

Transkription Interview 15

1 **I:** Perfect. I think now it works. ..um, okay, yeah.. uh, my first question is, um, how did you get in contact with uh BCIs?
2 ..What was-what was your first experience? like, was it during your studies or just for work?

3 **TN:** So, I was already working in this team and we are..um.. we are working with ECoG data because we have epilepsy
4 patients in our hospital and um.. I was at that time working on an animal electrophysiology project and uh, I was
5 asked to look into BCIs to see how they worked. and- and uh, then we organized a, so [mister a] organized a uh, a
6 symposium and got all the players at that time, so that was 2008, I think? 2006? No, it must be 2006. um.. and then
7 from then on, we went in there and.. and [mister a] decided to uh, to build a BCI

8 //I: mhm//

9 **TN:** so.. I was at the right time at the right place.

10 **I:** okay, and what did you study?

11 **TN:** I—I uh, I did study uh, biology, so it was called medical biology, so something like [?]-medicine. so it's biology,
12 but really only the... the, the... animal uh, human biology

13 **I:** so in the beginning, you did like studies about animals? and now, with patients, like human beings and uh-

14 **TN:** yeah

15 **I:** okay, uh-huh. so this changed as well in the course of time.

16 **TN:** it doesn't really matter whether you—if you want to understand how the brain works, it doesn't really matter
17 whether you work with animals or with-with humans

18 //I: mhm//

19 **TN:** so the-the data you get from epilepsy patients with uh, with electrodes under the skull...[??] uh, that is an amazing
20 opportunity to-to learn from the brain.

21 //I: mhm//

22 **TN:** um.. so this is why we, uh.. we went on to.. uh, to human data

23 **I:** and this is invasive, right?

24 **TN:** this is invasive, yeah.

25 //I: mhm//

26 **TN:** yeah, they implant it, uh, for about a week to figure out the source of the, the focus of the epilepsy.

27 //I: mhm //

28 **TN:** so with the minority of epilepsy patients, we don't know where the focus is..

29 //I: mhm //

30 **TN:** and uh, the medication doesn't work, so the only option is a resection of the area

31 //I: okay//

32 **TN:** and uh, so but, if you don't know where the area is, you have to investigate. so they are lying there for a week and
33 they are waiting for.. uh, basically waiting for uh, for a seizure.

34 //I: mhm //

35 **TN:** and if they have two of these seizures then they can go back in the signal and see which channel the first seizure-uh,
36 the first change-first change in signal starts

37 //I: mhm//

38 **TN:** so then they know the focus. and then the other thing they do is to, uh, look at the mapping of eloquent functions, so
39 eloquent functions meaning that you really don't want to lose them, like language.. motor functions.. so they do
40 tests to do that. and for the rest of the time, people are waiting for a seizure.

41 //I: mhm//

42 **TN:** and don't do anything. so then we come in and let them do all kinds of tests.

43 //I: mhm//

44 **TN:** and we started, uh.. first with mapping tests, and then we started with uh, doing some uh, some BCI

45 //I: mhm//

46 **TN:** and up to the point that uh, to patients control the [?] device with their brain signal from.. and, and then we... we uh..
47 uh.. we knew that it made sense to implant into a locked-in patient.

48 //I: mhm//

49 **TN:** so that's what we did.

50 //I: okay//

51 TN: and it took a long time to get it all organized.

52 I: yeah.. and your focus is on epilepsy patients, right?

53 TN: no, so so we—i- i- will say there are healthy people for our purposes.

54 //I: mhm//

55 TN: because we are not interested in epilepsy itself

56 //I: mhm//

57 TN: of course, I have run popular projects on epilepsy, but they are separate from BCI, um.. and so it just happens to be

58 people with electrodes under the skull and which are—which are very rare, so that's very interesting to-to look at

59 that.

60 //I: mhm//

61 TN: yeah.

62 I: and did you ever test a BCI by yourself as well? like-

63 TN: I actually didn't, so.. so the only thing um, what I did is um, is very simple ones. So you have these very cheap, uh,

64 Neurosky things with one electrode here (nonverbal gesturing), one here (nonverbal gesturing), and so I-I do that

65 for demonstration. so, so I can, I can uh.. lift a helicopter and-and let it fall down and these kinds of things.

