

Meme-Splicing: Promoting in Science Virtues and Behaviors Traditionally Associated with Other Cultures

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Abstract

In this paper I ask “What do other cultures do well that Science could learn lessons from?” and I find a rich vein of examples in Religion where many traditionally extra-scientific activities practiced and different virtues are stressed. I present the results of exercises where I have envisioned a culture of Science engineered to include these elements. I see that it could be possible to have a Science with: a strong emphasis on the personal; an emphasis on the practice of faith (as willful exercise and learning tool); and the incorporation of ceremony, liturgy, and possibly even godless prayer. The need for a new or improved subjective language is identified and open questions are then raised about: the appropriateness of incorporating these behaviors and virtues in Science; and the ways religious or other memes could be spliced into the scientific code. Underlying this paper is the long view of cultural development, fifty years ago C.P. Snow agitated for a change in non scientific cultures, I am advocating a revision of our own scientific culture to ensure that it can thrive fifty years into the future.

Let us Prey

“We, who long to behold the pre-established harmony, devote ourselves with inexhaustible patience and perseverance to the problems of our Science, and divert ourselves not into more grateful and more easily attained ends.

We wish for the state of mind of the worshiper or the lover. May our daily effort come straight from the heart, with no need for deliberate intention, willpower or discipline.

May the love of knowledge which surpasses all understanding continue to illumine our path and lead us to the solution of our most important problems, which others have posed and done so much to solve.”¹

Amen

Oxford, we have a problem

I believe in Enlightenment Science² and would like it to be thriving fifty years from now, but I fear that it is in danger and that the time available for defending it is quite short. We are now

¹ This is an adaptation of text in an address given by Einstein at the celebration of the 60th birthday of Max Plank in 1918. It is published on page 227 of Einstein, Albert. 1954. *Ideas and Opinions*. New York: Crown Publishers Inc.

² I use “Enlightenment Science” to imply a commitment to the personal search for a single consistent understanding of the outer material world, the inner world of thought, and the worlds of communication. If science is simply knowledge generation then a consistent worldview is not necessitated.

fifty years from C.P. Snow's *Two Cultures*³ and in another fifty years Enlightenment Science could be all but dead. My pessimism is fueled by observations that large segments of American society, including many scientists, are turning away from scientific enlightenment towards superstitious beliefs, unexamined pragmatism, or both. We remember Snow for his cultural advocacy and like Snow I advocate for cultural change, but unlike Snow I would like to see changes made to the culture of Science itself. I doubt that an Enlightenment Science of today's model is sustainable over a fifty year time scale so I propose designing a more resilient culture that emphasizes the unity of Science and Philosophy, claims meaning, moral voice, the right to political action, and is made more spiritually attractive through the adoption of many religious activities and attitudes.

Our centralized funding system provides heavy subsidies for cutting edge research and education that supports it because our society, the military, and industry see benefits in the technology it delivers. Philosophical and enlightenment aspects of Science have been carried through a cultural momentum that offers little guarantee for the future as increased focus is placed on funding projects likely to pay back in the fairly short term. Without these aspects, Science will become more pragmatic and lose its credibility as the magnificent search for truth. Such a weakly philosophical Science will be seen as dry and unappealing to the general public and the enlightenment movement in Science will be all but over. A slide in credibility is already occurring in America as witnessed by the recent (9th July 2009) Pew center data that shows a ten year decline from 47% to 27% in the number of Americans volunteering "*scientific advances*" as one of the country's most important achievements.⁴ Other worrying signs are the difficulty faced in recruiting individuals to careers as scientists and the lack of belief in evolution in America⁵. These problems are likely to grow over the next fifty years as Science and technology advance and personal connections to Science and the pre-technical world are lost and not replaced.⁶ The vast majority of people in future generations, will not be able to understand the fundamentals of their new technology, and it will become increasingly difficult to see past technology to the underlying Science. I fear that we are about to lose the enlightenment and enter another time where dangerous, inconsistent, and erroneous ideas flourish; another time of magical thinking.

Enlightenment Science will not only lose academic territory to pragmatic, results oriented engineering, but individual scientists will feel less pressure to seek a consistent world view and Science will become corrupted by self-contradictory world views, such as that of Polkinghorne⁷,

³Snow, Charles. 1959. *The Two Cultures and the Scientific Revolution*. Cambridge: Cambridge University Press

⁴ Pew Research Center for the People & the Press. Public Praises Science; Scientists fault Public, Media Scientific Achievements Less Prominent Than a Decade Ago. Pew Research Center for the People & the Press. <http://people-press.org/report/528/>.

⁵ 32% of the public and 87% of scientists "*Think that humans, other living things have evolved due to natural processes*". Pew Research Center for the People & the Press. Public Praises Science; Scientists fault Public, Media Scientific Achievements Less Prominent Than a Decade Ago. Pew Research Center for the People & the Press. <http://people-press.org/report/528/>.

⁶ I was born in 1963 and I feel a connection directly, or through others, to the advent of the twentieth century technologies and to the science behind the engineering. For example, I could take apart almost all the manufactured objects of my childhood and my "Great aunt Elizabeth" told me of a time before motor cars and what she uniquely termed "motor roads".

⁷ John Polkinghorne, is a theist and was a physicist at Edinburgh and Cambridge Universities. Polkinghorne can be forgiven to a large extent because he very actively struggles to interconnect his two conceptual structures.

that include both a theistic god and a belief in Science, what we could term “Theo-Science”. Engineering can encroach because it offers the same pragmatic rewards as Science but without the additional costs associated with blue sky research and rigorous philosophical questioning. Theo-Science will corrupt because it offers the same claim to seek truth without the additional costs of consistency. These two threats to Enlightenment Science are very much in progress already. The distinction between Science and engineering is getting less often stressed. Even amongst university faculty, I often hear “Science” and “engineering” treated as synonyms, or one used incorrectly as a substitute for the other. In the last few years, I have started to hear more references to STEM (Science, Technology, Engineering, and Math) run together into a single concept. The grouping has acquired an identity and funding all of its own. For example, the latest issue of the Connecticut Science Teachers Association Newsletter followed a page about the Carnegie Corporation report on transforming Math and Science education, with a note that the report would “... greatly affect how *STEM* is brought to and taught in the classroom.”⁸ This is a reversal of traditional priorities. The current extent of the Theo-Science is demonstrated by the almost casual acceptance of the idea that scientists can, without any mental distress, hold anti-scientific religious beliefs. This is evidenced by the recent Pew research center survey that shows that 87% of American scientists “*Think that humans, other living things have evolved due to natural processes*”.⁹ This shows that 13% of American scientists are not aligned with one of the most proven scientific theories. The only explanation that I can conceive, is that the missing 13% dismiss evolution because they hold anti-scientific theistic religious views. This 13% is not the full measure of Theo-scientists in America because many of them accept natural evolution. If a god being “personal” corresponds to interference in the measurable world then this troubling contradiction is less prevalent in the group of scientists that Larson and Witham separated out as “greater” or higher achieving.¹⁰ American scientists have the largest proportion of theo-scientists in the developed world but there are probably large proportions amongst other subgroups such as Taliban scientists.

