# The Materiality of the Internet

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Few would argue that the Internet, as it presently exists in the US and increasingly throughout the world, is a powerful force that shapes society and culture. The effects are so pervasive that it would be fruitless to try now to organize and understand them. With some passage of time, perhaps future generations of historians can make an attempt. Arthur Norberg, Janet Abbate, and other historians of computing have likewise demonstrated the reciprocal relationship: how culture and society shaped the Internet. Its architecture, management, and governance reflect the culture of the Cold War with the Soviet Union, the values of the 1960s-era counterculture, and even the philosophies of the Unitarian-Universalist church.[1]

In spite of this body of literature that examines the interaction between the Internet and American culture, significant gaps in our understanding still remain. One concerns the Internet's materiality—that is, the aesthetics of a technology that is as significant to 21st-century America as the automobile, electric power, or airplane were to 20th-century America. When the history of technology established itself as a discipline—not by coincidence shortly after the Soviet Union orbited Sputnik in 1957—scholars focused on the nonmaterial aspects of technology such as the management and organization of technical systems. They assumed that people already knew and understood that technology had a physical component so saw no need to belabor that fact. Early histories of technology, including those of the computer, were of an "internal" nature, documenting the engineering steps that inventors took to harness a force of nature to human ends. But the cultural dimension of this activity soon followed.

Some of the best analyses of this interaction have come from Thomas Parke Hughes, emeritus professor at the University of Pennsylvania. In his book *American Genesis* (Penguin Books, 1989), he demonstrates the close connection between the technologies of automobile production and electric power with the artistic movements that swept the western world in the last century. This was not an instance of designers covering a machine with a pretty shell (although that did happen); it was no less than the fusion of technology with the highest arts. The Tennessee Valley Authority's dams and power plants, for example, were aesthetic masterpieces of reinforced concrete and steel, with surfaces so clean you could "eat off them." An Art Deco inscription at one dam dedicates the structure: "Built for the People of the United States of America." Ordinary Americans could, and still can, take pride in these monuments to human ingenuity. In Detroit, Henry Ford's River Rouge plant was a masterpiece of integration of all the stages of automobile production. Ford commissioned the artist Charles Sheeler to photograph and paint pictures of what he saw there, producing a set of paintings that are as significant to the history of art as the Model A roadster is to the history of automobiles. In an example from the 1940s, the Bonneville Power Administration briefly hired Woody Guthrie to visit the construction of the Grand Coulee Dam, an experience that profoundly affected Guthrie and led him to write some of his most memorable songs.[2]

There is no equivalent to this fusion of art, culture, and technology with the Internet, despite the Internet's comparable place in modern American society. As an information technology, the Internet has a lot to do with culture and art, of course—it carries video, popular music, and ideas, and its Web pages reflect a new aesthetic that borrows from earlier media (such as glossy magazine layouts and the jump cutting of MTV music videos) but has an identity all its own. Still, that is not what concerns me. I am referring to the Internet itself—not what it carries—as a piece of engineering. As an engineering project, it is as massive as any network of hydroelectric dams, but I see no corresponding aesthetic.

One reason for this is that the Internet's physical power resides in physically small objects: silicon chips the size of a fingernail that require a microscope to view their circuits, and fiber-optic cables thinner than a human hair that, even with cladding, are little thicker than ordinary coax cable. We typically encounter the Internet on a plain desktop or laptop computers. Today, devices such as cell phones and handheld gadgets are becoming the preferred end-user device. With Moore's law in force, these laptops and gadgets become obsolete and are typically thrown away after approximately three years.

Science fiction movies love to depict a massive central computer that controls the whole universe, but in reality, no such thing exists. The closest the US ever got to that was the centralized Semi-Automatic Ground Environment system of the 1950s, but even SAGE was a suite of mainframes. SAGE's top-down architecture made it brittle and prone to overload in times of crisis. RAND

Corporation mathematician Paul Baran explicitly hoped to remedy this flaw with his distributed architecture, which has since become the Internet's essence.

This prosaic, almost banal nature of Internet control was dramatically brought home to me when I visited an office of a northern Virginia company that manages some of the domain-name system's high-level operations—the addressing scheme that lets Internet nodes find one another quickly. The master control for this high-level operation is a medium-sized room in which a single individual sits in front an ordinary computer, monitoring a graphic of global Internet traffic in Microsoft PowerPoint. Why not? As this point, any decent laptop, plugged into a phone jack anywhere in the US, can "run" World War III if necessary.

So is there anyplace we can go to "see" the Internet? Unfortunately, no. In addition to being modest, Internet switching points are not publicized for security reasons. Before the terrorist attacks of September 11, 2001, people used to trade images of a few of these switches, such as MAE-West in San Jose or MAE-East in Tysons Corner, Virginia. Even those so-called metropolitan access exchanges have since been dispersed to several sites throughout Silicon Valley and northern Virginia, and intermediate network access points of equal or greater bandwidth have been built in the Chicago region. If there ever was a set of switches that one could say constituted the Internet, it is no more.

Thus, should we expect a modern-day artist or folk singer to compose a work of art or song about the Internet? Perhaps I am being overly pessimistic. Artists have a remarkable ability to observe and record the essence of what is going on in the world, well before anyone else recognizes it. Sheeler's paintings of the River Rouge plant broke with conventions of what paintings were supposed to be about. Maybe current artists will surprise us with a rendition of what they see, that we don't, about the Internet's materiality.

## References and notes

1. In T. Berners-Lee, *Weaving the Web*, Harper, 1999, pp. 207-208, Berners-Lee states that "Unitarian universalism had no influence on the Web. But I can see how it could have, because I did indeed design the Web around universalist (with a lower-case u) principles."
2. Twenty years later that same agency hired Bill Gates, again briefly, to develop control software for its network of PDP-10 computers.

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