

# Table for Electronic Dreams

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## **ABSTRACT**

Since the invention of radio by Nikola Tesla and Guglielmo Marconi in the late nineteenth century, the electromagnetic spectrum has become increasingly noisy and dense. We communicate through this invisible medium through our electronic devices—radios, cellphones, Wi-Fi, bluetooth, etc. but we do not have direct access to this medium or an awareness of its invisible contours and boundaries.

I have constructed a table which reveals the hidden electrical activity of electronic objects placed upon it. Through this interaction, people will develop a greater awareness of the invisible workings of their electronic devices and the limits of human perception.

## **DESCRIPTION**

### **Invisible Light and Hertzian Space**

When we talk about electromagnetic radiation, the concept sounds quite abstract. But actually it is a phenomenon with which we are very familiar, in the form of light and sometimes heat. Electromagnetic radiation is light, although we can only see a very narrow range of light with our eyes. Typically the human eye can see wavelengths of 380nm to 750nm. Our brains interpret these different wavelengths, or combinations of different wavelengths, as color. Our bodies are also able to sense some electromagnetic radiation as heat. There is no doubt that some electromagnetic

radiation is harmful to our bodies, such as X-rays and gamma rays which can cause burning or genetic mutations. It is also currently unknown whether low-frequency radiation from high-voltage power lines or cellphones cause harm to our bodies and to what degree.

Many artists and designers have explored the concept of electromagnetic fields, but the designers most closely associated with the concept are Anthony Dunne and Fiona Raby, who coined the phrase *hertzian space* as a way to describe the contours of electromagnetic fields in space. Dunne and Raby describe hertzian space as “radio space”, but encompassing the entire electromagnetic spectrum. More concisely, hertzian space could be considered the physical space of invisible light. Dunne and Raby stress that hertzian space, although invisible, is a real, physical space- although we only interact with it through our electronic devices. Cellphones, radio transmitter and remote controls influence and manipulate hertzian space. Usually we only become aware of this space when it fails us, such as when we must move in order to get cellphone reception, struggle to find a Wi-Fi network, adjust the antenna on a radio or television, or when a cellphone call interferes with a nearby speaker.

Dunne and Raby named hertzian space after physicist Heinrich Hertz, who in 1886 was the first to experimentally demonstrate the existence of these electromagnetic waves theorized by James Clerk Maxwell by developing a simple antenna transmitter and receiver. Hertz did not understand the practical importance of his experiments. He stated that, "It's of no use whatsoever[...] this is just an experiment that proves Maestro Maxwell was right - we just have these mysterious electromagnetic waves that we cannot see with the naked eye. But they are there." Asked about the ramifications of his discoveries, Hertz replied, "Nothing, I guess." [9] But Hertz's demonstration would shortly lead to the “wireless age” of radio pioneered by Nikola Tesla and Guglielmo Marconi, and later, technologies such as television, cellphones, Wi-Fi, Bluetooth and other forms of wireless telecommunication.

Dunne and Raby are interested in not only in revealing hertzian space, but also the legal, ethical and symbolic implications it holds; the use of such fields by ghost-hunters, paranormal investigators and spiritualists, their potential military and surveillance uses, and the fear and paranoia of health risks associated with

electromagnetic fields. Many of the early pioneers of telecommunications were interested in spiritualism and the possibility of communicating with ghosts through the luminiferous aether. Alexander Graham Bell's famous assistant Thomas A. Watson believed that some of the whistlers picked up by the early telephone were voices of ghosts, and Nicola Tesla believed he could receive communications from Martians.[1] All of these seemingly odd beliefs and associations surrounding electromagnetism show that it is not only an invisible physical space but also a strange mental site of imaginative fixations.

## **Perception**

*Although when we look at an electronic product we only see what is radiated at the frequency of visible light, all electronic objects are a form of radio. If our eyes could see (tune into) energy of a lower frequency these objects would not only appear different but their boundaries would extend much further into space, interpenetrating other objects considered discrete at the frequency of light.*

- Anthony Dunne, Hertzian Tales

We are familiar with the idea that other animals such as birds and insects see the world differently. It is believed that pigeons are pentachromatic, or possess five color receptors as opposed to our three. Bees are able to see shades of ultraviolet, sometimes called "bee purple", as well as see the polarization of light. Similarly, some species of fish, sharks, rays and platypuses possess a perceptive ability called electroreception, which allows them to sense changes in electric fields in their immediate vicinity. Sharks have the most sensitive electroreception, which it uses mainly for electrolocation; a way of locating nearby objects by sensing their electric fields. Some fish are able to generate modulated electric fields and use this as a form of communication known as electrocommunication. Some body modification enthusiasts have experimented with magnetic implants in an attempt to replicate electroreception. However, this technique only approximates this sense through tactile feedback.