To ensure that a scientific culture can survive the next fifty years, I advocate a thorough self-examination of what we perhaps naively assume Science is and Science does. I advocate meme-engineering Science to make it a more “spiritual” philosophical activity that is fully grounded in subjective inner world experiences, in addition to its well established grounding in the external material world. I don’t want any of our current rigor lost, but I do advocate poaching some of the best traits of other cultures and adding them as memes to our existing scientific code. I have in mind the religious emphasis on personal experiences behaviors and virtues, their richness of culture, and their meaningfulness and moral political voice. I point to some justifications by reference to the following modern or contemporary thinkers. I recognize: Pierre Duhem¹¹ for his thesis of holism; Willard Van Orman Quine¹² for his advocacy for holism in the unification of

⁸ Delehant, Ray. 2009. “*Carnegie Corporation Issues Report on Transforming Mathematics and Science Education*.” Connecticut Science Teachers Association, Inc. Newsletter, Volume 57 No. 4 June.

⁹ Pew Research Center for the People & the Press. Public Praises Science; Scientists fault Public, Media Scientific Achievements Less Prominent Than a Decade Ago. Pew Research Center for the People & the Press. <http://people-press.org/report/528/>.

¹⁰ Larson, Edward J. and Witham, Larry. 1998. Leading scientists still reject God. *Nature* 394: No. 6691: 313

¹¹ Duhem, Pierre. 1954. *The Aim and Structure of Physical Theory*. Princeton: Princeton University Press.

¹² Quine, Willard. 1960. *Word and Object*. Cambridge: Massachusetts Institute of Technology Press., Gibson, Roger. 2004. *The Cambridge companion to Quine*. Cambridge: Cambridge University Press.,

natural Science and Philosophy; Daniel Dennett¹³ for his arguments for the utilitarian use of beliefs, thinking, and intention stances of others; Albert Einstein¹⁴ for his observations on the generation and sustaining of meaningfulness; and Hannah Arendt¹⁵ for her analysis of thinking and the generation of moral stance and thereby political action.

If Science is not perceived as a more spiritual endeavor then I expect that fewer and fewer individuals will turn to Science for philosophical or psychological rewards. The culture of Science should take this threat very seriously indeed. This puts Enlightenment Science in a tight spot. It needs to become more spiritual while remaining true to its anti-theism.¹⁶ Given the strong social pressures not to criticize religious views and the strong prejudices, at least in America, against atheism, it will be hard to sell any anti-theistic culture. But I believe that it can be done by stressing that Enlightenment Science is not anti-deistic and can in fact be pro-spiritual. Einstein sets a great precedent having been an atheist,¹⁷ an enlightenment scientist, and also a passionate deist/Spinozian/pantheist.¹⁸

Over the next fifty years the costs of having scientists at the cutting edge will become increasingly restrictive in both societal¹⁹ and individual²⁰ terms and I believe that our current centralized funding is likely to be severely cut back. Scientists need to ensure that their culture can survive. The current culture of Science thrives because it is well adapted to centralized funding with many behaviors strongly directed by the pursuit of a single goal, namely the generation of new knowledge. One consequence is that recruitment is focused on those in the high school or early college population who can be educated as specialists, while amateurs,

Orenstein, Alex. 2002. *W. V. Quine*. Princeton: Princeton University Press.

¹³ Dennett, Daniel. 1987. *The Intentional Stance*. Cambridge: Massachusetts Institute of Technology Press.

¹⁴ Einstein, Albert in the article "Science and Religion", pp21-30 of Einstein, Albert. 1950. *Out of my later Years*. New York: The Philosophical Library Inc.

¹⁵ Arendt, Hannah. 1971. Thinking and Moral Considerations: A Lecture. *Social Research* 38/3 Fall: 417-46

¹⁶ What we might call the underlying assumption of science, namely that we find ourselves in a steadily consistent predictable material world and Einstein's first postulate of special relativity, that "*The laws of physics are the same in every inertial reference frame.*", leave no place for the laws to be broken by any intermittent inconsistent interference from the supernatural. They do not deny the existence of the supernatural, but they limit it from any interaction with the natural.

¹⁷ Einstein's writings are rife with rejections of theism, albeit one Nazi propagandist did report Einstein as saying that he was "*not an atheist*", a quote that has been amplified by journalists and other writers such as Walter Isaacson. For a less populist account see for example the discussion beginning on page 18 of the biography Clark, Ronald. 1971. *Einstein: The Life and Times*. London: Times Mirror.

¹⁸ This distinction between "theist" and "deist", expressed from the Christian perspective by John S Spong, the Episcopal (Anglican) Bishop of Newark, New Jersey in chapter three of Spong, John. 1998. *Why Christianity Must Change or Die: A Bishop Speaks to Believers in Exile*. San Francisco: Harper Collins., and in E O Wilson in his Wilson, Edward. 1998. *Consilience: the Unity of Knowledge*. New York: Knopf., which on p32 describes a deist god as "... a Creator obedient to His own natural laws..."

¹⁹ The UK and US cancelling of funding for the International Linear Collider (ILC) in 2007 showed the limits to funding available even to consortiums of major economies. Experimental particle physics may simply stop, with the Higgs boson the last particle that we buy.

²⁰ It currently takes about a decade to learn enough mathematics and science to make a contribution at the cutting edge of physics. As the quantity of learning increases and as more and more subjects become increasingly cumulative then we will approach a limit to science established by the capacity of the individual. Before we reach that limit, the perceived costs and benefits of a career in science will discourage all but the most courageous individuals.

career changers, and the non-brilliant do not receive anywhere near the same amount of resources. This is in direct contrast to the culture of the Religions that extends a warm welcome to all people of all ages. Unfortunately, the adaptations that are good for us now could threaten our survival should centralized funding dry up. I believe that scientists should consider ways to adapt Science to a fee for service model, and that we should learn from Religions that do not sustain themselves on central funding delivering cutting edge Theology. Religions are attractive to a very wide client base and then pay for themselves from the collection of fees for services provided regularly throughout the whole life of the client.

A Philosophical Science has a unique service to offer, namely the honest search for intelligible truth.²¹ The market demand exists in the fundamental human need to pursue the search for truth. Unfortunately there are some memes in today's culture of Science that will hamper it. Science is exclusive, harsh in its discipline and judges humans by very narrow criteria.²² Its resources are skewed towards knowledge generation rather than education focused on the widespread appreciation of Science as a culture. Broadening the client base is already a movement underway but we could do more to make Science less exclusive and to demonstrate the human social and emotional benefits of being free thinking realists who indulge in a passionate search for knowledge. The image of Science as a service industry may seem very futuristic but it may become necessary. I believe that it will be possible and I suggest that Al Gore's "An Inconvenient Truth" movement is an example where we can see Science being proselytized and sold fee for service on a crusading model.

A Philosophical Science also operates with the full spectrum of human activities. It does not put a false separation between our inner world of feelings and emotions and our professional life; rather, it validates and promotes it. Personal experiences, such as faith, wonder, and the enjoyment of the mystical, can be recognized as professional activities.

The following sections describe a selection of possible changes. I began this paper with one example: the atheist's prayer. That is partly in jest and partly an attempt to see just how far we can push the envelope. My second example, beginning the main text with an explicit statement of belief, is more serious. I am advocating for the greater use of subjective language and the communication of states of mind and intentions as part of our Science discourse. The use of prayer and subjective language may never find wide spread use in Science, but they have good precedents: my prayer is adapted from Einstein's text that is all but a formal benediction²³ and Newton began his Opticks with his personal expression of volition: "My Design..."²⁴.

²¹ I use the phrase intelligible truth to exclude that sense of "truth" that is in the feeling of reality through experience. I perceive truth in that sense to be accessed through the arts not science, and I see Religion as one of the arts.

²² The tragedy of this narrow attitude can be read into the suicide of Ehrenfest. Gilder, Louisa. 2008. *The Age of Entanglement: When Quantum Physics was Reborn*. New York: Knopf., gives a powerful account, citing his suicide note complaining of finding it "... ever more difficult for me to follow developments with understanding. After trying, ever more enervated and torn, I have finally given up in DESPERATION. ...".

