

FLAT EARTH · FEMALE VIAGRA MYTH · IS GOD MORAL? · CAN YOU SMELL COLOR?

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*Who Says the Earth Is Flat
and Why Do They Say It?*



Understanding Flat Earthers

BY DANIEL LOXTON

REFLECTING UPON SOME STRIKING 2018 SURVEY findings, *Skeptics Guide to the Universe* host Steven Novella wrote that he was “stunned that there are seemingly average people walking around today with the firm belief that the world is actually flat.” That astonishing fact does indeed cry out for explanation. He wanted to know, “What Drives the Flat-Earthers?”¹

That’s an interesting question—and a complicated one. I’ve spent a fair bit of time reviewing the history of Flat Earth claims for *Junior Skeptic* and various other articles.² Reviewing the literature is a good first step. If we want to grapple with claims, it helps to know what those claims are and how they have developed over time. However, this may not answer the “Yes, but why?!” question. As one reader challenged me:

I was hoping to see something about why there are people who invest so much in it that they form a Flat Earth Society. . . . Something else is going on. Finding that something else was what I hoped the writer would do, but he didn’t give me that.

I conceded this point:

Yes. Explaining what people say and asking whether they are correct are the easy tasks; finding out *what’s really going on* is harder.

Much of my work involves straightforward description and assessment. However, I’m intensely interested in that harder question. *I want to understand weird beliefs.*

With that in mind, I’d like to try to expand upon Novella’s preliminary thoughts. I think that digging deeper might help to expose some of the root systems from which paranormal, pseudoscientific, and fringe claims grow.

Who Are These People?

When 8215 U.S. adults were asked “Do you believe that the world is round or flat?” in a February 2018 YouGov survey, only 84 percent of respondents felt certain that the world is round. Five percent had doubts, two percent affirmed a flat Earth, and seven percent weren’t sure.³ (There is reason for some caution about the

YouGov survey. *Scientific American* blog contributors Craig A. Foster and Glenn Branch were unable to reconcile discrepancies between the reported results and data supplied by the pollster.⁴) This and other surveys support the idea that around one or two percent of Americans and Britons believe in a Flat Earth.⁵

This suggests that several million Americans believe in a Flat Earth. Tens of millions more are open to the idea or unsure what to believe. It’s been widely reported that YouTube and social media are propelling Flat Earth beliefs to new heights of popularity (or at least visibility). Twentieth century Flat Earth advocates were generally lonely figures who struggled to attract any serious consideration for their ideas. Today, there is a growing, thriving Flat Earth *community*.

These Flat Earthers comprise a broad cross-section of people, “all of them unfailingly earnest and lovely” in the experience of *The New Yorker’s* Alan Burdick.⁶ I recommend the 2018 documentary *Behind the Curve* to humanize this oddly familiar community. The film reveals Flat Earthers as generally bright, funny, nerdy, morally motivated folks who rather resemble skeptics. Their shared convictions provide many of the same rewards that skeptics find together, such community, fellowship, common interests, and intellectual engagement. Flat Earthers often describe their community as finding a family or a home—a place to belong. And, like the skeptics, they enjoy the powerful emotional rewards of joining together to pursue moral goals (such as truthseeking). They’re bonded by a shared desire to change the world for the better. Flat Earth advocate Patricia Steere says this about her podcasting co-host: “We’re both in cause together. And that is a kind of love.”⁷

These rewards are all goals in themselves. Independent of the content of their beliefs, we can see that the Flat Earth community offers all of the comfort of any community (along with the typical dysfunctions that most communities experience, such as routinely accusing each other of being undercover CIA agents).

Conspiracy Theories

Novella correctly notes that there is “an intimate

relationship between belief in a flat earth and conspiracy thinking.” Flat Earthers often accept a variety of conspiracy theories about “chemtrails,” vaccines, evolution, 9/11, and so on. Many were conspiracy theorists before they encountered Flat Earth claims. This may have predisposed them to accept a flat Earth as just another (or perhaps the ultimate) part of the hidden truth.⁸

Flat Earth thinking does not merely correlate with conspiracy thinking. Modern Flat Earthers must necessarily be conspiracy theorists in order to dismiss evidence such as photographs and video of the Earth from space.

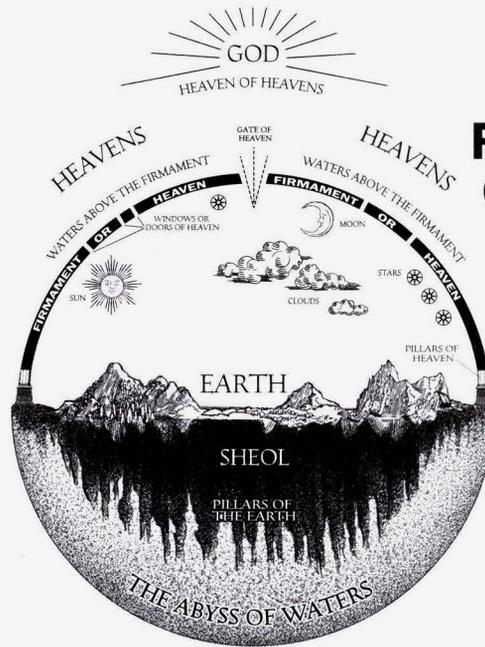
This was not always the case. The conspiracy component of Flat Earth beliefs has grown over time in response to advancing scientific knowledge. In the 19th century, it was easier for proponents of Flat Earth “Zetetic Astronomy” to charitably view round Earth believers as sincerely mistaken. They argued that mainstream astronomers had been misled by an overreliance on theoretical dogma. Proponents believed that astronomers and the public would accept the flatness of the Earth as soon as they were able to set aside their preconceptions and look frankly at the empirical evidence.

This perspective could not survive the dawn of the Space Age. Flat Earth believers were knocked on their heels by the first photographs of the Earth from space. “It was a terrible shock,” admitted International Flat Earth Research Society founder Samuel Shenton in 1966.⁹ One of two things had to be true: either Flat Earthers were mistaken about the shape of the Earth, or NASA and other space agencies must be concealing the true nature of the cosmos using manufactured evidence. Flat Earthers deeply committed to the latter. Believers insist that all images of the Earth from space are manufactured fakes. Every aspect of space exploration—astronauts, satellites, rocket launches, and so on—is part of an elaborate facade.

Religion

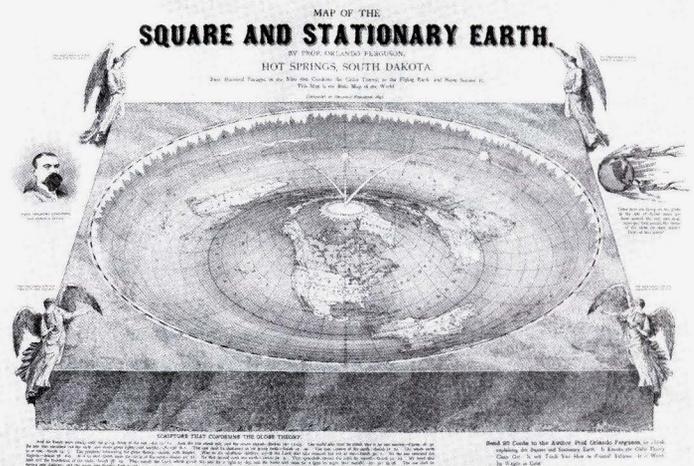
Religion is another key factor. Over half of those who asserted a Flat Earth in the YouGov survey also ranked themselves as “very religious,” compared to only 20 percent of globe-believers.¹⁰ I would have predicted a high level of religiosity based on the history and content of Flat Earth ideas.

