Juliana Cherston
Final Project: Awareness
May, 2018

Project Links

Dropbox Direct Links For Quicker Access:

Mac
Windows 32 Bit
Windows 64 Bit

Or Github Repo (Longterm Home)

1. Download entire zip file
2. Unzip file
3. Right click and select 'open' (important to right click)
4. Apple/Windows will display a warning message that the app is from an unidentified developer (me). Select 'open' anyway
5. In Windows, application is located in \application.windows64\application.windows64

Instructions

1. Slide heartbeat signal vs. Boeing stock data slider (upper right) back and forth to see a heartbeat buried in high-amplitude stock data

2. Click ‘Audio toggle’ to hear a sonified representation of this effect, where sonified stock data buries the sound of the heart

3. **Press space bar** to trigger an ‘impulse’, which charges up a capacitor. The capacitor’s charge state determines the mixing ratio for the heartbeat and stock data and audio.

4. Adjust resistor slider (lower right) to change the charge rate of the emotional capacitor. A higher resistor value will result in slower charge rate and reduced peak voltage achieved for the given impulse

Rapidfire Writeup

1. Self Portrait

When I reflect inwardly, I see within me a whimsical, spontaneous, and fun-loving personality. I feel attuned to the inherent absurdity of existence and nevertheless compelled to contribute to humanity's understanding of reality. "I am onto you, universe! Armed with the will to remain conscious of your existence while you laugh at mine." (-high school me).

But outwardly, I feel tension. My spontaneous and emotionally charged nature interfere with my wellbeing on a day-to-day basis, and so over the last few years I have been deeply determined to add more structure, regiment, and accountability to my life, all principles that are, at face value, antithetical to my core values. So, to make these adjustments effectively, I need to develop a working model for how my emotions operate, and I need to meditate on which aspects are deep-rooted elements of my identity and which are harmful bugs caught in my mischievous college days.

Emotions as Electrical Signals

"Lost in the noise", "emotionally charged", "impulses".... It's no coincidence that a lot of the language we use to describe emotion derives from signal processing.

Humans have evolved to seek pattern and sense in chaos. In this spirit, I have regularly observed that my emotions can be treated as signals acted upon by external stimuli. This project is about applying basic concepts in circuits and signal processing to create a model that provides insight on how my state of mind is determined. By identifying underlying mechanisms driving my emotional emotional state, I'll be able to evolve my 'thought-labeling meditations' to 'trend-labeling meditations', and thus meditate with more temporal resolution, even while remaining in the moment.

Project Theme 1: Getting Lost in the Noise

High amplitude noise needs to be quieted before I can actually experience pleasure and engagement from low amplitude sources. Pictured below is a heartbeat signal hidden within Boeing stock trend data. I could just as well have hidden the sound of breathing in the sound of Go tiles placed on the gameboard, or the sound of my laughter hidden in the uproarious dialog of a stressful social situation. When a stimulus induces a high amplitude emotional response in me, my mind naturally renormalizes my sense of intensity, and it is temporarily impossible to experience subtle appreciation for weaker impulses.

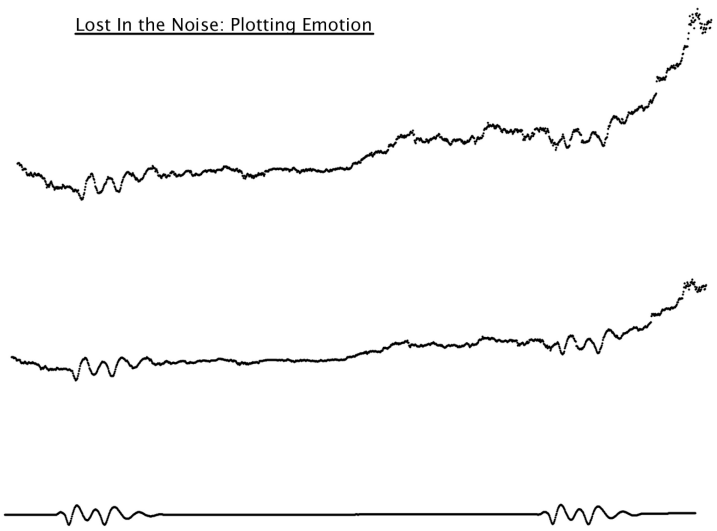

Fig 1. Heart beat buried in Boeing stock data

Project Theme 2: Emotional Impulse Response and Low Pass Filtering Of Stimulus

We are constantly bombarded with high-amplitude, short duration stimuli derived from both external and internal origin. Coincidentally, these short spikes are also called impulses in the world of signal processing, and the response of a signal to an impulse is called its impulse response. If we operate with a high reality-sampling rate, then a great many of these stimuli will affect our emotional state...but how?

