Are fluctuations in the stock market tied to a dopamine cycle in the human brain?

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The observations of a small and informal study are presented that propose a second 40-day-long dopamine cycle in the human brain. This cycle has 10 days of low dopamine followed by 10 days of high dopamine (resembling a pulse shape), followed by 20 days of normal dopamine. The model presents specific behaviors aligned to specific dates of the calendar year that produce a map of human temperament as well as nine specific "buy low" and "sell high" stock market S&P 500 intervals.

> *"Dopamine is known as the feel-good neurotransmitter - a chemical that ferries information between neurons. The brain releases it when we eat food that we crave or while we have sex, contributing to feelings of pleasure and satisfaction as part of the reward system. This important neurochemical boosts mood, motivation, and attention, and helps regulate movement, learning, and emotional responses."*
> *-- Psychology Today*

> *"Wouldn't economics make a lot more sense if it were based on how people actually behave, instead of how they should behave?"*
> *-- Dan Ariely -- Predictably Irrational: The Hidden Forces That Shape Our Decisions*

> *"Pages and pages of data... efficiency functioning on multiple levels and in multiple dimensions... there it was all the time, staring you in the face. Buried within the message itself."*
> *-- S.R. Hadden – Contact (film)*

Over a period of four years, three adult males in their forties were tracked on a daily basis measuring subjective values of temperament and behavior in an effort to research the structure and effects of dopamine cycles in the human brain. The subjects included an individual with ADHD and a benign essential blepharospasm (eyelid tic), an individual with only ADHD, and a control individual with neither condition. Changes in medication, behaviors (exercise, focus, creativity, quality of sleep) and blepharospasm occurrence and severity were monitored to attempt to isolate any possible behavioral cycles, aligned to dopamine variation, which might be common with all human populations.

Two patterns were observed. The first pattern matched previously researched fluctuations in brain dopamine tied to seasonal changes in the amount of blue light from sunlight that reaches dopa-receptors in human eyes. The sunlight, and thus dopamine, increases and then decreases from spring to summer, to fall, and to winter. This fluctuation created a sinusoidal wave pattern of mood and energy (Maruani et al, 2018) with a full wavelength lasting a week in winter, two weeks in spring and fall, and four weeks in summer. During the upper levels of the wave cycle, dopamine levels appeared high and behaviors were more active, hyperactive, confident, and impulsive. During the increasing and decreasing middle levels behaviors were calm, focused, and rational, while during the bottom levels of dopamine behaviors changed to anxious and depressed (Figure 1).

The second pattern observed also appeared to be dopamine driven and seemed to have more influence on behaviors than the first sinusoidal cycle (Figure 2). It was a reoccurring 40-day-long wavelength that resembled more of a pulse shape than a sine wave (Figure 3).

When the peaks and troughs of these two dopamine cycles were combined and overlaid on a calendar (Figure 4), the new graph appeared to be a map of temperament that matched and predicted the mood or state of all patients. The theory being that this aggregate dopamine pattern might represent a "map of human temperament" shared in all human populations - or at least for human populations in the northern hemisphere (Figure 5).

The key to identifying the second dopamine cycle was the careful tracking of the timing and severity of the eyelid blepharospasms in the one male patient. There are justified reasons to consider blepharospasms as a valid proxy or indicator for human dopamine levels. 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 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).

Limitations to this study include the obvious small sample size leading to large assumptions and generalizations not backed by standard statistical regression analysis. Other limitations to the final proposed 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 known other possible influencing factors. Those factors 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 Saving 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) or heartbreak related depression. Census, sociology, Big Data, and criminal justice groups would be urged to regress this model with their large 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 via f-MRI or PET brain scans and laboratory blood and sleep testing to qualitatively validate the theorized 40-day-long second dopamine cycle. The days or weeks in the model, when there are dual reinforcing peaks 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, etc.

Results

Analysis of the subjective data indicated a second dopamine cycle or "clock" in the human brain that begins on the winter solstice on December 21. This cycle started with a 10-day-long "low-dopamine phase" with five days of increasing anxiety until a day 5 low point with depression before 5 days of climbing dopamine levels returning to the "normal" level. This is immediately followed with a 10-day-long "high-dopamine phase" with 5 days of increasing dopamine reaching a day 15 peak, with hyperactive and impulsive temperament, before five days of diminishing dopamine back to the normal dopamine level. That is then followed by a 20-day-long "normal dopamine phase" with calm and focus before the entire cycle repeats. There are nine 40-day-long phases in the year (Figure 2).

An amazing observation of the study was that migraines were observed in multiple individuals always on the first day of the 5-day-long start of the low dopamine phase as dopamine began to drop (Figure 6). That same day also saw a re-living of traumatic events that had occurred any time in the prior 35 days since the previous 5-day-long low dopamine phase dopamine drop interval. The speculation is that the brain is offloading, similar to modern computer processing, critical learning from the prior 35 days into the brain's long term memory with painful i.e., critical and/or traumatic "lessons learned," that are thus stored first in the queue and processed on the first day (day 1) of the 5-day-long low dopamine phase with the process of long term memory storage creation. The fact that these dates are known and displayed below in a table can, thus, provide a therapeutic aid for mental health clinicians as these professionals will know every year on which days patients will re-experience recent trauma and, thus, likely be in need of care and company to help diminish the psychological pain and even to prevent possible actions like suicides or alcohol abuse.