In the 19th and 20th centuries, Flat Earth beliefs were driven more or less exclusively by Biblical literalism. In recent decades, Flat Earthers have been a subset within the community of so-called “scientific creationists,” where they were (and still are) viewed as a fringe by other creationists.¹¹ However, Flat Earth beliefs are consistent with a literalist approach. As skeptical Flat

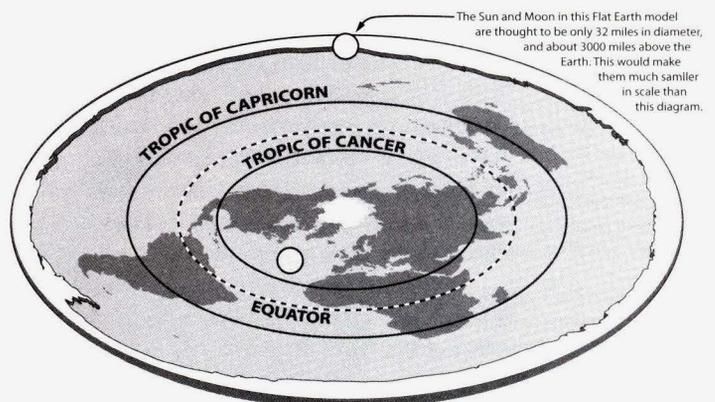


Flat Earth Concepts

Left—the ancient Hebrew concept of the Earth—the inspiration for the Flat Earth movement.



Orlando Ferguson's 1893 Flat Earth model is shaped somewhat like a roulette wheel. In the map's margins he has printed biblical passages and an attack on the idea that the earth moves. The image is from the Library of Congress.



The contemporary Flat Earth Society imagines a flat disk surrounded by an ice wall to keep the oceans in place. A tiny spotlight-like Sun moves back and forth from the Tropic of Cancer to the Tropic of Capricorn to create the seasons. Referenced from the Flat Earth Society website: <https://bit.ly/2kLibKG>.

Earth expert Robert Schadewald argued in 1987, “the Bible is a flat Earth book.”¹² Although not explicitly spelled out, numerous Biblical passages imply that the Earth is a plane, that it is immobile, or that it is enclosed within a dome (the sky, or vault of the heavens).

Modern social media may now attract a growing percentage of secular people to the Flat Earth movement, but there are reasons to think that religion still plays a crucial, central role. First, Flat Earthers often say so. Christian creationism is a standard presentation topic at Flat Earth conferences. During one such Bible panel at the 2018 Canadian Flat Earth Conference in Edmonton, Alberta, Christian moderator Robbie Davidson called for a show of hands: were there any atheists in the audience? A single hand went up. “I’ve been waiting a long time to meet a Flat Earther who’s one hundred percent atheist!” Davidson marvelled.¹³

For many Flat Earthers, creationism is the whole point. A Flat Earth could not form through natural processes. The existence of such an object would imply intelligent design. Some versions could conceivably be constructed by advanced aliens, but others—such as the “infinite plane” Flat Earth—would require a supernatural creator. As another Flat Earth conference speaker told *The New Yorker* last year, “You are a created individual. This is a created place.”¹⁴

This implication is a major part of the appeal of Flat Earth belief. Prominent Flat Earth YouTuber Mark Sargent describes our world as a “terrarium” that he likens to the enclosed sound stage imagined by the movie *The Truman Show*. Flat Earth beliefs bring spiritual solace. “You are not alone,” Sargent says. “You are the centre of the universe, as a matter of fact. You are the star of the show.”¹⁵

Skeptics and mainstream media typically treat the Flat Earth as an essentially secular belief system. This is a fundamental mistake. The founder of the modern Flat Earth movement, Samuel Birley Rowbotham, positioned the Flat Earth as an Intelligent Design-style “wedge” strategy. When “the Atheist is met by the Christian upon purely scientific grounds,” he may be “led to admit” that Biblical descriptions of “natural phenomena are literally true,” Rowbotham said in 1865. This realization would then lead disbelievers to admit that the Bible is “truly the ‘word of God.’”¹⁶

We’ll come back to religion later to help us shed light on Flat Earth activism. But first let’s consider the source of Flat Earth beliefs.

Flat but Round

Most Flat Earthers at some point adopted Flat Earth beliefs that they did not previously hold. They were persuaded by arguments they encountered in Flat

Earth videos, podcasts, and the like. To understand how this happens, and perhaps suggest which people might be more susceptible to these arguments, it’s helpful to consider how younger people understand the cosmos.

The YouGov survey’s most headline grabbing finding was that “just 66% of millennials firmly believe that the earth is round.” According to YouGov, respondents aged 18–24 also affirmed a flat Earth twice as frequently as Americans overall. (Foster and Branch’s critical reanalysis of the YouGov data broadly agreed that “younger people were more likely to be uncertain or ambivalent about the shape of the Earth.”)¹⁷

Does this represent a generational decline in science literacy? Not necessarily. There may be *some* generational difference in Flat Earth beliefs based on factors such as media consumption (in particular, the influence of YouTube). However, I would have predicted that *young people in any generation* would exhibit greater confusion on this topic.

To understand why, it’s important to realize that “round Earth” versus “flat Earth” is not a dichotomy. People’s cosmographies are so much weirder than that. It turns out that those options aren’t even mutually exclusive.

This has been explored in detail since the 1970s by researchers who’ve studied school children’s conceptions of the Earth and cosmos.¹⁸ Transculturally, Flat Earth notions and general confusion turn out to be common at young ages, and then to decline over time as children acquire greater scientific understanding. This seems unremarkable on the face of it, but the details have interesting implications.

I would suggest that “I dunno, flat?” is the initial default setting for human beings. I don’t mean that kids hold detailed mental models of a Flat Earth. “Flat” merely reflects the unexamined daily experience of young children. We experience “up” and “down.” When we look around, the world appears as a more or less horizontal plane extending in every direction. As science writer Isaac Asimov once said, “The curvature of the earth is nearly 0 per mile, so that although the flat-earth theory is wrong, it happens to be nearly right.”¹⁹ Flat is a close enough approximation for most daily purposes. In early years, young kids have no need to examine or even notice this as an assumption, nor to work out implications or predictions based upon that vague impression.

Eventually, however, children are told that the Earth is round. Kids believe adults when we say stuff. The Earth is round? OK. They accept that as a fact. They may repeat that fact when asked. But that may not mean that they have fully and immediately

replaced their unexamined flat Earth experience with a detailed new scientific conception of the Earth as a globe. This isn't a binary thing.

Understanding the globe and our place in the cosmos is a learning process. We may continue to expand and refine that scientific perspective throughout our lives—or not—depending on our circumstances and motivations. Along the way, children may express a bewildering array of hybridized misconceptions that incorporate aspects of both flatness and roundness.

