“(De)Naturalizing the Cyborg:
Science Meets (Feminist) Sci Fi.”

Dr. Dennis M. Weiss
English and Humanities Department
York College of Pennsylvania
York, PA 17405
dweiss@ycp.edu
http://goose.ycp.edu/~dweiss

Image: Bar-coded dancer by Warren Ellis and Darick Robertson (detail from Transmetropolitan 3, Helix, DC Comics).

Abstract: In Natural-Born Cyborgs Andy Clark argues that it is a plain and literal truth about human nature that we are natural-born cyborgs, complex bio-technological hybrids whose embodiment is multiple, identity fluid, and presence negotiable. While Clark appropriates the image of the cyborg, he disavows its complex literary and cultural history, choosing to portray the cyborg as a scientific, and therefore, literal truth. His marginalization of the literary cyborg is matched by his silence on the issues of gender and the normative implications of his view. This presentation seeks to denature Clark’s natural-born cyborgs, placing fiction at the heart of Clark’s science by drawing on cyber-feminist science fiction to suggest a critique of Clark’s view of the natural-born cyborg. In particular, I argue that Marge Piercy’s richly historical and intertextual ruminations on the cyborg in He, She and It mounts a persuasive critique of Clark’s supposed literal and scientific truth regarding the natural-born cyborg.

Denature: 1: DEHUMANIZE 2: to deprive of natural qualities: as a: to make (alcohol) unfit for drinking (as by adding an obnoxious substance) without impairing usefulness for other purposes b: to modify the molecular structure of (as a protein or DNA) esp. by heat, acid, alkali, or ultraviolet radiation so as to destroy or diminish some of the original properties and esp. the specific biological activity c: to add nonfissionable material to (fissionable material) so as to make unsuitable for use in an atom bomb.

The analogy to denaturing suggests that we make Clark’s natural-born cyborg unfit for consumption by adding to his scientific account of the cyborg the obnoxious substance of Marge Piercy’s cyber-feminist science fiction.

Clark’s Natural-Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence
• The basic issue is our own self-image, about what it means to be human:
  “This is not primarily a book about new technology. Rather, it is about us, about our sense of self, and about the nature of the human mind. It targets the complex, conflicted, and remarkably ill-understood relationship between
biology, nature, culture, and technology (7)…. The promised, or perhaps threatened, transition to a world of wired humans and semi-intelligent gadgets is just one more move in an ancient game. It is a move, however, that provides a wonderful opportunity to think longer and harder about what it should mean to be human (142).”

- The cyborg as a scientific truth, neither futuristic mumbo-jumbo nor postmodern metaphor: “I believe, to be clear, that it is above all a SCIENTIFIC truth, a reflection of some deep and important facts about our special, and distinctively HUMAN, nature” (3 emphasis in the original).

- The image of the cyborg must be rescued from writings on gender and postmodernism: “The cyborg is a potent cultural icon of the late twentieth century. It conjures images of human-machine hybrids and the physical merging of flesh and electronic circuitry. My goal is to hijack that image and to reshape it, revealing it as a disguised vision of our own biological nature” (5).

- We have always been cyborgs: “We have been designed, by Mother Nature, to exploit deep neural plasticity in order to become one with our best and most reliable tools. Minds like ours were made for mergers. Tools-R-US, and always have been” (7).

- The cyborg mind is distributed: “Minds like ours are complex, messy, contested, permeable, and constantly up for gras” (10).

- The cyborg undermines ancient prejudices over the “skin-bag”: “Perhaps then it is only our metabolically based obsession with our own skin-bags that has warped the popular image of the cyborg into that of a heavily electronically penetrated human body…The mistake…was to assume that the most profound mergers and intimacies must always involve literal penetrations of the skin-bag” (28).

**Piercy’s He, She and It**

The novel takes place in 2059 largely in a Jewish town, Tikva, on the margins of official society in a typical cyberpunk dystopic environment in which government has stopped functioning, the environment has been ruined, nuclear war has obliterated the Middle East, and there have been periods of famine and plague. Avram is a male scientist working in secret to create a cyborg, Yod, whose purpose will be to protect the town against attacks. Malkah and her granddaughter Shira are employed by Avram to help with Yod’s programming and help him learn to pass as a human being. Piercy weaves together Yod’s story with that of the creation of a golem, Joseph, in 17th century Prague, and the stories of Frankenstein and Pygmalion. Central to *He, She and It*, as
indicated by the title, is the question of Yod’s status, whether he is human, a person, and a Jew.

