

"Apologies to Galileo: A Theologian's Homage to Science"
International Vacuum Electronics Conference 2022
Monterey, California
27 April 2022

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Introduction

[2] No one is more surprised that an aging cleric is standing in front of a group of scientists at this gathering than the aging cleric himself. The route to this podium has admittedly been somewhat circuitous and very unexpected.

A number of years ago I was applying for a grant from the John Templeton Foundation [3a] on preaching and the sciences. The premise behind that grant, was that while preachers in my Roman Catholic tradition will often employ popular culture, a recent movie, literature, music or even the visual arts to enliven their sermonizing or drive home a point, the sciences are largely ignored. My grant proposal was a modest attempt to rectify that situation. In a parallel effort I was in the process of [3b] drafting a book on preaching, which contained an explicit chapter on preaching with the sciences. Trained in philosophy, the arts and theology, my formal education did not readily dispose me for drafting this section of the book. High school chemistry was a personal nightmare and a required college course in math was almost the undoing of my academic career. Thus, in view of my own history and in order not to appear completely ignorant in print, I recruited a congregant [3c] from one of the parishes in which I preach and asked him to review the text. Dr. Tucek was very gentle in his critique. Many months later we were at brunch and Jack mentioned his work with this conference. I reminisced that vacuum tubes were a part of my childhood. Jack looked up from his omelet. I explained that my [3d] father had been a radioman for the U.S. Navy during World War II and the Korean crises. After the war, in order to support his family, this novice industrial engineer repaired radios and televisions on the side. Consequently, I was the only kid in the neighborhood whose father's work bench was bedecked not with ban saws or wrenches, but with all sorts of electronic equipment [3d] including that endlessly fascinating tube tester. This recollection was the proximate trigger for this invitation, which I hope neither Jack in extending it nor I in accepting it will come to regret.

I did not follow into my father's engineering profession and chose a path that some believe by necessity takes at least a suspicious if not antagonistic view of the sciences. The relationship between science and religion in the West has clearly had its ups and downs. Theorists since the 1960's, when the history of the interplay of religion and science in the west began to be studied systematically, have offered a variety of taxonomies for framing this engagement. The most influential of these [4] remains Ian Barbour's 2000 prize winning publication, *When Science Meets Religion*.¹

According to Barbour, the possible relationships between religion and science can be characterized through a series of models. [4a] First is the conflict model, which holds that science and religion are in perpetual and principal conflict. This model is epitomized in the 1633 Vatican trial of Galileo, referenced in the title of this talk, which found Galileo guilty of heresy; as you may know, it only took about 350 years for the Vatican finally to acknowledge that Galileo was right! Next, according to Barbour, is the independence model, which holds that science and religion explore separate domains that ask distinct questions and, by consequence, live in two different worlds. The

dialogue model, on the other hand, assumes that there is common ground between these fields, and thus proposes their mutual relationship. Finally, there is the integration model, which looks for ways to unify science and theology.

While each of these has their theoretical value and historical anchor in the long interface of religion and science, I will venture a different approach here. [5] Appreciative inquiry is an organizational development method that emerged in the 1980's through the groundbreaking work of then doctoral student David Cooperrider and his supervisor Suresh Srivastva at Case Western Reserve University in Cleveland. In reaction to deficit-based approaches to organizational development, which focus on systemic problems that need first to be identified and then to be solved, appreciative inquiry is a strength-based, change-directed approach that, instead, leverages an organization's positive core strengths for a more hope filled and productive future. A driving principle of appreciative inquiry is that organizations develop in the direction of their questions. If you look for problems, you will find them. If you look for hopes and dreams, you will find them as well.²

In the spirit of appreciative inquiry, my intent here is [6] to illustrate how scientific work in general, and yours in particular, is a boon to my own tasks of preaching and accompanying people in their faith journey. In so doing I aspire both to appreciate and encourage your scientific progress in whatever forms it takes, so that you and your colleagues can be relentless in fulfilling the stated mission of your organization to advance technology for the sake of humanity. In the process [7] I hope that you in turn might have a renewed appreciation about how even highly specialized work by scientists like yourselves can have ramifications across many other universes of thinking and believing. I will attempt to achieve this task by proposing three hypotheses. [8] They are:

First: Your imagination can transform the world,

Second: Your inspirational motivations are generative,

And third: Your intelligent ignorance offers a path for confronting mystery.