Differences between human and other animals' abilities of perception underline the biological limitations of our bodies and the specific "humanness" of our experience of reality. As Dunne points out, were our perceptive sense constructed differently, our sense of other objects would be different. All of our experience is mediated through our senses. Our experience of hertzian space is mediated through our electronic devices. Through technology we are able to extend our senses, but generally our everyday phenomenological experiences are biologically situated. The increasing use of telecommunications technologies such as cellphones and Wi-Fi is leading to a greater awareness that we are living in a world where we are constantly surrounded by invisible energy. Table for Electronic Dreams gives us a sort of electroreceptive sense through another object, by translating some of the invisible electromagnetic spectrum into visible light.

## **Electronic Dreams**

*Electronic objects are not only "smart", they "dream" – in the sense that they leak radiation into the space and objects surrounding them, including our bodies. Despite the images of control and efficiency conveyed through a beige visual language of intelligibility and smartness, electronic objects... are irrational – or at least allow their thoughts to wander. Thinking of them in terms of dreaminess rather than smartness opens them to more interesting interpretations.*

- Anthony Dunne, Hertzian Tales

Dunne uses the metaphor of dreams for the electric fields produced by electronics. It represents an inefficiency, sloppiness and irrationality, in contrast to our typical views of electronics as "smart", predictable and self-contained. There is an indiscreetness and promiscuity about this leaky behavior.

We do not understand why we dream, but it seems to be necessary to our ability for thought. To help explain dreams, which on the surface might seem to be unnecessary and irrational, cultures explained them as meaningful: prophecy, pre-cognition, or omens. In modern times, Freud's interpretation of dreams was as wish-

fulfillment, or a symbolic route to the subconscious mind and repressed thought. Today a common explanation of dreams is that they have no real meaning, but are rather a side-effect, the result of “random” brain activity. Electronics create these fields as a side effect of the electricity running through them. Dreams seem to be a side effect of our waking thoughts. But while we only dream while asleep (unless "daydreaming"), electronic devices "dream" whenever they are "on". Perhaps a better analogy might be respiration, breath, circulation or thought.

At the beginning of *Interpretation of Dreams*, Freud discusses the understanding of dreams from the time of antiquity.

The dream is defined as the psychic activity of the sleeper, inasmuch as he is asleep. Aristotle was acquainted with some of the characteristics of the dream-life; for example, he knew that a dream converts the slight sensations perceived in sleep into intense sensations ("one imagines that one is walking through fire, and feels hot, if this or that part of the body becomes only quite slightly warm"), which led him to conclude that dreams might easily betray to the physician the first indications of an incipient physical change which escaped observation during the day.[4]

The father of medicine Hippocrates also discusses the relationship between dreams and disease. Freud and the ancients knew the importance of paying attention to dreams, and their ability to predict the future and amplify small sensations. Similarly, Table for Electronic Dreams amplifies the natural phenomenon of electromagnetic fields, and interprets them by translating them into the visible spectrum.

Freud believed that dreams represented the expression of repressed ideas: “The psychic energy accumulated during the day by inhibition or suppression becomes the mainspring of the dream at night. In dreams psychically suppressed material achieves expression.”[4] Perhaps our inability to see hertzian space is our repression of the dreams of electronic objects. There is a disconnect between the voice we hear over a cellphone and the raw medium which the cellphone uses to transmit sound- the two are not analogous. Table for Electronic Dreams allows these hidden dreams to become visibly apparent.

Just as electronic devices produce electromagnetic fields while in use, so do our brains. Magnetoencephalography (MEG) is a neural imaging technique used to measure the magnetic fields produced by electrical activity in the brain via extremely sensitive devices such as superconducting quantum interference devices (SQUIDs). MEGs are used both for clinical and research purposes. We examine the electrical fields produced by the brain in order to try to understand what the brain is doing and how it works. Electrical engineers might know exactly how a cellphone works, but this information is not typically available to the common cellphone user.

When electronic objects interfere with one another, such as when a “GSM buzz” is picked up by loudspeakers, something awkward and messy happens. We see a fragility and messiness in the hidden “sounds” produced by the cellphone, and the way these devices affect one another and interfere with each other’s normal functioning. We become cognizant of the electronic device’s invisible extension through space. But what if there was an object designed to be interfered with, one that invited exactly this sort of enmeshing of invisible fields?

