45 //I: mhm//
46 TN: ask a question, something like that. so the idea here is to see like application scenarios that allow people to use such
47 sensors, say EEG or uh, heart rate or so, and like communication settings and not just for reflecting on their own
48 mood.
49 I: mhm.. so there're like two areas: one area is in communication in general, like uh, when somebody gives a-a lecture

50 //TN: yeah//
51 I: to know how the people are actually
52 //TN: yeah//
53 I: in the brain
54 //TN: yeah//
55 I: if they are listening or not
56 //TN: yeah//
57 I: and if the presenter should, uh, change something maybe
58 //TN: yeah//
59 I: and the other thing is to.. to recognize mental states.
60 //TN: yes//
61 I: okay, so like you told me-
62 TN: but, t-th-the main, so recognizing the mental states is done also to communicate with the people so I mean, I don't-I
63 don't just reflect it to the single person, I also kind of also maybe share it with someone else
64 //I: mhm//
65 TN: so the idea is this kind of.. communicating the-the mental state to either someone else, or to yourself, or to multiple
66 other people,
67 //I: mhm//
68 TN: multiple presenters,
69 //I: mhm//
70 TN: or whatever.
71 I: so, the main aspect is the-the mental state
72 TN: yeah
73 I: in different contexts
74 TN: yes
75 I: mhm, and you have told me before about, um, this assimilator
76 TN: yeah
77 I: and your students,
78 TN: yeah
79 I: maybe you can, um, tell me something about it?
80 TN: yeah, so, if you're going to participate in a study, I cannot tell you a lot-
81 I: okay (laughs), just a bit
82 TN: (laughs) but uh, just a bit, so we are basically, um-in the beginning, we wanted to know if using the music and um,
83 uh.. a heartrate sensor we could get good data to, uh, classify emotional states into positive, negative, and neutral
84 //I: mhm//
85 TN: so, like, we have three states, and, um.. the first part was, we did a study just trying to elicit certain emotions in
86 people using a.. database of music videos from psychology, actually, and um.. uh.. we classified the data using
87 machine learning afterwards to see if we can really say okay this person was really feeling positive or negative or
88 neutral, depending on like how they actually rated the-the videos themselves.
89 //I: mhm//
90 TN: um.. that being said, um.. afterwards, we wanted to put this in a context of a driving simulator because while driving
91 it-it's been proven that if you are in a negative mood or in excessively positive mood, so you're extremely excited
92 or very very angry, or depressed, you are more likely to make a lot of more errors
93 //I: mhm//
94 TN: while driving, so like, not keeping your lane,
95 //I: mhm//
96 TN: missing the light, um.. braking too late, stuff like that. um.. and we are trying to see how we can, uh influence that in
97 a car setting.
98 //I: mhm//
99 TN: so we are, uh, buil-we built a driving simulator with, uh, ambient lighting and uh, we asked the people to also wear
100 the BCI and the, uh, heartrate sensor again and we change the.. the setting based on their mood.
101 I: mhm.. but um, as well the lights, you told me, like

102 **TN:** yeah
 103 **I:** the-the color of lights
 104 **TN:** yeah, yeah.
 105 //I: mhm//
 106 **TN:** so the color-the color of the ambient lighting in the car changes according to different things that we-we try.
 107 **I:** okay, I was (laughs)
 108 **TN:** (laughs) yeah
 109 **I:** okay.. so, your first contact with, uh BCIs was in [city]
 110 **TN:** yes
 111 **I:** and with your Master's-
 112 **TN:** yeah
 113 **I:** thesis,
 114 **TN:** yeah
 115 **I:** so it was like-how long is it ago?
 116 **TN:** um.. two thousand and.. twelve.
 117 **I:** okay, so five years ago.
 118 **TN:** yeah
 119 **I:** and you participated in several studies by yourself as well-
 120 **TN:** yeah
 121 **I:** like, like for..
 122 **TN:** yeah,
 123 **I:** yeah, for um.. Studienzwecke? (laughs)
 124 **TN:** yeah, yeah
 125 **I:** uh, and what kind of studies-studies, like um.. which contexts?
 126 **TN:** so.. so, again, like all the studies I did, I participated in them just to try
 127 //I: yeah//
 128 **TN:** because, I mean, if you don't try it out yourself, you-it doesn't make any sense.
 129 //I: mhm//
 130 **TN:** uh, you need to see the pain you're putting the people in (laughs)
 131 **I:** (laughs)
 132 **TN:** while wearing that, so-so that's one thing, and the other thing I-there was a study.. in Max Planck in [city] for.. the
 133 different audio.. how your brain reacts to different audio stimuli,
 134 //I: mhm//
 135 **TN:** and that, I participated in.. like.. stuff like that
 136 //I: mhm//
 137 **TN:** so, like, um.. that's, I think, more or less it. there are so many studies that are done here, the only problem is that
 138 they always ask for someone who is right-handed and I'm left-handed, so I never go.
 139 **I:** (laughs) lucky you! (laughs)
 140 **TN:** no, I actually wanted to go!
 141 **I:** (laughs)
 142 **TN:** I mean, every single time, they want someone right-handed.
 143 **I:** but, why?
 144 **TN:** I-I'm not sure. I mean,
 145 **I:** yeah
 146 **TN:** sure, it does-it might have an influence, but I guess.. the more the better, I don't know.
 147 **I:** yeah.. and you need variation as well,
 148 **TN:** yeah
 149 **I:** in my opinion
 150 **TN:** yeah, yeah.
 151 **I:** okay. (laughs) okay, so, you are, um.. experienced by yourself and you have conducted a lot of studies in this field
 152 **TN:** yeah
 153 **I:** okay

