Technology Naturalized

A Challenge to Design for the Human Scale

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Günther Anders was speaking for the age of nuclear weapons when he noted that technological capabilities exceed human comprehension. Genetically modified organisms, pervasive computing in smart environments, and envisioned nanotechnological applications pose a similar challenge; powerful technological interventions elude comprehension if only by being too small, or too big, to register in human perception and experience. The most advanced technological research programs are thus bringing about a curiously regressive inversion of the relation between humans, technology, and nature. No longer a means of controlling nature in order to protect, shield, or empower humans, technology dissolves into nature and becomes uncanny, incomprehensible, beyond perceptual and conceptual control. Technology might thus end up being as enchanted and perhaps frightening as nature used to be when humanity started the technological process of disenchantment and rationalization. Good design might counteract this inversion, for example, by creating human interfaces even with technologies that are meant to be too small to be experienced.

1 Machines of Nature vs. Nature as an Engineer

In 1665, Robert Hooke proposed that the microscope will help us:

> discern all the secret workings of Nature, almost in the same manner as we do those that are the productions of Art, and are manag'd by Wheels, and Engines, and Springs, that were devised by humane Wit. (Hooke 1665, preface)

With reference to the general aim of the Royal Society and thus of Baconian science to "improve and facilitate the present way of Manual Arts," that is, of technology, Hooke highlights further down that:

> those effects of Bodies, which have been commonly attributed to Qualities, and those confess'd to be occult, are perform'd by the small Machines of Nature, which are not to be discern'd without [the help of the microscope and which seem to be] the mere products of Motion, Figure, and Magnitude; and that the Natural Textures, which some call the Plastick

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> faculty, may be made in Looms, which a greater perfection of Opticks may make discernable by these Glasses; so as now they are no more puzzled about them, then the vulgar are to conceive, how Tapestry or flowered Stuffs are woven. (Hooke 1665, preface)

Nature will appear increasingly familiar, Hooke suggests here, when we look at it through better and better microscopes. We can all understand how machines work, there is nothing occult or puzzling about a loom that weaves tapestries, and once we see that nature consists of such tiny machines, we will find that there is nothing occult and puzzling in nature.

Even though it was written more than 300 years later, it would appear that the following passage makes a similar point. Better and better microscopes are allowing us to observe and intervene at the nanoscale. One of the first and most prominent public presentations of nanotechnology begins by pointing out that those microscopes tell us something about engineering at that scale.[1] Nature, it is said, begins with a pile of chemical ingredients which it then engineers into devices as elaborate and sublime as the human body.

> With its own version of what scientists call nanoengineering, nature transforms these inexpensive, abundant, and inanimate ingredients into self-generating, self-perpetuating, self-repairing, self-aware creatures that walk, wiggle, swim, sniff, see, think, and even dream. […]
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> Now, a human brand of nanoengineering is emerging. The field's driving question is this: What could we humans do if we could assemble the basic ingredients of the material world with even a glint of nature's virtuosity? What if we could build things the way nature does – atom by atom and molecule by molecule? (Amato, 1999, 1)

It has become a commonplace to emphasize in presentations of nanotechnology that it is biomimetic in principle, that it imitates nature in everything it does – whether or not it respects or preserves evolved nature as we know it.

There are fundamental differences, though, between the two mechanistic or engineering visions of nature from 1665 and 1999.[2] According to Hooke, we are already acquainted with looms, there is nothing mysterious about them, and now we discover that these rather familiar and unspectacular devices also operate in nature. At least, we can project their mechanism into nature as we generate mechanistic explanations of the phenomena. In other words, we assimilate nature to technology and thus get what one might call a technologized view of nature or "nature technologized."

By considering nature's original brand of nanoengineering, the temporal priority is reversed. The human brand emerges only as we assimilate technology to nature and thus get what one might call a technology that emulates nature or "technology naturalized."

> Even an early instance of nanotechnology like catalysis really is young compared to nature's own nanotechnology, which emerged billions of years ago when molecules began organizing into the complex structures that could support life. Photosynthesis, biology's way of harvesting the solar energy that runs so much of the planet's living kingdom, is one of those ancient products of evolution. […] The abalone, a mollusk, serves up another

[1] For a more extensive discussion of this brochure see Nordmann (2004).

[2] I am not considering all these differences here, see for example, Jones (2004) and Bensaude-Vincent and Guchet (2005).