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full moon and lunar effects



"...spooky effects have been ascribed to the phases of the moon....But when the statistics are redone properly, the correlation with lunar phase always evaporates....Yet many sensible people—including police officers and emergency room staff—continue to believe otherwise." --Steven Strogatz

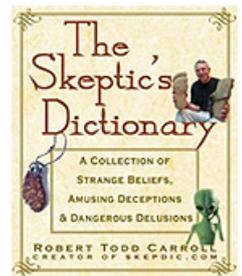
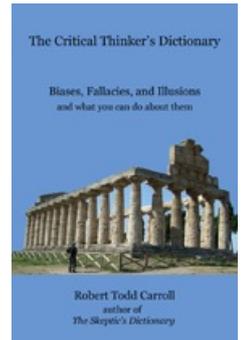
The full moon has been linked to crime, suicide, mental illness, disasters, accidents, birthrates, fertility, and [werewolves](#), among other things. Some people even [buy and sell stocks according to phases of the moon](#), a method probably as successful as many others. Numerous studies have tried to find lunar effects. So far, the studies have failed to establish much of interest. Lunar effects that have been found have little or nothing to do with human behavior, e.g., the discovery of a slight effect of the moon on global temperature,* which in turn might have an effect on the growth of plants. Of course, there have been single studies here and there that have found correlations between various phases of the moon and this or that phenomenon, but nothing significant has been replicated sufficiently to warrant claiming a probable causal relationship.

Ivan Kelly, James Rotton and Roger Culver (1996) examined over 100 studies on lunar effects and concluded that the studies have failed to show a reliable and significant correlation (i.e., one not likely due to chance) between the full moon, or any other phase of the moon, and each of the following:

- the homicide rate
- traffic accidents
- crisis calls to police or fire stations
- domestic violence
- births of babies
- suicide
- major disasters
- casino payout rates
- assassinations
- kidnappings
- aggression by professional hockey players
- violence in prisons
- psychiatric admissions [one [study](#) found admissions were *lowest* during a full moon]
- agitated behavior by nursing home residents
- assaults
- gunshot wounds

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If so many studies have failed to prove a significant correlation between the full moon and anything, why do so many people believe in these lunar myths? Kelly, Rotton, and Culver suspect four factors: media effects, folklore and tradition, misconceptions, and cognitive biases. A fifth factor should be considered, as well: [communal reinforcement](#).

[the media perpetuate lunar myths](#)

Lunar myths are frequently presented in films and works of fiction. "With the constant media repetition of an association between the full moon and human behavior it is not surprising that such beliefs are widespread in the general public" (Kelly et al. 1996). Reporters also "favor those who claim that the full moon influences behavior." It wouldn't be much of a story if the moon was full and nothing happened, they note. Anecdotal evidence for lunar effects is not hard to find and reporters know that one good anecdote trumps ten scientific studies when it comes to reader interest, even though such evidence is unreliable for establishing significant correlations. Relying on personal experience ignores the possibility of [self-deception](#) and [confirmation bias](#). Such evidence may be unreliable, but it is nonetheless persuasive.

[folklore and tradition](#)

Many lunar myths are rooted in folklore. For example, an ancient Assyrian/Babylonian fragment stated that "A woman is fertile according to the moon." Such notions have been turned into widespread misconceptions about fertility and birthrates. For example, [Eugen Jonas](#), a Slovakian psychiatrist, was inspired by this bit of folklore to create a method of birth control and fertility largely rooted in [astrological](#) superstitions. The belief that there are more births during a full moon persists today among many educated people. Scientific studies, however, have failed to find any significant correlation between the full moon and number of births (Kelly and Martens 1994; Martens et al.1988). In 1991, Benski and Gerin reported that they had analyzed birthdays of 4,256 babies born in a clinic in France and "found them equally distributed throughout the synodic (phase) lunar cycle" (Kelly, et al. 1996: 19). In 1994, Italian researchers Periti and Biagiotti reported on their study of 7,842 spontaneous deliveries over a 5-year period at a clinic in Florence. They found "no relationship between moon phase and number of spontaneous deliveries" (ibid.).

