

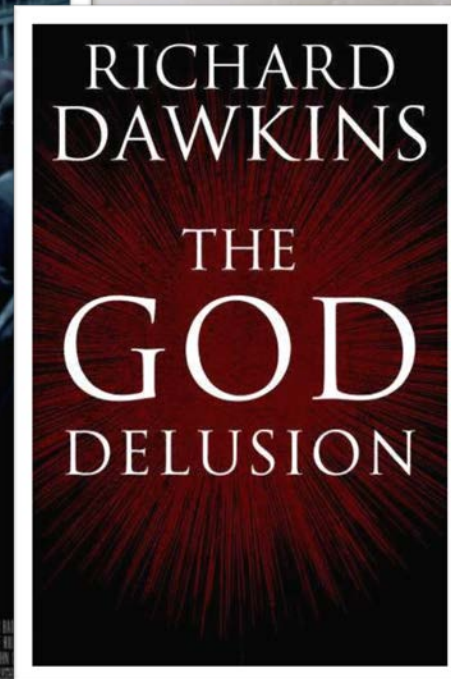
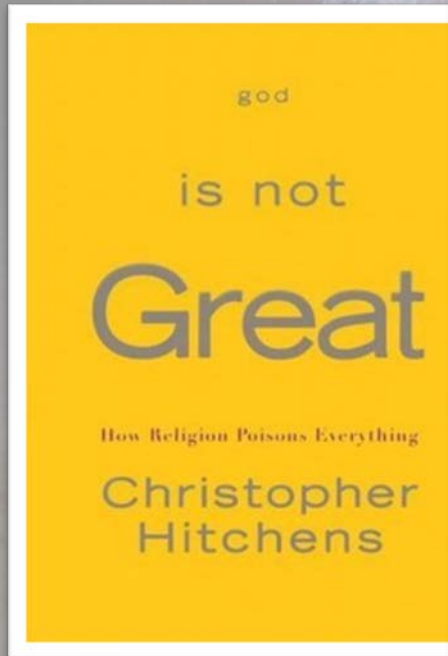
Epistemology in Science and Religion: A Surprising Commonality



A night-time time-lapse image of the sky over a church in Sounio, Greece

Tim Collins * LLE * Friday Apr 11 2014

Popular culture sees at best a standoff between science and religion, and at worst outright conflict



Angels and Demons trailer

From the young-adult book *How to be a Genius: Your Brain and How to Train it* (DK Publishing: NY, 2009)

Free association

When you think logically, you retrieve information from your memory and use it to solve problems. But sometimes your mind wanders and makes associations without conscious direction. This tends to happen when you are very relaxed.



Phobias

Many people are terrified of spiders. This type of fear is called a phobia. There are many different types of phobias. Some are understandable, like the fear of heights—after all, falling from a height can kill you. But others, such as the fear of fish, are illogical, irrational, and difficult to explain.

Ornithophobia is the fear of birds, and sometimes even just the feathers.



Musophobia is the word used to describe the fear of mice.



Aviatophobia is the fear of flying and is a very common phobia.



Ichthyophobia is the fear of fish, which is one of the rarer phobias.



ILLOGICAL THINKING

We all like to imagine that we think logically, but this is often far from the truth. Ideas jump into our heads for no obvious reason, and many people suffer from phobias or even serious delusions. A lot of us are superstitious, and all religions are based on faith rather than actual logic.

Luck

Many people believe in good and bad luck. Some buy lottery tickets because they think they might get lucky and win a big prize. Others will avoid flying in case they suffer "bad luck" and the plane crashes. In reality, the chances of both are very small, but people ignore the facts and act in line with their illogical thoughts.



Instinct

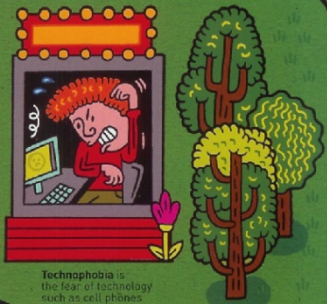
We all have natural instincts that make sure we get things like food, water, and air. Instincts also include some emotions such as the fear of fierce dogs. These instincts are the type of thinking that is shared by animals, but they are not governed by logic. This does not mean that instincts do not make sense—they are essential to our survival.



Demoisophobia is the fear of being trapped in a crowd of people.



Technophobia is the fear of technology such as cell phones and computers.



Faith

All religions are based on faith, which involves believing in something that cannot be proved. There is no logical reason to believe in a god, but a lot of people do—even if they do not practice any religious rituals—including many scientists who normally rely on logical thinking.



Arachnophobia is the fear of spiders and is one of the most common phobias.

Superstition

Many people are superstitious. They avoid walking under ladders, worry about what may happen on Friday the 13th, or believe in ghosts. Most of us try to avoid saying things like "I've never been in a car accident" because we feel that we are increasing the risk just by saying it, or "tempting fate." There is no logic in this way of thinking.