Closer monitoring of behaviors during the 10-day-long low dopamine phase of the second dopamine cycle shows a range of specific behaviors during the first 5 days on the downslope that exactly match those that occur on the next 5 days during the upslope. This remarkably close correspondence of behavior may imply a correlation of behaviors with specific brain memory levels. For example, days 1 and 10 involved spikes in imagination, days 2 and 9 had impulsive and addictive behaviors, days 3 and 8 had OCD behaviors like ranking and organizing, days 4 and 7 had anxiety, and days 5 and 6 had depression (Figure 7). Dopamine has been shown to be associated with memory from many research efforts (Braun et al, 2021; Frick et al, 2022; Kamiński et al, 2018; Sabandal et al, 2021), thus we have not only additional support for dopamine as the driver of the cycle and behaviors but also for changes in brain working memory as possibly a driver of the behaviors during the low dopamine phase.

The 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 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 (Figure 8) i.e., only as dopamine levels declined.

Perhaps the most unexpected observation from the research was that the first day of the 10-day-long low dopamine phase matched year-over-year low points of the stock market as tracked by daily closing values of the S&P 500. Local high point (sell high) days were also observed occurring 35 days after the low point (buy low) days and thus five days before the low point day of the next 40-day-long second dopamine cycle (Figure 9). Those values were overlaid on the calendar year to produce a standard calendar of high and low point values. A simple linear regression, not taking into account the growth in scale of the S&P 500, using the sixteen total "buy low" and "sell high" dates of each year for the years 2000 to 2021 showed the significance of the differences between the buy low and sell high dates (Figure 10). A Robinhood online brokerage account was created with about $1000.00 used to purchase shares of a Spyder ETF indexed fund (SPDR S&P 500 ETF) to represent the aggregate stock market as a proxy for the mood of the entire human population (Figure 11). Example linear regressions of a "buy low" day, the market day on or closest to April 19 (7th stock market date that is in the 4th second dopamine cycle) and a "sell high" day, the market day on or closest to September 21 (the 14th stock market date that falls in the 7th second dopamine cycle) show the significance (Figure 12). The data thus lead to a "risk free" method where an investor, since they know the key dates ahead of time, can choose to buy or sell, or just "wait" if a shock leads to a stock market value that is not higher than the "buy low" value of that specific second dopamine cycle 40-day-long interval (Figure 13). Thus, the United States stock market (S&P 500) can be interpreted, in theory, as based fundamentally only on exogenous shocks, endogenous shocks, and a second dopamine cycle in human brains. In essence, the primary changes or fluctuations in the stock market are tied to the second dopamine cycle in the human brain. The model has proven reliable to the extent that tracking of events in the Robinhood application of Spyder ETF investing during the leap year of 2024 (where the additional day on February 29 that moves the date of the 40-day window one day earlier following February 29), was actually observed (Figure 14).

The development of advanced medical technology (f-MRI, PET scans, etc.) and Big Data information sources will allow a window into a new "applied neuroscience," behavioral psychology, or sociology. While our modern 21st Century civilization 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 as these technologies and data sets mature.

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.

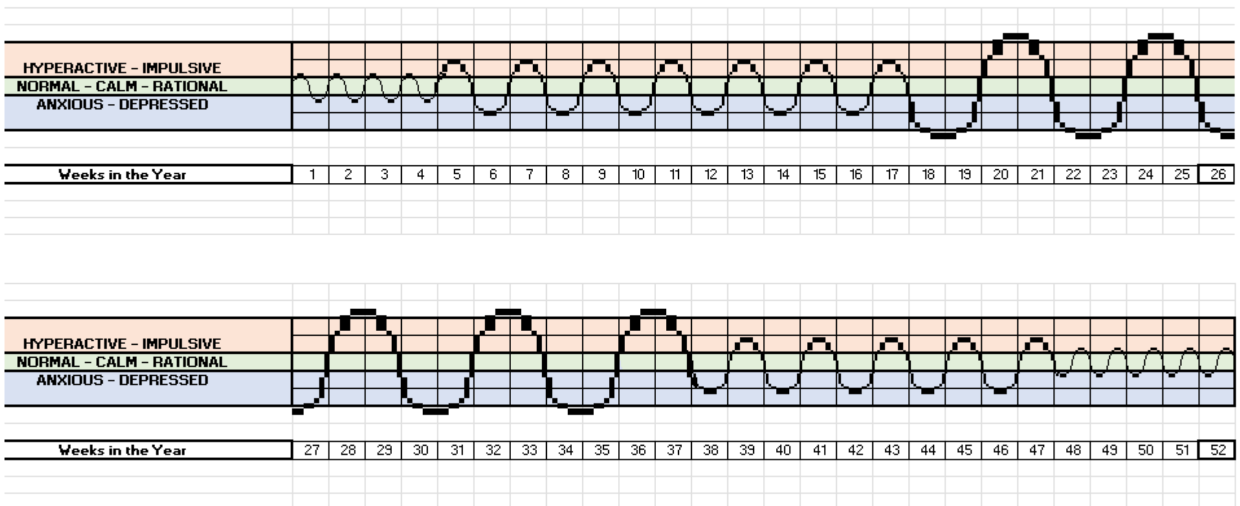


Figure 2.

The observed second dopamine clock-cycle involves a wavelength of 40 days that includes the first 10 days in an interval where there is a "low dopamine" state. The nine dates below are the lowest dopamine level dates of each of the nine cycles.

