Is the timing of human warfare correlated with cyclical dopamine and serotonin levels?

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A short and informal essay speculating on the impact of pollen and, thus, histamine on human serotonin levels, especially violence and warfare. The peak pollen months in spring of February, March, April, and May and the fall months of August and September are proposed as having higher levels of "impulsive anger" from the histamine-driven lowered serotonin in humans especially human males. The start dates of all war battles from 2001 to 2023 and from 1900 to 2023 as listed in Wikipedia are examined by month where the ranking, as well as medical research results, support the hypothesis.

"Mankind must put an end to war – or war will put an end to mankind."
-- John F. Kennedy, 1961 address before the United Nations

"What will it take to end war once and for all?"
-- John Horgan

"I hate war as only a soldier who has lived it can, only as one who has seen its brutality, its futility, its stupidity."
-- Dwight Eisenhower, 1946 address

Humans too often believe we are separate from our environment with full control of all events in our lives akin to unmitigated free will. However, analysis of the effects of environmental variables and human brain cycles appears to show that violent behaviors are triggered and more likely to occur in specific windows of time in any given year. The hope is that with this knowledge humans may be able to prevent the loss of life and resources. As the saying goes, "the first step in avoiding a trap is knowing of its existence."

Another challenge is the lack of investigation into the possibility of psychological attributes scene in individual humans scaling to large human populations. Might it be the case that the effects of changes in serotonin can scale into such large populations as to affect human history?

Few things, if any, are more complex than war. This hypothesis does not try to address the cause of something as complex as war with its assortment of social, economic, cultural, and political variables. The hypothesis in this essay is that the timing of human battles, as a subset of warfare, aligns with months of low serum serotonin caused by the increases in serum histamine from environmental tree (spring) and weed (fall) pollen. The chirality of the spring and fall pollen seasons, where spring has four months of various tree pollens (mid-February, March, April, and May) and fall has only ragweed weed pollen in two months (August and September) should be seen in the data if the hypothesis is accurate i.e., more battles should occur in these six months than other months and more should occur in spring than in fall. This pattern is observed examining the starting date of all battles as listed in Wikipedia since 1900 and since 2001.

Serotonin

Serum serotonin level, or the control of the level of serotonin in the human bloodstream, is inversely proportional to serum histamine levels that are directly correlated to environmental pollen as allergens (2) (3) (4). It is also critical to note that male humans have 52% more serotonin than female humans (5). In terms of specific biochemical mechanisms, mast cells (mood-modifying molecules) in the human body emit serotonin, per Science magazine (6). The European Journal of Neuroscience notes that "mast cells are a source of serotonin. We conclude that mast cells contribute to behavioral and physiological functions of the hippocampus. It is known that mast cells can synthesize and store serotonin and that the hippocampus is important in the regulation of anxiety and depressive behaviors" (7). Also, as noted in the journal Nature:

> Because of mast cell involvement in these clinical syndromes… there has been great interest in the pharmacological modulation of histamine release from mast cells. Serotonin is also stored in mast cell granules. Because histamine and serotonin may have divergent functions in delayed hypersensitivity, we hypothesized that these amines could undergo differential release (8).

"Normal" human individuals may even be able to observe, track, or understand simple impulsive behaviors from similar, albeit manageable, increases in blood serum serotonin levels leading to excess confidence and risk taking from the biochemistry of the associated crash in airborne allergens of pollen that, thus, lowers serum histamine levels. Those behaviors can include individuals getting anxious or angry, gambling, buying stocks, spending more, increased sexual activity or alcohol use, or even spikes in suicide (9).

Dr. Ligi Thomas MD discusses, in her online Medical & Life Sciences News article *Serotonin and Aggression*:

> …the role of serotonin in abnormal aggression. Some have termed this negative relationship the most reliable finding in the history of psychiatry - people with low serotonin levels have an impulsive personality. Another model, called irritable aggression, says that impaired functioning of serotonin-secreting nerve cells produces greater irritability and a higher level of reactivity to triggers and situations. Impulsive aggression is also said to be characterized by low cerebrospinal fluid levels of serotonin (10).

Dopamine

Research findings suggest that when serotonin levels are low, it may be more difficult for the prefrontal cortex to control emotional responses to anger (11). Additional 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" (12). Research by Seo, D., Patrick, C. J., & Kennealy, P. J. in 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 (12).

Dr. Ligi Thomas MD discusses, in her online Medical & Life Sciences News article *Serotonin and Aggression* also notes that "[a]nother hypothesis is that the presence of a connection between serotonin-secreting and dopaminergic neurons causes higher levels of activity of dopamine neurons when the serotonin levels are low. This could underlie the observed increase in addictive as well as depressive conditions in persons with low serotonin levels (10)."

