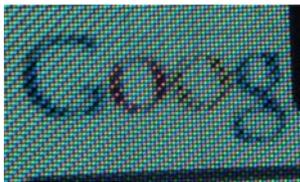


A Missing Piece in the Economic Stimulus: Hobbling Arts Hobbles Innovation

By Michele and Robert Root-Bernstein on February 11, 2009 - 8:28am in [Imagine That!](#)

As the economy stumbles, the first things to get cut at the national, state, and local levels are the arts. The first thing that goes in our school curricula are the arts. Arts, common wisdom tells us, are luxuries we can do without in times of crisis. Or can we?

Let's see what happens when we start throwing out all the science and technology that the arts have made possible.



You may be shocked to find that you'll have to do without your cell phone or PDA. In the first place, it uses a form of encryption called frequency hopping to ensure your messages can't easily be intercepted. Frequency hopping was invented by American composer George Antheil in collaboration with the actress Hedy Lamarr. Yeah, really.

Next, the electronic screen that displays your messages (and those on your computer and TV) employ a combination of red, green, and blue dots from which all the different colors can be generated. That innovation was the collaboration of a series of painter-scientists (including American physicist Ogden Rood and Nobel laureate Wilhelm Ostwald) and post-impressionist artists like Seurat - you know, the guy who painted his pictures out of dots of color, just like the ones in your electronic devices. The programming inside owes its existence to J. M. Jacquard, a weaver, who invented programmable looms using punch cards. Exactly the same technique was borrowed to program the first computers and is incorporated into modern programming languages.

Then there are all those computer chips running our critical devices. They're made using a combination of three classic artistic inventions: etching, silk screen printing, and photolithography. Add to that the fact that data from NASA and NSA satellites is enhanced using artistic techniques such as chiaroscuro (a Renaissance invention) and false coloring (invented by Fauvist painters) to increase contrast so it's easier to perceive important information. (Parenthetically, artists also figured out how to hide information. Camouflage was invented by the American painter Abbot Thayer and during WWI the Vorticists in England and the Cubists in France were co-opted by their governments to design prints to protect troops, equipment, and planes.) Hey, the arts look pretty useful, huh?



That's only the beginning. In medicine, the stitches that permit a surgeon to correct an aneurysm or carry out a transplant were invented by American Nobel laureate Alexis Carrel, who took his knowledge of lace making into the operating room. Alexander Fleming discovered the antibiotic penicillin while gathering beautifully colored microbes for his (rather

<http://blogs.psychologytoday.com/blog/imagine-that/200902/a-missing-piece-in-the-economic-stimulus-hobbling-arts-hobbles-innovation>

unusual) hobby of "painting" with microorganisms. Pacemakers are simple modifications of musical metronomes. If you have a neurological deficit, your neurologist may employ dance notation to analyze your problem. Physicians at Harvard, the University of Pennsylvania, and other major medical centers are trained by actors to interact humanely with you as a patient. These same physicians may learn to observe your symptoms more closely by being taught to draw, paint or photograph, or through art appreciation courses. Many hospitals employ music to relieve stress in operating rooms and post-operatively. Painting, drawing and sculpting are also used to treat depression and other psychiatric disorders. Indeed, our own institution, Michigan State University, originated music therapy as a way to treat soldiers suffering from what we now call post-traumatic stress disorder.

Oh, and that bridge you may drive over on the way to work? Princeton engineering professor David Billington and Smithsonian historian of technology Brooke Hindle have demonstrated that most innovations in bridge design originated with artistically trained engineers such as John Roebling and Robert Maillart. They're part of a long tradition of American artist-inventors. You may not know that Samuel Morse (to whom we owe the telegraph) and Robert Fulton (to whom we owe the steam ship) were two of the most prominent 19th century American artists before they turned to inventing -- visit the Smithsonian American Art Galleries some time and see for yourself. Alexander Graham Bell was a pianist whose invention of the telephone began with a simple musical game. Buckminster Fuller's geodesic domes don't just provide us with unusual architectures, they also inform our understanding of cell and virus structure and permit new biomedical insights. Kenneth Snelson's tensegrity sculptures (stroll past his "Needle Tower" outside the Hirshhorn Museum & Sculpture Garden on the Washington Mall) aren't just fascinating constructions in and of themselves, they've also created a whole new form of engineering. Google it!



The fact is that the arts foster innovation. We've just published a study that shows that almost all Nobel laureates in the sciences actively engage in arts as adults. They are twenty-five times as likely as the average scientist to sing, dance, or act; seventeen times as likely to be a visual artist; twelve times more likely to write poetry and literature; eight times more likely to do woodworking or some other craft; four times as likely to be a musician; and twice as likely to be a photographer. Many connect their art to their scientific ability with some riff on Nobel prizewinning physicist Max Planck words: "The creative scientist needs an *artistic* imagination."

Bottom line: Successful scientists and inventors are artistic people. Hobble the arts and you hobble innovation. It's a lesson our legislators need to learn. So feel free to cut and paste this column into a letter to your senators and congressmen, as well as your school representatives, or simply send them a link to this column. One way or another, if we as a society wish to cultivate creativity, the arts **MUST** be part of the equation!

References

Root-Bernstein, R. S. "Hobbled Arts Limit Our Future," Los Angeles Times, Op-Ed page B7, 2 September 1997.

Root-Bernstein, R. S., Root-Bernstein, M.M. "Learning to Think with Emotion," Chronicle of Higher Education, 14 Jan 2000, p. A64.

Root-Bernstein, R. S. "Art Advances Science," Nature 407: 134, 2000.

Root-Bernstein, R. S. "Music, creativity, and scientific thinking," Leonardo 34, no. 1, 63-68, 2001.

Root-Bernstein, M. M. and Root-Bernstein, R. S. "Body Thinking Beyond Dance: A Tools for Thinking Approach," In Overby, Lynette, and Lepczyk, Billie, eds. Dance: Current Selected Research, vol. 5, pp. 173-202, 2005.

Root-Bernstein RS, Lindsay Allen[^], Leighanna Beach[^], Ragini Bhadula[^], Justin Fast[^], Chelsea Hosey[^], Benjamin Kremkow[^], Jacqueline Lapp[^], Kaitlin Lonc[^], Kendell Pawelec[^], Abigail Podufaly[^], Caitlin Russ[^], Laurie Tennant[^], Erric Vrtis[^] and Stacey Weinlander[^]. Arts Foster Success: Comparison of Nobel Prizewinners, Royal Society, National Academy, and Sigma Xi Members. J Psychol Sci Tech 2008; 1 (2): 51-63.

The authors will be happy to send copies to individuals who send their addresses to rootbern@msu.edu or rootber3@msu.edu