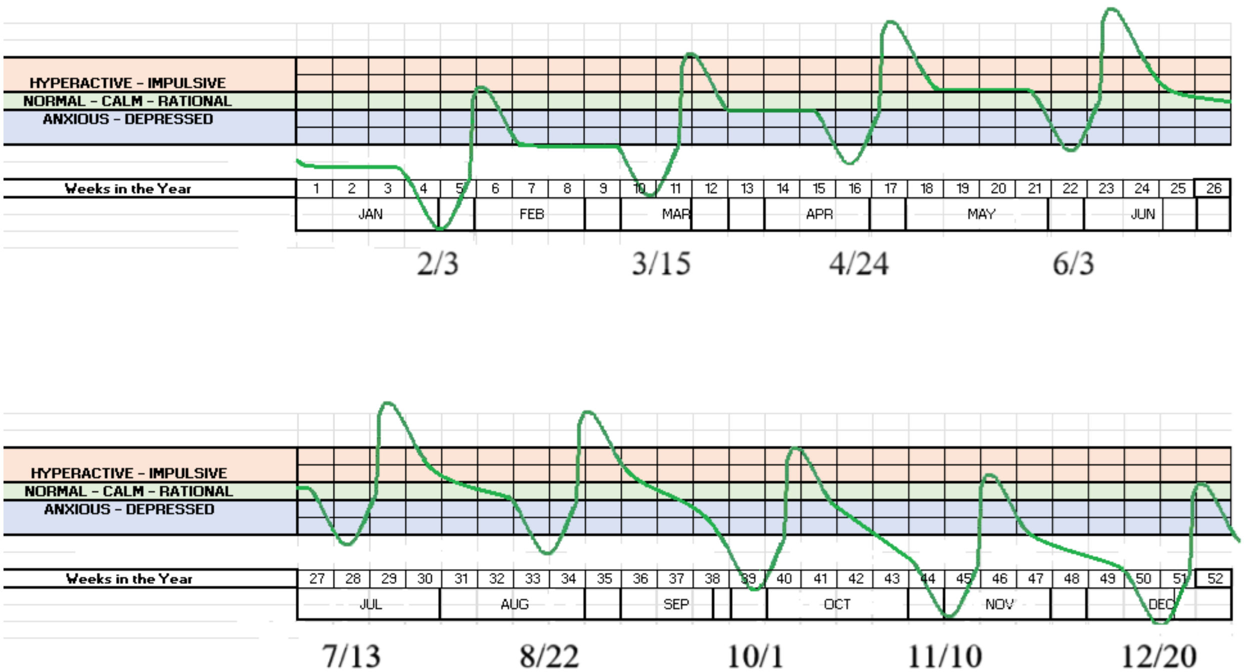
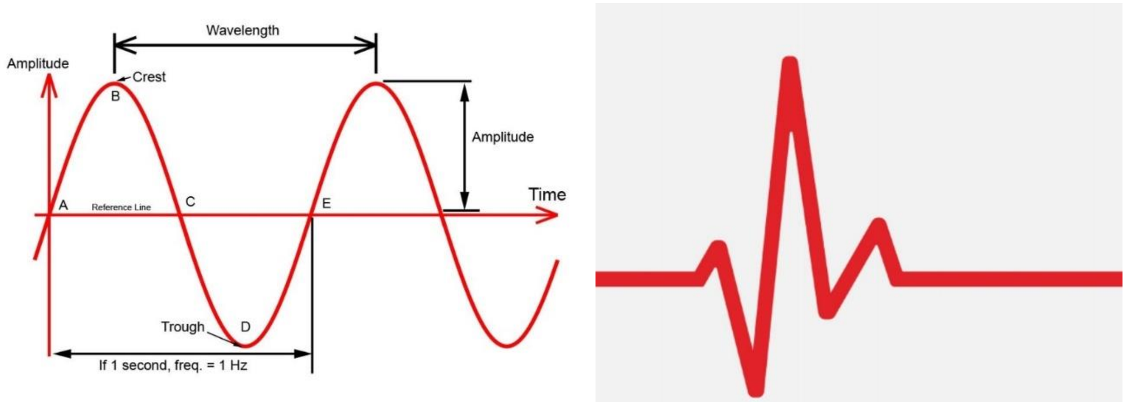


Figure 3.

The "sine wave" shape of the primary sunlight-driven dopamine cycle and the "pulse" shape of the observed 40-day-long second dopamine cycle.



Source: https://www.heart.org/en/news/2021/02/10/watch-your-heart-rate-but-dont-obsess-about-it and https://mathematicalmysteries.org/sine-wave/

Figure 4.

A combined graph of the primary dopamine sinusoidal cycle with the additional proposed secondary 40-day-long dopamine cycle is shown that is used to create a final aggregate "human temperament map."