For example, it's quite common for children to accept that we live on a globe and also suppose that we live only on the "top" of that globe. Things on the "bottom" of the globe would fall off. (Some readers may remember a moment when they personally marvelled at the realization that Australians live "Down Under.") In some cases, children have even expressed a belief that there are two worlds—a flat world where we live, and another round Earth that astronauts can photograph in space.

There has been much debate in recent years whether children's naive misconceptions of the Earth are coherent alternative mental models of, say, flat, hollow, or dual worlds, or if kids instead simply have fragmented, confused, incomplete ideas. Recent research suggests the latter. For our purposes what matters is that it takes time and effort for young people to develop a fully integrated science-based model of what it is like to live on a sphere in space. While their developing mental models of the globe remain incomplete, children may exhibit any number of hazy or contradictory ideas.

Living On a Sphere

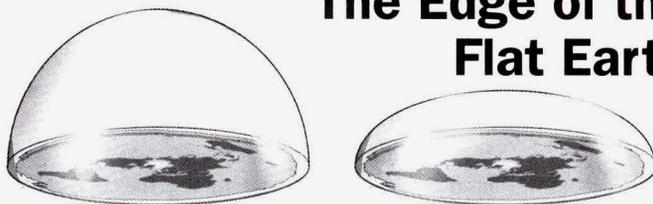
Now let's consider adults.

Skeptics often talk about cognitive dissonance. One of the interesting things about people is just how little of it we experience. Yes, it's uncomfortable to confront a contradiction between two beliefs, *but we rarely have to*. Our contradictory ideas can co-exist in unexamined harmony until something forces us to contrast them against each other. Noticing a contradiction takes mental effort. Resolving it takes more effort. This is especially true when our ideas are fuzzy or incomplete to begin with. There is little obvious contrast between two patches of mental fog.

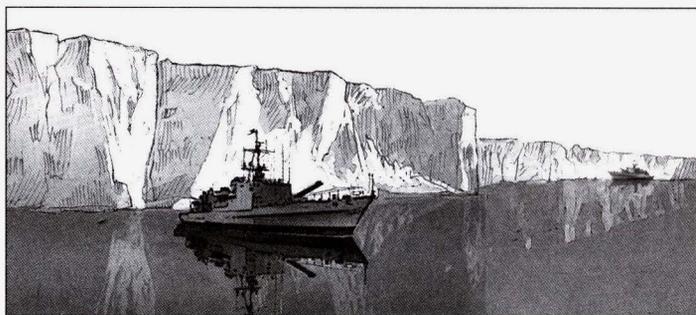
Referring to a talk show host who expressed uncertainty about the shape of the Earth, Novella acknowledges "the Sherri Shepherds of the world who simply can't be bothered to clutter their minds with extraneous facts, such as the shape of the world on which they live." This is an important point to explore.

When Shepherd was asked on camera whether

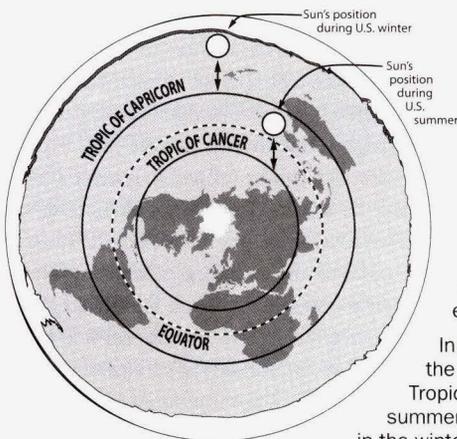
The Edge of the Flat Earth



Opinions of Flat Earthers vary. Most think the Earth has a dome, although its exact shape varies. The Sun, Moon, and stars are contained within it. Antarctica is not a continent but an ice wall that circles the outside edge of the Earth and keeps the oceans in. Some imagine an area under the Earth somewhat like Sheol in the Hebrew model.



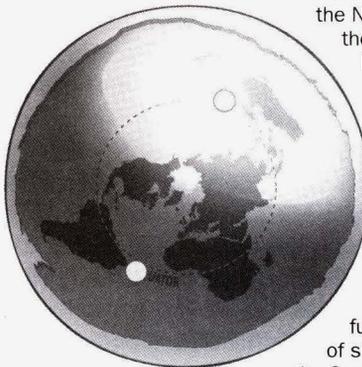
Many Flat Earthers believe the edge of the Earth ice wall and its dome can not be reached because it is guarded by an international navy composed of the 12 nations that signed the initial Antarctic Treaty in 1959. (The treaty set aside Antarctica as a scientific preserve, and ironically, banned military activity.)



Explaining Seasons, plus Day and Night

Any alternative to a scientific theory should explain everything better.

In some Flat Earth models the Sun switches from the Tropic of Cancer in the Northern summer to the Tropic of Capricorn in the winter to create the seasons. The seasons last the same time in both the North and South—but we don't see the Sun speed up to get around the longer Capricorn track. Nor does this close-up Sun change size as we view it switching between Tropics.



Exactly half the Earth is in light and half is in darkness at any time. A globe earth explains this easily. The Flat Earth needs to explain how a spotlight Sun model does this. Flat Earthers also must explain how the Antarctic area (their full circle ice wall) gets a full 24 hours of sunlight at times during what would be the Southern hemisphere summer.

the Earth is flat, she replied that she did not know because she “never thought about it.” I would suggest that *this is true for most people to some degree*. Living on a sphere is a complicated idea that we’re rarely required to think through in detail.

1984 author George Orwell once reflected that his own “reasons for thinking that the earth is round are rather precarious ones.” If asked to prove that the Earth is round, Orwell said, most “ordinary newspaper-reading” citizens “would start off by saying that ‘everyone knows’ the earth to be round, and if pressed further, would become angry.”²⁰

Orwell considered this topic a decade before the first space flight. Today, most people would point first to NASA photographs. Nonetheless, Orwell described many modern adults when he admitted that most of his basic astronomical facts were “blindly” accepted, not based “reasoning or on experiment, but on authority.”

It’s common for skeptics, pollsters, and other commentators to reduce ideas of the Earth down to two categories: “credulous” Flat Earth belief versus “scientifically literate” understanding of the globe. This conceptual flattening is misleading and unhelpful. People are more accurately considered to fall somewhere on a broad continuum of understanding. (Even “continuum” may be an inadequate metaphor, because there are multiple axes to consider.)

As Asimov noted, people who think that the Earth is a sphere are much less wrong than those who think the Earth is flat, but technically, “sphere” still isn’t quite right. The globe idea can be refined to greater accuracy by integrating the knowledge that the Earth bulges at the equator because of its rotation. And yet, “Even the oblate-spheroidal notion of the earth is wrong, strictly speaking,” Asimov went on. When measured more carefully, the Earth is also very slightly lop-sided. “It turned out that the equatorial bulge south of the equator was slightly bulgier than the bulge north of the equator,” Asimov explained, “and that the South Pole sea level was slightly nearer the center of the earth than the North Pole sea level was.”²¹

Orwell noted that there were a “few thousand astronomers, geographers and so forth” who had detailed, justified knowledge of the shape of the Earth. We can add various other specialized experts to this list. We can next acknowledge those who for reasons of professional or personal interest may have somewhat less refined but still sophisticated understandings: science enthusiasts, science fiction fans, airline pilots, and so on. Each person has their own reasons for refining or not refining their ideas about the Earth, which need not have any relation to intelligence, credulity, or criti-

cal thinking skills. Travel agents, freighter crews, or people with relatives or business dealings overseas might have reason to refine their mental models of the Earth in more detail than stay-at-home doctors, poets, or computer science professionals.