So to hypothesis 1: [9] Your imagination can transform the world.

Your scientific ancestors were often berated by some of the Western civilizations most celebrated poets for destroying the sense of mystery and awe in the world. The Romantic Poet John Keats (d. 1821) [10], for example, caricatured scientists as purveyors of "cold philosophy," writing: [10a]

*Do not all charms fly
At the mere touch of cold philosophy?
There was an awful rainbow once in heaven:
We know her woof, her texture; she is given
In the dull catalogue of common things.
Philosophy will clip an Angel's wings,
Conquer all mysteries by rule and line,
Empty the haunted air, and gnomed mine—*

Slandering scientists as dull empiricists intent upon sucking the mystery out of the cosmos has been a common refrain among Church leadership as well. Conversely, scholarship on modern science has effectively refuted such assertions, documenting how central the gifts of imagination and creativity are to great science.³ For example, [11] while not the originator of heliocentric theory, Nicolaus Copernicus (d. 1543) established the plausibility of this system through astronomical imaginings that

could not be unequivocally proven – not even by Galileo’s observations in the next century – but only with the work of the 19th century astronomer F.W. Bessel whose successful measurement of a parallax ellipse established the sun as the central body of the solar system.⁴ The Copernican math alone combined with his rudimentary observations could not suffice for Copernicus’ theoretical advancement here. Rather, this move required coupling empirical work with the gift of imagination. It was only such a partnership that could effectively promote the plausibility of what was then yet a widely rejected theory.

Each of you assuredly have your own list of the most imaginative breakthroughs in science, **[12]** be that Newton’s laws of gravity, Curie’s work in radioactivity, Darwin’s theory of evolution, Einstein’s theory of relativity, Heisenberg’s work in quantum mechanics, Hubble’s vision of an expanding universe, Hawking’s area theorem on black hole mechanics, or the many minds that birthed string theory.

Imagination does spur technological breakthroughs that make our lives easier such as micro-waves, or Magnetic Resonance Imaging to help us sustain our health. But even more, imagination was an essential component **[13]** for the very evolution of our species. Neuroscientists remind us that while some non-human creatures craft and employ tools, and even have what could be described as languages, neither the insect world nor the animal kingdom demonstrate imaginative gifts such as the poetry or music making that spurred on the development of our species. Some will actually argue, for example, **[13a]** that the human brain evolved precisely to achieve the cognitive survival tactic we call story telling.⁵ Dr. Beau Lotto of the University of London asserts that through imagining we can actually change our neurons, our perceptual behaviors and, by consequence, can decidedly alter our conduct.⁶ Imagination is an exercise in mental deviation, an intentional stepping away from deeply embedded assumptions and their often unmonitored, consequent reflexes.

If you can mentor a young mind **[14]** or energize a colleague to deviate from standard understandings and imagine new possibilities – for example inside a vacuum tube – aren’t you analogously helping them **[14a]** to imagine how to engineer something new within the philosophical, social and political vacuums that too often surround and separate us and even bring us into devastating conflict? The Irish philosopher **[15]** Richard Kearney takes our imaginations seriously not simply as sources of entertaining musings but as moral and ethical tools. According to Kearney, the failure especially of the narrative imagination and its proven capacity to generate empathy makes possible genocides and atrocities. He concludes, **[15a]** “If we possess narrative sympathy – enabling us to see the world from the other’s point of view – we cannot kill. If we do not [possess narrative sympathy], we cannot love.”⁷

In my world imagination is essential. A favorite explanation for this is articulated in George Bernard Shaw’s (d. 1950) play *Saint Joan*.⁸ In one scene Shaw dramatizes the 14th century title character Joan of Arc pleading for backing in her crusade against English domination of France. **[16]** She has come to the military squire Robert de Braidicourt to solicit his support for her campaign. In the course of Robert’s questions about her intentions, Joan reveals that she hears voices directing her moves. In fact, Joan had been instructed to come to petition Robert by one such voice. The squire is understandably taken aback: **[16a]** “How do you mean? Voices?” “I hear voices telling me what to do,” Joan replies, adding, “They come from God.” Robert is unconvinced: “They come from your imagination.” To which Joan answers, “Of course. That is how messages of God come to us” (Shaw 1924, 59).⁹

While you may not in any way share my belief system, the churning imaginary across the sciences to which you constantly contribute is a great boon for those of us committed to expanding the moral and ethical imaginations of others – be those Sikhs or humanists, Jews or Muslims – and in my opinion an expanding scientific imaginary seriously contributes to a more just and inclusive humanity.