**Why it is worth drawing on Piercy in the context of considering Clark’s view**

There are several interesting similarities between these two texts:

1. First, and most importantly, both are concerned with similar issues: the “ill-understood relationship between biology, nature, culture, and technology” and “what it should mean to be human.” Both Piercy and Clark are centrally preoccupied with the issues of the meaning of and place of humanity in a techno-scientific culture. Both are very much interested in the question of what it means to be human, the extent to which we are becoming bio-technological hybrids, the manner in which artificial life forms raise questions about what we are and what our place in the cosmos is. Ultimately these are works which explore our self-image, our self-interpretation, and how that self-image is being transformed by transformations taking place in the culture at large.

2. The issue of continuity: Both of these texts are concerned with the issue of whether “there is anything new under the sun.” Clark argues that we have always been cyborgs, that a close examination of our evolutionary history reveals the multiple ways we have merged with our tools, and that for this reason rejects the posthuman: “There has been much written about our imminent post-human future, but if I am right, this is a dangerous and mistaken image. The very things that sometimes seem most post-human, the deepest and most profound of our potential biotechnological mergers, will reflect nothing so much as their thoroughly human source.” (6) By placing her meditations on the status of Yod in the context of a dual narrative on the status of the golem, Piercy too seeks to emphasize the continuity of our situation rather than its discontinuity.

3. A similar focus on boundary issue: Piercy agrees with Clark that questions about the boundary relations are up for dispute in our technological age (real/virtual, material/informational, artificial/natural, human/machine). She accepts some of his fundamental insights about how technology has transformed the human being into a cognitive hybrid.

4. Neither Piercy nor Clark are inherently pessimistic about technology. Importantly, Piercy doesn’t take an overly facile stance in opposition to science and technology. She provides us with a narrative focused on
strong female characters who define their sense of self in terms of their work with technology (Malkah, Shira, Riva, Nili).

Despite these similarities, there are important differences between these two texts that go well beyond one purporting to be scientific and therefore literal, and the other being a novel. **My central claim:** Piercy’s science fiction is a more productive reading of the cyborg and a more satisfying reflection on these issues than Clark’s science.

**There are four key issues wherein Piercy’s literary text complicates and critiques Clark’s scientific text.**

(1) *Whether science and technology have a history and a culture*

Piercy’s exploration of technology underscores Judith Wacjman’s claim in *Feminism Confronts Technology*, that “the evolution of technology is…the function of a complex set of technical social, economic, and political factors.” Technology is a culture, and we must critically analyze the traditional patriarchal culture of which it is a part and recognize that “[t]he evolution of a technology is thus the function of a complex set of technical, social, economic, and political factors” (23). Wacjman contends that we need to rethink the culture in which technology is both produced and functions, a culture in which technology comes to embody patriarchal values. From *Reload*: "each technology carries with it a culturally and historically specific meaning or resonance" (29). While Clark claims to be exploring the relationship between biology, nature, culture, and technology, culture in fact plays little role in his discussion and is explicitly marginalized in his account of the natural-born cyborg. Clark’s view of technology is ahistorical, neutral, and individualistic. Clark suggests that new smart technologies will usher in “new social, cultural, educational, and institutional structures” (45), but he never specifies what he takes these changes to be. Piercy perhaps provides us with at least one account of what that future might look like.

Piercy complicates this view in a number of ways:

(a) *technology has a culture:* Piercy reworks the tale of the golem in an effort to establish that Yod has a culture, a history. Throughout the novel, we are reminded that one of things that distinguishes Yod from human characters is that he lacks a culture. Shira comments to Yod, “there’s not culture of cyborgs for you to fit into,” and Yod himself recognizes the need to construct modern
myths by which he can come to find or construct a place in the world. Technology without culture has no place. By counterposing the story of Yod with that of the golem and moving back and forth between the fictional town of Tikva and the Jewish ghetto of Prague and the fictional characters of Tikva with the characters of Tycho Brahe, Giordano Bruno, Copernicus, Piercy places the development of science and technology in a rich religious, mystical, and cultural context. Piercy further links the survival of the Jewish free-town of Tikva on its relation to the technology it develops and its ability to stay out of the way of the 23 multi-nationals that control much of the planet’s economy. You can’t understand the place of technology in the novel independent of the geo-political context Piercy has developed for exploring it.

