**Applications of Brain Computer Interfaces:**

There are many possible uses of BCIs and even more potential BCI users. There are two main routes in which manufacturers of BCI technology / products can choose to go down: clinical applications and consumer products.

Clinical Applications:

In this field there is one main demographic of BCI users; and this is individuals who have been severely disabled in some way whether that be by injuries such as a spinal cord injury, lost limb etc. or by disorders such as muscular dystrophies, brain stem stroke, ALS etc. Obviously not everyone would be affected in the same way by an illness or an injury, therefore, especially in the cases which involve paralysis, it is necessary to categorize potential BCI users by the extent of their injury i.e. the level of control in which an individual has over their muscles. (Paraphrasing from Mak & Wolpaw, 2009, SECTION III)

Knowing this, one can extrapolate what kind of BCI equipment would be needed / wanted for each individual. For example, if an individual suffers from severe paralysis, an EEG headset could be linked to a mobility scooter allowing the wearer to accelerate by simply focusing. According to Daly and Huggins (2015) “A recent review showed that 4 (17%) of 24 patients who had been diagnosed as being in a vegetative state were not only consciously aware but could answer yes or no questions.” If an individual is in a vegetative state, an EEG device could be used in order for said individual to answer basic yes or no questions. With some advancements in BCI technology we may also see robotic prosthetic limbs which could be controlled by the brain thus allowing those who have lost a limb to come much closer to having a functioning limb once again.

EEG technology for treating some mental illnesses is also being / has been developed. Such as an EEG headset developed by BrainCo which is designed to treat ADHD by requiring and rewarding focus. There have also been numerous studies based around treating epileptic seizures using BCI technology such as the journal “Brain Computer Interface for Epilepsy Treatment” by L. Huang and G. van Luijtelaar.

Consumer Applications:

As is the case with any new development with technology, the consumer is often prioritized as there is generally more profit in developing technology for consumers as opposed to developing it primarily for healthcare. Therefore, the success of consumer focused BCI products will have a large impact on the speed at which this technology is developed.

There are already many consumer BCI products that exist however for the most part these products are generally just gimmicky toys such as the Puzzlebox Orbit Helicopter which is described by puzzle box as being a toy helicopter which is “Operated with an EEG headset, users can fly the Orbit by focusing their concentration and clearing their mind”. While, as I said, this is a gimmicky product, it does however showcase the potential of EEG technology and BCI technology as a whole. This concept alone lends itself to a slew of potential consumer products that may be created in the future such as EEG controlled vehicles in which drivers could potentially possess faster reaction times while driving however it isn’t known if this would really be the case at this current point in time.

An area in which there seems to be a large market for BCI technology is the video game industry, more specifically the area of virtual reality video games. There are already a number of advancements being made in this area by a company named Neurable, an American neurotech startup who have developed a game by the name of ‘Awakening’. The premise of the game is that the user plays as “a child with telekinetic powers who must escape a government lab by using mind power to pick up various toys—a balloon dog, alphabet blocks, rainbow stacking rings—and throw them” (Mind-Controlled VR Game Really Works by Rachel Metz). This alone would be enough to get virtually any virtual reality enthusiast excited about the technology and its future.

It is clear that the creation of video games alongside BCI technology has the potential to have a great impact on furthering the research and development of more sophisticated and more powerful BCI devices. This is in part largely due to the size of the video game industry and the culture that comes with it. Once more and more companies decide to develop EEG controlled video games, more and more hype will surround the technology. If the technology shows tangible results in this industry there will most likely be a large amount of people willing to crowdfund such projects thus allowing more funding to be put into the development of BCI technologies.

The idea of a game where a player can fully immerse themselves in a world where the player character moves in the ways in which the player wants them to without being held back by the clunky-ness of a controller or a mouse and keyboard is an ideal which is shared by a lot of gamers around the world. The vision of BCI in gaming in which many gamers hold is essentially the ability to play games in which when paired with virtual reality and BCI equipment will allow gamers to play through a game while feeling almost as though they are moving their own body throughout a virtual world without being confined by their own range of movement, stamina or room space.

Another application of BCIs that could enhance the lifestyle of consumers is the use of BCIs alongside the smartphones and personal computers of the consumer. Using BCIs in this way could allow for hands free operation of consumer devices, thus making them more accessible and/or potentially improving the efficiency of the devices i.e. improved typing speed.

There are many applications of BCI technology at this point in time and I am sure that as our understanding of the technology expands, the number of applications of said technology will also increase.

Neural Dust

Neural dust is form of brain computer interface. It is a collection of sensors which can be as small as 6.5 cubic millimetres which can be attached to various muscles and organs including the brain. Ultrasound is used in order to communicate with and power the neural dust wirelessly, allowing for a less invasive experience for the user. (Paraphrasing from Recent advances in neural dust: towards a neural interface platform by Neely, Piech, Santacruz, Maharbiz and Carmens, 2018) Ultrasonic vibrations are capable of penetrating every part of the body, thus allowing neural dust to also function wherever they are placed.

Neural dust through stimulation of the nervous system, has been successfully used to treat numerous disorders such as stimulation of the spinal cord in order to treat pain. At this point in time we don’t fully understand how different diseases are influenced by the nervous system however as this understanding grows the number of potential diseases that could be treated will expand greatly as the neural dust could be placed on the correct specific neurons. That being said, current technologies are lacking in many ways which if some advancements in the field were made then this would further the expansion of this type of treatment. (Paraphrasing from Neely, Piech, Santacruz, Maharbiz, and Carmens, 2018)

The potential applications of neural dust appear to be nearly limitless. With the ability to place these sensors inside the body, individuals could have high precision 24/7 health monitoring or permanent constant never before seen therapy for various chronic ailments and pains. The applications of neural dust could also extend to consumer products such as a replacement for existing workout trackers / health monitors such as fitbits etc. as they would be less bulky than these traditional trackers. Neural dust could, in the future, also be used to detect certain oncoming illnesses much earlier than traditional methods by having round the clock monitoring. In theory neural dust could detect oncoming cancer much sooner thus potentially saving lives. Neural dust could also be used in place of tradition BCI equipment thus users would no longer be required to wear clunky and potentially uncomfortable headgear. This would also allow for a certain level of discreteness for those who may be self-conscious about requiring BCI technology in order to go about their daily lives. Granted neural dust technology is still in the research and development stage and will most likely be very expensive to produce, that being said I have no doubt that one day this technology will be accessible to the average consumer.