²³ Einstein, Albert. 1954. *Ideas and Opinions*. New York: Crown Publishers Inc. on page 227 quotes Einstein's original text: "The longing to behold this pre-established harmony is the source of the inexhaustible patience and perseverance with which Plank has devoted himself, as we see, to the most general problems of our science, refusing to let himself be diverted to more grateful and more easily attained ends. I have often heard colleagues try to

Traditionally Religious Behaviors in the Service of Science

The following is a selection of traditionally religious acts that might be beneficial to Science. Whether behaviors such as these should be introduced into Science is an open question.

Emphasis on the Inner Life

The communication of subjective, inner world, experiences of doing Science is pathetic in comparison to the richness of that communication in Religions. The subjective is usually driven out of scientific writing early in a scientist's career with pressure applied to have the scientist write in the third person.²⁵ The working assumption that Science is objective acts to suppress, if not eliminate, the subjective from our discourse. There are pragmatic reasons for treating Science as objective; it certainly offers a shorthand for communication. But this objective image is false²⁶ and that falseness may end up severely damaging the culture of Science. I believe that innocent sounding statements such as: "*A black oblong stiff Paper was taken ...*" gives an implicit but false indication of objectivity, and this puts the writers and the culture of Science in an awkward position. I believe that the real costs to this small white lie are large and mounting. Over the last century or two this philosophical sleight of hand was easily overlooked as it was overshadowed by the ridiculous religious claims of young-earth creation and the earth centered universe. The recent evolution of western Religions away from making false and falsifiable statements removes this distraction, and as with the emperor's new clothes, this philosophical deceit will be seen through. And, as in the fairy story, it will be seen through by children's eyes. Therefore I advocate greater subjectivity in Science writing, and most particularly in the scientific reports that we ask our children to write. I suggest that a statement such as "*I took a black oblong stiff Paper ...*" is more honest and is perfectly acceptable Science writing.²⁷

Reformatting our Science education to build consistently on personal subjective experiences requires a reemphasis on subjectivity in Science writing. We can turn to Religions for many fine

attribute this attitude of his to extraordinary willpower and discipline – wrongly, in my opinion. The state of mind which enables a man to do work of this kind is akin to that of the religious worshiper or the lover; the daily effort comes from no deliberate intention or program, but straight from the heart. There he sits, our beloved Plank, and smiles inside himself at my childish playing-about with the lantern of Diogenes. Our affection for him needs no threadbare explanation. May the love of science continue to illuminate his path in the future and lead him to the solution of the most important problem in present-day physics, which he has himself posed and done so much to solve. May he succeed in uniting quantum theory with electrodynamics and mechanics in a single logical system."

²⁴ Newton, Isaac. 1704. *Opticks: or a Treatise of the Reflexions, Refractions, Inflexions and Colours of Light*. London: Royal Society., begins "*My Design in this Book is ...*"

²⁵ For example, McClure, Craig. 2009. Introducing Scientific Writing to Students Early in Their Academic Careers. *Journal of College Science Teaching*, National Science Teachers Association, Volume XXXVIII issue 6 July/August: encourages writing in the third person.

²⁶ TS Kuhn stresses his agreement with Karl Popper in this regard. Kuhn writes "... *Sir Karl and I are united in opposition to a number of the most characteristic theses of classical positivism. We both emphasize, for example, the intimate and inevitable entanglement of scientific observation with scientific theory; we are correspondingly skeptical of efforts to produce any neutral observational language...*" from Kuhn, Thomas. 1970. *Criticism and the Growth of Knowledge*, Ed. Imre Lakatos, and Alan Musgrave, Alan. ed. I. Lakatos and A. Musgrave. Cambridge: Cambridge University Press.

²⁷ These are the words that Isaac Newton used to start his descriptions of his experiments in *The First Book of Newton, Isaac. 1704. Opticks: or a Treatise of the Reflexions, Refractions, Inflexions and Colours of Light*. London: Royal Society. Part I.

expressions of the inner life. It would also require bringing forward more sophisticated ideas about the Philosophy of Science. In my personal education, I was fed a false objectivity until my second year at university. At that point, I began to learn about theory laden observation through the works of Kuhn²⁸, Feyerabend²⁹ and later others³⁰. I consider myself fortunate to have shoehorned some Philosophy of Science into my undergraduate curriculum; the vast majority of my physics peers in did not have space in their curriculum to receive any formal education in Philosophy. I believe that early education in Philosophy and describing the foundation of our knowledge in deeply subjective terms will greatly enrich Science and make it more honest.

Explicit Exercise of Faith

Science is a belief system built through the exercise of faith³¹ as well as the widely recognized elements of reason and experimentation. Every time a scientist says “let ...” or “if ...” or “assume ...” there is an invitation to exercise faith, and it is exactly this use of faith that enables the flexibility of thought that is necessary for scientific discovery. Einstein is well known for his thought experiments, and in that sense he was a man of great faith.³² At times, a scientist has to accept a great deal on faith in order to allow themselves to think through ideas that may be in deep conflict with their core beliefs.³³ While faith is a central tool in Science, we barely, if ever, mention it and I know of no cases where techniques of using faith are explicitly taught in Science.

The religious talk about faith explicitly and employ many faith building exercises. They propose ideas that demand a great deal of faith, the more ridiculous the idea being considered, the more faith has to be exercised. For example, the creationism movement demands extremely strong willful acts of faith. The methods used to exercise faith include proposing anti-scientific ideas publicly in venues where no disagreement is brooked. Being present and silent at such an event can imply a tacit agreement with what is being proposed. This is reinforced by encouraging individuals to make a public profession. In Christian churches this is performed through adult baptism, the public conversions in the low churches, and the public eating and drinking of human flesh and blood. Religions often discourage the testing of key ideas. This taboo serves two

²⁸ Kuhn, Thomas. 1962. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

²⁹ Feyerabend, Paul. 1981. *Realism, Rationalism, and Scientific Method: Philosophical Papers, Volume 1*. Cambridge: Cambridge University Press.

Feyerabend, Paul. 1981. *Problems of Empiricism: Philosophical Papers, Volume 2*. Cambridge: Cambridge University Press.

³⁰ Churchland, Paul. 1988. *Matter and Consciousness: A Contemporary Introduction to the Philosophy of Mind*. Cambridge: Massachusetts Institute of Technology Press.

³¹ I use “belief” to imply a deeply held assumption that can be seen from one’s unconscious actions, whereas I use “faith” to name the mentally demanding activity of holding an assumption. Thus one would assume that any belief was unshakable but would qualify the word faith with an indication of the strength, such as in “unshakable faith”. In preparing this paper I have become aware that the meanings for “belief” and “faith” are mixed and various.

³² TS Kuhn provides an analysis of thought experiment in his A Function for Thought Experiment, L’aventure de la science, Melanges Alexandre Koyre Hermann, Paris, 1964, 2:307-34, and reprinted as chapter 10 of Kuhn, Thomas. 1977 *The Essential Tension: Selected Studies in Scientific Tradition and Change*. Chicago: Chicago University Press.

³³ This occurs in the normal steps of scientific education, such as switching an oversimplified image of the atom for a more sophisticated one or in the large structural “revolutionary” changes noted in Kuhn, Thomas. 1962. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

purposes, it avoids juxtaposing the ideas with contrary evidence, a proximity that could make the ideas ridiculous, and on the other hand this taboo avoids demonstrating the reliability of the idea (ironically validating the idea destroys faith by developing belief). Religions also reinforce faith by emphasizing the pleasures humans get from contemplating something mystical.

