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Reducing Scientific Skepticism

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ABSTRACT

Many people with strong religious beliefs in the United States struggle with trusting the pronouncements of scientists. This is primarily because they have come to believe that science offers a perspective on ultimate questions such as origins and life after death that conflicts with their own. Education and public outreach efforts by scientists can go a long way towards persuading religious believers that they can trust the results of the scientific process, especially if that outreach is led by scientists who share their beliefs. In this article, I discuss how astronomy and space science can be an ideal entry point for religious believers to understand how science works, why it can be trusted to yield true information about the world, and to engage in critical thinking about how to understand their faith in light of scientific discoveries, and vice-versa.

Keywords: Science and religion, scientific skepticism, astronomy, space science, NOS

Editors' Comment

John ZuHone, Ph.D., (2013-2015 Fellow) *is a staff scientist at the Center for Astrophysics at Harvard & Smithsonian in Cambridge, Massachusetts. His research interests are clusters of galaxies, cosmology, X-ray astronomy, and computational astrophysics. He writes and gives talks on the interface between science and religion. In Reducing Scientific Skepticism, ZuHone draws upon his deep knowledge of astrophysics as well as his own religious commitment to describe how education, public outreach, and popularization efforts in astronomy and space science can be an ideal opportunity for scientists and religious believers to engage with each other, and ideally result in greater public confidence in science. His recommendations could inform our own science teaching with profound implications, especially among our students who hold strong religious commitments.*

Introduction

The COVID-19 pandemic has highlighted, in a vivid way, the importance of maintaining public trust in science and scientists. In the face of a deadly respiratory virus, the medical and scientific communities mobilized to provide public guidance on the most effective ways to stop the spread. The public has been famously polarized on believing in the effectiveness of mitigations such as mask wearing and lockdowns. More alarmingly, vaccine hesitancy is widespread, and one factor that appears to influence the decision to be vaccinated is religious affiliation. At the time of writing, a recent study by the Pew Research Center (2021) has shown that white evangelical Protestants evidence more vaccine hesitancy than any other religious group in the United States.

There is no doubt that many factors play important roles in determining if one is more likely than not to trust the views of the scientific community. However, religion has long been an important factor. At the risk of oversimplification, the world's religions, varied as they are, share the common characteristic that they serve for many as the most authoritative source of knowledge and wisdom

about matters of *ultimate concern*, such as origins, the meaning and purpose of one's life, morality, and the possibility of life after death. Since the Enlightenment, science has increasingly been seen as an authoritative voice on many of these questions, and often as one that is seen to be in direct conflict with religious voices.

If one strongly believes that their religious perspective provides comforting answers to the questions of origins, the meaning of life, and the ultimate fate of oneself and the universe as a whole, and a scientist comes along and provides what is seen (and often presented) as an alternative story entirely contradictory to one's own, the result is often a hardening of one's established religious view and a rejection of the authority of the scientist. Often, the rejection can broaden beyond the elements of the scientific account that appeared to contradict the religious view and expand to more peripheral but important issues. As an example, if one becomes convinced that believing in science requires abandoning Christian faith because the former contradicts the creation story in Genesis, then it is often the case that skepticism about other, seemingly unrelated issues such as climate change and vaccines will follow.

This is a state of affairs with profound implications for the future. In a democratic society such as ours, buy-in from the general public to marshal resources to combat issues such as climate change and future pandemics is essential. Religious believers need to be just as convinced of the ability of the scientific enterprise to produce truthful and actionable information as anyone else.

I am a professional astrophysicist and a practicing evangelical Anglican Christian. Therefore, I have vested interests in seeing both the scientific enterprise succeed in terms of convincing more people of its ability to discern truths about our world, and in religious communities (in particular the church) become more scientifically minded and thus make their worldviews more robust. In my (admittedly biased) view, astronomy and space science are ideal entry points for educating religious believers about how science works and that it can be trusted. These fields directly engage with the same kinds of *ultimate questions* that the world's religions are concerned with, and at the same time have historically captivated the public's imagination across partisan and religious identification. One only needs to note the popularity of NASA in the United States to see this. In the remainder of this article, I will argue that public outreach and popularization of astronomy can provide unique opportunities for scientists and religious believers to have constructive engagements about science and religion, which can result in religious believers becoming less skeptical about science.

