

Predicting the Daily Temperament of Any Human Using Two Dopamine Cycles

RUNNING HEADER: PREDICTING DAILY TEMPERAMENT

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A speculative essay where, in addition to the previously established human behavioral patterns tracked to the annual sunlight-driven dopamine cycle, a second dopamine “clock” or cycle is proposed in the human brain. This measured cycle starts with a 10-day-long *low dopamine phase* (with various stages of impulsivity, anxiety, and depression and then the reverse as the dopamine level climbs back up), then a 10-day-long *high dopamine phase* (with confident and manic behaviors), before diminishing to a 20-day-long *normal dopamine phase* (with calm and focus), before the cycle starts again with the *low dopamine phase*. The levels of the primary sunlight-driven cycle and the proposed secondary dopamine cycle aggregated together are considered as the only factors needed to create a calendar map of human temperament. There are nine 40-day-long cycles in the calendar year with the cycles occurring on the same days every year.

The data that supports the findings of this study are available from the corresponding author upon reasonable request. The author has no conflict of interest to declare, and no funding source is associated with this work.

Predicting the Daily Temperament of Any Human Using Two Dopamine Cycles

“I can calculate the movement of stars, but not the madness of men.”
-- Isaac Newton

A model is proposed where, in addition to the previously established human behavioral patterns tracked to the annual sunlight-driven dopamine cycle (Maruani et al, 2018) (Figure 1), a second dopamine “clock” is proposed in the human brain. This measured cycle starts with a 10-day-long *low dopamine phase* (with various stages of impulsivity, anxiety, and depression and then the reverse as the dopamine level climbs back up), then a 10-day-long *high dopamine phase* (with confident and manic behaviors), before diminishing to a 20-day-long *normal dopamine phase* (with calm and focus), before the cycle starts again with the *low dopamine phase* (Figure 2). There are nine 40-day-long cycles in the calendar year with the cycles occurring on the same days every year. The proposal intimates a sort of “universal cyclothymic disorder” where the vast majority of human beings share the same general temperament on any given day of the year that can be mapped and that is the same every year with an inherent and possibly inverse difference between humans in the northern and southern hemispheres.

Methods

Over a period of three years, three adult males in their forties were tracked on a daily basis measuring subjective values of mood or temperament. The subjects included a bipolar individual with ADHD, Tourette’s Syndrome motor tics, and a benign essential blepharospasm, an individual with only ADHD, and a control individual with none of these pre-existing conditions. Changes in medication, behaviors (exercise, focus, creativity, quality of sleep) and motor tic and blepharospasm severity (in the bipolar subject) were monitored to attempt to isolate any possible reoccurring seasonal or annual patterns or cycles inherent in all humans

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(e.g., the proposed additional cyclic pattern of fluctuating dopamine levels) that could help explain behaviors in aggregate human populations. A pattern was observed in all three subjects with the severity of the effects diminishing from the bipolar subject to the ADHD subject and the control subject. The observed pattern was of the noted drop and then spike and normal slope temperament function that had a reoccurring pattern of nine 40-day-long wavelength cycles year-over-year.

The observations in this informal study and prior literature were used to create a year-long calendar where the dopamine sinusoidal wave pattern (Maruani et al, 2018), tied to blue light from sunlight, was overlaid with the proposed secondary 40-day-long wavelength (Figure 3) to create an *aggregate map of human temperament* (Figure 4).

One premise driving this informal study was that the severity and reoccurring timing of the motor tics and blepharospasm events, of the bipolar subject, might reveal a subtle brain dopamine pattern via the regularity of tics and blepharospasms triggered during periods of decreasing or dramatically changing dopamine. This pattern would otherwise get “lost in the noise” of variations in mood from everyday life events and exogenous factors listed below as limitations to this work.

Note that benign essential blepharospasms (the uncontrollable eyelid blinking and facial dystonia or “motor tics” i.e., the blink system) are sensitive to central dopamine levels (Evinger, 2013). Dopamine depletion alone is also noted as a cause of blepharospasm (Evinger, 2013). Evinger (2013) also noted that “abnormalities in dopamine transmission may be a proximate cause of the predisposing condition that allows the development of benign essential blepharospasm.” Abnormalities in the basal ganglia dopamine system are also noted as leading to abnormal sensorimotor mappings manifest as blepharospasms (Peterson DA and Sejnowski

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TJ, 2017). Abnormal dopaminergic signaling in the striatum of the human brain could also induce pathological reinforcement learning and lead to blepharospasms (Peterson DA and Sejnowski TJ, 2017).