Scientists should seek ways to improve our use of faith as a tool in Science. As the business world employs trust building exercises, so Science could use faith building exercises. These do not have to be invented from scratch; they could be developed from those used in Religions. This could include: the regular exploration of unbelievable ideas, albeit on an explicitly temporary basis; the deliberate practice of avoiding the immediate and obvious testing of ideas, and the deliberate celebration of wonder at mysteries. Science could emphasize these practices publicly and in Science education. Lewis Carroll might have been thinking along similar lines when he invented the White Queen who practiced for half an hour a day and sometimes believed six impossible things before breakfast.³⁴

Meditation

Meditation is a willful attempt to control one's own thinking in the short term usually done by minimizing external stimulus and having a single central mental focus. The religious goals of meditation, such as emptying the mind of thoughts, or hearing the voice of a god, are not appropriate goals for Science. But the practices of meditation make one aware of mental experiences not usually noticed in the clutter of normal thinking and could be used to enhance the skills used in Science for the control of the thinking processes. I believe that many of the mental processes are similar to those of scientific problem solving but there is an enormous gap between the descriptions used by scientists to describe their inner experiences and the descriptions used by proponents of religious meditation; the former being basic and perfunctory and the later being flowery, poetic, and flighty.³⁵ A clear articulation of these experiences building on examples of experiences common to scientists would be a major task but would be useful to scientists who wished to put in words what they already do. Elements of religious meditation techniques could be adapted for use by scientists to improve their mental abilities and self awareness.

Some religious meditations are used to co-opt the personality traits of another. Notably, some Christians meditate with the intent to become more like Jesus. This involves empathizing with an imaginary friend. This is a mind game disturbingly close to delusional thinking, but it might be possible to practice it skeptically as a technique for developing empathy, or for gaining insights into someone's thinking. Perhaps scientists could meditate on Dennett and receive insights into his thinking that cannot be found by consciously asking "What would Dan do?"

³⁴ Dodgson, Charles (Lewis Carroll). 1871. *Through the Looking-Glass, and what Alice Found There*. London: Macmillan

³⁵ For teachings on meditation that are approachable from a naturalistic perspective I recommend those of Eckhart Tolle, such as in his popular book: Tolle, Eckhart, 1999. *The Power of Now: a Guide to Spiritual Enlightenment*. California: New World Library.

Prayer

Prayer is a personal or communal act of willfully directing intention. The prayer may or may not be articulated. When not articulated then prayer is very similar to meditation. Traditional concepts of prayer are associated with a belief in the supernatural. However, a broad naturalist interpretation of prayer would be recognized in many of the consciously willful acts we practice in the secular world. Designing our architecture and consciously selecting our clothing are forms of unarticulated (non-verbal) prayer. Writing a diary, a poem, or giving a key note address (apologies to Dawkins)³⁶ are forms of verbal prayer.

Prayer also offers a unique opportunity to travel both inside and outside one's mind in the same moment. It is an instant of both subjectivity and objectivity. So the techniques of prayer allow one to think, express and respond in one package. Thus, in prayer, we hold a moment of Science.

The word prayer is not associated with Enlightenment Science, but this need not remain the case. Science includes conscious willful acts of directing our intention, so the question is not so much whether prayer is used in Science, as much as it is whether or not Science would benefit from naming these acts as prayers. Explicitly using the word "prayer" would raise our consciousness about our willful activities and it would be a tacit invitation to model some scientific acts on established religious behaviors. I believe that a significant benefit to the culture of Science would come from demystify the acts of praying.

Vague Languages

Science seeks exact language, with mathematical functional equations being the ultimate form. Frustrating this ideal is fact that no scientific concept exists in isolation. In fact, the rigorous mathematical statements only have meaning in a web of related ideas and experiences, and to teach any one concept is to teach the web of connections that arise in the mind when the concept is used. This is a highly parallel system which Science tries to document using serial languages (English) with supplemental use of equations and diagrams. In the use of written or spoken language, the scientist usually tries to be unambiguous. If we compare this to religious expressions, we can see that we are missing out on a plethora of other forms of communication. We can ask, what are the scientific equivalent of psalms and parables, poems and allusions, inferences and connotations, and where, in Science, do we expound on word origins? Religious expression is rich in a way that reflects the tremendous richness of the human mind. Many of these practices could be adapted to the benefit of communication in Science. Some attempts are being made such as by Pangratios Papacosta at Columbia College, Chicago and I offer my attempts with this poem.

Towards the Highlands³⁷

Down in the foggy bottom amongst bogs and trees,
with thickets, hedgerows, and wheel rut roads,
we drink the local lore and sing about our plans
Then casting about as merry men

³⁶ Richard Dawkins gave the introductory address at the Summer 2009 Oxford Round Table

³⁷ Griffiths, Matthew. 2009. *Towards the Highlands*. Collection of the author.

we steer each other through meandering middle ways
To send a noble few
to clamber and climb
to scrape about on bare rock
searching surfaces on craggy peaks
drawing with critical acuteness and clarity every heavy breath
for there are no paths, no friends, no singing
so near the goals so far
from mud and flavor

Culture, Celebration, and Community

Religious experiences are rich with culture. The high church has carefully constructed acoustics, the smells and bells, the flickering candles, the architecture, alters, robes, processions, carvings, music, psalms, hymns, the liturgy, greetings, after church meetings, baptisms, visits to the sick, requiems, burials, and the cyclic seasonal rebirth. The rites and rituals are high theater; they invoke strong and subtle emotions, and are rife with expressions of empathy and sympathy. Many elements, particularly the repetitive ceremony and cyclical calendar, reassure and instill comfort. Religions construct both physical environments and occasions where the rich culture is experienced. Similarly, the Arts have their written, musical, visual, and performance masterpieces. Science, by contrast has a little more than Orson Welles' "*cuckoo clock*".³⁸ There are nice photographs of our tools or of our samples, for example, sextants and space rockets, or crystals and supernova. But there is precious little art that actually *contains* Science. Notable exceptions are Tufte's books such as "*The Visual Display of Quantitative Information*"³⁹, the Cathedral-like Science Museum, the *San Francisco Exploratorium*, and the physics cartoons by Paul Hewitt. Great as all these exceptions are, there is no comparison between the cultural richness of the Religions and the cultural richness of Science.

If Science is to thrive, and particularly if it going to survive as a cultural service provider, then it should embrace artistic behaviors, wherever possible integrating them with genuine scientific content. If we look to Religions for guidance, then we see culture celebrated at a range of scales, not only with cathedrals and pilgrimages, but with more humble local parish churches that have weekly schedules and the regular communion amongst individuals. Creating behavioral equivalents is a challenge because the natures of the psychological rewards of Science and Religion are so very different. In Science we hunger for new and personally relevant information and are dismissive of the repetitive and the old. Religions on the other hand, can pleasure themselves through repetition and familiarity. But this should not stop us from deliberately enriching our Science with culture, creating the equivalents of religious ceremonies and liturgies. As an example, consider the farmers' market in my village. It is a popular, volunteer attendance, pay for service, weekly event that includes a seed corn of intellectual scientific stimulation in the form of handbills explaining organic farming, sustainability, renewable energy, yoga, and ecology. It is also rich with live music, and flowers, and we even break bread and sample olive oil together.

³⁸ I owe the basis of this joke to Orson Welles as Harry Lime in Graham Greene's 1949 film "The 3rd Man".

³⁹ Tufte, Edward. 1983. *The Visual Display of Quantitative Information*. Connecticut: Graphics Press.