Made from Stardust

As a staff scientist, I have participated in education and public outreach (EPO) events related to our science intended for the general public. One of the astrophysical phenomena that we present at these events is that of supernova explosions, which are the deaths of massive stars. During the life of a star, it maintains pressure against gravitational collapse by generating energy from thermonuclear fusion, which takes lighter elements and produces heavier ones from them. For the most massive stars, at some point the star is no longer able to continue the process of fusion, and catastrophic gravitational collapse ensues, followed by a powerful explosion that can be seen from millions of light-years away. During the explosion itself, other heavier elements are also formed by nuclear reactions. A significant portion of the periodic table appears to have been built up by previous generations of stars generating various elements and exploding them out into space at the end of their lives, which then get incorporated into clouds of gas and dust, eventually serving as the building blocks for stars and planets.

The story just outlined is very fascinating and exciting, and at these events we scientists press its relevance to the general public by highlighting the fact that this means that many of the elements which make up our own bodies were once inside a massive star, experiencing unfathomable temperatures of millions and billions of degrees.

Being "made of starstuff", as astronomer Carl Sagan put it in his book and TV series *Cosmos* (Sagan 1980, p. 190), is an arresting and humbling thought. But for many, it can be seen as potentially threatening. If I believe that God made me from the "dust of the ground," as the book of Genesis states (The Holy Bible: New International Version [NIV], 1978/1984, Genesis 2.7), then this story certainly seems to contradict that at face value. More to the point, the origin story as presented in Genesis provides me with meaning and purpose, since it communicates the involvement of a wise and loving Creator in my beginnings. On the other hand, if I am made of stardust originally formed in a supernova explosion, it can seem as if I am instead an unintended byproduct of the complex interplay between the fundamental forces of nature on a cosmic scale.

This sense is often affirmed and enhanced by scientists themselves who write for the public at a popular level. Sagan also stated in *Cosmos* that "The cosmos is all that is or ever was or ever will be" (Sagan 1980, p. 1). What is often the result of being confronted with statements like this by the religiously devout? Many decide that science is not a worthwhile pursuit or interest for them or their children, and abide a deep skepticism about the pronouncements of scientists.

Must this be so? The scientific evidence that we are made from material that was once inside the interior of a star is overwhelming and should not be in serious doubt. But what implications does this hold for religious faith? It would be too simple to say that there are no implications, as strong versions of the *non-overlapping magisteria* framework ("Non-overlapping magisteria", 2021) of the relationship between science and religion would suggest. But it would be saying more than the science can to suggest that the fact of my stellar composition rules out of court the belief that I am an intentional creation by God.

Similar considerations apply in the realm of cosmology. All of the available evidence points strongly to an origin of the known universe in an event nearly 14 billion years ago known as the Big Bang. At this point, the universe had zero (or at least *nearly* zero) volume, and has been expanding outward from that moment ever since. According to Big Bang cosmology, not only is the universe very old, but it is also very large.

To the religious believer, being confronted with this information may be troubling. As is well known, many conservative Christians believe that the Bible unequivocally states that the universe and Earth cannot be more than 10,000 years old at most, far short of what both Big Bang cosmology and the astronomical evidence indicate. Also, the sheer vastness of the universe, with its hundreds of billions of galaxies each containing hundreds of billions of stars, seemingly renders our significance rather small. Along these lines, Physicist Steven Weinberg, in his book *The First Three Minutes* describing Big Bang cosmology, opined in the last chapter that "the more the universe seems comprehensible, the more it seems pointless" (Weinberg 1993, p. 154).

Faced with statements like these from prominent scientists, it is no wonder that many religious believers adopt an adversarial attitude towards science and scientists—instead of marveling at the wonders of the cosmos, they feel as if their worldview is on the defensive.

The Importance of Personal Encounters

In my own experience, personal encounters can make all of the difference. At one of these EPO events mentioned above, after I excitedly described the process of stellar death and the formation of heavy elements, as well as their incorporation into our origins, the person I was speaking to noted that these ideas had profound religious implications. She then described herself as a Christian believer and spoke of the tension she was feeling. I immediately noted to her that I was taking off my *scientist* hat for the moment and putting on my personal, *religious* one. We then had a delightful conversation about how impressive the Creator must be to craft such an amazing process to forge the elements needed for our existence. She walked away that day with both her faith and her appreciation for science strengthened.