[17] Hypothesis 2: Your inspirational motivations are generative.

One of the more celebrated aphorisms about genius, [18] linked to imagination and creativity, is Thomas Edison's (d. 1931) purported assertion that genius is one percent inspiration and ninety-nine percent perspiration. This statement is erroneous on several levels. First, there is evidence that Edison never wrote or said those words; the saying should probably be credited to the academic Kate Sanborn who asserted in a series of lectures in the early 1890's that genius is a mix of inspiration and perspiration, although she never seems to have provided any ratio of their proposed interaction. [18a] It was commonplace, in that era, to attribute such sayings to men of stature – not women – regardless of the veracity of such attributions. Later on Edison did contend that genius is 98% hard work, and that it is "not inspired." He continued: "Inspiration is perspiration."¹⁰

Recent research demonstrates that Edison is clearly wrong on other levels in this assertion beyond its false ascription to him. While the nature of creativity and imagination have been empirically studied, the clinical examination of inspiration is more recent. Edison's apparent dismissal of inspiration is a misconception that this trait achieves little on its own. [19] Studies suggest, however, that inspiration serves a unique function. Apart from imagination, such studies clarify that inspiration is a motivational state that compels individuals to bring ideas into fruition.¹¹ Creative people have many ideas, but they do not always have the motivation to explore, test, and actualize them. Inspiration is what psychologists and neuroscientists consider the essential trait here; it is a critical mediator between a creative idea and the effective realization of that idea.

We can be inspired by many things: [20] researchers Todd Trash and Andrew Elliot suggest that one can be inspired "from above,"¹² be that some artistic muse, divine revelation, or an unknown force akin to what George Lukas summoned in his Star Wars saga. [21] Others contend that inspiration is more reliant on intrapsychic sources and ultimately comes from within, from our own musings or dreams or subconscious. More common is the perception that inspiration comes from our environment, which is the context and people that we encounter and experience. [22] These sources can provoke a positive emotion or state of "elevation," elicited when one witnesses a virtue such as generosity and is prompted to be virtuous in turn. Our contexts can also trigger inspiration disclosed as awe, prompted by an experience of vastness – be that of a Serengeti migration or the distant explosion of a nova. Then there is the inspiration we call admiration, prompted by an unusual display of skill, be that an Olympic performance in snowboarding or the ability to execute the water landing of an airline packed with passengers on the Hudson River without a single loss of life.

While some might presume that my chosen profession disposes me to believe that inspiration largely comes from above, [23] I am more inclined to believe that it comes from context. Sometimes that's an unusual display of virtue [23a], other times, it is a sense of awe at beauty, but it is also admiration of a skill that engineers a scientific discovery that, in turn, motivates me to pursue a parallel project. Recently, for example, I have been inspired by the previously mentioned neuroscientist Beau Lotto and his insistence that the only way to break out of instinctual responses and our own prejudices and presumptions is to deviate from the reflexes often rooted deep in our reptilian brains and to dare

to think and act differently. My research project this coming fall at the University of Notre Dame on the neuroscience behind effective preaching will be rooted in Lotto's inspiring work.

Motivation can come from any source. If a falling apple was an inspirational trigger for Isaac Newton to craft his law of universal gravitation, what cannot be a source of inspiration? A piece of poetry? A vacuum tube? A Jamaican bobsled team?