One possible cause of the proposed additional 40-day-long dopamine cycle is a possible lag in the adjustment in eye retina size to seasonal changes, i.e., the pupil size is incorrectly sized too large or too small (thus leading to excessive or diminished dopamine levels from blue light) until the lag is adjusted to the proper pupil size for the given time of year after 40 days or longer. Murani et al (2018) noted that “retinal anomalies are apparent in Seasonal Affective Disorder during the depressive phase in autumn/winter” (pg. 11). Murani et al (2019) also note in their research that:

The photoperiod also alters the balance of dopamine. Dopamine acts to regulate the sleep/wake cycle. Dopamine is also important to adaptation to the light/dark cycles in retina photoreceptors (pg. 11).

Also note that lack of sleep, like that caused by sleep apnea or poor circadian rhythm “clocking,” has been linked to poor impulse control and emotion dysregulation (McCarver-Reyes, 2019). McCarver-Reyes (2019) noted in their research that sleep deprivation was associated with “impaired response inhibition, risky decision-making, increased risk-seeking, attention deficit hyperactivity disorder (ADHD), gambling disorder symptoms, Internet addiction symptoms, and personality-related impulsiveness.” Dopamine via its involvement in the sleep process, as well as directly, can influence impulsive and hyperactive behaviors. Katherine Harmon wrote that “impulsivity has long been linked to the neurotransmitter dopamine, which is involved in learning and reward” (pg. 1) in her July 29, 2010, article in *Scientific American* titled

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Dopamine Determines Impulsive Behavior: Brain scans illuminate the internal connection among the neurotransmitter, impulsiveness, and addiction.

Limitations to the proposed model include the obvious small sample size leading to large assumptions and generalizations not backed by standard statistical regression analysis. Other limitations to the model include the lack of detailed tracking of many other factors that can influence human temperament and thus behavior.

The claim of the model is that only two dopamine associated cycles are needed to represent the vast majority of temperament of a given individual on a given day of the year which, at an individual level, may obviously not be accurate given the number of other known possible influences or factors. Those factors could include stress, travel, sleep apnea, low blood sugar (glucose) levels, cloudy or stormy days, medications for blood pressure, SSRIs, sedatives, stimulants, tranquilizers, alcohol, illegal drugs, daylight savings time interruptions to sleep, time of day, physical or psychological trauma, medical conditions like rapid-cycling bipolar disorder, and even oxytocin (i.e., emotional love euphoria or “heartbreak” related depression).

Additional limitations include estimates made for the scale of change and the relative or comparative weights of the primary and secondary dopamine cycles, or between comparisons of these cycles, created by subjective data and analysis.

Census, sociology, Big Data, and criminal justice groups would be urged to regress this model with their vast year-over-year and larger data sets to find additional granularity and possibly additional contributing factors. Scientists, researchers, and medical professionals can work to confirm the number of dopamine cycles in the human brain via Big Data supercomputing top-down analysis as well as via f-MRI or PET brain scans and laboratory blood and sleep testing to qualitatively validate the theorized 40-day-long secondary dopamine cycle.

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The days or weeks in the model, when there are dual reinforcing peaks or troughs from both of the dopamine cycles, should be compared against data sets of violent crimes, mass shootings, stock purchasing, heart attacks, consumer spending, consumer sentiment, suicides, engagements, military actions, etc.

Results

Analysis of the subjective data indicated a second dopamine cycle in the human brain that begins on 12/20, basically at the winter solstice on December 21. This cycle starts with a 10-day-long *low-dopamine* phase with five days of increasing depression until a day 5 low point with the most severe depression, before five days of climbing dopamine levels ultimately returning to the normal dopamine level. This is immediately followed by a 10-day-long *high-dopamine* phase with five days of increasing dopamine reaching a day 15 peak level with confident and impulsive temperament, before five days of diminishing dopamine back to the normal dopamine level. This is then followed by a 20-day-long *normal dopamine phase* with calm and focus before the entire cycle repeats (Figure 5). There are nine 40-day-long phases in the year.

