

# What Is Science and What Is Not?

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## Abstract

In the classical scientific method, a proposed alternative hypothesis that an observable event is not attributable to chance is Popper-falsified by deductive testing of the corresponding null hypothesis that the occurrence is random. However, legalist post-modern scientism promotes a species of proposition that is not a true hypothesis at all: the manifestly irrational antihypothesis, which, though of its essence aprioristic and often imprecise, unquantified, untestable, untested or fallacious, may gain credence even where the null hypothesis has been demonstrated or falsification has not been attempted or is unattainable. The characteristics and dangers of antihypotheses are discussed.

Examples concern the supposedly divine or alien origin of the Great Pyramid, the alleged imperialism of the triangle in geometry, the notion that the Earth is flat, our purportedly dangerous influence on the Earth's climate and the alleged net welfare benefit of global-warming mitigation.

A mechanism is derived for the identification of antihypotheses and either for their outright elimination by means of the scientific method or for their emendation by sufficiently rigorous and precise formulation, quantitative where possible, to render them falsifiable and thereby to bring them safely within the orbit of the scientific method and hence within the compass of science itself.

**Keywords:** *Philosophy of science; Null hypothesis; Alternative hypothesis; Antihypothesis; Scientific method; Great Pyramid; Pi; Golden ratio; Euler's number; Flat-Earth theory; Climate change; Global warming; Logical fallacy; Mitigation economics.*

## Introduction: The principle of the universality of truth

Truth alone, said Fr Vincent McNabb, a celebrated divine in the London of the early 20<sup>th</sup> century, is worthy of our entire devotion. The end and object of science, as of religion, is to answer the question posed by the judge in history's most celebrated show-trial: "What is the truth?" That question of questions underlies all true enquiry. Notoriously, the judge – the governor of an unconsidered province of the early Roman Empire – did not stay for an answer: but the Defendant in that trial, Who was uniquely qualified to provide the answer, had provoked Pilate's question by uttering the noble manifesto no less of the true scientist than of the man of true religion: "To this end was I born, and for this cause came I into the world, that I should bear witness unto the truth." (John XVIII, 37: King James Bible).

It was by that maxim that the late Professor Nils-Axel Mörner lived. For more than half a century he studied sea level. He found that it was not rising anything like as fast as had been predicted, and was vilified for telling the truth. But it is he, not his shoddy detractors, whom science will remember. This essay in the philosophy of science is dedicated to his memory.

Mathematics is the *lingua franca* of all the physical sciences. Logic is the heart and soul of mathematics. The fundamental principle of logic is the principle of the universality of truth. That great principle resonates throughout the history of thought, in the Old Testament and the New, in Plato and Aristotle, in Euclid and Thales, in Kung Fu-Zhi and Lao-Tse, in Thabit ibn-Qurrah and Abu Ali ibn al-Haytham, in Cicero and Justinian, in Augustine and Aquinas, in Bacon and More, in Euler and Gauss and Einstein, in Huxley and Popper, in Feynman and Snow. It is this –

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Each proposition that is true stands consistent with every proposition that ever was or is or ever will be true, throughout the universe of time and space, from the beginning of the beginning to the end of the end and from here to the outermost stars; but each proposition that is false, whether or not it stand consistent with any other propositions that are false, falls inconsistent with every proposition, in every time and place, that ever was or is or ever will be true.

Note *en passant* that the principle of the universality of truth does not conflict with Gödel's incompleteness theorem, which states that in every formal system there subsist statements whose truth-value is indeterminable. Just as the behavior of a chaotic system is deterministic but indeterminable, so there subsist propositions that are true, but whose truth we cannot determine. A Sufi story about Mullah Nasruddin illuminates the incompleteness theorem:

The King decided that he could, and would, make people observe the truth. He could make them practise truthfulness.

His city was entered by a bridge. On this he built a gallows. The following day, when the gates were opened at dawn, the Captain of the Guard was stationed with a squad of troops to examine all who entered.

An announcement was made: "Everyone will be questioned. If he tells the truth, he will be allowed to enter. If he lies, he will be hanged."

Nasruddin stepped forward.

"Where are you going?", said the guard

"I am on my way", said Nasrudin slowly, "to be hanged."

"We don't believe you!"

"Very well, if I have told a lie, hang me!"

"But if we hang you for lying, we will have made what you said come true!"

"That's right: now you know what truth is – YOUR truth!"

The sparse notation of formal logic states the principle of the universality of truth more prosaically (1):

$$\neg (\mathbf{P} \wedge \neg \mathbf{P}) \quad \mathbf{(1)}$$

Formal logic is a rare instance of common ground between the Two Cultures: the arts and the sciences (Snow 1959). Karl Popper (1934) formalized the scientific method in logical terms as an iterative algorithm starting with a general problem, to address which a falsifiable alternative hypothesis is advanced. During the subsequent error-elimination phase, the tentative theory is (very rarely) demonstrated, (less rarely) disproved, or (usually) neither. In the last case the hypothesis acquires some credibility not because any imagined consensus of experts endorses it but because it has endured falsification without disproof. By the iterative advancement of hypotheses and elimination of those that are erroneous via deductive testing of the null hypothesis, the original general problem is progressively refined. Science thus inches *pedetemptim* toward the truth. By contrast, falsification of the experimental or research hypothesis by inductive as opposed to deductive reasoning is vulnerable to Hume's "uniformity of nature" assumption (Wilkinson, 2013).

To falsify an alternative hypothesis, the corresponding null hypothesis that the occurrence of a given observable event is random is scrutinized. In Popper's words, "Insofar as a scientific statement speaks about reality, it must be falsifiable; and, insofar as it is not falsifiable, it does not speak about reality."

The summation of the scientific method attributed to Einstein is apt: "No amount of experimentation can ever prove me right. A single experiment can prove me wrong."

Huxley (1866) wrote:

The improver of natural knowledge absolutely refuses to acknowledge authority, as such. For him, scepticism is the highest of duties: blind faith the one unpardonable sin. And it cannot be otherwise, for every great advance in natural knowledge has involved the absolute rejection of authority, the cherishing of the keenest scepticism, the annihilation of the spirit of blind faith, and the most ardent votary of science holds his firmest convictions not because the men he most venerates hold them; not because their verity is testified by portents and wonders; but because his experience teaches him that whenever he chooses to bring these convictions into contact with their primary source, Nature – whenever he thinks fit to test them by appealing to experiment and to observation – Nature will confirm them. The man of science has learned to believe in justification not by faith but by verification.

Except on the rare occasions when a theorem is demonstrated, science is a Sisyphean endeavour. Absent absolute proof, the best the scientist can do is to clamber crabwise towards the truth inch by inch, knowing that others behind him may at any time fault his footwork and bring him and his hypothesis down. As will be seen, even a universally-believed theorem may not be as universally true as is universally imagined. *A fortiori*, unprovable, unproven or disproven antihypotheses should not be paraded for our deference (Figure 1).



Figure 1. The Royal Society's motto: "Take no one's word for it."

Feynman and Robbins (1999) agreed: "Science is the belief in the ignorance of experts". For the deadliest form of appeal to authority is the pre-emptive adoption and enforcement of an aprioristic, ideological party line contrived to appear as a legitimate scientific hypothesis.

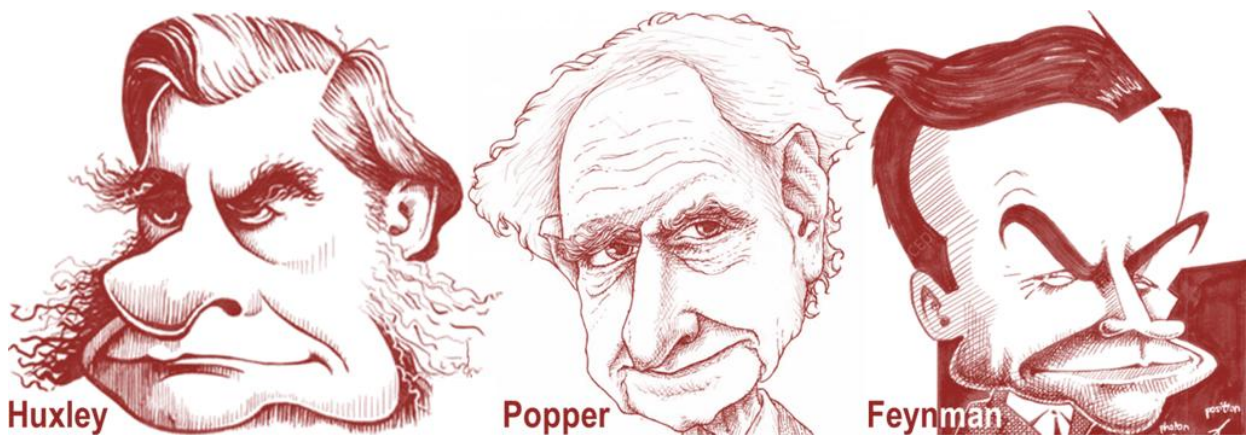


Figure 2. Three opponents of apriorism in science.

The true objective of science is the passionately dispassionate search for the objective truth. Science does not say, “I believe!” as does the man of religion, or “You must believe, or else!” as does the slavish adherent of some transient totalitarian tyranny. Science says, “I wonder!” and then, “I wonder?” For the true scientist stands at once in awe of Nature and in ceaseless curiosity as to her secrets. He hunts and hunts for the laws that underlie and govern the workings of the natural world. Diligently, he applies previously-established theory to the results of observation, mensuration and experimentation, either to disprove or to modify that theory, by little and little, until the objective truth is ever more clearly revealed, ever more deeply discerned and ever more merrily enjoyed.

### 1. The antihypothesis

Religion attains to the truth by accepting the Words handed down by Messiahs or Prophets and pondering these things in its heart (Luke II, 19: King James Bible). Religion, then, is at root aprioristic: it begins by accepting as axiomatic what it calls “revealed truth”. The narrow-minded, intolerant, totalitarian, legalist scientism that holds sway in academe today is likewise aprioristic, but without any of the morality and merriment that are the saving graces of religion. Scientism has increasingly supplanted science in the universities. Questioners of the orthodoxy on a growing range of scientific topics are vilified, excluded, excoriated, condemned and even menaced with execution for “high crimes against humanity”.



Figure 3. Al-Haytham on an Iraqi 10-dinar banknote

Yet Abu Ali Ibn al-Hassan Ibn Al-Hussain Ibn Al-Hussain Ibn Al-Haytham (Figure 3), founder in the East of the scientific method as Thales of Miletus had founded it in the West, wrote most beautifully during the golden age of Islamic scholarship in 11<sup>th</sup>-century Egypt:

The seeker after truth is not one who studies the writings of the ancients and, following his natural disposition, puts his trust in them, but rather the one who suspects his faith in them and questions what he gathers from them, the one who submits to argument and demonstration and not the sayings of human beings whose nature is fraught with all kinds of imperfection and deficiency. Thus, the duty of the man who investigates the writings of scientists, if learning the truth is his goal, is to make himself an enemy of all that he reads, and, applying his mind to the core and margins of its content, to attack it from every side. He should also suspect himself as he performs his critical examination of it, so that he may avoid falling into either prejudice or leniency (Voss, 1985)

The “seeker after truth” – the scientist – places no faith in any mere totalitarian, ideological consensus, however venerable or widespread, but applies his hard-won scientific knowledge to check

and check again. “The road to the truth is long and hard,” wrote al-Haytham, “but that is the road we must follow.” In the classical understanding, then, the scientific method is a moral process whose end and object is the truth. If there were no such thing as objective truth, there would be no such thing as science. For without objectivity there is naught but apriorism, the adoption *a priori* (and often for purely ideological reasons) of propositions whose objective truth has not previously been demonstrated with sufficient rigor, if at all.

Apriorism – the adoption by faith alone of propositions that owe all to ideology and little or nothing to the scientific method – is a characteristic of all totalitarian systems of thought. Two of the commonest species of apriorism are superstition and legalism. A superstition is demonstrably false. A religion, by contrast, advances for its adherents’ assent propositions that may or may not be true but, being unfalsifiable, fall outwith the scientific domain. The term “legalist” arose among the political philosophers of the early post-Confucian Chinese empire, who, meditating upon the fundamental divide in politics, concluded that an abyss was fixed between the “legalists” (with Fu 1996 we might call them “totalitarians”, but will prefer the more neutral ancient term) and the “Confucians” (philosophical libertarians in the enlightened spirit of the *Analects*).

The eugenicist notion that the Jewish race is inferior to an imagined Aryan race, the Lysenkoist doctrine that soaking seed-corn in water over the winter rather than planting out the seeds in the autumn will produce better harvests, or the environmentalist demand that a billion people without electric power should be denied the life-saving benefits of affordable, reliable, low-tech, continuous, base-load, coal-fired or gas-fired electricity on the ground that the planet must be saved from global warming that is occurring at a third of the predicted rate are genocidal instances of a recent species of aprioristic, pseudo-scientific proposition that is not, properly speaking, a hypothesis at all. It is an intrusive, alien species whose legalist advocates demand that it be treated with obeisance, as though it were a demonstrated theorem, even where it is egregiously, patently false.

This alien species is the antihypothesis, a proposition that revels in its own falsity, monstrosity and even absurdity. Antihypotheses that spring from legalistic apriorism are likely to prove particularly pernicious, since the totalitarian governing power may decide not merely to adopt them even in the absence of legitimate scientific justification but also to enforce them for selfish, partisan reasons of political expediency, social convenience or financial profit. The dismal antihypotheses of Heydrich and Lysenko killed tens of millions. Those who escaped genocide were flung into “psychiatric” prisons, on the ground that disagreement with the Party Line was *a priori* evidence of lunacy.

The typical antihypothesis exhibits one or more of the following commonplace defects –

1. The antihypothesis is not expressed in quantitative terms and cannot be quantitatively Popper-falsified.
2. The antihypothesis is imprecisely defined (often by deliberate vagueness), or is otherwise of such a nature or in such a form that it is unfalsifiable.
3. The antihypothesis is Popper-falsifiable, but falsification has not been attempted.
4. The tyrant, the State or another agency of compulsory untruth has imposed legalistic or peer-pressure constraints inhibiting or even forbidding falsification.
5. The antihypothesis has been falsified but is perversely insisted upon.
6. Scientists sceptical of the antihypothesis are reviled, punished, subjected to “re-education”, incarcerated, certified as lunatic, exiled or even executed for daring to question it.

Today, for instance, tens of millions die annually because they are denied electrical power. An unquantified but growing fraction of those millions die because they would by now have had access to electricity were it not for global-warming mitigation policies dictated by legalist institutions falsely praying science in aid to justify the taxation, regulation and rationing upon which they insist, but whose motive is chiefly political.

For instance, Christiana Figueres, for many years the chief executive of the secretariat of the United Nations' Framework Convention on Climate Change, said at a press conference shortly before the Paris climate conference of 2015:

“This is the first time in the history of mankind that we are setting ourselves the task of intentionally, within a defined period of time, to change the economic development model that has been reigning for at least 150 years, since the Industrial Revolution. This is probably the most difficult task we have ever given ourselves, which is to intentionally transform the economic development model for the first time in human history.”

Likewise, Dr Ottmar Edenhofer, lead author of the *Fourth Assessment Report* of the Intergovernmental Panel on Climate Change (IPCC, 2007), said in 2017:

“One has to free oneself from the illusion that international climate policy is environmental policy. Instead, climate change policy is about how we redistribute *de facto* the world's wealth.”

Such legalists are open about their distaste for the market economy that has served well those nations where it has been to some degree permitted. The legalists are also open about their intention to use climate policy to destroy capitalism from within.

Ms Figueres holds up Communist China as the model of how to deal with global warming. Legalists such as she now command the levers of international power.

How, then, will it be possible to establish a mechanism for the early identification and exposure of legalistic antihypotheses such as that upon which these new tyrants rely – that anthropogenic global warming will prove catastrophic without at least a radical interference with the market economy?

How can antihypotheses be rapidly identified and either eliminated outright from acceptable scientific and political discourse where they are not falsifiable or have already been falsified, or, at minimum, be modified to render them Popper-falsifiable and thus to remove them from the merely political sphere and bring them back within the ambit of the scientific method?