154 **TN:** again, like, all the studies I-I-I'm doing are in HCI, so they're all, like, again with healthy users and consumer-based
155 BCIs.
156 **I:** mhm.. okay. and um, you are like, um.. yeah. working with uh, applications as well. what kind of applications?
157 **TN:** so.. um, like the stuff I just told you,
158 //I: mhm//
159 **TN:** so, like the car,
160 **I:** yeah, something like this
161 **TN:** the-the presentation. so, in the presentation, for example
162 //I: mhm//
163 **TN:** we show the people, um.. like, on a tablet, um.. just a graph of the concentration of the audience,
164 //I: uh-huh//
165 **TN:** um..
166 **I:** that's a great idea, yeah. (laugh)
167 **TN:** (laugh) um.. yeah, so.. maybe these are the types of applications. we had another more crazy one, so we wanted to
168 see if we can actually transfer emotions, so, uh, from an input side, we used EEG to classify emotions again into
169 positive or negative
170 //I: mhm//
171 **TN:** and um.. send the classified emotion to another person, say you, and make you perform a gesture, uh.. to help you
172 feel what I am feeling.
173 //I: mhm//
174 **TN:** so, uh.. and those gestures were performed by EMS, I don't know if you know EMS. EMS is Electrical Muscle
175 Stimulation,
176 //I: uh-huh//
177 **TN:** and, it's basically, so it's-it's sold, uh, like everywhere, it's just like a massage, um, device,
178 //I: mhm//
179 **TN:** you just change the circuit a bit, that's not me, that's my colleague in [city], so you can talk to him about like ethical
180 stuff. (laughs)
181 **I:** (laughs)
182 **TN:** but all our participants knew beforehand how this works and they tried it out and basically um.. it sends a small, um,
183 signal in your muscle, let's say this muscle, and then this muscle contracts, so you can be sitting and then your
184 hand goes up.. by it's own. so the idea was, what if we can transfer emotions remotely between two people with,
185 like, an implicit way
186 //I: mhm//
187 **TN:** so one person feels something, the other person does this, for example.
188 //I: mhm//
189 **TN:** so, so that they feel the first person is happy, for example. yeah. that was a crazy project.
190 **I:** and did it work?
191 **TN:** um, kind of. so, I mean.. did it work is something very relative (laughs)
192 **I:** (laughs) yeah, in science (laughs)
193 **TN:** in our field
194 **I:** yeah. yeah
195 **TN:** I mean, so we had first, again a study where we tried to classify the emotions, we built a classifier using machine
196 learning. we had the people wear the EMOTIV Epoc in this case, classify the emotions. uh, we had another study
197 for the gestures, so like, we put different electrodes on the-on the person's hands and tried okay, uh, doing like this
198 (gestures) versus doing like this (gestures) versus doing like this (gestures), and different emotions, uh, to-to try to
199 convey different emotions.
200 //I: mhm//
201 **TN:** we took the gestures from sign language, so like, the gesture for sad and the gesture for happy and, um.. uh, then we
202 tried to put th-the two sides of the system together, but since we wanted to try everything, so I mean, like, we
203 wanted to show the people videos and make the emotion now happy, but maybe some person is watching the same
204 video and he is sad and not happy,
205 //I: mhm//

206 **TN:** so then you don't have the full spectrum of things. so, we did the, uh, an experiment in the end with an end-to-end
207 system, so one person was in a room watching a video wearing a BCI and the other person was in another room,
208 um.. with electrodes, playing on his phone, and then um.. when a new emotion comes in, I send the-so it was
209 Wizard of Oz, I'm not sure if you know this term, so like,

210 **I:** ah, yeah//

211 **TN:** we told the people-yeah, so it's not like real, that the data is transferred, we just let them wear the stuff, but the data
212 is what I transfer, so..