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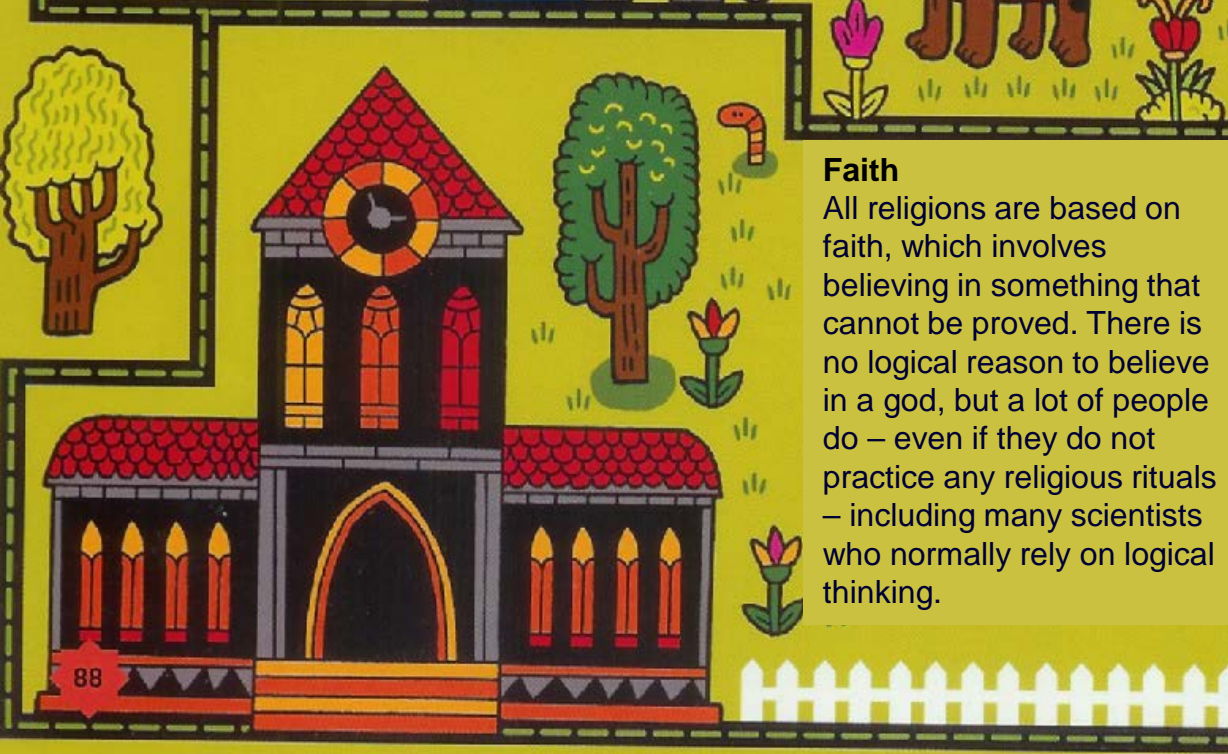
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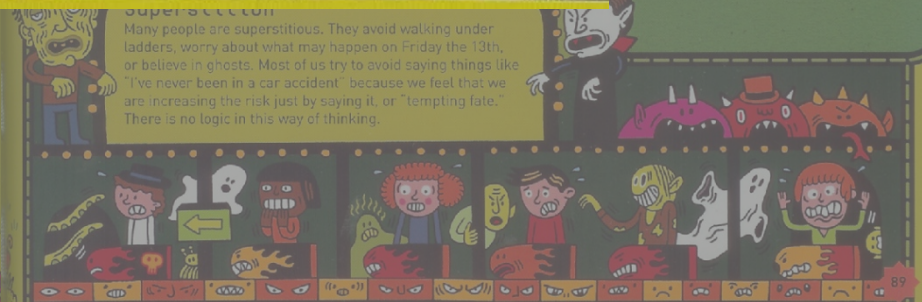
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Science and faith occupy very different places in mainstream cultural consciousness

Some cultural associations:

Science:

1. Atheist scientists
2. Benefits society (medicine, technology)
3. Deals with the physical world
4. Evidence
5. Deduction

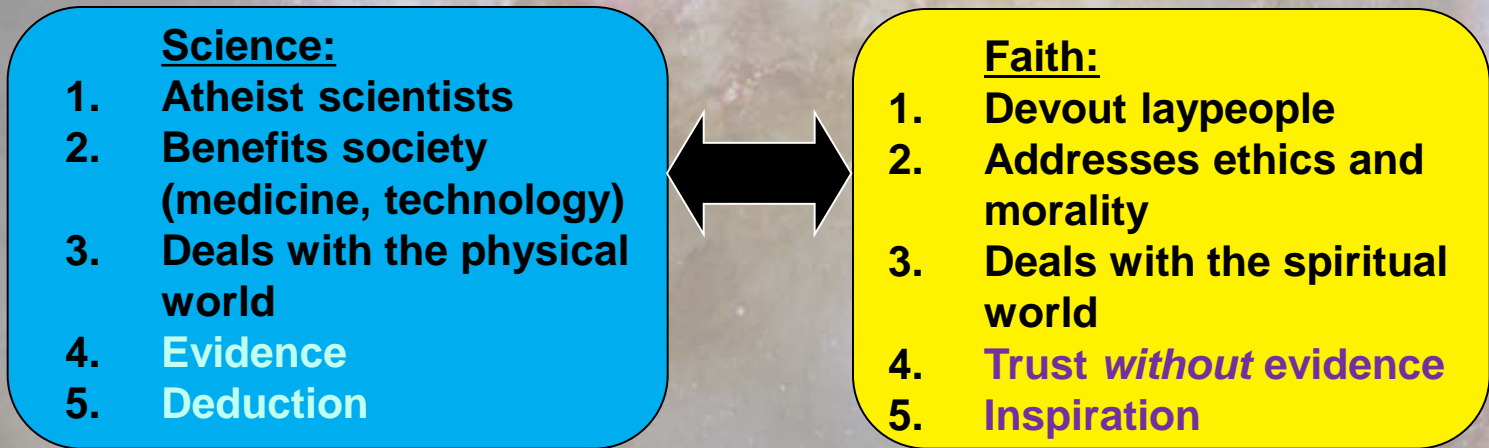


Faith:

1. Devout laypeople
2. Addresses ethics and morality
3. Deals with the spiritual world
4. Trust *without* evidence
5. Inspiration

Science and faith occupy very different places in mainstream cultural consciousness

Some cultural associations:



The **modest goal** of this talk:

Demonstrate that #4 and #5 represent false dichotomies

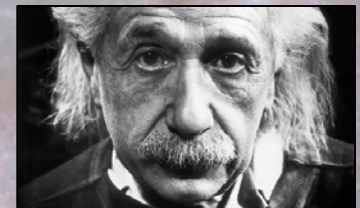
Ground rules and caveats

- I am a scientist, not a philosopher of science
- *However:*

“So many people today—and even professional scientists—seem to me like somebody who has seen thousands of trees but has never seen a forest. A knowledge of the historic and philosophical background gives that kind of **independence from prejudices** ... This independence created by philosophical insight is—in my opinion—the mark of distinction between a mere artisan or specialist and a real seeker after truth.”

—Einstein (1944)

- Since I am most familiar with my own faith tradition, I will address orthodox Christian belief—but there *may* be areas of commonality with other religions
- Motivation for this talk: **sympathy** for my atheist friends (!); intellectual “**travelogue**” of interesting landmarks in the in the topics of scientific and religious epistemology
- I will not try to prove the validity of Christianity (a very different talk) nor presume to speak for all Christians