(b) the competing cultural appropriations of technology: Piercy is careful to delineate a variety of contexts for the cultural development of technology and to show how distinct technologies emerge in distinct cultures. Her narrative moves among several spaces, including Tikva, the large multi-nationals with their officially sanctioned cultural patterns, the so-called Black Zone of the Middle East, and the Glop, or megaglopolis. In each of these contexts, we see distinct appropriations of technology for distinct ends. Shira’s mother is an information pirate who liberates information from the multinationals and turns it over to the residents of the Glop. The Jewish and Palestinian women living in the Black Zone have developed their own technologies: “We have no men. We clone and engineer genes. After birth we undergo additional alteration. We have created ourselves to endure, to survive, to hold our land. We have a highly developed technology for our needs, but we don’t tie into the Net…” (198).

(c) the social construction of knowledge: Piercy’s tale explicitly weaves together science, myth, and mysticism. This comes across clearly in how she distinguishes between Avram and Malkah. Avram is portrayed a the cold, calculative, rational scientist who chides Malkah for her trifling with the Kabbalah, arguing that she is a scientist not a mystic. Malkah responds that she finds different kinds of truth valuable. “In fascination with the power of the word and a belief that the word is primary over matter, you may be talking nonsense about physics, but you’re telling the truth about people” (259). Indeed, its these different truths that Malkah embodies in Yod’s programming, giving him what she refers to as emotional and personal knowledge, which ultimately permits Avram’s experiments with cyborgs to succeed. Piercy regularly returns to this theme of the intertwining of myth, mysticism, and science. As Malkah relates the story of the golem and connects it to the rise of the Enlightenment and the scientific revolution, she suggests, “I cannot always
distinguish between myth and reality, because myth forms reality and we act out of what we think we are” (29). Piercy’s account of the golem interweaves the origins of the Enlightenment and the scientific revolution with the Jewish mysticism of the Kabbalah. The intertextual nature of Piercy’s novel mirrors the competing cultural traditions in terms of which we must examine technology.

(d) the dangers inherent in the masculine appropriation of technology: As I will suggest in a moment, we see this explicitly in Avram’s construction of cyborgs. Additionally, Piercy’s earlier eco-feminist roots play a role in *He, She and It* where she catalogs the impact of technology on the environment: greenhouse effect, great hurricanes, polar ice caps melting, famines, ruined cities, wide scale infertility.

(2) *Whether technology has a gender*

Clark explicitly marginalizes any discussion of gender: “I’d encountered the idea that we were all cyborgs once or twice before, but usually in the writings on gender or in postmodernist studies of text. What struck me in July 1997 was that this kind of story was the literal and scientific truth” (4). Clark’s focus in *Natural-Born Cyborgs* is almost exclusively on human intelligence and the nature of the mind. In fact the only popular culture image of a cyborg Clark uses is the bar-coded dancer image I have included in the outline to this presentation.

Piercy’s account of the contribution of Malkah and Shira to the construction of Yod’s (masculine) nature, raises critical questions about how technology is gendered. As Alison Adams notes in *Artificial Knowing*, work in AI and robotics often presupposes masculine, competitive, rationalist, individualist models of human life, while ignoring that human beings function as members of a social group, have a shared culture and forms of embodiment that generally require looking after and caring for other bodies. Jenny Woolmark: cyberpunk explores the interface between human and machine in order to focus on the general question of what it means to be human; feminist science fiction has also explored that interface, but in order to challenge those universal and essentialist metaphors about humanity which avoid confronting existing and unequal power relations.

Malkah’s contribution to Yod’s programming: Avram made him male—entirely so. Avram thought that was the ideal: pure reason, pure logic, pure violence. The world has barely survived the males we have running around. I gave him a gentler side, starting with emphasizing his love for knowledge and extending it
to emotional and personal knowledge, a need for connection” (142). Piercy suggests that technology is not neutral in design but that gendered perspectives are written into the technical code. Piercy implicitly raises the question about how technology ought to be nurtured and shepherded in the world. She draws connections between the midwife Chava and the work that Shira does in raising both her own son Ari and the cyborg Yod.