Similarly, when discussing Big Bang cosmology with believers who may be inclined to see it as conflicting with their beliefs, I emphasize the consonance of the idea of the universe having a beginning with the biblical concept of creation, while being careful not to suggest that Big Bang cosmology *proves* the Genesis 1 creation account or any other religious text (a category mistake which has often been made). With regard to the vastness and age of the universe, I emphasize how these reflect the power, might, and glory of the Creator—to my mind far more than the puny geocentric cosmos of ancient times ever could.

One obvious question arises, however. It is quite easy for myself, as a person of faith, to speak to other believers who are wrestling with science and faith questions. But what about those believers who encounter non-religious or even areligious scientists? These scientists cannot speak to religious concerns in the same way as a believer, and nor should they try, for the sake of honesty. But scientists in general can adopt a posture of openness towards the possibility of rapprochement between science and religion, while leaving it up to the audience to sort out those details with their clergyperson or others in their religious community. They can emphasize the commonality between science and religion in that they both are human responses to the wonder of the universe. They should adopt a humble posture towards ultimate questions, recognizing that most of the questions that religious believers are really worried about (e.g., the existence of God, the afterlife, one's own purpose and destiny) are not the proper subjects of science. Finally, the scientific community can and should highlight the existence of people of many faiths and no faith among their ranks, emphasizing that science is a fundamentally human endeavor that all can take part in. If scientists want first and foremost for everyone to be as captivated by scientific discovery as they are, find the results convincing, and support further study, we should go out of our way to not leave religious believers with the impression that the story we are telling is fundamentally incompatible with theirs.

It is important to note what is *not* being said here. Scientific theories supported by strong evidence can and do directly contradict particular religious beliefs. For example, young-earth creationism is flatly contradicted by many lines of evidence from astronomy and geology. When speaking to the public, scientists should not downplay these facts for fear of offending believers. However, it is entirely possible to communicate these evidences without adopting an antagonistic or hostile response to people of faith or their overall worldviews.

Why Astronomy?

The positions I have outlined here would be relevant for public engagement with any scientific field. Why do I believe that astronomy and space science are uniquely positioned to make inroads with religious believers who may be skeptical about science and scientists? Three reasons come to mind. The first, as I mentioned above, is that astronomy is a popular subject. Nearly everyone, regardless of religious persuasion, is fascinated by the night sky, tunes in when a man lands on the moon or a robot lands on Mars, and enjoys speculating about the possibility of alien life. Secondly, as I have laid out, astronomy engages with big and important questions about our origins, providing opportunities for science and religion to come into contact. This can and often does provoke conflict, but it can also be an occasion for fruitful and creative thinking. Thirdly, though it does deal with the subject of origins, astronomy does so in a way that is less immediately personal than other fields, and thus less likely to elicit a defensive response from the beginning. For example, the study of human origins is a far more sensitive subject from the perspective of religious belief. I submit that for these reasons using astronomy as a springboard to discuss matters of science and religious faith can provide an opportunity to show how powerful the scientific method is, which then can be translated to other fields of study.

Conclusions

I thus submit that education, public outreach, and popularization efforts in astronomy and space science can provide opportunities for scientists and religious believers to engage with each other, and ideally result in greater public confidence in science. I have personally seen up close how religious communities, when faced with difficult scientific questions with an open mind, have used the overlap of science and religion to constructively engage and resolve tensions between scientific discoveries and interpretations of the world offered by their faith perspectives. The result is that leaders of these communities, seen as important authorities within them, have been able to project a message of confidence in science, incorporation into their worldview, and a lessening of the perceived threat of science to their belief system.

It is sometimes argued that the solution to the problems discussed in this essay is to simply try harder to convince the public that science deserves to be a unique arbiter in the pursuit of truth, to the diminishment or even elimination of other perspectives, including religious ones. I suspect that this strategy will likely backfire most of the time. Leaving aside the question of the veracity of religious truth claims, it is highly unlikely that religion will not continue to be a significant force in the lives of millions for the foreseeable future. Rather, I suggest that the best outcome for continued support for the scientific community by the public would be that all people, regardless of their religious outlook, were convinced of the ability of science to provide true information about the nature of the universe.

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Author's Comment

The views expressed in this article are my own and do not represent those of the Smithsonian Institution or the Center for Astrophysics.

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