An Illustration

By the time we’re adults, most of us have been repeatedly exposed to basic astronomical information presented by claims makers in privileged positions of authority (parents, teachers, science books, etc). Not surprisingly, we therefore do tend to cluster near the scientific end of the spectrum when asked very elementary questions. The 2018 YouGov finding that 84 percent of respondents affirmed a “round” Earth is virtually identical to the percentage of adults who said that the Earth is “round like a ball” in a 2008 *British Journal of Psychology* study. (The percentage of Flat Earthers was also virtually identical.)²²

Committed Flat Earth believers are relatively rare. However, significantly larger percentages of adults exhibit other misconceptions or a simple lack of knowledge. Fourteen percent of YouGov respondents indicated some sort of uncertainty about the shape of the Earth, compared to just two percent who believed that the world is flat. “Not sure” was the second most common response after belief in a globe.

We should expect that some people who do affirm that the Earth is round will nevertheless hold incomplete or misconceived ideas about what that means. Globe-believers should exhibit some range of responses when their mental models of the Earth and cosmos are put to the test.

To illustrate this point, I decided to try a completely unscientific little back-of-the-envelope test. I borrowed a diagram from Joseph Nussbaum and Joseph Novak’s 1976 *Science Education* study “An Assessment of Children’s Concepts of the Earth Utilizing Structured Interviews,” and informally polled my friends and relatives. Nussbaum and Novak had asked children to imagine two diverging tunnels drilled deep into the Earth. The kids were then asked to imagine that a rock was dropped at the mouth of the tunnels. Which tunnel would the rock fall down, “O” or “P”?

I put up a Facebook poll asking my adult friends this same question. I also printed off a copy of the diagram and canvassed a number of kids, teens, and adults.

My expectation was that everyone would accept the diagram’s assumption of a round Earth, and that most people I knew would answer this question correctly. I also expected that some people would get this wrong. Finally, I guessed that kids and teens would get

this wrong more often. That's exactly what happened. (As an aside, bonus points to the kid who said, "Well, the rock wouldn't get very far. Those tunnels would just fill up with lava.")

Ignoring the lava and accepting the diagram on its own terms, the correct answer is P. Gravity pulls objects toward the Earth's center of mass, meaning that P plummets straight down while O diverts sideways at an angle. It's easier to see this when we re-orient the diagram. (Indeed, the angle of gravitational attraction would vary along the length of O; the tunnel would feel angled like a mountain slope at its mouth, then level off to horizontal further along.)

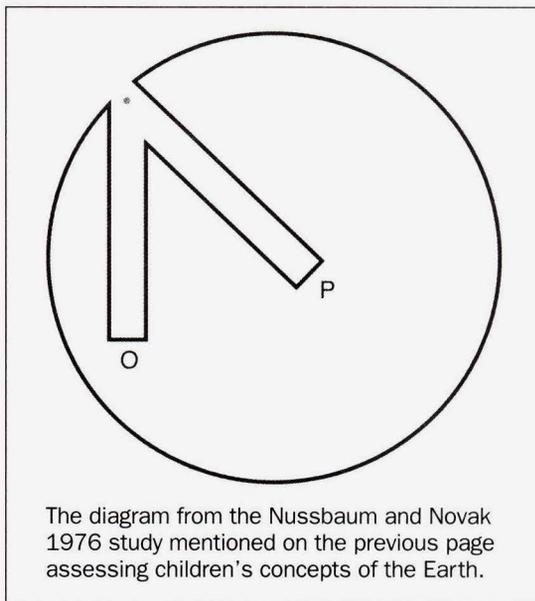
What's going on here? Everyone I asked understood that we live on a globe. They're all smart. Why would intelligent, educated people get this wrong?

Well, the diagram is a bit of a trick. It's designed to get at the unexamined tension between our *knowledge* that we live on a globe and our *experience* of "up" and "down." Asked why she chose tunnel O, one bright, science-minded teen explained with a shrug that "it just seemed more down."

This misconception could be interpreted as revealing a hybrid cosmography that implicitly accepts a round planet within a wider Flat Earth cosmos with a universal up and down. However, I think this mostly just tells us that some people have given more attention than others to developing their mental models. Most people I asked had already gotten around to integrating their knowledge enough to know the answer at a glance, as though it's self-evident—but it isn't. Other people's models were less complete. When put on the spot, those people were less able to harness their factual knowledge to make an accurate snap judgement. A less complete model has less explanatory and predictive power. However, *there's no reason for us to notice this* until we're called upon to offer an explanation or make a prediction.

I was especially delighted that one of the most sophisticated thinkers I know couldn't decide which tunnel to choose. She's a perfect example of what I think is happening. My friend is extraordinarily smart, well-read, and educated. She has sharp critical thinking skills. At the same time, she's a humanities person who *never had any previous need to refine her model of the Earth enough to answer this question*.

It's easy to pose any number of puzzles that quickly expose the limits of people's planetary models. Do you weigh more at the equator or the North Pole? If the International Space Station is floating in space, why doesn't it just float away? Or, if the station is within the Earth's gravity, how can astronauts float around inside it? And so on.



Working this stuff out is largely a function of where we've had reason to focus attention, which is a function of *time* as much as anything else. The more occasions we have to notice, test, and refine our understanding, the more developed our understanding is likely to become.

Openness to Flat Earth Belief

There's a doozy of a step between having hazy or incomplete ideas about the Earth and adopting a detailed Flat Earth model. However, I think there is a connection.

There's much discussion in the skeptical literature about confirmation bias. Once we commit to a belief, we unconsciously filter new information to support that belief. We tend to accept evidence that confirms what we already think, and dismiss evidence that doesn't. This makes us resistant to changing our beliefs. We'll come back to that, but here's the thing: *the opposite is also true*. When our ideas are hazy and incomplete, they're also more plastic. Before we commit to one idea, we can be more easily swayed to another.

I suspect that the people most susceptible to adopting Flat Earth beliefs are those whose conceptions of a round Earth are least complete. Because this is partly a function of time, we should expect young people to be more often open to Flat Earth ideas.

The YouGov survey appears to support this. Younger people expressed the most uncertainty about the Earth's shape and the greatest openness to Flat Earth belief. Uncertainty fell with increasing age brackets, while belief in a round globe rose with age. A whopping 30 percent of respondents aged

18–24 indicated uncertainty about the shape of the world. The same was true of only *four percent* of people over 55! (Age probably accounts for similar differences across income brackets.)

Here, we can even discern the effect of confirmation bias. With increasing age, people were more likely to affirm that they “have *always* believed the world is round” [emphasis added]. This was the position of 94 percent of respondents over age 55. But that pattern of increasing confidence suggests that a significant percentage of older globe-believers were, when younger, much less committed to a round Earth than they now recall. It may be that over a quarter of the population becomes convinced of a round Earth sometime after the age of 24.

Available Explanations for Personal Experience

Skeptics have often confronted the power of personal experience in shaping paranormal belief. “I know what I saw” is a frustrating cliché. However, this again raises the issue of confirmation bias following initial plasticity.