Solutions

While our 21st Century civilization is still far from the societal behavioral prediction capabilities of a science or technology like *psychohistory*, envisioned by Isaac Asimov in his Foundation science fiction novels, the possibility should not be considered out of reach as progress is made in both neuroscience and brain imaging tools like fMRI and PET scans. But active efforts to prevent, modify, predict, and/or control large populations remain speculative even after years of research but academic and government institutions. The possibility however should not be ignored outright and solutions to societal scourges like mass shootings and warfare could involve actions like the free distribution of antihistamines and/or SSRI medications (to lower histamine and raise serotonin during peak pollen months) and sedatives and/or serotonin lowering meds, immediately after pollen seasons, to reduce serotonin that spikes or surges after pollen levels fade. The knowledge in this essay alone may be enough to drive leaders to at least reconsider certain battlefield actions given this new context with pollen/histamine/serotonin interactions driving impulsive aggression and

violence. The very hierarchical organization of armies where individuals follow individual leaders (Generals, Admirals, Presidents, Emperors, and Kings) could be called into question at a macro scale with given the hypothesis presented. A sanity-check of decisions to attack during even just the six pollen spiking months of the year alone could save millions of unnecessary deaths.

Figures

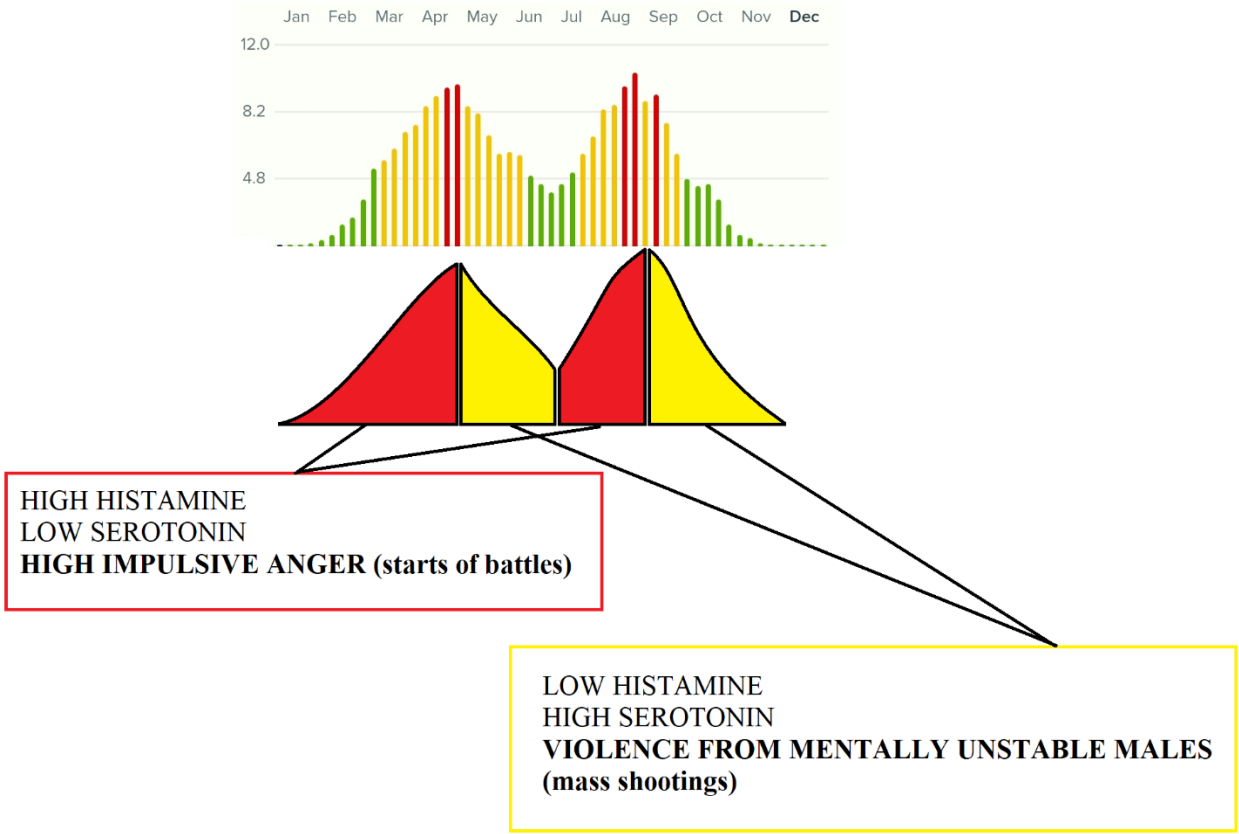
Figure 1.

A table showing the effects seen during pollen heavy months and the month right after them.

	POLLEN SEASON	IMMEDIATE POST-POLLEN SEASON
Months	Spring: March, April, May - Fall: August, September	Spring: April, May, June - Fall: September, October
Direction	Pollen level increases	Pollen level decreases
Effect 1	Serum Histamine increases	Serum Histamine decreases
Effect 2	Serum Serotonin decreases dramatically	Serum Serotonin increases dramatically
Effect 3	Anger control decreases	mentally unstable men reach excessive serotonin
Associated Action	impulsive violence and starts of battles	mass shootings

Figure 2.

