Can A Satellite Read Your Thoughts? - Physics Revealed

http://deepthought.newsvine.com/_news/2010/07/13/4656599-can-a-satellite-read-your-thoughts-physics-revealed
News Type: Event — Tue Jul 13, 2010 4:28 PM EDT
science, radio, nsa, spies, ai, microwave, nlp, mri, fmri, sis, intelligence-gathering, bci, gchq, brain-computer-interface, interfaces, transcranial-magnetic-stimulation, nmr, artifical-intelligence, terrahertz, synthetic-telepathy, sentience
By Deep_Thought

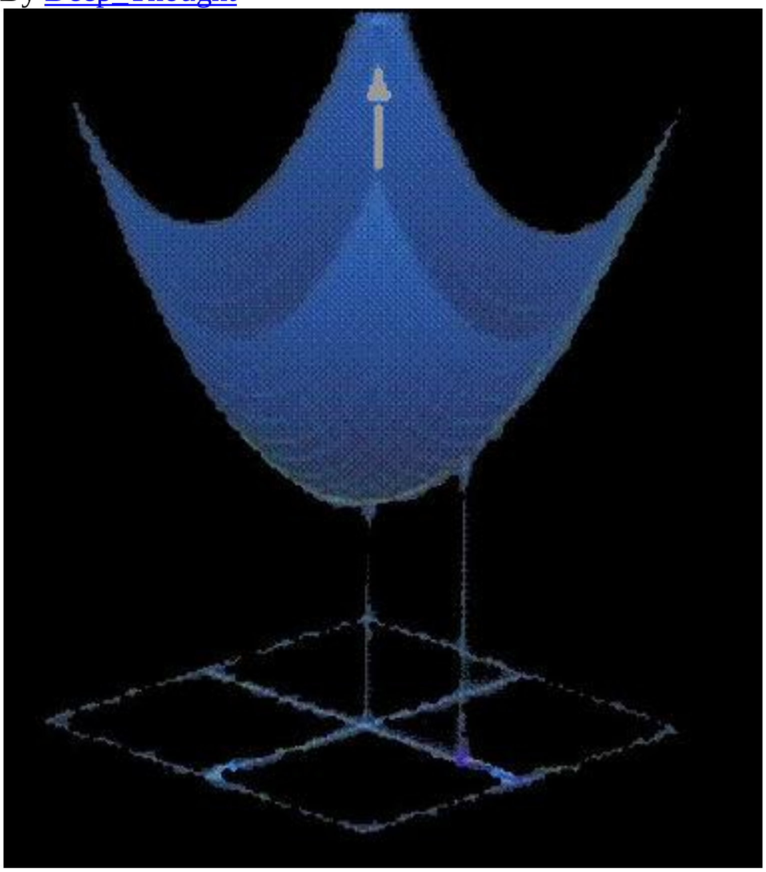

Figure 1: QED viewpoint of a moving charge.

$$Pd = \frac{Pt}{4 \cdot \pi \cdot R^{\wedge}2}$$

Figure 2: Formula to calculate the power density in the far field at a given radius.