(3) Whether bodies matter
While Clark suggests that bodies matter, “the details of the body do not matter so very much. Soon the body may be biological, robotic, standard, enhanced, extended, multiple, all-in-one place or spread across several physical locations. Embodiment is crucial, yet always and everywhere negotiable” (Interview). Actual bodies play no role in Clark’s analysis. We are shape shifters, Clark suggests. The only actual bodies appearing in Natural-Born Cyborgs is Stelarc’s cyborg body. Here too Piercy offers a counter-narrative:

(a) the body in cyberspace: consider the significant contrast between Gibson’s portrayal of Case and Piercy’s portrayal of Shira. Early in the novel we are told that since the birth of her child, Shira chooses not to enter stimmies. There are few characters who live for the disembodied experience of cyberspace, a common trope in Gibson and other cyberpunk narratives. We do know that Malkah enjoys the bodiless experience of cyberspace and that she alters her sex when online (74, 146, 155-62). She likes to be changing and multiple. But we also know that Malkah is aging and that she has chosen to end her self life following her affair with Yod.

(b) the particularity of the body; We also know that Tikva is distinct from Y-S because of its toleration of human variety (247): of age, size, sexual typology. Most importantly, there is Malkah’s aging body, something not often present in cyberpunk novels. Piercy includes a variety of particular bodies in her novel, to contrast the abstract and unspecified body of Clark. There is the youthful body of both Ari and Shira, the mothering body (Shira who decides to have her child naturally); the Jewish body (Shira is very natural and doesn’t do anything about it); clearly the gendered body and the implications for being both male and female (both Yod and the golem Joseph comment that they were specifically created male). We also have sick and infirm bodies and bodies that no longer are able to inhabit the natural environment made unnatural (sec skins, the inability to reproduce). Bodies are always particular and are being shaped by their environments. Piercy suggests that it is not enough to consider the
plasticity of the body without thinking correlative about the cultural regime which shapes that body.

(c) Shira’s naturalness; Interestingly, one of the central characters of the novel, Shira, is repeatedly described as being natural, her body unenhanced. Shira was commonplace, banally human, as natural as seaweed and mud. She felt ashamed, as if her unaltered, unenhanced body were something gross. She is described later on as natural, as her mother made her. She is described as overly aware of her Jewish body, how it is marked as different and yet she does nothing to erase that difference, which is possible and normative given the emphasis on cosmetic surgery in the multis. She chose to pursue a natural birth, described in the novel as archaic and somewhat backwards.

(d) Yod’s embodiment: Yod’s success in passing as a human is connected to touch: Malkah had given Yod the equivalent of an emotional side: needs programmed for intimacy, connection. A given need to create relationships of friendship and sexual intimacy. A need for bonding, the ability to bond strongly and consistently. Shira notes, for instance, that he is like a woman in his desire and need to be touched. She points out that his desire for intimacy and the need to join with and understand others is also typically feminine. As she comments, “You want telepathy. It’s a prominent human fantasy, usually a fantasy of women, who wish they could understand what men want and tell men what they want” (184). While Shira suspects that men were “put together mentally as well as physically on some completely different principle than herself,” she finds this is not the case with Yod. She comments that his desire for connection and his need to communicate his feelings is uncharacteristically male.

(e) the desiring body: Shira and her inability to feel sexual pleasure, the fact that her body is described as shut down. In the case of Shira we see that it is her body that responds to Yod, the body seems to have a knowledge (167, 168). In her physical reactions to Yod, the myth that had governed her emotional life for the last 10 years was peeling off (178). Where previously, she felt alienated from her body and distrustful of her own intuitions, Shira matures and grows through her intimate relationship with Yod. There is also the issue of the messiness of passion: Gadi, Shira, Avram in the reaction to his wife’s death (Gadi suggests that Avram’s sole pleasure in life is to deny himself pleasure: “He gets more fun out of refusing to overindulge, refusing sex, refusing pleasure, than us messy types get from wallowing in our passions. Literally, he looks down on us” (249)). Shira’s strong emotional attachments. Our humanity
is perhaps connected to our passions, in contrast to the overly cognitive emphasis one finds in Clark.

To some extent perhaps Piercy is suggesting that in our techno-scientific culture, the body and its pains and passions must still be given its due, denying Clark’s suggestion that we get over the metabolically based obsession with our own skin-bags.