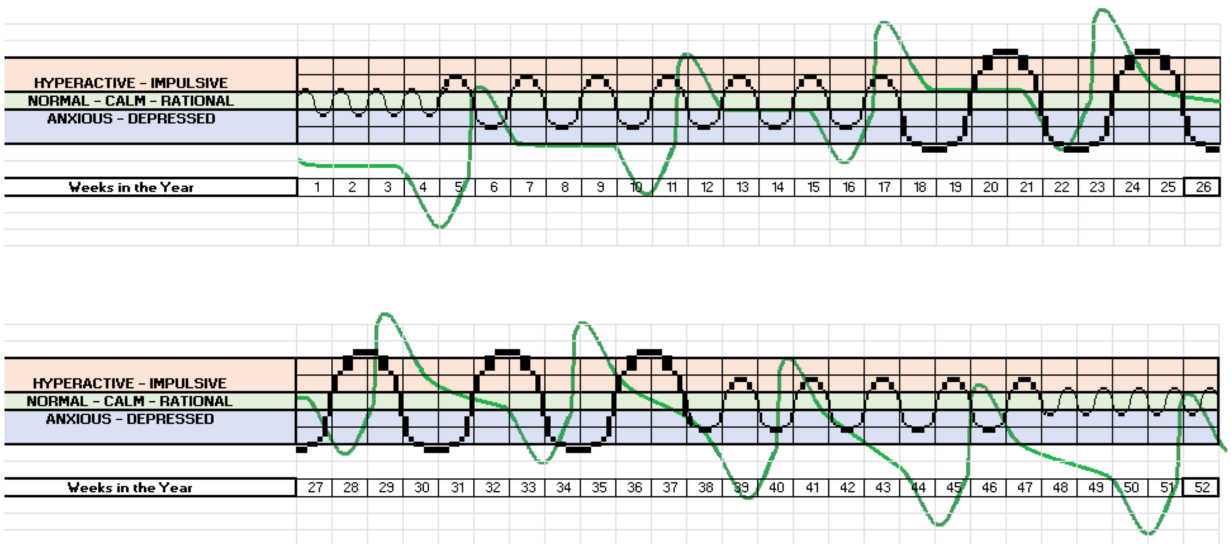
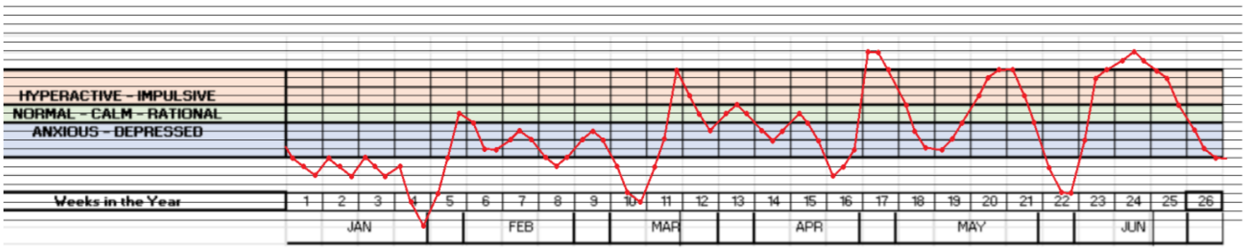


Figure 5.

An aggregate summation graph from the combined values of the two dopamine cycles produces a "human temperament map" where the mood of any human being can be predicted on any day or week of a year.



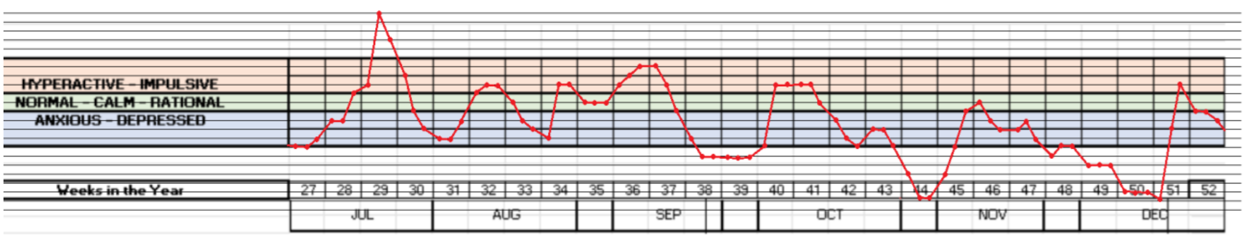


Figure 6.

A table showing the nine dates of the year when migraines will occur from the start of dopamine decrease and possible long-term memory activity.

Dopamine Cycle #	Migraine Date	Leap year adjustment
1	December 15	December 14
2	January 29	January 29
3	March 10	March 9
4	April 19	April 18
5	May 29	May 28
6	July 8	July 7
7	August 17	August 16
8	September 26	September 25
9	November 5	November 4

Figure 7.

The 10-day-long "low dopamine phase" of the secondary dopamine cycle resembles an inverted triangle with behaviors seen each day of the first five days matching those of the last five days intimating a relationship between behaviors and "levels" or amount of brain memory.

