

Compression as beauty and how the success of *The Dark Side of the Moon* hints at a computational brain.

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A speculative theory is proposed in this informal essay on how Pink Floyd's songs *Brain Damage* and *Eclipse*, from their seminal album *The Dark Side of the Moon*, are masterpieces of not only melody but data compression and how this becomes synonymous with beauty. A causal chain of high histamine, low serotonin, low brain working memory, OCD, and even marijuana use, is all shown to support the argument for the continued success of the album.

"And if there is no room upon the hill."

-- *Brain Damage* lyrics, Pink Floyd album *The Dark Side of the Moon* [1]

"It's a brief list compiled by a few people who've smoked marijuana in their lives.... We've tried to refrain from too many obvious choices – you don't need another reminder to listen to *Dark Side of the Moon* while high." [2]

"...subjective observer once he learns to predict or compress the data in a better way, thus making it subjectively simpler and more beautiful."

-- Jurgen Schmidhuber [3]

Might the success or popularity of a song be determined by its ease of storage in our brain's short term or working memory? Could a beautiful melody, thus, be synonymous with how optimized a song is for data compression? We can speculate that this is the case given the analysis of a use case involving Pink Floyd's final two songs (*Brain Damage* and *Eclipse*) on their album *The Dark Side of the Moon* and some assumptions. These assumptions include:

- Historical data shows the tremendous appeal of the album and its songs [4].
- There is a historical and cultural association with the album to marijuana use [2].
- Marijuana use helps to boost serotonin (akin to an act of "self-medicating") [5].
- Humans, more often than generally considered, find themselves in low serotonin states via stress, environmental causes like allergens that trigger histamine, or brain cycles [6].
- Low serotonin indicates impact to working memory and OCD behaviors [7].

From these assumptions we may conclude that:

- 1) A melody that can "fit" into a smaller working memory in the brain would be more likely to be recalled and, thus, obsessed over during periods of low serotonin.
- 2) Melodies that involve optimized compression of data are more likely to fit into working memory and, thus, are preferred melodies or considered beautiful [3].

Assumptions

Pink Floyd's 1973 album *The Dark Side of the Moon* is one the best selling and most critically acclaimed albums in history. The album has spent a total of 962 weeks in Billboard 200 as of February 2022 [4]. The Recording Industry Association of America has certified the album as having sold more than fifteen million copies in the United States and the album has sold over 45 million copies worldwide [8][9][10]. The most famous tracks of the album are the ninth and tenth songs written by Rogers Waters called *Brain Damage* and *Eclipse* that are often played as a single piece as there is a seamless transition between them as

demonstrated here on YouTube https://youtu.be/DVQ3-Xe_suY. The United Kingdom used the track *Eclipse* to close the opening ceremony of their London 2012 Olympic Games: <https://youtu.be/WS2Xw1xr7o4>.

As the fame of the album and its tracks are understood, so is the association with the album and the band with psychedelic and pot smoking counter-culture. In 2017 Jeffrey Bukowski went so far as to write an online essay titled "10 Albums for 4/20 Besides "Dark Side of the Moon" [2]. But marijuana has been shown to increase serotonin levels when used in low doses [5]. Thus, we can imagine large swaths of the population, in essence, "self-medicating" in an attempt to normalize their serotonin levels.

Serotonin is a neurotransmitter that has been shown to have a significant impact on many body functions [5]. University of California researchers have shown that "approaches to improving creativity center around the importance of serotonin" [11]. Gwen Smith et al. in their 2017 research noted how "lower serotonin transporter binding was associated with worse performance in verbal and visual-spatial memory" and that they suspected that "increasing serotonin function in the brain could prevent memory loss [12]." University of Cambridge researchers research showed "that low brain serotonin made communications between specific brain regions of the emotional limbic system of the brain (a structure called the amygdala) and the frontal lobes weaker compared to those present under normal levels of serotonin" [13]. Dr. R.Y. Langham wrote how researchers "found that obsessive-compulsive disorder (OCD), an anxiety condition, is linked to low levels of serotonin" and that serotonin "performs a variety of functions in the body, which is why a serotonin deficiency can lead to anxiety-provoking OCD symptoms" [7].