To assist in formulating a process for eliminating antihypotheses and reasserting the paramountcy of objective truth in science, some instances of antihypotheses will now be considered.

## 2. Superstitious antihypothesis: “Aliens made the Great Pyramid”

A series of antihypotheses concerning the mathematical principles that are thought by some to have underlain the design and construction of the Great Pyramid of Khufu (*Graece* Cheops) at Giza will illustrate the arbitrary, capricious and often fanciful approach that arises from superstitious apriorism.

The Pyramid was built during the reign of the Pharaoh Khufu some 4500 years ago. In that era, a royal cubit (0.524 m or 1.717 ft) was subdivided into seven palms each of almost 7.5 cm or 3 in. Each palm comprised four fingers of about 1.9 cm or 0.75 in. The standard cubit comprised six palms, but all references to a “cubit” hereinafter will be to a royal cubit of seven palms.

The Pyramid's altitude or *peremos* appears to have been 280 royal cubits (146.6 m, or 481 ft), and the base, the *ukha thebt*, 440 royal cubits (230.3 m, or 756 ft). The basal inradius is half the *ukha thebt*.

The *seqed* is the ratio of the basal inradius to the *peremos* in palms and fingers per cubit: i.e., the cotangent of the lateral inclination. With seven palms to a royal cubit, this cotangent expressed as a decimal is simply one-seventh of the *seqed*.

The *seqed* of the Great Pyramid is 5 palms 2 fingers (i.e. 5.5 palms) per cubit of the *peremos*: i.e., the cotangent of the lateral inclination is  $5.5/7$  or 0.786. The slant height of the triangular lateral faces is thus 356.090 cubits.

Dimensions of the Great Pyramid  
 assuming a *peremos* of 280 cubits  
 and an *ukha thebt* of 440 cubits

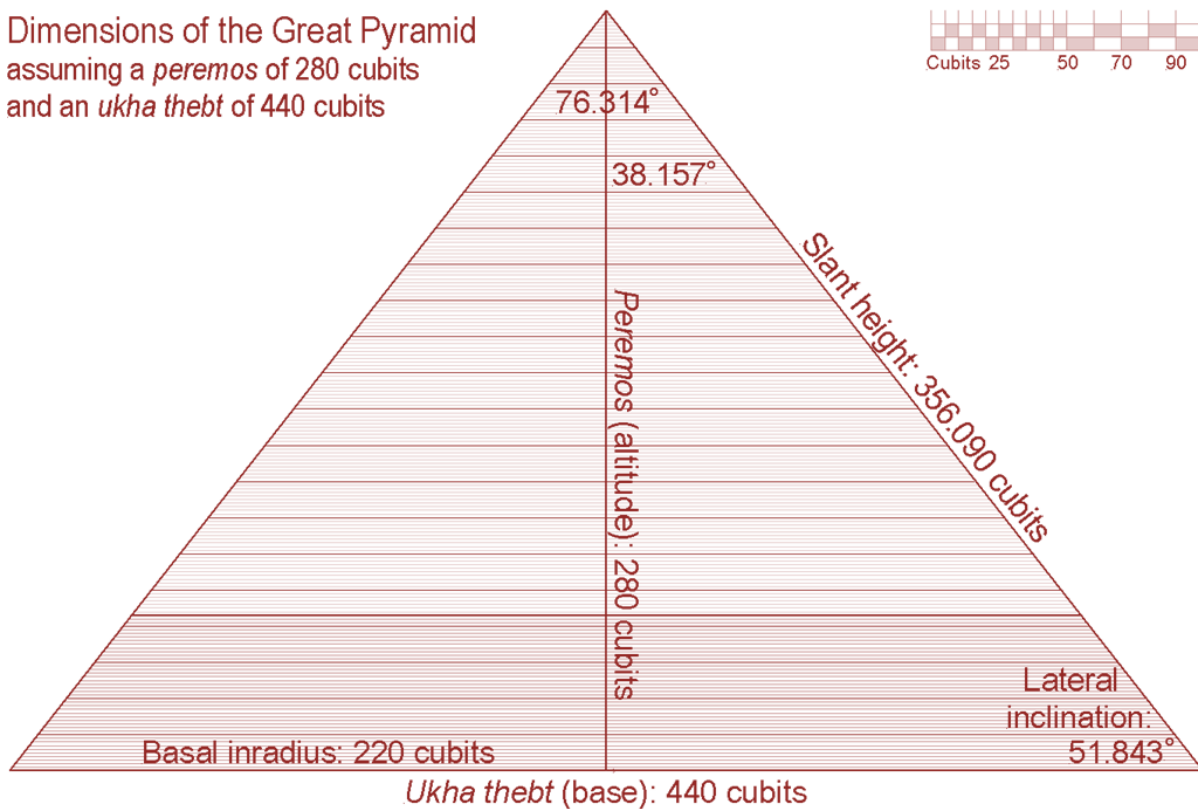


Figure 4. Sectional triangle of the Great Pyramid bisected through opposite slope heights. All 210 courses of masonry are shown approximately to scale. The lower 43 courses (darker) comprise approximately half the volume of the Pyramid.

The apical dihedral and semi-dihedral angles are  $76.314^\circ$  and  $38.157^\circ$  respectively. The basal dihedral or lateral inclination is  $51.843^\circ$  (Figure 4).

The following are among the many antihypotheses concerning the Pyramid's dimensions that have been promoted, some of them by respectable archaeological or mathematical sources:

1. The squaring of the circle is encoded in the Pyramid in that the *peremos* is the radius of a circle of circumference equal to the perimeter (four times the *ukha thebt*).
2. The ratio of the *peremos* to the basal inradius is  $4/\pi$ .
3. The ratio of the slant height to the basal inradius is the golden ratio  $\phi$ .
4. The square of the ratio of the area of all four triangular faces to that of the base is  $\phi$ .
5. The isosceles triangle whose base is the terrestrial diameter and whose altitude is the sum of the terrestrial and lunar radii (Figure 5) is similar to the sectional triangle of the Pyramid (Figure 4).
6. The sum of the lunar and terrestrial diameters in miles is equal to the sum of the vertex angles of the regular dodecahedron and the regular icosahedron in degrees.
7. On concentric *vesicae piscis* one being one-third the scale of the other as in Figure 6, a triangle similar to the sectional triangle in Figure 4 appears.
8. In Figure 4, the ratio of the basal to the apical dihedral is  $e/4$ , where  $e$  is Euler's number 2.718 ..., the base of the natural logarithms.
9. "Proceeding around the globe due north and due south of the Great Pyramid ... there is more earth and less sea in that meridian than in any other meridian all the equator round." (Smyth, 1880, p. 89) (Figure 7).

10. “The height of the Pyramid is precisely one billionth of the distance from the Earth to the Sun.” (Smyth, *op. cit.*).
11. The small irregularities in the dimensions of the four lateral faces of the Pyramid were deliberate, so that both  $\pi$  and  $\varphi$  could be more precisely encoded in its dimensions.
12. The latitude of the center of the Grand Gallery within the Pyramid is  $29^{\circ} 58' 45.28'' \text{ N}$ , or  **$29.9792458^{\circ} \text{ N}$** , encoding the velocity of light *in vacuo*, namely  **$299,792.458 \text{ m s}^{-1}$** .

Do these dozen superficially mathematical propositions indicate that the Egyptians of the Old Kingdom possessed knowledge that no mere humans of that age could possess, or that the pyramids were built by aliens or, a little less fancifully, by Egyptian architects ambitious to encode into its design such fundamental constants of mathematics as  $\pi$ ,  $\varphi$ , and  $e$ , or units such as the meter, the mile and the velocity of light? Or are these propositions antihypotheses?

From the Middle Ages to the mid-20<sup>th</sup> century, the educated classes in Europe were trained in three foundational subjects, the *trivium*, as a *sine qua non* for any form of higher education. The elements of the *trivium* were grammar, logic, and rhetoric. Some acquaintance with logic was intended to liberate students from apriorism, and to enable them to recognize antihypotheses.

One simple logical test is Occam’s Razor: *essentia non sunt multiplicanda praeter necessitatem*. There is little to be gained from an excess of complication. Of several explanations for an observed event, the simplest is likeliest.

Occam’s Razor is inherent in the scientific method: it is the yardstick for the null hypothesis that an observable event arose not by design nor by necessity, still less by alien or divine agency, but by mere chance.

Applying Occam’s Razor to propositions 1-4 above, the null hypothesis is that the apparent encoding of  $\pi$  and  $\varphi$  in the Pyramid’s dimensions was either accidental or, even if intentional, unremarkable. Of the ~100 Egyptian pyramids of the period, many (see e.g. Table 1) had *seqeds* in the region of 5 palms 2 fingers per cubit of the *peremos*. Several earlier pyramids with large *seqeds* had suffered structural failures, but pyramids with small *seqeds* would consume disproportionately large volumes of stone in their lower courses and would accordingly lack the presence – what architects call the “massing” – of taller pyramids.

Pharaoh	<i>Ukha thebt</i> (base)	Basal inradius	<i>Peremos</i> (altitude)	<i>Seqed</i> (palms cubit <sup>-1</sup> )	Ratio <i>Seqed</i> / 7	Apical dihedral	Basal dihedral
Sahure	78.5 m	39.3 m	48.0 m	5.75 palms cubit <sup>-1</sup>	0.821	79.0°	50.5°
Menkaure	103.4 m	51.7 m	66.5 m	5.50 palms cubit <sup>-1</sup>	0.788	77.4°	51.3°
<b>Khufu</b>	<b>230.3 m</b>	<b>115.2 m</b>	<b>146.6 m</b>	<b>5.50 palms cubit<sup>-1</sup></b>	<b>0.788</b>	<b>76.3°</b>	<b>51.8°</b>
Userkaf	73.3 m	36.7 m	49.0 m	5.25 palms cubit <sup>-1</sup>	0.750	74.0°	53.0°
Khafre	215.3 m	107.6 m	143.5 m	5.25 palms cubit <sup>-1</sup>	0.750	73.8°	53.1°

Table 1. The similar *seqeds* or lateral-inclination cotangents of five pyramids at Giza.

Even with a steepish *seqed* of 5 palms 2 fingers, i. e., a lateral inclination of  $51.843^{\circ}$ , half the volume of stone in the Great Pyramid was taken up by the first 43 of the 210 courses (Figure 4), representing little more than 20%, or less than 100 ft, of the 481 ft *peremos*. It is likely, then, that the first four propositions listed above depend not upon “sacred geometry” but upon two far from esoteric circumstances: first, that the *seqed* was derived from experience, falling between a high value that risked structural failure and a low value that consumed much stone and labor for little massing; secondly, that the ratio of the *peremos* to the *ukha thebt* was 7: 11, so that ratios involving these two primes give tolerably close approximations both to  $\pi$  and to  $\varphi$ . For  $\pi$  is approximately  $2 \times 11/7$  or 3.143, close to the true value 3.142 ... Likewise,  $\varphi$  is approximately  $(2 \times 7/11)^2$  or 1.620, close to the true value 1.618 ... From the 7: 11 ratio of the *peremos* to the *ukha thebt*, taken

with these approximations expressed in that ratio or its reciprocal, the facts behind propositions 1-4 automatically follow, strongly suggesting nothing more than coincidence.

The fifth proposition likewise follows from the ratio of the *peremos* to the *ukha thebt*. All that is necessary is that the diameter of the Moon shall be approximately  $3/11$ , or  $0.2727$ , times the diameter of the Earth. Sure enough, NASA’s lunar factsheet (NASA, 2015) gives the ratio of the lunar to the terrestrial diameter as  $0.2725$  (Figure 5).

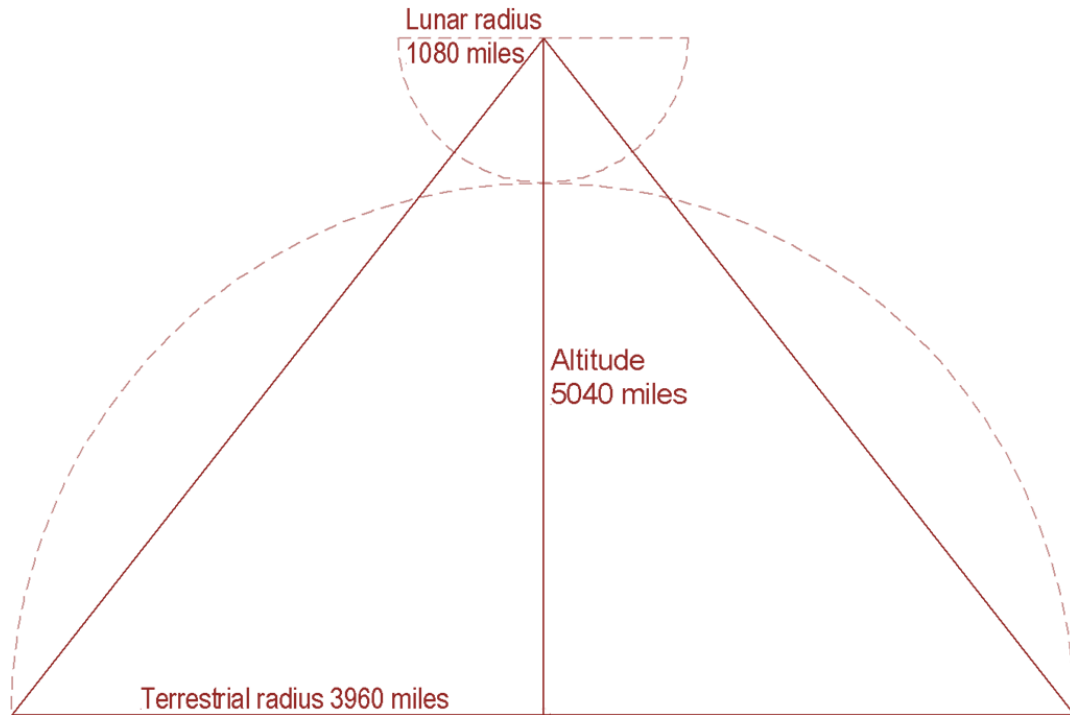


Figure 5. The lunar and terrestrial radii “encoded” in the *peremos* of the Great Pyramid.

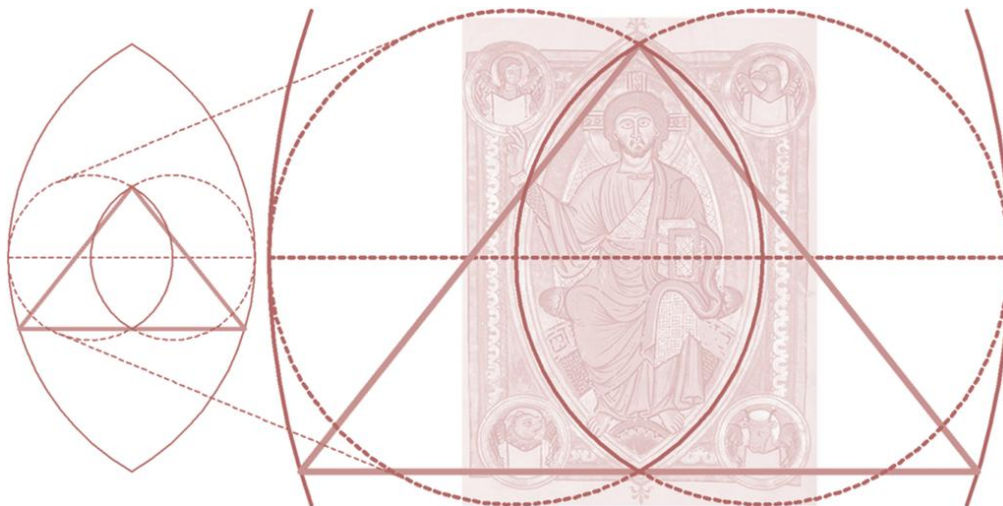


Figure 6. The *vesica piscis* (“fish bladder”) or *mandorla* (“almond”), often used in Christian and Islamic art, is the symmetrical lens formed by the intersection of two unit circles whose centers are one radius apart (Pedoe, 1995, p. xii). Left panel: concentric vesicae, the outer having thrice the radius of the inner. Main panel: a triangle whose apex lies at the upper cusp of the inner vesica and whose base is the horizontal distance between the arcs of the outer vesica through the lower cusp of the inner vesica.