213 **//I:** mhm//

214 **TN:** so I send that the person is now sad, so..so the other person does this or this or this or, so

215 **I:** so, okay um.. and it normally works, like BCI? because, I have talked to a lot of other people, as I told you, like um,
216 with this EEG cap and a lot of participants, for example in the project I told you before,

217 **//TN:** mhm//

218 **I:** told me it worked very well or it didn't work at all.

219 **TN:** yes, that's true. so, with some people, it's just very very hard and every study we do, we always have to remove
220 some participants because it absolutely didn't work with them.

221 **//I:** mhm//

222 **TN:** and this goes for any-any kind of.. any kind of BCI. sometimes, for example, take the EMOTIV, there is stuff that is
223 due to the fact that the device looks a certain way, so when you put this EMOTIV on your head, if your head is too
224 big or too small, then it's not fitting very well,

225 **//I:** mhm//

226 **TN:** and you are losing again the good locations where you can get the good data.

227 **//I:** mhm//

228 **TN:** so, that makes it sometimes not work.

229 **//I:** yeah//

230 **TN:** and sometimes (?) with stuff like, uh.. not active.. um.. where you have to do a lot of training and so on, like you are
231 just looking at mental states, it's something that goes inside the person's head, so it's not like something that they
232 can really tell you, so sometimes it's just doesn't work.

233 **//I:** mhm//

234 **TN:** or the data that we get is so bad, or..

235 **I:** and, in your case, did it work well, or?

236 **TN:** yeah, yeah.

237 **I:** yeah.

238 **TN:** yeah

239 **I:** okay.. okay. so, it depends as well, um, on the kind of BCI which is used.

240 **TN:** yes, yeah. I mean, the more-the more expensive or.. higher-grade BCI you have, the higher the chance that you get
241 good data.

242 **//I:** mhm//

243 **TN:** because, so, it's-so the EEG signal is very very small, and there are a lot of other factors that influence it, like
244 blinking, muscle movements, even your heart beating, um.. other stuff in the room, like electric, uh, other electric
245 devices in the room,

246 **//I:** mhm//

247 **TN:** uh, having no insulated room and trying to do this in a-in a classroom, for example. all of this is, like.. has it's effect,
248 basically.

249 **I:** as well, okay.. wow. okay, good. um, so how does a typical training look like with a BCI?

250 **TN:** um.. in my end, we do not do a person-based training, we rather do a system training.

251 **//I:** mhm//

252 **TN:** so, for example, um, if we are classifying an emotion, we use machine-learning to classify the emotion, so the
253 training is done on the classifier side. so, I let the persons watch many, many, many videos and collect the data,
254 uh, while they're watching these videos, so like, for example, ten videos that are positive, ten videos that are
255 negative, or like, twenty or forty, it depends, to get the mo-the highest amount of data.