66 I: ahh, okay

67 I: for, for demonstrations

68 I: yeah, that works

69 //I: uh-huh//

70 TN: I know how to do-

71 //I: mhm//

72 TN: so, so it's very vague and you have to have attention so mental calculation works very well for that. So I do that for

73 demonstrations. So, I never did EEG.

74 //I: mhm//

75 TN: um. I did.. do NIRS once.. uh.. here in [city] actually.

76 //I: mhm//

77 TN: uh.. it didn't work out very well. um.. so uh, not with EEG. so, since I-I'm working with implanted BCIs, it's not

78 much sense to-to do anything ourself.

79 I: yeah, yeah. okay.. but with uh, the BCI you used, for just—

80 TN: yeah

81 I: this purposes, uh you just have to be awake and concentrated, uh you don't have any special strategy, something like

82 this.

83 TN: uh, I do mental calculations, so that's my strategy. so if you-if you, so we do that with our patients. so uh.. that's

84 what I [??] tomorrow, so. uh, so the patient has uh, besides electrodes—the patient has electrodes on the motor

85 cortex

86 //I: mhm//

87 TN: and those attempted movement

88 //I: mhm//

89 TN: so, there's no difference between attempted and imagined movement-

90 //I: mhm//

91 TN: if you are paralyzed. uh, but th-she also has electrodes on dorsolateral prefrontal cortex, which is working [?]

92 memory, to get working memory um, uh, working memory is active, mental calculations is a very good strategy to

93 do that. so, I knew that.

94 //I: mhm//

95 TN: and uh, but it's also a very good way to get attention higher because you have to really have to focus on your.. so,

96 what we do is we give, we give, we start with a number, let's say 89, and then go count back in steps of 7.

97 //I: mhm//

98 TN: so 82, 75, 68, and etcetera. you have to think about that, that's a real calculation. uh, that's enough to raise your

99 attention level or to raise your working memory areas, uh, signal.

100 I: mhm.. okay.. and um, do you know how long it normally takes to use a BCI successfully? ..like calibration? or does it

101 depend on the patients?

102 **TN:** ...that's a hard question. um.. it uh, it depends on what you want.
103 **//I:** okay//
104 **TN:** so cursor control is done within a few minutes
105 **//I:** mhm//
106 **TN:** with these kinds of things. and so if you do E-Cog
107 **//I:** mhm//
108 **TN:** very very simple. uh, in our patients, we wanted to go to spelling and the steps for cursor-to controlling a cursor,
109 which is continuous signal to a uh, to a spelling which in our case is a click so you have highlighted, you highlight
110 letters and if the letter you want to spell is selected, then you do this (gestures)
111 **//I:** mhm//
112 **TN:** and then it selects. so that step, it's a short thing and depends on timing, so that step turned out pretty difficult uh, so
113 we had to change our, our algorithms to get that working in our first patient. the interesting thing is that in the epi-
114 the two epilepsy patients, we tried that, it worked pretty well.
115 **//I:** mhm//
116 **TN:** and its a very simple thing, so based on-on a threshold in gamma.
117 **//I:** mhm//
118 **TN:** uh, with this patient, we uh, we use uh the difference between gamma and beta in the motor cortex and uh, have
119 smoothing and these kind of things built in together. stable system.
120 **//I:** mhm//
121 **TN:** uh, what is interesting it-it-it's really stable so there it's-there- are the same settings for one and a half years now
122 **//I:** mhm//
123 **TN:** and uh, that is something which is uh, we didn't expect at all. so that's why you learn if you really implant that in a
124 patient and you can ask a lot of questions nobody can answer.
125 **I:** mhm. You get to know the brain like, very well I guess?
126 **TN:** yeah
127 **I:** when it's implanted, it's another way because when you have the electrodes here (non-verbal gesturing), a lot of
128 artifacts and like-
129 **TN:** yeah,
130 **I:** noise
131 **TN:** yeah, so. so if you implant the-the, you have no artifcats. you, you don't pick up 50 Hertz from-from the from the
132 power uh, in your house. uh, it's this beautiful signal, it's really very, very good.
133 **//I:** mhm//
134 **TN:** and uh, so a lot of, a lot of issues with which will probably be [??] this week about uh, artifact uh removal..
135 **I:** mhm... you don't have-
136 **TN:** no, we don't have that. we have beautiful gamma signals that appear under the skull, you have much higher
137 frequencies
138 **//I:** mhm//
139 **TN:** so it's uh, a very interesting signal
140 **I:** mhm. it's reliable
141 **TN:** yeah
142 **I:** you, you can trust the signal
143 **TN:** yeah, yeah
144 **I:** okay
145 **TN:** that-that was actually—that was the original reason to, to go for implants, to get a reliable system.
146 **//I:** mhm//
147 **TN:** uh and now we learned that there are many other reasons why patients uh would choose for an implant system.
148 **//I:** mhm//
149 **TN:** um they don't want to have an EEG cap on all of the time. it's way easier for the caretakers, uh caregivers uh, of-of
150 the patients because the only thing they have to do now is place an antenna here (non-verbal gesturing) and then
151 it's-it connects and then they're done.
152 **I:** but it's quite dangerous, I guess? This like, the surgery?
153 **TN:** n-no. it's- of course there are risks, it's a surgery