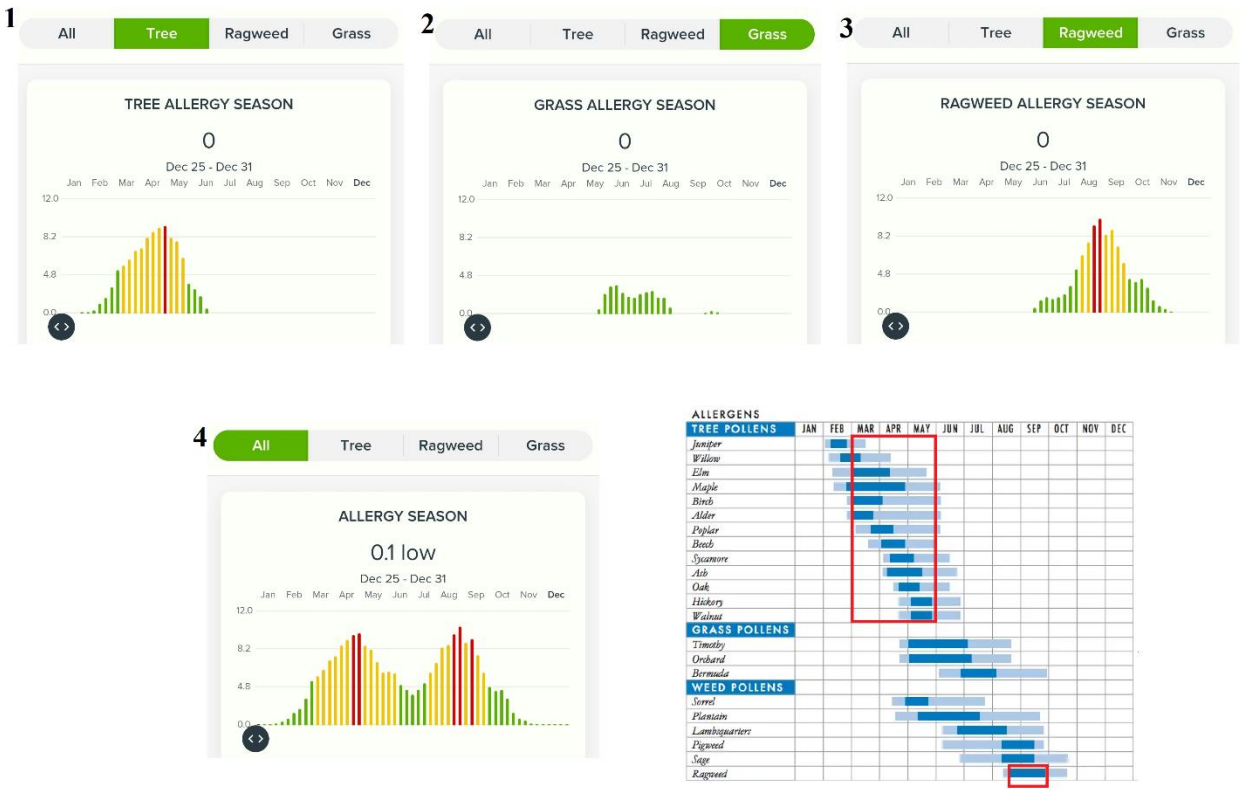
The major spring and fall pollen seasons are shown on the www.pollen.com smartphone application with pollen severity by month. The effects are then shown in red and yellow subsections for clarity.



Source: www.pollen.com

Figure 3.

The www.pollen.com smartphone application breaks out the pollen seasons by month and severity in 1, 2, and 3 with the entire year shown in 4. The individual pollen generating plants and weeds are displayed individually to reiterate the different length of pollen seasons with spring lasting four months from February through May and fall lasting from August through September for ragweed.



Source: Khan, T. (2022, June 11). United States mass shootings triggered by serotonin spikes from seasonal pollen level drops. https://doi.org/10.31234/osf.io/r7djc (13).

Figure 4.

The starting dates of battles (by month) are counted and sorted from Wikipedia data listing all major battles from 2001 to 2023. Note how four of the five top months match the pollen peak months (only September is missing). The correlation being that a certain degree of attack decisions i.e., "impulsive aggression" is due to the influence of serotonin lowering histamine from environmental pollen sources in those red months.

March	3	104
August	8	100
April	4	87
February	2	84
May	5	84
January	1	75
June	6	51
September	9	50
November	11	47
October	10	46
July	7	39
December	12	26

Source: Wikipedia contributors. (2023, May 6). List of battles in the 21st century. In *Wikipedia, The Free Encyclopedia*. Retrieved 16:00, May 13, 2023, from https://en.wikipedia.org/w/index.php?title=List_of_battles_in_the_21st_century&oldid=1153512334 (14).

Figure 5.

An excel histogram showing the Wikipedia list of start of battle dates by month for the years 2001 to 2023.