256 **//I:** mhm//

257 **TN:** why is this? because we are classifying mental states, we are not doing active BCI. if I am doing something for
258 active control, then I definitely need training,
259 **//I:** mhm//
260 **TN:** but since this is not for control, so..
261 **I:** but have you used an active BCI?
262 **TN:** no
263 **I:** just passive.
264 **TN:** yes
265 **I:** mhm. and here, in this field, um, in general, uh, passive BCIs are used?
266 **TN:** yeah
267 **I:** right?
268 **TN:** yeah
269 **I:** okay.
270 **TN:** on the.. um, like, I'm now doing a project that's not part of my thesis, it's on SSVEP, and that's, like.. they call it
271 reactive BCI if we, um.. may say that, so basically you look at different flickering frequencies and then you get a
272 similar frequency in your occipital lobe in your brain, and then you can say "okay the person is looking at this
273 part," so that can be kind of considered an active BCI,
274 **//I:** mhm//
275 **TN:** but all the other stuff is more on the passive side.
276 **I:** okay.. so, and the first time when you used a BCI, how long did it take that it worked well? or did it work well at once,
277 like?
278 **TN:** so, so with the Neurosky for example, that was the one I very, I first used. th-th-the single electrode one
279 **//I:** mhm, yeah//
280 **TN:** that doesn't really give you-it's just one bit, so it doesn't give you a lot of data.
281 **//I:** mhm//
282 **TN:** um.. and there is no way you can say if that works well or not, because they, so-it comes with, like one um.. game,
283 where some person is going in a-in a park or something like that, and if you concentrate, uh, you can blow a bloon,
284 if you can-if you relax, then the balloon goes down.
285 **//I:** mhm//
286 **TN:** so you try to do that but at the end of the day, you are not hundred percent sure if the problem is with you
287 concentrating not very well or with the system.
288 **//I:** mm.. okay//
289 **TN:** because the hardware is-is not good. with the EMOTIV Epoc, it took me a lot of time.. I-like, many hours.. so to
290 say, in one day, for example, just because they also had this, um.. they have a control panel software and in this
291 software, you have a ball that you can push and pull and levitate and you have like, different, um.. actions that you
292 can train, and it really gets quite hard to do this multiple times and have it classified correctly.
293 **I:** mhm.. and did you use, like, a mental strategy to-to handle that BCI?
294 **TN:** yeah, so the, like the EMOTIV, like I was just telling you?
295 **I:** yeah
296 **TN:** yeah, so.. yeah, for example, for the.. for the pull and the push, I always imagined, like, punching someone for the
297 (cellphone vibrates) push and like, for the pull, like (cellphone vibrates) opening a door, and that (cellphone
298 vibrates) usually worked out well... I'm sorry.
299 **I:** no problem... okay, so you had, like, a-
300 **TN:** an image of-
301 **I:** pull and push-
302 **TN:** yeah
303 **I:** like, an image in your head?
304 **TN:** yes
305 **I:** okay, but no emotions, like
306 **TN:** no, no no. this one was for training th-the software itself, so,
307 **//I:** yeah//

308 **TN:** I mean, I got th-the device, I want to use it, so I see what it offers, and one of the things was, uh, training different
309 actions, so push, pull, and like, many other actions.

310 **I:** okay.. so when you're thinking back when you started BCI in [city],
311 **TN:** mhm

312 **I:** what expectations did you have in the beginning, like BCI, okay?

313 **TN:** moving, um.. limbs where people who had stroke, for example, could not move limbs and I was not also very aware
314 of the field, so-
315 //I: mhm//

316 **TN:** and like, of the limitations and so on.. um.. doing real-time stuff, like, okay, I got the data now, I can classify it right
317 now and get a good output,
318 //I: mhm//

319 **TN:** that kind of works but it's very complicated to let it work for more than three different, uh.. outputs.
320 //I: mhm//

321 **TN:** yeah

322 **I:** okay.. so you were not like, afraid or something like this that you were thinking-
323 **TN:** no, so it's-
324 **I:** what's this now?

325 **TN:** so the only thing I was kind of afraid of were the other paradigms, so like, um.. mostl-mos-so, as I said I'm using
326 EEG and I'm using th-the raw EEG data in the frequency domain, for example, to-to, uh, to do my classification.
327 but, uh, I always wanted to try SSVEP for example, but I was always skeptical because it's visual, uh, it's a visual
328 stimulus and uh, like seeing something flickering
329 //I: mhm//

330 **TN:** can trigger, uh.. like, fits in people who have epilepsy or have a history of something like that and that always scared
331 me
332 //I: mhm//

333 **TN:** but otherwise, like trying the passive BCI, no, it was more like a fun game kind of thing.
334 //I: mhm.. cool. and how did you feel with a BCI when you used it or when-you're still using it, how does it feel for you?
335 now you're used to it, or-
336 **TN:** yeah, um-
337 **I:** it's still like a special feeling?
338 **TN:** um.. so, it depends on how comfortable it is.
339 **I:** mhm. and which kind.
340 **TN:** yeah, so the Epoc for example is to tell you okay to wear for an hour, but afterwards it's too much
341 //I: mhm//

342 **TN:** the-the open BCI for the SSVEP study for example, you're only using, um, two electrodes on the occipital lobe and
343 like, uh, references on the earlobes,
344 //I: mhm//

345 **TN:** so it's fine, I can wear it for like.. more than that, but it's not very mobile, so you can't walk around with it because
346 there are a lot of wires and so on, so...
347 **I:** okay. so it depends on the kind of-of BCI-
348 **TN:** yeah
349 **I:** -which you are using?
350 **TN:** yeah
351 **I:** okay.. and um, the people, uh, with you-you conducted a lot of studies with other people,
352 //TN: mhm//

353 **I:** they were telling you the same? like, how does it feel, the BCI or?
354 **TN:** um, so, yes. so, some people were very scared in the beginning,
355 //I: uh-huh//