From my experience, our emotional states do not precisely track the fluctuations in stimuli. Rather, I posit that each time I expose myself to a surge, I charge a figurative capacitor that models my heightened energy state in reaction to this impulse. And this capacitor takes time to charge, and then time to decay, even if the stimulus itself has disappeared, or proven to be unimportant.

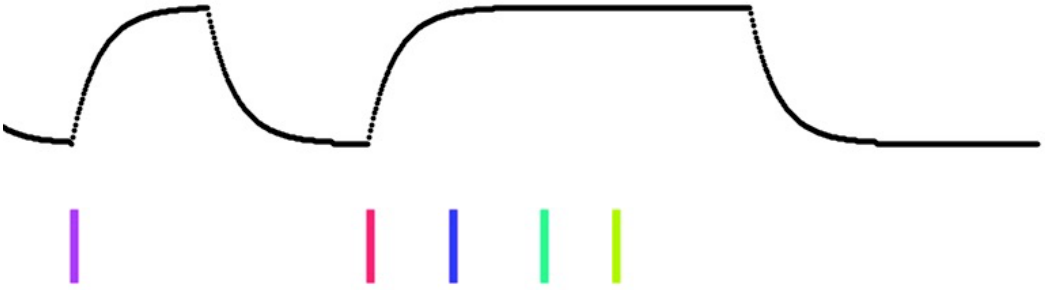

Fig 2.
Bottom: Sampled stimuli triggering capacitor charge
Top: Capacitor charge/discharge in response to sampled stimuli

I suspect there is biological justification for this effect - when emotionally charged, we release a surge of adrenaline or other chemical that must dissipate even if the initial stimulus has proven unwarranted.

Through awareness and deep meditation I can tune 3 variables dictating this capacitor's charge and discharge behavior:

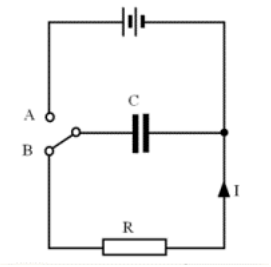

Fig 3:
(A) Capacitor charging (B) capactior discharging

(1) **Sampling Rate (Fs):** how often do stimuli even trigger an emotional capacitor charge cycle at all? I believe some people operate with low sampling rates in life. For example, recently my friend and I resolved to have an important conversation "soon". One week passed, and still no conversation. This then became a high-amplitude stimulus that has charged up my capacitor each time I sample it. Meanwhile, my friend operates with a lower sampling rate, and therefore a different notion of "soon". He remains level, and confident that the conversation will take place when it is right. His temporal reality is stretched relative to mine.

(2) **Resistor Value (R):** how quickly does my emotional capacitor charge or discharge? A high resistor value causes it to charge more slowly, and thus a narrow impulse may not manage to charge it up much at all. That is, the capacitor manages to filter out high frequency noise.

(3) Capacitor Value (C): In my simulation, I treat the circuit's capacitance as fixed, but I believe that it might also model how much we cling to emotional stimuli. If we store a lot energy from an impulse in a large capacitor, its energy will take longer to dissipate than if we operate with smaller capacitance.

Sometimes in life we wish to embrace the whimsical and spontaneous! For now I'm aiming to reduce my sampling rate and increase my R value, but in the much longer term I'd prefer a variable resistor with a separate control circuit for tuning my R value appropriately based on the nature of the stimulus.

Fig 4. (left) Low R value creates substantial emotional charging. (right) High R value creates a much smoother response

Project Theme 3: Emotional Capacitance: Why we Don't Always Feel Ourselves Recovering

As described in the previous section, my C value determined how much energy is required to be fully charged. But it turns out that my conscious mind does not have any notion of a "true" C value. Instead, if I am regularly fully charging C, or regularly only partially charging C, my sense of what "fully charged" means may change. To borrow more from signal processing, we 'renormalize' what fully charged means.

For example, I may not feel myself emotionally recovering from a breakup because my capacitance shrinks at the same rate as the objective emotional oscillations I am experience. My peak emotional swings remain at the same percentage of total capacitance, and thus I do not subjectively believe myself to be recovering. At low enough oscillation, my notion of "intense" starts to restore, and I am hit with a sudden realization of my substantial improvement.

This effect sometimes manifests in reverse when learning new skills.

Conclusion

Models like this one are not meant to replace vivid graphical or musical or written depictions of emotional state. I have long indulged in a hearty dose of depressed poetry or emotionally charged painting session. But unlike these forms of artistic expression, I find that modeling my emotions as signals helps me to interpret them with a simplicity that I never thought possible.

Perhaps "Emotions as Electrical Signals" would make for an interesting blog theme ... I've been looking for a good focus area for my new website!