When people have strange experiences, they do not instantaneously commit to unshakable beliefs about what happened. They first go through a fundamentally rational process of considering possible explanations in light of the facts. During this process, they are not yet committed to any explanation in particular (though they may well be predisposed in some particular direction based on prior beliefs).

Say that a person experiences an episode of sleep paralysis (a disrupted sleep state in which we regain consciousness of our surroundings before we regain waking motor control of our bodies). These terrifying episodes can include hallucinations, distressing physical sensations, and panic. Experiencers intensely desire an explanation. They look for one. But there’s a problem.

“When you are looking for the cause of an anomalous experience, your search is limited to the set of explanations you’ve actually heard of,” noted psychologist Susan Clancy in a 2005 book about sleep paralysis and alien abduction claims.²³

Sleep paralysis experiencers cast about for culturally available explanations, and find several. Perhaps they were attacked by a ghost? Or a demon? Or abducted by aliens? The scientific explanation of sleep paralysis has typically not been readily available in public awareness (this may be changing).

It’s rational to hold proposed explanations up against our own experience and see how well those explanations fit. We generally accept the available model that appears to best match the facts. From there, confirmation bias slowly hard-

ens our chosen explanation into a committed belief.

We see this in the paranormal literature all the time. People who clearly experienced sleep paralysis often come to believe that they experienced a paranormal event. Once they’re convinced, the subjective evidence of their personal “paranormal” experience takes on overwhelming weight. (“I was there. I know what I saw.”) But if they had encountered and fully explored “sleep paralysis” as an explanatory model before committing to “aliens” or “demonic attack,” they might well have accepted the scientific explanation because their beliefs were originally plastic.

Events like sleep paralysis feel so extraordinary that we’re compelled to explain them. It may not occur to people that ordinary, familiar, everyday experiences such as “up” and “down” also require an explanation until challenged by something like a Flat Earth video. Nor may people consider the details of the globe idea until their half-formed concepts are challenged. (“If the Earth is spinning so fast, why aren’t we all flung off into space?”) When a person is challenged by Flat Earth claims, they are also immediately offered a culturally available explanation that appears to fit their experience: the world is exactly as flat as it looks and feels.

Encountering Flat Earth Claims

When researchers interviewed 30 Flat Earth conference attendees in 2017 and 2018, all but one said they were convinced by arguments they encountered on YouTube.²⁴ The video service recommends Flat Earth videos to unsuspecting viewers who search for information on vaccines or other topics. Additional research suggests that poorer science literacy and greater interest in conspiracy theories can make some YouTube viewers more susceptible to Flat Earth arguments. But how can anyone ever find those arguments convincing?

I suspect that widespread scoffing, including disdain from skeptics and scientists, plays some role in pushing people into Flat Earth belief. Flat Earthers are stigmatized by their reputation as quintessentially backward kooks. Universal snickering has the perverse effect of disguising wolves in sheep’s clothing. Misleading expectations set up the public for failure.

Flat Earthers routinely report that they were initially skeptical and dismissive of Flat Earth claims. *They expected those claims to be self-evidently ridiculous, because that’s what the mainstream culture told them to expect.* It would then seem to follow that Flat Earth claims should be easy for anyone to debunk from their own knowledge.

But that’s not what happens. Instead, people find themselves confronting rhetorically sophisticated

arguments honed for well over a *century* to win debates and frustrate critics. Half-formed notions about the globe are not always a match for such a detailed system of arguments and beliefs. Flat Earthers have persuasive sounding answers prepared for any objection or line of evidence that an average person might raise. Identifying the critical failures of Flat Earth thinking requires scientific literacy and knowledge of Flat Earth claims. Few who encounter Flat Earth claims have the tools to thoroughly assess them.

This point deserves emphasis. It isn't enough to have scientific knowledge or critical thinking skills (though these certainly help). To fully engage with fringe claims, we need specific knowledge regarding those claims.

It's the nature of fringe movements to develop in opposition to a mainstream view. This means that the fringe has already done its homework. Fringe proponents have spent time considering and rejecting mainstream arguments. They already have counter-arguments. They're prepared for debate. When the mainstream finally notices and attempts to confront the fringe, it's usually from a standing start. This is true for ordinary YouTube viewers. It's true even for scientists.

This was the hard lesson that scientists learned in the 1980s when they attempted to debate creationists. Biologists went in prepared to talk about biology, only to find that the debates were actually about *creationist arguments*—which made creationists the dominant experts on stage. Scientists routinely lost those debates.

Most people will find themselves off balance and outmatched if they attempt to improvise a response to prepared opponents. It's like stumbling into a courtroom to act as your own lawyer against a well-rehearsed legal team. Truth hardly matters in such a setting; *argument* is everything. The fact is that slippery Flat Earth arguments frequently reduce opponents to helpless, infuriated sputtering. (This makes Flat Earth arguments attractive to trolls as well as sincere believers, but that's a topic for another day.)

Some YouTube viewers find their encounters with Flat Earth arguments to be doubly shocking. They're unnerved by their inability to debunk those claims *and* by the subversion of their expectation that this should be easy to do. This may trigger a kind of intellectual vertigo: they're *surprised* into wondering if the Flat Earthers might be onto something after all. Flat Earth believers frequently report that they were shaken and eventually convinced after failing to debunk Flat Earth claims.

Down the Rabbit Hole

Some viewers soon dismiss Flat Earth arguments as a

Suggesting a Conspiracy of Mind boggling Proportions

You would think the hundreds of thousands of photos taken from space would be enough to convince anyone that the Earth is round. But many Flat Earthers claim all space photos are faked, as are rocket launches, astronaut excursions into space, and the nearly 5,000 satellites that have been put in orbit.



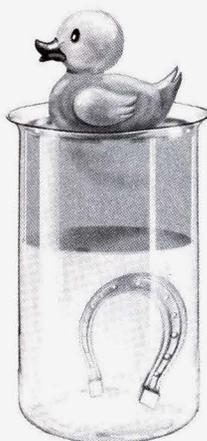
The back side of the Moon passes in front of the Earth, taken by NOAA's DSCOVR (Deep Space Climate Observatory) satellite, which occupies a point a million miles (1,600,000 km) away.

Getting Rid of Gravity

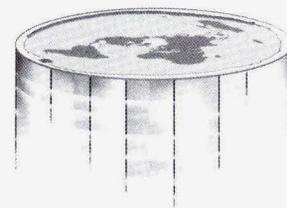
Gravity explains a lot—why things fall and float, the atmospheric gradient (the thinning of air with height), sea level, and the tides. But the biggest problem for a flat-shaped planet is that gravity pulls celestial bodies into a ball shape, and explains their orbits. So especially for those Flat Earthers who are geocentrists, gravity has got to go.



Flat Earth response: focus on discrediting scientists—such as Isaac Newton and Henry Cavendish, who made discoveries about gravity—as if their findings were merely spoken edicts that were adopted by the scientific and engineering communities without constant verification afterwards.



Flat Earth response: suggest that “buoyancy” and “density” are the only reason things float up or sink down, even though neither is a force. If the downward pull of gravity does not exist, what makes materials that vary in density rise or fall relative to each other?