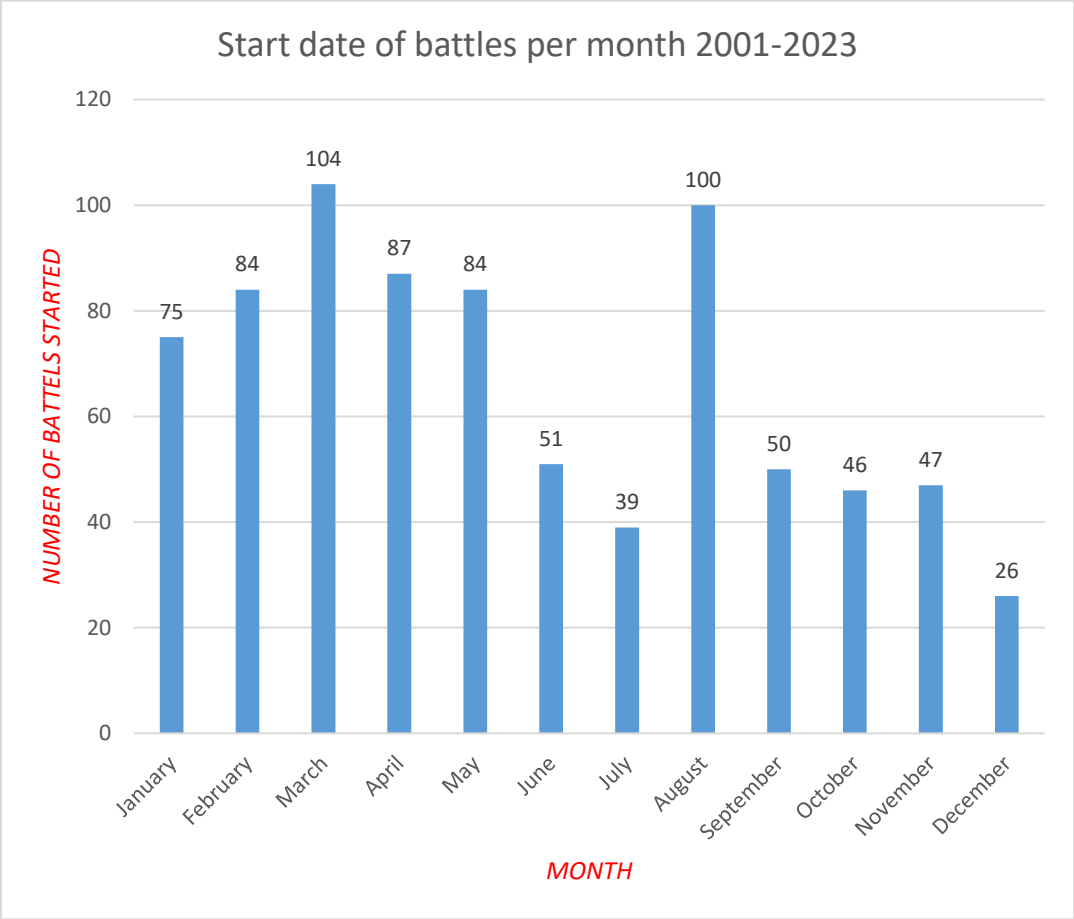


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Figure 6.

An excel created histogram showing the Wikipedia list of start of battle dates by month for the years 2001 to 2023 is overlaid on the pollen seasons from www.pollen.com to visually show the close alignment with the increase in the number of battles matching the lowered serotonin during pollen heavy months.

