

The popular conception of the electroencephalogram within science fiction and fantasy drama

The electroencephalogram (EEG) uses electrodes to record the electrical activity of the cerebral cortex. The kinds of brainwaves that can be recorded are shown in Fig.1.

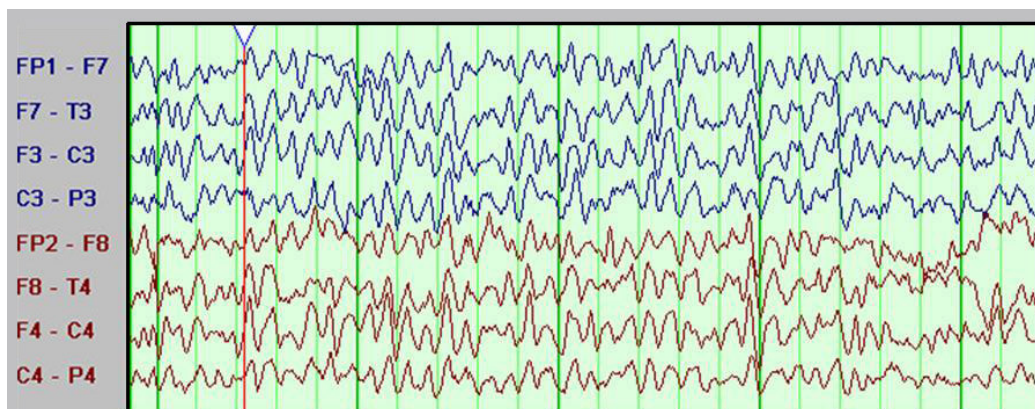


Fig.1: An EEG montage showing cortical electrical activity (the blue channels represent the left hemisphere, the red channels the right hemisphere)

Routine EEGs performed within a clinical setting in England usually use 23 scalp electrodes. The striking image of a person with electrodes and/or wires attached to their scalp has been used in many recent science fiction and fantasy television and film productions. This image, with its inherent vulnerability and implicit references to electric shock treatments and ‘mind reading’ or ‘mind control’ can be a powerful motif. It also lends a superficial medical or scientific legitimacy to the pseudoscience necessary for these programmes’ far-flung storylines. However, the way that the EEG is used in these programmes bears little resemblance to its actual function. The EEG is a monitoring device and does not alter electrical brainwaves whatsoever. It is mainly used to record the abnormal and excessive synchronised discharges of cortical neurons in the brain that suggest epilepsy.

I will discuss the way these films suggest the EEG’s potential to penetrate the body, the way that the EEG is linked to implicit or explicit violence and the way it is associated with mind reading and control. I will also explore the way that the EEG has been used within film and television as an interface for communication between the brain and the computer.

The EEG is usually non-invasive although intracranial electrodes can be inserted if scalp electrodes have not clearly identified an epileptic seizure focus. This clinical potential for penetration into the actual body is expanded upon in the *Doctor Who* spin-off *Torchwood* (Series 2, Episode 2, 2008) and *Paprika*, a science-fiction anime film released in 2006. In *Torchwood* a ‘mind probe’ is used to investigate a suspected alien’s mind.



Fig.2: Beth reveals her true identity under the influence of a mind probe in Torchwood (Series 2, Episode 2, 2008)

The probe ‘drills down through [the] consciousness so if there’s anything hidden it’ll pop to the surface’ and the prisoner is warned that it will hurt. Effectively, it acts as a torture method. The violence of this assault upon the mind is foreshadowed by the use of wrist restraints with the captive. The ‘mind probe’ itself is a metallic head cap. Its power to actually affect the functioning of the body is shown visually by flashes of pale green fluorescent neurones and the surge of blood through vessels. The probe causes the suspected alien to groan and scream in agony but serves its purpose; it reveals that she is an alien, as shown in Fig.2, but was never aware of it.

In *Paprika*, the DC mini – a device to record dreams – is intended as a non-invasive monitoring device which can visually record dreams so that they can be watched back afterwards during psychotherapy sessions. It curves around one side of the head and extends against the anterior temporal area. Five fluorescent green protrusions extend from the loop which sits against the back of the head. Some form of responsiveness to the environment is shown when the device is removed from the scalp of a subject and these extensions automatically retract against the main frame (like hairs on the arm when you enter a warm room from outside). This hint at artificial intelligence is expanded upon later in an alarming example of medical technology out of control. The DC mini is misused and actually embeds itself underneath the skin and, apparently, within the brain matter itself.

The DC mini references the conventional EEG in two ways. Firstly, its intended purpose of recording REM dream activity is a key purpose of the EEG which can help to diagnose sleep disorders by differentiating REM brainwaves from other stages of sleep. Secondly, later in the film a traditional EEG is shown with bands of fluorescent green stripes underneath the electrode pads. This links the traditional EEG equipment to the DC mini which featured the same fluorescent green colour.



Fig.3: Dr. Atsuko Chiba (the alter ego of Paprika) with a traditional EEG being performed behind her in *Paprika* (2006).