154 //I: mhm//

155 TN: uh, it-the, the risk is comparable with any neurosurgery where they don't do resections.

156 //I: mhm//

157 TN: so it's-it's in some brains a devious surgery

158 //I: mhm//

159 TN: which is 1 or 2% of complications, which are in most cases infections, uh. which can, uh, be cured by antibiotics.

160 //I: okay//

161 TN: so the risk is actually—so we don't—so remember, we don't implant in the brain, it-it sits under the skull,

162 //I: mhm//

163 TN: under the dura

164 //I: mhm//

165 TN: so it touches the brain, but it's not in there. it's not-not like the-the invasive, the do you know [??] are the needle-

166 type [??] sleep induces in the brain. and what happens is that the brain, the brain is just a blob floating in-in CSF.

167 so, what happens is that the brain goes a little bit like this (non-verbal gesturing) all the time and it moves forward

168 or, or.. uh.. the brain tips a little bit if you go lie down. and so all these very little uh, movements that [?] theory

169 causes an inflammatory reaction. so if you do this (non-verbal gesturing) all the time, then you will get

170 inflammation

171 //I: mhm//

172 TN: so, the-and then you get scar tissue, which pushes away the neurons from the, from the, from the electrode.

173 //I: mhm//

174 TN: so you can record less and less electrodes over time. this system is stable for one and a half years with these patients

175 with the same settings. so nothing changes there, the-the-it seems to be so the-the body seems to have no problem

176 with these electrodes.

177 I: mhm. okay.. and uh, do you think in ge-more general about BCIs? do you think there is a great potential for the future?

178 TN: I-I do think that for the long-for for, for far future it has enormous potential. um.. uh.. any uh.. so for uh.. for uh

179 patients, all kinds of patients, you can conceive of getting.. uh information from the brain and and sending it out

180 and this will help in some points, depend, depend on so uh... whether it's closed-loop uh systems for epilepsy

181 surge-seizures or or uh, closed-loop DBS kinds of things um, that will help a lot of patients. um, so I think

182 increasingly more and more patient groups will have benefit for that. (Pause) uh for healthy people that will, I-I

183 probably society will develop in some way that it makes sense to do that but we have no clue what exactly

184 //I: mhm//

185 TN: brain-to brain communications, these kind of things uh, so uh the FaceTime uh, the Facebook Elon Musk kind of

186 things

187 I: yeah

188 TN: uh, yes.. well.. people are talking about this in-in Hollywood for a long time already. it will probably happen.

189 whether it will be uh, whether we, we want that or not is not really how science works, so if it's there then people

190 will start using it. another thing I *do* think is that there is a, there- there's a.. possibility that-that at some point

191 development stops because we simply are not enough patients to get enough money for the se early stages of these

192 and the the the amount of money you need to get to the next stage.. will be for each step will be more and more

193 larger and and the fact that we are successful is-one of the reasons is that we are using hardware which was