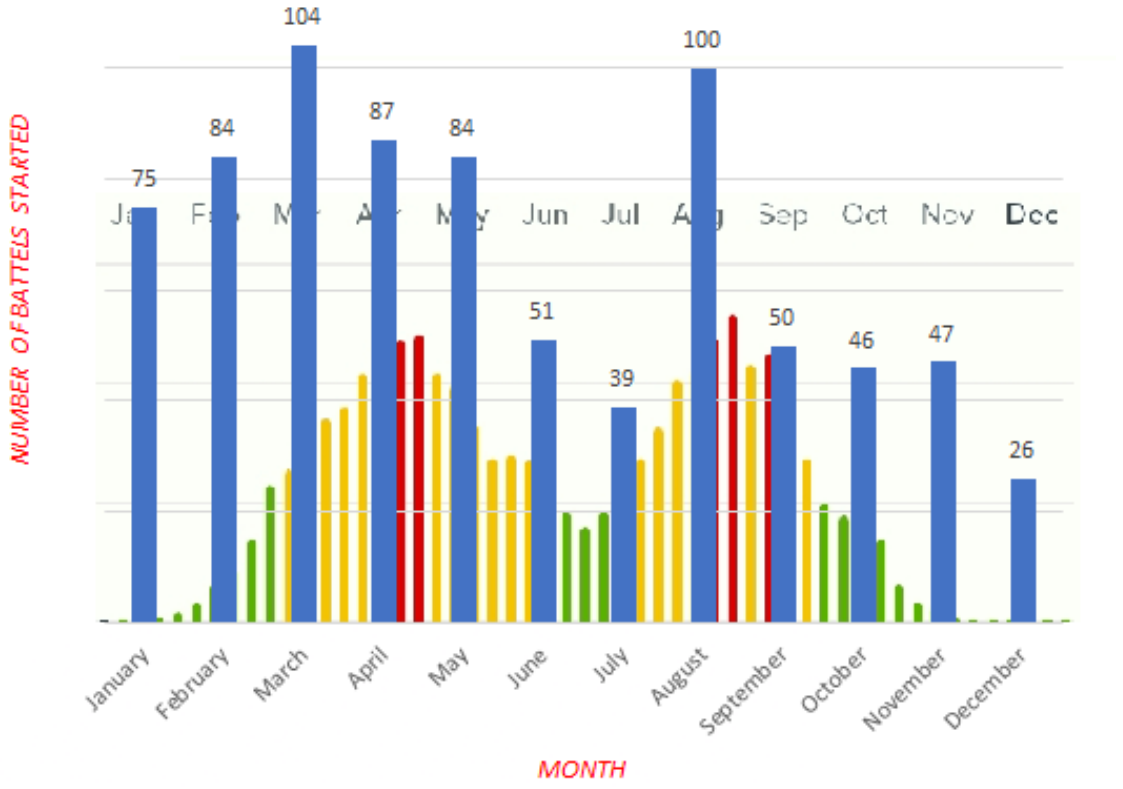

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Figure 7.

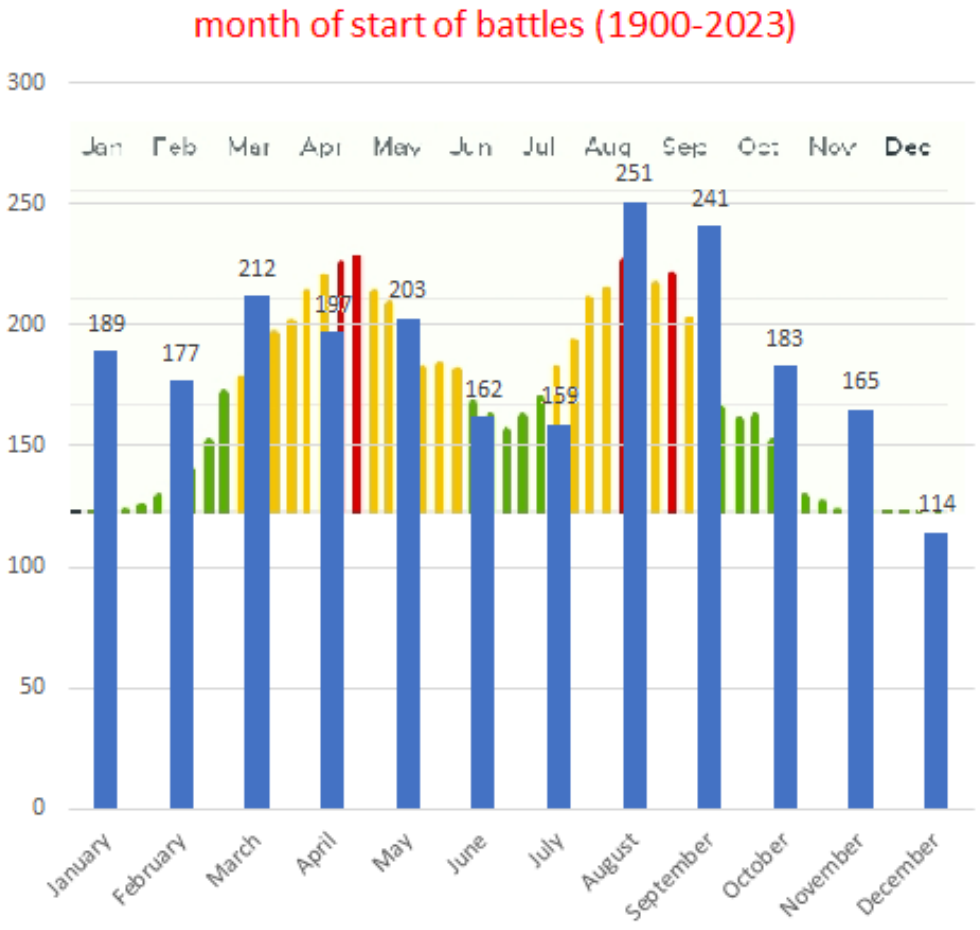
The starting dates of battles (by month) are counted and sorted from Wikipedia data listing all major battles from the year 1900 to 2023. Note how the top five months exactly match the top five months ranked in the list. The correlation being that a certain degree of attack decisions i.e., "impulsive aggression" is due to the influence of serotonin lowering histamine from environmental pollen sources in those red months.

August	251
September	241
March	212
May	203
April	197
January	189
October	183
February	177
November	165
June	162
July	159
December	114

Source: Wikipedia contributors. (2023, May 14). List of battles 1901–2000. In *Wikipedia*, The Free Encyclopedia. Retrieved 19:35, May 14, 2023, from https://en.wikipedia.org/w/index.php?title=List_of_battles_1901%E2%80%932000&oldid=1154763968

Figure 8.