Religious Virtues in the Service of Science

“A skillful teacher ... is committed to knowing each learner and how he or she is perceiving input and constructing understanding. Much like a minister, the “virtuous” teacher listens and cares about the learners and brings them closer to understanding.”⁴⁰ I believe that many virtues are practiced in Science, but that the culture of Science could be improved by increasing the emphasis on the virtues it demonstrates and by adopting some virtues that are strongly emphasized and actively propagated by other cultures. The following virtues are strongly emphasized by Religions but essentially ignored in Science; I offer them as candidates for adoption in Science, but I do not mean to imply that this is a comprehensive list.

Empathy and Presence

In researching for this paper, I went back into the lab; to be specific I went to The Episcopal Church of Old Lyme. One of my key observations was the repeated use of shared emotional experiences. This is very different from the teaching of Science which refers to concepts and reasoning but ignores the emotions. There is, however, a growing recognition of the emotional element in Science. It is growing slowly and growing piecemeal; recognized when teachers are described as having “presence” and when scientists are called “sympathetic”.

It is hard to imagine a minister of Religion who is not alive to, and emphasizing with, the struggles and the joys of the person he or she is ministering to. This virtue is well used in many Religions and actively developed by some of their practices. I believe that by embracing emotion and by emphasizing the practices of empathizing and having presence, we can significantly improve our culture of Science. Do you feel that too?

Humility

The year that CP Snow was giving his Two Cultures address, Lord Kelvin was quoted at the beginning of the then new *“University Physics”*⁴¹ text book as saying: *“I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the state of Science, whatever the matter may be.”* Although the tone of this quote may lack humility, I believe that the pinnacle of human achievement is the cemented edifice built of measurable quantities and exact mathematical relationships. However, I also believe that there is much more to Science than that, and more to non-numerical thought than Lord Kelvin allows. Half a century later the quote from the Lord has been removed and replaced by the much gentler statement *“... we usually use numbers to describe the results of measurements.”*⁴² In dropping the original quote, the textbook editors exhibit a greater degree of humility.

The public does not have much tolerance for an arrogant culture of Science. Therefore I do not believe that scientists should rest on their laurels, believing that they will always be useful and

⁴⁰ From a personal communication from Liz Buttner, Science Specialist at the Connecticut State Department of Education.

⁴¹ Sears, Francis and Zemansky, Mark. 1949. *University Physics*. Cambridge: Addison Wesley. 1st edition.

⁴² Young, Hugh, Freedman, Roger, 2000. *Sears and Zemansky’s University Physics*. Cambridge: Addison Wesley Longman. 10th edition, page 3.

therefore needed and valued by society at large. In CP Snow's day Science could get away with hubris and arrogance as it was still widely seen as the provider of objective truth. Now that the scientific claim to truth is muted and its claim to objectivity in tatters, the perception of arrogance could be the Achilles' heel for Science. The need to speak strongly but with humility is a real bind for Science. How can one say that creationism is a load of rubbish while maintaining both humility and a sense of perpetual skepticism? Perhaps the answer is in using subjective statements; it is humbler to state "*I saw ...*" than the presumptuous "*It was seen that...*". Perhaps we should moderate the extent of our humility to match the humility of others that we may disagree with.

Caring

Scientists care, but caring is done more obviously, perhaps ostentatiously, by the religious. It is demonstrated in their use of empathy, and developed by their careful control of emotion. Perhaps ways could be found to increase the emphasis on caring in the culture of Science. We could deliberately notice and comment on our emotions, and communicate them to others. I see the virtue of caring playing a significant role in the way that the general public perceives scientists. We have some great role models. We can emphasize Einstein and deemphasize Lord Kelvin. The future of Science will depend on the public perception of Science and that adopting a more caring attitude will be key to the future success of Science. It might be that Einstein's biggest contribution to physics in the long run will not be any of his theories but his breaking the stereotype of the uncaring scientist.

Living by ones Personal Values

We all have "values" that help us determine the balance of time between family and work, socializing and solitude. The cultures of Religions and the Humanities are very good at expressing these values and making them conscious guides to daily life. Our scientific culture has values too, but we have much less of a public discussion of them and therefore I expect that we tend to operate in our daily lives with less conscious attention to them. If I compare myself to those Christians that follow Jesus' values of love and forgiveness, I see very similar values being held. However, the cultures of the religions promote discourse on such personal values but the culture of Science, by not promoting discourse, gives the impression that these values are outside the professional realm of Science. This Oxford Round Table is rare in providing a forum where expressing personal values is promoted in a professional setting.

The validation of one's personal values as part of one's professional life is very important. Members of the public who are weighing up competing cultures may well get the sense that religious cultures offer more comfort by being "values" cultures, while Science is seen as more hostile by not offering this comfort. Science is not devoid of references to values. It is creeping in to such places as the introductions to textbooks, in teacher training, and in research mentoring. This is occurring piecemeal; person to person, and in small groups. The long term health of the culture of Science will probably depend crucially on the public perception of its values. Science would be well served by initiating a pre-emptive discussion on the personal values of scientists, and establishing processes for promoting those it identifies as beneficial. Where needed, several of these memes could be deliberately lifted from the Religions. Science could then become known as a "values culture" for more than our existing commitments to honesty, seeking truth, and our willingness to be wrong.

Listening

Scientists use technical languages and often think that if others use them incorrectly then they are wrong. Taking this attitude can immediately alienate a lot of people; oddly, people don't like being told that they are wrong! As an example, I wince when I hear the word "energy" used to describe something that new-age healers believe flows around the body in channels. But if I allow for a completely different meaning from the one that I use in Physics, then I can realize that there may be useful meaning in their statements. If they can heal by using their theories, then I had better accept that as evidence. The virtue that is in play here is that of listening. Religions have a long and good practice of actively listening to people. They allow the user the right to their own language and they assume that someone speaking has something to say. They do not assume that the listener's language is being used and the listener makes the effort to translate. We, who at all costs must preserve the rigorous nature of our technical language, must also learn to listen to what is being said in other ways. This is particularly important in teaching, where a teacher can be incredibly off putting if he or she insists that the student's statements are wrong. Because we may no longer have the luxury of alienating large proportions of the general public, we should listen more actively, perhaps, modeling ourselves on Socrates who acted to bring forward truths from the citizens⁴³. Or in the words of another great teacher, we should suffer little children to come unto us.

Valuing Effort

Effort alone is utterly useless in Science. Perhaps because of this, there is a tendency amongst scientists to pooh-pooh the efforts of others, believing in the value of wit not work. This can be very destructive. It is premised on the idea of Science being only the advancement of knowledge and being dismissive of scientific activities that are not likely to generate new knowledge. Adopting a more positive attitude towards effort will make Science more accommodating to that vast majority of the population. We should value the effort of all those working in Science and we should see them all as scientists. Cutting edge scientists can still be our research heroes but there is a role for others heroes too. Even the inventors of such things as the simplest of steam engines could be called "Heroes"!

A Welcoming Attitude

There is a strong contrast between the welcome given by Science to low achievers and the welcomes given by Religions. Science places great emphasis on hothouse education of those likely to get PhDs and make original contributions to knowledge, whereas Religions genuinely embrace both high and low achievers. Science is a competitive culture, and because of the knowledge generating element, is likely to always need some competition. However, as we look ahead fifty years, the major cultural shifts are not going to take place amongst the tiny minority that can make genuinely original contributions to Science, rather, they are going to occur

⁴³ "Socrates wanted to make the city more truthful by delivering each of its citizens of their truths. The method of doing this is *dialegethai*, talking something through, but this dialectic brings forth truth not by destroying *doxa* or opinion, but on the contrary reveals *doxa* in its own truthfulness. The role of the philosopher, then, is not to rule the city but to be its "gadfly," not to tell philosophical truths but to make citizens more truthful." Arendt, Hannah. 1990. *Philosophy and Politics. Social Research* 57/1 Spring: p.81

amongst the remainder of the public. If Science remains a viable culture, it will need to adopt the virtue of being welcoming.