There are many scientists who *are* believers and who have similar views

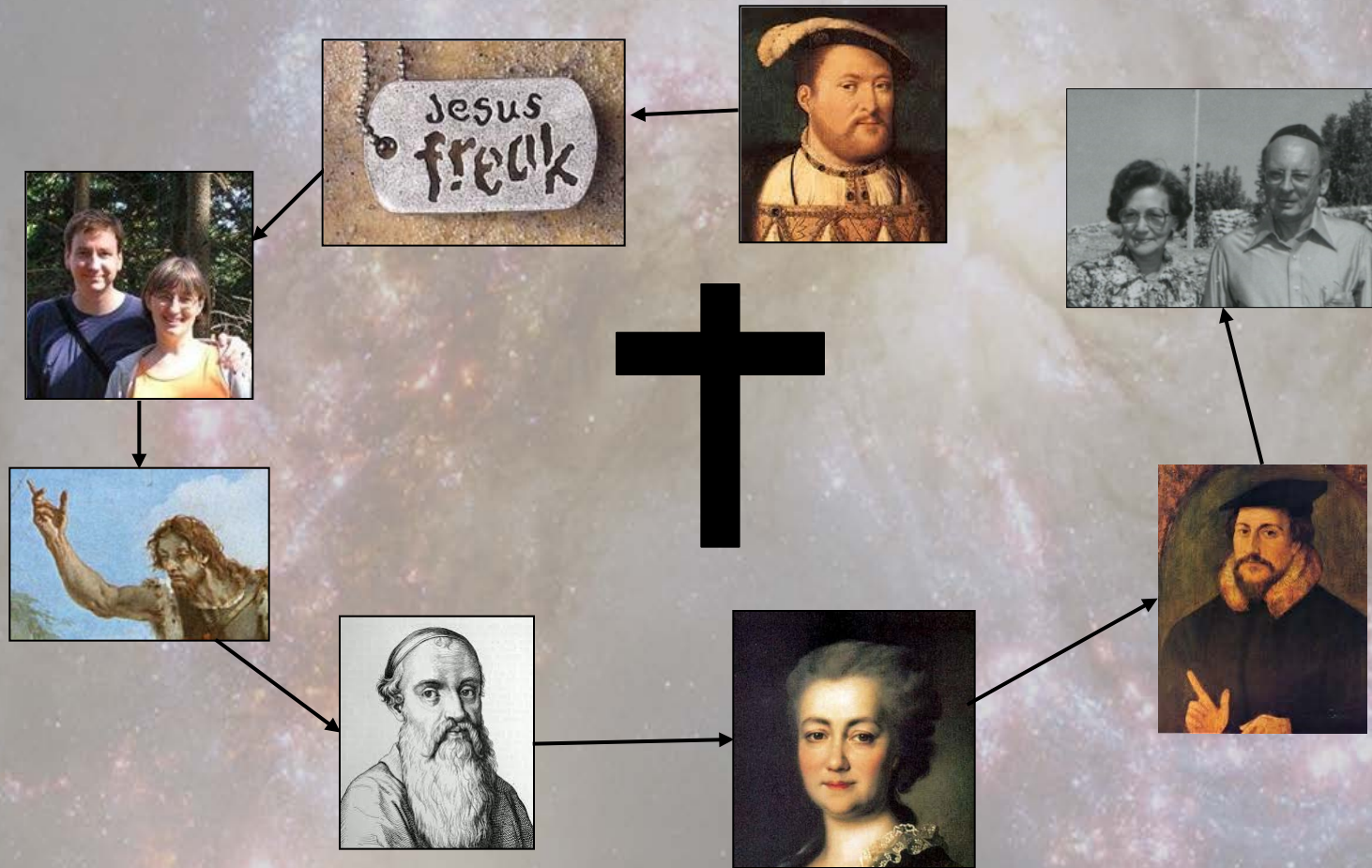
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(There are more of us)

University of Washington * University of Texas * ASTRON, Netherlands * SOFIA E/PO at NASA Ames * Rutgers University * Kapteyn Astronomical Institute, Netherlands * US Naval Observatory * Jet Propulsion Laboratory * Carleton College * Institute for Astronomy and University of Hawaii * Planetary Science Institute * University of Arkansas * University of Milano, Italy * Ohio State * University of Witwatersrand, South Africa * King College * Adler Planetarium, University of Notre Dame * National Observatory of Athens * University of Padua * George Mason University * Georgetown College * Bridgewater College, VA * New Mexico Tech * Eastern University * Clemson University * Cal Baptist University * Space Telescope Science Institute * Swinburne University * UC Riverside * Universidad Nacional de La Plata, Argentina * South Carolina State University * Pisgah Astronomical Research Institute * NASA/Goddard Space Flight Center * Gemini Observatory * California Polytechnic State University * Baylor University * University of Rochester * Vatican Observatory * University of Arkansas * MIT and Stanford Linear Accelerator Center * Yerkes Observatory and University of Chicago * University of British Columbia * Montreat College * Wheaton College * University of Hawaii * Johns Hopkins University * University of Durham * Franklin & Marshall College * University of Louisville * Seattle Pacific University * University of Arizona * UC Santa Cruz * UC Berkeley * University Nijmegen * University of Arizona and Steward Observatory * University of South Carolina - Lancaster * Max-Planck Institute for Astronomy * Institut d'Astrophysique Spatiale, France * University of London Observatory * Santa Monica College * University of North Carolina * Vatican Observatory * University of California at Santa Cruz * Southern Illinois University Edwardsville * Harvard-Smithsonian Center for Astrophysics * University of New Mexico * California Institute of Technology * Max-Planck-Institut for Radioastronomie * Hope College * Grove City College * Rutherford Appleton Laboratory * Calvin College * Shawnee State University * Indiana University * Space Telescope Science Institute * Swarthmore College * Tennessee State University * University of Arizona and Large Binocular Telescope Observatory * Valparaiso University * University of Maryland, College Park * University of the Free State and Boyden Observatory, South Africa * Nyack College * East Tennessee State University * Institute for Astronomy and University of Hawaii

...Not to mention historical figures such as Maxwell, Newton, Bacon, Descartes, Leibniz, Linnaeus, Charles Townes, and many others

I speak from a varied faith background



- **S&T Bonus of the Day: You are now all < 20 degrees of separation from a 16th-century French humanist-lawyer-turned-theologian!**

Science offers a paradigm for investigating the world

- Scientific models must
 - *Have Reproducibility*: The experiment must be repeatable
 - ❖ Or, as for astrophysics, there must be an ensemble of events/objects
 - ❖ The Big Bang: physics tested elsewhere is *applied* to a singular event
 - ❖ Counterexample: Cold fusion, Pons & Fleischman, 1989
 - *Have Clarity*: The questions and measures must be well-defined;
 - ❖ Counterexample: “Do you love your spouse”? (important but not quantitative)
 - ❖ This is related to the possibility of mathematical modeling
 - *Verifiable or Falsifiable*: A model should add fewer unknowns than it removes
- Science has been tremendously successful
- However, science has limited scope, excluding ethics, history, theology, some elements of consciousness, etc.

Other criteria are crucial, but harder to quantify

- Science is more often about *consistency* than proof
- ❖ Ex: Newtonian mechanics:

“Newton had no proof that the earth moved, or that the sun was the center of the planetary system. Yet, without that assumption, his system didn’t make much sense. What he had was an elaborate and highly successful scheme of both explanation and prediction, and most people had no trouble believing it, but what they were accepting as truth was a grand scheme whose validity rested on its coherency, not on any proof” ¹

Play
“BigBangTheoryClip.mov”

¹ Owen Gingerich, “Is there a role for natural theology today?”, in *Science & Theology, Questions at the Interface*, ed. Murray Rae et al. (Eerdmans, 1994) p. 43.