## **Reference Works**

I have been interested in human perception and its limits since reading Plato's *Allegory of the Cave* when I was a student in high school. I was excited by this metaphor on the limits of human perception regarding true physical reality. It was only recently that scientists discovered that there exists a form of energy called electromagnetism, and that it is the same as light. Only a thin band of light is visible to our eyes. Despite all of the progress we have made in science, our understanding of the universe remains very limited. I want to underline this brute fact. I wanted to create something that would let us see the electromagnetic fields constantly surrounding us, which we cannot see.



*cellphonedisco*, Ursula Lavrencic & Auke Touwslager

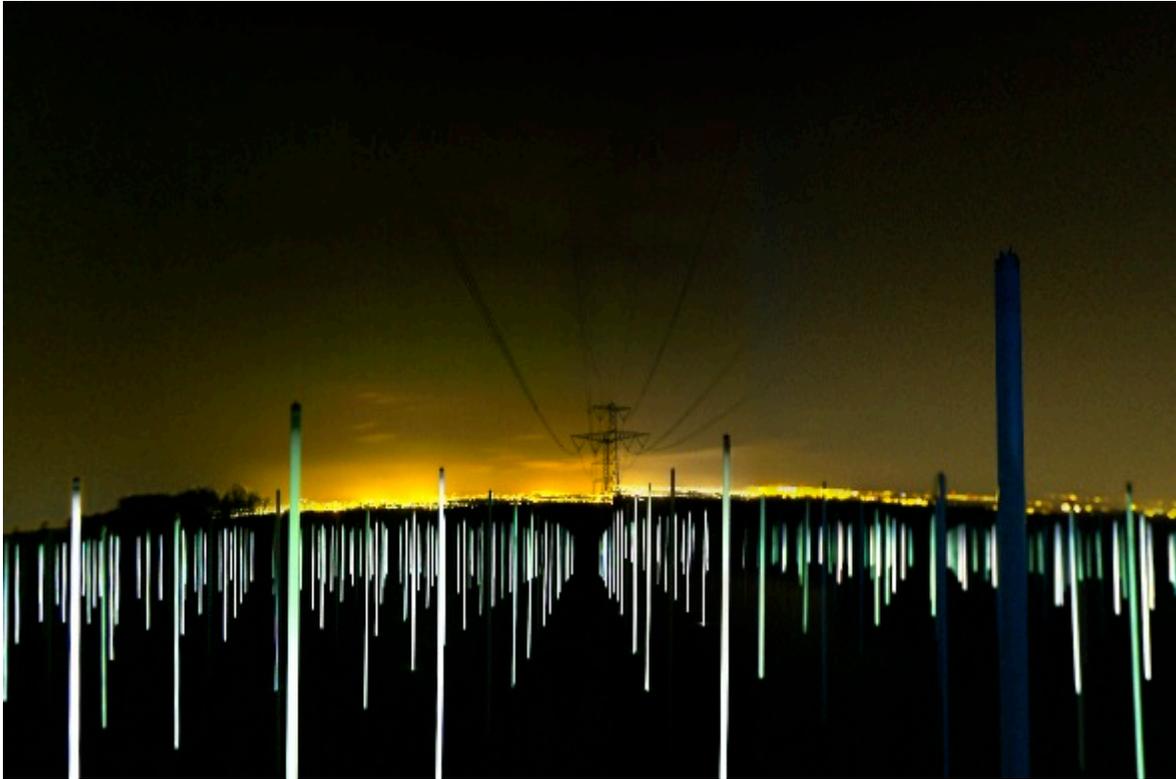
Ursula Lavrencic and Auke Touwslager created a project called *cellphonedisco*. Lavrencic and Touwslager bought thousands of “cellphone charms” and created a surface out of them. These charms light up when a cellphone is in use nearby, normally attaching to the cellphone by a lanyard. Simply by using a large quantity of this low-tech, off-the-shelf technology, they were able to reveal a hidden quality of the cellphone, something which is ubiquitous in our lives.

*Cellphonedisco* uses electronics to create a physical visualization of something existing in space. This physical mapping is done by having a sensor and output very close together. Ideally, as in *cellphonedisco*, these can exist as the same object. At the very least, the sensor and output devices need to be physically very close together. Another project which has done this is *Sky Ear* by Usman Haque, which consists of many helium balloons containing gaussmeters and color LEDs, revealing the presence of Wi-Fi, cellphone transmissions, radio and natural whistlers when released over a cities such as London and Berlin. *Sky Ear* also shows that such a mapping need not exist in an ordered grid; because each unit works independently, the units can function in a disordered cloud.