The EEG also features within an episode of *Bionic Woman* (Series 1, Episode 4, 2007). Like in *Torchwood*, the test is carried out on a prisoner strapped down onto a reclined chair lending an air of violence to the procedure. However, it is not an important part of the scene; there is no obvious reason for the prisoner to require an EEG and the electrodes on her forehead are not referred to. The actual brainwaves that can be recorded by the electrodes, which can only be interpreted by experts, are not seen. Instead, several real-time CCTV images of the prisoner including a fluorescent green and black image of a brain can be seen in the background, as shown in Fig. 4, increasing the impression that she is being treated as some kind of specimen.



Fig. 4: Sarah Corvus, the first bionic woman, with electrodes on her forehead and real-time CCTV images of her in the background in *Bionic Woman* (Series 1, Episode 4, 2007)

The electrodes increase the prisoner's appearance of vulnerability and exposure and serve as an immediate visual sign that she is being closely monitored. This fits in with the prisoner's life story: she is the original 'bionic woman' whose 'technology' has been extensively studied but whose moral and emotional development has been sadly ignored. Her technology is now beginning to fail

and the head of the biotechnology unit that made her bionic is trying to convince her that he may be able to ‘fix’ her. This suggests the possibility that the electrodes have been used to add some kind of medical legitimacy to this promise. Eventually the prisoner escapes and when the scene changes to show her threatening the security staff, the electrodes are gone from her forehead.

In *Heroes* (Series 1, Episode 4, 2006), a similar scene features a man with mind-reading powers who has been abducted and taken to a testing laboratory where he is strapped to a bed with forehead, wrist and ankle ties. The voiceover begins, ‘Sometimes questions are more powerful than answers – how is this happening? What are they?’ as the camera pans across brain images on a computer screen before resting on the prisoner who has traditional EEG electrodes across his scalp.



Fig. 5: Matt Parkman having an EEG done in a testing laboratory in *Heroes* (Series 1, Episode 4, 2006)

The supremacy of research and control over human dignity is reinforced when the man becomes agitated. The researcher says coldly, ‘Please don’t get excited Matt – we’re trying to test your resting rate’. In this instance, the EEG electrodes are not just used as a visual signifier of scientific testing. The researcher actually looks at a screen of Matt’s brainwaves which have shown a burst of activity of different frequency and amplitude to the background and deduces, ‘Trying to hear my thoughts Matt?’ Later in the scene, a man with the ability to erase memories from the mind places his hand across Matt’s face and destroys his memories of the last 24 hours.

In the *Heroes* episode described above, the EEG is implicitly linked to mind reading and control. These associations are expanded upon in *Bionic Woman* (Series 1, episode 5, 2007). A man whose Parkinson’s disease has been cured by a neural implant is shown in a laboratory with one electrode visible on his forehead. Students of neuroscience watch from a separate room as their lecturer’s assistant types some commands into a computer and makes the patient juggle. The assistant explains, ‘the neural implant not only rewrites the pathway but it acts as a receiver – what you’re seeing there – totally involuntary’. The prominent placement of the electrode on the patient’s forehead suggests that this may be the way that the neural implant ‘receives’ commands. The sinister potential of the technology is fully realised when the assistant enters commands into the computer which make the patient hold his palm over a blowtorch. Later in the episode it is made clear that this technology has been used to force people to commit acts of violence.

Flight of the Navigator is a family film from 1986 which uses the EEG extensively to further the plot and provide striking imagery to emphasise the extraordinary nature of events. A young boy called David goes missing and returns to his home years later having not aged at all. An EEG is performed in hospital and as David recounts what he can remember, there is suddenly a huge increase in EEG activity on the paper trace.



Fig. 6: David having his EEG done in hospital in *Flight of the Navigator*

The technician cries, ‘he’s communicating directly with the computer in binary code’. Instead of tracing out David’s brainwaves, the pen galvanometer draws out an image of a spaceship. It eventually transpires that the aliens that abducted David filled his brain with an encyclopaedic knowledge of star charts, their planet and their technology. David can not only communicate in binary code but is described as ‘downloading’ data to the computer. The EEG is the link between David’s brain and the computer. The possibility that electronic devices may ‘expand the capabilities of the normal brain, making the bionic man of science fiction a reality’ is now being researched (O’Shea, 2005, p.102). Laboratories are trying to grow networks of real brain neurons on silicon chips (O’Shea, 2005). *Flight of the Navigator* not only foreshadows modern research and suggests the untapped potential of the human brain but imagines and fantasises an untapped potential within the EEG – as do the other television programmes mentioned.

Within the films and programmes mentioned, the EEG is a visually arresting symbol of scientific progress and the human sacrifices necessary, one of the recurring themes of science fiction drama. It particularly lends itself to the dramatisation of ‘mind reading’ or ‘mind control’ and serves to suggest a scientific basis to this fantastic notion. The use of electrode imagery, commonly associated with electric shock therapy, lends the dramas a dark undertone of violence and violation, most fully realised in *Paprika* and *Torchwood* in which the electrodes penetrate the body. This potential for the EEG to penetrate the human body and consciousness is reversed in *Flight of the Navigator* in which David’s brain penetrates the computer he is connected to and connects with it directly in binary code. Overall, the EEG serves as a device to connect the opposing themes of science and fantasy and the computer and the human.

O’Shea, M., 2005. *The brain: A very short introduction*, Oxford: Oxford University Press