Despite the fact that there is no evidence of a significant correlation between phases of the moon, the [menstrual cycle](#), and fertility, some people not only maintain that there is, they have a "scientific" explanation for the non-existent correlation.* Some think the light of the moon affects fertility in women, the way it does [in corals](#). The light of the moon is a very minor source of light in most women's lives, and is no more likely than the moon's gravitational force to have a significant effect on a woman's ovulation. Furthermore, the average menstrual cycle is 28 days but varies from woman to woman and month to month, while the length of the lunar month is a consistent 29.53 days.* Some of us have noticed that these cycles are not identical. Furthermore, it would seem odd that natural selection would favor a method of reproduction for a species like ours that depended on the weather.

Clouds are bound to be irregularly and frequently blocking moonlight, which would seem to hinder rather than enhance our species' chance for survival.

Some mythmakers believe that long ago women all bled in sync with the moon, but civilization and indoor electric lighting (or even the discovery of fire by primitive humans) have disturbed their rhythmic cycle. This theory may seem plausible until one remembers that there are quite a few other mammals on the planet that have not been affected by firelight or civilization's indoor lighting and whose cycles aren't in harmony with the moon. In short, given the large number of types of mammals on our planet, one would expect that by chance some species' estrus and menstrual cycles would harmonize with lunar cycles (e.g., the lemur). It is doubtful that there is anything of metaphysical significance in this.

What we do know is that there has been very little research on hormonal or neurochemical changes during lunar phases. James Rotton's search of the literature "failed to uncover any studies linking lunar cycles to substances that have been implicated as possible correlates of stress and aggression (e.g., serotonin, melatonin, epinephrine, norepinephrine, testosterone, cortisol, vasopressin [directly relevant to fluid content], growth hormone, pH, 17-OHCS, adrenocorticotrophic hormone [? adrenocorticotrophic hormone?])" (Rotton 1997). One would think that this area would be well-studied, since hormones and neurochemicals are known to affect menstruation and behavior.

misconceptions

Misconceptions about such things as the moon's effect on tides have contributed to lunar mythology. Many people seem to think that since the moon affects the ocean's tides, it must be so powerful that it affects the human body as well. The lunar force is actually a very weak tidal force. A mother holding her child "will exert 12 million times as much tidal force on her child as the moon" (Kelly et al., 1996: 25). Astronomer George O. Abell claims that a mosquito would exert more gravitational pull on your arm than the moon would (Abell 1979). Despite these physical facts, there is still widespread belief that the moon can cause earthquakes.* It doesn't; nor does the sun, which exerts much less tidal force on the earth than the moon.

The fact that the human body is mostly water largely contributes to the notion that the moon should have a powerful effect on the human body and therefore an effect on behavior. It is claimed by many that the earth and the human body both are 80% water. This is false. Eighty percent of the *surface* of the earth is water. Furthermore, the moon only affects *unbounded* bodies of water, while the water in the human body is bounded.

Also, the tidal force of the moon on the earth depends on its distance from earth, not its phase. Whereas the synodic period is 29.53 days, it takes 27.5 days for the moon to move in its elliptical orbit from perigee to perigee (or apogee to apogee). Perigee (when the moon is closest to earth) "can occur at any phase of the synodic cycle" (Kelly et al. 1990: 989). Higher tides do occur at new and full moons, but not because the moon's gravitational pull is stronger at those times. Rather, the tides are higher then because "the sun, earth, and moon are in a line and the tidal force of the sun *joins that of the moon* at those times to produce higher tides" (ibid.: 989).