An amazing observation of the study was that migraines were observed in multiple individuals always on the first day (at the start) of the 5-day-long interval of the low dopamine phase as dopamine starts dropping. That same day also saw a re-living (recalling) of traumatic events that had occurred any time in the prior 40 days since the previous 5-day-long low dopamine phase dopamine dropping interval. The speculation is that during these five days, the brain is doing a “data backup,” similar to modern computer processing, of critical learning from the prior 40 days into the brain’s long term memory with painful i.e., critical or traumatic “lessons learned,” that are thus processed and stored first from the short term memory “queue” and processed on the first day (day 1) of the 5-day-long dopamine dropping interval as part of

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the process of long term memory storage. Dopamine has been shown to be associated with memory from many research efforts (Braun et al, 2021; Frick et al, 2022; Kaminski et al, 2018; Sabandal et al, 2021). It is the decrease in serum dopamine, as dopamine is removed from the bloodstream as it is used by the brain to backup memories, that triggers the blepharospasm and migraine events and thus makes these events calendar “markers” that were used to identify the 40-day-long cycle.

This study’s research involved the tracking of behaviors and blepharospasm events mapped to the 365-day calendar year where the second dopamine cycle pulse aligned to exact days of the year with the cycle repeating every forty days. The most severe blepharospasm events were observed to occur exactly during the dopamine diminishing first five days of the 10-day-long low dopamine phase and the last five days of the high dopamine phase i.e., only as dopamine levels declined.

The astute reader will note that nine 40-day-long cycles total to only 360 days of a 365-day-long year. Just as the brain is believed to backup recent events within each 40-day-long dopamine cycle, the first cycle that ends each January places into long term memory not only the events in the nine prior 40-day-long cycles, but also the major events for the entire year - all nine prior cycles. Just as television news and media programs conduct a “year in review,” the human brain between January 19 and January 24 each year does basically the same by backing up major events from the prior 365 days into its long-term memory. The first cycle of the year is thus the only cycle of the nine cycles that is actually 45 days long.

The human mind is thus proposed as maintaining internal “clocks” including: the 24-hour-long circadian rhythm, a 40-day-long dopamine cycle, and an annual 365-day-long cycle. Note how the 10-day-long *low-dopamine phase* (between 12/15 and 12/25) ends on Christmas

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Day, the 25th day in December. This day thus becomes special and the perfect day for a holiday of joy (given the date's location in the 40-day-long cycle) where dopamine is being boosted by the cycle and also via the acts of gift giving, community involvement, and celebration.

A benefit of knowing, a priori, the likelihood of one's temperament on a given day or week, is that one could adjust or "sanity check" their decisions accordingly e.g., pause, seek advice, sedate, isolate, avoid spending, give the major speech, do the job interview, relax, or enjoy nature or the company of friends, etc. (Figure 6).

Additional analysis of the temperament map shows that it is also consistent with research related to the timing of violence and aggression. Research "suggests that dysfunctional interactions between serotonin and dopamine systems in the prefrontal cortex may be an important mechanism underlying the link between impulsive aggression and its comorbid disorders. Specifically, serotonin hypofunction may represent a biochemical trait that predisposes individuals to impulsive aggression, with dopamine hyperfunction contributing in an additive fashion to the serotonergic deficit" (Seo et. al., 2008, pg. 1). Research by Seo, D., Patrick, C. J., & Kennealy, P. J. (2008) noted that:

...considering the functional regulation of serotonin over the dopamine system, deficient serotonergic function may result in hyperactivity of the dopamine system, promoting impulsive behavior. This relationship may account for co-occurring serotonin and dopamine dysfunctions in individuals with impulsive aggression (pg. 5).

Discussion

The creation and verification of an actual annual temperament calendar has the possibility to be formalized into an actual mood or impulsivity "gauge." Note that the amplitude of any given dopamine based gauge or "map" would be more severe for bipolar individuals due to their

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blue light sensitivity. One can envision a smartphone application or “dashboard,” akin to a pilot's altimeter or cockpit instrumentation (Figure 7), showing a daily or weekly “score” or meter (Figure 8) as a form of “temperamentometer.”

Some additional possible applications could include an add-on feature for a Microsoft Outlook email calendar or an add-on feature for a Zoom, WebEx, or Microsoft Teams video conferencing meetings where the week of the year and participant location data (obtained via area code, I.P. address, or Active Directory information) could allow a salesperson to know which person in their meeting is most likely to make an impulsive purchase (individual with a red colored outline) versus “normal” participants (green) and those that are least likely spend due to anxiety, depression, or low energy (blue). The calendar feature can also be used to note when it is best for an employee (green) to give a speech or an important sales pitch and also which weeks to avoid (blue and possibly red).

