Boundary Problems to Networked Solutions

By Katherine Nielsen

> … when you come right down to it the reason that we did this job is because it was an organic necessity. If you are a scientist you cannot stop such a thing. If you are a scientist you believe that it is good to find out how the world works; that it is good to find out what the realities are; that it is good to turn over to mankind at large the greatest possible power to control the world and to deal with it according to its lights and its values (Oppenheimer 317).

In 1945 Robert Oppenheimer affirmed his core belief that one motivating impulse behind scientists is a commitment to the value of learning. The above passage is from an address Dr. Oppenheimer made to the scientists and staff in Los Alamos who had participated in the Manhattan project which had just resulted in the construction of the first atomic bombs. These remarks not only illuminate of Oppenheimer's historically situated perspectives and his real life dilemmas, they resonate with visions of science in the world that still have relevance today.

While science policy, ethics, and funding might seem to the general public like a dry topic more appropriately handled by experts, scientific research involving nuclear weapons instantly sets a dramatic scene for playing out the questions of who holds what kind of accountability and responsibility. In a 1951 letter, Einstein wrote, "I cannot concur in your opinion concerning science and ethics or the determination of aims. What we call science has the sole purpose of determining what is. The determining of what ought to be is unrelated to it" (Einstein 1951). Most atomic era physicists took some version of the position that society as a whole has final responsibility for allocation of resources and decisions about the use of technologies. They disagreed over the relevance or importance of individual scientists' ethical commitments.

In the speech Oppenheimer gave to the scientists of Los Alamos he called for new ways of understanding the relationships between ethics, science policy, and scientific research. Even at the dawn of the era of big science, it was clear to Oppenheimer that issue of the role of defense contracts in the shape and course of physics could no longer be avoided nor easily dismissed. At that time he identified 3 strains of thought he found problematic regarding responsibility and the future of physics:

> One of them is the attempt to try, in this imperiled world, in which the very function of science is threatened, to make convenient arrangements for the continuation of science, and to pay very little attention to the preconditions which give sense to it. Another is the tendency to say we must have a free science and a strong science, because this will make us a strong nation and enable us to fight better wars. It seems to me that this is a profound mistake, and I don't like to hear it. The third is even odder, and it is to say, "Oh give the bombs to the United Nations for police purposes, and let us get back to physics and chemistry" (Oppenheimer 322).

Each of these three approaches posits a vision of the landscape of knowledge as territories that can be cleanly divided into distinct domains. The first—making convenient arrangements for the continuation of science while ignoring the preconditions—identifies an approach that suggests one could blithely use public science policy as a money tree; it implies that funding methods could be kept separate from the doings of science. The second approach of strong science and nation suggests that the domain of science and the domain of national interest, including defense, could be made into parallel and unified vectors. The third pretends that as scientists, they had briefly tread on the dirtier soil of the domain of national conflict, but could return to a pure realm. By rearticulating boundaries for science, all three approaches released or reduced scientists' ethical responsibilities.

Oppenheimer gave no explicit critique of these three strains of thought; however, they each have blind spots resulting from conceiving knowledge as divided into cleanly defined domains. The approach which blithely viewed public policy as a money tree lacks a comprehension of how funding processes shape the sociology of science and how social/cultural factors shape the conditions of knowledge making. The past 30 or 40 years in science studies has been redressing this oversight. Recently the image of a triple helix has been used to capture the increasingly intertwined worlds of industry, government, and academic research (Etzkowitz 2000). This newer metaphor indicates that these domains may have identifiable trajectories and at the same time highlights the weave.

The idea that one could get back to doing "physics and chemistry" imagines pristine boundaries between ethical considerations and science that have since steadily eroded. Since 1949 knowledge making activities have broken down from such easily containable disciplinary boundaries. Although practitioners may have shifted past perspectives routed in a concept of knowledge making as occurring in cleanly defined domains, a deep understanding of the complex relationships is rare outside science studies fields. If the public is to wisely inform decisions of science policy, such as regarding ethics or allocation of research funding, they clearly need to know more about the ways knowledge is made in science.

Crucial elements in the process of making and transmitting knowledge by scientists occurs by means that are not captured by traditional archives because it is never written down, for example the tacit knowledge transmitted from teacher to student, the embodied knowledge students and post-doc's discover simply by being in the "best" laboratories, or the particular ways that a research group collaborates (Traweek 2004). One way to close the gaps of understanding underlying the three flawed approaches that Oppenheimer identified is to enable people at all educational levels to be exposed to and even interact with the everyday activities of scientists. Studying what scientists do—the embodied activities they perform—is a crucial aspect of getting hold of how people express their scientific minds.

One project I am involved with that addresses these issues is the development of digital archives and cohort oral histories of scientist at KEK, the Japanese national laboratory of research in high energy physics, accelerators, and materials science. The KEK digital archive project will be a prototype for other research institutes within Sokendai, the Graduate University for Advanced Study in Japan. We are currently in the process of developing the infrastructure needed to support researchers collecting oral histories, resources informing participants on what to expect, mechanisms for uploading and querying digital data and media, etc.

Oral history and digital archives might offer the opportunity to create more than a static repository; they could literally be a vehicle for posing questions and offering answers. Digital archives could respond to the on-going development of questions of professional historians as well as many other audiences. Access to and even participation in oral history could become a means to educate youth and the public at large about scientific work so that they can better understand the day to day experience of scientists and play an informed role in shaping science policy. Exposure to the everyday scientific activities of collaboration, tinkering, efforts to secure funding, etc., would be a powerful force to help transform the stereotypic image of science as a set of facts to be absorbed from a textbook. The old vision of science as a domain distinct from issues of accountability and responsibility of scientists would be transformed by a more complete picture. Digital archives and oral histories also promote conversation across current disciplinary lines. The need of researchers working in divergent fields for a dynamic way to share information and findings is well acknowledged. For example, the Sokendai president's statement calls for a "high-level literacy that can achieve syntheses over sharply differentiated research disciplines" (Kodaira).

This approach is a shift from more traditional forms of oral history in which the interview process is conceived and performed as a closed unit. In this new model, questions coming from multiple sources become like nodes in a network: the archive would emerge from the collection of questions and answers. Not only would such an archive help people understand the fuzzy areas that don't neatly fit into a simple delineation of a discipline, it is based on a model of knowledge-making as creating nodes and drawing connections between nodes. The creation of knowledge based on and within the archive is supported by a network among nodes, allowing each learner/researcher to follow and establish their own path. Containing the three layers of data, information, and knowledge digital archives could make publicly funded research more accessible (Ginsparg 2000). The infrastructure of the archive could be built not just to store the results of today's questions and methodologies but to support questions and methodologies that we can't even imagine today.

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