Flat Earth response: The effect called gravity is created by the flat earth *itself* constantly accelerating “upward” at the rate of the acceleration of gravity: 32ft/s² (9.8m/s²). Even though some Flat Earthers reject the very idea of “space,” others say “dark energy or aetheric wind” causes this motion. <https://bit.ly/33PSxt0>

waste of time. For others, curiosity and irritation lead on to further videos, deeper immersion—and eventually to a tipping point. It isn't remotely surprising that some people eventually do adopt a Flat Earth model. They may, again, encounter this model when their ideas about the Earth remain uncertain and plastic.

When comparing the Flat Earth and globe models, people may find that a flattened world resonates better with their prior beliefs about conspiracies, divine creation, or the inerrancy of the Bible. For example, creationist Flat Earth proponent Rob Skiba has described struggling with a very painful “tension” between his previous assumption of a globe and his interpretation that the Bible affirms a Flat Earth. He resolved this cognitive dissonance by rejecting the globe and accepting Flat Earth claims.²⁵

Some people also conclude that a Flat Earth model *better matches the empirical evidence*. This point can't be overemphasized. The dominant themes of Flat Earth thinking are conspiracy, religion, and empiricism.

The Flat Earth movement has prioritized the evidence of our senses for more than a century and a half. Just go outside and *look*, proponents insist. Flat Earthers are only willing to trust personal observation. (What else is there, given the assumption of a conspiracy to fake evidence of a globe?)

For example, leading Flat Earthers argue that our senses refute the claims that the Earth rotates, orbits the sun, or otherwise moves through space. According to science, the surface of the globe rotates at roughly a thousand miles an hour at the equator. The Earth itself hurtles around the Sun at around 66,000 miles per hour. And our entire solar system orbits the centre of our Milky Way galaxy at a speed of *hundreds of thousands* of miles per hour! Even our galaxy is moving.

If any of that were true, ask Flat Earthers, wouldn't we *feel* it? But we don't. As far as our bodies can tell, we're standing completely still. And under most circumstances, it appears to our eyes that we're standing on a plane.

Now, there are scientific answers to these wheedling questions. (Our bodies feel *acceleration*, not motion. Think of travelling at constant speed on a smooth new highway. We'd sure feel it if our planet suddenly slammed on the brakes!) But it's hard to address Flat Earth arguments without a detailed scientific model. On a superficial level, the Flat Earth does appear consistent with our sensory experience, while a globe presents counterintuitive weirdness we're asked to accept on authority.

Of course some people become persuaded by arguments that the Earth is flat. It is not stupidity that

leads people into Flat Earth belief, but curiosity, reason, and a deeply human search for understanding and meaning. Nor is the problem lack of critical thinking, but what I think of as “feral” critical thinking—reasoning untethered from any scientific framework of evidence-based fact.

Locked Into Belief

Once a person commits to a belief that the world is flat, confirmation bias and motivated reasoning come into play. They're effectively locked in. Normal, well-understood psychological effects bias them against counterarguments. Their sense of what's plausible becomes retroactively rewritten: the Flat Earth becomes obvious common sense, while the globe seems newly ridiculous.

Anyone who believes anything is hard to convince otherwise. However, Flat Earth beliefs may be especially resistant to criticism for a number of reasons.

Flat Earthers know that their beliefs are stigmatizing. They may pay a high social cost for admitting those beliefs. (They often describe this as “coming out.”) Family members may reject them. Outsiders may openly deride them as stupid or crazy.

This means that committing to Flat Earth belief requires an unusually high emotional investment. When we've paid dearly for something, it's harder to let go. We need the price to be worth it. When that value is challenged, we double down. We invest more.

Social stigma also has the consequence of isolating Flat Earthers into an echo chamber. It's human nature to listen to people who respect us, listen to us, and understand our views. We disregard people who don't. Why would Flat Earthers listen to contemptuous critics who typically haven't bothered to learn about the ideas they're criticizing? Why *should* they? Of course they turn to like-minded people for fellowship, informed opinions, and emotional support. And that community embodies social forces just like any other. It has respected figures to emulate. It has social norms. Normative beliefs are praised and reinforced. Doubts are reassured. Ultimately, those who stray too far from accepted views risk disapproval from their peers. They are, after all, in this together.

The Flat Earth community is *built on the expectation of mockery*. When they *are* mocked, this only confirms that expectation. Ridicule reinforces their sense of intellectual correctness and moral fortitude. It strengthens the bonds of solidarity between believers. Marginalized groups may embrace the role of outsiders in order to recover the status and dignity denied them by others. Flat Earthers redefine the fringe to make themselves an elite.

The Taboo of the Flat Earth

Skeptics, scientists, and lay critics who do bother to turn their attention to Flat Earth claims are often a dollar short and a day late. We, too, are misled by the reputation of the Flat Earth. Generations of scientific skeptics have considered Flat Earth thinking to be so completely, obviously, fundamentally stupid as to be beneath the effort of criticism. The topic is so unworthy that it becomes taboo. It's shameful to debate or even acknowledge except as an object of ridicule.

Science communicators who are ordinarily generous about explaining science and correcting public misconceptions find themselves hobbled by disdain for Flat Earthers. English astronomer and science popularizer Richard Anthony Proctor declared in 1884 that "Flat-Earth nonsense... is not and never has been worth the trouble of crushing."²⁶ (He did engage, with obvious reluctance.) In 2008, *Bad Astronomy's* Phil Plait wrote, "I was thinking of writing up a definitive post debunking this silliness, but decided I have better things to do, like clipping my toenails."²⁷

This attitude may be understandable, but it amounts to an abdication. Contempt effectively forfeits an elementary matter of scientific understanding to the Flat Earthers. We abandon millions of curious minds—mostly young minds. "It serves them right for leaving the subject unstudied," huffed Proctor.

His comment may apply just as well to skeptics. We're reluctant to engage with or study such a stigmatized subject. Other skeptics discourage us from doing so. (When I've written about the Flat Earth, skeptical readers have often expressed disgust that the topic should be covered at all.) As a result, we typically ignore the subject. Or, we may mock Flat Earthers, which serves little purpose beyond virtue signalling to our in-group. At best, we may occasionally offer improvised arguments to confront an entrenched belief system that we may not understand in detail.

That's on us. It's a gift to the Flat Earth movement. And they know it. "Science should have wiped us out literally in the first month. And it's the exact opposite," Mark Sargent has crowed. "We're not just winning—we're *crushing* them because they don't know how to address it!"²⁸

Attempts at Critique

It's hard to see clearly when we're rolling our eyes. But some science communicators have made some preliminary effort to engage Flat Earth claims. In 2018, for example, astrophysicist Neil deGrasse Tyson offered his own contribution to the YouTube conversation about the shape of the Earth.²⁹

It was a worthy attempt. But like the scientists

Flat vs. a Curved Earth

The concepts of "level," "elevation," "sea level," and "flat" are different for those who do not believe in the downward pull of gravity.



Some Flat Earthers have compared the altitude on Google maps on the beaches of distant ocean ports and discovered... they are all the same elevation above sea level. They think this is proof of a flat earth.