356 **TN:** but they came to the study even though they're scared because they're curious
357 //I: uh-huh//

358 **TN:** because it's something new.
359 //I: yeah//

360 **TN:** and, um, not everyone was aware that the BCIs are passive. I mean, th-the electrodes we put are not something that
361 conducts electricity, they-they capture the electricity from your brain basically. so a lot of people were scared, like
362 what health issues this might cause or whatever,
363 **//I:** mhm//
364 **TN:** but they came nevertheless which means that there is a lot of curiosity about the topic.
365 **I:** yeah.. okay. so when you're using a BCI, do you have a-the sensation that you're acting yourself, or the machine, like
366 the BCI or technology, or like, a mixture of both?
367 **TN:** um, it's definitely a mixture of both.
368 **//I:** mhm//
369 **TN:** ..since I know how it works, uh.. like, this question can't really apply to me because I already know I'm not a
370 regular user, I'm someone who knows all of the limitations as well. so I do know that a big part-if you're using
371 consumer BCIs, a big part lies in how good you.. uh, collect and filter the data. so, I know that there is a bigger
372 part on the system-
373 **//I:** mhm//
374 **TN:** than on me,
375 **//I:** mhm//
376 **TN:** as a-as a person.
377 **I:** with all these, um, yeah, circumstances you told me before,
378 **//TN:** mhm//
379 **I:** like, um.. the room
380 **//TN:** mhm//
381 **I:** and electric devices,
382 **//TN:** mhm//
383 **I:** something like this. the quality,
384 **//N:** yeah//
385 **I:** how it fits-
386 **//TN:** yeah//
387 **I:** to your, um..
388 **TN:** head
389 **I:** head, yeah. exactly. okay, so it's-it's both
390 **TN:** yeah
391 **I:** it's a mixture. okay. um.. and, yeah. the [?] when you're using BCI, they are often not intended, d-does this happen
392 often?
393 **TN:** the what?
394 **I:** like, when, normally it's just for active BCIs, that you want to do something
395 **//TN:** mhm//
396 **I:** and you're trying to do it with a BCI, uh, and something completely different happens, like you-it was not your
397 intention.
398 **TN:** as someone who is running the study or as a user of the BCI itself?
399 **I:** as-as a user.
400 **TN:** yeah, I mean.. that kind of, actually, always happens
401 **//I:** yeah//
402 **TN:** like yeah, you're.. y-you want, uh.. you're expecting a certain light or a certain emotion or whatever but you get
403 something else, or the system classifies what you're thinking of wrongly, or it says you are relaxed while you are
404 concentrated in th-in the presentation, or..
405 **//I:** mhm//
406 **TN:** yeah
407 **I:** and how often does this happen that the system is wrong?
408 **TN:** I mean that's, uh, what the research is about
409 **I:** yeah
410 **TN:** you're always wrong until you.. make it better and so on. so like.. let's take the SSVEP example, we taught like
411 having, um.. so it's supposed to work well with low frequencies like between five and let's say.. twenty-

412 //I: mhm//

413 TN: Hertz and for some people, it worked absolutely amazing, we got so very very nice curves with, uh, like seeing a

414 peak at the correct frequency, and with others, it just did not work at all and we didn't expect that.

415 //I: mhm//

416 TN: so and as a person in-in a BCI study, I don't know, I mean, the person is focused on the stimulus, why is it not

417 working? so that's always like..

418 I: yeah.. it's hard to-to figure out

419 TN: yes

420 I: why it's-

421 //TN: yeah//

422 I: it doesn't happen, uh, it doesn't work. okay, um, when you are using BCI or even you're-when you're conducting a

423 study, um, does, uh, or-normally, the people are telling you that they are exhausted afterwards, or do they feel

424 okay, or, um, it's, um, it's-it's depending on the BCI which is used?

425 TN: so it definitely depends on how comfortable the device is

426 //I: uh-huh//

427 TN: um, since our-most of our BCI studies are not done in a closed, uh.. like, BCI room, which-in which you have no

428 light except the light of the screen, so, I participated in a study like that, it was for like one and a half hours and I

429 hated it in the end, it was horrible.

430 //I: mm//

431 TN: um.. the room gets very claustrophobic and so on, but since the stuff we do again is on the, "okay let's do it in a

432 regular normal condition and see where we can go with this,"

433 //I: mhm//

434 TN: um, it wil-th-the most like, deterministic factor here is the-how good th-the BCI is comfortable on-on your head for

435 a long time or not

436 //I: mhm. so if it fits or not

437 TN: yeah, if it fits and if it fits and it's not too tight because sometimes you just-

438 //I: mhm//

439 TN: you're like okay, I feel there-I feel it, I feel it on my head and I don't want to feel it anymore.

440 //I: uh-huh//

441 TN: yeah

442 I: okay.. so, um.. with, um, yeah, concerning the-the BCI actions, are you feeling responsible for it? like, are you th-the

443 initiator, or do you think it's just the technology? also... are you feeling that you are like responsible or not?