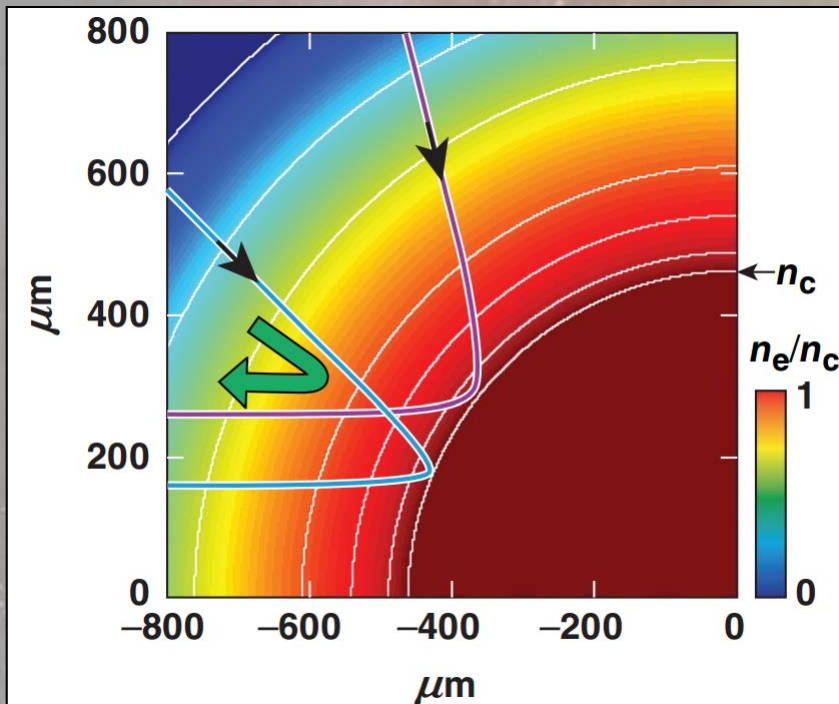
Other criteria are crucial, but harder to quantify

- **Simplicity**, or elegance
 - ❖ Ex: Grand unified theories of physics seek to unite the theories of the four basic forces (gravity, electromagnetism, weak and strong nuclear), to gain insight through *simplicity*
- An extreme example: String Theory can't be experimentally tested, so is judged by its elegance and consistency, leading some, like Burton Richter of Stanford, to complain that it's "theology"

¹ Owen Gingerich, "Is there a role for natural theology today?", in *Science & Theology, Questions at the Interface*, ed. Murray Rae et al. (Eerdmans, 1994) p. 43.

The modeling at the LLE of cross-beam energy transfer in its implosions shows the interplay of these criteria

- At the LLE we implode small capsules of DT fuel using 60 high-intensity laser beams, generating conditions similar to the sun's core in turn producing fusion reactions
- The beams interact with the plasma they travel through, and the plasma can in turn affect other incoming beams



- One such process, cross-beam energy transfer (CBET), reduces the laser “drive” making it harder to obtain the desired high temperatures and densities
- Currently we can model this and have identified mitigation strategies

CBET figures from J. Myatt, invited talk, 55th Annual Meeting of the American Physical Society, Division of Plasma Physics (2013)

The modeling of CBET has an interesting history

- The effect was first described in print by Randall et al. in 1981
- Analytical and numerical modeling was done in the 1990s (McKinstrie et al.)
- ...but it was not incorporated into our target-implosion modeling until **over a decade later** (Igumenshchev, Delettrez, Edgell, Marozas and many others)
- **If it was “well understood” and predicted to be important, why wasn’t CBET being modeled in our implosion simulations?**

Summary

The power transfer between crossed laser beams is well understood

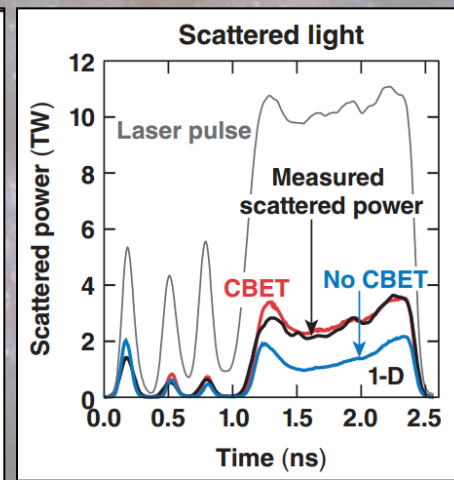
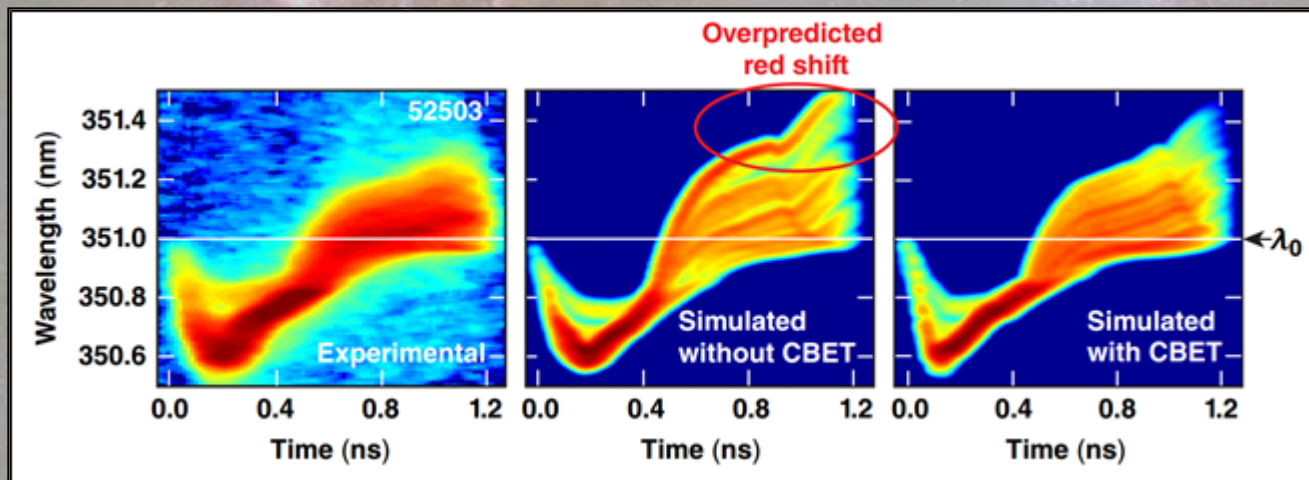
- The evolution of crossed laser beams in time and two spatial dimensions was studied analytically and numerically.
- A simple formula was obtained for the steady-state power transfer that depends on a single parameter, the normalized beam width
- Numerical simulations showed that the linear saturation time $2\gamma_0^2/v_2v_s^2$ is an upper bound on the time required for the interaction to reach steady state.