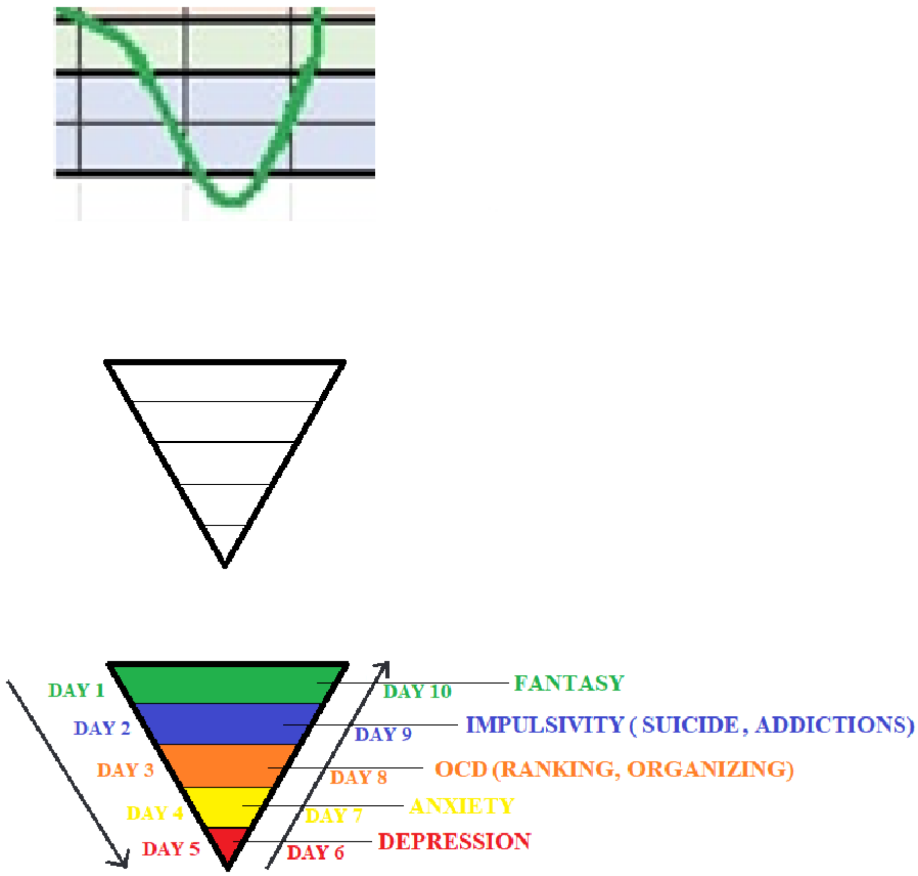


Figure 8.

The 10 days of low dopamine and 10 days of high dopamine of the secondary dopamine cycle, which resemble a pulse shape, occur on the same days each year leading to a direct mapping to an annual calendar with red days being days of declining dopamine and blepharospasm events.

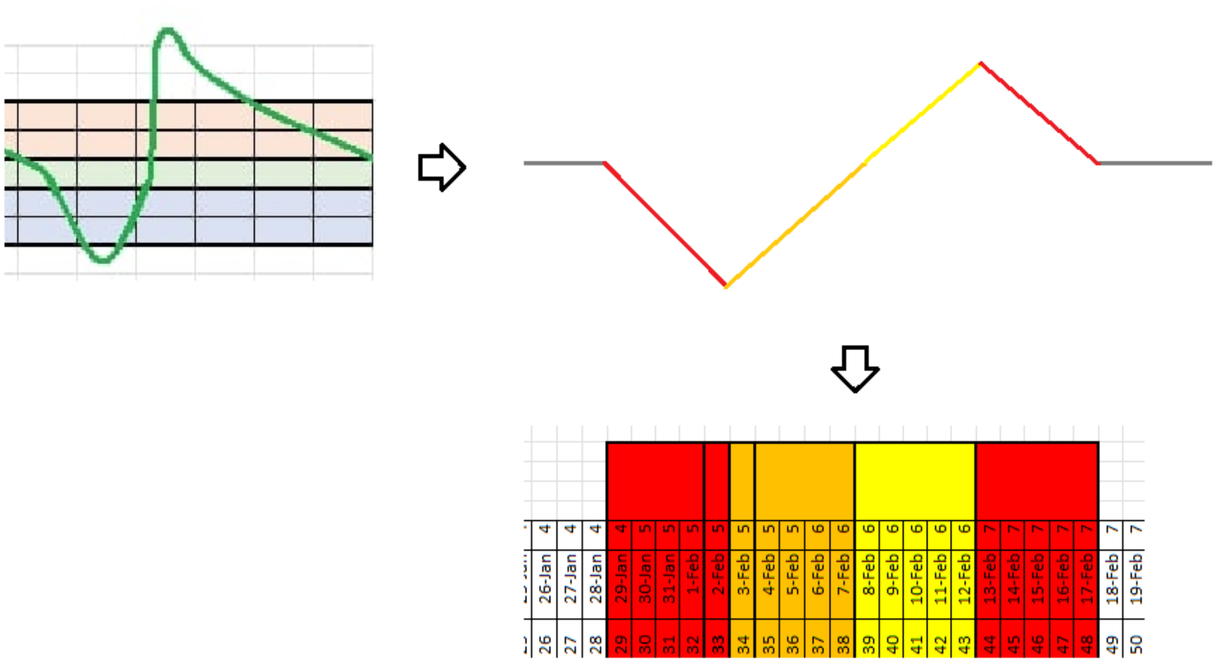


Figure 9.

The observed S&P 500 stock market "buy low" and "sell high" dates of each cycle.

Stock Market Date	Date adjusted for leap years	Action (BUY/SELL)	Event #	Cycle #
12/20	12/19	BUY low	1	1
1/20	1/20	SELL high	2	1
1/29	1/29	BUY low	3	2
3/4	3/3	SELL high	4	2
3/10	3/9	BUY low	5	3
4/14	4/13	SELL high	6	3
4/19	4/18	BUY low	7	4
5/24	5/23	SELL high	8	4
5/29	5/28	BUY low	9	5
7/3	7/2	SELL high	10	5
7/8	7/7	BUY low	11	6
8/12	8/11	SELL high	12	6
8/17	8/16	BUY low	13	7
9/21	9/20	SELL high	14	7
9/26	9/25	BUY low	15	8
10/31	10/30	SELL high	16	8
11/15	11/14	BUY low	17	9
11/20	11/19	SELL high	18	9

Figure 10.

