Our ‘brain-tech’ future

Imagine technologies that would allow anyone to have a profound spiritual experience, give you a photographic memory, meditate like a monk, or even tell your IQ from reading your brainwaves… all at the touch of a button!

Surprisingly, these technologies already exist. During the past decade we have learned more about the workings of the brain than during the whole of recorded history preceding it. Now, neuroscientists are poised to unleash practical applications based on these revelations. The question for us is will this forthcoming ‘brain-tech’ revolution usher in an era of greater mental powers for all, or will it trigger a totalitarian society in which our very minds are brought under push-button control?

There are five main areas in which brain science could have the most influence on our lives:

1. EEG- interfaces

In Arthur C. Clarke’s sci-fi novel ‘3001’, society 1000 years in the future is depicted as having ‘brain caps’ which people can wear that will read their thoughts, and even allow direct brain-to-brain communication. However, we probably won’t have to wait a thousand years for this kind of technology, prototypes of the brain cap are already in existence. EEGs, which can monitor brain activity through sensors placed over the top of the head – usually embedded in a cap – are now being used to control electronic devices. The technique is difficult to master, and (at the moment) of limited use, but with practice a person can control a cursor on a screen, and use it to spell out words.

Although fairly primitive and clunky at the moment, these EEG interfaces are likely to develop exponentially in the coming years. The continued growth in computing power will

speed up these developments as ‘neural networks’ (software that can search for extremely complex patterns in sets of data) are able to discover more of the secrets of how the brain works.

2. EEG – neurofeedback

Another EEG technique, neurofeedback, has already been demonstrated in scientific studies to successfully treat ADHD and epilepsy, and the latest findings are suggesting that it could even help us to increase our intelligence and creativity. EEG neurofeedback (also called biofeedback) is a technique for training your brain to produce certain desirable patterns of activity, just like a person can train their muscles to increase their strength or subtleness. However, the reason why we find it possible to learn to control our limbs when we grow up, but less easy to learn to control our own brains, is because we can see the activity of our limbs, so we easy learn to make the connection between our efforts to move them, and how those efforts actually make the arm or leg move. In other words, we have visual feedback, which helps us learn.

In neurofeedback, the person wears an EEG cap and their own patterns of brain activity are turned into the movement of a character or object on a computer game on a screen. For example, if a brain-scan reveals that a person is producing an abnormal frequency at a certain part of the brain (such as in ADHD),the game is set so that the character moves in the desired direction whenever the person makes the more normal frequency pattern. Eventually, after many sessions, the person learns to produce the desired frequency. Its champions point out that, unlike alternative drug treatments, the benefits of neurofeedback are permanent and do not have unwanted side-effects.

3. Magnetic mind control

In 1896, the journal ‘Popular science monthly’ published

a photograph produced by the scientist David Starr Jordan, which he claimed was a ‘Sympsychograph’ or an image formed from a device he claimed could transform an image from a person’s mind onto photographic film. Unfortunately the claim turned out to be a hoax, yet a century later the idea no longer seems quite so implausible.

Using very powerful electromagnets, the technology called MRI can take 3-D ‘x-ray’ style images of a person’s brain. Now, the more sophisticated version, fMRI, can image the brain while in action. The latest research using this technology can pinpoint which of a range of images a person has looked at – essentially reading the person’s brain and revealing what image they are thinking of! Who can say where this technique might lead in the years ahead?

If this seems far-fetched, well there are other even more amazing possibilities for enhancing the mind with magnetic control. About one in ten people who suffer from autism are what psychologists call ‘savants’, they have extraordinary mental abilities in very specific areas. For example, some can look at an object or view, and then draw it in incredibly accurate detail. It seems the reason for this is that areas of the brain that in non-autistic people summarise information into its ‘gist’, and help us deal with the subjective meanings of things, are damaged. Without these functions – which are usually useful to help us make sense of the world, particularly the social world – the autistic person is able to have a very literal and objective perception of what they are seeing. So, rather than perceiving, for example, the general idea of a building, its feel and mood, they will remember the lines, angles and shades from which it is composed, and be able to replicate them in a drawing with an ease that they rest of us can only marvel at. Of course, in order to access these narrow but amazing skills, very few people would be willing to deliberately have those parts of their brain that are ‘blocking’ these skills damaged – particularly as they are

important for other areas of life. However, using sophisticated electro-magnets, researchers have managed to temporarily switch off these areas, successfully releasing the latent abilities that we all appear to have within us. When this technique becomes more sophisticated, maybe we will all be able to own devices that can safely enhance our memories and objectivity at the press of a button.

4. Smart drugs

We're all aware of the mood altering effects of such drugs as caffeine in tea and coffee, or nicotine in cigarettes (not to mention the effects of illegal narcotics), but scientists are developing drugs that can enhance memory, concentration and intelligence without any unhealthy side-effects. There are even drugs that are claimed to control impulses to engage in addictive behaviours, such as gambling. Developments in this area will probably increase due to our ever growing knowledge of bio-chemistry and genetics.

However, it's not only in terms of synthesising new drugs that the biological revolution could enhance the brain: there is the possibility that in the near future we might start genetically engineering our children to be more intelligent. The evidence seems to be that at least to some extent our levels of intelligence are inherited. In other words that they are genetic.

5. Brain chips

Chips that can be implanted into the brain itself have been in existence since the 1960s. However, it's only within the last five years that they have become sophisticated enough to offer real hope to those who are disabled and have lost control over their limbs.

For example, the 'brain gate' chip, developed in 2003 uses 100 hair-thin electrodes to monitor brain activity in areas associated with muscle control, and then turn those activity

patterns into electrical signals to move the person’s muscles. More recent research has even managed to get brain cells to grow onto a computer chip – the ultimate mind-machine interface.