Proposition 6 has a similarly trivial explanation. The dodecahedron has 12 pentagonal faces each with an angle-sum  $540^\circ$ : total  $6480^\circ$ . The icosahedron has 20 triangular faces each with an angle-sum  $180^\circ$ : total  $3600^\circ$ . The combined angle-sum is  $10,080^\circ$ . The Earth's mean diameter is about 7920 miles; the Moon's diameter is about 2160 miles: the sum of the two diameters is 10,080 miles. Since degrees and miles are distinct units independent of one another, neither of them in use in ancient Egypt, this outcome is an unremarkable coincidence.

The seventh proposition is inexact. The ratio of the *peremos* to the base of the pyramid in Figure 5 is 0.631, while the same ratio in the Great Pyramid is 0.636. The two triangles are sufficiently dissimilar that their approximate similarity is more likely to be attributable to coincidence than to design (Figure 3).

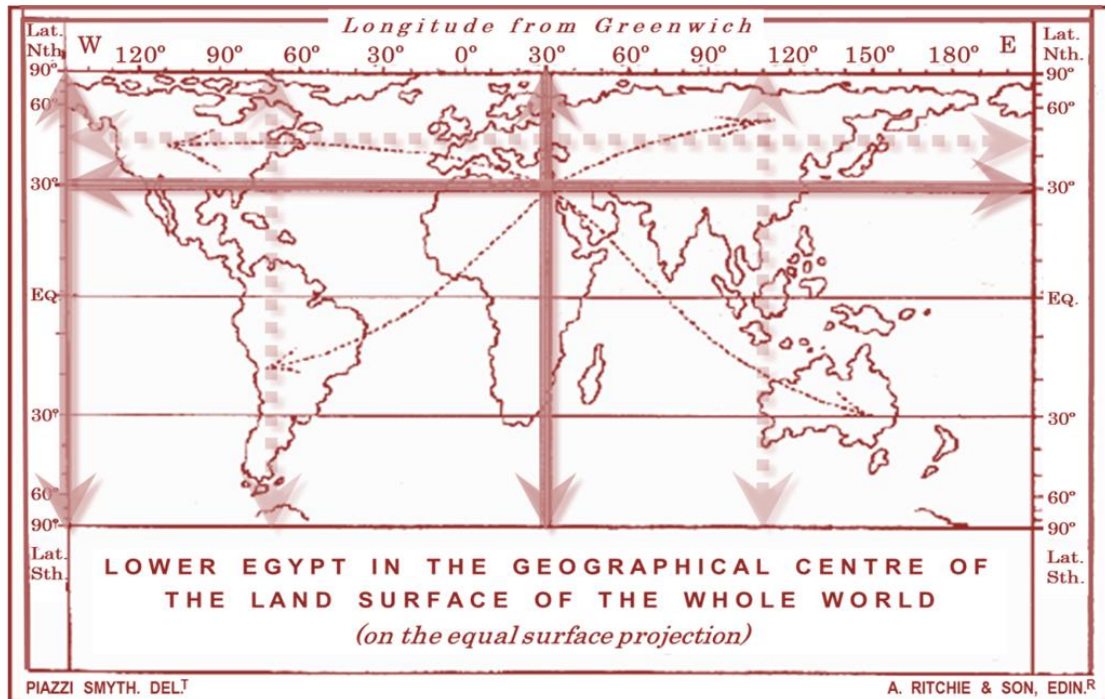


Figure 7. World map from Smyth (1880), enhanced to show lost detail and amended (dotted light gray arrows) to show the true latitudes and longitudes covering the greatest distances overland. Solid dark gray arrows show the latitudes and longitudes centered on lower Egypt, which Smyth had imagined to cover the greatest distances overland. The line of latitude at the edge of the map is a continuation of the line at the center but on the far side of the globe.

The eighth proposition likewise depends upon mere coincidence. There is no evidence that the Egyptians were familiar with the natural logarithms and, therefore, with Euler's number  $e$ , the base of the Napierian logarithmic system, which was not described until 1618. Therefore, the proposition that  $e$  was encoded in the Pyramid is no more likely than that the digits of the year 1618 are mystically connected to the first four digits of  $\varphi = 1.618 \dots$

The ninth proposition is false (Figure 7). The two points on Earth at which the lines of latitude and longitude pass over more land than anywhere else are at the mouth of the St. Lawrence River and in western China. Though Smyth (1880) has remained in print since its first edition, it contains many such readily-identifiable errors.

The tenth proposition, again attributable to Smyth, is likewise false. The International Astronomical Union declares the astronomical unit – the mean Sun-Earth distance – as  $< 149.6 \times 10^9$  m. Since the Earth's orbital eccentricity varies on a 100,000-year cycle and thus did not greatly differ from today's during the Old Kingdom period a mere 4500 years ago, a billionth of the annual interval

from perihelion to aphelion falls on [147, 152] m. However, the altitude of the Great Pyramid, at 146.6 m, does not quite fall on that interval. It is half a meter below one-billionth of even the perihelion. It is in any event implausible that the Egyptians were capable of obtaining a reliable estimate of the astronomical unit. And why would they capriciously adopt a billionth of it as their *peremos*?

As to the eleventh proposition, due to the dependency of common approximations of  $\pi$  and  $\varphi$  on the 7: 11 ratio any sufficiently small construction error in the alignment of the lateral faces will tend to pull the geometry of that face closer to one of the two fundamental constants and farther from the other. Since an error in one face will tend to cause a compensating error in another face, the approximation to  $\pi$  derivable on one face and to  $\varphi$  derivable on another is very likely to be an inadvertent consequence of these irregularities.

The twelfth proposition, like the sixth, is a contrived coincidence of units unknown to the Egyptians, who did not measure angles, latitudes, or longitudes in today's degrees of arc. The meter was not defined until after the French Revolution, and was then specified as one ten-millionth of the quadrant from the North Pole to the Equator along the Paris meridian, which in any event differs from the Greenwich meridian (the Earth being an irregular oblate spheroid), and was of no more significance to the Egyptians than to us, even if they had been no less capable than the French revolutionaries of conducting the necessary geodesy campaign. In any event, the French estimate of the Paris meridian was inaccurate.

Antihypotheses such as these were elegantly parodied by Umberto Eco (1995, ch. 48):

He threw open the shutters dramatically and pointed. At the corner of the narrow street and the broad avenue stood a little wooden kiosk, where, presumably, lottery tickets were sold. "Gentlemen," he said, "I invite you to go and measure that kiosk. You will see that the length of the counter is 149 cm – in other words, one hundred-billionth of the distance between the Earth and the Sun. The height at the rear, 176 cm, divided by the width of the window, 56 cm, is 3.14. The height at the front is 19 dm [190 cm], equal, in other words, to the number of years of the Greek lunar cycle. The sum of the heights of the two front corners and the two rear corners is  $2(190 + 176)$ , which equals 732, the date of the victory at Poitiers. The thickness of the counter is 3.1 cm, and the width of the cornice of the window is 8.8 cm. Replacing the numbers before the decimals by the corresponding letters of the alphabet, we obtain C for 10 and H for 8, or  $C_{10}H_8$ , which is the formula for naphthalene."

These dozen antihypotheses at least have the merit that, to the extent that they are quantitatively expressed, they may be quantitatively falsified. However, the key antihypothesis underlying all of them, namely that what are shown to be scientifically unremarkable coincidences in the Pyramid's dimensions were encoded by aliens or Egyptian architects, is not Popper-falsifiable and falls out-with the purview of science. Nevertheless, if science does not stoop to correct those antihypotheses that are falsifiable, scientifically untenable notions may become entrenched and misguided policies may ensue.

### 3. Superstitious antihypothesis: "The Earth is flat"

Even today, a doggedly misguided faction of YouTube clickbait-miners contends that the Earth is not a near-spherical planet rotating about its own axis and orbiting the Sun but a flattish disk akin to a dinner-plate with the North Pole at its center and the ice-wall of Antarctica forming the rim (Figure 8).

This central antihypothesis is artfully bolstered by an elaborate compendium of suchlike ingenious but scientifically nonsensical antihypotheses. For instance:

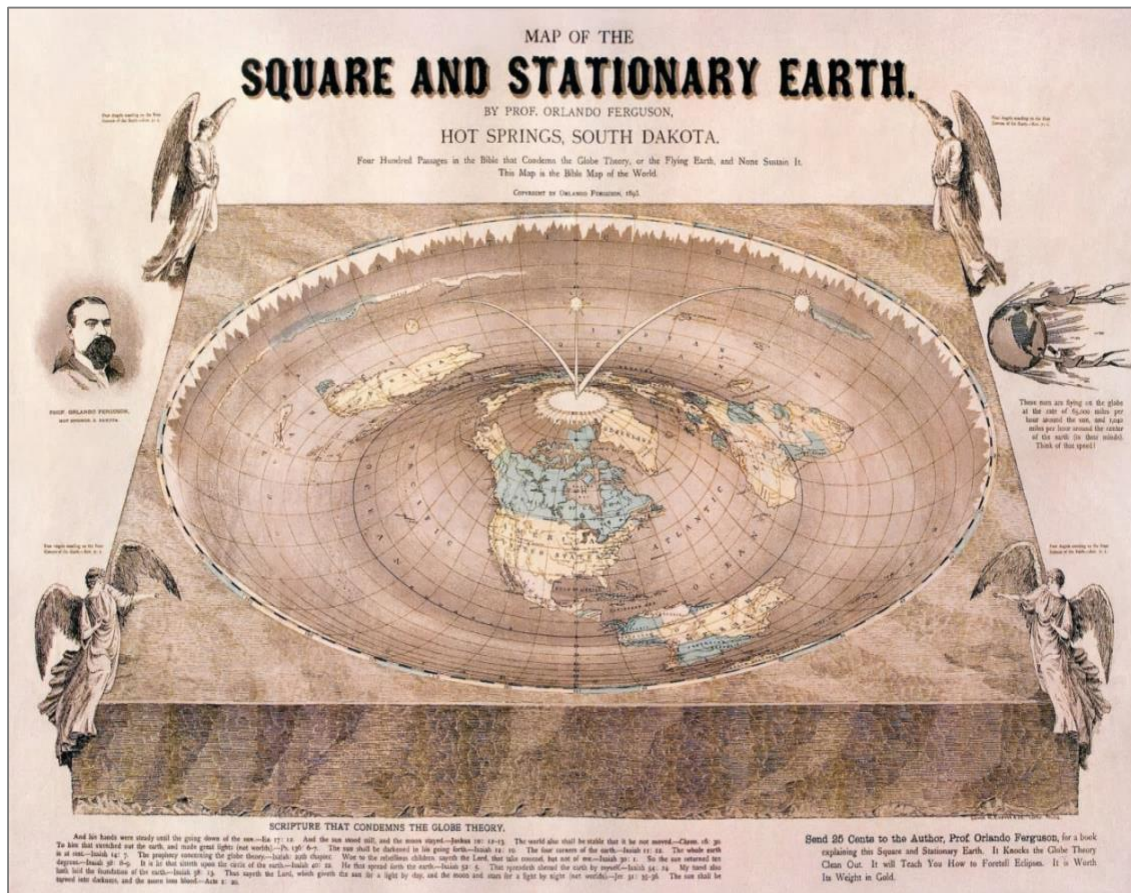


Figure 8. A dinner-plate-Earth image by Professor Orlando Ferguson (1893).

1. The Sun and Moon orbit only 3000 miles directly above the dinner-plate's "equator", the circle halfway between the center of the plate and the rim (3000 miles being the convenient altitude at which roughly the correct zenith angles would be observable);
2. No one can see beyond the icebound rim of the dinner-plate because various nations' armed forces deny access to Antarctica;
3. Space flight is impossible and all NASA films, including those of the Moon landing, of the space station and of the Earth from space, are costly and ingenious fabrications, as in the movie *Capricorn One*;
4. Cities that would be permanently below the horizon from certain vantage-points if the Earth were a spheroid are occasionally visible, proving that the surface of the ocean is not curved (atmospheric refraction due to transient temperature inversions having been meticulously overlooked).

The traditional response to flat-Earthers is to sneer at them. The rational approach, however, is to use Socratic elenchus: i.e., to test their antihypothesis against the null hypothesis using their own premises, deriving an observable conclusion that demonstrates the falsity of theirs in a manner that leaves them no escape route.

Assume *ad argumentum* the flat-Earthers' long-cherished assertion that the Earth is a flattish dinner-plate with the North Pole at its center. Then, wherever one stands on the dinner-plate, the Pole Star will always be visible and the northern constellations will appear to rotate widdershins about it.

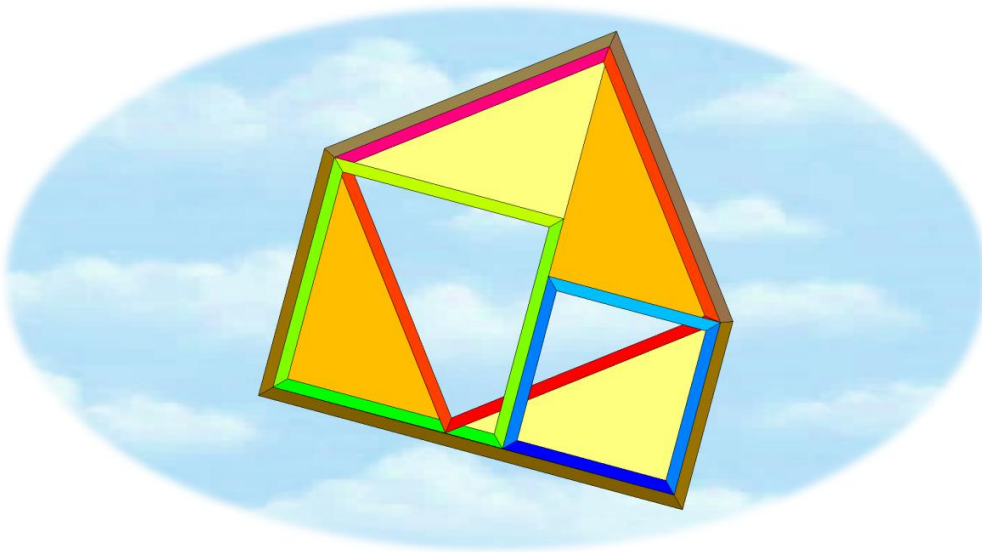
On a spherical Earth, however, Polaris will be visible only from the Northern Hemisphere, while the Southern Cross will be visible only from the Southern Hemisphere. The southern constellations are visibly distinct from the northern, but would not be so as seen from the dinner-plate Earth. On the

sphere they will appear to rotate not widdershins but clockwise about the South Pole. It is necessary only to visit both Hemispheres and take time-lapse photographs of the stars on clear nights to demonstrate irrefutably the impossibility of the Flat-Earthers' long-standing dinner-plate model.

#### 4. Superstitious antihypothesis: “The triangle is imperialist”

Ascher (1994) maintains that mathematics is one of the imperialistic mechanisms by which a Western *Weltanschauung* is inflicted willy-nilly upon a reluctant world:

The relationship between the length of the hypotenuse and lengths of the sides of a right triangle is an eternal truth, but that does not mean that any other culture need share the categories triangle, right triangle, hypotenuse. ... A critical issue is that, as it stands, much of mathematics education depends upon assumptions of Western culture and carries with it Western values.