Many of the misconceptions about the moon's gravitational effect on the tides, as well as several other lunar misconceptions, seem to have been generated by Arnold Lieber in *The Lunar Effect* (1978), republished in 1996 as *How the Moon Affects You*. In *The Lunar Effect*, Lieber incorrectly predicted a catastrophic

earthquake would hit California in 1982 due to the coincidental alignment of the moon and planets. Undeterred by the fact that no such earthquake had occurred, Lieber did not admit his error in the later book. In fact, he repeated his belief about the dangers of planet alignments and wrote that they "may trigger another great California earthquake." This time he didn't predict when.

cognitive biases and communal reinforcement

Many believe in lunar myths because they have heard them repeated many times by members of the mass media, by police officers, nurses, doctors, social workers, and other people with influence. Once many people believe something and enjoy a significant amount of **communal reinforcement**, they get very **selective** about the type of data they pay attention to in the future. If one believes that during a full moon there is an increase in accidents, one will notice when accidents occur during a full moon, but be inattentive to the moon when accidents occur at other times. If something strange happens and there is a full moon at the time, a causal connection will be assumed. If something strange happens and there is no full moon, no connection is made, but the event is not seen as counterevidence to the belief in full moon causality. Memories get selective, and perhaps even distorted, to favor a full moon hypothesis. A tendency to do this over time strengthens one's belief in the relationship between the full moon and a host of unrelated effects.

the moon, madness and suicide

Probably the most widely believed myth about the full moon is that it is associated with madness. However, in examining over 100 studies, Kelly et al. found that "phases of the moon accounted for no more than 3/100 of 1 percent of the variability in activities usually termed *lunacy*" (1996: 18). According to James Rotton, "such a small percentage is too close to zero to be of any theoretical, practical, or statistical interest or significance" (Rotton 1997).

Finally, the notion that there is a lunar influence on suicide is also unsubstantiated. Martin et al. (1992) reviewed numerous studies done over nearly three decades and found no significant association between phases of the moon and suicide deaths, attempted suicides, or suicide threats. In 1997, Gutiérrez-García and Tusell studied 897 suicide deaths in Madrid and found "no significant relationship between the synodic cycle and the suicide rate" (p. 248). These studies, like others which have failed to find anything interesting happening during the full moon, have gone largely unreported in the press.



postscript. There are likely to be many studies in the future that find a positive correlation between some lunar phase and some human behavior (or process affected by human behavior, such as the stock market). Remember to consider a few caveats: correlation doesn't establish causation; studies that are well designed still need to be

replicated before they are accepted as not being flukes; some studies with positive results will suffer from design flaws or methodological errors. For example, in 2005 **Yuan, Zheng, and Zhu found** "that stock returns are lower on the days around a full moon than on the days around a new moon. The magnitude of the return difference is 3% to 5% per annum based on analyses of two global portfolios: one equal-weighted and the other value-weighted." Whether this is a lunar effect remains to be seen. The study needs to be replicated with a significant number of data points.

update Feb 1, 2000: According to Allan Hall of the *Sunday-Times*, German researchers Hans-Joachim Mittmeyer of the University of Tübingen and Norbert Filipp from the Health Institute of Reutlingen claim that "a study of police reports for 50 new and full Moon cycles" shows that the moon is "responsible for binge drinking."

According to Hall, Mittmeyer and Filipp claim in their paper "Alcohol Consumption and the Moon's Influence" to have studied police arrest reports and blood-alcohol tests of 16,495 people and Mittmeyer said "The results show there is a definite correlation between new and full Moons and the amount of alcohol consumed."

Hall writes:

More of those with an excess of 2ml of alcohol per 100ml of blood inside them - drunk, according to German law - were caught by police during the five-day full Moon cycle.

On average 175 drink-drivers per day were caught in two German states two days before a full Moon, 161 were caught during the full Moon cycle and the figure dropped to about 120 per day at other times.