You may have seen the 1993 hit comedy *Cool Runnings*, [24] a fictionalized retelling of the four-man bobsled team from Jamaica that competed in the 1988 Calgary Winter Olympics. As the record books note, the team crashed and received a "did not finish" result. [24a] Despite that disastrous finish, this unlikely quartet of athletes have inspired generations of Jamaicans, including a growing number of winter sports stars.¹³ Evidence of the improbability of alpine athletes from a country [24b] whose yearly temperatures typically vary between 73- and 89-degrees Fahrenheit, was on display at the 2022 Beijing Olympics. There the Island Nation was represented by teams for three bobsled events as well as the [24c] first ever alpine skier from the Caribbean. Inspiration does not replace hard work, as evidenced by the training routine for Jamaica's two-man bobsled team who trained during the COVID lockdown of gyms and other athletic facilities [24d] by pushing a mini cooper through the streets. Nonetheless, these athletes and their Olympic compatriots acknowledge that the story behind *Cool Runnings* was the inspiration for their own pursuit of glory.

While they may not be making a movie about your exploits, and they certainly will not be making one about mine, who knows what legacy you might intentionally or accidentally trigger? [25] If previous pioneers in your field could inspire scientists with devices that stood guard during the cold war, advanced particle physics, treated cancer patients and made the Beatles sound good,¹⁴ is it not your task to take up not only the technical but also inspirational vocation of sparking the imaginations and motivations of the next generation in the hopes that they will continue the contributions of your fields to the betterment of humanity?

[26] Hypothesis 3: Your intelligent ignorance offers a path for confronting mystery.

Wes Jackson is a botanist and geneticist [27] who has taught at major universities in the United States and helped found the Land Institute. This organization is concerned with the development of agricultural patterns that are both ecologically sustainable and economically viable. As a farmer turned scientist, Jackson and like-minded colleagues are concerned that too often decisions about our environment are made by people with insufficient scientific information. Nonetheless, such folk forge ahead with untested policies and practices that sometimes cause more harm than good to the environment. In response to this situation Jackson and his collaborators began a movement and even convened a conference [27a] advocating the value of an "ignorance-based world view." It was their contention that such a pointed self-awareness could prompt more caution in the scientific community that would then be less apt to wager on untried approaches that could jeopardize the well-being of our planet.¹⁵

What Jackson and others are promoting, of course, is not stupidity nor indifference to fact or reason, but the communal gap in our knowledge that spurs people – especially scientists – to ask how and why. [28] In a word, such intelligent ignorance invites us to say "I don't know" as the beginning of a quest into mystery. This idea is not new.¹⁶ Already in the 18th century, the Enlightenment philosopher [28a] Immanuel Kant (d. 1804) formulated his famous "Principle of question propagation," asserting that science produces questions more than it

generates answers. Delivering a speech in London in 1930 honoring Albert Einstein, the previously quoted playwright George Bernard Shaw famously quipped that “Science is always wrong.” He continued, “[it] can never solve one problem without raising ten more problems.”¹⁷ The quantum physicist Erwin Schrödinger (d. 1961) advisedly remarked, “In an honest search for knowledge, you quite often have to abide by ignorance for an indefinite period of time.”

Some neuroscientists contend that all brains are deathly afraid of uncertainty.¹⁸ **[29]** Not knowing, they contend, is an evolutionary bad idea. If you are unsure whether the dark shape in front of you is a shadow or a predator, not knowing could be lethal. In response, our brains evolved to solve the problem of uncertainty. There are multiple responses to uncertainty. **[29a]** Anger and fear are certainly two possibilities, often observable when children confront the new. Another response is the imposition of intransigent rules or rigidly defending against creeping ambiguity. The world is flat, the sun circles the earth, the world was created in a period of six twenty-four-hour days, humans cannot change the climate, vaccines do not work. Such stances against new situations and fresh explorations punctuate human discourse even into our own day.

Anger, fear, and rigidity, however, do not move us forward as a species. They confine us to responses embedded deep in our reptilian brains, which are inadequate for confronting new uncertainties, fresh ambiguities, looming mysteries. Something different happens, however, when we admit “I don’t know,” **[30]** when we acknowledge the limitations of our knowledge base or experience, and when we dare to ask the probing question that pulls the rug out from under our common assumptions and figuratively upsets the Newtonian applecart. In the language of the **[30a]** neuroscientist Beau Lotto not knowing, uncertainty and bafflement are opportunities for active doubting. This is doubting with humility, wrestling with the questions that in their resolution will generate more questions. Doubting does not free us from ignorance, but in the language of Dr. Stuart Firestein – who actually teaches a course in the biological sciences at Columbia University aptly entitled “Ignorance,” – doubting leads us to high-quality ignorance born of great questions that push us further into the unknown.