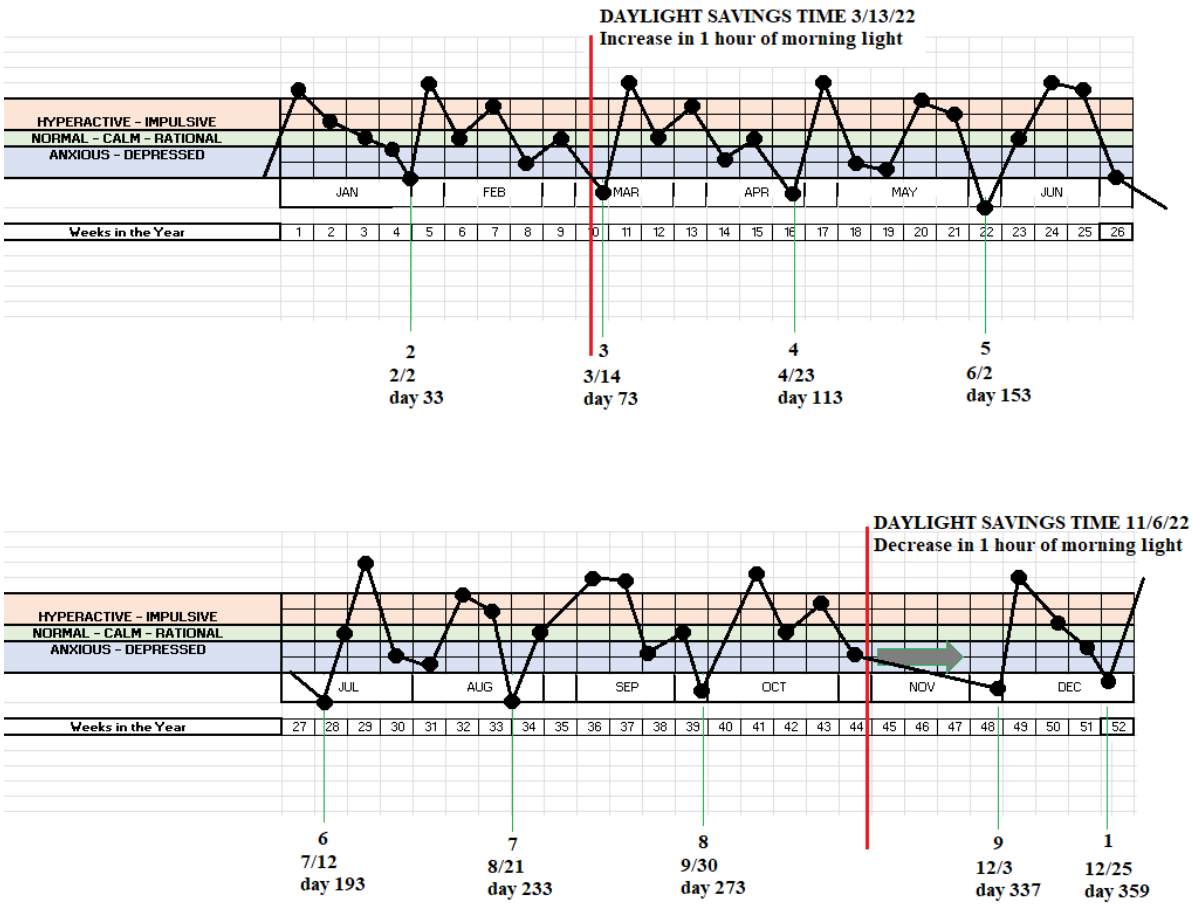
An excel created histogram showing the Wikipedia list of start of battle dates by month for the years 1900 to 2023 is overlaid on the pollen seasons from www.pollen.com to visually show the close alignment with the increase in the number of battles matching the lowered serotonin during pollen heavy months.



SOURCE: www.pollen.com and Wikipedia contributors. (2023, May 14). List of battles 1901–2000. In *Wikipedia*, The Free Encyclopedia. Retrieved 19:35, May 14, 2023, from https://en.wikipedia.org/w/index.php?title=List_of_battles_1901%E2%80%932000&oldid=1154763968

Figure 9.

A summation graph from the combined values of the two human dopamine cycles produces an aggregate dopamine map at a level of granularity measured in weeks.



Source: Khan, T. (2023, March 18). Are fluctuations in the stock market tied to a dopamine cycle in the human brain. https://doi.org/10.31234/osf.io/vq2jf (16).

Figure 10.

A map of aggregate human dopamine is overlaid on the www.pollen.com monthly pollen seasons graph (the inverse relationship of serotonin to histamine is shown at bottom in black). The new graph reveals five weeks of the year where the specific scenario of "high dopamine and low serotonin" occur – windows of high-probability of violence and aggression – as seen in the vertical red boxes and yellow lines. Those weeks include the second or third week of March, the last week of April or the first week of May, and the third or fourth week in May in spring, and the second week of August and the first or second week of September in fall. While perhaps only coincidence, the dates of the 2001 September 11 terrorist attack on the United States and the start of the 2022 Ukraine invasion by the Russian army, both fall precisely in these "anger box" week-long timeframes in the months of highest pollen and increased number of battles.