Thankfulness

The godly have a readymade image to give thanks to, but the enlightenment scientist has no single uber-thankee. Yes we thank our teachers, assistants, parents, siblings, partners, and those that have gone before us. But I suspect that many scientists pride themselves for putting their ideas together, thinking that if no one else will recognize their inner world effort then they will do it themselves. I think that we could learn so much from the religious in this area. We should see that we are not our own creation but that we have benefited immeasurably from circumstance after circumstance. We should be very grateful, and this gratefulness is not a saying of thank you, it is an attitude of thankfulness.

Mystery, Wonder and Awe

Mystery, wonder and awe are great sources of motivation and comfort. They are well recognized as being active elements in science, yet, again, they are pushed to the margins. Science would be a much more attractive activity if these were given higher value and placed more visibly in our professional activities. Einstein has done much to promote these, not only as great practitioner but a great spokesman. He explicitly and repeatedly stated their importance in his life, such as in this statement. "*The most beautiful thing we can experience is the mysterious. It is the source of all true art and science. He to whom the emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead: his eyes are closed. This insight into the mystery of life, coupled though it be with fear, has also given rise to religion. To know that what is impenetrable to us really exists, manifesting itself as the highest wisdom and the most radiant beauty which our dull faculties can comprehend only in their most primitive forms - this knowledge, this feeling, is at the center of true religiousness.*"⁴⁴ I believe that science should build on his example and that scientists should practice these virtues as sources of motivation and demonstrate the pleasures we get as advertisements for our culture.⁴⁵

Respecting the Well Rounded Individual

The final virtue that I stress is the virtue of being a well rounded person. Religions do a good job of respecting the whole person: the parent, friend, person of faith, prankster, car lover, soccer player, working person, and spouse. In Science we value research and mathematical ability. We might reluctantly add teaching, but all else is peripheral. Einstein and Feynman are very attractive role models for Physics, in part, because they were both so well rounded, and for the culture of Science to thrive it should be attractive. I encourage taking this as a meme from Religion and splicing it to the scientific meme-code.

⁴⁴ Einstein, Albert. 1930. What I Believe. *The Forum* 84: 194

⁴⁵ An invigorating description of scientific wonder in the years between the voyages of Cook and Darwin is contained in Holmes, Richard. 2008. *The Age of Wonder: How the Romantic Generation Discovered the Beauty and Terror of Science*. New York: Pantheon

A Call for a New Language of Art Objects Tied to Subjective Experiences

“Science is an adventure of the whole human race to learn to live in and perhaps to love the universe in which they are. To be a part of it is to understand, to understand oneself, to begin to feel that there is a capacity within man far beyond what he felt he had, of an infinite extension of human possibilities ...

I propose that science be taught at whatever level, from the lowest to the highest, in the humanistic way. It should be taught with a certain historical understanding, with a certain philosophical understanding, with a social understanding and a human understanding in the sense of the biography, the nature of the people who made this construction, the triumphs, the trials, the tribulations.⁴⁶” I. I. Rabi, Nobel Laureate in Physics.

In the human/spiritual behaviors identified above and in this quote Rabi, the subjective, inner world experiences are stressed. These inner world experiences are every person’s fundamental experience of Science yet in current practice they are pushed to the margins, barely mentioned in classes or text books, and a certain disdain for discussions of emotions and feelings is endemic in Science. This attitude might have been appropriate in CP Snow’s day when the main tools were poorly understood Jungian and Freudian analyses, but studies of the brain and mind are extremely active now and over the next fifty years I expect that the immaterial scientists will develop extremely useful tools that will break the skepticism of the hard scientists.

Philosophical justifications for using subjective descriptions are already in place. Pragmatic argument suggests that because both objective statements and subjective statements are useful then we should use both. Michael Polanyi has documented the way that scientists use the experiencing of common situations to communicate knowledge tacitly.⁴⁷ Daniel Dennett has justified the ancient practice of inferring the mental states of others through his intentional stance arguments.⁴⁸ Van Ormand Quine justifies the association of words with objects, thus explaining why Science can exist as shared material objects (written or spoken words).⁴⁹ I suggest that the combination of Dennett’s and Quine’s arguments justify the objective expression through words, or other art objects, of subjective experiences.

This could be simply a new language where the symbol (word or other art object) stands in for a distinct subjective experience. For example we could use the word “Eureka” to stand for the moment of scientific understanding. However, I propose going one stage further and selecting art objects that stimulate the inner world experience being referred to. For example, the gestalt switch image⁵⁰ of the cup or faces paradox shown here could be both symbol for and provoker of the inner world gestalt experience. Words can also serve as art objects to provoke the inner world experience.⁵¹



⁴⁶ I.I. Rabi, quoted here from the front page of Cassidy, David, Holton, Gerald, and Rutherford, James. 2002. *Understanding Physics*. New York: Springer

⁴⁷ Polanyi, Michael. 1958. *Personal Knowledge: Towards a Post-Critical Philosophy*. Chicago: University of Chicago Press.

⁴⁸ Dennett, Daniel. 1987. *The Intentional Stance*. Cambridge: Massachusetts Institute of Technology Press.

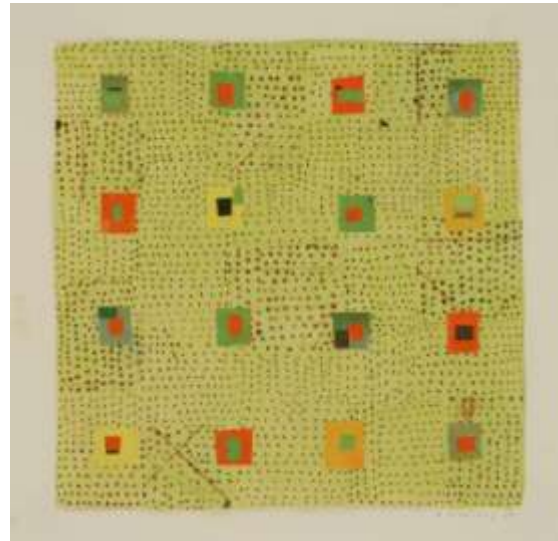
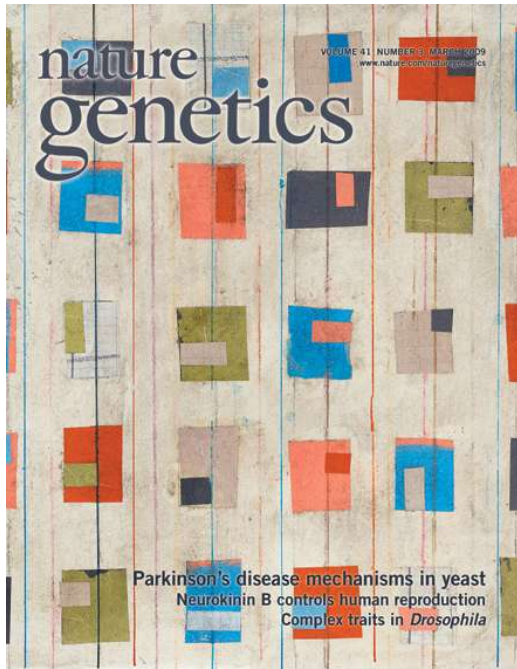
⁴⁹ Quine, Willard. 1960. *Word and Object*. Cambridge: Massachusetts Institute of Technology Press.