P1532

McKinstrie, 1995

As diagnostic ability increased the need for CBET modeling became clear

- The implosion modeling in the late 90s successfully reproduced, *without CBET*, the time of peak neutron emission
- CBET required greater computing resources than were available in the 1990s
- Measurement of the total and spectrally-resolved light reflected from the target, developed in the 2000s, provided a fingerprint of CBET
- A competing effect, non-local electron transfer, was simultaneously increasing the drive (and was being addressed using a free parameter affecting drive)
- Now modeling of CBET is considered crucial; how, as a theory, was CBET being judged? (Clarity, simplicity, consistency, but not verifiability or reproducibility)

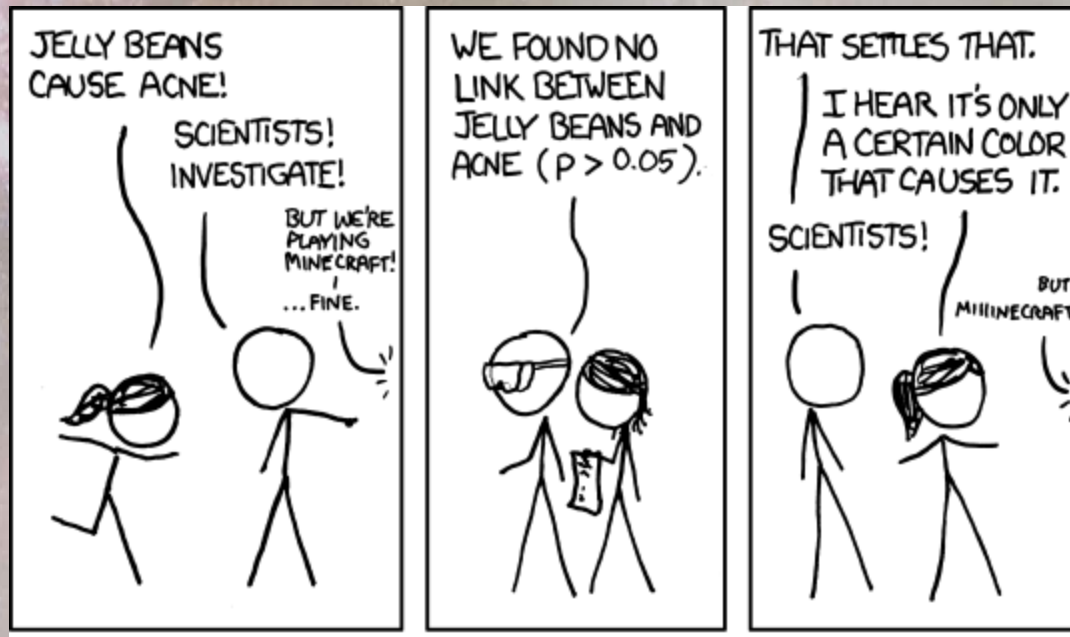


What happens when these criteria are applied to social psychology?

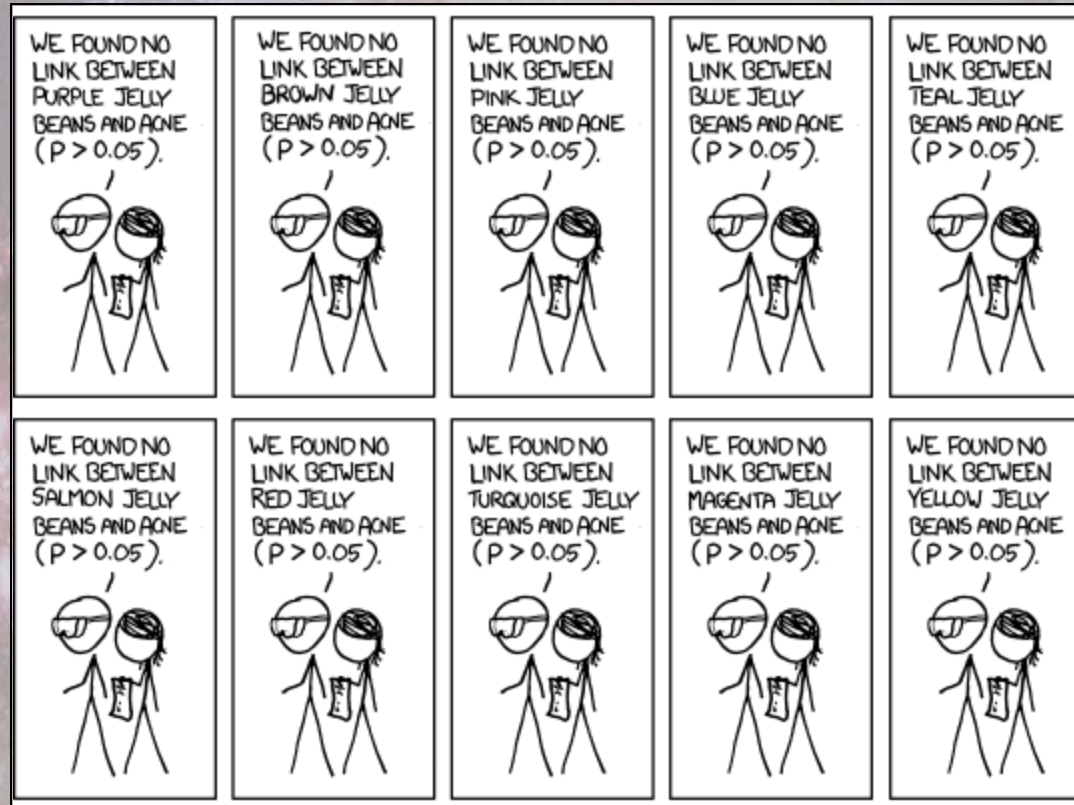
- The U of R has a very active social psychology department—e.g. Rich Ryan, who is often in the news for research about *what makes people happy* (e.g.: not money)
- The criteria which are still useful include:
 - ❖ **Coherency**: does the model explain a wide range of data?
 - ❖ **Simplicity**: without an array of exceptions and special cases
 - ❖ **Reproducibility**: Can the results be widely replicated?
- But we no longer can draw as powerfully upon:
 - ❖ **Clarity**: The mathematical modeling is now in the form of statistical analysis
- And the type of evidence goes from physical diagnostics to surveys and behavioral observations
- Careful research in psychology has great power to address interesting questions, but since it deals with all the complications of behavior is in many ways harder

The issue of reproducibility has brought social psychology to a point of quiet revolution