*Figure 9. Beweisführung ohne Worte of Pythagoras' theorem. The irregular pentagon comprises either two congruent right-angled triangles and the square on the hypotenuse or the same two triangles translated and the squares on the two catheti. Subtract the two triangles from each disposition and the Pythagorean identity is established. The author's tessellation proof by inclusion is easier to grasp than Euclid's demonstration, justifiably described by Schopenhauer as "a triumph of perversity".*

At least the cited passage concedes that there is such a thing as objective truth. The Pythagorean theorem is even described as an “eternal truth”, which is not in fact the case. Though Pythagoras is demonstrably true in the Euclidean plane (Figure 9) and even in the hyperbolic domain, it is not true, for instance, on a spherical surface such as that on which we live and move and have our being. Ascher asserts that the triangles to which that “eternal truth” applies are not themselves eternal, in that by implication they are mere instruments of, or in some unspecified fashion contingent upon, “Western cultural imperialism”.

Contrary to Ascher's belief, the archaeological and historical evidence is that the triangle and its properties are the common mathematical heritage of most sufficiently advanced cultures. The properties of the triangle were studied, and the Pythagorean identity understood and demonstrated, in the East no less than in the West. Therefore, the assertion that the triangle is an instance of Western imperialism is itself an instance of Western cultural imperialism.

The early Chinese – hardly Western – were well aware of the Pythagorean theorem. The *Zhou Bi Suan Jing* (Han Dynasty, 221-206 BCE) demonstrates it with concision as follows. Figure 10 (left) is a square of area  $(a + b)^2$  comprising four congruent right triangles  $abc$  each of area  $ab/2$ , and

the square  $c^2$  on their hypotenuses  $c$ . Thus,  $(a + b)^2 = 4ab/2 + c^2 = 2ab + c^2$ . Deducing  $2ab$  from  $(a + b)^2$  and from  $2ab + c^2$  gives the identity  $a^2 + b^2 = c^2$ .

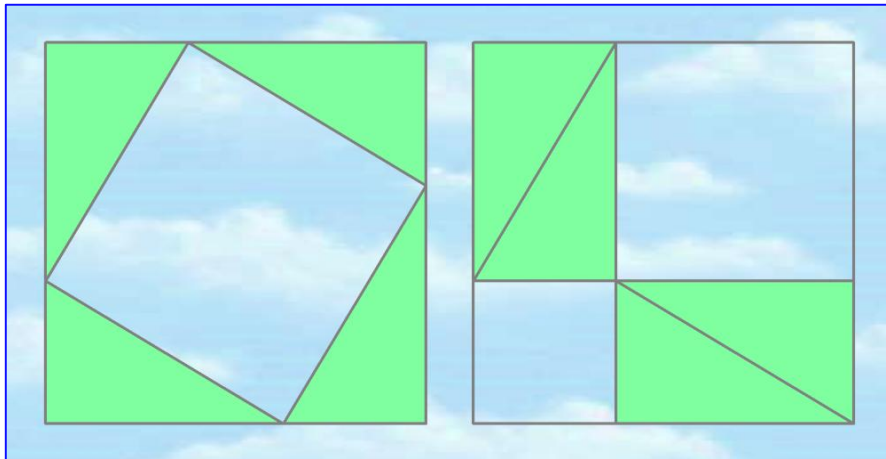


Figure 10. Bhaskara's demonstration of Pythagoras' Theorem

The *Beweisführung ohne Worte* attributed by Coxeter to the fifth-century Indian mathematician Aryabhata (Figure 10) is perhaps the most instantly comprehensible of the hundreds of demonstrations of Pythagoras found in all parts of the world.

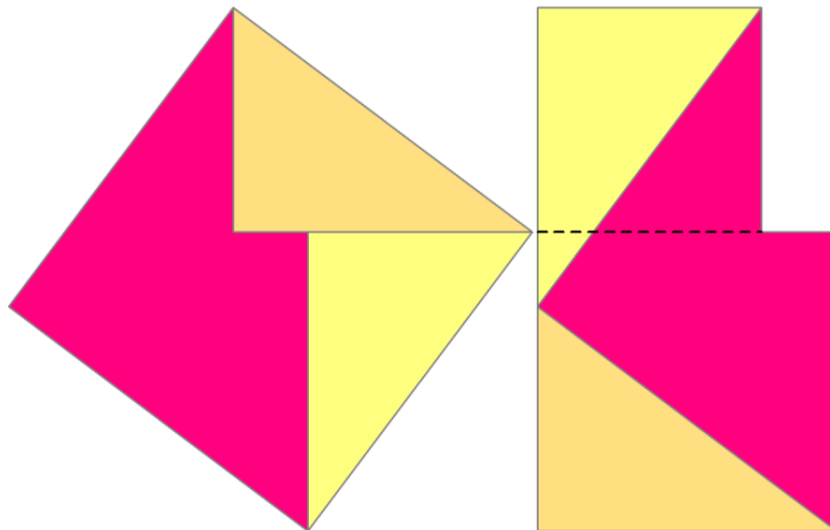


Figure 11. Thabit ibn-Qurra's demonstration of Pythagoras' Theorem.

Al-Sabi Thabit ibn-Qurrah al-Harrani (836-901 CE) of Baghdad devised an elegant tessellation proof (Figure 11), a variant of the earlier demonstration by the fifth-century Indian mathematician Bhaskara, which was itself a variant of the proof attributed to Aryabhata.

These dissection proofs are instantly comprehensible to the student, unlike that of Euclid in the West, which Schopenhauer justly described as “a triumph of perversity”.

The Babylonians recorded Pythagorean triples on tablets in cuneiform, perhaps as an exercise for geometry students, such as Plimpton 322, dated 1800 BCE and thus long predating Pythagoras himself (Figure 12).

The tallest structure extant on Earth until the skyscrapers of the late 19<sup>th</sup> century was no glory of Western architecture but a Pharaoh's tomb all four sides of which remain, 4500 years after they were built, among the largest triangles ever erected by Man on Earth, East or West.



Figure 12. Cuneiform tablet Plimpton 322, listing several Pythagorean triples in sexagesimal notation.

In the face of such evidence for familiarity with the triangle and its properties from so many advanced Eastern civilizations, how did a paper fatuously alleging that the triangle was a manifestation of “Western cultural imperialism” ever pass peer review? One reason is that in recent decades academe has for various reasons, including direct subornation first by Russian and then by Chinese Communism, adopted a narrow-minded, intolerant, totalitarian, anti-Western prejudice.

##### 5. Legalist antihypothesis: “Global warming is a global crisis”

Antihypotheses arising from superstition or prejudice, such as those described above, are these days less likely to prove harmful than those arising from legalism. Consider the notion that anthropogenic global warming is a global crisis demanding urgent and very costly intergovernmental action to mitigate it and thus to prevent “the end of the world” that might otherwise occur by 2100 (Dietz et al., 2007).

At minimum, the four logical sieves recommended in Popper (1934) should be applied to every such notion that is presented for peer review in a scientific journal or promoted by profiteering legalist lobby-groups to generally innumerate politicians and civil servants.

###### *Popper’s first sieve: the local-consistency test*

The internal logical consistency of a theoretical system may be tested for the presence of any inherent contradictions. Socratic elenchus tests for logical consistency by contrasting the conclusions of two arguments. In logic, an argument is a formal system comprising at least one declarative premise and a conclusion. If the premises entail the conclusion, the argument is valid but the conclusion may or may not be true and the argument may or may not be sound. If the premises entail the conclusion and are all objectively true, the conclusion is necessarily true and the argument is described as not only valid but also sound.

To test an argument *A* for local consistency by Socratic elenchus, the premises of a second, related argument *B* are put to the proponent of *A* for assent. If *B* is well chosen, that assent will be

willingly granted. The conclusions of *A* and *B* are then compared and demonstrated to be mutually inconsistent. The local-consistency test having failed, the conclusions of either *A* or *B* or both must be rejected, in which event, if *B* is well chosen, the proponent of *A* is compelled to concede that *A* is untenable. *Exempli gratia*, the local-consistency test will now be applied to the climate debate.

The notion that unmitigated anthropogenic warming may prove cataclysmic is asserted to be a scientific proposition. It is fostered by legalist scientific societies worldwide – legalist because they are signally intolerant of dissent. Many such societies have issued tendentious, self-serving and more or less hysterical statements about global warming, as have numerous national, international and global entities, including the United Nations’ Framework Convention on Climate Change and the Intergovernmental Panel on Climate Change.

IPCC presents itself as a scientific body producing authoritative scientific reports but is in reality a political entity founded at the instigation of a Communist resident in China, which has since profited greatly from the extensive transfer of energy-intensive manufacturing industries to it from Western nations where ill-informed global-warming mitigation policies have rendered bulk consumption of electrical power in manufacturing unaffordable.

If the notion of anthropogenic warming sufficient enough to be potentially catastrophic were scientific, it would be consistent with the scientific methodologies asserted by its advocates. That notion depends upon the proposition *A* that that temperature feedback response is the cause of two-thirds to three-quarters (at the extreme, up to nine-tenths) of all warming, and, therefore, of a similarly large fraction of the very broad and refractory interval of uncertainty in climate models’ predictions. For instance –

“Noncondensing greenhouse gases, which account for **25%** of the total terrestrial greenhouse effect, ... provide the stable temperature structure that sustains the current levels of atmospheric water vapor and clouds via feedback processes that account for the remaining **75%** of the greenhouse effect” (Lacis et al. 2010).

Recall the universality of truth. Feedback formulism applies to all dynamical systems, from the electronic circuits for which and through which it was originally derived to climate. Therefore, we may offer to the adherents of the current orthodoxy the reference proposition *B* that the feedback formulism applied to the climate must be consistent with the long-established, definitively-demonstrated norms of control theory, the physics of feedback processes in dynamical systems, from which climatology explicitly borrowed and internalized feedback formulism in the 1980s. Our interlocutors must, if they wish to be regarded as scientifically credible, assent to that proposition.

Once they have done so, we are in a position to draw their attention to an inconvenient truth. For a substantial inconsistency, with grave consequences, subsists between official climatology and the wider scientific realm. Due to the barriers between overspecialized scientific disciplines, the resulting flagrant error of physics went unnoticed until recently.

For when climatologists borrowed feedback formulism from control theory they did not understand what they had borrowed. They erroneously defined temperature feedback as responding only to perturbations, such as the 8 K direct warming forced by preindustrial greenhouse gases, but not also to the 30-times-greater input signal, the 255 K emission temperature that would obtain near the surface even in the total absence of greenhouse gases.

For instance, IPCC (2013, p. 1450) defines a “climate feedback” as –

“an interaction in which a *perturbation* in one climate quantity causes a change in a second, and the change in the second quantity ultimately leads to an additional change in the first. A negative feedback is one in which the initial *perturbation* is weakened by the changes it causes; a positive feedback is one in which the initial *perturbation* is enhanced. In this Assessment Report, a somewhat narrower definition is often used in which the climate quantity that is *perturbed* is the global mean surface temperature,

which in turn causes changes in the global radiation budget. In either case, the initial *perturbation* can either be externally forced or arise as part of internal variability.”  
[Author’s emphases]

IPCC’s definition repeatedly mentions *perturbation* as the driver of feedback but is silent on the emission-temperature feedback response. The definition should read:

“**Temperature feedback**, in Watts per square meter per Kelvin of emission temperature or a perturbation thereof, induces a **feedback response** in Kelvin. Positive feedback amplifies output; negative feedback diminishes it.”

The equilibrium temperature in 1850 was the 287 K observed global mean surface temperature (Morice et al. 2020). Climatology imagines that the emission temperature that would obtain near the surface in the absence of greenhouse gases is 255 K. The natural greenhouse effect is then the 32 K difference between these two. The directly-forced warming by the preindustrial noncondensing greenhouse gases present in 1850, before our influence became appreciable, was approximately 8 K. These are values derivable from mainstream climatology and planetary physics. Thus far, there is little argument between adherents to and dissenters from the orthodoxy on climate.

However, climatologists erroneously drew from the above agreed quantities the erroneous conclusion that the 32 K natural greenhouse effect comprised just two components: the 8 K reference sensitivity directly forced by the preindustrial greenhouse gases and 24 K feedback response thereto. The implications of this conclusion were that feedback response was about thrice the reference sensitivity to which it was a response; that, therefore, the eventual warming by (or equilibrium sensitivity ECS in response to) the  $\sim 1$  K direct or reference warming RCS by doubled CO<sub>2</sub> would be approximately  $32/8 = 4$  K; and that, therefore, unless the West were shut down there was a 10% probability that the Earth would come to an end by 2100 (e.g., Dietz et al., 2007). Sure enough, current models (Zelinka et al., 2020) predict that the 1 K reference doubled-CO<sub>2</sub> sensitivity will become close to 4 K equilibrium doubled-CO<sub>2</sub> sensitivity ECS. Climatology, therefore, implicitly assumes that unit feedback response is near-invariant with global temperature.

Climatologists had unfortunately, and expensively, neglected the observably fact that the Sun is shining. For in any feedback-moderated dynamical system the feedback processes must necessarily respond not only to perturbations in the input signal but also to the input signal itself. In the climate, the input signal – the overwhelmingly predominant temperature signal, representing almost nine-tenths of current global mean surface temperature – is the 255 K emission temperature that would obtain near the Earth’s surface in the absence of any greenhouse gases, simply because the Sun is shining.

It follows that the 32 K natural greenhouse effect was the sum of not two but three components: the 8 K natural reference sensitivity forced by the preindustrial noncondensing greenhouse gases, the feedback response thereto, and the far larger feedback response to the 255 K emission temperature. Therefore, the equilibrium sensitivity to doubled CO<sub>2</sub> (ECS) is not  $32/8 \approx 4$  K but more like  $(255 + 32)/(255 + 8) \approx 1.1$  K. This result, like that of climatology, assumes near-invariance of unit feedback response with temperature. However, it is possible to verify that unit feedback response is indeed near-invariant with temperature across the narrow interval from emission temperature to current temperature.

For much the same ECS as was obtained above from preindustrial data may also be obtained by the distinct energy-balance method (first described in Gregory 2002) applied to the industrial era, using recent, midrange, mainstream data from 1850-2020. For  $3.52 \text{ W m}^{-2}$  doubled-CO<sub>2</sub> forcing (Zelinka et al. 2020),  $3.2 \text{ W m}^{-2}$  net period anthropogenic forcing from all causes (NOAA Annual Greenhouse-Gas Index: Butler et al., 2021), 1.04 K period observed global warming (HadCRUT5: Morice et al. 2020),  $0.87 \text{ W m}^{-2}$  Earth energy imbalance (von Schuckmann et al. 2020) and the 70%

anthropogenic fraction of period warming and hence of Earth energy imbalance (Wu et al. 2019), ECS is as follows:

$$\text{ECS} = 3.52 \frac{70\% \text{ of } 1.04}{3.2 - 70\% \text{ of } 0.87} \approx 1.0 \text{ C}^\circ \quad (2)$$

The two corrected results, obtained by different methods, cohere, confirming not only that unit feedback response is near-invariant with temperature but that it is negligible. With little error, feedback response may safely be ignored altogether in deriving equilibrium sensitivities.

Without the error arising from the inconsistency between the climate orthodoxy’s erroneous definition of feedback and the definition universally applied in describing all other dynamical systems, the climate “emergency” vanishes as though it had never been.