*Compass Table, Anthony Dunne & Fiona Raby*

Dunne and Raby have created a very clever, non-electronic way of creating this mapping with their Compass Table; essentially a simple wooden table with a grid of 25 compasses embedded in the table's surface. The compasses spin and move around in the presence of electromagnetic fields, but also remind us that the earth is a giant magnet by all pointing in a straight line no matter how the table is oriented.



*Field*, Richard Box

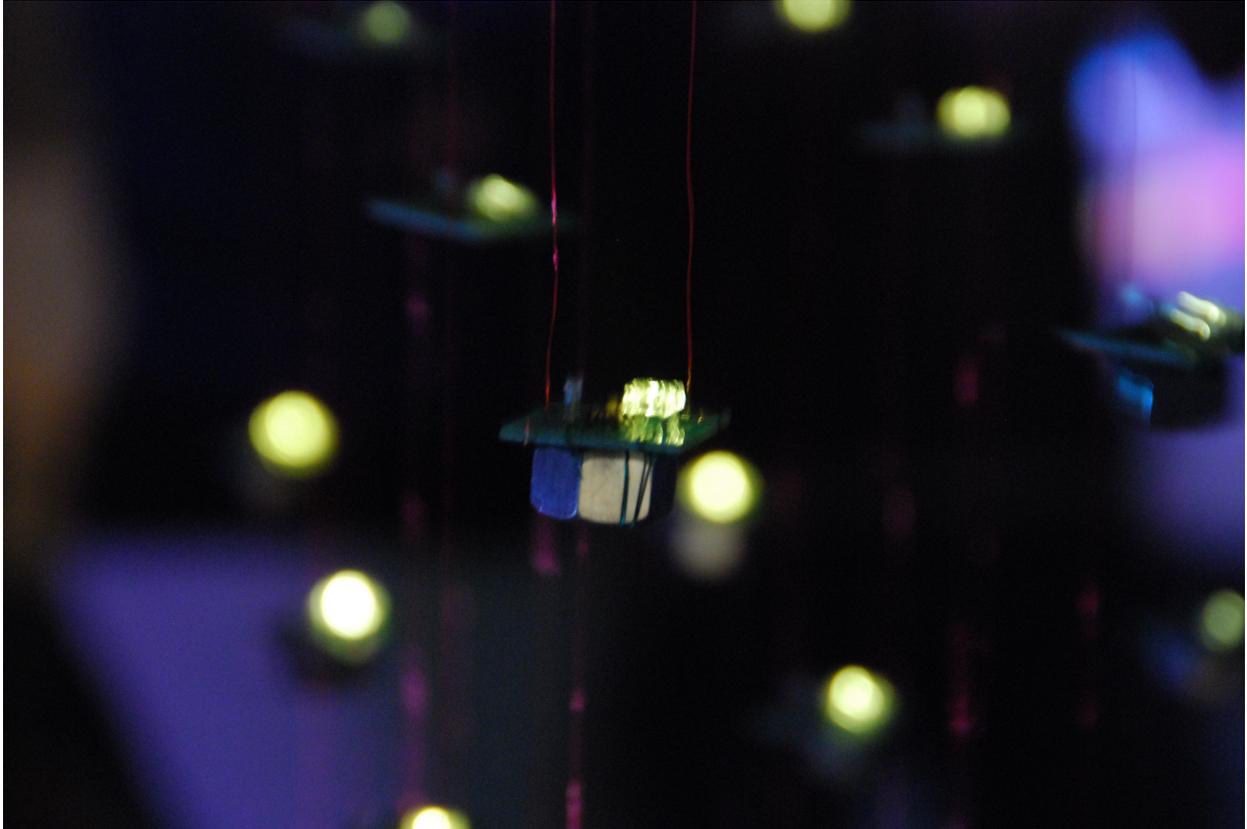
A very clever example of this physical mapping is a project by Richard Box called *Field*, which consisted of hundreds of fluorescent tubes embedded in the ground in a field near Bath, England under high-voltage power lines, all lit up from the electromagnetic field generated by the power lines. Box uses a simple property of fluorescent tubes; that they will light up in the presence of strong electric fields. Not only does it create a physical mapping of hertzian space, but the property of the fluorescents tubes to receive power wirelessly is also their ability of detection.