444 TN: you mean like, in control?

445 I: ..for example.. it's-a lot of questions are dealing with, uh, active BCIs as well. if you are like, uh, in a flight simulator

446 or a car simulator and you try to drive right,

447 //TN: mm//

448 I: for example, and it finally-it works, the question is.. if the person feels responsible for it. I don't know if, in this field, I

449 can ask this question as well-

450 TN: yeah I-

451 I: responsibility.

452 TN: I get your point but I don't think it really applies, I don't think it applies to the-to the passive BCI that much,

453 //I: mhm//

454 TN: because often you don't see the action right away

455 I: mhm.. so you don't get the feedback

456 TN: yes, it's not like right or wrong.

457 //I: mhm//

458 TN: or.. for example if I see that I am concentrating, like taking the presentation example, then yes, I definitely feel

459 responsible for that but it's not like, going left, right, or like, something very defined like that

460 I: mhm.. okay.. okay, so that's-this was the part of BCI and, uh, your experiences and the experiences of the users you're

461 worked with, and now we are, uh, switching a bit and we're talking about more general aspects

462 //TN: mhm//

463 **I:** um, so I would like to ask you what is, uh, self-determination for you? like, to-to um, act the way you want, what does
464 this mean for you? to decide independently,
465 **TN:** yeah definitely something I want, like um.. I'm not so like, I mean what does it mean for me? but you mean like
466 just, what I understand from that, like, also reflecting on a-on a BCI perspective?
467 **I:** yeah
468 **TN:** so like,
469 **I:** if it changes-
470 **TN:** I am making the decision,
471 **I:** yeah
472 **TN:** or the system is taking the decision from me,
473 **I:** yeah, exactly.
474 **TN:** I mean, in general, with all this kind of stuff, so since I'm mainly doing passive BCI, still the system doesn't do
475 anything I don't want it to do,
476 **//I:** mhm//
477 **TN:** or I can always be in control and shut down the system,
478 **//I:** mhm//
479 **TN:** and even if I was doing active BCI, I'm still.. uh.. as long as I'm still capable of doing the same action that the BCI
480 is doing for me without the BCI taking over, then I'm okay with it.
481 **//I:** mhm//
482 **TN:** but I can imagine if I am someone disabled and I cannot move my legs and the BCI moves my legs for me, then it's
483 not necessary that I feel the same way, like, maybe I do not feel very independent at that point,
484 **//I:** mhm//
485 **TN:** I would feel dependent on the BCI
486 **I:** mhm, mhm. okay.. but, good.
487 **TN:** I mean, I didn't-I was not in this situation for myself to say that... it-it works or it doesn't work.
488 **I:** okay.. I think this is just another field because of the passive-
489 **TN:** yeah
490 **I:** BCIs.
491 **TN:** yeah, yeah
492 **I:** so, but it's very interesting as well, to see it from another perspective
493 **//TN:** mhm//
494 **I:** and another thing is, um, this combination of, uh, technology and, uh, the brain-the human brain, does it, um, change
495 your-your picture from a human being, like, that you say "ah, this combination or (?) now changes my picture
496 from-from a human being?"
497 **TN:** um.. so in general, the fact that-I mean, I think it's a big plus that there is technology now to do stuff like that and I
498 think that the human body is very rich with signals and making use of them with technology is something cool but
499 can definitely go some other way that's not nice and like, even from like the-looking at the heart, the brain, any
500 other part of the body, all those signals that, uh, we can get, we can do so much with them. for healthy and non-
501 healthy users.
502 **//I:** mhm//
503 **TN:** so, like during the course of my studies, I definitely was more intrigued, like, "okay, the brain is way more complex
504 than I thought and.. wow, this is amazing and.. and so on," so, I mean that's-that's just a natural reaction.
505 **I:** mhm. okay. so you didn't have fears? in-maybe in the beg-in the beginning because now you are like an expert in this
506 field-
507 **TN:** um-
508 **I:** in the beginning and even now, or maybe the participants in your studies.. do they have fears?
509 **TN:** um, sometimes, like I said, they are like, unaware or they are not sure how this works,
510 **//I:** yeah, okay//
511 **TN:** so they feel, okay, it's not like I'm doing hypnosis for example, it's just a passive device with some metal electrodes
512 that I'm putting on your head and they're just sensing what's there, I'm not putting anything in there,
513 **//I:** mhm//

514 **TN:** so like, once this is over, th-th-it's no longer fear, it's more like "oh wow, that's interesting" or they get this "ah-ha"
 515 effect of "oh, nixxe, it's nice to understand how your brain works" and so on from an educational perspective.