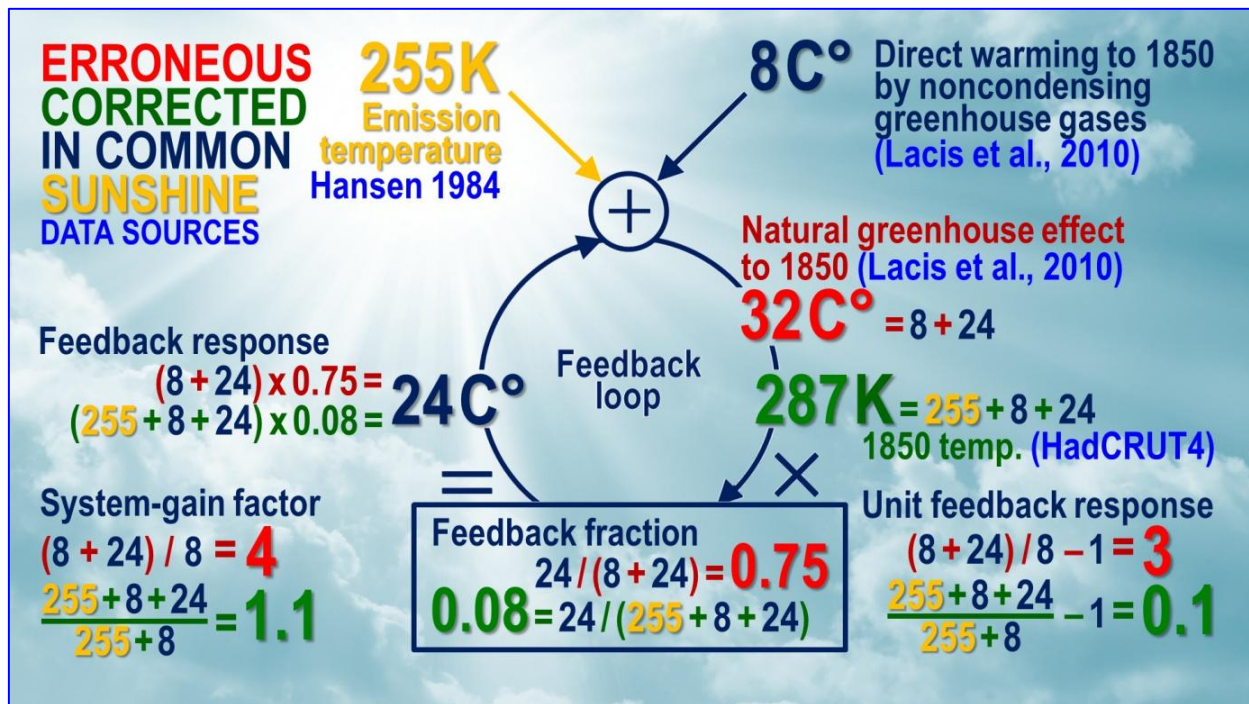


Figure 13. Climate feedback-amplifier block diagram. Erroneous values are in red; the emission temperature neglected by climatology is in yellow; corrected values are in green; values common to the erroneous and to the corrected approach are in dark blue; data sources are in bright blue. Values are rounded for clarity.

Figure 13, a simple control-theoretic block diagram for feedback amplification in the climate, demonstrates the differences between climatology’s unfortunate neglect of the emission-temperature feedback response and the corrected position. It will be seen that climatology, misled by its misunderstanding of control theory, has overstated the unit feedback response by a factor 30, the fraction of equilibrium output represented by feedback response by a factor 10 and consequently the system-gain factor, and thus equilibrium sensitivity, by a factor 4. These order-of-magnitude errors misled climate modelers into expecting, and hence predicting, approximately four times as much global warming as is scientifically tenable.

How did so gross an error, with such grave and costly consequences, ever arise? Before sufficiently well-resolved satellite radiative flux densities and stratified bathythermographic ocean temperature profiles became available in about 2010, the energy-balance method was incapable of constraining equilibrium sensitivities reliably. Likewise, no response to any feedback process can be quantified by measurement, and even the aggregate feedback response could not be empirically derived.

Accordingly, when feedback formulism was imported into climatology in Hansen (1984) and Schlesinger (1988), a frame of reference to provide a basis for testing models' outputs was required.

Since satellites had measured the total solar irradiance as  $1365 \text{ W m}^{-2}$  and the mean terrestrial albedo as 0.3, climatologists were able to derive emission temperature  $R_0$  via the Stefan-Boltzmann equation (2), in which the eponymous constant is  $5.6704 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$  and the divisor 4 is the ratio of the Earth's surface area to that of its great circle:

$$R_0 = \left[ \frac{1365(1 - 0.3)}{4 \times 5.6708 \times 10^{-8}} \right]^{1/4} = 255 \text{ K} \quad (3)$$

Even here, climatologists perpetrated an elementary error. They did not realize that at emission temperature the absence of greenhouse gases in the air would remove the clouds, reducing the albedo to 0.1.

Correcting this further error increases emission temperature from 255 to 271 K, and thus halves the natural greenhouse effect from 32 to 16 K, halving the system-gain factor (the ratio of equilibrium to reference sensitivity) from  $32/8 = 4$  to  $16/8 = 2$ , correspondingly halving all global-warming predictions, even before taking account of the major error of neglecting the feedback response to emission temperature.

Once the correction of climatology's major error of neglecting the sunshine is made, the precise value of emission temperature is irrelevant: it is so much larger than the direct warming by preindustrial noncondensing greenhouse gases that any value from 255-271 K may be adopted without altering ECS.

Once climatology had made these errors, it tuned its models to predict equilibrium sensitivities of about 4 K, consistent with its erroneous system-gain factor 4. Then, when the satellite and bathythermograph data became available, allowing the energy-balance method to yield a far simpler, far more robust and far less alarming equilibrium sensitivity of 1-1.5 K, climatology had already set its heart on the high equilibrium sensitivity that had arisen from its errors.

Climatology was, therefore, unwilling to accept that the inclusion of the large feedback response to emission temperature as a component in the 16-32 K natural greenhouse effect, with a corresponding reduction in the feedback response to direct warming by preindustrial noncondensing greenhouse gases, provides a simple and robust benchmark against which models' predictions of global warming may be reliably subjected to falsification.

It is further demonstrable that the general-circulation models of climate, though they have many uses, are valueless for predicting the evolution of global temperature in response to a forcing.

First, the published estimates of the feedback fraction  $f$  derived from the models fall on the interval  $[0, 1]$ , implying system-gain factors  $A = (1 - f)^{-1}$  on the interval  $[1, \infty]$ , rendering equilibrium sensitivity the least well-constrained quantity in the entire history of physics.

It is this broad interval of uncertainty that compelled climatologists to carry out the erroneous preindustrial calculation, neglecting the large emission-temperature feedback response, that led them to imagine that equilibrium warming would be four times direct warming.

Secondly, the models are required to solve the Navier-Stokes equations (Figure 14) for each of half a million atmospheric cells  $100 \text{ km} \times 100 \text{ km} \times 1 \text{ km}$ , and to do so repeatedly in a sequence of small, successive time-steps over periods of up to several centuries, the output of each time-step serving as the input to its successor. The chief processes being modeled, such as the resonance of the individual  $\text{CO}_2$  molecules on interaction with photons in the principal absorption band of  $\text{CO}_2$ , or the Svensmark nucleation of water-vapor molecules to form cloud droplets, of course occur at sub-grid scale. The models do not capture them and must parameterize them. In modeling, "parameterize" is a long word for "guess".

## The Navier-Stokes equations

Time  $t$ , pressure  $p$ , heat flux  $q$ , density  $\rho$ , stress  $\tau$ , velocity components  $(u, v, w)$ ,  
total energy  $E_T$ , Reynolds number  $Re$ , Prandtl number  $Pr$

$$\begin{aligned}
 \text{Continuity:} \quad & \frac{\partial \rho}{\partial t} + \frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial y} + \frac{\partial(\rho w)}{\partial z} = 0 \\
 \text{x-momentum:} \quad & \frac{\partial(\rho u)}{\partial t} + \frac{\partial(\rho u^2)}{\partial x} + \frac{\partial(\rho uv)}{\partial y} + \frac{\partial(\rho uw)}{\partial z} = -\frac{\partial p}{\partial x} + \frac{1}{Re_r} \left( \frac{\partial \tau_{xx}}{\partial x} + \frac{\partial \tau_{xy}}{\partial y} + \frac{\partial \tau_{xz}}{\partial z} \right) \\
 \text{y-momentum:} \quad & \frac{\partial(\rho v)}{\partial t} + \frac{\partial(\rho uv)}{\partial x} + \frac{\partial(\rho v^2)}{\partial y} + \frac{\partial(\rho vw)}{\partial z} = -\frac{\partial p}{\partial y} + \frac{1}{Re_r} \left( \frac{\partial \tau_{xy}}{\partial x} + \frac{\partial \tau_{yy}}{\partial y} + \frac{\partial \tau_{yz}}{\partial z} \right) \\
 \text{z-momentum:} \quad & \frac{\partial(\rho w)}{\partial t} + \frac{\partial(\rho uw)}{\partial x} + \frac{\partial(\rho vw)}{\partial y} + \frac{\partial(\rho w^2)}{\partial z} = -\frac{\partial p}{\partial z} + \frac{1}{Re_r} \left( \frac{\partial \tau_{xz}}{\partial x} + \frac{\partial \tau_{yz}}{\partial y} + \frac{\partial \tau_{zz}}{\partial z} \right) \\
 \text{Energy:} \quad & \frac{\partial(E_T)}{\partial t} + \frac{\partial(uE_T)}{\partial x} + \frac{\partial(vE_T)}{\partial y} + \frac{\partial(wE_T)}{\partial z} = -\frac{\partial(up)}{\partial x} - \frac{\partial(vp)}{\partial y} - \frac{\partial(wp)}{\partial z} - \frac{1}{Re_r Pr_r} \left( \frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial y} + \frac{\partial q_z}{\partial z} \right) \\
 & + \frac{1}{Re_r} \left[ \frac{\partial}{\partial x} (u\tau_{xx} + v\tau_{xy} + w\tau_{xz}) + \frac{\partial}{\partial y} (u\tau_{xy} + v\tau_{yy} + w\tau_{yz}) + \frac{\partial}{\partial z} (u\tau_{xz} + v\tau_{yz} + w\tau_{zz}) \right]
 \end{aligned}$$

*Figure 14. The Navier-Stokes equations*

Thirdly, there are so many adjustable parameters that any desired output may be achieved, whether or not that output bears any relation to observed reality. In fact, because climatology has not yet realized its chief error – forgetting that the Sun is shining and would generate its own large feedback response even in the absence of any greenhouse gases at the outset – in 1990 the Intergovernmental Panel on Climate Change predicted two and a half to three times as much anthropogenic global surface and lower-troposphere warming from 1991-2020 as was subsequently observed, and similar overstatements have been observed in ocean-surface temperatures, in mid-troposphere temperatures and in bulk-troposphere temperatures.

These numerous and grave overstatements have been very widely unreported. So refractory are the complex partial differential equations of Navier-Stokes that no closed-form solutions to the equations have been found: indeed, the Clay Mathematical Institute offers \$1 million to anyone who can find such solutions. In the absence of closed-form solutions, it is necessary to attempt to solve the equations numerically – a highly uncertain process.

Fourthly, any uncertainty in the initial conditions of any general-circulation model must propagate in quadrature through each successive time-step. Frank (2019) demonstrated the devastating effect of propagated uncertainty in just one of the thousands of initial conditions in the models – the  $4 \text{ W m}^{-2}$  annually-averaged uncertainty in the low-cloud fraction. This one uncertainty exceeds the  $0.04 \text{ W m}^{-2}$  total predicted annual anthropogenic signal by two orders of magnitude. Propagated over a century, this single uncertainty leads to an uncertainty interval of at least  $\pm 15 \text{ K}$ , so that any prediction falling within that capacious uncertainty envelope is statistically meaningless (Figure 15). Whatever else the models can do, therefore, they are formally demonstrated to be incapable of predicting global temperature.

It is for reasons such as these that serious scientific observers do not consider climatology's use of general-circulation models in equilibrium-sensitivity studies to be worthwhile. Yet the entire case for concern about our influence on the climate is founded upon the outputs of these models, even though it is formally demonstrated not only that they are incapable of making any statistically-meaningful predictions but also that their outputs are as consistent with climatology's error of control theory as they are inconsistent with observed warming, of which there has been none at all for six or seven years.

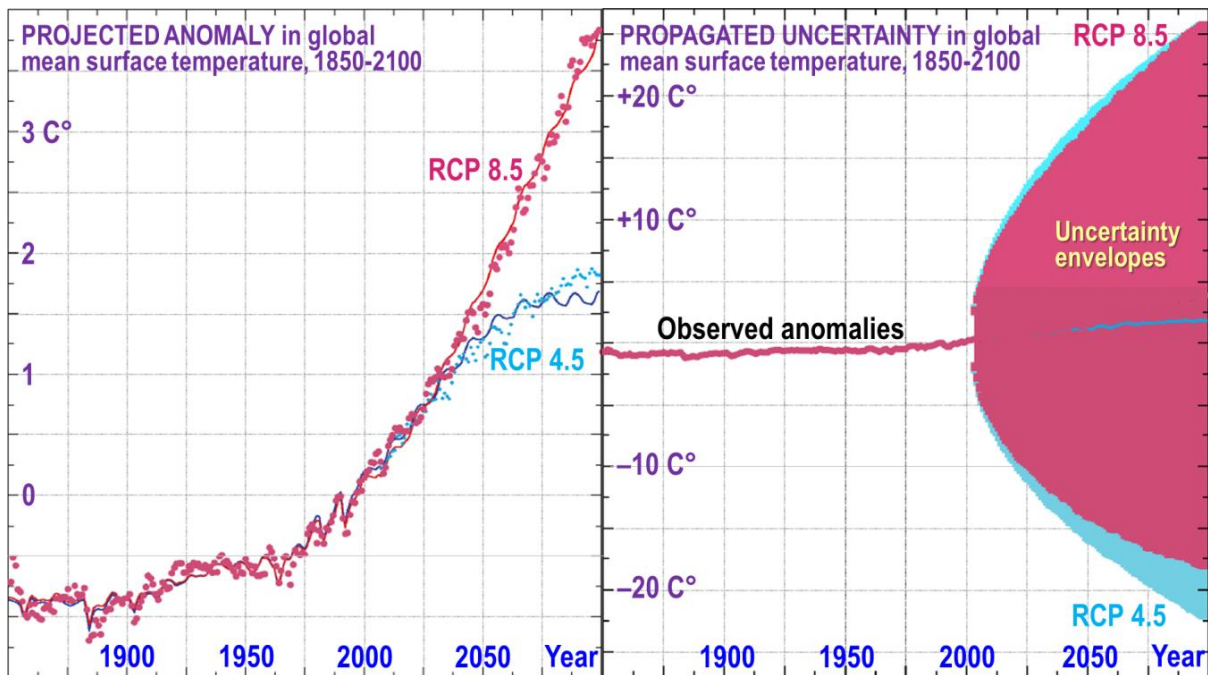


Figure 15. The [2, 5.7] K interval of current models' global-warming predictions falls entirely within the broad propagated-uncertainty envelope, and is thus guesswork.

*Popper's second sieve: the external-consistency test*

Popper's second sieve entails the separation of the hypothesis into its empirical and its logical elements, making the logical form explicit, whereupon it can be tested to determine its consistency with the wider principles of logic. A dozen commonly-asserted antihypotheses concerning the extent of Man's influence on the terrestrial climate will illustrate the operation of the second sieve:

1. "Ninety-seven percent of scientists agree: climate change is real, man-made and dangerous" (tweet from Mr Obama's Twitter account, 2013).
2. The consensus should be accepted because it is a consensus of experts (Anderegg et al. 2010).
3. The consensus should be accepted because it is a consilience of evidence (Cook et al. 2013).
4. Only a strong warming effect from CO<sub>2</sub> explains 60 years' warming (IPCC 2013, Figure SPM.6).
5. Global warming is accelerating, so we are to blame (IPCC 2007, FAQ Figure 3(1) caption).
6. Global warming endangers polar bears as a species (EPA 2009).
7. "Indications ... confirm that the world is warming. For instance, ... ocean heat content is increasing, ..." (UK Committee on Climate Change).
8. CO<sub>2</sub> concentration has risen; warming has occurred; therefore the former caused the latter (mass-media reports, *passim*).
9. Global warming caused storm Sandy and typhoon Haiyan (mass-media reports, *passim*).
10. Melting Arctic sea ice indicates manmade global warming (IPCC 2013, SPM).
11. Those who spurn the consensus are paid by fossil-fuel interests (mass-media reports, *passim*).

12. Those who spurn the consensus should be executed (academics and pressure groups, *passim*).

It is telling that, though these dozen antihypotheses embody the pretexts most commonly advanced for drastic intervention to mitigate global warming, only the first is expressed quantitatively. It is a Tweet from the account of Mr Obama that appeared shortly after publication of Cook *et al.* (2013), in which it had been falsely alleged that 97.1% of 11,944 climate-related papers published in the reviewed journals over the 21 years 1991-2011 had explicitly stated that recent global warming was mostly anthropogenic.