If all the questions of science were resolved, science per se would evaporate and devolve into application of what is already known. But it is the unknown that keeps moving scientific frontiers. **[31]** What is the cause of Alzheimer? How do you explain ball lightning? Is light the ultimate speed limit? What is dark matter? Are there parallel universes? Is string theory a credible unifying formulation? What happens in a black hole? Do we live in a false vacuum? Is there a neurochemical explanation for falling in love? **[31a]** What happens after death? What’s the meaning of life?

Sometimes people think of scientists as problem solvers, who when faced with a dilemma – like how to get a man on the moon – compute and engineer and theorize and calculate ... and then launch into the unknown. Alternately, I consider scientists and engineers, mathematicians and technology specialists as mentors in the face of mystery. You confront the unsolved, take on the riddle, face off against the conundrum. And sometimes, maybe often, your hypotheses and proposals, experiments and research fails. But when you fail forward you

move not only your respective fields, you also move humanity as well ... mentoring us with courage and determination to face the mysteries mysteries that I pray will always be there, for I fear that if and when every mystery is solved, humanity will have run its course.

My professional life over the last five decades or so [32] has been, in a sense, an attempt to make sense of mystery. I have buried the teenager who committed suicide, sat with the novice attempting to discern their vocation, baptized the child with down's syndrome, witnessed the marriage of the most unlikely of lovers, consoled the husband whose wife is ravaged by Alzheimer's disease and no longer recognizes him, watched young ministry students awaken to the wonders of theology, and offered a blessing over the couple renewing vows after 70 years of marriage. I observe and ponder, but seldom can explain why in the face of the manifold mysteries of life. Imaginative people – musicians, calligraphers, architects, poets – provide hints for me ... what the preacher-poet Barbara Brown Taylor calls traces of divinity ... that help me remain faithful in my doubt. Scientists do that for me in a particular way

Several years ago a chance click of the television remote led me to a program documenting the work of Katy Payne. [33] She is the founder of the "Elephant Listening Project," now housed at Cornell University in Ithaca, New York. Originally trained in both music and biology, she helped develop the field of bioacoustics that studies the sounds animals use for communication. With her husband, Roger, she studied the singing of humpback whales. [33a] They came to understand that whales communicate through long, complex patterns that are similar to the songs of birds. Their work on whale songs remains an influential and highly regarded piece of research that brought them international recognition.

Later in her career Payne was visiting the Portland Zoo, when she felt (more than heard) a rumbling communication between two elephants [34], standing on opposite sides of a concrete enclosure. She enlisted the help of two other acoustic biologists who began to study and record these pachyderm "conversations." Payne and her colleagues discovered that elephants vocally transmit at a very low frequency [34a], significantly below the threshold of human hearing. Her findings — popularized in the book *Silent Thunder* — document how these apparently silent goliaths have developed a sophisticated communication system, capable of broadcasting across many miles through African forests. Subsequently the [34b] Elephant Listening Project was officially established at Cornell University. Their scientists and collaborators in the United States and in Africa continue the work to this day now that Payne has retired. This ongoing endeavor has emerged as a valuable tool for protecting elephants in their natural habitat against poaching and other environmental dangers.

My religious tradition tells me that some higher power is communicating with humanity, even with me [35]. Many, even stalwart Christians, have their doubts. I do as well; that is why I have faith about this and not empirical knowledge. But the work of a bio-acoustician like Payne fires my imagination in the face of that mystery. The empirical evidence is not that pachyderms are mute, but that our hearing is not calibrated to their frequency. They can hear each other fine; it is we who are sonically impaired in their environment. Analogously, deafness to some higher calling is not evidence of a silent divinity. Rather, for me, it is symptomatic of our flawed

ability to tune ourselves to the Holy and the good, often present in each other. Whatever frequency of the good and the beautiful calibrates your life, know that your imaginations, your inspiration, your thoughtful doubt and even higher ignorance in the face of some mystery does contribute to the advancement of humanity.

