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Myth-free space advocacy part III: The myth of educational inspiration

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ABSTRACT

I argue against a common belief among space advocates that spaceflight is "educationally inspiring" in that it has a clear, positive impact on scientific literacy and on STEM education. On the basis of a variety of survey analyses I show that, while there is some indication that being scientifically literate makes a person more likely to support spaceflight, there is no clear indication that the extent of spaceflight activities (or the extent of funding for spaceflight) makes people more likely to be scientifically literate or to be supportive of spaceflight (at least in the United States). Regarding STEM education, while there is a correlation between US spaceflight spending and STEM degree conferrals, a similar correlation obtains between spaceflight spending and degree conferrals in virtually every other discipline, and between overall US spending on science and degree conferrals in virtually every discipline. Thus there is no clear evidence that spaceflight spending is uniquely inspirational for STEM. It follows that there is little evidence that clearly supports the idea that spaceflight is educationally inspiring in the ways that many space advocates have claimed, in both academic and popular settings.

1. Introduction

This paper is the third in a series on unsubstantiated beliefs that pervade the space advocacy literature and rhetoric, both academic and popular. In Part I [25], I criticized the myth that as humans we have some kind of innate drive or compulsion to explore. In Part II [26], I criticized the myth that settling the space "frontier" is necessary for avoiding societal stagnation. Here my concern is with the myth that spaceflight activities provide educational inspiration for students and the wider public. This myth functions as a premise of what is sometimes called the "educational inspiration argument" - actually, a cluster of related arguments, which cite a cause-and-effect relationship between the level of spaceflight activities and a variety of educational outcomes, e.g., STEM degree production, public scientific literacy, public enthusiasm for science, etc.

Concerning scientific literacy and enthusiasm for science, the inspiration argument takes the following form:

1. Spaceflight is uniquely and particularly effective at bringing about increases in scientific literacy and the enthusiasm for science of the wider public.
2. We ought to seek increases in the public's scientific literacy and its enthusiasm for science.
3 Therefore, we ought to increase spaceflight activities
4. Spaceflight is uniquely and particularly effective at bringing about increases in STEM education.

And concerning STEM education in particular the inspiration argument takes this form:

5 We ought to seek increases in STEM education.
6 Therefore, we ought to increase spaceflight activities.

The goal of this paper is to explain why these arguments are not rationally compelling by highlighting the dearth of properly sourced evidence in support of their major premises, (1) and (4).[1] Thus, these arguments, as promulgated by space advocates, are *not* supported by evidence but seem instead to be products of wishful thinking – they are myths or articles of faith shared by many space advocates. Note that in calling attention to the absence of supporting evidence for (1) and (4) I do not claim to establish their falsehood. My intention is only to indicate that, at present, we lack the necessary evidence for taking these claims to be true, with the emphatic reminder that in the absence of evidence, our duty is to *suspend*, rather than form, judgment. Given this, we should avoid assuming (1) and (4) in the construction and articulation of justifications for space activities or for increased funding for spaceflight. There are simply too many unanswered questions about how students are influenced in their educational and vocational decisions.

Note that this paper does not discuss the general inspirational value

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[1] There has also been some debate about whether, e.g., the United States genuinely needs more STEM-education individuals. So the truth of (5) may be disputed, however I shall not pursue the matter further.

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of spaceflight but only the impact of spaceflight on scientific literacy and STEM education. To what degree spaceflight provides inspiration to art, music, film, literature, etc., is not considered here.

Before beginning in earnest, I feel obliged to inform the reader that I support space exploration ardently. Most of my work on the philosophy and ethics of space exploration defends the existence of an ethical duty to engage in the scientific examination of the Solar System. Thus, my skepticism about the *rhetoric* commonly employed by space advocates should not be confused for skepticism about the importance or value of space exploration, which I think can and should be defended using assumptions that are more evidentially stable.

2. Two kinds of educational inspiration

The idea that spaceflight is educationally inspiring is often put forward in equivocal ways, since it could refer, as in (1), to impacts on scientific literacy and enthusiasm for science. But on the other hand, one might have more concrete items in mind, such as in (4), which focuses on STEM enrollment and degree conferral rates. As I show below, claims about spaceflight's impacts both on (1) scientific literacy and enthusiasm for science and on (4) STEM education in particular suffer from a lack of compelling evidence.