Jan Willem Nienhuys, a mathematician in the Eindhoven (Netherlands) University of Technology, claims that "Hall's story is a garbled version of a story by the German Press Agency DPA." According to Nienhuys, *Hall* invented the notion of a five-day full Moon cycle; the expression is not used by Mittmeyer and Filipp in their paper. Furthermore, 668 of the 16,495 arrested and tested were found to be sober, leaving 15,827 with alcohol in their blood, but only 4,512 with more than 0.2 percent blood alcohol (i.e., drunk).

According to Nienhuys, the 161 figure refers to the average number of drunk drivers arrested on any given date in the lunar month; he believes this number was arrived at by dividing 4,512 by 28 (rather than 29.53, the length of a lunar month) and hence should be 153, not 161. About the only thing Hall got right, says Nienhuys, is that Mittmeyer and Filipp do claim to have found a significant correlation between the moon and excessive drinking. He notes that the pair provide graphs but no statistical analysis of their data. When such an analysis is done, says Nienhuys, one discovers that the study is "pompous pseudoscience." According to Nienhuys, a standard statistical test yields p-values which show that there is nothing to investigate.

Here are the data, according to Nienhuys. Day 0 is the day of the new moon and day 14 is the full moon.

day drunks drinkers, including drunks

0	145	551
1	160	528
2	162	552
3	122	527
4	162	538
5	157	531
6	156	504
7	158	560
8	140	523
9	152	540
10	150	552
11	146	477
12	173	563
13	150	545
14	150	523
15	149	498

16	145	543
17	142	539
18	143	507
19	119	508
20	157	532
21	163	552
22	156	513
23	148	530
24	154	528
25	158	536
26	175	582
27	176	581
28	169	590

4437 15553
missing 75 274

4512 15827

The three big days were the 12th, 26th and 27th. You figure it out!

(Nienhuys's article, entitled "Triply garbled tripe" is being prepared for publication. He was kind enough to send me a pre-publication copy of the paper.)

See also [control study](#) and [post hoc fallacy](#).

reader comments

further reading

books and articles

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Martens R., I. W. Kelly, and D. H. Saklofske. 1998. "Lunar phase and birth rate: A fifty-year critical review," *Psychological Reports*, 63, 923-934.

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Rotton, James. "Moonshine," *Skeptical Inquirer*, May/June 1997.

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Thompson, David A. and Stephen L. Adams. The full moon and ED patient volumes: Unearthing a myth. *The American Journal of Emergency Medicine*, Volume 14, Issue 2, March 1996, Pages 161-164. (Alleged relations between phases of the moon and behavior can be traced to inappropriate analyses, a failure to take other (e.g., weekly) cycles into account, and a willingness to accept any departure from chance as evidence for a lunar effect.)

websites

[The Physical Moon and Its History](#)

[Moonstruck! Does The Full Moon Influence Behavior?](#) by Eric Chudler

[Bad Astronomy: The Dark Side of the Moon](#)

[Bad Astronomy: Once in a Blue Moon](#)

[Bad Astronomy: The Biggest, Brightest Moon?](#)

[Bad Astronomy: Big Moon, Little Moon](#)

[Bad Astronomy: Fox TV and the Apollo Moon Hoax Hoax](#)

news stories

[Maneaters most likely to strike after full moon](#) Lions and other predators may be at their most dangerous when the moon begins to wane, finds study of 500 attacks in Tanzania "In more than two thirds of cases, the victims were killed and eaten. The vast majority of attacks occurred between dusk and 10pm on nights when the moon was waning and providing relatively little light." What a shock!

On March 19, 2011 the moon will make its closest approach to Earth in 18 years. The last time the moon got nearly this close was on January 10, 2005 around the time of the 9.0 Indonesia earthquake. An 8.9 quake hit Japan on March 11th. Coincidence? [Astronomers think so. Astrologer Richard Nolle doesn't.](#) He calls such events a Supermoon. Never mind that February 18, 2011 was also a Supermoon and that the Japan quake hit a week early. Wait. New Zealand was hit with a 6.3 quake about 10 days after the Supermoon. Close enough for astrologer's work. Nolle will surely find friends in low places who will cite his "accuracy" as proof of his belief that the moon caused the Japan quake. I wouldn't worry about future earthquakes caused by a Supermoon —the next one isn't due until January 2, 2018, anyway. I predict, however, that there will be some big earthquakes and volcanic eruptions between now and then.