A simple linear regression of the “buy low” and “sell high” dates from the years 2000 to 2021 displays the significance and growth.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.191933591
R Square	0.036838504
Adjusted R Square	0.031172848
Standard Error	677.0686827
Observations	172

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2980692.952	2980692.952	6.502072208	0.011658152
Residual	170	77931740.18	458422.001		
Total	171	80912433.13			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-122.5498796	103.703877	-1.181729007	0.23896366	-327.2630655	82.16330624	-327.2630655	82.16330624
X Variable 1	2.651330777	1.039771763	2.549916118	0.011658152	0.598803945	4.703857609	0.598803945	4.703857609

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*
1	-119.8985489	226.3085489
2	-117.2472181	-254.4227819
3	-114.5958873	491.5458873
4	-111.9445565	-27.66544347
5	-109.2932258	142.8332258
6	-106.641895	498.461895
7	-103.9905642	-186.1294358
8	-101.3392334	441.1592334

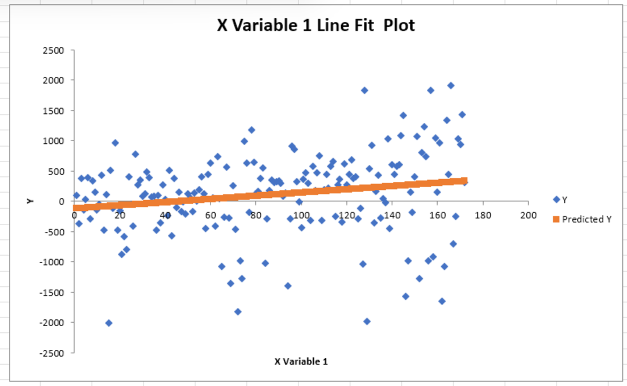


Figure 11.

A screenshot of the Robinhood mobile app showing the values of the Spyder S&P 500 ETF stock market "indexed fund" for a week in March 2022 where the March 4 "sell high" of cycle 2 and the March 10 "buy low" of cycle 3 are seen along with a screenshot of a $500.00 purchase of SPDR shares.

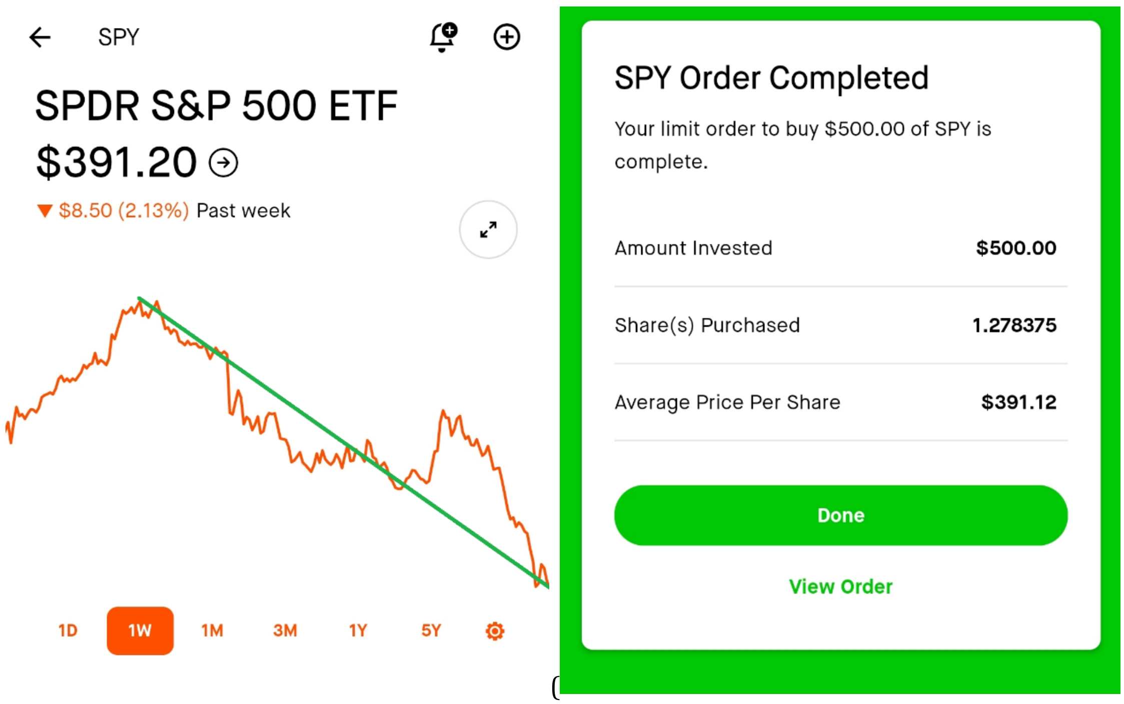


Figure 12.

Example linear regressions of a "buy low" day, the market day on or closest to April 19 (7th stock market event that falls is in the 4th second dopamine cycle) and a "sell high" day, the market day on or closest to September 21 (the 14th stock market event that falls in the 7th second dopamine cycle) are shown to illustrate the significance of the differences between the S&P 500 values on the "buy low" and "sell high" dates for the years from 2000 to 2021.