Vivian Sobchack
“Beating the Meat/Surviving the Text, or How to Get Out of this Century Alive”

One of the consequences of our high-tech millenarianism is that the moral material and significance of the lived-body is elided or disavowed. Pain would remind Baudrillard that he doesn’t just have a body, but that he is his body, and this it is in this material fact that affect and anything we might call a moral stance is grounded. Both significant affection and a moral stance are based on the lived sense and feeling of the human body not merely as a material object one possesses and analyzes among others, but as a material subject that experiences its own objectivity, that has the capacity to bleed and suffer and hurt for others because it can sense its own possibilities for suffering and pain.

If we don’t keep this subjective kind of bodily sense in mind as we negotiate our techno-culture, we may very well objectify ourselves to death. It is only by embracing life in all its vulnerability and imperfection, by valuing the limitations as well as possibilities of our flesh, and by accepting mortality, that we will get out of this—or any—century alive.

(4) Whether we should embrace our cyborg future
Clark’s tale is ultimately a very optimistic one. “By seeing ourselves as we truly are, we increase the chances that our future biotechnological unions will be good ones” (198). Piercy is far more ambivalent regarding our cyborg future and suggests that naturalizing technology is fraught with complexities. While Piercy presents Yod as a fully human character, by the end of the novel, he destroys himself and his “father” and creator Avram. Malkah travels to the Middle East (the Black Zone) with the Jewish feminist cyborg Nili to receive her own cybernetic implants. And in the final chapter, “Shira’s Choice,” Shira flirts with the idea of rebuilding Yod but concludes that “she could not
manufacture a being to serve her, even in love.” She dumps Yod’s memory cubes into the trash and “sets him free.”

Piercy initially seems to be in agreement with Clark that we are all cyborgs now. As Shira comes to realize and explain to Yod:

Yod, we’re all unnatural now. I have retinal implants. I have a plug set unto my skull to interface with a computer. I read time by a corneal implant. Malkah has a subcutaneous unit that monitors and corrects blood pressure, and half her teeth are regrown….I couldn’t begin to survive without my personal base: I wouldn’t know who I was. We can’t go unaided into what we haven’t yet destroyed of nature….We’re all cyborgs, Yod. You’re just a purer form of what we’re all tending toward.

(150).

Repeatedly the novel introduces the idea that there is no substantive difference between Yod and human beings. There are several passages where Yod’s nature is debated and our own constructed nature is highlighted.

- Socialization is like programming;
- Shira’s sexual responses are awoken by a machine;
- Yod: “I’m a fusion of machine and lab-created biological components—much as humans frequently are fusions of flesh and machine”;
- “If I can’t reproduce, neither can many humans”;
- In some respects Yod is presented as superior to men, as superior to Gadi for instance, “I want to do with you exactly what he wants to. But I can do it better…”;
- “How could she have held in her arms a thing that was part of a production series, like models of dolls. But then she remembers her resemblance to Malkah’s sister Daria.
- I was making love…with something built of crystals, chips, neural nets, heuristic programs, lab-grown biologicals. She could not cook up disgust. After all, her own interior was hardly aesthetically pleasing. Were biochips more offputting than intestines?”
- Shira reminds Yod that he is as much a part of the earth (the Golem) as she is: “We are all made of the same molecules, the same sets of compounds, the same elements”.
- also the connection between questions about Yod’s status and the status of the Jews, connecting anti-semitism to Luddism.
So what does all of this establish? The strong continuity between human and machine, as Clark suggests. But then Yod must be destroyed and he is specifically contrasted with Nili. Why? Is there a Kantian element at work here? Is this a basis on which to critique Clark? Minimall there is Piercy’s ambivalence as suggested by the historical context she constructs for her tale and the fact that she maintains a connection to the natural and the role that the body still plays her narrative.

**Contrasting Yod and Nili**

Maybe one way to think of the contrast between Yod and Nili is to consider the issue (raised by Feenberg) regarding the context of technical innovation and how social and cultural forces shape the technology. He distinguishes between how different groups will use technology and cites a dominant and a subordinate take on technology. The recognition that Nili is the path and not Yod might reflect the origins of the technology in the Black Zone and in a specific kind of woman's collective distinct from the masculine and militarist origins of Yod. So you have similar technologies but created in different contexts with different visions and this must be taken into consideration. Clark seems not to think very much about the context in which the technology is created nor the ways in which the technology is appropriated. Again, this seems to suggest that the biggest difference between Piercy and Clark is in terms of a philosophy of technology.