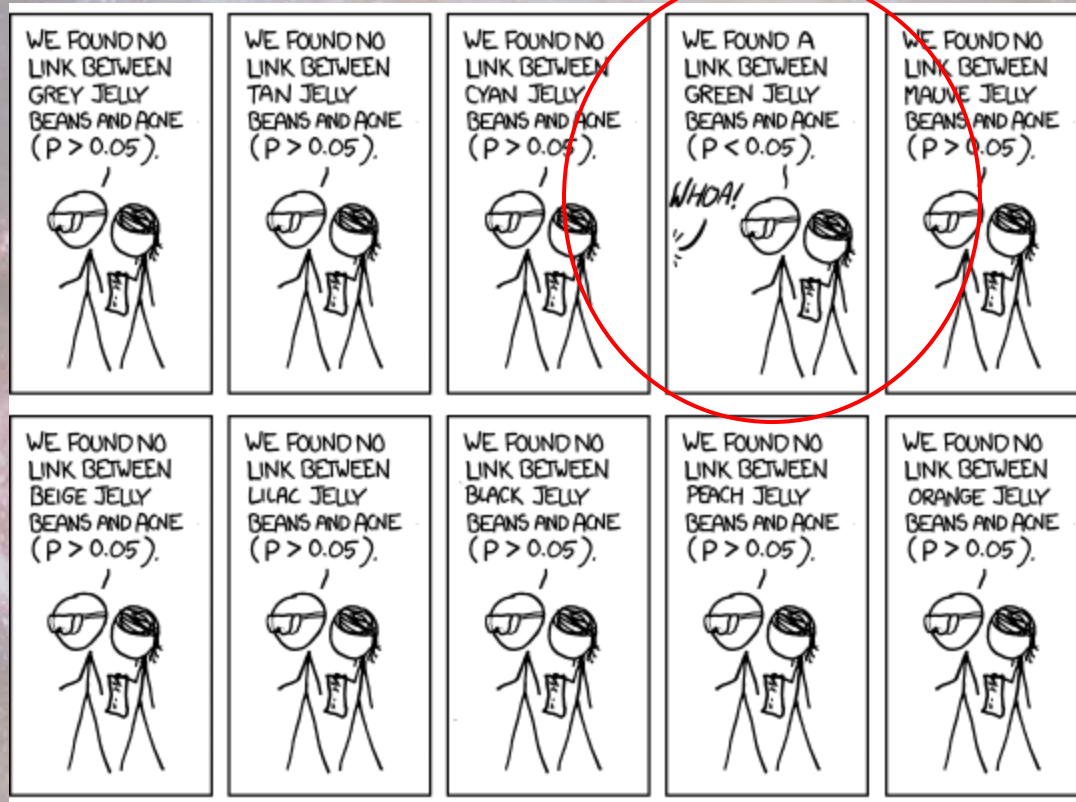
- The $p < 0.05$ criterion (“null hypothesis significance testing”) has ruled the field for a generation: a result was considered statistically significant if the odds fall below 5% of the result occurring and the hypothesis isn’t true
- Independent labs are having trouble replicating some well-known results
- ❖ E.g. **priming**: the theory that e.g. you will do better on an intelligence test if you spend time beforehand thinking about a professor than if you spent time thinking about a soccer hooligan



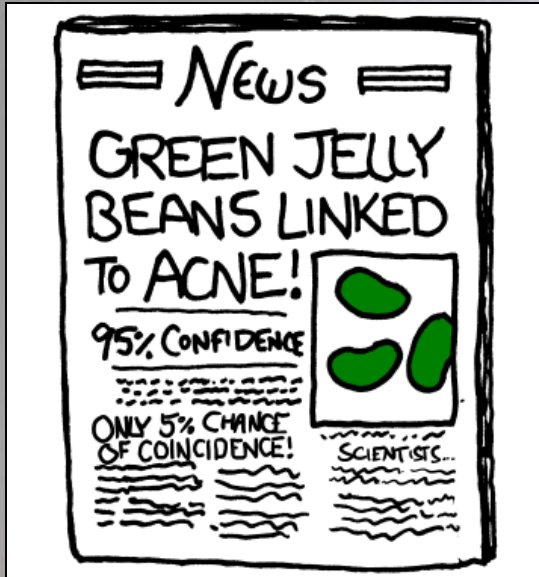
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The issue of reproducibility has brought social psychology to a point of quiet revolution



- No one wants to publish a null result
 - It's too easy to simply keep adding to the survey until a hypothesis is confirmed, or only publish those studies which generate a positive result
 - Psychology isn't the only field subject to biases: the Milikan oil-drop experiment famously obtained the wrong result because the viscosity of air was neglected—and it took a long time for this to be corrected because subsequent researchers only scrutinized their results when they disagreed with Milikan!
-
- Feynman referred to this sort of science as “**cargo cult science**” since it has the *appearance* of science without the *effectiveness*¹
 - It is crucial to be brutally honest about the shortcomings of your theories
 - “The first principle is that you must not fool yourself—and you are the easiest person to fool” (Feynman)

¹Richard Feynman, 1974 Caltech commencement address; reprinted in *Surely You're Joking, Mr. Feynman!*

What happens when these criteria are applied to cultural anthropology?

- The criteria which are still useful include again coherency and simplicity
- Reproducibility and clarity in the sense described above may not be achievable
 - ❖ As in astronomy, you may have to work with an ensemble (e.g. a collection of cultures) rather than a repeatable test
- Two types of evidence are added:
 - ❖ **Anecdotal**: gathering data by living within a culture
 - ❖ **Historical**: E.g. “why does capitalism overcome other economic systems”
- Over the past generation some anthropologists have embraced the idea that there are things which can only be learned by entering into the culture being studied—a practice the previous generation would have derided as “going native”
 - ❖ E.g. Edith and Victor Turner’s study of Zambia rituals addressed to Yoruba deities¹
- **It may be necessary to enter into the culture to understand it**



Edith Turner

¹See *Experiencing Ritual* by Edith Turner

Can these criteria be applied to faith claims?

- **Claim: Jesus was raised from the dead**

This is judged based on *historical* and *textual* data:

- ❖ Are the biblical texts reliable? (Texts date to 4th c. and there are many)
- ❖ Are there indications which support or undermine their claims? (E.g. female eye-witnesses)

- **Claim: Conversion can change the way you think and live**

This is judged based on *sociological* data

- ❖ E.g. Surveys show that Christians don't behave differently from the rest of the culture in areas such as divorce, giving to the poor, sexual ethics and racism
- ❖ ...except a small minority who hold to a much tighter set of beliefs

- **Claim: Physical healing and other “6- σ ” events**

These are judged based on *anecdotal* evidence

- ❖ You can interview those who have experienced these, but the lesson of cultural anthropology may be most apt: to really know you have to practice immersion

To avoid “cargo-cult science” the investigator must bear in mind common psychological biases

- ❖ **Self-serving bias**: we favor conclusions which make us look good
- ❖ **Illusion of control** (when none exists): we report control even of random events
- ❖ **False pattern identification**: We tend to find patterns even when there are none
- ❖ **Tendency to favor data** which support the desired conclusion
- Criteria for judging these claims include again coherency, simplicity and (in some cases) reproducibility
- The types of data include (as in anthropology) historical (textual) and anecdotal, and as in psychology, behavioral observations

Religious claims *can* and *should* be treated on the basis of evidence

What about “blind faith” and “spiritual mysteries”?

