Balancing Acts

A Case for Confronting the Tyranny of STEM

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Programs in technical and scientific communication are indelibly connected with science and technology: not surprising given the titles of the field and associated programs and organizations. Yet, our visibility and power when it comes to competing for resources with science and technology is not at all a level playing field. This, too, comes as no surprise. However, I believe it is time to be surprising. We have every right to have our role more centrally recognized in the development of technologies and the explorations of science. Now is the right time to begin a conversation among our programs that could make the weaker the stronger, in the old sophistic sense of overcoming the tyranny of thinking that has evolved from the current education acronym of STEM—science, technology, engineering and mathematics.

To this end, I present an argument for finding at least some modest avenues for beginning a larger public conversation about STEM and the rest of us. "The rest of us," as I cast it here, places technical and scientific communication in the context of the humanities and liberal arts. That, in itself, might raise some other conversations among the readers of this journal. I can only hope ;-)!

I will begin at the top, with a consummate communicator who now resides in the Oval Office.

On April 27, 2009 President Obama addressed members of the National Academy of Sciences at their 146th annual meeting. The address covered a number of issues ranging from health to the environment to renewable energy to biomedicine, among others. In addition, his speech emphasized the commitment that the administration has to furthering education in what we often now refer to as STEM:

> Since we know that the progress and prosperity of future generations will depend on what we do now to educate the next generation, today I'm announcing a renewed commitment to education

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> in mathematics and science. Through this commitment, American students will move from the middle to the top…for we know that the nation that out-educates us today will out-compete us tomorrow. And I don't intend to have us out-educated. (para. 58)

To this end, the government is ramping up financial resources and incentives in grand ways to reach the goal of educating American youth in STEM at all levels of the educational strata, from K-12 to graduate study. For example, an immediate $5 billion is being provided for the Race to the Top program which will reinforce endeavors to, as Obama (2009) states, "dramatically improve achievement in math and science standards, modernizing science labs, upgrading curriculum, and forging partnerships to improve the use of science and technology in our classrooms…[and] to enhance teacher preparation and training" (para. 62). In addition, the new budget will triple the number of graduate research fellowships.

Avoiding Folly: The Problem of "Proportionate Share"

Few would argue that this gearing up of STEM education is unwarranted. Quite the opposite is true as it is clear that the U.S. has been challenged in these matters of STEM education and the potential for advancements in future research and development. At the same time, this commitment is not new. Specifically, it is opening a one-sided commitment that we were warned against over sixty years ago when a similar motion was put into place in 1945 with the proposing of a new government agency, The National Science Foundation (NSF).

In July of 1945 Vannevar Bush, The Director of the Office of Scientific Research and Development under Presidents Roosevelt and Truman, wrote a report titled "Science the Endless Frontier" that would eventually become the basis of NSF a few years later. The report, as you would expect, made a strong case for governmental support of basic research leading to innovation that would draw upon public funding to make the U.S. the premier nation in scientific research and development. The rest, as they say, is history as the NSF has become one of the most highly funded foundations in the world receiving in 2009 over 6 billion dollars with an additional one-time stimulus award of 3 billion dollars.

In Bush's report, however, there was a strong comment made about what he called "science's proportionate share" in public financial support. In a section of the report under the heading "A Note of Warning," Bush stated,

> It would be folly to set up a program under which research in the natural sciences and medicine was expanded at the cost of the social sciences, humanities, and other studies so essential to national well-being. This point has been well stated by the Moe Committee as follows:

> "As citizens, as good citizens, we therefore think that we must have in mind while examining the question before us—the discovery and development of scientific talent—the needs of the whole national welfare. We could not suggest to you a program which would syphon into science and technology a disproportionately large share of the nation's highest abilities, without doing harm to the nation, nor, indeed, without crippling science. Science cannot live by and unto itself alone . . . There is never enough ability at high levels to satisfy all the needs of the nation; we would not seek to draw into science any more of it than science's proportionate share." (para. 1–3)