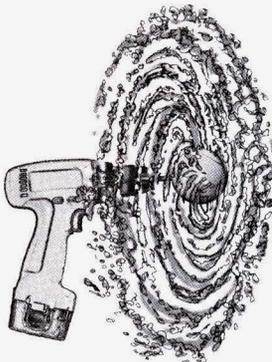
The horizon is only about 3 miles (5 km) away on a large body of water, depending on the height of the observer. It's been known for millennia that the sails of a ship appear over the horizon before the hull becomes visible. And the tops of buildings or hills become visible first as seen from the deck of a boat. But Flat Earthers dismiss this by attributing the effect to atmospheric distortion, perspective, or other optical properties.



Why Don't We Feel the Earth Move?

Flat Earthers reject the idea that all motion is relative: that we feel acceleration and deceleration, but not movement. To put it another way, there is no absolute motion. You can easily stroll up and down the aisle of a plane or train traveling at a constant speed as if it were standing still, but not if it is accelerating or decelerating.

Our favorite demonstration of relative motion is this delightful video clip of a moving trampoline. The high-flying acrobat is not left behind as the wagon moves under him—he moves with it—because he and the trampoline are part of the same internal reference frame. <https://bit.ly/2Cqay56>



Flat Earthers show water flying off a spinning tennis ball and ask, "Why doesn't the ocean fly off a rotating Earth?" First, centrifugal force is much weaker than the force that keeps the water in place: gravity. This is especially true on a tiny object like a tennis ball compared to the tremendous size of the earth. Second, the rate of spin at 500-2000 RPM vs. 1 revolution per day makes the comparison even less valid.

For more detailed rebuttals of Flat Earth arguments, check out these YouTubers who have done a yeoman's work responding to Flat Earthers: **Bob the Science Guy**, **SciManDan**, and **BlueMarbleScience**.

who debated creationists, Tyson's expertise is science, not fringe ideology. His arguments assume a shared baseline of basic scientific fact that Flat Earthers often reject, such as the scale of the cosmos, the existence of spherical planets, the concept of orbits, and heliocentrism.

For example, Tyson explains that lunar eclipses reveal the shadow of the Earth to be round at all times. This implies that the Earth must necessarily be a sphere. "If Earth were flat, sometimes you'd get, like, a flat shadow," Tyson argues. Of course, "we've never seen a flat shadow!" This would seem to disconfirm a prediction of the Flat Earth model.

Except that it doesn't. The Earth's round shadow on the moon is perfectly good confirming evidence for the standard model of the globe. This has been known since the time of Aristotle. But Flat Earthers *do not think that lunar eclipses are caused by the shadow of the Earth*. Flat Earth cosmographies assume that the Sun and Moon are small, nearby objects that both remain above the Earth at all times (like ceiling lights over a kitchen table).

Tyson is reassuring viewers that the standard model has been evidence based for millennia. He's correct to say so. However, his argument is totally unconvincing to Flat Earthers because he's debunking claims they aren't making. Flat Earthers have rejected eclipses as a test of their theory for well over a century, with Samuel Birley Rowbotham scoffing in 1865 that "it is not proved that the Moon is eclipsed by a shadow."

Flat Earthers have made various attempts to explain away lunar eclipses. Some, like Rowbotham, have denied that the Moon is illuminated by the Sun or is even a solid object at all. The most common Flat Earth explanations for lunar eclipses propose an unknown, unseen "shadow" object—either a semi-transparent object that sometimes passes between the Moon and observers on Earth, or an object that passes between the Sun and Moon.³⁰

This "shadow object" hypothesis is founded on nothing, but it does remind us that most Flat Earth models propose an entirely different alternative cosmos. The Earth is not a planet. The Sun is not a star, but a unique "light" of perhaps 32 miles diameter. According to many Flat Earth models, the stars and galaxies known to scientists don't even exist. Astronomers are misled by mere points of lights that appear on a solid enclosing dome of the sky like projections in a gigantic planetarium. Some Flat Earthers reject gravity.

Testing the Flat Earth

These claims are immensely frustrating. As Proctor reflected over a century ago,

Nothing, indeed, can much more thoroughly perplex and confound a student of science than to be asked to prove, for example, that the earth is not flat... for the circumstance that such a question is asked implies ignorance so thorough of the very facts on which the proof must be based, as to render argument all but hopeless from the outset. ... The conclusion at which I have arrived is, that to make a rope of sand were an easy task compared with the attempt to instil the simpler facts of science into paradoxical heads.³¹

It may be the case that many committed Flat Earth believers are essentially unreachable. (We'll consider some further reasons in a moment.) But tens of millions of other people remain uncertain and undecided about basic astronomical facts. *They* are reachable. Is the Earth round? They're happy to learn more about that. Are Flat Earth arguments wrong, or is that just something "everyone says"? Millions would like to hear answers rather than having their questions dismissed.

Flat Earth claims are weird, but that weirdness does not make them untestable. Taken seriously on their own terms, these models make predictions. We should not be able to detect any rotation of the Earth, for example. Large bodies of water should be entirely level over long distances without any observable curvature. And although Flat Earthers deny this with much hand-waving, I would add that their model clearly does predict that the Sun and Moon should never rise nor set.

Moreover, these claims have been tested, repeatedly—and they've repeatedly failed. The Flat Earth theory has been shown to be wrong, and not only by skeptics. Flat Earthers have themselves tested and refuted their own claims.

In 1870, for example, natural selection co-discoverer Alfred Russel Wallace accepted a wager from Flat Earther John Hampden. Wallace successfully demonstrated the curvature of water over a stretch of English canal using targets of uniform height sighted through a telescope at the same height. On a Flat Earth the targets would line up. On a round Earth, the central target would appear higher due to curvature—which is what happened. Infamously, Hampden refused to look through the telescope, declared victory, and launched an obsessive years-long campaign of illegal harassment against Wallace.

Similar demonstrations have been made countless times since. In every case, Flat Earthers have denied or dismissed the results. In 2018, for example, members of the Independent Investigations Group sent out a boat to carry a visual target over the curvature of a lake in California. Flat Earthers were on

hand to witness the proceedings. Although curvature was clearly observed, the Flat Earthers rejected the results as an illusion caused by refraction. In another recent example filmed for the *Behind The Curve* documentary, Flat Earthers performed a variation on the Wallace canal experiment and inadvertently demonstrated curvature yet again. (The Flat Earther seen reacting on camera has since claimed that the results were inconclusive.)

It's been known since the 1850s that the rotation of the Earth can be demonstrated using a large pendulum ("Foucault's pendulum") or a gyroscope. To understand how, imagine a pendulum swinging over the precise North Pole as the Earth turns below it. Over a 24-hour period, a pendulum at the North Pole will undergo one complete rotation relative to the surface of the Earth—which is to say that the Earth will undergo one rotation relative to the fixed plane of the pendulum's swing. The pendulum experiment has been repeated many times. For example, a version of this experiment was recently performed by the Flat Earth "Globebusters" group using a precision ring laser gyroscope. The group expected to "prove once and for all that there is no rotation to the Earth." They were "taken aback" when their device instead recorded the exact amount of rotation predicted by the standard globe model. However, they "were not willing to accept that" result. They arbitrarily decided that their gyroscope was not recording the Earth's rotation, but unknown "energies generated by the Heaven" above.³²

Flat Earth predictions have been tested many times. They've repeatedly failed because the Flat Earth model is wrong. But Flat Earthers appear totally unable to change their minds in response to new evidence even when they've gathered that evidence themselves.