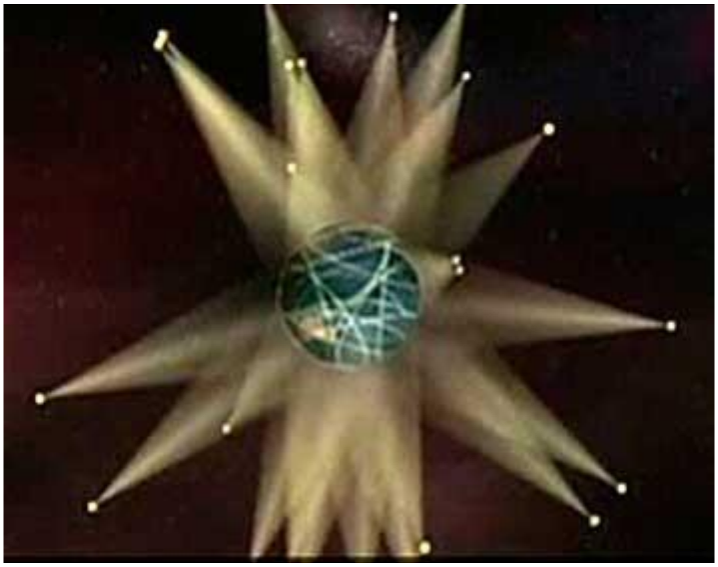

Figure 3: ELF satellite array.

Most people, when they hear of Synthetic Telepathy, especially by means of satellite, jump to the immediate conclusion that such things are not possible. If they were, we would have heard of them, right?

Looking back at the history of classified technology, places and events shows a wide range of time periods where things are kept secret. Stealth aircraft are just one example, the F-117 Nighthawk was not publicly acknowledged until 1988 although it had been in operation for over six years. Documents sealed for "National Security" purposes can be hidden away for up to 70 years. So, it would be really surprising if certain technologies were not classified as you read this.

Whilst you can hide certain technology to an extent, what becomes very difficult to hide as time passes is the physics of a given technology. An example would be a nuclear device. Whilst you could, in theory, hide a given nation's development of a nuclear bomb, the physics still shows that nuclear fission/fusion is possible. Thus, if you weigh up the various factors that are required to create a nuclear device, you can make an educated guess as to the likelihood a nation has such technology.

With this in mind, I decided to look at the transceiver and the physics involved in that process. Its all well and good claiming that a satellite can read thoughts, but how does the physics stack up?

Does The Brain Transmit Like A Radio

To understand this, we first need to look at how antennas work, its relationship to neurons and what similarities, if any, exist. Coming from a QED angle, if you take a look at figure 1 we can get a better viewpoint of how a moving charge creates an EM wave. As the electrical field moves towards the bottom of the picture, virtual photons are radiating magnetic energy into free space.

As per Maxwell's equations, a changing magnetic field will induce a changing electrical field resulting in a free standing EM wave. This is a good applet that shows how a moving charge produces electromagnetic radiation.

So, what is the connection with neurons? Information is processed by the brain in the form of electro-chemical interactions. That is, every perception you have sends electrical signals to the brain that are routed to specific areas that deal with them. The neuron has a long strand called an axon, along this axon propagates an electrical charge. With a resting potential of -70mV an action potential moves along the axon, in a millisecond, elevating it to a voltage of +30mV which drops off over a few milliseconds. This makes an action potential a form of alternating current with an almost triangular waveform. As such, this produces a very weak form of modulated electromagnetic radiation or radio source.

For the astute reader, it means that a neuron is a type of transducer.

Can You Hear Me Now?

So, whenever you have a thought, feeling, speak or our heart beats, tiny little radio emissions are being made by the brain that emanate into free space. The real questions are, given modern technology can these signals be detected and does a method exist of associating them with particular functions? That is, whilst signals in this power range may be detectable, is there something unique about the signals that can be used to differentiate between different roles?

Let's deal with first problem, detection. I tracked down an example of satellite sensitvity to radio frequencies that should act as a baseline. The following data is from NASA's Jet Propulsion Lab:

The sensitivity of our deep-space tracking antennas located around the world is truly amazing. The antennas must capture Voyager information from a signal so weak that the power striking the antenna is only 10 exponent -16 watts (1 part in 10 quadrillion). A modern-day electronic digital watch operates at a power level 20 billion times greater than this feeble level.

So, does the brain emit radio waves at a power level greater than 0.0000000000000001 Watts after several hundred miles?

To answer this we must turn to this scientific paper. From this paper, we can observe the charge per square centimeter which is around 22-29 microamperes. We can perform some rough math on these figures that will reveal the answer to our question. The equations are rough and leave out a lot of additional factors. That said, the final figures will not be far from the truth and will probably under-estimate the capabilities of current classified technology.