A full list of potential uses of a *temperament map* could include using it to find: when to schedule a sales promotion and who (based on zip code or location) to most likely sell to, gym exercise workout routines - when to lift heavy (red) and when to light weights (blue), diet routines - when to fast diet (red) and when not (blue), optimal weeks for: military actions, holidays, long work activities or projects, medication adjustments (mental health), and when law enforcement should be aware of potentially increased violence.

Note, that while the scientific community can monitor gravitational waves smaller than an atomic nucleus, we have comparatively little tooling or visibility for “real-time monitoring” of dopamine and serotonin levels in humans and, thus, temperament, for any given individual. Progress is being made however, with current smartwatch technology now able to check metrics like blood pressure, pulse, and even blood sugar.

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This proposal, while very speculative in nature and informal in presentation, is an effort to instigate additional focus in the direction of individual biochemical monitoring and feedback and the development of applications using this information to optimize outcomes.

The claim of the work is that there are only two major factors - annual calendar neurotransmitter cycles: 1) the primary sunlight-driven cycle and 2) the proposed secondary 40-day-long dopamine cycle - that play into an individual's temperament or impulsivity and that this temperament can be measured, scored, and predicted and, thus, help a person to avoid sub-optimal impulsive actions and poor decision-making. While advertising and marketing firms analyze "Big Data" statistics related to aggregate consumer spending and sentiment, this work proposes also examining behaviors and temperament from a biological basis.

A perfect long-term vision could involve nano-tech sensors inside individuals directly providing real-time feedback of dopamine, serotonin, histamine, oxytocin, testosterone, etc. levels, and also their external blue light, pollen, ozone, pollution, etc. level exposures, to help create an improved measure or score of an individual's temperament on a given day.

Tech firms like Facebook (Meta), Twitter (X), or Google (Alphabet) could even use their massive behavioral data stores and super-computing resources to examine human temperament or mood from smartphone text messages and social media post "text analysis" to produce an optimal temperament assessment tool. This tool would allow an individual or party to know the likelihood of their own bias toward (or against) impulsive, emotional, or irrational action to allow proper assessment of factors (including their own "state of mind") for better decision-making. Consider the scenario where, if you knew that you would be anxious on a given day, you could proactively move the date of your major speech. If you know you are at risk of

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impulsive behavior today, avoid the trip to the shopping mall or, from the vendor perspective, increase the number of advertisement buys.

Conclusion

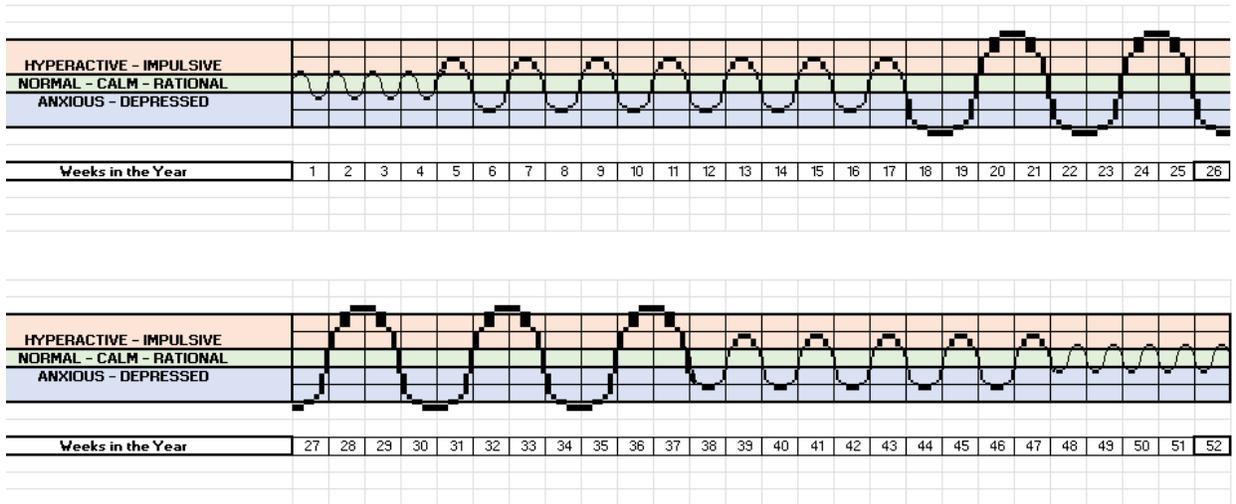
While modern civilization in the 21st Century is still far from the societal behavioral prediction capabilities of a science like *psychohistory* envisioned by Isaac Asimov in his *Foundation* science fiction novels, the possibility should not be considered out of reach. Changes in the level of dopamine can lead to impulsive, depressed, and hyperactive behavior. Thus, the two main points of this work involve a proposed additional 40-day-long dopamine brain clocking cycle and that an examination of this cycle, aggregated with the annual sunlight dopamine cycle, can lead to a *human temperament map* or calendar to predict individual and even aggregate societal behaviors on any given day of the year.

