Review of the intendiX P300 BCI with SJ1

**GOOD NEWS**

The system can work. Indeed, it provided 100% accurate communication on the first day.

The BCI worked within 20 minutes of mounting the cap – there was one training run, then he began spelling perfectly. This is unusually fast.

SJ1’s EEG reflected relatively normal P3 and N4 activity, although it was stronger on some channels than others. He can definitely form messages or commands, understand directions, see the monitor, choose to count specific characters, and remember the word he wants to spell. If he could not do any of these things, the BCI would not have worked. This does not prove that he is totally cognitively intact – this could not be proven in such a short time without more testing and equipment – but he is “there” and he wants to communicate.

SJ1’s family is positive, motivated, and attentive. You mounted the cap both times and operated intendiX. I provided advice both times, but I think you could use it independently. I showed you how to reconfigure the board to change the number of flashes, speed up the flashes, add a row, and add or change icons. I think you could also do this independently, and thus (for example) add a bedpan command or other special commands.

In short, it is likely you could replicate the achievement we had on the first day: accurate spelling within minimal training and setup. However, there are a lot of caveats.

**CONCERNS AND ISSUES**

On the second day, the system did not work. SJ1 reported that he was tired. SJ1 said he was sorry through the ABC board, but I told him that he should not be. This is common with late stage ALS patients, and not at all SJ1’s fault.

SJ1 said his eyes were sore on the second day. Teresa noted that he had reported sore eyes a few days earlier, so there may be a concern independent of the BCI.

SJ1 said the system was fatiguing. This might be reduced with practice, and/or different parameters such as alternate matrix sizes, monitors, images, or other parameters. It might not. In other words, it is possible that a BCI might only be practical for short periods.

Since we did not work with him on the second day, we could not optimize the system by reducing the number of flashes or the flash time. Therefore, the system has only been tested in a slow mode, with 15 flashes (15 row and 15 column) and 310 ms ISI. This is below 2 characters per minute. I said that I think it is realistic to get to a few characters per minute, but above 5 per minute is iffy.

The main problem is, as always, the need for support to really extend the application flexibility of the system. intendiX can support email, printing, and twitter. It is possible to use a BCI for other things like web browsing, BrainPainting, games, or smart home control. Word completion, error correction, and other improvements are also possible, but not easy. This does not necessarily require an expert in BCIs; a good software engineer could probably adapt intendiX and/or BCI2000 if willing to devote the effort. I do not have the technical skill. I could recommend such people, but they are not in the Bay Area and I do not know if they are available or what they would charge.

You may want to consider other BCIs, and other BCI people to help. I can put you in contact with other people, but I do not know anyone available and they would presumably charge for travel and other costs, assuming they are available.

You might consider an invasive BCI. I already put you in contact with Dr. Hochberg, who is a respected expert with invasive BCIs. In my opinion, he is an honorable and highly competent BCI expert and doctor. However, I have never worked with him. I could put you in touch with my friend Dr. Kai Miller, who has also worked with invasive BCIs and lives near Stanford. He is an MD/PhD who is becoming a neurosurgeon, but cannot yet do neurosurgery. He could put you in touch with the right people. Of course, invasive BCIs entail neurosurgery and this should not be taken lightly. SJ1’s doctor, and the relevant neurosurgeon, should help you evaluate the risks, benefits, and costs. I am not a medical doctor, so I can only provide limited advice.

Overall, I would definitely recommend against relying on the BCI as the sole means of communication. At best, a BCI could be part of a suite of other assistive technologies and options, including the ABC board with Teresa. If SJ1 is interested, you should contact g.tec to ask about costs for renting or buying a system so you can best consider your different options. I think that SJ1, and you, now have a better idea of both the promise and problems with BCIs and can make a more informed decision.

Good luck and please give SJ1 my warmest regards. I hope to communicate with him again.