All of these artworks reveal some part of hertzian space using a series of identical units consisting of a sensor and output. This is not the only approach to revealing hertzian space- Christina Kubisch's *Electrical Walks* express electromagnetic fields sonic qualities through special headphones. The form of a table became attractive to me because it is a familiar object, and the table surface is likely location to place electronic objects. This solved certain problems such as finding very sensitive sensors for electromagnetic fields and creating a natural interaction with an object.

## **Previous Works**

One of my first projects investigating hertzian space using this physical mapping in space was Electronic Copy (Infrared Detector Cloud). I designed many small circuit boards, each containing only an infrared phototransistor and warm white LED (light emitting diode). The more infrared light received by the phototransistor, the brighter the LED would glow. This simple circuit translated infrared light into visible light. I organized 130 of these circuits into a spherical grid. My intention was to place a small tea candle in the center, the flickering of which would be mirrored by the circuits. Warm white LEDs approximate the color of light from the sun. An infrared filter would be placed around the tea candle to block the visible candlelight, but still allowing infrared light to pass through and “copied” by the LEDs.

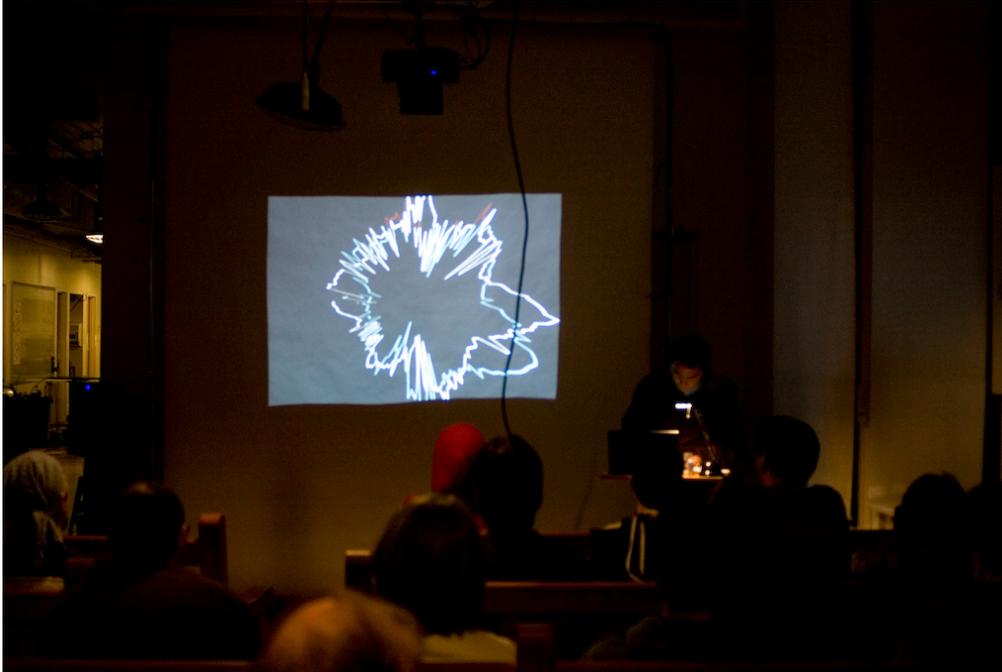
When I exhibited Electronic Copy at the 2007 Interactive Telecommunications Program Winter Show and told visitors that it responded to infrared light, many people immediately took out their cellphones, believing that the sculpture would respond to infrared light emitted by their cellphones. Cellphones don't emit much energy in the infrared range, so the sculpture wouldn't react. I thought this was an interesting response, because it showed me that there is a lack of understanding about invisible light, and that people want something which will reveal the invisible radiation from their cellphones.



*Electronic Copy (Infrared Detector Cloud)*, Andrew Doro & Rory Nugent

Another project I was working on around the same time was an audio-visual performance exploring the sonic qualities of electronic objects. In this performance I used Max/MSP/Jitter to sample and loop sounds generated from a telephone pickup, while the visuals were a rotating white circle distorted by the sound. I felt that there was a strong emotional response to these machine noises, and that different electronic devices emit very specific aural personalities, depending especially on their use; for example, when a cellphone is involved in a call or not, or a digital camera taking a photograph.