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Figures

Figure 1.

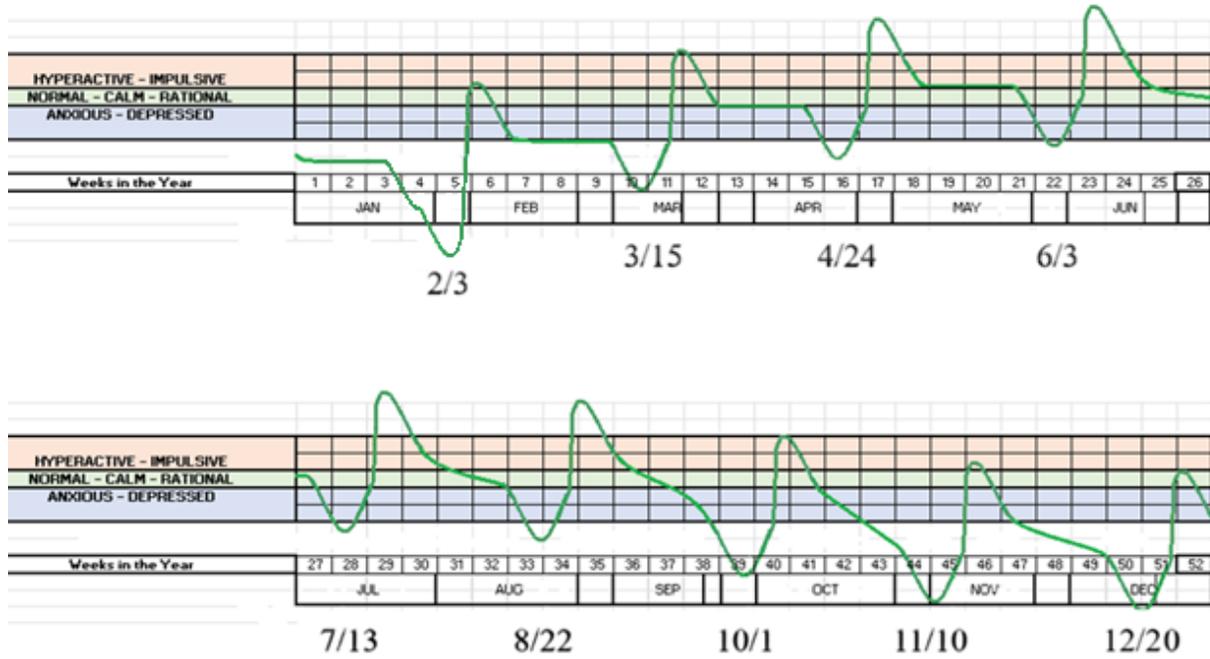
The primary sunlight-driven (blue light) dopamine cycle, with shorter wavelengths in winter and longer in summer, mapped to the calendar year (Maruani et al, 2018).



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Figure 2.