2.1. Spaceflight's influence on scientific literacy

One way in which spaceflight is said to educationally inspire is in its effect of increasing both the scientific literacy and the enthusiasm for science of the general public. In so far as the United States suffers from a privation of scientific literacy, spaceflight's impact, if significant, would provide some justification for increasing spending on space in order to pursue sufficiently provocative projects. Carl Sagan, with his usual elegance, makes this case in *Pale Blue Dot*:

> Exploratory spaceflight puts scientific ideas, scientific thinking, and scientific vocabulary in the public eye. It elevates the general level of intellectual inquiry. The idea that we've now understood something never grasped by anyone who ever lived before - that exhilaration, especially intense for the scientists involved, but perceptible to nearly everyone - propagates through the society, bounces off walls, and comes back at us. It encourages us to address problems in other fields that have also never before been solved. It increases the general sense of optimism in the society. It gives currency to critical thinking of the sort urgently needed if we are to solve hitherto intractable social issues. It helps stimulate a new generation of scientists. The more science in the media - especially if methods are described, as well as conclusions and implications - the healthier, I believe, the society is. People everywhere hunger to understand. [[1], p. 281]

Meanwhile, Bruce Jakosky mentions astrobiological projects in particular as a source of public enthusiasm:

> This convergence of scientific and intellectual thought is ultimately the strongest justification for continuing our space exploration program. The overlap between public excitement, interest, and enthusiasm and scientific interest in profound problems makes astrobiology an exciting way for the public and the scientists to come together. And it is the justification for astrobiology's importance in space exploration. [[2], pp. 128–9]

Both Sagan and Jakosky hint at least part of a mutualism that, I suspect, informs much of the sentiment behind these claims: That spaceflight, through inducing increases in scientific literacy and science enthusiasm, thereby inspires greater sympathy for spaceflight and greater willingness to fund ambitious projects, which in turn lead to further increases in scientific literacy, etc., which in turn cause the public to be more willing to support spaceflight, and so forth.

Both aspects of this mutualism must be addressed. In particular, we must distinguish between:

7. Spaceflight's impact on scientific literacy (and science enthusiasm).
8. The impact of scientific literacy (and science enthusiasm) on support for spaceflight.

It will turn out that exceptionally little data exist regarding (7). There are however data relating to (8) that indicate that increasing the scientific literacy of the general public may well be an effective way of pushing for increases in support for spaceflight. However it is not clear that spaceflight activities themselves will provide the hoped-for improvements in scientific literacy.

Public approval of NASA has always been relatively high, at least for a federal agency. However, as Roger Launius has often pointed out, the ebb and flow of this support has not always correlated with the scope and success of NASA's activities. For instance, contrary to what many might expect, the success of the Apollo program did not have a dramatic positive impact on willingness to support spending on space:

> Consistently throughout the 1960s a majority of Americans did not believe Apollo was worth the cost, with the one exception to this a poll taken at the time of the Apollo 11 lunar landings in July 1969. And consistently throughout the decade 45–60 percent of Americans believed that the government was spending too much on space, indicative of a lack of commitment to the spaceflight agenda. [[3], p. 163]

Launius' claims about *Apollo*'s impact on public support are consonant with analyses of more recent data on public opinion. In his thorough discussion of public perceptions of space, William Sims Bainbridge notes that:

> ….it is hard to escape the conclusion that space-related events have only a modest impact on public opinion, not enough either to kill the program or to give it new life. To the extent that the future of NASA and other space efforts are guided by public opinion, therefore, one would expect only incremental progress that eventually could accomplish much, but only after many decades. [[4], p. 109]

Still, robust conclusions are difficult to come by. A contributing factor here is that much of the available survey data - in particular, from the now-semi-annual General Social Survey (GSS) - is not collected for the purpose of assessing the impact of spaceflight. As Wendy Whitman Cobb explains,

> …space as a policy area is simply not salient or relevant enough to cause major polling organizations to ask questions on the topic regularly. If we truly wish to get a handle on the contours of public opinion on space, questions must be asked at a regular interval, regardless of whether it is salient or not. [[5], p. 12]

Regular polling is needed, according to Whitman Cobb, largely because the impact of spaceflight on public opinion is likely to occur on time scales that are too small to be captured by a survey such as the GSS that is only conducted every other year. Reflecting on responses to questions about NASA's level of funding, she writes:

> Given the relatively short periods of time in which a policy like space may come to be salient and then recede, asking the question once every two years may simply not be often enough to capture small scale, yet important changes in support for the program. For example, imagine if the question had been asked in the spring of 2003, shortly after the Columbia accident. It's possible that a larger number of respondents would have said that the US was not spending enough on space exploration. However, the question was not asked then, but only in 2002 and 2004. By the time the question was asked in 2004, it's likely that the salience of space policy following Columbia had declined substantially. [5]

A potential remedy, suggests Whitman Cobb, is to supplement the GSS