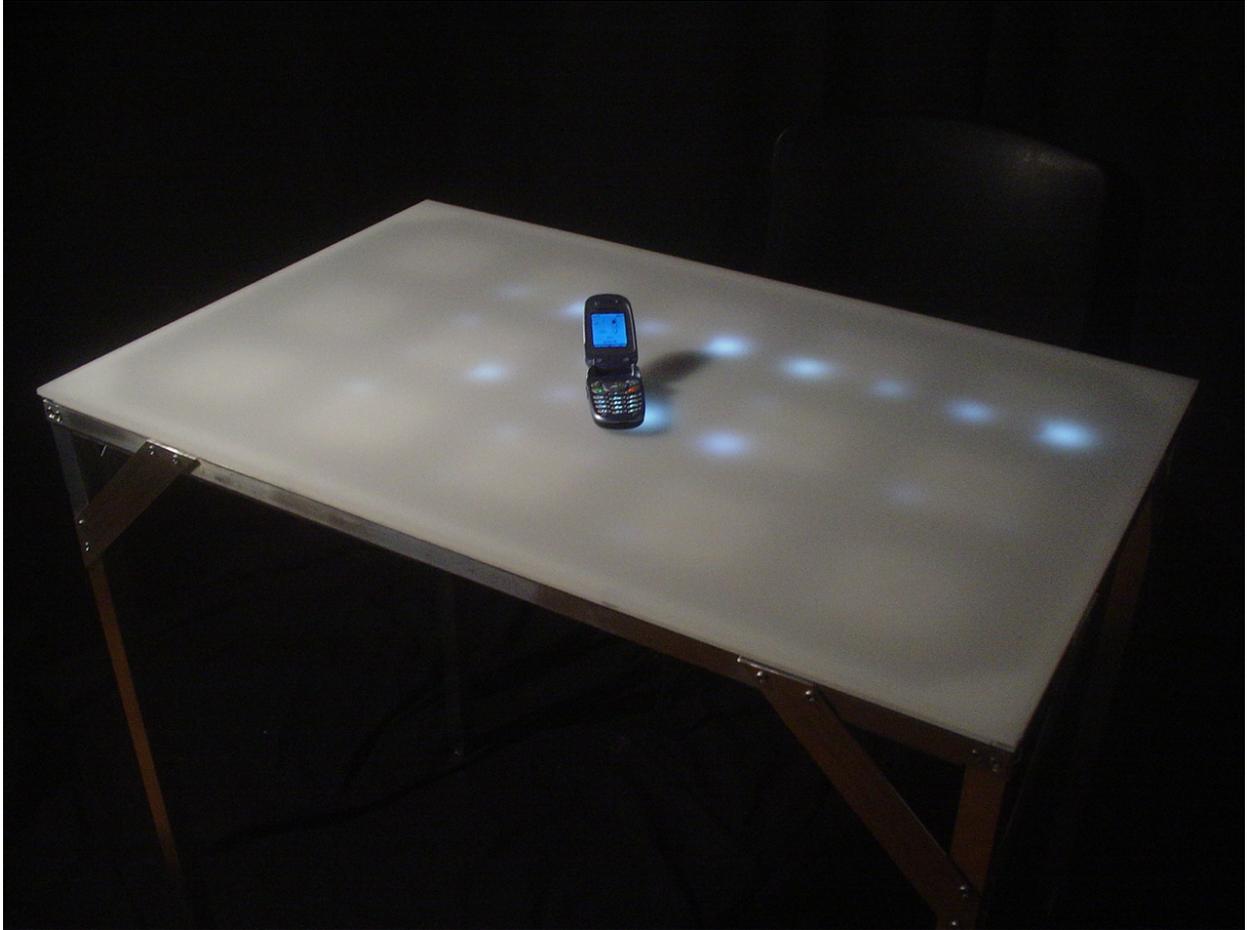
Table for Electronic Dreams in many ways is a synthesis of these two projects, to the extent that it uses telephone pickups in order to respond to low-frequency electromagnetism emitted by electronics, and involves a physical mapping using analog circuitry on a grid of printed circuit boards.