⁵⁰ http://en.wikipedia.org/wiki/File:Cup_or_faces_paradox.svg

The inner world experiences of doing Science are subtle. For example, my experience of learning to solve problems in Theoretical Physics was akin to feeling a spooky ghost wave exploring memories of past experiences of mathematical processes. Using the correct mathematical action was triggered by the feelings from these explorations. Compared with the experiences solving theoretical Physics problems, both the “Eureka” moment and the gestalt switch experience are crude and unsubtle. Therefore the art objects corresponding to Physics or Mathematical thinking should be subtle, too. Because, like C.P. Snow, I have the wonderful experience of coming home from scientific work to a world of the Arts, I have been exposed to many visual art objects, and have experienced the ways that they can stimulate very subtle but distinct inner world experiences. Below are two images of my wife’s work, and I hope that the reader can get subtle but distinctly different pleasurable experiences from looking at each, sustained experiences that echo the pleasurable experiences of thinking. The Nature Genetics cover demonstrates that this use of art to stimulate experiences is already used. The visual designer, in this case the person who selects cover art, deliberately chooses an image; this can be representational like a gun on the cover of a spy novel, or purely abstract where there is no literal interpretation of the image. Words and images are easy to put into a paper, but many other forms of Modern Art produce specific inner world experiences.⁵²

⁵¹ A student of mine quite appropriately (and some would say inappropriately too) blurted out “Holy Shit” just after he had struggled through a page of algebra and just as he made the connection to a basic and familiar result. This was not quite a “Eureka” moment, because this student could not quickly playback the page of algebra, but he had had a sudden recognition that the long and hard journey in strange formal and unfamiliar territory had brought him back home. His phrase, taken literally is an extremely good piece of a sonic verbal work of art, language that accurately sums up the inner world experiences of this young man. “Holy” brings to mind the fine robes, the stiff, statuesque figure of the pope, a strange formality and a long pilgrimage, a human journey, and buried forgotten and all but denied is the biological humanity of the journeyer. The scatological exclamation dumps us into the most basic but real element of our biological nature. The tortuous journey returns home.

⁵² As starting points I cite the following artists that have particular resonance for me: in the visual arts Elizabeth Gourelay and Mel Bochner, in fiction Haruki Murakami, in poetry Penny Rimbaud, in dance the Mark Morris Dance Group, and in music Beethoven for emotion and Philip Glass and Steve Reich for more subtle mental feelings.



Above left: Nature Genetics Vol 41 No 3 March 2009 featuring *Medlar Orange* 2008 by Elizabeth Gourlay
 Above right: *Leaf 16* 2009 by Elizabeth Gourlay, Collection of the artist.

To be useful for Science, any language of inner world experience should convey well established common meanings and the effects of the art objects should be repeatable and similar in feeling to the effects of performing a particular scientific task. Asking for such a language to be developed is a huge, if not outrageous, request, but much progress is currently being made on articulating our inner world experiences⁵³ and now is an appropriate time for such a call. We could start with those very important but vaguely understood feelings that provide scientists with their inner world compasses. I have in mind the feelings that occur upon the realization that something is unacceptable to the point of being laughable (reduction *ad absurdum*), the “Eureka” and “Holy Shit” moments referred to before, and other inner compasses, touchstones, that are to be found at the interface between mental processes and their associated feelings. The broader language should contain the rather longer list of words already in use but not well defined, such as: *think, feel, wonder, know, believe, conclude, meaning, understand, explanation, confidence, sure, true, convinced, tentative, emotion, decide, catharsis, reasonable, and ridiculous*. Implementing such a language would require a process of ostensive language learning and should parallel the

⁵³ As examples of recent developments I point to Churchland’s who as a philosopher presents seven paragraphs describing seven salient dimensions of human consciousness, (Churchland, Paul. 1995. *The Engine of Reason, the Seat of the Soul: A Philosophical Journey into the Brain*. Cambridge: Massachusetts Institute of Technology Press.) and from neuroscience, I quote the following description of terminology given by E. O. Wilson in 1998, (Wilson, Edward. 1998. *Consilience: the Unity of Knowledge*. New York: Knopf. p115). I am leaving his original italicization. “What we call *meaning* is the linkage among the neural networks created by the spreading excitation that enlarges imagery and engages emotion. The competitive selection among scenarios is what we call *decision making*. The outcome, in terms of the match of the winning scenario to instinctive or learned favorable states, sets the kind and intensity of subsequent emotion. The persistent form and intensity of emotions is called *mood*. The ability of the brain to generate novel scenarios and settle on the most effective among them is called *creativity*. The persistent production of scenarios lacking reality and survival value is called *insanity*.”

learning of words described by Quine.⁵⁴ As he put it, our associations should be “...*inculcated in the individual by training on the part of society.*” This could be achieved by using associated art objects in much the same way that Science teaching uses effectively standardized lecture demonstrations as ways to inculcate students within the existing paradigm.

What Should We Do?

History shows many twists and turns in the evolution of Science. It appears to be surviving moderately well in its post modern or post-positivist form. But my pessimistic view of the future leads me to suggest some unorthodox changes. Suggesting such acts breaks many of the taboos of Science. For example, political acts such as mine and Snow’s, are commonly regarded as at, or beyond, the edge of professional scientific activities, and there is the oft repeated idea that Science should say what *is*, and not what *ought* to be. I suggest that scientists *ought* to act to promote a resilient scientific culture for the next fifty years. Similarly, I suggest that scientists ought to ask *why* questions, such as: why are scientists not encouraged to say what ought to be? I fear that by not asking such questions we will passively enable the status quo and might bring upon ourselves the stagnation and death of Science. In this, I am echoing what Hannah Arendt wrote about thirty years ago: “*It is more than likely that men, if they were ever to lose the appetite for meaning we call thinking and cease to ask unanswerable questions, would lose not only the ability to produce those thought-things that we call works of art but also the capacity to ask all the answerable questions upon which every civilization is founded.*”⁵⁵

If scientists do ask such unanswerable questions⁵⁶ then Science might justify its moral voice and right to political action on grounds that Arendt has put forward. Arendt describes right and wrong emergent from thinking that asks unanswerable questions.⁵⁷ Following her path requires breaking taboos; it demands that we engage in open-ended creative thinking associated with asking *why*,⁵⁸ and it leads to Science speaking *ought* statements. Where Arendt built moral standing from unanswerable questions, Einstein described a completely different, but oddly symmetric path to meaning. He identified meaning as rooted in the sustaining through tradition

⁵⁴ Quine, Willard. 1960. *Word and Object*. Cambridge: Massachusetts Institute of Technology Press.

⁵⁵ Arendt, Hannah. 1978. *The Life of the Mind*. New York: Harcourt Brace Jovanovich.

⁵⁶ Arendt explicitly separates the open, uplifting thinking from the more deductive thinking-as-knowing that I associate with how questions. She describes the scientific or knowing related thinking as “*such mental processes as deducing, inducing, and drawing conclusions whose logical rules of non-contradiction and inner consistency can be learned once and for all and then need only to be applied.*” Arendt, Hannah. 1961. *Between Past and Future: Six Exercises in Political Thought*. New York: Viking Press. Revised edition, 1968, p. 14.