194 developed for a completely different application

195 //I: mhm//

196 TN: and it happened to have uh [?] possibilities to be advanced. so we don't need, so we are working on, on on lot of-

197 lots of groups are working on hardware to get that into patients. that's a *very* long trajectory to to get that. if you

198 want to put that on the market that will cost you tens of millions

199 I: oh wow, okay

200 TN: because of all the tests you have to do. all the, all the safety and performance issues uh you are required to do for

201 [??] for FDA approval. so uh one company tried that, [xy], that's what [?] does, and they went bankrupt. so there's

202 one company that really tried that. other companies are, are uh.. thinking about it but that is uh what, what is

203 an...uh...wh-what's.. uih, if there is a reason why it will be stop this.. then money will be.. at some point, it's too,

204 too, it costs too much money to develop that kind of hardware and do these kinds of studies.

205 I: okay, and what do you think about healthy users? which applications could be possible? like for everybody?

206 **TN:** enhancements
207 //I: uh-huh//
208 **TN:** memory enhancements, these kinds of things
209 **I:** and in the military context?
210 **TN:** mm....not necessarily, no. just to, to be more competitive than uh.. than other competitors
211 **I:** okay
212 **TN:** if you are... so, many areas are very very competitive. so, uh, so in financial work uh... uh.. so, so.. in Amsterdam,
213 there's a uh... cable from States to Amsterdam, uh.. for very fast uh financial information. all the companies
214 move.. as close as possible to that endpoint because the nanoseconds earlier you get the information will give you
215 a competitive uh advantage over um.. over other companies.
216 //I: mhm//
217 **TN:** the same mechanism will probably will start with healthy users once enhancement by implants or BCIs in general
218 will come. whether we reach to that end that happens [??] gap where I talked to you before. but if so, then yes,
219 then healthy people will start to use them like they use drugs, like they do use doping and sports.
220 **I:** mhm. okay, but you think uh, it's more in the field of enhancement?
221 **TN:** yeah, so I think, I think that will. so, so for entertainment uh.. BCIs with EEG or something will um..will be be a
222 small niche market I think. I don't think that will be a huge thing, uh although there are many gamers so it is
223 probably commercially uh, uh attractive, uh but for enhancement that would be a direction where this is really
224 long-term thinking. this will be tens of years where people will be interested.
225 //I: okay//
226 **TN:** and, and of course the patients, but that's a different story.
227 **I:** mhm.. okay, so it's now, it's uh more about your personal experience, um how does it feel for you personally when
228 you are using a BCI? like, is it kind of strange or like a normal feeling?
229 **TN:** uh, I-I-I'm not at all a naïve subject, so I know what I'm doing and... uh, it.. it doesn't really feel that strange to me
230 because I have all this knowledge
231 //I: mhm//
232 **TN:** if I explain it to someone else, then they say "oh, this is great"
233 //I: uh-huh//
234 **TN:** so then I realize that it's something uh, interesting, so I um... I-I did uh, I did uh [??] pop festival, so they also uh,
235 some science in there so I did some art and science as well
236 //I: mhm//
237 **TN:** so I let them, let the audience control the same cursor task, so the cursor-up cursor-down uh task uh.. as uh, as all
238 BCI groups actually use. um.. and but now of course I couldn't implant it into the audience, but they uh, I used
239 sound for that. so they could shout and then it went up
240 //I: mhm//
241 **TN:** and, and then if they were silent then it went down. and so next day there was an article in the.. on on the internet
242 about that and it ended with the-so, so now the audience knows how it feels to control something without moving.
243 I really didn't realize that, tha-tha-that is what it is. so, so you're.. you're thinking something, or shouting, but it's
244 it's not an action-reaction with your hands or with your body, and and so, I do feel feel that um.. the other thing is
245 uh, with the people starting uh investigating that, so you have.. you have to have a sense of agency over what
246 you're doing
247 //I: mhm//
248 **TN:** and it only works when the reliability is very high, um.. with these crappy things, I-I, it's not very reliable. so, then
249 since reliability is not that high, so that's probably the reason why I don't feel very special doing that
250 **I:** and you don't feel like responsible for that action because you know it's--
251 **TN:** so, so yeah, if it works, yes. so I know, but if it doesn't work, then I know it's a crappy system.
252 //I: okay//
253 **TN:** so for the, for our our uh, participant in our study, that's a different thing of course because he knows it's not a
254 crappy system
255 //I: mhm//
256 **TN:** we have worked on that for 10 years
257 //I: mhm//