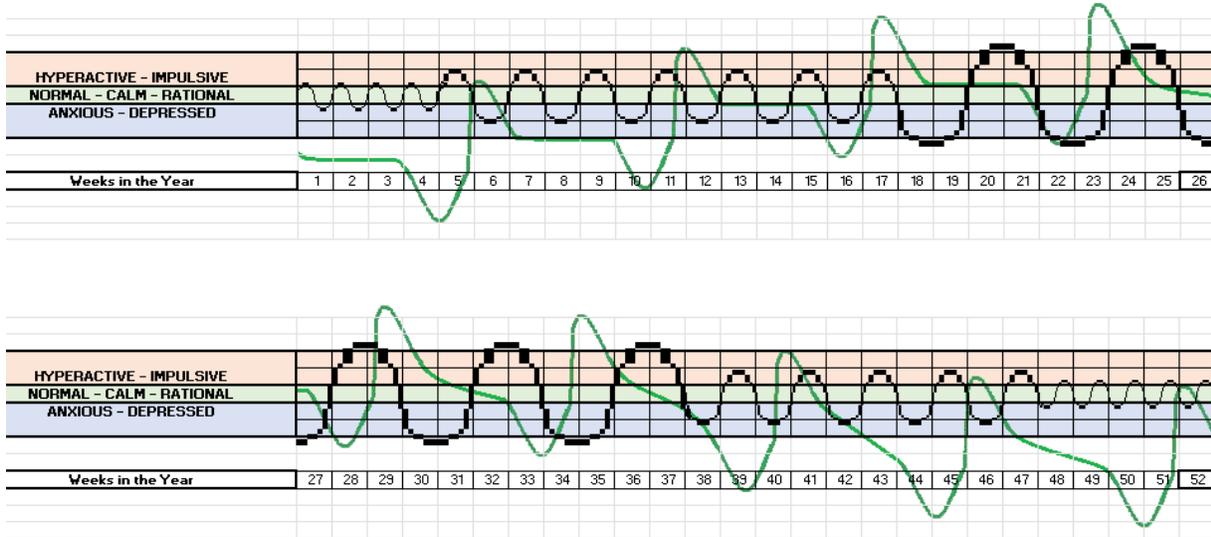
The observed second dopamine cycle involves a wavelength of 40 days. The nine dates below are the lowest dopamine level dates of each of the nine cycles in a given year.



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Figure 3.

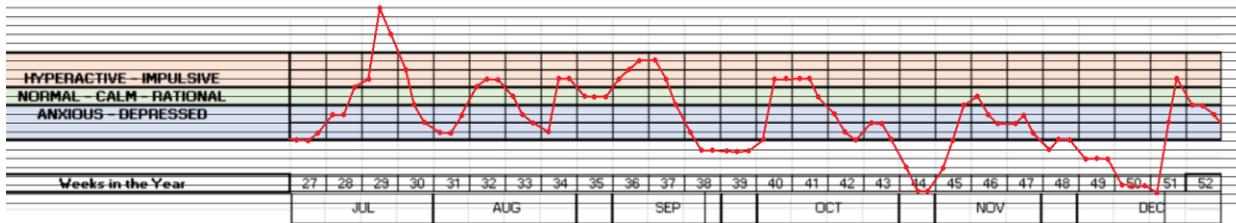
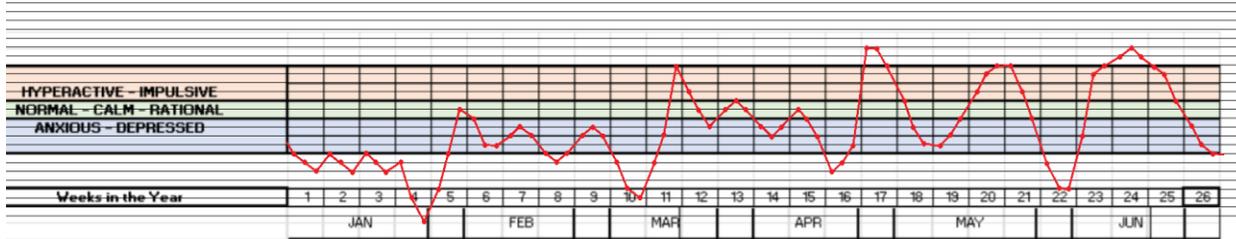
A combined graph of the primary dopamine sinusoidal annual wave with the additional proposed secondary 40-day-long cycle is shown below that is used to create a final aggregate graph or “temperament map.”



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Figure 4.