The antihypothesis that a “consensus” had been identified was quantitatively refuted by Legates *et al.* (2013), who examined Cook’s list of all 11,944 abstracts and found that Cook *et al.* had themselves marked only 64 abstracts, or 0.5% of the entire sample, as stating that that recent global warming was mostly anthropogenic. Examination of those 64 papers demonstrated that only 41 of the 64, or 0.3% of the entire sample, had thus written. It is for this reason, among many others, that argument from an alleged consensus, even of alleged experts, has no place in the scientific method. Indeed, its deployment indicates not sound science but interference with and politicization of scientific reasoning and argument by circumventing the formerly universal academic requirement that any proposition, however fashionable or venerable, only gains acceptance by little and little, and only after prolonged and searching scientific scrutiny.

At first blush, it may appear that the remaining 11 propositions will prove more difficult to falsify, since they are qualitative rather than quantitative. However, all 12 propositions share a common characteristic, not immediately obvious, by which each is shown to be an antihypothesis. Like the first, they are all instances of logical fallacies – categories of specious argument in which the premises do not validly entail the conclusion. Some 2350 years ago, Aristotle (c. 350 BCE, translated by Pickard-Cambridge) first categorized the dozen commonest fallacies in human discourse in his *Sophistical Refutations*. The medieval schoolmen would later give them their Latin names. The 12 commonly-asserted antihypotheses about climate change enumerated above are instances respectively of –

1. The headcount fallacy (*argumentum ad populum*), in that the fact of a consensus – supposing that it exists at all, which should not be assumed and is in the present instance proven false – demonstrates neither the truth nor the falsity of the proposition to which its supporters are said to adhere;
2. The fallacy of appeal to authority (*argumentum ad verecundiam*), in that even those with reputations as experts may be inexpert, prejudiced or simply wrong;
3. The red-herring fallacy (*argumentum ad ignorationem elenchi*), the fundamental fallacy of relevance, in that insentient evidence cannot hold opinions and, in any event, points both ways on the climate question, as the earlier internal-consistency test demonstrated;
4. Argument from ignorance (*argumentum ad ignorantiam*) in that unawareness of a natural cause of observed warming does not demonstrate that there is no such cause;
5. Argument from false cause (*non causa pro causa*) in that some or all of observed global warming may be of natural origin, so that, if some of the industrial-era warming were natural, the industrial-era feedback fraction might be still less than the 0.05 derived above;
6. Argument from misplaced pity (*argumentum ad misericordiam*), in that the polar-bear population is growing robustly, particularly where the Arctic has warmed fastest, as a report for the World Wide Fund for Nature inadvertently revealed in 2002, and polar bears survived the last interglacial, which was appreciably warmer than the present;

7. Circular argument (*argumentum ad petitionem principii*), in that the ocean heat content is calculated from measurements of ocean temperature. Increased ocean heat content is thus a consequence, not a cause, of directly-measured ocean warming.
8. The “after, therefore because” fallacy (the *post hoc ergo propter hoc* subspecies of the *non causa pro causa* fallacy), in that correlation, though it may be suggestive of correlation, does not necessarily entail it;
9. Inappropriate argument from the general to the particular (argument from accident or *argumentum a dicto simpliciter ad dictum secundum quid*), in that the slow rate of observed global warming rules out attribution of any recent extreme-weather event to warming (IPCC, 2012, *passim*; IPCC, 2013);
10. Inappropriate argument from the particular to the general (argument from converse accident or *argumentum a dicto secundum quid ad dictum simpliciter*), in that Antarctic sea ice has recently been near a satellite-era maximum and global sea-ice extent shows a rising trend since 1979 (Parkinson 2019);
11. Assault on the personal attributes or reputation of the scientist rather than on the soundness of his argument (*argumentum ad hominem*, a disfiguring subspecies of *ignoratio elenchi*), in that what matters scientifically is the quality of a scientist’s research and the soundness of his scientific reasoning and argumentation, not his supposed character defects or the sources of his funding; and
12. The argument of force (*argumentum ad baculum*) in that, as Nazi and Soviet precedents have demonstrated, the brutal mistreatment of those who disagree on scientific grounds with the legalist position is an extreme, unwarrantable and sometimes fatal interference in academic freedom.

All of the above 12 propositions are antihypotheses because they are logical fallacies from which no conclusion can be drawn except that their proponents are insufficiently educated. The 12<sup>th</sup> and most dismal argument, the *argumentum ad baculum*, is of particular relevance to the debate about climate: for legalists demand that authors of research such as the present work should be tried, imprisoned, re-educated, sent to psychiatric institutions or even executed. A non-exhaustive list of such demands over the past dozen years is at Annex A.

#### *Popper’s third sieve: consistency with existing theory*

The third sieve is the comparison of a new hypothesis with existing hypotheses that are either demonstrated or at least not yet disproven after expression in scientific and preferably quantitative terms in a learned journal, followed by a reasonable period for falsification. Climatology’s method of deriving the temperature feedback fraction is inconsistent with control theory as enunciated, for instance, in Black (1934) or Bode (1945), and inconsistent with experiments commissioned by the author of the present work at a government laboratory, in that it errs by neglecting the emission-temperature feedback response and thus inadvertently adding it to, and miscounting it as though it were part of, the actually minuscule feedback response to direct warming forced by the preindustrial noncondensing greenhouse gases. Therefore, either the pre-existing and formally-demonstrated feedback theory is incorrect (though it is of course well-established and its essential characteristics may be demonstrated using a simple electronic feedback-amplifier circuit as an analog computer) or climatology’s current basis for its prediction that equilibrium sensitivity to doubled CO<sub>2</sub> is high is inconsistent with existing feedback theory.

#### *Popper’s fourth sieve: empirical falsification*

The fourth sieve is the testing of the normative or null hypothesis by the empirical application and consequent falsification of the conclusions derived from the alternative hypothesis. For empirical experience, in the Popperian analysis, cannot tell us which hypotheses are true, but it can tell us

which are false. It is already clear that the central predictive hypothesis advanced by IPCC with what it called “substantial confidence” in 1990 is failing. The least-squares trend on the anthropogenic fraction of the satellite monthly mean lower-troposphere temperature anomalies (UAH, 2021) is equivalent to  $1.1 \text{ K century}^{-1}$  (Figure 16) during the 30 years 1991-2020, about a third of the  $3.4 \text{ K century}^{-1}$  midrange estimate of originally predicted by IPCC (1990) but near-identical to the  $1.1 \text{ K century}^{-1}$  corrected midrange estimate derived earlier during the internal-consistency test.

IPCC (2013), though compelled to halve its medium-term predictions from  $3.4$  to  $1.7 \text{ K century}^{-1}$ , has not made corresponding reductions in its long-term predictions of equilibrium doubled- $\text{CO}_2$  sensitivity.

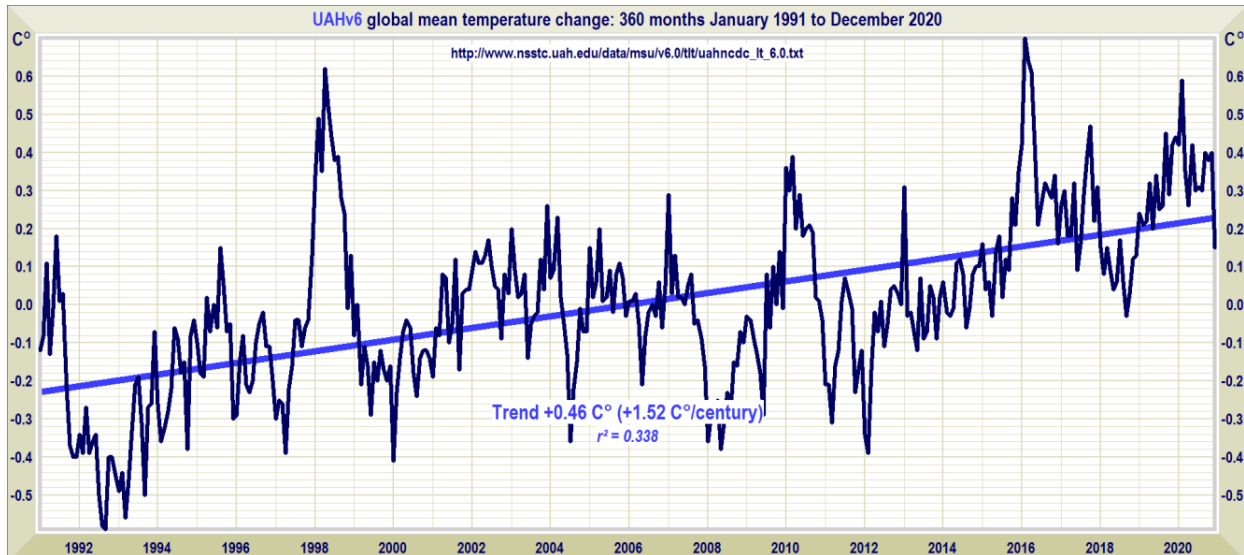


Figure 16. Of the  $1.52 \text{ K century}^{-1}$ -equivalent global warming trend observed over the 30 years 1991-2020, 70%, or  $1.1 \text{ K}$ , was anthropogenic, one-third of what models had predicted.

## 6. Legalistic antihypothesis: “Mitigation is cost-effective”

The economic case for mitigating global warming asserts that the welfare benefits of immediate mitigation of allegedly catastrophic global warming exceed the welfare losses anticipated from later adaptation to its consequences. Stern (2006) set out the premises:

1. Unmitigated global warming will be  $3 \text{ K}$  in the 21<sup>st</sup> century, costing 0-3% of GDP.
2. Since Stern estimated that 21<sup>st</sup>-century warming may reach  $11 \text{ K}$  by 2100, his estimated probability that global warming will end the world by then is 0.1 (Dietz et al. 2007).
3. To prevent the end of the world, a submarket intertemporal discount rate of 1.4% (rather than a mid-market rate such as the U.S. Treasury’s 7%) should be adopted for appraisals of measures to abate global warming.

Stern concludes from these premises that global-warming mitigation is not only justifiable but mandatory on grounds of preventing extinction. Applying the falsification principles enunciated earlier, we may examine Stern’s quantitative argument quantitatively.

In economic terms, intervention to abate greenhouse-gas emissions and thus to mitigate global warming is only justifiable if one assumes a significant probability that unmitigated anthropogenic warming will end the world by 2100. In the light of the findings discussed here, that probability is actually zero. Therefore, a standard intertemporal analysis, such as the following very simple but reliable analysis, is permissible.

The welfare losses and benefits of achieving global net-zero  $\text{CO}_2$  emissions by 2020 will now be assessed. The first question is this: If the world were to cease to emit  $\text{CO}_2$  by 2050, how much

global warming would be forestalled? What would be the direct welfare benefit in CO<sub>2</sub> emissions abated by that policy?

**Business-as-usual CO<sub>2</sub> concentration by 2050** – if CO<sub>2</sub> concentration continues to grow unabated as it has throughout recent decades – would rise from 415 ppmv in 2020 to **497 ppmv** in 2050.

**CO<sub>2</sub> concentration by 2050**, with a straight-line reduction from 2021's emissions to zero emissions in 2050, would be  $(415 + 497)/2$ , or **456 ppmv**.

**The CO<sub>2</sub> forcing coefficient**, at midrange, is the ratio of the currently-estimated  $3.52 \text{ W m}^{-2}$  doubled-CO<sub>2</sub> forcing (Zelinka et al. 2020) to  $\ln 2$ : i.e. **5.078**.

**The CO<sub>2</sub> forcing abated** over the 30-year term would then be  $5.078 \ln(456/497)$ , or **0.44 W m<sup>-2</sup>**.

**The industrial-era equilibrium-sensitivity parameter** is the ratio of the equilibrium anthropogenic warming of  $0.9 \text{ C}^\circ$  from 1850-2020 to the  $3.2 \text{ W m}^{-2}$  anthropogenic forcing: i.e.,  $0.28 \text{ C}^\circ \text{ W}^{-1} \text{ m}^2$ .

**Equilibrium warming abated by global net-zero emissions** is the product of  $0.28 \text{ C}^\circ \text{ W}^{-1} \text{ m}^2$  and the  $0.44 \text{ W m}^{-2}$  forcing abated by 2050 is **0.12 C<sup>o</sup>**, or less than one-eighth of a degree.

With the principal welfare benefit quantified and found to be negligible, the welfare losses arising from the policy may be assessed. Here, for simplicity, only the direct cost of the policy will be assessed. We shall not consider the far larger indirect costs caused by overpriced fuel and power, as well as by environmental damage from low-energy-density wind and solar power and by prevention of affordable and dispatchable electrification for the billion people who cannot so much as turn on a 60-Watt lightbulb for four hours a day (the International Energy Agency's less than generous definition of "access to electricity").

**The cost of buying a barely measurable reduction of just 0.12 C<sup>o</sup> in global warming** can be estimated from the (probably optimistic) estimate by HM Treasury that the cost of achieving net-zero in the UK, which accounts for 0.88% of global emissions, would rise from £15 billion per year in 2020 to **£70 billion per year** in 2050. The Grid authority estimates the realistic cost of net-zero as almost three times the Treasury estimate.

**The discounted cost of net-zero for the UK alone**, assuming a straight-line inflation-adjusted cash increase from £15 billion p.a. to £70 billion p.a., discounted at a commercial 7% p.a., would be **£440 billion** at present value, or at least **£1 trillion** if the Grid authority's estimates are correct.

**The discounted cost of attaining global net-zero by 2050** would be £55 trillion (**\$76 trillion**), or more like **\$200 trillion** based on the Grid authority's estimate.

**The cost of abating 1 C<sup>o</sup> of global warming** would thus exceed £400 trillion (**\$560 trillion**). The cost of abating  $3.7 \text{ C}^\circ$  currently-projected ECS would exceed £1.5 quadrillion (**\$2.1 quadrillion**), or up to **\$5 quadrillion** if the Grid authority is right about the Treasury's cost underestimate.

These very large welfare losses do not purchase any net welfare benefits, for there will be far too little warming to cause net harm. Therefore, there is no statable case at all for emissions abatement. The slow and modest warming that is foreseeable will be net-beneficial, and the very heavy welfare loss occasioned by the direct cost of abatement would exceed any legitimately foreseeable welfare benefit.

In the light of these results, the economic case for concerted international action against catastrophic global warming no longer exists.

## 7. Discussion and conclusion

Post-modern or totalitarian scientism has its origins in the modernist movement that emerged from the writings of Rousseau and the French Revolution and was condemned by Pope Pius X (1907) as the heresy of heresies, in that it repudiated the existence of objective truth. The modernist *Weltanschauung* is encapsulated in Feyerabend (1987): “There are no universal rules of science. Basically, anything goes. Truth and meaning are internal to theories.” This approach is, in essence, indistinguishable from the “zetetic” pretext adopted by flat-Earthers, who assert that what they see and feel is more reliable than what is scientifically observed or objectively deduced.

Kuhn (1970) denies that science is a discipline in which understanding of the truth grows by little and little. “Science comes in cycles that we call paradigms. It is not a cumulative process. One [paradigm] supersedes another.” And “facts” are interpreted in accordance with the aprioristic political outlook or world-view of the scientist. Post-modern aprioristic scientism, then, echoes political and religious modernism in maintaining that there is no such thing as objective truth, on the undisciplined ground that every observer is subjective and may please himself as to the answer to Pilate’s question.

Post-modern scientism is an assault upon and a denial of science itself, motivated by a desire to replace scientific discipline and rigor with an aprioristic paradigm. Paul Johnson, in his *History of the Modern World*, argues that modernism’s interference with science to create post-modern, aprioristic, totalitarian scientism arose in part from a semantic confusion between relativity and relativism: on the one hand, Einstein’s rigorous theorems of relativity; on the other, the very antithesis of rigor that is the please-yourself moral nihilism inherent in Feyerabend’s phrase “Anything goes”.

If there were no objective truth, one important casualty would be the fundamental principle of logic: namely, that every proposition that is objectively true is consistent with all other truths and inconsistent with all propositions that are objectively false.