258 **TN:** uh, so she will have completely different sense of agency uh, about this then then I have on-on the, on the very
 259 unreliable uh, system

260 **//I:** mhm//

261 **TN:** so uh, that's basic uh.. uh yeah, that's the basic thing where you uh.. where you feel it's, it's.. it's something very
 262 strange to to use or or not. it's.. if you have a lot of- lot of knowledge then it's.. not that spectacular

263 **I:** mhm, and normally your participants, like the people you are working with.. patients, for example, do they have fears?
 264 like in the first step, they like, feel like "maybe you can read my thoughts," something like this?

265 **TN:** uh.. no, I-I didn't experience that, um.. uh.. but I have to say that we probably inform them about that as well. so
 266 [??] the patient is lying in the bed and they sign the informed consent

267 **//I:** mhm//

268 **TN:** and so they know a little bit about that and you just chat with them and try to learn uh.. uh.. to learn each other, uh..
 269 to get used to each other because the rest of the week you are going there every time

270 **//I:** mhm//

271 **TN:** and even if they.. they're not feeling well, most of the m-many patients, uh.. it's-they did have brain surgery just the
 272 day before, for example, so so yeah, you are trying to, to bond a little bit for that week, to do experiments. so you
 273 say a lot of these kinds of things, so "okay so we we read your brain, we can't read anything about your thoughts"
 274 and and so, but.. most people-patients don't talk about that

275 **//I:** mhm//

276 **TN:** the-they don't have these fears

277 **//I:** mhm//

278 **TN:** society has these kinds of fears but the patients, individual patients-- our participant in our implant study, she's a
 279 medical professional herself so she had no issues with that at all

280 **I:** mhm.. yeah, maybe it's just um depending on the sample you're using? like I think with the healthy users, it's
 281 completely different

282 **TN:** it-yeah

283 **I:** they are more critical, they are not relying that much on the technology

284 **TN:** yeah

285 **I:** like the patients

286 **TN:** maybe, yeah

287 **I:** yeah, okay.. good, um.. just one more thing. a bit more of your um.. yeah, uh, what do you think about technology in
 288 general? like, its influencing more and more our daily lives, like our smartphones, computers, are you thinking this
 289 is a, a good development? or maybe they're like.. where is the limit? you wouldn't, then you would say "it's
 290 enough, it's my privacy," something like this?

291 **TN:** yes okay, so um.. um there is a-there is a, a website which is called technologywillsaveus.com or something

292 **I:** (laughs)

293 **TN:** and so I, so the.. th-the human body, including brain is very limited. uh.. humans make very stupid mistakes, even if
 294 they are highly educated. um.. they are th-the number of misconceptions about how the world-the world works,
 295 how bodies work is enormous. technology can change that. so, all flaws in, in in psychology in, in sociology, um..
 296 if that can be uh, lessened by technology that will probably be a good-have a good impact on culture.

297 **//I:** mhm//

298 **TN:** so, for the human culture. the only problem is that if.. m-maybe because of the same flaws in-in, in uh, human
 299 psychology, um.. you have to trust, uh, technology and uh.. artificial intelligence, that's where for many people is
 300 "okay, this is going too far"

301 **//I:** mhm//

302 **TN:** um.. so, so...bu-...so, then, of course humans are better than technology so they-they rule technology so they can
 303 build in limits to um.. to-to avoid problems that artificial intelligence will take over or whatever. um..so in general,
 304 uh.. I-I do think it is a good thing and.. but we, uh, the brightest minds, uh, will have to think about, uh, how to
 305 prevent all kinds of, uh, side effects

306 **//I:** mhm//

307 **TN:** and um.. and.. that is very very hard. and um, I cant-I can't think of a.. um.. I can't think of an example.. an-any
 308 other thing that.. there are many many um.. examples of... oh okay, so I know one.. um.. so the... the..uh, how do
 309 you call that? the-the-the-the, rolling st-stairs? or the?