- “Trust”, “confidence”, “faith” are used to translate the Greek πιστις
- This is not blind faith, but faith based on the reliability of the one trusted (e.g. Heb 11:11)
 - ❖ “Since many have undertaken to set down an orderly account of the events that have been fulfilled among us, just as they were handed on to us by those who from the beginning were eyewitnesses and servants of the word, I too decided, after investigating everything carefully from the very first, to write an orderly account for you, most excellent Theophilus, so that you may know the truth concerning the things about which you have been instructed.” (Luke 1:1-4)
- When “mysteries” are discussed, they are things which were *previously* hidden and are now disclosed (Eph 3:9)
- “Blind faith” represents a fundamental misunderstanding:
 - ❖ Central to the biblical narrative is God’s desire to communicate and disclose himself, not keep secrets or secure trust without evidence of trustworthiness (John 17:6-8)

So how did we end up in this cultural standoff?

- As far back as Francis Bacon, the father of philosophy of science, the “two books” perspective reigned:
 - ❖ The **book of nature—science**
 - ❖ The **book of Scripture**
- In the 1800s these appeared to diverge, as astronomy and geology appeared to fly in the face of Biblical interpretation, mechanics suggested a deterministic world, and biology was leading to the view of man as an animal
- This led to the apparent conflict between science and faith, devaluing the questions science can’t address

An uneasy truce exists culturally between science and faith

- Lawrence Krauss, physicist at Case Western Reserve, in a NYT op-ed:¹

“The point here, which should be obvious, is that science and religion are separate entities: science is a predictive discipline based on empirically falsifiable facts; religion is a hopeful discipline based on inner faith”

- Steven Jay Gould (paleontologist), referring to Pope Pius’s *Humani Generis*, writes:

“No such conflict should exist [between science and religion] because each subject has a legitimate *magisterium*, or domain of teaching authority—and these *magisteria* do not overlap...”

The net of science covers the empirical universe: what is it made of (fact) and why does it work this way (theory). The net of religion extends over questions of moral meaning and value. These two magisteria do not overlap, nor do they encompass all inquiry (consider, for starters, the magisterium of art and the meaning of beauty)”

- “The Bible tells us how to go to heaven, not how the heavens go.” –Galileo
- Sounds reasonable, right...?

¹ “When Sentiment and Fear Trump Reason and Reality”, March 29, 2005

The false separation between science and faith paints faith into a corner and guarantees conflict

- If God is permitted only where science can't explain then as science expands, God is squeezed out
- This implicitly assumes that if science can provide an explanation for an event, then any further explanation is not just unnecessary, but is wrong
- This compels some Christian apologists to find evidence of God in the *failures* of science (e.g. some understandings of Intelligent Design)

- Dietrich Bonhoeffer:

...how wrong it is to use God as a stop-gap for the incompleteness of our knowledge. If in fact the frontiers of knowledge are being pushed further and further back (and that is bound to be the case), then God is being pushed back with them, and is therefore continually in retreat.

We are to find God *in what we know, not in what we don't know*; God wants us to realize his presence, not in unsolved problems but in those that are solved.¹



Bonhoeffer

- Conclusion: **Let propositions stand and fall on their merits**

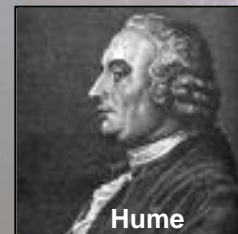
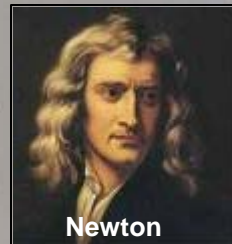
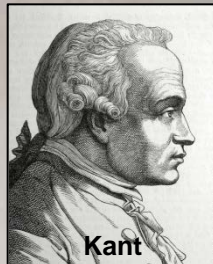
How science learns: The Newtonian Model

- To discuss the apparent dichotomy of deduction vs. inspiration, we consider models of scientific knowing, or *epistemology*
- Newton (1642-1727) imagines observing the world through a part of the brain called the *sensorium*, and drawing conclusions from these observations
- phenomena \Rightarrow observation \Rightarrow deduction by abstraction \Rightarrow scientific concepts
- Example: This model is like an Englishman trying to deduce the rules of baseball by watching a match on TV with the sound off
- Newton: “I frame no hypothesis”—in experimentation, everything is *deduced* from observation then rendered general by *induction*



The Newtonian model is *necessarily incomplete*

- Newton's success with Calculus and the laws of motion leads others to believe his practice matches his model, *even though it doesn't*.
- David Hume (1711-1776) points out that Newton didn't observe the *space and time* in which motion takes place—nor causality
 - ❖ Hume's Ex: You may *think* when you observe a rock shattering a window that they are causally related, but really they are just adjacent perceptions
- ❖ **Critical elements of the scientific inquiry come not from observation but *are added to them by the observer***
- Immanuel Kant (1724-1804): We not only discover form in nature; *we also impose it with our minds*
- This is a shift from the intrinsic intelligibility of the universe to the constructive power of the mind which reads rational structure into nature



How science learns: Einstein's model

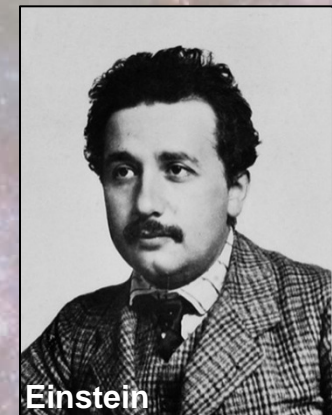
- Einstein (1879-1955) asserts that *neither* view is complete because we learn through *intuition and inspiration* which occur as we study the world:

“A new idea comes suddenly and in a rather intuitive way. That means it is not reached by conscious logical conclusions. But, thinking it through afterwards, you can always discover the reasons which have led you unconsciously to your guess and you will find a logical way to justify it. Intuition is nothing but the outcome of earlier intellectual experience.”