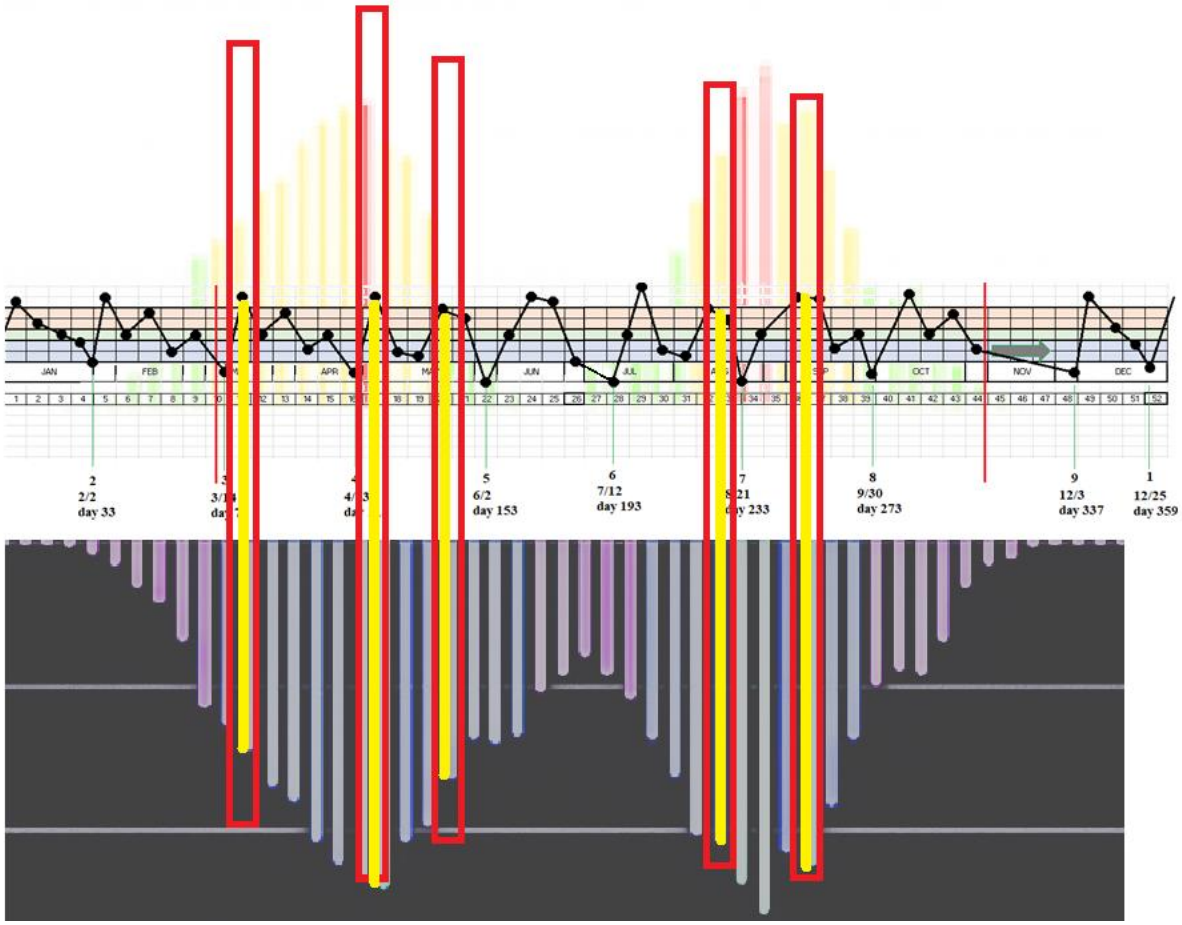


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Figure 10.

Simple analysis of the Wikipedia information shows that war battles are 40% more likely to start in 5 specific (1-2) week intervals than on any other week in a year. In the last 123 years, 49 days in the five windows had a total of 247 battles start on them or an average of 5.04 battles per day on these days. The rest of the days, outside these 5 windows, included 1,075 battles on 247 days or an average of 3.607 per day. It is proposed in this essay that humans will always be angry in these intervals as dopamine is high and serotonin, via high histamine from seasonal pollen in spring or fall, is thus low. The results support the accuracy of the dates of the aggregate dopamine "temperament map." The "anger box" weeks, where northern hemisphere humans have increased "impulsive anger," include the:

1) Second or third weeks of March - March 3/7 to 3/21 are used as the days in the analysis.
2) Last week in April or the first week in May - 4/21 to 5/7 are used as the days in the analysis.
3) Third or fourth week in May - May 21 to May 30 are used as days in the analysis.
4) Second week in August – August 7 to August 14 are used as days in the analysis.
5) First or second week in September – September 1 to September 14 are used as days in the analysis.

This effect is proposed as a universal effect and should be seen in most humans, especially males, in the northern hemisphere during the five noted weeks - not just mentally unstable males who are impacted when histamine drops thus increasing serum serotonin after pollen season. It is during these five weeklong intervals when bosses, wives, sisters, and associates act abnormally with impulsive anger and when battles are much more likely to begin – a valuable aid for military forces.

