

The significance of environmental factors and brain clocking on human health and behavior.

Tariq Khan
Department of Economics
University of Nebraska at Omaha,
Omaha, Nebraska, USA

The influence of sunlight on human biology including brain circadian rhythms is discussed. The impact of a lack of sunlight, allergens, and modern society on brain clocking and sleep is discussed in detail including specific data from bipolar disorder research. Evidence is provided noting the significance of brain clocking and its importance to overall human health and its variation compared to seasonal cycles and human behaviors. The nature and origin of specific forms of music matching the general themes are also noted.

A recent essay on *Edge.org* noting the small likelihood that humans will be inhabiting other planets with active ecosystems anytime soon, basically due to the viral risks and the lack of evolutionary fit with the microorganisms of that environment, has led to reexamination of human everyday beliefs relating to our day-to-day lives and how biases may lead us to ignore key aspects of our world and how the environment actively influences, not only our health, but our mental state and the decisions we make.

Now much of biology relates to systems operating in a “sweet spot” mode or working toward homeostasis or equilibrium as opposed to say binary or working versus non-working technology systems. An example of an environmental influence, that very few individuals consider, is the dependency on sunlight exposure for the proper daily functioning of the human body and mind. This is of particular importance in bipolar disorder individuals that are notoriously sensitive to light.

In our modern society bipolar individuals, as well as the general public, face two significant concerns related to the lack of sunlight exposure which are the lack of sunlight from so many careers involving work that is indoors, and in cubicles without any windows, as well as a dramatic increase in what has become known as “light pollution” with smartphones, computers (e.g. iPads, Kindles, Nooks, etc...), televisions, and even external sources like city street lamps producing excess blue light especially late at night that is impacting the circadian rhythms of humans and animals alike.

Recent research has called out the benefit of sunlight for human blood pressure regulation noting how sunlight lowers blood pressure, and subsequently stress, and thus literally adds years to lives especially for those in higher latitudes that normally would not get enough sunlight; perhaps some “evolutionary wisdom” in those that retire to Florida and Arizona.

Separately, there is evidence that changes in environmental elements like pollen allergen levels have a significant influence on human behavior as dramatic decreases in allergen levels will cause a subsequent spike in serum serotonin levels in human brains and thus potentially become a trigger for violence in mentally ill individuals, i.e. those sensitive or at risk from serotonin changes. Dramatic increases in allergen levels not only have the unwelcome increase in associated histamine side-effects, that so many people dread with seasonal allergies, but it also drops serum serotonin levels causing mild depression, poor sleep, and potentially, ironically, increased intellectual or mathematical abilities in humans. Heavy levels of allergens in the air also directly leads to very poor sleep. Poor sleep is known to lead to irritability as well as an increase in impulsive behaviors. This is likely not a missed fact by marketing experts and perhaps adds to so much compulsive shopping around Christmas time in December in Western society. Thus, we can suggest sleep loss from seasonal allergens, with fall global ragweed peaks between the 10th and 20th of September as well as spring global juniper or tree pollen peaks in March, as a cause for the historical association of the autumnal and vernal equinoxes as being times of irrationality, festivity, and lascivious behaviors.

Research also indicates a direct association with bipolar disorder and a drift in proper brain and body clocking from lack of sunlight cues. All human beings have mood swings however many bipolar individuals will have a wavelength (length of their peak and trough cycle) of four weeks or more in the summer, two weeks in fall and spring, and one week in winter months. The increase in this mood or polar cycling appears synonymous if not identical to electrical “clocking drift” in computer processors or network protocols where signal timing drift can have such dramatic impact. This drift results in a dramatic impact to physical and mental health mainly from a lack of proper sleep with sleep critical, not only for proper brain restoration, but also for the proper functioning of adrenal-pituitary axis immune system and hormonal

activities. Anxiety will also spike in the winter for these bipolar individuals if not all individuals again making winter December holidays such a logical time of year to rest and to not do critical decision focused work activities.

Recent research demonstrated how the human body clocks not only off of the brain's circadian rhythm tied to sunlight, but also off of the activities of other organs (stomach, liver, skin, etc...) including the timing of meals. Thus, individuals that have appetite spikes or cravings at night (especially those with fall seasonal affective disorder) will inadvertently be making their body's ability to clock even worse as the late meals confuse the brains into "thinking" that the midnight snack occurred at around noon and thus their brains internal clock resets to six hours later making midnight now noon and they take days to return to a normal sleep schedule; i.e. a very difficult hangover indeed. This brain to sunlight "clocking drift" can result in a "deflationary spiral" as poor sleep itself can lead to an increase in impulse control as well as appetite control, thus leading to late night eating binges, which thus lead to worse brain clocking, and thus worse sleep, and over and over. From the above scenarios we can see the significant importance of external environmental cues on the proper health of the human mind and body.