But how many people could actually have lower levels of serotonin? Perhaps a very large number. Many countries, especially the United States and the United Kingdom, have large amounts of pollenating plants that produce long seasons of pollen allergens including spring tree pollen, summer grass pollen, and fall weed pollen (Figure 1). These allergens cause increases in human serum histamine that leads to a reduction in serum serotonin. British neuroscientists "found that the histamine in the brain was triggered by the inflammatory response and directly inhibited the release of serotonin" and that "this appears to confirm the theory that histamine directly dampens serotonin release" [6].

We can thus imagine a large number of humans during pollen seasons, analogous to the pot smoking subset, that do not have enough serotonin. So what does this have to do with the success of the noted songs from *The Dark Side of the Moon*? It is here that we make our speculative claim. We have a larger number of individuals with lower than normal serotonin and we know that low serotonin impacts working memory and causes obsessive-compulsive (OCD) behaviors. Thus, when one wonders why they cannot get a tune "out of their head," we can imagine certain well-written melodies that can "fit" into a smaller working memory in the brain and that are, thus, more likely to be remembered or recalled. Thus, perhaps melodies that involve optimized compression of data are more likely to fit into working memory and, thus, are preferred melodies or considered beautiful songs.

In this model, the love of marijuana or pot smokers for Pink Floyd appears, thus, to be valid. The idea is that when serotonin is low, the brain's "working memory" size is reduced (Figure 2). So why is this song by Pink Floyd so addicting, especially to individuals in a low serotonin state? Because the song creates a beautiful melody using an incredibly consistent and slow clock rate (tempo) and with an extremely limited variety of notes and a limited variety of inflection. Thus, the brain does not require, for example, 50 "units" of memory - or unique "pointers" to a large variety of notes - to recall the entire song but, rather, the brain is able to enjoy it as the song is, for all intents and purposes, perfectly compressed (Figure 3)! Note how the famous computer scientist Donald Knuth considered "assignment statements and pointer variables to be among computer science's "most valuable treasures" [14].

One can see the limited variety of notes and structural elements in the Pink Floyd song *Brain Damage* by comparing its sheet music to that of another song like the faster David Bowie pop song *Modern Love* (Figures 4 and 5). In essence, it is not just that low serotonin leads to OCD behaviors that cause songs to be "stuck" in working memory, they must also be amazing works of art i.e., they are optimally compressed, to fit into a smaller working memory. Big Data corporations with data of song purchases, YouTube and iTunes plays, and requests, will likely show those items to correlate with specific optimally data compressed songs during peak pollen periods of the year.

Thus, Pink Floyd recorded a perfect low brain serotonin song as the brain can easily store and recall it all in short term, low serotonin, memory windows, when the energy and ability to do some is at its least. One could also compare a zipped or compressed file of these Pink Floyd songs, versus a more complex song of the same duration, but that result is obviously implied. The implicit assumption here is that the brain is computational in nature but the fact that humans have memory and recall already hints at this to a degree.

Discussion

In no way does the claim of the success of Pink Floyd songs correlating to low serotonin states detract from their quality. In fact, the claim is quite the opposite. While the exact count and variety of notes, and the degree of change, in the songs are left to statisticians, the ability to create such a finely crafted melody in a limited space is akin to painting the Mona Lisa with only three colors. Likely all popular songs exist in some optimized space between complexity and compression. Modern medical diagnostic equipment like fMRI and PET scans might also be used to observe and compare memory processing of individuals in low and normal serotonin states to experimentally validate the model. The average length of all popular music songs (between 3-5 minutes in duration) may even provide hints of a certain level of human brain working memory. All songs can thus be given a complexity score or compression size or value and compared to their success in general and via sales, YouTube plays, and radio requests versus low serotonin times of year that occur during high histamine (high pollen) months of the year.