What are we to make of the character of Nili? There has to be some significance to the fact that she comes out of the Black Zone, a pestilent radioactive desert. Also, her community is a female-only community. And significantly, Nili is born of a woman, in fact only women and that is the first question Shira wonders about when she wonders whether Nili is human: was she born from a woman. Yod clearly was not. They have no men but clone and engineer genes. “I am sent like the dove or maybe the raven from Noah’s ark to find out if the world is ready for us, and also if there’s anything out here we might want.”

There is a significant difference between Yod and Nili in that Yod was designed for a purpose. Yod and Nili are distinct in that Yod doesn’t really have a birth, doesn’t die, and has no culture or history. Nili is presented as steeped in culture and tradition—the traditions of the Jews and Palistinians. It is also interesting to note that Yod can rebuilt while Nili of course cannot. There is a sense of individuality and uniqueness associated with the human being that distinguishes us from Yod. Perhaps Piercy is not as quick as Clark to embrace the decentered subject. There is the issue of free will as well. Does Clark ever confront the
question of agency? So does Nili maintain something that Yod lacks that suggests that she is a better path than Yod’s? Hicks might suggest that what Nili maintains is a sense of identity and agency.

We should keep in mind that at the same time that Yod is destroyed, Y-S is destroyed and Avram and his lab is destroyed. Simultaneously, the Glop begins to organize. Consider the significance of Yod’s destruction in the context of these broader socio-political changes. The golem also is destroyed and Shira’s maturing is represented as her giving up her myths—Piercy doesn’t identify with the feminist appropriation of myth and magic and she doesn’t turn her back on technology. Perhaps there is a notion of replacing older forms of knowledge (myth, mysticism, but also patriarchal forms of science and technology) with new forms of science and technology.

**Piercy’s Philosophy of Technology**

Part of what I am interested in claiming is that Piercy’s approach to technology and the cyborg is reflective of a different philosophy of technology than Clark’s and that Feenberg’s *Questioning Technology* sets up a context in which we might examine this difference. Clark’s approach might be more reflective of instrumentalism (technology as humanly controlled and neutral; liberal faith in progress) and Piercy’s might be more reflective of critical theory in which technology is value-laden (means form a way of life that includes ends) and human controlled (choice of alternative means-ends systems). Feenberg connects this to Marcuse and Foucault, the left dystopian view, and adopts the perspective himself. “Critical theories, such as Marcuse and Foucault’s left dystopianism, affirm human agency while rejecting the neutrality of technology. Means and ends are linked in systems subject to our ultimate control” (9). This is the position he defends.

How to characterize this view:

- avoids the romantic protest against mechanization (Marcuse was not a romantic technophobe)
- technologies are not just means subservient to independently chosen ends but that they form a way of life, an environment
- technologies are forms of power
- introducing a socially specific notion of domination
- does not claim that technology is autonomous
- relate technical domination to special organization
• technology has no singular essence but is socially contingent and could therefore be reconstructed to play different roles in different social systems.
• Left dystopians reject essentialism and argue for the possibility of radical change in the nature of modernity
• Different from the common sense view that technology is a neutral means available to serve any end because the choices are not at the level of particular means but at the level of the whole mean-ends systems
• The ambivalence of technology: its availability for alternative developments with different social consequences
• In left dystopianism, politics and technology meet in the demand for democratic intervention into technical affairs
• Human action can change the epochal structure of technological rationality and the designs which flow from it. A new type of reason would generate new and more benign scientific discoveries and technologies.

For Marcuse, technology is ideological where it imposes a system of domination, and forces extrinsic ends on human and natural material in contradiction with their own intrinsic growth potential. What human beings and nature are and might become is subordinated to the interests of the system. This view has some similarity to substantivist critique (Heidegger, Ellul), although Marcuse holds out the possibility of a radically transformed technology in the future that would be more respectful of its objects, that indeed would recognize nature as another subject.

Feenberg also connects this view to Foucault’s subjugated knowledges that arise in opposition to dominating rationality. The view from below reveals aspects of reality hidden from the hegemonic standpoint of science and technique. And he points out that in addition to the influence of Kuhn and Feyerabend (the break with positivism), the emergence of these new approaches to technology owes much to the environmental and feminist movements.

Feenberg himself is working towards a revised political constructivism that incorporates micropolitical resistances in its understanding of technology.