310 **I:** ah, in like in a shopping mall

311 **TN:** yes, yes

312 **I:** yeah, I know what you mean, yeah, mhm

313 **TN:** ja, “roltrap” in in [language]. so, uh that was invented to get more people in the same time to go to the next floor

314 **//I:** mhm//

315 **TN:** what happened if one thought “okay so now I can stand still and rest a while-

316 **I:** don’t have to move

317 **TN:** and don’t have to move..

318 **I:** (laughs)

319 **TN:** and so, technology is always understan-(laughs)-understanded--understood differently than it was supposed to. so if

320 he.. if he can grasp that, that thing so that you invent something and then people use it for something else, uh, um,

321 if you know how that process works then technology will be an integrated part of the.. of the culture and will be no

322 problem.

323 **I:** you think like uh, man can control technology?

324 **TN:** yes I do think that, yes

325 **//I:** mhm//

326 **TN:** yeah

327 **I:** okay, and even when artificial intelligence--

328 **TN:** but yes, and even with artificial intelligence, so th-the problem starts if you.. If you don’t think ahead. so, when the

329 internet came, nobody envisioned that many people would like, uh, would love to make viruses... so, so we cured

330 it somehow

331 **I:** (laughs)

332 **TN:** with virus scanners and but they’re all out there. so they could’ve saw that in front and then built in the internet

333 protocols something like stopping viruses, um.. they didn’t. so it’s, it’s thinking ahead what you have to do

334 **//I:** mhm//

335 **TN:** and that uh, I-I do understand it’s very hard and I do understand that uh, maybe it’s impossible to get all ki-all-

336 everything done, but if you have uh, the same rules, uh, which you think society should have, every soc-there are

337 many societies and they have different rules but there’s uh.... some some some common morality uh, rules which

338 are are universal, um.. uh.. if you use these kinds of things, uh, *before* you start in technology, then it is a good

339 technology.

340 **//I:** mhm//

341 **TN:** if you just try something and then someone else takes up the idea and then, then at some point you could realize that

342 this has a bad impact on society

343 **//I:** mhm//

344 **TN:** so that trajectory is not very well defined now so that’s the flaw in the technology development.

345 **I:** yeah, yeah. absolutely. and it’s a bit curious because um, in Germany for example, we don’t have any laws concerning

346 technology or to drive a car autonomously, you know we have a lot of um.. for example BMW, car companies and

347 they are working on it of course. um, the question is always who is responsible? and--

348 **TN:** yeah, th-th-the-one of the problems um, is that society is-so the-the rules are are written down by lawyers who don’t

349 know anything about technology

350 **//I:** mhm//

351 **TN:** and um, so the, I-I spent uh, a lot of times, uh, for my research uh.. reading European law on medical devices

352 **//I:** mhm//

353 **TN:** and it’s enormously complicated, that’s why it costs millions to do anything.. because these lawyers and and they

354 are not lawyers, all, of course they are experts, medic-uh, medical technology experts in there as well, but but

355 many of the people involved there don’t see beyond their own scope and they don’t understand that uh.. medical

356 technology development will will be at a halt at some point because the rules are way too difficult, so they create

357 something which in the long-term doesn’t work anymore. and then of course they realize and change the laws and

358 that makes all kinds of exceptions, that’s how law works... um, but the basic flaw is that the people who do know

