



Brain-computer interaction:

Transforming our networked future?



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The interaction between human beings and machines has enabled us to achieve incredible things. Now, as we enter a new era of brain-computer interfaces, we should prepare ourselves for innovations that will transform the way we learn, communicate and control devices – and perhaps even each other.

Traditional human-computer interactions can already be described as brain-computer interfaces (BCI):

Our intentions are sent from our brain to the computer through our fingers, via a keyboard, or through a camera that tracks eye movement. However, a more specific definition of BCI describes the ability of computers to read, interpret and act on our thoughts using electroencephalography (EEG).

In a recent experiment at the University of Washington, a researcher mentally controlled the hand movements of his



A woman using a brain-computer interface (BCI) at the Hannover Messe industrial trade fair in Germany
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colleague by sending EEG signals over the internet. At Princeton University, scientists have used EEG to show that when someone understands what you are saying, their brain waves begin to synchronise with yours – they are literally on the same wavelength. If this connection can be captured, measured and transmitted, we will soon be able to modify it.

Over the next decade, the ability to control individual machines through EEG will gradually develop, with a broad range of applications ranging from computer games to robotics and prosthetics. We are still a long way from sci-fi clichés such as interface sockets embedded in human spines, or the ability to learn kung fu by downloading a program directly into our brains; it's hard to even imagine the biological basis for 'downloading' a skill. But BCI could certainly help with skill acquisition. My team is currently working with the United States Navy on a project that uses both BCI and physiological sensing to optimize individual and team training. You could soon have a computer that acts as an intelligent tutor, using BCI to sense when your attention wanders, and restructuring the lesson to set an efficient pace of study.

In time, we will be able to use BCI for simple tasks such as controlling the cursor on a computer screen, or interacting, hands-free, with mobile phones. But in the more distant future, advances in BCI will have huge ramifications for the interaction between human beings. Some colleagues and I have used the term 'cognitive coupling' to describe the synchronization of neural signals between people. In simple terms, you could say that we are looking at the idea of 'connecting the crowd to the cloud'.

As we move from networking devices through the Internet of Things to networked humans, we'll witness a revolution for brain-computer interaction. By capturing human cognition, capabilities and actions, and putting them in a connected environment, we

could become – to borrow a term from Star Trek – a global Borg community, albeit an empathic one.

In the popular TV series, the Borg is a collective of cybernetic humanoids interconnected to function as the drones of 'the Hive'. The image of a Borg society suggests two potential – if extreme – outcomes. In the dystopian depiction, people no longer have a choice over their actions – an external mind, more powerful than yours, would control your every move. The other imagining would see us build an empathic society with a collective consciousness. In such a scenario, we would share each other's perceptions of the world, along with our problems. We would develop a common empathy. If you think of this group consciousness as an individual, it would be in our own self-interest to solve society's problems and to maximize the potential of every human being.

These hypothetical scenarios represent the far-flung future of BCI advances, but even in the short term, this new technology raises many ethical questions - and one of the biggest issues is going to be control. People need to maintain actual control over their lives, not just the illusion of it. At the same time, regulation is unlikely to keep up with the pace of technological development. We're seeing that now with autonomous weapons and the worldwide debate about the legitimacy of drone strikes. If you leave safeguarding to industry and don't consider the ethics at a regulatory level, it'll be too late.

Rather than predicting the future and figuring out the ramifications of our predictions, we should say what we want the future to look like and drive towards that. I think that's where the Forum can play an important role as a convening organization, especially with regards to the Global Agenda Councils. However we pursue this new technology, it's obvious that we're going to need some serious group thinking ■

The value of the augmented reality market



global market value for augmented reality dedicated devices by 2018



value of US augmented reality market



projected compound annual growth rate of US augmented reality market by 2018

Source: ABI Research, Cloud Strategies for Augmented Reality, 2013