Somehow in the years following Vannevar Bush's thoughtful commentary we have lost our bearings in regard to the proportionate share of funding provided to the humanities, arts, and social sciences (what I will refer to in the remainder of this essay as HASS). At present, the combined allotments to The National Endowment for the Humanities (NEH) and the National Endowment for the Arts (NEA) is about $330 million. This imbalance is even more stunning when we add the government allotments to the National Institutes of Health of over $30 billion provided for 2009–2010. In short, government funding through these flagship foundations of the arts and humanities isn't even in the proverbial government funding ballpark, and pretty much not even in the sandlot. Further, when the U.S. Senate proposed $50 million of stimulus money for the arts last year, there was an outcry in Congress that nearly stalled this miniscule proportion of the $775 billion American Recovery Act (ARA) package. It finally passed, but only when attached to an unrelated bill.

Rethinking the Balancing Act

Reasons for this imbalance have been the result of various factors over the years, but there have been at least two constants driving the imbalance: (a) The desire for the U.S. to be the world's premier superpower, and (b) the consistent argument by the sciences that we are continually lacking in youth who pursue careers in the sciences and related fields like engineering and technology.

The beginnings of NSF were rooted in promoting the notion of "basic research" in the sciences. At the beginnings of NSF there was a paucity of resources allotted by the government to basic research in the sciences as such research was seen as within the province of universities and corporations. The whole enterprise surrounding the development of the atomic bomb, however, changed all of that about ten years before the NSF was born. The basic research needed to create the bomb engrossed the government in support of intensive scientific research at levels never seen before, and that could never have come

from university or corporate coffers as the financial support was needed quickly and, in the case of atomic bomb development, secretly. Starting with a humble budget of $6,000 in 1942, The Uranium Committee of the Roosevelt administration grew to the eventual $2+ billion expended by 1945 for the Manhattan Project and the dropping of the bombs on Japan. Following this auspicious beginning, scientific research gained momentum through the founding of the NSF and other related government agencies. Not surprisingly, the Cold War and its insatiable need for military build-up, the Space program and the race to put a human on the moon, and growing concerns over increased funding for research in health and medicine have contributed to the growing support of scientific research to aid America's worldwide leadership role.

Linked to this ongoing endeavor to uphold America's status has been the call for more scientists, engineers, and technologists to carry forward the mission. Thus, NSF and many other foundations have developed virtually innumerable educational programs to promote the sciences to the country's youth. These projects run from formal initiatives developing curriculum and academic programs in K-20 and graduate classrooms to informal, public interest initiatives that operate through television, hands-on demonstrations, summer workshops, and a variety of other venues.

In short, the effort to engage youth in STEM has been intense for well over fifty years, and in fact the government's "turn to the sciences" has taken on epic proportions. The call for more money to support STEM education is, as Obama's speech demonstrates, very strong. This acronym of science and engineering holds sway under the banner of supposed national deficiencies in scientists, mathematicians, and engineers. Ever since Vannevar Bush's argument for a national effort encouraging individuals to pursue science and technology careers in measured ways, the acronym associated with STEM has gone beyond measure by funneling untold billions of dollars toward convincing more youths that STEM is both what they need and what the country needs.

Yet, we still pump the money endlessly into this endeavor with few accounts as to its effectiveness. When was the last time we heard that we have gotten closer to the goals of more STEM teachers and practitioners; that the nation is "winning the war" of providing us with more scientists and engineers? Instead, we most often hear that we are far short of the STEM needs and goals. Thus, more calls come for grants to take the project into the future with few calls for even a fraction of this number in HASS.

It is clear that we will need more scientists and technologists. That is the way of the world in the 21st century. We also need more humanists, artists, and social scientists who study the past, speculate on the future, and make things of aesthetic and functional beauty. Just as importantly, we need scientists,

engineers, and technologists who fill the needs of "the whole national welfare": scientists who strongly wed their expertise and knowledge with knowledge of HASS so that science does not, as Bush warned, attempt "to live by and onto itself alone." Clearly, we need in our present time, desperately, to reset our bearings.

