I used to wish I was superman. Not so that I could have super strength, or heat vision, or even the ability to fly. I wanted to be Superman so that I wouldn’t have to go to school.

In my 12-year-old eyes, the most impressive of all of Superman’s abilities was that he was able to learn an entire planet’s worth of knowledge while floating from Krypton to Earth in his space pod. Baby Superman passively learned everything about his home planet from a voice assistant, whereas I had to go to school for 7 hours a day. What an outrage!

Ever since my initial frustration of not being able to learn passively, I have been obsessed with extracting patterns from the natural world and making them simple to understand. I believe that data should be presented in such an intuitive way that it can be learned almost passively (although completely passive understanding is likely impossible). Why should I be forced to read a musical score, note by note, when I can just listen to a song instead? Similarly, why should I have to learn a bunch of complicated equations about electromagnetism when I could just sense electromagnetic phenomena instead?

When I try to think of the gold standard of data mapping—a mapping that feels intuitive and “passive” to my brain—I think of music. When I listen to music, I can recognize if the tempo of a song has changed or if a note is out of key. Consider how much more focus is required in order to read sheet music as opposed to the focus required to listen to a song. Despite the fact that a song is easier to listen to than a score is to read, both formats contain the exact same amount of encoded information.

If we think of a single note as a bit, we can think of the written musical score as “raw information,” and the sound created when the score is played as “mapped information.”

In many modern information processing scenarios, people are required to “read the musical score” (process raw information) as opposed to “listen to the music” (process conveniently mapped information). Instead of processing raw information, wouldn’t it be nicer to have a device, similar to a mechanical player piano, that maps information streams into forms that are easy for the human brain to process?

In the case of the Buzz AC field detector, my goal from the start has been to make processing information about electromagnetic phenomena as intuitive as listening to music. The goal is straightforward, but the execution is complicated. To begin with, it is hard to identify which types of mappings are easy for the brain to “make sense” of. I personally believe that the clearest way to absorb passive information through the skin is through outlier selection in the time domain. In layman's terms, I believe that changes in tempo and frequency are easy for the brain to understand through the skin.

Based on the concept of encoding information through frequency and tempo, I have designed the Buzz AC field detector to map electromagnetic signals into beat frequencies. Similar to how a pendulum of length L will oscillate with a natural frequency and period, motors 1, 2, and 3 are coded such that they process signals with their own natural frequencies and periods. The input electromagnetic field data signal also oscillates at a frequency, but its frequency can change. Usually the electromagnetic field data signal oscillates at 60Hz, corresponding to the AC frequency of the electric grid. Based on the difference between the natural frequency of motor 1, 2, or 3 and the frequency of the EM field data, a beat frequency is created.

For example, say the natural frequency of motor 1 is set at 62Hz, the natural frequency of motor 2 is set at 60.1Hz, the natural frequency of motor 3 is set at 57Hz, and the frequency of the EM field data is 60Hz. Motor 1 will pulse with a beat of 2Hz, motor 2 will pulse with a beat of .1Hz, and motor 3 will pulse with a beat of 3Hz. In the scenario described above, a user wearing the Buzz AC field detector should be able to identify the frequency, strength, and modes of the EM field by feeling the beats created by frequency differences between the natural motor frequency and the EM field frequency. As the EM field frequency changes from something like 60Hz to 60.5Hz, the user should feel motor 1 go from pulsing 2 times per second, to pulsing 1.5 times per second. They should also feel motor 2 go from pulsing 0.1 times per second to pulsing 0.4 times per second, and motor 3 go from pulsing 3 times per second to pulsing 3.5 times per second. Based on these changes, a user should intuitively be able to feel that the EM field frequency has changed, how much it has changed, and in what direction it has changed.

The motor vibration also changes in accordance to the amplitude of the EM field signal, which changes in accordance to the proximity of the sensor to the EM signal. For example, if a user is a few feet away from a 60Hz signal, they should feel motors 1, 2, and 3 each pulsing at a certain frequency. As the user gets closer to the 60Hz signal, the amplitude (intensity) of each motor’s vibration should increase, but the beat frequency should not change.

Buzz AC field detector users should be able to feel if one EM field signal is oscillating at a higher frequency or amplitude than another, but they will not know the exact numerical values associated with the frequency and amplitude of the signal. This is similar to how a normal Buzz user can feel that one note is at a higher pitch than another, or louder than another, but cannot know the exact numerical values associated with the note’s volume and tone. In both cases, all that matters is that the motors consistently map data relative to a certain structure.

Ok, so why go through all of this trouble? Can’t you just turn everything into Morse code and send it through Buzz? In theory, this might be possible. The problem is that it takes a lot of attention to understand Morse code. It may be true that after many years of “listening” to Morse code it would become just as easy to understand as English. However, even if this were true, it is still hard to listen to someone speak English when you aren’t paying attention. I would argue that it is much easier to tap your foot to the beat of a song while you read a book than it is to listen to someone talk while you read a book. Following this analogy, a Buzz AC field detector user would be unable to read a book while “listening” to Morse code through Buzz, but would be able to read a book while absorbing frequency beats through Buzz.