ætherspace

nick knouf

1. introduction and background

From a certain point of view our perception of the world is rather limited. While the richness of our experience is deep, varied, and unique from other living beings, there are definite physical limits to our natural abilities. For example, the human retina is limited to viewing electromagnetic (EM) radiation of wavelengths from only around $4*10^{-7}$m to $7.5*10^{-7}$m. Yet the entire spectrum reaches from tens of meters to angstroms and below. This leaves many orders of magnitudes unperceived; used, definitely, through various modern technologies, like cell phones, radio, and television, but experienced directly, no.

It may seem nonsensical to ask questions like: What does this radiation look like? What does it *sound* like? Yet these are the very questions the *ætherspace* project aims to address. In what ways can we explore these invisible waves? The ultimate effects of the waves influence our lives so, yet our visualization and visceral understanding lags way behind.

The book *Design Noir*[*DunneRaby2001*] introduces the concept of "hertzian space", the "dreams of electronic objects" that create a "new, invisible but physical environment". Our body does not have transducers for electromagnetic waves; instead, we have to use other objects, like mobiles and radios, to pick up the effects of these EM waves. Because of this, hertzian space has a special aura about it: it's invisible, thus it's not understandable.

With *ætherspace* I would like to make hertzian space audible, make the invisible sonic. Briefly, wearable transducers/antennae would pick up the various components of hertzian space as the user walked around in the city, home, or workplace. These components feed to a scaling algorithm that would bring the range of hertzian space to that of normal hearing. Finally, the results of the scaling algorithm would feed headphones on the user. The user would then have a sonic representation of the invisible æther.

Other projects have examined related areas. For example, *Sonic Cities*[1] used various types of wearable sensors to give participants a real-time electronic music stream based on their surroundings. *Fashion Victims*[2] made the usage of mobiles visible in handbags by causing the bag to "bleed" every time a mobile was used in the vicinity.

This project will raise as many questions as it may answer. What does a cell phone sound like when it is idle in a bag? What do dangerous EM waves, like high energy gamma waves, sound like? Should the scaling algorithm take into account the perceived danger of certain types of EM radiation, *e.g.*, make gamma waves a high-pitched screeching noise? If so, how would this change our interaction with space? What about infrared (heat)? Since humans give off much heat, should the scaling algorithm make infrared radiation sound pleasing? Would such a mapping cause us to desire interaction with strangers?

2. usage scenarios

2.1. Gerhard—the absorber

Gerhard puts on the ætherspace collar before leaving home. He’s going to be going downtown this afternoon and wants to take in the full EM spectrum. The ætherspace collar is set to "sonorous"; since Gerhard is not bothered by EM radiation, the usual settings that warn him of gamma waves and excessive mobile phone radiation would only be an annoyance. He’s quite interested in hearing the crowds. Also, perhaps there’ll be an æther tag or two: a special location, discovered by other ætherspace users, that’ll sound especially wonderful.

Gerhard adjusts the front and back antennae, the collar thus settling nicely over his tank-top. With the volume set he walks down his front steps, entering a unique sonic experience.

2.2. Julia—the avoider

Julia pulls down the copper shades and looks at the dial; EM radiation, minimal. Then why does her skin still tingle? She looks around the room and notices a stray mobile. Jeez! One of her friends from the party last night must have left it behind. Julia quickly places it in the Faraday cage, her skin returning to normalcy.

Before leaving the house she dons the ætherspace collar. Trips outside always meant an ordeal of dodging centers of EM waves; it might be a home with four TVs or an electronics research centre. In any event, it would make Julia sick. But with ætherspace Julia was able to hear the radiation before she saw it. While it didn’t plan out the proper route for her, it did give her a "heads up" that something was amiss ahead, allowing her time to change her path to prevent undue suffering.

3. implementation thoughts

Ideal implementation of ætherspace would be a multi-faceted process.

I would like to do basic user research/ethnographic studies beforehand to ask users what they imagine EM waves to sound like. What is the sound of radio waves? How about the heat from humans? These types of questions (with obviously no correct answers) would inform the later scaling algorithm. Such interviews would also help gage people’s thoughts about EM radiation: are they afraid of it? If it were made audible, would this change their relationship to hertzian space? Other studies could include investigations of areas with high amounts of EM radiation to inform places for later testing of *ætherspace*

I envision the main component of *ætherspace* to be a wearable computing device, most likely embodied as a collar (given the time of year of this project). I would need to research the size, shape, and configuration of different types of antennae, *e.g.*, what is the best to pick up radio waves? Mobile phone radiation? These antennae could become components of a wearable shirt, if needed. The collar would also contain infrared sensors to pick-up the heat of nearby people.

The output of each EM wave transducer would feed into a microcontroller. A predetermined scaling algorithm would bring the frequency of the transduced wave into that of normal hearing range. The combined result, over all transducers, would then feed headphones worn by the participant. Alternatively, the result could be saved for later listening.

Ideally, no changes to the transducer output other than scaling would be done. However, I know that it might be necessary to do some processing on the data in order for semi-pleasing sounds to be made. Initially, I would like to keep data processing to a minimum in order to hear hertzian space as naturally as possible.

ætherspace presents a number of technical challenges. What is the best way to design transducers for a wearable computing garment? What sampling rate limits of microcontrollers am I going to face when I want to sample from various types of EM waves? Can I perform the audio conversion without resorting to a laptop? (*Sonic Cities*[1] required the use of a laptop with PureData installed for its real-time electronic music creations.) Other technical challenges are apt to appear as the project progresses.

Once a working prototype exists, the second stage of user research/ethnographic research begins. I want to test *ætherspace* on two groups: those that I interviewed before the project, as well as naïve users. I want to know how they experience the world with *ætherspace*: does it change their perception of hertzian space? Are they more aware of gadgets that emit EM radiation? Does this worry them?

Long-term implementation goals include user-modifiable scaling algorithms and more wide-spread adoption.

Bibliography

[DunneRaby2001] Anthony Dunne and Fiona Raby, 2001, 3-7643-6566-8, Birkhäuser, *Design Noir: The Secret Life of Electronic Objects*.

Notes

1. Sonic Cities (http://www.tii.se/reform/projects/pps/soniccity/index.html)
2. Fashion Victims (http://www.fashionvictims.org/)