So, using the formula Watts = Voltage x Amperage, we get the following peak power:

0.003 V x 0.0000029 A = 0.0000000087 Watts/cm2

So, at source, the weak radio emission of a cubic centimeter of brain matter is well within the detectable limits of the satellite. We now need to project that into space and determine the signal

strength at orbital distances. To do this, we need to apply the inverse square law to the emission and the formula is provided in figure 2. So, the formula would be (disregarding gain):

(0.000087 Watts/m2) / (4PI x (500000m^2)) =

0.000087 / 3141592653589.7932384626433832795 =

2.7692960097989788423785774826817e-17 Watts/m2

This is fine, its somewhat larger than our baseline, but nothing that cannot be accounted for. Firstly, we need to identify the frequency range. As noted before, due to Maxwell's equations the motion of the action potential results in a changing electrical field. In turn, this results in a changing magnetic field and thus a free space radio wave.

Typical frequencies for an action potential are in the range of 0-500Hz which will result in free space waves in this range, known as the SLF and ELF Band. This somewhat matches up with experimental evidence that shows humans do broadcast signals on the ELF band. This scientific paper and others show that SLF/ELF reception gear and antennas are of a practical form factor to be placed upon a satellite. An array of such satellites (see figure 3) would use the principle of aperture synthesis to create a type of space-born Very Large Array.

Given that the Ohio State's radio telescope had a sensitivity, in 1977, of 2 ×10^-22 W m-2 per channel and the VLA is described as being 100 times as sensitive, any signals we are producing could be heard loud-and-clear by a space-borne array. This arrangement would provide for a very high resolution of brain activity.

What's more, the development time line for this technology places the capability to detect brainwaves as far back as the early 1970's. Given an average lifespan for a satellite as 5 years, with an initial deployment during 1970, the satellite technology would be in its 8th generation today.

So, we can detect the signals but now it must be processed.

Information Overload

There is a significant difference between detecting a signal, or signal range, and being able to process that information and make sense of it. To do this, we need to find unique patterns in a signal that would allow us to isolate individuals and isolate neural activity we can categorize.

The three main characteristics of a wave are its amplitude, frequency and phase. To be able to detect a single person, in a crowd for example, we need to find something unique about the waves they are emanating. This allows us to eliminate the noise and only have information regarding a single person. There are a number of ways this can be achieved. In a satellite array, examining the timing of signals received across the array, on a given frequency range, will provide you with both the location (in 3D) and the coding of the neuron structure. From this, the function of the cluster can be inferred by comparison with generalizable signals in a database.

A cluster of neurons will broadcast across a given range of frequencies, slightly out of phase and with slight variation in amplitude. The characteristics are dictated to by the rate of neuronal firing, the timing of neuronal firing and the amount of energy in the neuron at the time. Given that neurons are biological and the unique structure of a cluster, the statistical likelihood of the wave characteristics being identical between different people would be quite low. Thus, from a technical viewpoint, pattern analysis lies at the heart of the development of a lexicon.

Now, we have our signals, we know what they mean, all that's left is to scale the process up, allowing us to track thousands of targets in real-time. The only real limit here is processing horse power and satellites.

Conclusion

In answer to our original question, it is technically possible for a satellite to detect your thoughts, your emotions and your perceptions and pass that information to a computer for interpretation. I bet that comes as quite a shock.

The only ever real restriction was the receiver sensitivity in the SLF/ELF band. The whole tinfoil hat brigade will be pleased, but will ultimately feel stupid as waves in the SLF/ELF band cannot be blocked by tinfoil hats. Even in the deepest tube stations, you would be heard perfectly from orbital distances.

Do you see the benefit to intelligence gathering?

So, given that it is technically possible, the questions now become which governments are using it and why was the public not informed?

There will be a lot of raised eyebrows in the world tonight.