1 September	21			25 June	13	19 April	5	3 July	4	1 February	3	8 April	2	12 November	2	26 October	1		
14 August	12			1 November	12	19 August	5	7 July	4	4 February	3	13 April	2	17 November	2	28 October	1		
22 April	9			19 Septembe	12	12 December	5	11 July	4	11 February	3	15 April	2	23 Novembe	2	16 Septembe	1		
9 August	9			8 December	11	13 December	5	12 July	4	13 February	3	16 April	2	24 Novembe	2	30 Septembe	1		
27 May	9			31 January	11	10 February	5	14 July	4	16 February	3	20 April	2	8 October	2	TOTAL	Avg per day		
18 March	8			26 Septembe	10	28 February	5	15 July	4	21 February	3	5 August	2	10 October	2	1075	3.60738255		
8 March	7			15 August	9	17 January	5	16 July	4	27 February	3	20 August	2	13 October	2				
3 September	7			9 April	8	18 January	5	18 July	4	2 January	3	22 August	2	18 October	2				
5 September	7			6 August	8	27 January	5	19 July	4	5 January	3	1 December	2	19 October	2			1.433433776	
6 September	7			17 February	8	29 January	5	20 July	4	12 January	3	4 December	2	10 Septembe	2				
24 April	6			4 July	8	30 January	5	23 July	4	13 January	3	5 December	2	22 Septembe	2			0.397361177	
26 April	6			15 June	8	6 July	5	24 July	4	24 January	3	15 December	2	24 Septembe	2				
8 August	6			10 May	8	6 June	5	14 June	4	2 July	3	16 December	2	7 April	1				
4 September	6			3 November	8	10 June	5	19 June	4	5 July	3	18 December	2	10 April	1				
8 September	6			3 October	8	11 June	5	21 June	4	25 July	3	23 Decembe	2	14 April	1				
9 September	6			25 October	8	11 May	5	23 June	4	29 July	3	25 Decembe	2	1 August	1				
12 Septembe	6			17 Septembe	8	13 May	5	28 June	4	4 June	3	27 Decembe	2	6 December	1				
27 April	5			28 Septembe	8	8 November	5	23 March	4	7 June	3	28 Decembe	2	22 Decembe	1				
28 April	5			18 April	7	16 Novembe	5	26 March	4	8 June	3	30 Decembe	2	24 Decembe	1				
10 March	5			23 August	7	18 Novembe	5	27 March	4	17 June	3	31 December	2	2 February	1				
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28 May	5			6 October	7	9 October	5	12 May	4	27 June	3	20 February	2	24 February	1				
7 September	5			23 October	7	11 October	5	16 May	4	1 March	3	3 January	2	25 February	1				
11 September	5			29 Septembe	7	14 October	5	18 May	4	2 March	3	6 January	2	29 February	1				
13 Septembe	5			16 August	6	20 October	5	31 May	4	6 March	3	7 January	2	4 January	1				
14 Septembe	5			17 August	6	27 October	5	2 November	4	22 March	3	8 January	2	15 January	1				
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19 March	4			24 August	6	21 Septembe	5	16 October	4	30 March	3	14 January	2	8 July	1				
23 May	4			26 August	6	25 Septembe	5	22 October	4	1 May	3	21 January	2	26 July	1				
2 September	4			7 December	6	17 April	4	29 October	4	7 May	3	22 January	2	30 July	1				
27 Septembe	4			19 February	6	25 April	4	18 Septembe	4	4 November	3	26 January	2	1 June	1				
21 April	3			1 January	6	30 April	4	23 Septembe	4	6 November	3	9 July	2	2 June	1				
29 April	3			19 January	6	4 August	4	1 April	3	7 November	3	13 July	2	12 June	1				
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7 March	3			10 July	6	28 August	4	2 August	3	21 November	3	31 July	2	29 June	1				
11 March	3			21 July	6	3 December	4	3 August	3	22 November	3	9 June	2	24 March	1				
15 March	3			22 July	6	10 December	4	18 August	3	25 Novembe	3	30 June	2	29 March	1				
11 August	2			13 June	6	26 December	4	25 August	3	29 Novembe	3	3 March	2	3 May	1				
9 March	2			15 May	6	5 February	4	27 August	3	5 October	3	5 March	2	6 May	1				
16 March	2			17 May	6	9 February	4	29 August	3	12 October	3	19 May	2	9 May	1				
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14 March	1			24 October	6	26 February	4	17 December	3	31 October	3	29 May	2	28 Novembe	1				
24 May	1	TOTAL	AVG per day	15 Septembe	6	23 January	4	19 December	3	5 April	2	5 November	2	4 October	1				
30 May	1	247	5.040816327	11 April	5	28 January	4	20 Decembe	3	6 April	2	10 Novembe	2	21 October	1				

Source: Wikipedia contributors. (2023, May 14). List of battles 1901–2000. In *Wikipedia*, The Free Encyclopedia. Retrieved 19:35, May 14, 2023, from https://en.wikipedia.org/w/index.php?title=List_of_battles_1901%E2%80%932000&oldid=1154763968 and Wikipedia contributors. (2023, May 6). List of battles in the 21st century. In *Wikipedia, The Free Encyclopedia*. Retrieved 16:00, May 13, 2023, from https://en.wikipedia.org/w/index.php?title=List_of_battles_in_the_21st_century&oldid=1153512334

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