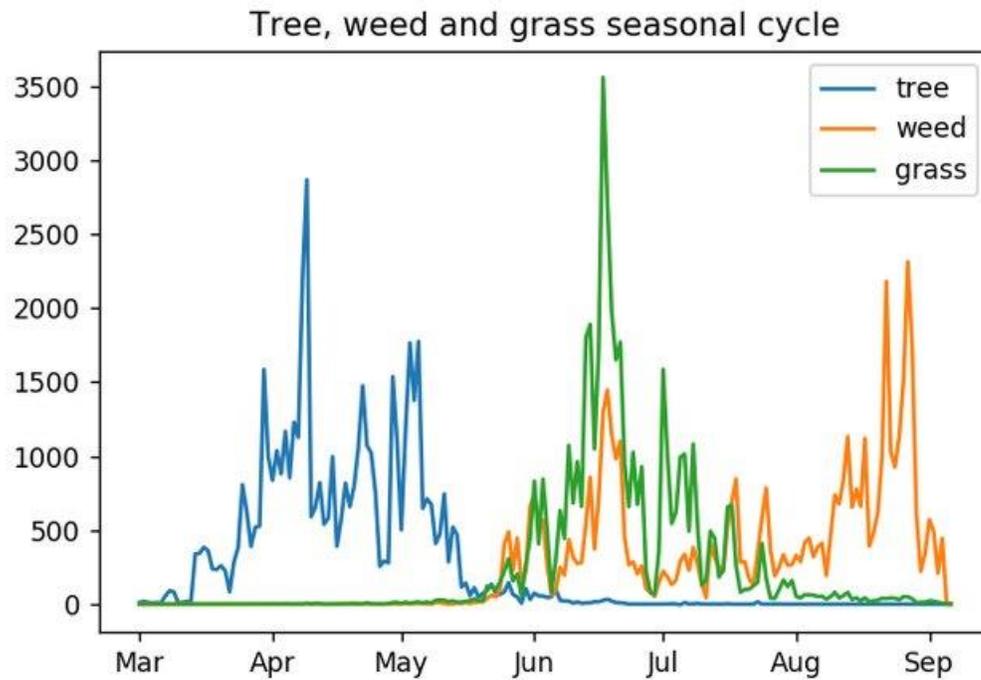
The converse of this idea is that it hints that the brain is computational by the very fact that so many people appear to love great melodies that are also easily compressed. Some researchers have worked to analyze the complexity of songs via statistical techniques and mathematical complexity [15] [16]. But how might the ability to make a perfect melody be more than just a “good fit” into working memory that permits easy recall but, actually, a beautiful masterpiece? Famous Deep Learning computer scientist Juergen Schmidhuber perhaps says it best in the abstract of his paper on data compression and beauty and how the former leads to the latter:

I argue that data becomes temporarily interesting by itself to some self-improving, but computationally limited, subjective observer once he learns to predict or compress the data in a better way, thus making it subjectively simpler and more beautiful. Curiosity is the desire to create or discover more non-random, non-arbitrary, regular data that is novel and surprising not in the traditional sense of Boltzmann and Shannon but in the sense that it allows for compression progress because its regularity was not yet known. This drive maximizes interestingness, the first derivative of subjective beauty or compressibility, that is, the steepness of the learning curve. It motivates exploring infants, pure mathematicians, composers, artists, dancers, comedians, yourself, and (since 1990) artificial systems [3].

Figures

Figure 1.

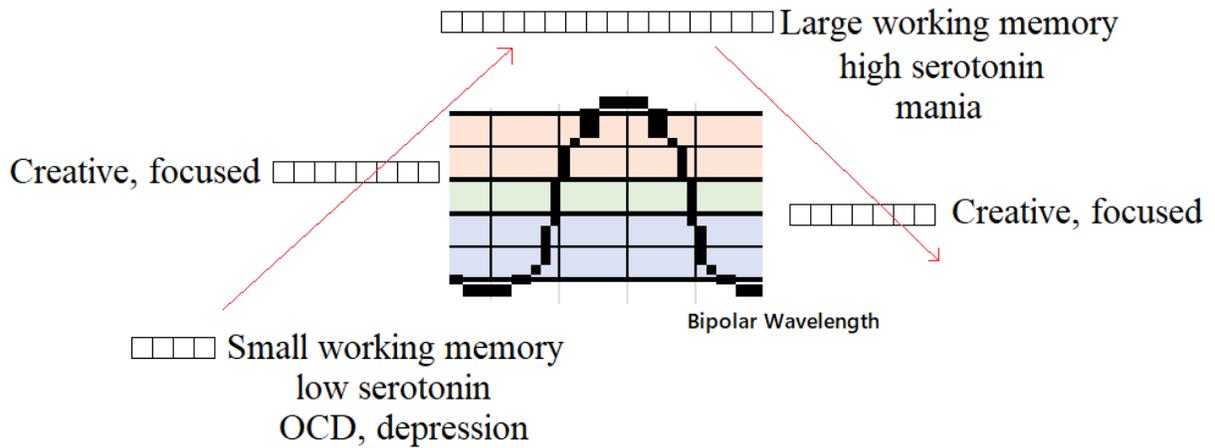
Many months of the year have seasonal pollen that leads to elevated histamine, and thus lower serotonin, for many humans.