- Real science proceeds not just with deduction and induction but by necessary “ah-hah” experiences in which inferences are made and patterns recognized

“While actively engaged in the process of inquiry, the knower in another sense is, in Einstein's own words, ‘helpless... until principles he can make the basis of deductive reasoning have revealed themselves to him’”¹

- Ex: In developing his theory of Special Relativity in 1905, Einstein had to have the tremendous leap of intuition to recognize that time and space are themselves mutable



¹ Quoted in E. Colyer, *How to Read T. F. Torrance* (IVP, 2001), p. 333

Polanyi: The intuitive leap is analogous to visual pattern recognition

- **Michael Polanyi, British chemist and philosopher of science (1891-1976) proposes:**

- ❖ **The intuitive leap is drawn from what he called “tacit knowledge”, which we may not even be aware of**
- ❖ **This enables us to “discern... patterns of coherence previously undetected in a given field through a heuristic leap from the parts to the whole”**

- **He likens this to psychological experiments with glasses designed to invert vision:**

- ❖ **After eight days bumping around, suddenly the brain comprehends what it sees**



A volunteer experiencing balance problems immediately after putting on Image-inverting glasses



Polanyi



Graduate student Fred Snyder after 30 days wearing the glasses, is able to ride and control a bicycle flawlessly—but after taking the glasses off is unable to maintain his balance (~1950)

Einstein's model is a feature of all true problem solving

- Some straight-forward problems are amenable to deduction
- But the interesting problems are solved by immersion, followed by a period of waiting helplessly for inspiration
- As scientists we tend not to articulate this helplessness at times even behaving as if we have *accomplished* the act of intuition
- This is the source of the common advice: when stuck, go take a shower!
- What Einstein describes is the psychological phenomenon of *incubation*:

The thinker senses that a problem is soluble (and perhaps what direction the solution will take), but fails to solve it on his or her first attempt; later, after a period in which he or she has been occupied with other concerns (or, perhaps, with nothing at all), the solution to the problem emerges full-blown into conscious awareness.¹



Beautiful Mind clip

¹ *Implicit Cognition*, ed. G. Underwood, p. 257;
Is this model of learning true just for theorists?;

This immersion in the data is analogous to selfless love

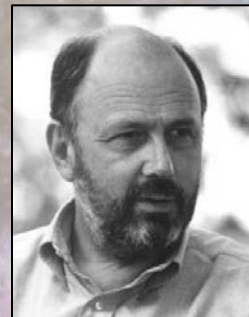
“The state of mind which enables a man to do work [in science] is akin to that of the religious worshipper or the lover; the daily effort comes from no deliberate intention or program, but straight from the heart.”

—Einstein

“My sense from talking to some scientific colleagues is that, though it’s hard to describe, something like this is already at work when the scientist devotes him- or herself to the subject matter so that the birth of new hypotheses seems to come about, not so much through an abstract brain... but more through a soft and mysterious symbiosis of knower and known, or lover and beloved...”

“Love is the deepest mode of knowing, because it is love that, while completely engaging with reality other than itself, affirms and celebrates that other-than-self reality. This is the mode of knowing which is necessary if we are to live in the new public world, the world launched at Easter, the world in which Jesus is Lord and Caesar isn’t.”¹

—N. T. Wright

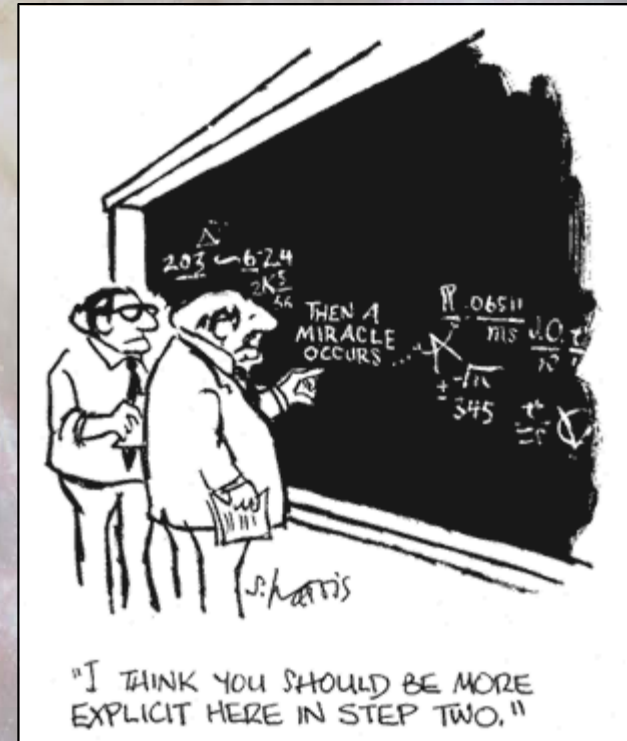


**Anglican
Theologian
N. T. Wright**

¹ Tom Wright, “Can a scientist believe in the resurrection?”, The James Gregory Lecture 2007
See also David Brooks, “Stairway to Wisdom”, NYT, May 15, 2014

There are many fascinating implications for both science and religion

1. To prepare yourself for inspiration of *any sort*, immerse yourself in the subject
 - ❖ E.g., when praying for someone in need
2. Learning is primarily not *volitional*
 - ❖ We prepare the soil for inspiration, but don't *choose* to have an intuitive leap
 - ❖ So the divisions between psychology and divine action may become blurred
3. Imagine the subject isn't the physical world, but rather a *person*. How do you immerse yourself in a person, whether human or divine?



“Why do you complain to [God] that he answers none of man's words? For God does speak—now one way, now another—though man may not perceive it” (Job 33:13-14)

Conclusions:

- ❖ **Despite differences in method, both seek to understand data**
- ❖ **Both science and faith come to know via inspiration and incubation**

Acknowledgements:

- ❖ **Scottish Reformed theologian Thomas F. Torrance (epistemology)**
- ❖ **MIT plasma physicist Ian Hutchinson (scientism and scientific method)**

The sun, in the ultraviolet, showing plasma formations in the corona

Scottish Reformed theologian T. F. Torrance uses Einstein's model to describe "scientific theology"

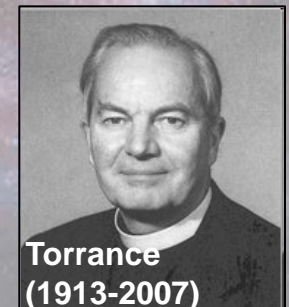
- Torrance refers to the immersion in the data under study as "indwelling":

"We indwell the field of inquiry, in this case the biblical witness, until a structural kinship arises between the human mind... and the interrelations and intrinsic structures in the realities to which the Scripture bears witness"¹

- For Torrance, the development of the doctrine of the Trinity and Incarnation in the 3rd & 4th centuries is an example of this process:

"We cannot deduce or abstract the incarnation or the Trinity... from the 'data' concerning the historical Jesus, for these doctrines arise out of a much more complex integrative theological activity concerned with the conjoint witness of Scripture to God's *oikonomia*."² [Colyer, 350]

- For Torrance a truly scientific understanding of Biblical study is necessarily *holistic*: to perceive the patterns in the Scriptures, study must be done in light of the plan and history of salvation; this rules out atomistic study of Scripture



**Torrance
(1913-2007)**

¹ E. Colyer, *How to Read T. F. Torrance*, p. 350-351 ; ²*oikonomia*: from Irenaeus, God's plan of salvation, also called his "economy of salvation"