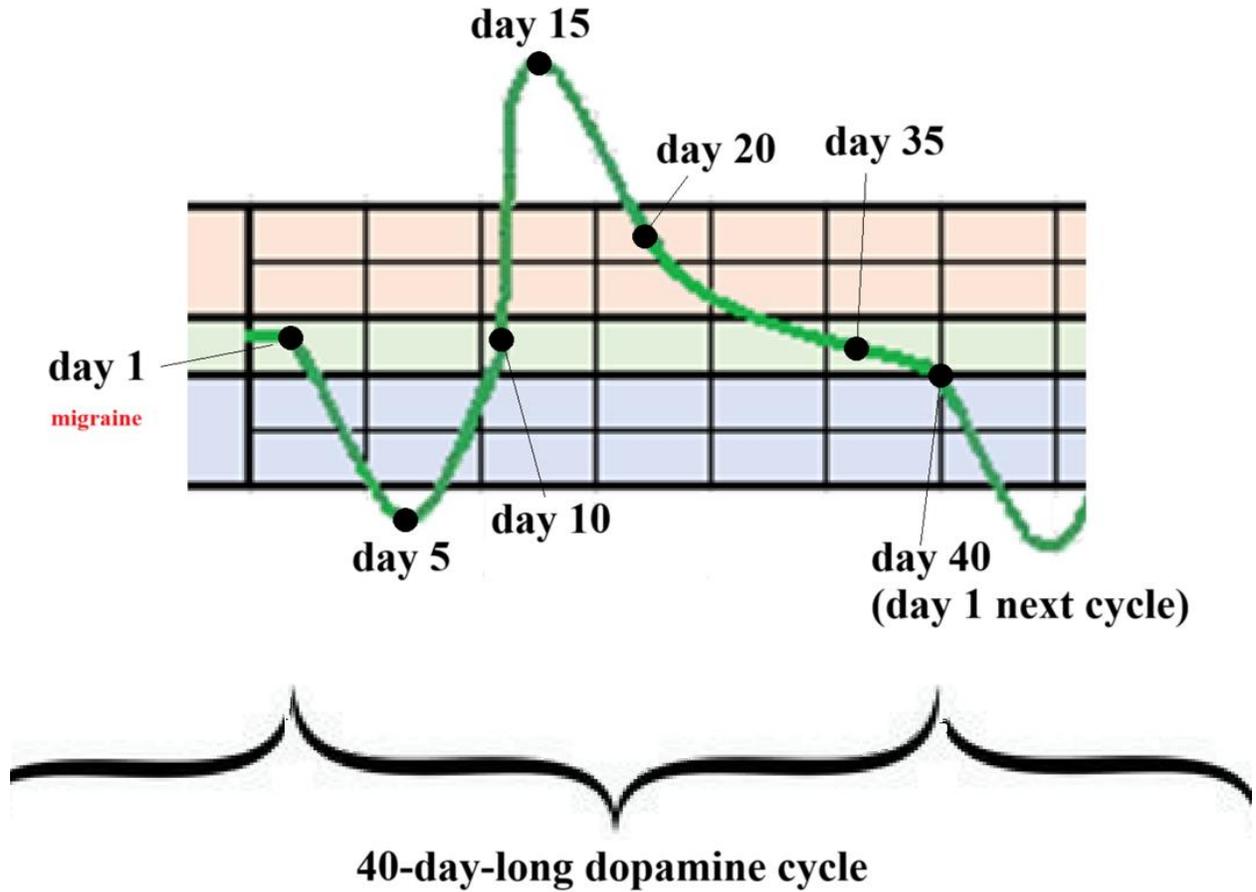
An aggregate summation graph from the combined values of the two dopamine cycles produces this “human temperament map,” the red line in the image below.



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Figure 5.

A graph of a single cycle of one of the nine 40-day-long dopamine cycles (green line) in the human brain that occur each year.



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Figure 6.

Two tables show the key dates of the year in the nine 40-day-long major dopamine cycle in human brains. Note that the first day of the cycle is the start of the 10-day-long “dopamine well” as dopamine levels drop and that this day is the day (and the only day) that migraine headaches were seen in all subjects. The second table is the same information but adjusted for leap years with the additional day of 2/29.

NORMAL YEAR	START Low dopamine well (day 1)	Impulsivity Day 1	Lowest dopamine date (day 5) Depression Worst	Impulsivity Day 2	START high dopamine surge and Low dopamine well end (day 10)	Highest dopamine date (day 15) Energy Peak	Impulsivity Day3	High dopamine surge end (day 20)	40-day-long Cycle #	Days done
	1/24	1/30	2/3	2/7	2/8	2/13	2/14	2/18	1	45
	3/10	3/11	3/15	3/19	3/20	3/25	3/26	3/30	2	85
	4/19	4/20	4/24	4/28	4/29	5/4	5/5	5/9	3	125
	5/29	5/30	6/3	6/7	6/8	6/13	6/14	6/18	4	165
	7/8	7/9	7/13	7/17	7/18	7/23	7/24	7/28	5	205
	8/17	8/18	8/22	8/26	8/27	9/1	9/2	9/6	6	245
	9/26	9/27	10/1	10/5	10/6	10/11	10/12	10/16	7	285
	11/5	11/6	11/10	11/14	11/15	11/20	11/21	11/25	8	325
	12/15	12/16	12/20	12/24	12/25	12/30	12/31	1/4	9	365
		winter solstice		Christmas Day		New Year's Eve				