359 what they’re working on are not the people making the laws

360 **//I:** mhm//

361 **TN:** and the people making the laws have no.. it's impossible to do both. so there must be some, some uh structures in
362 society which do that, um.. but there are very very few people who think about these kind of issues
363 **I:** yeah.. this, in my opinion, this could be a future point to address like-
364 **TN:** yeah
365 **I:** to.. yeah to talk about the topic with um, policymakers, something like this
366 **TN:** yeah
367 **I:** in one way, I think--
368 **TN:** a lot of, so so policymakers and philosophers.
369 **I:** and philo-
370 **TN:** and and, but philosophers, I-I talked to a philosopher um, just uh last week and there were a lot of misconceptions
371 about the kind of work we do.
372 **//I:** mhm//
373 **TN:** and and they, philosophers are very good at at starting at some point and then thinking, thinking this through, but
374 then if the-the point they-is id a misconception or at least, not a complete misconception, but.. but.. then, so.. but,
375 yeah, but.. you should've talked to us, I can explain why that is
376 **//I:** mhm//
377 **TN:** that's a very simple dopamine something, blah blah blah
378 **//I:** okay//
379 **TN:** so, so you have to, you have to combine the expert-expertise of these people to come up with a good design
380 **//I:** yes//
381 **TN:** and that doesn't happen that much
382 **I:** so you personally don't think that uh technology restricts you or just.. yeah, affects you in your privacy, something like
383 this? like the-
384 **TN:** no, no
385 **I:** data from uh, smartphones?
386 **TN:** no, so, so uh, th-that's all solvable. so if you-if you-if you are um very much privacy is not a thing. if you are, if you
387 want to be very private, don't use Facebook. it's that simple... so.. so, you can't blame Facebook for giving away
388 privacy in the world. people.. did that.
389 **//I:** mhm. yeah//
390 **TN:** yeah, so-so-so it's never the technology that does certain things, it's always people that are unaware that it has these
391 effects
392 **//I:** mhm//
393 **TN:** and that holds for all kinds of uh, uh things. and then some people realize that and then you have uh, search engines
394 who are uh, less uh, uh.. that don't-don't gather all kinds of data on you. um.. and with google, you-you-google
395 really does have a page, *it takes a while to find it*, but there is a page where you can have all settings no cookies
396 switched off and.. that's all there.
397 **//I:** mhm//
398 **TN:** it's-technology it is there. it's the people who, who don't want to do that because that's where the-where the money
399 comes from. but other competition, so Apple, claims at least that privacy is a very big thing and they don't want to
400 sell data. and they are larger than google, so.. it-it's, it's not the technology
401 **I:** mhm. it's like uh, the people want it, or-
402 **TN:** yeah, so th-the goals of the people, uh, will tell you where-where-which direction it goes
403 **//I:** mhm//
404 **TN:** so we want to make money and, and selling data is a very good way of making money. so don-we don't tell them
405 that you can switch all-all these kinds of things. (pause) some people know that and, and these are the people who
406 really do mind.
407 **I:** mhm.. yeah, exactly... okay, yeah. I think I have ask you everything I have here. um.. did I forget something which is
408 important for you in the context of BCIs? (laughs)
409 **TN:** (laughs)
410 **I:** (laughs) sometimes people telling me something special
411 **TN:** yeah, well something about uh, uh, choice of patients, I had patients that-
412 **I:** ethical issues maybe in your context?

413 **TN:** uh, yeah
414 **I:** with patients
415 **TN:** instead, yeah, but that's very long. uh.. I think patient choice is very important. so, there is a lot of discussion about
416 uh, is-is-is it, uh... or actually, the discussion not that large because most people agree with us, but some people,
417 uh, have ethical problems with the fact that we implant a very simple, uh, system and we should've waited we-
418 with-until we had a system which, uh, is perfect and-and gets [????] as uh, as healthy people and uh, um.. but..
419 patients actually, so this particular, uh, patient, uh, was not so sure whether she will benefit from this, but was
420 really wanted to help science progress, and that was her main motivation, and thought "well, maybe I could
421 benefit, maybe not, but this motivation alone is enough." turns out, she has a benefit. sh-she uses the system on an
422 almost daily basis, which she didn't expect when she started, uh... started as a participant. um.. I think.. that-that is
423 how-how it will work and at some point, people will make choices based on the possibilities of the technology,
424 and so not developing that will give patients, uh, less choice.
425 //I: mhm//
426 **TN:** although we are not really sure which choice we offer them at, uh, at that point
427 //I: mhm yeah//
428 **TN:** [????]
429 **I:** yeah
430 **TN:** okay
431 **I:** good good (laughs) I've learned a lot (laughs) thank you very much (laughs)
432 **TN:** yes, you're welcome
433 **I:** I switch this thing off