Explaining Flat Earth Activism

How can we explain such extreme denial of evidence? And what motivates Flat Earthers to become activists on behalf of their belief?

Well, they have a lot to lose. The shape of our world isn't a neutral scientific question for Flat Earthers. Their identity and community are defined by Flat Earth belief. Their friendships and even romantic partnerships depend upon maintaining that belief. Prominent Flat Earthers may also enjoy the benefits of niche social status. (Mark Sargent appears rather chuffed about being a micro-celebrity, even wearing an "I AM MARK SARGENT" t-shirt during interviews.)

Beyond social rewards, the Flat Earth is thought to have profound political, moral, and spiritual implications. Some of those implications are frightening, such as a world-wide conspiracy of deception. But Flat

Earthers are not frightened or depressed by their conspiracy theory; they're elated. Why? Because this conspiracy is supposedly hiding proof that the *Earth required an architect*. This theological implication gives Flat Earth beliefs an enormous emotional charge.

"This matters to me," said one visibly moved Flat Earther interviewed by *National Geographic Explorer*. "Flat Earth shows you that you are not a mistake, and you were created. And so you have *meaning*, and you matter to the world. . . . We're not monkeys floating through space on a ball as an accident."³³

The stakes are high for the highly religious majority of Flat Earthers. Their model promises a scientific foundation for faith. Conversely, evidence of a globe would undermine a major source of spiritual conviction and personal meaning. This gives many Flat Earthers powerful positive incentives to promote their beliefs, seek to confirm them, and refute challenges. They're after nothing less than proof of God.

It would be emotionally difficult to surrender this supposed evidence of creation, but the vast majority of theists maintain their faith while accepting a round Earth. Some Flat Earthers could surely manage to do the same. But for others, the stakes are higher still. The globe threatens some Flat Earthers with complete existential catastrophe.

Here I'll build upon arguments that religion scholar Joseph Laycock presents in his 2015 book about promoters of the 1980s *Satanic Panic*, *Dangerous Games: What the Moral Panic over Role-Playing Games Says about Play, Religion, and Imagined Worlds*. Laycock argues that some faith-based activists are "motivated by repressed fear and unwillingness to face the possibility that the world might not operate as they imagine it does."³⁶

Biblical literalism has an obvious weakness: it cannot admit errors. This makes it brittle. Literalists must win every argument, or they instantly lose their case. This became true when literalists applied modernist binary "true or false" notions of fact and evidence to Scripture as a whole. It is not enough for statements in the Bible to be true in a merely moral or spiritual sense; they must be objectively, demonstrably inerrant. It's an all or nothing gamble to claim that the Bible must be divinely inspired because it only makes factually accurate statements. This implies that *one incorrect statement of fact would discredit the Bible as a whole*.

A literalist subset of Flat Earthers therefore perceive the globe as a critical threat to the Bible. "No one can believe a single doctrine or dogma of modern astronomy and accept Scriptures as divine revelation," claimed 19th century Flat Earth activist John

Hampden.³⁵ “If the Bible is the word of God it is absolutely true. We must accept it as a whole or else accept none of it. We cannot divorce the religion of the Bible from the science of the Bible,” claimed Lady Blount (the leading Flat Earth proponent at the dawn of the 20th century).³⁶ “The whole point of the Copernican theory is to get rid of Jesus by saying there is no up and no down,” declared 1980s International Flat Earth Research Society of America president Charles Johnson. “The spinning ball thing makes the whole Bible a big joke.”³⁷

These activists painted themselves into an existential corner: either the Earth is literally flat, or *the universe is a nihilistic nightmare without meaning, goodness, or any possibility of salvation*. It’s hard to fully appreciate this dire position from the outside. Secular people can’t imagine why a creator god would be the exclusive source of all meaning in the cosmos. Fundamentalists can’t imagine anything else. For them, God is the ground of goodness and being. Without God, morality is a sham. Murder and kindness become interchangeably arbitrary. There’s no reason to even bother existing in a godless universe. Every thought, word, and deed becomes equally pointless. The globe represents *utter annihilation for every person they’ve ever loved and everything they’ve ever done*.

That’s terrifying. No wonder these particular Flat Earthers spend so much energy denying that possibility. Globe claims pose a threat that must be continually held at bay.

Consider the challenge that Flat Earthers face when suppressing their own doubts. Other religious believers must sustain a faith they can’t prove. Flat Earthers *must sustain a faith that’s demonstrably false*. Flat Earthers are told every day that their faith is definitely wrong. They’re bombarded with evidence of the globe. Their claims are debunked even by other creationists. Their worldview is constantly under siege.

When we feel threatened, we want to fight back. Flat Earth activism is a predictable reaction to the internal and external pressure of doubt. Some Flat Earthers double down on “the truth” because the alternative seems unthinkable.

The Challenge for Skeptics

I submit that Flat Earth beliefs offer scientific skeptics a valuable test of our own convictions. Are we serious about intellectual humility? Are we committed to informed understanding of fringe claims? And are we genuinely interested in educational outreach to alternative believers or the undecided public?

Here’s something Flat Earthers understand better than we do: it’s mostly confirmation bias that gives us

the gut feeling that the globe is perfectly sensible while the Flat Earth is idiotic. Once we commit to a belief in a globe—often for weak reasons—our belief feels instinctively, self-evidently true. But it isn’t. There never was an *a priori* reason to think that an enclosed Flat Earth is more preposterous than a spherical world spinning through a vast cosmic void. Honestly, those are both weird ideas. It just turns out (weirdly enough) that the globe is supported by overwhelming evidence while the Flat Earth fails every test. Flat Earth claims aren’t wrong because they’re stupid. They’re wrong because they’re wrong.

And yet, one out of every six Americans is apparently confused about the shape of the planet we live on. Only a fraction of those are dedicated Flat Earthers, but that fraction adds up to millions of people. Surveys suggest that there may be more Flat Earthers in the U.S. than Mormons, Jews, or Muslims. Flat Earthers appear to outnumber doctors, soldiers, or teachers. From a sociological and psychological perspective, that’s *interesting*. It cries out for further study. From an educational perspective, it’s also a challenge. It demands effective outreach, which requires understanding.

“People are not stupid. They believe things for reasons,” said astronomer Carl Sagan. “Let us not dismiss pseudoscience or even superstition with contempt.” If uncertainty about the globe is contemptible, that contempt goes far beyond Flat Earthers. We heap scorn upon children, teens, and some 50 million Americans who are still learning their place in the cosmos.

None of those people are helped by ridicule. Poor communication only erects barriers to understanding, which can cause additional harm. When we sneer at the claims of alternative medicine, we put patients at risk. When we shame non-vaccinating parents, we put children at risk. We may feel that Flat Earth beliefs deserve mockery, but indulging this emotional temptation only pushes people into the arms of conspiracy theorists.

From an educational or interventionist perspective, one of the most interesting results of the YouGov survey is that some people indicated increasing skepticism about Flat Earth claims they previously accepted. These people may suspect there’s something wrong with Flat Earth claims while also taking those claims seriously. If we’re interested in reaching those people—and if we wish to know what we’re talking about—we need to do the same.

Ultimately we must choose between two incompatible roles whose tension is rarely acknowledged. Is our role to improve public understanding? Or is to shame people for the things they don’t already know? **S**

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