516 **I:** mhm, and you personally, you didn't have any fears in the beginning?

517 **TN:** not really. I mean, at the end of the day, so.. I choose to do a [??] human-computer interaction and it's all about
 518 trying new things, so, like new technologies, we.. in-in the first time I saw this Neurosky for example, I was
 519 looking for a thesis and my supervisor came with like five-six different devices and he's like, "we have these and
 520 we want to do stuff with them." and I picked this one,

521 **//I:** mhm//

522 **TN:** so, um, so I mean, in general.. um.. like, my background as a researcher or academic or whatever in this particular
 523 field makes me always want to try new technologies. so I was not afraid of trying it out, I was intrigued.

524 **I:** yeah. okay.. so, and how do you see like the-the future potential of BCIs?

525 **TN:** um..

526 **I:** passive and active, both.

527 **TN:** so I cannot really talk for the active because-

528 **I:** okay, so-

529 **TN:** at least, like, looking at the many many hardware devices that are out there, they're making it more accessible to the
 530 public, so making this idea of using your brain to do something more appealing or, like, um, uh, accessible to
 531 anyone who is not like, in a university and so on, I mean th-the Neurosky one is for one hundred euros, so.. but it-
 532 once you try it, it doesn't have much, it doesn't offer much. it offers very little. uh.. but once you-I mean, I think..
 533 like, as the-this whole notion of having like, more wearables and more devices that are connected and so on, I can
 534 see that BCIs can come into the homes of people but it will remain largely only for meditation or stuff like that
 535 and not for other kinds of interaction because there are a lot of, um.. like, limitations in the signal processing, in
 536 the artifact removal, in the noise removal, and so on, and they are huge, so.. in this aspect, I see that. on the other
 537 aspect, of course the medical BCIs, um, the-especially the ones that are th-with the electrodes implanted in your
 538 brain and so on, I think these are the ones which really have the BCI potential, like, moving someone's hand after
 539 a stroke,

540 **//I:** mhm//

541 **TN:** rehabilitation, uh, you know, this kind of stuff.

542 **I:** okay, so you're thinking the-the active one's, there is more potential.

543 **TN:** there is more potential in them, especially if you are using.. uh, implanted electrodes.

544 **I:** mhm, okay.. okay.. okay, so, um, we are quite at the end, I just want to talk with you about, uh, technology in general a
 545 bit.

546 **//TN:** mm//

547 **I:** and um, and, I think, I'm here, I know this is your job, technology, um, how um, important is it for you and maybe in
 548 your daily life as well, like, the use of technology?

549 **TN:** so, I have a smartphone (laughs). as everyone, I have a wearable, I'm not wearing it today because I decided not to
 550 wear it.

551 **I:** like, like a clock? oder a watch?

552 **TN:** um.. a fitness tracker.

553 **//I:** ah, uh-huh//

554 **TN:** just for walking, running, biking, and so on, like this kind of stuff is very interesting for me,

555 **//I:** mhm//

556 **TN:** uh, just to see like, okay put person goes and so on and try to get there just.. it's more interesting for me from a
 557 technology perspective than a sport perspective and, um.. I think technology is pretty important for me, like in..
 558 my work and otherwise, I'm always looking for new stuff, and like, okay, what can we do with this? so, basically
 559 we have some fun for example, there is a really cool device coming out, so we order it and we see what we're
 560 going to do with it. it's like, "hey, we have this, what can we do?"

561 **//I:** mhm//

562 **TN:** and we're always doing that for-for new devices basically

563 **//I:** mhm//

564 **TN:** as well as, sure, I mean, in our institute, we have a 3-D printer, we have a laser cutter, we have all this so we can
 565 also make our own stuff so.. and that's always a nice thing to do.

566 **I:** and what should technology make possible for mankind? do you feel like it limits, or is it like, okay, it will benefit um-
567 **TN:** I mean it definitely really benefits, uh, just looking at my life in Germany, um, I first came in 2009, there were no
568 smartphones, I only talked to my parents back at home, which is not very far and in the same time zone, only 4
569 hours away, um, with a phone booth from the street and not from a smartphone. there was no GPS, I don't know
570 how I lived.