*Statik*, Andrew Doro

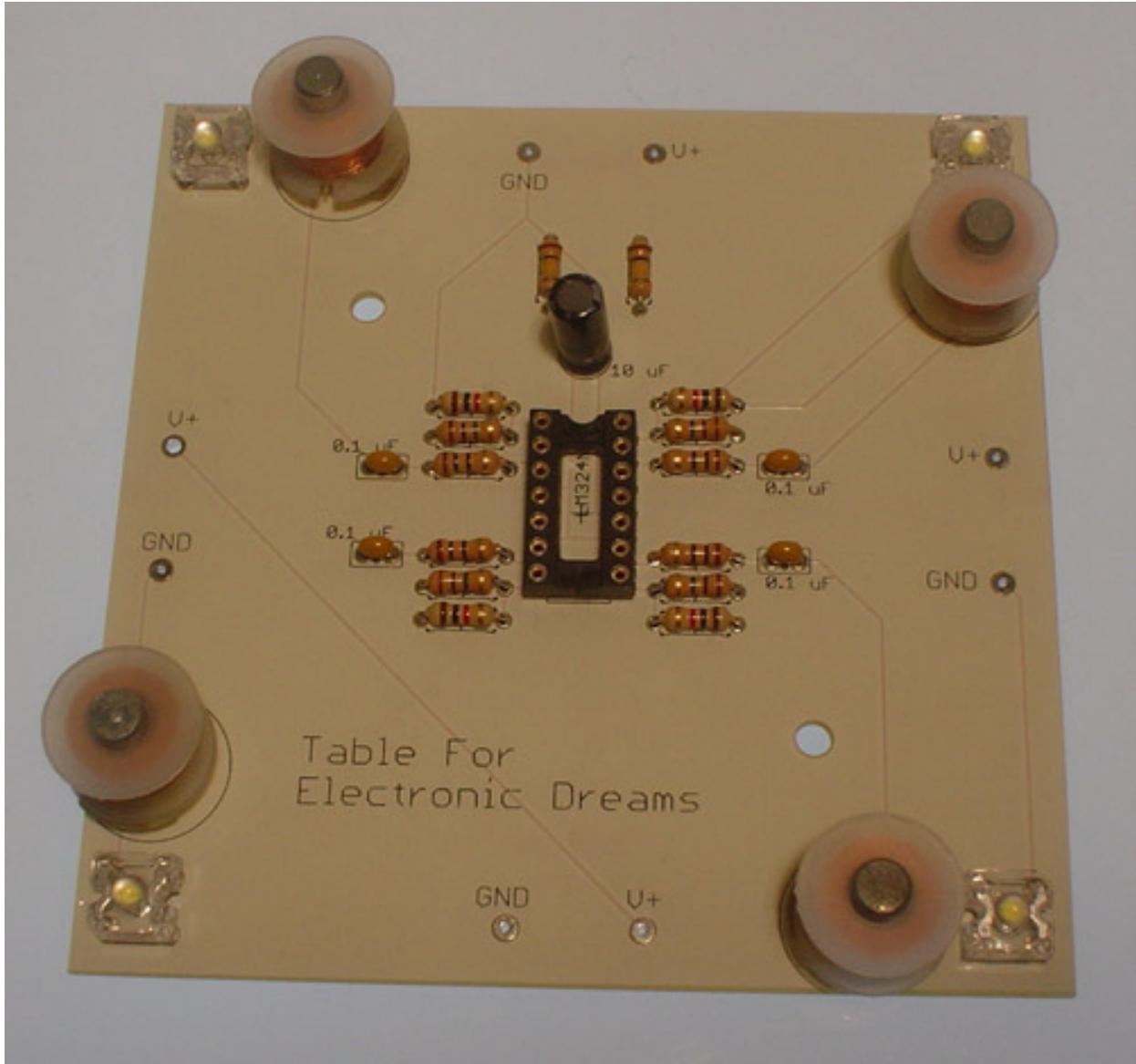
## **Design**

Table for Electronic Dreams is designed to be a work desk for laptops and other electronic devices. The table surface is 33 by 21 inches, and the table is a standard height 30 inches high. The table contains a grid of circuits which detect electromagnetic activity through induction coils. The circuits are mounted to a sheet of transparent acrylic, and hidden underneath a surface of translucent matte white acrylic, which prevents the circuits from being seen while transmitting light. This top layer of white acrylic is removable, resting on eight vinyl bumpers. A power jack is installed in one of the table legs, allowing it to be powered with a direct current transformer.



*Table for Electronic Dreams*

Each circuit consists of an induction coil connected to an operational amplifier (op amp), which amplifies the detected signal. The amplified signal powers a high-flux white LED. There are 60 identical circuits in a 6 by 10 arrangement with each LED three inches apart. The 60 circuits are contained on 15 identical printed circuit boards each containing 4 induction coils, 4 LEDs, and 4 op amps in a single integrated circuit (IC). I made a conscious decision to use only analog electronics, without any micro-controller. Using analog electronics for me is a way of being true to materials. A micro-controller destroys that with analog to digital conversion and introduces a kind of artificiality. With analog electronics computations are made on the level of the electrical properties of the materials.