According to John Vidale, a seismologist at the University of Washington in Seattle and director of the Pacific Northwest Seismic Network, particularly dramatic land and ocean tides do trigger earthquakes. "Both the moon and sun do stress the Earth a tiny bit, and when we look hard we can see a very small increase in tectonic activity when they're aligned," Vidale told [Life's Little Mysteries](#). At times of full and new moons, "you see a less-than-1-percent increase in earthquake activity, and a slightly [higher response in volcanoes](#)."

The moon's gravitational pull at lunar perigee [the point in the moon's orbit when it is closest to Earth's center], the scientists say, is not different enough from its pull at other times to significantly change the height of the tides or the likelihood of natural disasters.* Many studies have been done on this and nothing of significance has been found, according to John Bellini, a geophysicist at the U.S. Geological Survey.

NASA astronomer Dave Williams said: "At the time of the earthquake in Japan, the moon was actually closer to its furthest point in orbit from Earth than it was to its March 19 closest point, so the gravitational effect of the moon was, in fact, less than average at that time."

[Full moon: Ill met by moonlight](#) The lunar effect, also known as the Transylvania effect, has long been a source of fascination. Many people – half of university students and 80 per cent of mental health professionals, according to two studies – believe lunar phases can affect behavior.

A new study from the Graduate School of Medicine at Kyoto University says it's down to changes in the geomagnetic field. The researchers say geomagnetic activity drops by around 4 per cent for the seven days leading up to a full moon, then increases by a similar amount after.

"We think moonlight increases the sensitivity of animals' magneto reception," they say. "We propose a hypothesis that animals respond to the full moon because of changes in geomagnetic fields." How that affects behavior is not clear but one suggestion is that changes in the electromagnetic field disrupt the nocturnal production of melatonin in the pineal gland. Melatonin helps regulate other hormones and maintains the body's circadian rhythm – the "internal 24-hour clock" – and its production is affected by light.

[Full Moon Does Not Affect Surgery Outcomes](#) A new study, which will be published in the October issue of the journal *Anesthesiology*, shows the moon's phase has no effect on the outcome of a heart-related surgery.

[Full Moon Effect On Behavior Minimal, Studies Say](#) by John Roach, National Geographic News

[Sexy Corals Keep 'Eye' on Moon, Scientists Say](#)

[Austrian study debunks notion that full moon causes more workplace injuries](#)

[Crackdown on lunar-fuelled crime \(in Sussex\) but does the crackdown make any sense?](#) See *Dark side of the moon* by the Guardian's Aida Edemariam

[Find out what the moon is really made of click here!](#)

[Full Moon Not to Blame for Epileptic Seizures](#) by Robert Roy Britt

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Does a full moon effect people's mood and behaviors? I decided to write about Lunar Lunacy since we just had a full moon the other evening. I have always been intrigued with the fascinating topic of a full moon and it's possible effects on mood and behavior in people. So much so, I wrote a research paper on it in my college days and continue to be captivated by the subject. Let me start out by explaining what a full moon actually is: Wikipedia states that a full moon happens "when the sun and moon are on opposite sides of the earth." Some researchers believe that the gravitational changes that occur during a full moon, may affect

The lunar theory, known as the lunar effect, is based on the assumption that there is a connection between Moon cycles and human behavior. What scientific proof is there that can shed more light on how the full Moon and supermoon affect human health? Since ancient times, people have said "there must be a full moon out there" in an attempt to explain weird happenings at night. The word lunacy, state of being a lunatic (insane) stems from luna, the Latin word for moon.