571 **I:** (laughs)

572 **TN:** uh.. sure, I mean, I don't like the fact that sometimes technology kind of takes over my brain and I actively try to
573 shut this down, so, no, I want to remember the roads and not the GPS to tell me. sometimes I want that and, uh,
574 honestly like, stuff like social media and stuff, I think it makes people sometimes more stupid instead of more
575 intelligent, so I have to actively think of stopping myself from, for example, scrolling Facebook too long or using
576 the GPS, if I have the time, so what if I get lost, like, I don't want to feel entirely dependent on technology because
577 at the end of the day, when the battery dies.. there is nothing that I can do, so.. I mean, like anything in the world,
578 so it has positive and negative things.

579 **I:** mhm. so, do you would like to restrict it a bit, the technology? the role of technology?

580 **TN:** I-I don't think we should restrict anything, I think everything should be left for the person to decide,
581 //I: mhm, yeah//

582 **TN:** not for some bigger system to try to suppress technology somehow. I think we are all born with brains so, and like,
583 everyone is intelligent in their own way and they should figure out what's the best combination for them. like in
584 daily life and also in like, I don't know, I mean definitely restricting technology and stuff, like... military or
585 intelligence or privacy stuff, you know, this kind of stuff, sure, I mean, but probably these institutions are the ones
586 which have the greatest technology that's already ten years ahead, so.. that's not feasible.

587 **I:** and you're not having fears concerning your privacy or your data?

588 **TN:** um, I-I do of course, but at the same time, um, I don't like to restrict myself. so, I'm not going to use a specific
589 browser that never sends my data because it sucks, it's very hard to use.

590 //I: mhm//

591 **TN:** I would rather use Google Chrome and have-and know that Google has everything, I trust them. um.. that's probably
592 a naïve way of looking at things but I just don't want to bother with, uh, an extra aspect.

593 //I: mhm//

594 **TN:** and like, with stuff like commercials and so on, I am not easily convinced (?) with any commercial and-and-and so
595 on, so I don't care about commercials. what I care about is like, using my data in anything illegal, for example, or
596 anything that it's not supposed to be used in it, or so using my photos or whatever,

597 //I: mhm//

598 **TN:** but like using my data to know what advertising they're gonna show? sure, show it, but I'm not gonna buy it
599 anyway.

600 **I:** (laughs)

601 **TN:** I know that. and I'm not going to like, add a lot of effort on myself to try to only talk to people on telegram instead
602 of Whatsapp while my whole family in Egypt doesn't have telegram, they only have Whatsapp.

603 //I: mm//

604 **TN:** so, I'm gonna use Whatsapp, you know?

605 //I: yeah//

606 **TN:** yeah

607 **I:** so, to have, like, an easy life?

608 **TN:** yes

609 **I:** because it's-

610 **TN:** yeah

611 **I:** technology,

612 **TN:** because it's so-

613 **I:** yeah

614 **TN:** I mean it's already complicated. there are a lot of not very nice stuff going on everywhere, so, I don't want to add
615 another aspect to make me worried all the time that, uh, "okay someone is watching me, someone is watching
616 me." okay, so what. I'm just one other person. I can't do anything about it and the stuff I need to do to do it is a lot
617 of effort, so I'm grateful that Whatsapp has end-to-end encryption now, but it's still owned by Facebook, you

618 know? and like, everything is connected. and sometimes, I-I get, um, skeptical because, very random example: we
619 have a smart TV, my husband was watching a certain, uh, series on Netflix, which is not connected to any account
620 he has on his.. uh, on-on Facebook or whatever, but then he found, uh, a Facebook ad of that same series on his
621 Facebook feed, so he was like, “how did that happen?” and we are trying to trace it back. sure, there is some
622 connection somewhere, Netflix is selling, uh, Facebook the data probably,
623 //I: hmm//
624 TN: you know?
625 I: yeah
626 TN: so.. so, get scary at moments, but at the same time, the effort to try to shove this all out can mean that you just live in
627 your bubble.
628 I: hmm. yeah, absolutely.. okay, so, uh, thank you very much.
629 TN: you’re welcome
630 I: this was it, um.. do you think about something, um, which I, uh, forgot? like, a very important point concerning BCI or
631 maybe technology in general or have we said, um, everything?
632 TN: mm, I don’t think you-I mean, I think you covered everything, but I’m not sort of-I don’t know if you want any
633 more insight, we can always talk later. If I remember something, I can also tell you.
634 I: okay, good. okay, so, we can stop.
635 TN: yeah
636 I: and, uh, thank you very much (laughs)