⁵⁷ Arendt, Hannah. 1971. Thinking and Moral Considerations: A Lecture. *Social Research* 38/3 Fall: 417-46

⁵⁸ Arendt gives the following description of her thinking-as-opposed-to-knowledge in Arendt, Hannah. 1968. *Men in Dark Times*. New York: Harcourt, Brace & World. pp. 205-206 “*This thinking, fed by the present, works with the “thought fragments” it can wrest from the past and gather about itself. Like a pearl diver who descends to the bottom of the sea, not to excavate the bottom and bring it to light but to pry loose the rich and the strange, the pearls and the coral in the depths and to carry them to the surface, this thinking delves into the depths of the past – but not in order to resuscitate it the way it was and to contribute to the renewal of extinct ages. What guides this thinking is the conviction that although the living is subject to the ruin of the time, the process of decay is at the same time a process of crystallization, that in the depth of the sea, into which sinks and is dissolved what was once alive, some things suffer a “sea change” and survive in new crystallized forms and shapes that remain immune from the elements, as though they waited only for the pearl diver who one day will come down to them and bring them up into the world of the living – as “thought fragments,” as something “rich and strange,” and perhaps even as everlasting Urphanomene.*”

of unquestionable answers, his “fundamental ends”.⁵⁹ The scientific goals of *Sustainability*, *Knowledge for knowledge’s sake*, and *Gender Equality* have acquired such fundamental status. They were brought into being by Einstein’s “powerful personalities”. We can identify Carlson and Lovelock and Pankhurst as the respective prophets, arising from Biology and Chemistry/Medicine and Suffrage respectively.⁶⁰ Einstein’s “traditions” can be identified with such secular activities as “Earth day” and “bring your daughter to work day”. The fundamental standing of the goals is evident by thinking of the likely response you would have to challenging any of them. Freeman Dyson, ever the critical thinker, did challenge the proposed approaches to the reduction of carbon emissions, and he is now in trouble for heresy.⁶¹ Giving up on the search for knowledge is about as distasteful as taking the proverbial bottle from the baby and Gender Equality is also unquestionable⁶², at least in the non-religious parts of Western culture. I believe that these fundamental ends have acquired moral standing and have justified recent political acts. I suspect that many such acts⁶³ were inadvertently political responses to what scientists saw as the second Bush administration’s political abuse of Science in meaningful areas.⁶⁴ So it appears that Science has unwittingly found a moral voice and has taken hold of the sword of political action. Further, because the goals are untouchable, Science has also gained the invincibility bestowed by the scabbard.⁶⁵

These arguments from Arendt and Einstein and our recent practices show Science with moral standing, rights to political action, and with them moral responsibility. Looking back we can see gross behaviors that have stemmed from the denial of any moral element in scientific thinking; to ask how to kill efficiently was somehow separated from asking why. We must reject the all too

⁵⁹ In reference to ultimate goals Einstein wrote: “...*To make clear these fundamental ends and valuations, and to set them fast in the emotional life of the individual, seems to me precisely the most important function which religion has to perform in the social life of man. And if one asks whence derives the authority of such fundamental ends, since they cannot be stated and justified merely by reason, one can only answer: they exist in a healthy society as powerful traditions, which act upon the conduct and aspirations and judgments of the individuals; they are there, that is, as something living, without its being necessary to find justification for their existence. They come into being not through demonstration but through revelation, through the medium of powerful personalities. One must not attempt to justify them, but rather to sense their nature simply and clearly.*” From Einstein, Albert. 1950. *Out of my later Years*. New York: The Philosophical Library Inc. pages 22-23.

⁶⁰ Carlson, Rachel. 1962. *Silent Spring*. Boston: Houghton Mifflin. and Lovelock, James, and Margulis, Lynn. 1974. Atmospheric homeostasis by and for the biosphere: the Gaia Hypothesis. *Tellus XXVI*, 1-10.

And Emmeline Pankhurst was a leading suffragette.

⁶¹ Dawidoff, Nicholas. 2009. The Civil Heretic. *New York Times* March 29

⁶² The unquestionable element of Gender Equality was used in the ouster of Laurence Summers as president of Harvard.

⁶³ IPCC (Intergovernmental Panel on Climate Change) reports appear to go out of their way to translate dull statistics into provocative written statements. The July 2007 *Scientific American* that contains three prominent opinion articles titled in turn “*Act Now on Global Warming*”, “*Still Needed: A Climate Plan*”, and “*I want to Believe*”. Appell, David. 2009. Stumbling over Data. *Scientific American*, August. states that: “*These days climate researchers have to scrutinize their work for not only its scientific implications but also for the public-relations ramifications, too.*”

⁶⁴ Union of Concerned Scientists and the Government Accountability Project. 2007. *Atmosphere of Pressure: political interference in federal climate science*. Massachusetts: Union of Concerned Scientists publications.

⁶⁵ Traditional stories associate having Excalibur’s scabbard with the power to bleed without harm, or to take a flesh wound without bleeding. In Malory, Thomas. *Le Morte D’Arthur*, London: Penguin., Merlin is quoted as saying “*keep well the scabbard of Excalibur ..., for ye shall lose no blood while ye have the scabbard upon you.*”

easy separation, whenever we ask ourselves how we must allow the unanswerable question why to fly free. In adopting this attitude I would like to start with apology for all suffering caused to the individual scientists who have believed themselves castrated from the life of why and to all individuals who suffered from the banality of our thinking.

Looking forward we should address issues such as the deliberate engineering of our culture, and those questions should be attended by the moral questions of why. So, we should ask questions like: Should the culture of Science become more “spiritual”? Should Science splice religious memes into its code? How could Science do so? Should Science adopt naturalized religious practices and thereby demystify the practices? And: Should we claim Science as the sole path for seeking intelligible truth? We should ask each of the attending why questions, such as “Why should we claim Science as the sole path for seeking intelligible truth?”

In doing this we should be assured that Science has the standing to ask these questions, and we should not be limited in our thinking by the various taboos of recent orthodoxy. It appears to me that scientists already practice the form of thinking that Arendt describes, and that we are already making “ought” statements. Thinking-for-meaning is very much part of my experience of Science; I am endlessly asking *why* whenever I seek explanation through the mysterious processes of seeking an inductive solution,⁶⁶ and Science has established clear *ought* statements in its pronouncements on *Sustainability*, *Knowledge for knowledge’s sake*, and *Gender Equality*.

Conclusion

Under a business as usual scenario, I picture the culture of Science fading into obscurity. It suffers from two challenges: encroachment by engineering; and corruption from within as the enlightenment attitude of rigorous internal consistency continues to be replaced by the belief that theological beliefs and scientific beliefs are compatible. To avoid calamity I advocate 1) ignoring any artificial separation of Philosophy from Science, 2) grounding our scientific dialogue in a new language of subjective experiences of Science, 3) splicing into our culture memes poached from Religions (such as the virtues of empathy and the explicit exercise of faith), 4) preparing ourselves to be a fee for service provider ready for the drying up of central funding, and 5) establishing Enlightenment Science as the only culture that honestly searches for truth. These changes will make the culture of Science stronger, more honest, more consistent, more “spiritual”, and more attractive. The human desire for truth will then sustain this united culture of Philosophy/Natural Philosophy.

⁶⁶ In placing induction within thinking-for-meaning, I separate from Arendt as she lists induction under thinking-for-knowing.

Resolution Triangle Backwards and Forwards⁶⁷

From mud and slime the plants grow

From vegetables the animals grow

And in the brain the mind grows

From mind the science grows

From the mud ideas form

From ideas words form

From words babble

From babble science

All is not clear

All is not acute

In the mud

We puddle

Happy

God

Do

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⁶⁷ Griffiths, Matthew. 2009. *Resolution Triangle Backwards and Forwards*. Collection of the author.

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