	7
2000	3.58236211
2001	5.26797105
2002	1.61923265
2003	-0.26583324
2004	0.57718528
2005	-1.47235802
2006	1.26705364
2007	0.69313531
2008	4.25099536
2009	-0.99050779
2010	-0.27923845
2011	-0.14977432
2012	0.3303819
2013	-2.13621741
2014	1.45487237
2015	-1.1665105
2016	0.70939947
2017	-0.23839732
2018	1.25101908
2019	0.6623897
2020	-1.24978288
2021	1.02795983

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.404351
R Square	0.1635
Adjusted R	0.121675
Standard E	1.716757
Observatic	22

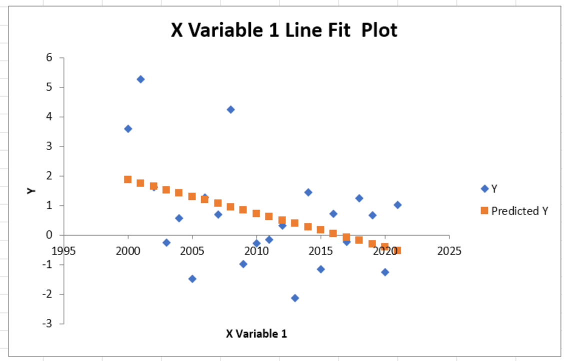
ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	1	11.52123	11.52123	3.909142	0.061973
Residual	20	58.94507	2.947254		
Total	21	70.46631			

	Coefficients	*andard Errı*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	229.9994	115.99	1.982924	0.061279	-11.9516	471.9504	-11.9516	471.9504
X Variable	-0.11407	0.057692	-1.97715	0.061973	-0.23441	0.006277	-0.23441	0.006277

RESIDUAL OUTPUT

Observatior	*Predicted Y*	*Residuals*
1	1.867933	1.714429
2	1.753867	3.514104



	14
2000	-2.62418096
2001	-19.5782938
2002	-9.0229504
2003	1.30635488
2004	2.7284131
2005	-1.63666711
2006	1.74919012
2007	5.66637715
2008	-4.03941324
2009	7.04429173
2010	3.41327234
2011	-2.50100568
2012	2.2920182
2013	2.93356623
2014	3.70181439
2015	-5.89899904
2016	-1.50878058
2017	2.79760725
2018	4.18468428
2019	4.05261375
2020	-2.50390466

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.386098
R Square	0.149071
Adjusted R	0.104286
Standard E	5.648802
Observatic	21

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	1	106.2104	106.2104	3.328545	0.083854
Residual	19	606.2703	31.90897		
Total	20	712.4808			

	Coefficients	*andard Errı*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-746.862	409.1749	-1.82529	0.08372	-1603.28	109.5508	-1603.28	109.5508
X Variable	0.371397	0.203569	1.82443	0.083854	-0.05468	0.797471	-0.05468	0.797471

RESIDUAL OUTPUT

Observatior	*Predicted Y*	*Residuals*
1	-4.06844	1.444263
2	-3.69705	-15.8812

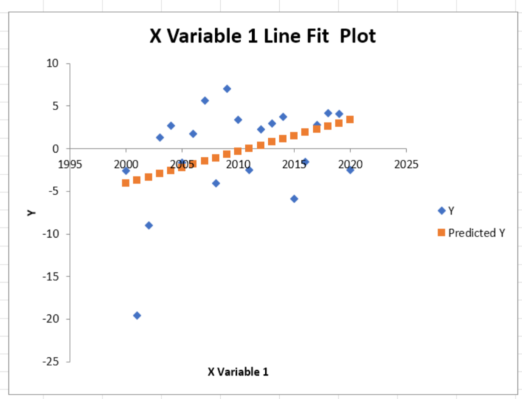


Figure 13.

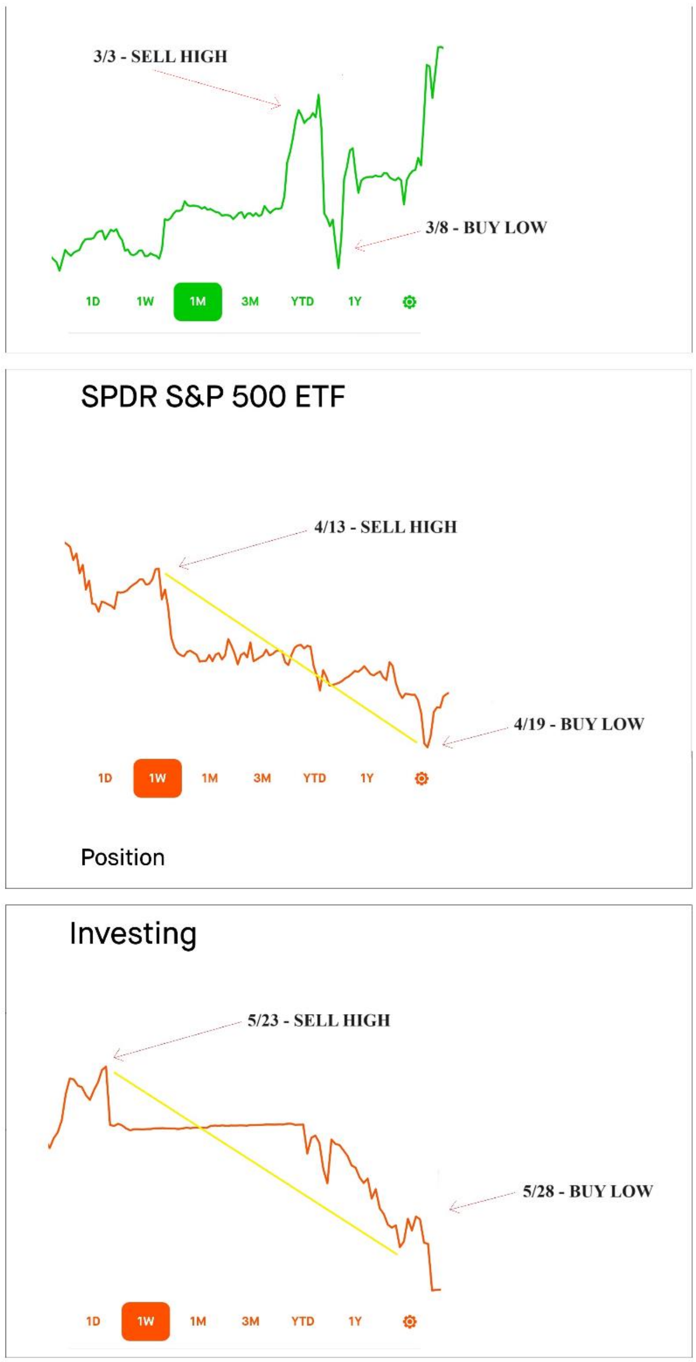
With the dates known ahead of time for “buy low” and “sell high” events, a method is established that is “risk free” as an investor can simply “wait” if a shock causes the next “sell high” interval to not be higher than the cycle’s “buy low” amount. An investor can also use separate funds “buy low” on the following cycle if desired.