LEAP YEAR 2/29 added	START Low dopamine well (day 1)	Impulsivity Day 1	Lowest dopamine date (day 5) Depression Worst	Impulsivity Day 2	START high dopamine surge and Low dopamine well end (day 10)	Highest dopamine date (day 15) Energy Peak	Impulsivity Day3	High dopamine surge end (day 20)	40-day-long Cycle #	Days done
	1/24	1/30	2/3	2/7	2/8	2/13	2/14	2/18	1	45
	3/9	3/10	3/14	3/18	3/19	3/24	3/25	3/29	2	85
	4/18	4/19	4/23	4/27	4/28	5/3	5/4	5/8	3	125
	5/28	5/29	6/2	6/6	6/7	6/12	6/13	6/17	4	165
	7/7	7/8	7/12	7/16	7/17	7/22	7/23	7/27	5	205
	8/16	8/17	8/21	8/25	8/26	8/31	9/1	9/5	6	245
	9/25	9/26	9/30	10/4	10/5	10/10	10/11	10/15	7	285
	11/4	11/5	11/9	11/13	11/14	11/19	11/20	11/24	8	325
	12/14	12/15	12/19	12/24	12/25	12/30	12/31	1/4	9	365
		winter solstice		Christmas Day		New Year's Eve				

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Figure 7.

An aircraft cockpit instrument that monitors real-time altitude and orientation as an example of a “state” monitoring tool. An application that is presently absent for human neurotransmitter levels and temperament.

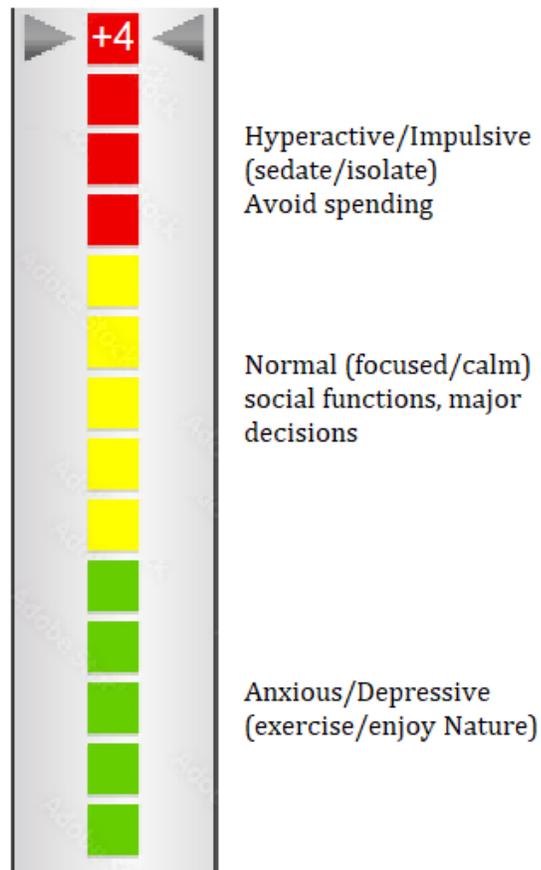


Source: https://allavionics.com/product/uavionix-av-30-c-primary-flight-display-certified/?gclid=Cj0KCQiAgP6PBhDmARIsAPWMq6mYOXR2xaEPKh_fBgayUXjlJJD1DIXeyipNQ7nudgaN38LTI1gdBOsaAkmwEALw_wcB

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Figure 8.

An example of a possible smartphone application where a standard scale is used to notify the user by color and the number of their measure of temperament per any given week or day of the year to allow them to adjust accordingly knowing how neurotransmitters are impacting their state of mind.



Source: https://www.123rf.com/photo_140341271_stock-vector-bar-of-meter-with-progress-level-from-red-to-green-vector-illustration.html

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