Now, in this context, we can speculate on some other ways in which our environment might influence our daily lives. Consider, of all things, Rock 'N' Roll music. We can ask, why did Rock 'N' Roll music develop, and continue to primarily flourish, in England and the United States? We are not asking about the origins of the art form from American Blues music but, rather, how or why so many bands and musical fans exist in these areas or location versus others parts of the world that are equally modern. Perhaps, to reinforce the point, we can examine what is known as electronic club or "trance" music. Trance music was born from musicians and disc-jockeys "DJs" in England, Holland, and Belgium that are all Northern European nations with very dark fall and winter seasons with heavy clouds and low levels of aggregate annual sunlight. Now trance music is known for having catchy melodies that repeat over and over at a very fast rate. For all intents and purposes, these melodies directly resemble, and we speculate is used as (and thus loved for being), a clocking rhythm or brain clocking circadian rhythm substitute. Thus, we see a clear possible evolutionary and biological cause or "need" for the development of trance and even Rock 'N' Roll music with both having relatively fast and repetitive rhythms that, being "catchy," remain in our minds and thus help our minds stay in-sync or "clocked." In essence, we can hypothesize that music allows, or helps, the brain clock especially when there is a lack of sunlight. It would be interesting to speculate the origin of music beginning, not during nomadic ancient man periods, but rather once man moved into dwellings in caves and habitats and migration moved to lands higher in latitude and darkness.

Now is this idea so outlandish? Let us examine this idea by looking at music from various locations and latitudes with different sunlight levels and start with Jamaica. In Jamaica there is plenty of sunlight and thus we can assume in general that brain wavelengths will be long (a la summer time wavelengths), blood pressure will be low, and humans will be relaxed from the large amounts of equatorial sunlight. Thus, we enjoy Reggae music with a much slower and relaxing tempo. Contrast this again to the Northern European nations where trance music originated and is "needed" for "dark" Holland and England.

So why did rock 'n' roll begin in England? England is the birthplace of the Industrial Revolution and from here we have a musical art form that becomes addicting as English workers worked inside in factories and mills, lived in row houses, and took subways all away from the sunlight. England was dark and so was Holland. Thus, in general, modern forms of music very likely originate as the result of a need in humans in those regions to maintain a brain "clock."

The data suggests that the human brain will primarily use its circadian rhythm (dependent on vitamin D, calcium, and vitamin B12 to properly work) and then it will use secondary clocks, if sunlight or those chemicals are missing, from the human body's other organs including the stomach (meal times), liver, heart rates, skin etc... But the brain will not only use sunlight, organ, and even musical rhythms to help with its daily clocking. The brain has also been shown to have an annual 365-day clock as well. It is here that, unbeknownst to so many, the brain appears to use music as a final "emergency clock" as music in our memory (like so many events our mind records from our lives) appears to be "time-stamped" to match the time of year it was first heard in, in the past. An interesting test suggested for the reader, is to wait until a song from their past randomly "pops into their head" (as if from out-of-nowhere but not from someone or something else playing it) and they will likely discover that they had heard that specific song first (or many times) in that exact week or month of the year after first hearing it in the same exact week or month a year or even decades prior. Note also how the "summer blockbuster song" always lasts four to even eight weeks on top of the

charts, but that songs that top the chart in winter almost never seem to last more than one to two weeks in this position, as if their usefulness required to clock or maintain their rhythm in a mind has expired, again hinting at a match to shorter winter brain wavelengths so clearly visible in bipolar patients. Now we could also speculate that our human love of music may be closer to a root mind's algorithmic desire to identify and preserve beautiful structures however it is, beyond a doubt, used as a tool for brain clocking.

Now if we consider how bipolar individuals are effected by sunlight we have bipolar individuals most likely anxious in winter and possibly hyperactive (exposure to too much blue light) in summer, thus we might even be able to examine spikes in child births, from bipolar individuals or a bipolar disorder parent in September or October (winter procreation) or April or May from (summer procreation) and then, possibly, December spikes in childbirths from impulse control issues from those with allergens to spring allergens and July or August childbirths from ragweed induced impulse control encounters. These December and July and August births would more than likely be associated with individuals that have moved to a new country, state, or environment and that are thus not immune to those allergens in that new environment. The tests of Amish children raised in indoor environments having much higher incidences of allergies and asthma versus those raised on farms is research providing evidence along these lines related to environmental exposure adaptation.

A final speculative proposal regarding brain clocking associated to a human environment is the idea that perhaps some individuals are not only sensitive to sunlight exposure but perhaps they actually have a genetic sensitivity to the Earth's latitude location in general and that perhaps sleep issues or especially "delayed sleep phase disorder" (also known as delayed sleep phase-shift disorder) - akin to bipolar disorder clocking issues where bipolar individuals prefer to wake up late and work in the evening - could actually be due to drift away from a genetic heritage or predisposition linked to a specific longitude of the planet. For example a women from Mumbai India might migrate to the United States and suddenly become wide- awake at seven at night if she is exposed to bright lights at that time of night as her brain perhaps defaults to a genetic "clock" predisposed to a longitude in India that is actually twelve hours ahead of a longitudes in the United States.