DEMOCRATIC THEORY AND EPOCHAL TECHNOLOGIES: THE CASE OF 3D PRINTING

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Democratic Theory and Epochal Technologies, a book manuscript in progress, distills late 20th-century scholarship on major technologies into an index of twenty variables conducive to intelligent, democratic governance of innovation (see below). The book then assesses a range of 21st-century technologies (military robotics, synthetic biology, gene therapy, nanotechnoscience, and more) to determine how well each arena approximates conditions favoring relatively intelligent steering.

For the Phoenix conference, I could adapt to the organizers' priorities. If other participants propose a rich set of specific cases but are weaker at systematic linkages and frameworks, I could distribute and discuss the index itself using brief illustrations from a diversity of emerging technologies. If, in contrast, another case-oriented paper would be more useful, I could analyze development/diffusion of 3D printing – layer-by-layer deposition of powdered titanium, ceramic, or plastic to form objects. Being popularized by mavens such as *Wired Magazine*'s Chris Anderson (*Makers: The New Industrial Revolution*), the usual breathless hopes beautifully combine Western hubris with personal empowerment as "people will be able to fabricate exactly what they need where and when they need it." This is a light version of Drexler's molecular manufacturing – with easier chemistry, less evident risks, and more chances for youth to buy in via "maker spaces."

Preliminary lifecycle cost analysis suggests energy/environmental savings (e.g., from transport) coupled with improved prospects for bioregionalism. However, advocates are paying little attention to employment implications even though as many as 100 million workers globally might become unemployed if export-oriented economies falter due to localized production. So there is a lot at stake.

Whether you prefer my focus to be primarily conceptual or primarily empirical, I would be attempting to foster explicit comparison among emerging technologies by providing an easy-to-use yet somewhat comprehensive framework. My aim is to encourage cumulative improvements in scholarly understanding rather than disparate insights that seem to be rediscovered with each new technological promise/threat.

An Index of Technology Under Intelligent, Democratic Control
(Maximum score = 100; each variable scored on a zero to five scale)

1. Deliberation
   a. Early as possible?
   b. Maximum feasible diversity of concerns debated?
   c. Well informed participants?
   d. Deliberations intense and long-lasting?

2. Decision-Making Process
    a. Fair sharing of influence?
    b. Highly transparent process?
    c. Burden of proof appropriately distributed?
    d. Authority to decide allocated appropriately?

3. Prudence
    a. Stringent initial precautions (e.g., containment)?
    b. Erring on side of caution (e.g., redundant back-up systems)?
    c. Very gradual scale up?
    d. Substantial built-in flexibility (e.g., minimum dedicated infrastructure)?

4. Preparation for learning from experience
    a. Stringent premarket testing?
    b. Extensive, well-funded, multipartisan monitoring?
    c. Funds to ease resistance to error correction (e.g., victims compensation)?
    d. Strong incentives for error correction?

5. Appropriate Expertise
    a. Substantial percentage of relevant technoscientists have public-interest employment or other protections against widely shared conflicts of interest?
    b. Sophisticated, well-funded study/advice specifying strategies/tactics for prudence and learning?
    c. Substantial advisory assistance to have-not partisans?
    d. Skilled, multipartisan communicators with good access to media?