A single circuit board from *Table for Electronic Dreams*

The frame of the table is constructed out of aluminum. This allows for a metallic, electronic-looking table which is thin and sturdy. In terms of design the table references popular contemporary devices such as the iPod, with its signature chromophobic combination of white plastic and shiny metal.

## CONCLUSIONS

Table for Electronic Dreams is not really designed to be a “useful” object. Although it is designed to look roughly like a work desk, its electronic element does not really contribute to “work” or productivity. Rather, it provides an aesthetic experience. Perhaps it could be thought of as a work desk contra work.

I have tried to think of possible ways in which this table is “useful”: (1) alerts user to cellphone ringing a few seconds before phone actually rings. (2) alerts user visually to cellphone on silent mode. (2) alerts user to electronic device activity which would otherwise be invisible or difficult to detect. (3) warning of possibly deleterious electric fields. (4) alerts user to electrical energy usage and wastage, e.g. from “wall warts” and power adaptors. In creating this work I did not intend to make a judgment about the possible damaging effects of electromagnetism or provoke paranoia. It is up to viewer to interpret what this table is revealing.

Table for Electronic Dreams is not designed as a useful product with a specific function in mind which would force a specific interpretation; as with Dunne and Raby’s post-optimal objects, it is an object which fosters encounters with aesthetic spaces which exist beyond our everyday perception.[3] The Table is a portal between the spaces of the visible and invisible electromagnetic spectrum.

I hope to promote the idea that quotidian objects, such as a table, can be used as informational displays which will subtly change our relationship with our electronic devices, by revealing their hidden auras of activity. The activities of electronic devices are normally invisible to us. By revealing electronic devices’ hidden mechanisms, perhaps we can develop a more intimate relationship with these devices. This use of objects or architecture as informational surfaces has been called *softspace interfaces* by Usman Haque and *augmented spaces* by Lev Manovich. Haque applies computer terms of hardware and software to architecture, drawing analogies between *hardspace*- “physical, static elements that make up our environments and enclose us, like walls, roofs and floors” and the “ephemeral qualities of architecture including smell, sound, light, heat and electromagnetic fields.” [6]

Our electronic devices are personal. Our laptops, cellphones and iPods, are intimately enmeshed with our lives because they contain our data; emails, call logs, text messages, photographs. But our personal electronic devices each have hidden personalities. The very astute among us can listen to the sound of our hard drive spinning up, which signals data being written or read from the drive. But generally the electronic behavior of our electronic devices is invisible to us. Table for Electronic Dreams reveals these invisible actions and hidden personalities.

Different electronic objects and even different models of cellphones exhibit very different characteristics when brought near the table, creating different moving patterns of light. The interaction is very open-ended because a wide-variety of devices can be brought to the table and experimented with, creating unexpected reactions.

Microsoft's Surface, a new "table" computer, allows users to use a table surface as an interface to exchange information between devices. Table for Electronic Dreams offers a different use of a technological table, something subtler and not as bombastic. By using the simple properties of analog electronics, users are given an enhanced understanding of their everyday devices and the universe in which they inhabit.

## **User Reactions**

Table for Electronic Dreams was left on the floor of the Interactive Telecommunications Program for two weeks for people to use. A short questionnaire was left nearby asking the following questions:

Would you use this table? Why or why not?

Where would you want to use it? Where do you picture it?

Does this table make you think differently?

Does this table change how you think about electric fields?

Can you think of any practical uses for this table?

What do you think of the title of this project (Table for Electronic Dreams)?

Can you think of another name for this project?

Do you have any other comments?

Many respondents wrote that they would like to use the table at home as a desk or coffee table, although many also pictured it in a public setting, such as a bar or cafe. One respondent wrote that she would like to use the table at work “to distract [her] from tedium,” while others felt that the flashing lights would be too “distracting in a study or work situation.” In a bar or night club setting the table could provide interactive lighting or alert patrons of incoming cellular calls that they might not otherwise hear. Most respondents felt that the artistic or recreational uses were more interesting than practical uses. Others suggested that the form could be different, such as a textile or tile for walls and other surfaces.

### **Future Directions**

By design the circuitry in Table for Electronic Dreams is infinitely expandable. For this reason it has applications in interactive architecture. The circuitry could be built into a wall, ceiling or floor, making visible electrical wiring or coaxial cable as well as other more temporary electromagnetic fields. The form does not need to exist as a flat grid either; three-dimensional forms could be explored, or even wearable versions which could be built into a shirt or dress.

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