Source: Cowie, Sophie & Arthur, Rudy & Williams, Hywel. (2018). @choo: Tracking Pollen and Hayfever in the UK Using Social Media. Sensors. 18. 4434. 10.3390/s18124434. Retrieved from: https://www.researchgate.net/publication/329669438_choo_Tracking_Pollen_and_Hayfever_in_the_UK_Using_Social_Media on August 30, 2022.

Figure 2.

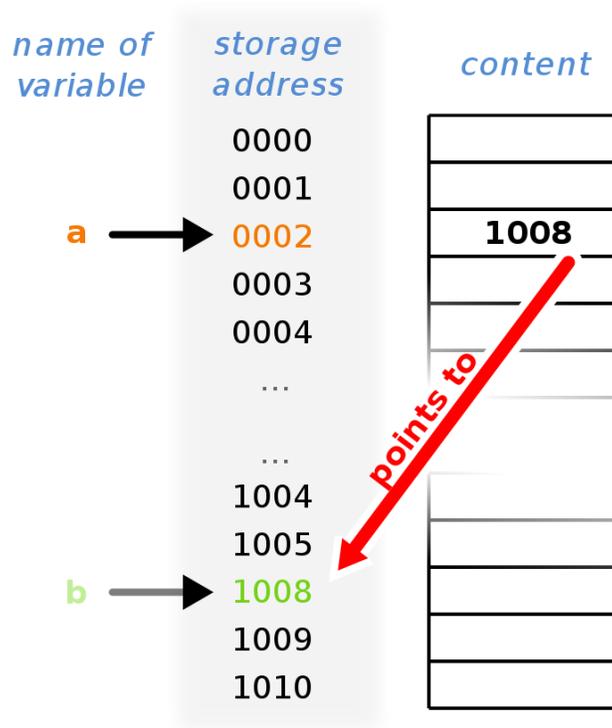
Human brains have a wavelength of fluctuating serotonin levels where low serotonin levels, lasting ten days every thirty days, involves lower size of working memory and OCD behaviors.



Source: Khan, T. (2022, June 21). Serotonin as a Creativity Pump and an Explanation for Western Civilization Success. <https://doi.org/10.31234/osf.io/4de3r>

Figure 3.

A standard example of a computer pointer may be intimated to exist in the human brain from the popularity of easily compressed songs during low serotonin periods.



Source: https://en.wikipedia.org/wiki/Pointer_%28computer_programming%29#/media/File:Pointers.svg

Figure 4.

Sheet music of Pink Floyd's song *Eclipse* from *The Dark Side of the Moon* showing a limited variety of notes and remarkably consistent tempo and inflection.

ECLIPSE

Words and Music by
ROGER WATERS

Asus4 A7 D D

All that you touch, And all that you see.

Bbmaj7 Gm6 A A7 D

All that you taste. And you feel. And all that you love, And

Source: retrieved August 30, 2022 from Android smartphone app Musicnotes.

Figure 5.

Sheet music of David Bowie's song *Modern Love* as an example of a faster rock music song with larger variety of notes and structure and, thus, complexity and compressibility.

Modern Love

Words and Music by
DAVID BOWIE

Fast, Driving Rock

CHORUS

2.,4.

C

Nev - er gon - na fall for mod - ern love, _ Walks be - side _ me

D7

Em

mod - ern love, _ walks on by _ mod - ern love; _

Source: retrieved August 30, 2022 from Android smartphone app Musicnotes.

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