Hume’s philosophy spotlights a contradiction inherent in traditional empiricism, which encompasses the zetetic notion that experience is the source of all knowledge (*experientia docet*) as well as the empirical notion that experience is the instrument by which universal scientific laws are falsified. The contradiction is rooted in the notion that, although experience is open-ended, it can definitively establish the truth of scientific laws.

Popper removes the contradiction by asserting that scientific hypotheses are not inferred from experience by induction, nor are experiments conducted to establish the truth of a hypothesis, but only to establish its falsity. If a hypothesis fails, it falls. If it be not shown false, until it is falsified or a better hypothesis survives falsification it may be retained as a working hypothesis. To the extent that it is demonstrably true, as the theorem of Pythagoras is true in the Euclidean and hyperbolic domains, it must be accepted.

Above all, the value of the Popperian scientific method lies in its exclusion of the irrational. By the mechanism illustrated here – outright rejection of merely superstitious or legalistic antihypotheses, dismissal *a priori* of predictions calculated to be unfalsifiable in a reasonable timeframe, exposure of internally inconsistent propositions, reformulation of unspecific, illogical or unquantified hypotheses in a rigorously logical and quantitative form that also identifies prospectively the criteria for predictive success or failure as in prospective clinical trials, comparison of the alternative hypothesis with the null hypothesis to establish whether anything new or better is offered, and finally deductive, experimental testing of the corresponding null hypothesis – science, including legalist climatology, may rid itself of antihypotheses and shake off the politicized interference that now menaces it.

If the four sieves that constitute the stages in Popper-falsification had been followed with no less rigor than has been attempted here, the error would not have survived.

How did the error persist? Here, the answer seems to be political rather than scientific. Global warming is one of a growing range of topics on which legalists, in academe as well as in politics, have adopted a Party Line, have then demanded no dissent from it, and have finally sought the punishment and even execution of all who question it (Appendix A).

The climate-change episode thus serves as a warning that, in academe, internal no less than external political interference with the freedom of scientific enquiry is to be firmly resisted.

A brief history of climatology's control-theoretic error is at Appendix B.

The legalist antihypotheses underpinning the global warming storyline are close cousins of the superstitious propositions about the origin and design of the Great Pyramid, in that climate predictions cast so far into the future that their makers will be retired or dead before they can be falsified are no more susceptible of Popper-falsification than speculations about the existence and terrestrial interventions of gods or aliens. Science should as readily reject the former as the latter.

Yet, to take one example, the Royal Society has said it will only reconsider its avowedly extreme propaganda stance on the climate question if there has been no warming at all for two-thirds of a century, when all current Fellows of the Royal Society will be safely dead. Their successors, if the Society survives, will surely look back in bafflement at the sullenly anti-scientific determination of a *soi-disant* scientific body, the world's oldest at that, to require universal deference to an antihypothesis that was not empirically falsifiable within a reasonable timeframe, and is now proven false.

The elimination or reformulation of antihypotheses will assist in the now-urgent task of removing internal as well as external legalist interference with academic freedom of thought, speech, research, publication and argumentation, and restoring the paramountcy of the exercise by scientists of the faculty of reason, regarded in traditional theology as the central property or charism of the soul. It is that faculty that distinguishes our species most markedly from the beasts and brings us closest in likeness to the Divine. Let us reclaim it, following the noble example of the long and splendid scientific lifetime of the late Professor Niklas Mörner. How much we shall miss his merriment. Never was such profound wisdom so lightly worn.

## Appendix A

Legalists' demands to kill climate skeptics, end capitalism and cut population:

### In 2005

- Margo Kingston, in Australia's *Daily Briefing*, said: "Perhaps there is a case for making climate change denial an offence. It is a crime against humanity, after all."

### In 2006

- Bill McGuire, Professor of "Climate Change Impacts" at University College, London, said: "We have Holocaust deniers; we have climate change deniers. And, to be honest, I don't think there's a great deal of difference";
- The Grist.com website called for Nuremberg-style trials for climate skeptics (though the article was later retracted);
- Heidi Cullen featured Dave Roberts, who said online, "When we've finally gotten serious about global warming, when the impacts are really hitting us and we're in a full worldwide scramble to minimize the damage, we should have war crimes trials for these bastards – some sort of climate Nuremberg";
- Mark Lynas, a "green" columnist often published in *The Guardian*, a London legalist newspaper, wrote: "I wonder what sentences judges might hand down at future international criminal tribunals on those who will be partially but directly responsible for millions of deaths from starvation, famine and disease in decades ahead. I put [their climate change denial] in a similar moral category to Holocaust denial – except that this time the Holocaust is yet to come, and we still have time to avoid it. Those who try to ensure we don't will one day have to answer for their crimes";
- *Spiked Online* reported that when a correspondent for the American current affairs show *60 Minutes* was asked why his various feature programs on global warming did not include the views of global warming sceptics, he replied: "If I do an interview with Elie Wiesel, am I required as a journalist to find a Holocaust denier?";
- The UK's Foreign Secretary said climate skeptics should be denied access to the news media, following a much-publicized article in the *Sunday Telegraph* by the present author drawing attention to defects in official climate science.

### In 2007

- The Weather Channel's climate expert called for skeptical meteorologists to have their certification withdrawn;
- Ellen Goodman, in the *Boston Globe*, said: "Let's just say that global warming deniers are now on a par with Holocaust deniers";
- In an interview with KGW TV, Governor Ted Kulongoski of Oregon confirmed that he wanted to take away the title of state climatologist from George Taylor on the ground that he had dared to cast doubt upon the extent of Man's contribution to global warming;
- Professor David Legates, the state climatologist in Delaware, received a letter from the Governor saying his views did not coincide with those of the legalist administration and warning him that if he spoke in public about climate change in future he must do so as an individual and not as the state climatologist;
- Robert F. Kennedy Jr. said of climate skeptics, "This is treason. And we need to start treating them as traitors" (the penalty for treason is death);
- Yvo de Boer, secretary general of the UN Framework Convention on Climate Change, said that ignoring the urgency of global warming would be "criminally irresponsible";
- Dr. Gro Harlem Brundtland, a UN special climate envoy, said: "It's completely immoral even to question" the UN's scientific opinion on climate;

- Dr Patrick Michaels lost his job as state climatologist in Virginia after the governor had told him he could no longer use his official title when mentioning his opinions on climate change;
- In June Dr James Hansen of NASA, in testimony before the U.S. Congress, demanded that skeptical chief executives of fossil-fuel companies be “put on trial for high crimes against humanity and nature” (the penalty for such crimes is death).

### **In 2008**

- The *Herald-Sun* in Australia ran an article revealing that Vint Cerf, the manager of Google’s “Internet for Everyone” project, had suggested that the internet should be nationalized as a public utility because, as a “tech policy blogger” had argued, “giving power over the internet to well-heeled interests and self-interested politicians is a bad idea”;
- Dr David Bellamy revealed that the BBC had ceased to use him as a presenter when he decided that global warming was being exaggerated.

### **In 2009**

- Robert F. Kennedy Jr said at a Capitol Climate Action rally that Don Blankenship, then chief executive officer of Massey Energy, a coal-producing corporation, “should be in jail ... for all of eternity”;
- David Suzuki, a Canadian environmentalist campaigner, said government leaders skeptical of global warming should be “thrown into jail”;
- Alex Lockwood, a British journalism professor, said that writers questioning global warming should be banned; a writer at Talking Points Memo said global warming “deniers” should be executed or jailed (he later retracted this remark); the Washington DC *Examiner* reported that climate extremists have “a desire to kill heretics” and talked of “calls for capital punishment for ‘global warming deniers’”;
- The Talking Points Memo website carried, but later retracted, removed and apologized for an article asking “At what point do we jail or execute climate skeptics?”;
- Joe Romm, a former official of the Clinton administration, wrote, under the heading *Strangle Skeptics in bed*, that “An entire generation will soon be ready to strangle you and your kind while you sleep in your beds”; At the University of the West of England in Bristol, a conference of “ecopsychologists”, led by a professor, explored the notion that “climate change denial” should be classified as a form of “mental disorder”.

### **In 2010**

- James Lovelock, inventor of the “Gaia hypothesis”, [told \*The Guardian\*](#): “I have a feeling that climate change may be an issue as severe as a war, so it may be necessary to put democracy on hold for a while”;
- Dr. Donald Brown, Professor of “Climate Ethics” at Penn State University, declared that skeptics, who had caused “a 25-year delay in acting to stop climate change”, may be guilty of a “new crime against humanity” (death penalty again);
- A video from the “10:10 campaign” showed climate-skeptic children being blown up by their teacher in class, and their classmates being spattered with their blood and guts (the campaign was compelled to remove the video, but it was widely and uncritically reported in legalist news media).

### **In 2011**

- An Australian journalist said climate skeptics should be “branded” with cattle-irons to mark them out from the rest of the population; another Australian journalist said skeptics should be “gassed”;
- Ecosocialism Canada described “climate denial” as a “psychiatric disorder”;
- Professor Richard Parncutt of the University of Graz, Austria, posted an article entitled “Death penalty for global warming deniers?” but later withdrew the article and apologized for it after having been reminded that in Austria hate-speech is a serious, imprisonable offence, then reposted it, then withdrew it again, but only under threat of prosecution.

## In 2012

- Robyn Williams, on Australian Broadcasting's *Science Show*, compared climate skeptics to pedophiles, saying: "Now, what if I told you that pedophilia is good for children or that asbestos is an excellent inhalant for those with asthma, or that smoking crack is a normal part, and a healthy one, of teenage life, to be encouraged? You'd rightly find it outrageous. But there have been similar statements coming out of inexpert mouths again and again in recent times, distorting the science" about what *The Economist* called "the comforting myth that there is no such thing as climate change, or, if there is, that humans are not involved";
- Dr. Donald A. Brown, Professor of "Climate Ethics" at Widener University School of Law, again declared that skeptics may be guilty of a "new crime against humanity" (death penalty again).

## In 2013

- Dr Kari Norgaard, professor of sociological and environmental studies at Oregon State University, wrote a paper [calling for](#) the treatment of climate denial as a psychiatric disorder;
- Dr Donald A. Brown, this time described as "Scholar in Residence in Sustainability Ethics and Law" at Widener University Law School, in an article entitled "The Climate Change Disinformation Campaign: What Kind Of Crime Against Humanity, Tort, Human Rights Violation, Malfeasance, Transgression, Villainy, Or Wrongdoing Is It?", wrote: "The climate change disinformation campaign is equal in destructive power to many human activities that are classified as crimes against humanity" (death penalty again).



Figure A1. A February 2014 *New York Times* cartoon, *Self-Destructing Sabers for Dispatching Climate-Change Deniers*, showing a climate skeptic being stabbed with an icicle.

## In 2014

- Dr Lawrence Torcello, assistant philosophy professor at Rochester Institute of Technology, wrote that people who disagreed with him on the climate question should be jailed; during a February cold snap,
- The *New York Times* ran a cartoon headed "Self-Destructing Sabers for Dispatching Climate-Change Deniers" and showing a climate skeptic being stabbed with an icicle (Figure A1);
- Adam Weinstein at the *gawker.com* website said: "Those denialists should face jail; they should face fines; they should face lawsuits from the classes of people whose lives and livelihoods are most threatened by denialist tactics";
- Bill Nye, a broadcaster in the United States who describes himself as "The Science Guy", discussed the idea of jailing those who disagreed with him on the climate question on the ground that they were "affecting his quality of life";

- The host of MSNBC's *The Ed Show* promoted Soviet-style re-education for climate skeptic politicians by conducting an on-air poll on the question "Should climate-denying Republicans be forced to take a basic earth science course?"

### In 2015

- Katie Herzog at Grist.com wrote: "If this planet is to survive the scourge that is humanity, we *all* have to stop reproducing. Yes, all of us. In that spirit, I propose we ... sterilize every human male on his 10<sup>th</sup> birthday";
- A comment on the webpage of the *Brisbane Times* about a category 5 cyclone along the Queensland coast on 19/20 February said: "These type of weather events could happen further south in future and be more intense with global warming ... if anyone has to suffer out of this one I hope it is a climate change denier, if anyone";
- The Australian Capital Territory's Arts Fund gave \$18,793 "to assist with costs of the creative development of a new theatre work, *Kill Climate Deniers*", which, however, did not appear owing to a public outcry;
- *The New York Times*, in an op-ed entitled *The Next Genocide*, said that "Climate 'deniers'" presented an "intellectual stance that is uncomfortably close to Hitler's";
- Scientists wrote an open letter to Mr Obama, who then occupied the office of President of the United States, calling for those who disagreed with their opinion on climate to be investigated, prosecuted and jailed as racketeers under the RICO statute;
- During a propaganda event held in Court 1 of the UK Supreme Court in London, Philippe Sands, a professor of international law at University College, London, said that a ruling by a body such as the International Court of Justice against climate skepticism would carry much more weight with public opinion and would pave the way for future legal cases on climate change;
- The "Ring of Fire Network" posted an article saying, "The people working at the [Crimes Against Humanity] Initiative need to include climate change denial as a crime against humanity".

### In 2016

- Arnold Schwarzenegger, former governor of California, said in a YouTube video that if politicians wanted to take away the EPA's ability to regulate "carbon", "I would like to strap their mouth to an exhaust-pipe of a truck, turn on the engine and let's see how long it would take them to tap out," whereupon YouTube received several reports that this video contained hateful or abusive content, but did not take it down;
- Professor Joseph A. Palermo wrote in the *Huffington Post* that "people who dismiss science in one area shouldn't be able to benefit from science in others. If Trump and his cohort believe the science of global warming is bogus then they shouldn't be allowed to use the science of the Internet for their Twitter accounts, the science of global positioning for their drones, or the science of nuclear power for their weaponry."

### In 2017

- Eric Idle, once a comedian with *Monty Python's Flying Circus*, circulated a tweet calling for global warming skeptics to be put on trial at the World Court because "denying climate change is a crime against humanity" (Idle said those whom he considered to be "deniers" of climate science should be "executed gently" or, like dogs, "put down humanely");
- Rob Quist, the legalist candidate to replace Ryan Zinke in the U.S. House of Representatives, said during a televised debate during the special-election campaign in Montana that climate change "is something that the entire world needs to address and you know what, if any of you that feel like this is not a problem, I challenge you to go into your car in your garage, start your car and see what happens there";
- John Gilkison, an astronomical technician at New Mexico State University, wrote a blog posting about a fictional trial for crimes against humanity held at the International Court at the Hague, in which various named climate skeptics, including the present author and President Trump, were tried,

convicted and executed for their role in questioning the climate change “consensus” (the posting was eventually taken down, but not until it had received extensive worldwide publicity);

- Brian Merchant in *The Outline* said “Climate change denial should be a crime ... In the wake of [Hurricane] Harvey, it’s time to treat science denial as gross negligence – and hold those who do the denying accountable ... Call it what it is: negligence; criminal negligence, even ... Harvey is a lightning rod that makes this clear: Climate change denial can and will leave people dead”;
- Mark Hertsgaard argued in *The Nation*, under the title *Climate Denialism Is Literally Killing Us*, that “murder is murder” and “we should punish it as such,” and the strapline read: “The victims of Hurricane Harvey have a murderer – and it’s not the storm”;
- Brad Johnson, executive director of Climate Hawks Vote, posted on Twitter a set of “climate disaster response rules,” the third of which was to “put officials who reject science in jail”;
- Jørgen Randers, professor of climate strategy at BI Norwegian Business School, wrote in the Swedish daily newspaper *Svenska Dagbladet* “If people don’t want my preferred solution, then people are stupid, shouldn’t be allowed to decide their fate, and we should install a climate dictatorship instead”;
- Rob Quist, a “Democratic” congressional candidate, suggested during a televised Montana House of Representatives debate that sceptics of global warming should kill themselves.

### In 2018

- A British environmentalist lobby group, “Forum for the Future”, suggested the establishment of three penal concentration camps for those “criminals” who are “convicted of denying the existence of climate change”: Kerguelen Island, South Georgia, and the South Island of New Zealand;
- The play *Kill Climate Sceptics* was shown in Australia.