And so to conclude

In the same year [36] that the chemist John Newlands produced the first periodic table of the elements, James Clerk Maxwell was the first to treat light as an electromagnetic wave, and Charles Darwin received the Copley Medal from the Royal Society of London for Improving Natural knowledge, the poet Emily Dickson celebrated the spirit of scientific inquiry with these words:

[36a] The Brain – is wider than the Sky –
For – put them side by side –
The one the other will contain
With ease – and you – beside –

The Brain is deeper than the sea –
For – hold them – blue to blue-
The one the other will absorb –
As sponges – buckets – do –

The brain is just the weight of God –
For – heft them – pound for pound –
And they will differ – if they do
As Syllable from Sound –

I agree with the poet, that the mind's power to imagine, to observe, to dream, to create is as immense as the sky, as deep as the seas, as limitless as the heavens themselves. I thank you for your imagination, your inspiration, your journey in mystery for the sake of every people: for it is not creed or color, gender or nationality, age or status that we have in common, but only our shared humanity. I wish you every blessing in your work, on your distinctive mission, and thank you most sincerely for your kind attention.

¹ Ian Barbour, *When Science Meets Religion* (New York: HarperSanFrancisco, 2000).

² See the AI Commons at <https://appreciativeinquiry.champlain.edu/>; a useful overview of the emergence and core principles of this approach continues to be James Ludema, "From Deficit Discourse to Vocabularies of Hope: The Power of Appreciation," in *Appreciative Inquiry*, ed. David Cooperrider et al. (Champaign IL: Stipes Publishing, 2001), 265-87.

³ See, for example, Tom McLeish, *The Poetry and Music of Science: Comparing Creativity in Science and Art* (Oxford: Oxford University Press, 2019).

⁴ <https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/heliocentric-theory#:~:text=The%20heliocentric%20theory%20argues%20that,of%20ancient%20Greek%20philosopher%2Dscientists.>

⁵ See, for example, Daniel Smith et al, "Cooperation and the evolution of hunter-gatherer storytelling," *Nature Communications*, DOI: 10.1038/s41467-017-02036-8

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- ⁶ Beau Lotto, *Deviate: The Science of Seeing Differently* (New York – Boston: Hachette Books, 2017), 121-2.
- ⁷ Richard Kearney, *On Stories* (London-New York: Routledge, 2002), 140.
- ⁸ I am grateful to David Lose for this example, “Imagination and Preaching,” in *A Handbook for catholic Preaching*, ed. Edward Foley (Collegeville: Liturgical Press, 2015), 190.
- ⁹ George Bernard Shaw, *Saint Joan* (New York, Penguin Classics, 2001), 59.
- ¹⁰ <https://www.forbes.com/sites/maseenaziegler/2014/09/01/how-we-all-got-it-wrong-women-were-behind-these-7-famously-inspiring-quotes/?sh=298f407e1016>
- ¹¹ Victoria Oleynick et al., “The Scientific Study of Inspiration in the Creative Process: Challenges and Opportunities,” *Frontiers in Human Neuroscience* 8 (2014) article 436, e creative process: Challenges and opportunities. *Frontiers in Human Neuroscience*, 8, Article 436. <https://doi.org/10.3389/fnhum.2014.00436>
- ¹² The following paragraphs draw heavily upon Todd Thrash and Andrew Elliot, “Inspiration as a Psychological Construct,” *Journal of Personality and Social Psychology* 84:4 (2003) 871-889.
- ¹³ <https://www.cnn.com/2022/02/18/sport/cool-runings-tal-stokes-jamaica-winter-olympics-intl-spt/index.html>
- ¹⁴ <https://ieeexplore.ieee.org/document/9262150>
- ¹⁵ Wes Jackson, “Toward an Ignorance Based Worldview,” *The Land Report* 81 (2005) 14-16. Online at <https://landinstitute.org/learn/land-report/>
- ¹⁶ The following paragraphs are reliant upon the TED talk by the neuroscientist Stuart Firestein, https://www.ted.com/talks/stuart_firestein_the_pursuit_of_ignorance
- ¹⁷ “Shaw and Einstein Speeches,” *New York Times* (29 October 1930) page 12, column 3.
- ¹⁸ What follows is largely from Beau Lotto, *Deviate*, pp. 8-11, 247-8.