But how might we begin a process of re-navigating? There are many possibilities to this end, but one at the forefront would be to bring the scientists and technologists together with those in HASS within a meaningful context. One such context is the realm of ethics: one of the most challenging, but potentially most rewarding for scholars, researchers, developers, and the general public.

Building a Base for "Good Science" with HASS

Redistributing some of the resources from the sciences to the humanities and arts will require, to an extent, pronouncements from the top, just as President Obama has done for the furthering of scientific research and education. This work can, and already is being brought to the national arena in some small ways, but it has to be enlarged and strengthened. For example, the phrase "good science" has brought forward the issues of ideology and bias that has clouded problems of environmental degradation and biomedical research. Thus, politicians, scientists, educators, and foundation managers have latched on to this phrase as a way to demonstrate to policy makers and the general public what science is, in part, all about: free and open inquiry that attempts to understand the world and life without being directed by preconceived notions of what is good or bad.

Missing in many discussions of good science, however, is the notion of practical ethics: the activity of truly embedding ethical theory, methods, and practices into the entire cycle of scientific and technological research and development. Of course, ethics often is brought up in terms of ethical imperatives for science, such as having an ethical obligation to control global warming or to find new cures for debilitating diseases. But such use of ethics in these conversations rarely turns ethics toward science itself in ways that rigorously question science *before the fact* rather than after all of the research, experimentation, and implementation are over and the resulting products of science and technology have been unleashed into the world.

Ethics is about looking into the future and is very much within the province of HASS, but voices of the philosophers, rhetoricians, literary critics, creative writers, and historians are often absent in any meaningful ways. For instance, in 1999 two worldwide summits were held in Anaheim, CA and Budapest, Hungary that brought together "the largest, most diverse gatherings of scientists in history" (Tobias, Timmers, & Wright, 2003). Over 6,000 scientists and policy makers

delivered papers, entered into numerous conversations and interviews with the media, and covered just about every imaginable major topic in scientific research. Interestingly, ethics was on the lips of many of these scientists and was bandied about through many of the papers and presentations, but in terms of actually focusing on ethics there was only one panel devoted to the topic, and in that panel there was only one ethicist who took part: Margaret Somerville of McGill University.

In *A Parliament of Science: Science for the 21st Century* (2003), a published collection of interviews conducted at the two summits by Michael Tobias, Teun Timmers, and Gill Wright, Dr. Somerville had this to say about her experience:

> In the session on ethics at the *World Conference on Science*, I was the only ethicist who spoke. The other people talked about issues that raised ethical concerns, but that's different from doing ethics . . . Most people, when they first encounter ethics, particularly scientists, see it as something of an add-on. But ethics has to be embedded in the science. I call it "doing science in ethics time," not just doing ethics in science time. Unethical science is bad science no matter how much you discover in doing it. Good science has good ethics. (p.161)

Actually "doing ethics" will not only take commitment and buy-in among scientists and technologists, but it will also take material resources. Placing ethical action across the research and development spectrum and building it into the educational goals of STEM will be costly in the short-term. Gathering public input, developing STEM curricula that incorporates practical ethics, evaluating the ethical problems in development processes, and then testing potential products before they are put into place is not something contemporary science, and especially technology, are used to doing. However, the long-term benefits can be substantial. We will never know until we try, and the effort is certainly worth the costs if the outcomes of science and technology are truly going to benefit the whole of life, life that includes more than just humans. HASS specialists, however, will have to be at the table to make good science happen, writ large, in a meaningful way. This would be just one step, but indeed an important one, toward reclaiming balance in our intellectual, educational, and research endeavors.

Acknowledgement

Another version of this essay will be forthcoming in 2010 in *The Pantaneto Forum*, an online journal from the United Kingdom dedicated to communication and education in science and technology: ‹http://www.pantaneto.co.uk›.

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