### In 2019

- “Generation Atomic”, a Communist front group, published the following cartoon portraying “climate deniers” as on a par with flat-Earthers:

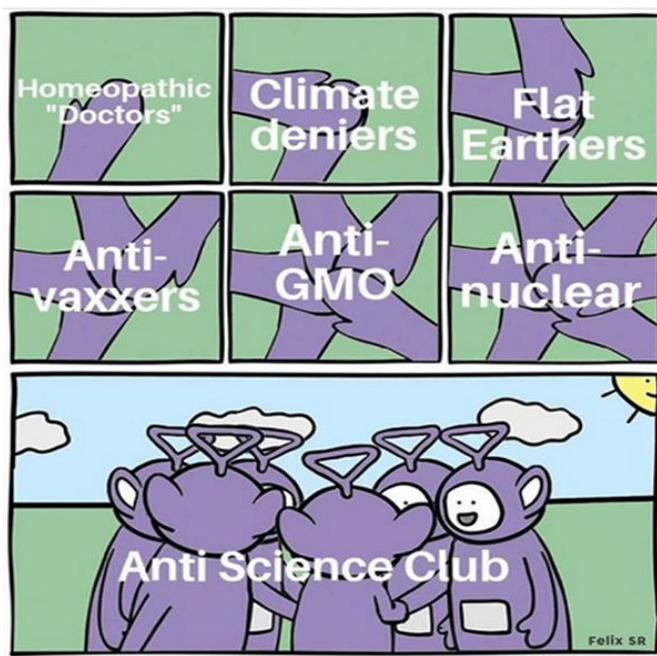


Figure A2: “Climate deniers” on a par with flat-Earthers

### In 2021

- Roger Harrabin, the BBC’s “environment analyst”, said there would be “climate change police” by the 2040s.

**Further instances of irrationality** on the climate question include the following.

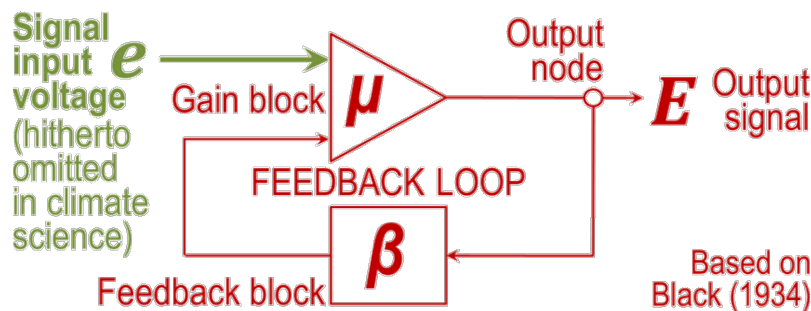
- Judy Bari, an “Earth First” activist, said: “If we don’t overthrow capitalism, we don’t have a chance of saving the world ecologically.”
- David Brower, founder of “Friends of the Earth”, said: “Loggers losing their jobs because of spotted-owl legislation is no different than people being out of work after the furnaces of Dachau shut down.”
- David Graber, a scientist with the U.S. National Park Service, said: “People have become a cancer ... a plague upon ourselves and upon the Earth. Until such time as *homo sapiens* should decide to rejoin nature, some of us can only hope for the right virus to come along.”
- Prince Philip, consort to Queen Elizabeth II of England, said: “In the event that I am reincarnated, I should like to return as a deadly virus, to contribute something to solving overpopulation.”
- Ingrid Newkirk, president of “People for the Ethical Treatment of Animals”, said: “Even if animal research produced a cure for AIDS, we’d be against it.” Ms Newkirk also said: “Six million people died in concentration camps, but six billion broiler chickens will die this year in slaughterhouses.”
- Charles Wurster, a scientist with the “Environmental Defense Fund”, said: “People are the cause of all the problems. We have too many of them. We need to get rid of some of them, and this [a malaria epidemic] is as good a way as any.” Mr Wurster also said: “In the United States, DDT substitutes only kill farm workers, and most of them are Mexicans and Negroes.”
- Paul Ehrlich said: “Giving society cheap, abundant energy would be the equivalent of giving an idiot child a machine gun.”
- Brent Blackwelder, president of “Friends of the Earth”, said people in developing countries “cannot expect to have the material lifestyle of the average American”.

## Appendix B

### History of climatology's control-theoretic error

**Fourier (1827)** first posited the existence of a *chaleur obscure* (invisible heat) in the atmosphere. **Tyndall (1868)** reported laboratory experiments from 1861 confirming the greenhouse effect. **Arrhenius (1906)** concluded that equilibrium sensitivity to doubled CO<sub>2</sub> would be about 4 degrees.

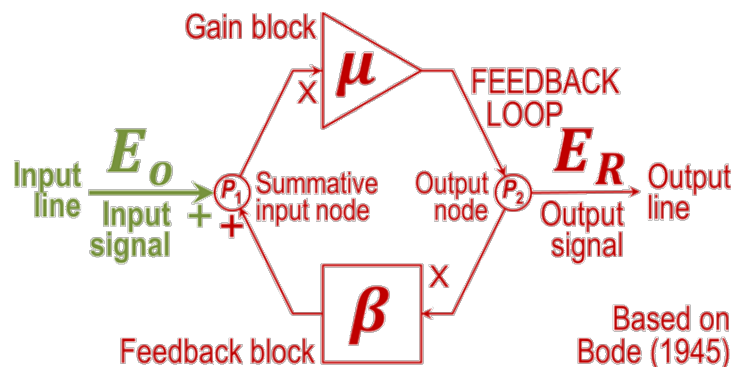
Temperature feedback operates analogously to voltage feedback in a feedback amplifier circuit, for feedback formulism applies *mutatis mutandis* to any feedback-moderated dynamical system. It was in electronics that the mathematical foundation of control theory – the physics governing feedback in dynamical systems – was first laid. In 1927 Harold S. Black, then at Bell Labs in New York, was going from Hoboken, NJ, to work in Manhattan on the Lackawanna Ferry when the feedback equations came to him. He jotted them down on that day's newspaper. His feedback amplifier block diagram (**Black, 1934**; here Figure 3) correctly shows the input signal  $e$  and labels it “signal input voltage”. The equivalent input signal in the climate system is emission temperature. The diagram shows that the  $\beta$  feedback block, now usually labeled  $H$ , modifies not only the signal from the  $\mu$  gain block (now usually labelled  $G$ ), but also the input signal  $e$  itself.



**Feedback amplifier block diagram** (based on **Black, 1934**). The input signal  $e$  (analogous to emission temperature  $R_0$ ) is amplified by the  $\mu$  gain block. The amplified signal  $\mu e$  passes round the loop, where the  $\beta$  feedback block further modifies it. It leaves the circuit via the output node.

**Bode (1945)**, again at Bell Labs, wrote a textbook on feedback amplification in electronic circuits, which was published in annual editions for 30 years. His block diagram also correctly shows the input signal. At p. *vii*, he defines the input signal  $E_0$  as the “input voltage”.

It is this input signal, the 255 K emission temperature that is missing in climatology's defective definition of feedback and its consequent overstatements of feedback response and so of ECS:



**Feedback amplifier** (based on **Bode 1945**). The input signal  $E_0$  (analogous to emission temperature  $R_0$  in climate) proceeds from the input line to the summative input node  $P_1$ , and thence round the loop via the  $\mu$  gain and  $\beta$  feedback blocks to the output node  $P_2$  and the output line. Perturbations (in climate, reference sensitivities) are allowed for in the  $\mu$  gain block; feedbacks (e.g. more water vapor in warmer air) modify the signal in the  $\beta$  feedback block.

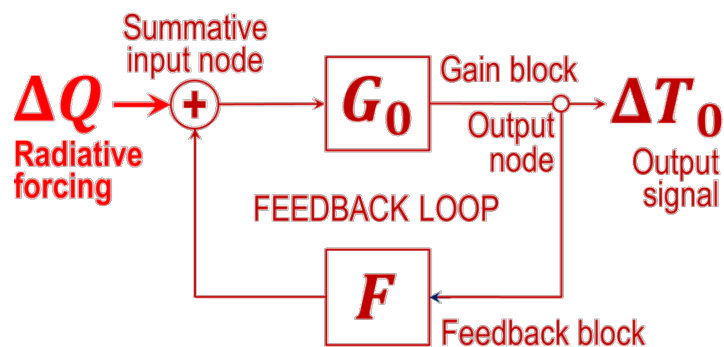
It was thus established at the earliest moment in the mathematical treatment of feedback in dynamical systems that not only any *perturbation* of the system but also the input signal is modified by the feedback block.

**Hansen et al. (1984)** cited Bode (1945) as the authority for feedback formulism. At this stage, sufficiently reliable measurements of the Earth’s energy imbalance to derive ECS simply by the energy-balance method described in the learned paper were not available. Hansen, therefore, attempted to quantify the individual feedbacks by the use of a general-circulation model. He incorrectly used the term “system gain” for the feedback fraction, defining it as –

“... the ratio of the net feedback portion of the temperature *change* to the total temperature *change*.”

Hansen et al. did not encompass in that definition, or in any of their calculations, any reference to the fact that not only a *perturbation* but also the absolute input signal – the 255 K emission temperature – drives a large feedback response.

**Schlesinger (1988)** cemented Hansen’s error. In his block diagram, the sole input is a *perturbation*  $\Delta Q$  (i.e., a radiative forcing). However, there is no originating input signal from the pre-existing state of the climate in the shape of the 255 K emission temperature.



**Feedback amplifier block diagram** based on Schlesinger (1988), omitting the input signal, emission temperature  $R_0$ . The signal  $\Delta Q$  is a radiative forcing, driving a *perturbation* of  $R_0$ . The input signal itself is omitted. There is also a confusion of units between the input (radiative forcing, in Watts per square meter) and the output (in degrees).

Since the natural greenhouse effect has a fixed magnitude of about 32 degrees, overlooking the large feedback response to emission temperature effectively adds that large response to, and miscounts it as part of, the small preindustrial feedback response. In round numbers, climatology follows Hansen and Schlesinger in assuming that there are only two components in the natural greenhouse effect: 8 degrees’ direct warming by preindustrial noncondensing greenhouse gases, and 24 degrees’ feedback response thereto, implying a system-gain factor  $32/8 = 4$ , where a more correct value would be  $(255 + 32)/255 + 8 < 1.1$ .

**The American Meteorological Society (AMS, 2021)** uses a definition of feedback that likewise overlooks feedback response to the initial state –

“A sequence of interactions that determines the response of a system to an initial *perturbation*”.

**Soden & Held (2006)** also talk of feedbacks responding solely to *perturbations*, but not also to emission temperature –

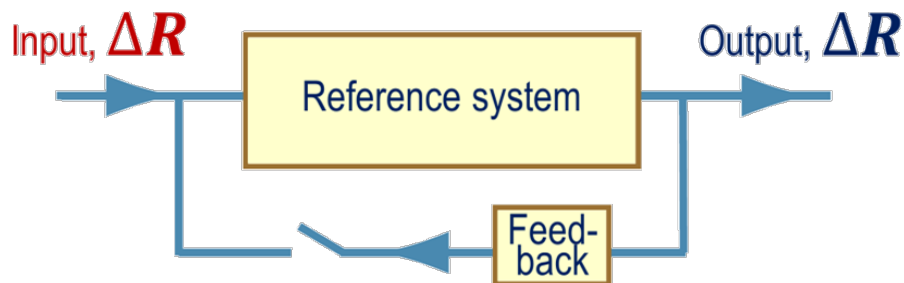
“Climate models exhibit a large range of sensitivities in response to increased greenhouse gases due to differences in feedback processes that amplify or dampen the initial radiative *perturbation*.”

**Sir John Houghton (pers. comm. 2006)**, then chairman of IPCC’s climate-science working party, asked why IPCC expected a large anthropogenic warming, replied that, since feedback response in the preindustrial era accounted for three-quarters of the natural greenhouse effect, so that the preindustrial system-gain factor was 4, and one would thus expect a system-gain factor of 3 or 4 today.

**IPCC (2007, ch. 6.1, p. 354)** again overlooks the large feedback response to the 255 K emission temperature:

“For different types of *perturbations*, the relative magnitudes of the feedbacks can vary substantially.”

**Roe (2009)**, like Schlesinger (1988), shows a feedback block diagram with a *perturbation*  $\Delta R$  as the only input –



**Lacis et al. (2010)** repeat the error and explicitly quantify its effect, defining temperature feedback as responding only to *changes* in the concentration of the preindustrial noncondensing greenhouse gases, but not also to emission temperature itself, consequently imagining that ECS will be  $\geq 3$  times the  $\sim 1$  degree direct warming by those gases:

“This allows an empirical determination of the climate feedback factor [the system-gain factor] as the ratio of the total global flux change to the flux *change* that is attributable to the radiative forcing due to the noncondensing greenhouse gases. This empirical determination ... implies that Earth’s climate system operates with strong positive feedback that arises from the forcing-induced *changes* of the condensable species. ... noncondensing greenhouse gases constitute the key **25%** of the radiative forcing that supports and sustains the entire terrestrial greenhouse effect, the remaining **75%** coming as fast feedback contributions from the water vapor and clouds. ... For the doubled  $\text{CO}_2$  and the 2% solar irradiance forcings, for which the direct no-feedback responses of the global surface temperature are 1.2 and 1.3 degrees, respectively, the  $\sim 4$  degrees’ surface warming implies respective feedback factors [actually, system-gain factors] of 3.3 and 3.0.”

**Schmidt et al. (2010)** find the equilibrium doubled- $\text{CO}_2$  radiative forcing to be five times the direct forcing:

“At the doubled- $\text{CO}_2$  equilibrium, the global mean increase in ... the total greenhouse effect is  $\sim 20 \text{ W m}^{-2}$ , significantly larger than the  $4 \text{ W m}^{-2}$  initial forcing and demonstrating the overall effect of the long-wave feedbacks is positive (in this model).”

**IPCC (2013, p. 1450)** defines what Bates (2016) calls “sensitivity-altering feedback” as responding solely to *perturbations*, which are mentioned five times, but not also to the input signal, emission temperature:

**“Climate feedback:** An interaction in which a *perturbation* in one climate quantity causes a change in a second, and the change in the second quantity ultimately leads to an additional change in the first. A negative feedback is one in which the initial *perturbation* is weakened by the changes it causes; a positive feedback is one in which the initial *perturbation* is enhanced ... the climate quantity that is *perturbed* is the global mean surface temperature, which in turn causes changes in the global radiation budget. ... the initial *perturbation* can ... be externally forced or arise as part of internal variability.”

**Knutti & Rugenstein (2015)** likewise make no mention of base feedback response:

“The degree of imbalance at some time following a *perturbation* can be ascribed to the temperature response itself and changes induced by the temperature response, called feedbacks.”

**Dufresne & St.-Lu (2015)** say:

“The response of the various climatic processes to climate change can amplify (positive feedback) or damp (negative feedback) the initial temperature *perturbation*.”

**Heinze et al. (2019)** say:

“The climate system reacts to *changes* in forcing through a response. This response can be amplified or damped through positive or negative feedbacks.”

**Sherwood et al. 2020** also neglect emission temperature as the primary driver of feedback response

—  
“The responses of these [climate system] constituents to *warming* are termed feedback. The constituents, including atmospheric temperature, water vapor, clouds, and surface ice and snow, are controlled by processes such as radiation, turbulence, condensation, and others. The CO<sub>2</sub> radiative forcing and climate feedback may also depend on chemical and biological processes.”

The interdisciplinary knowledge gap prevented anyone in climatology from noticing the error. It has not been possible to find a single climatological paper that specifically mentions the feedback response to emission temperature, still less that quantifies it and correspondingly reduces the feedback response to direct warming by greenhouse gases. The politicization of the climate-change question, and the adoption of an avowedly extreme, alarmist stance by the totalitarian faction in politics, coupled with the growing suppression of all dissent both in academe and its journals and in very nearly all news media, has ensured the perpetuation of the error and its severe economic and strategic consequences for the West.

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