Date	Closing Value	DIFFERENCE	%CHANGE	%CHANGE INTERVAL	EVENT #	INTERVAL #	BUY SELL	ACTION	$100 compare	ANNUAL % INC
Wednesday, December 16, 1914	55.35				1	1	BL	BUY	100.00	
Wednesday, January 20, 1915	58.42	3.07	5.55	5.55	2	1	SH	SELL	105.55	
Friday, January 29, 1915	56.54	-1.88	-3.22		3	2	BL	BUY	105.55	
Thursday, March 4, 1915	56	-0.54	-0.96		4	2	SH	WAIT		
Wednesday, March 10, 1915	56.66	0.66	1.18		5	3	BL	WAIT		
Wednesday, April 14, 1915	66.14	9.48	16.73	16.98	6	3	SH	SELL	123.21	
Monday, April 19, 1915	67.86	1.72	2.60		7	4	BL	BUY	123.21	
Monday, May 24, 1915	65.46	-2.4	-3.54		8	4	SH	WAIT		
Friday, May 28, 1915	65.01	-0.45	-0.69		9	5	BL	WAIT		
Saturday, July 3, 1915	69.98	4.97	7.64	3.12	10	5	SH	SELL	127.05	
Thursday, July 8, 1915	68.65	-1.33	-1.90		11	6	BL	BUY	127.05	
Thursday, August 12, 1915	78.14	9.49	13.82	13.82	12	6	SH	SELL	144.61	
Tuesday, August 17, 1915	81.78	3.64	4.66		13	7	BL	BUY	144.61	
Tuesday, September 21, 1915	84.83	3.05	3.73	3.73	14	7	SH	SELL	150.00	
Monday, September 27, 1915	89.2	4.37	5.15		15	8	BL	BUY	150.00	
Monday, November 1, 1915	95.16	5.96	6.68	6.68	16	8	SH	SELL	160.02	60.02

Date	Closing Value	DIFFERENCE	%CHANGE	%CHANGE INTERVAL	EVENT #	INTERVAL #	BUY SELL	ACTION	$100 compare	ANNUAL % INC
Monday, December 17, 2018	23592.98				1	1	BL	BUY	$100.00	
Tuesday, January 22, 2019	24404.48	811.5	3.44	3.44	2	1	SH	SELL	$103.44	
Tuesday, January 29, 2019	24579.96	175.48	0.72	0.72	3	2	BL	BUY	$103.44	
Monday, March 4, 2019	25819.65	1239.69	5.04	5.04	4	2	SH	SELL	$108.65	
Monday, March 11, 2019	25650.88	-168.77	-0.65	-0.65	5	3	BL	BUY	$108.65	
Monday, April 15, 2019	26384.77	733.89	2.86	2.86	6	3	SH	SELL	$111.76	
Thursday, April 18, 2019	26559.54	174.77	0.66	0.66	7	4	BL	BUY	$111.76	
Friday, May 24, 2019	25585.69	-973.85	-3.67		8	4	SH	WAIT		
Wednesday, May 29, 2019	25126.41	-459.28	-1.80		9	5	BL	WAIT		
Wednesday, July 3, 2019	26966	1839.59	7.32	1.53	10	5	SH	SELL	$113.47	
Monday, July 8, 2019	26806.14	-159.86	-0.59		11	6	BL	BUY	$113.47	
Monday, August 12, 2019	25897.71	-908.43	-3.39		12	6	SH	WAIT		
Friday, August 16, 2019	25886.01	-11.7	-0.05		13	7	BL	WAIT		
Friday, September 20, 2019	26935.07	1049.06	4.05	0.48	14	7	SH	SELL	$114.01	
Thursday, September 26, 2019	26891.12	-43.95	-0.16	-0.16	15	8	BL	BUY	$114.01	
Thursday, October 31, 2019	27046.23	155.11	0.58	0.58	16	8	SH	SELL	$114.67	14.67

Figure 14.

During the leap year of 2024, the "sell high" spike events and the "buy low" drop events, were seen to match the predicted shift that would occur as the additional day of February 29, would lead to these event dates (after February) occurring one day earlier for the predicted 40-day calendar pattern. The three below examples are from screenshots of Spyder ETF graphs from a Robinhood smartphone application taken on March 12, 2024 (month view), April 19, 2024 (week view), and May 29, 2024 (week view).



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