The Technology of World Pictures

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INTRODUCTION

The purpose of this paper is to better understand how technologies project the world picture of those who construct them. Imaging technologies—linear perspective, film, virtual reality, etc.—are of particular interest to this investigation because their social purpose is to literally construct pictures of alternative worlds. The term *world picture* derives from Martin Heidegger's critique of the modern ontology formalized by Descartes and Kant.[1] Heidegger observed that the very act of *picturing* the world documents our alienation from an organic, or inclusive, understanding of earth. His point is not that our world picture has changed from an earlier and somehow more authentic rendition, but that the modern age is characterized by the experience, in the first instance, of grasping the world as a picture.[2] Heidegger's complaint is that modern ontology, and the positivist imaging technologies that derive from it, privilege the point of view of the picturer by excluding it from the material reality pictured. Linear perspective is, of course, the technology which best exemplifies the isolation of the picturer from the pictured. Heidegger's complaint is then an objection to the subject/object split conceptualized by Descartes and Kant and represented by a perspectival view of the world.

In Heidegger's view, modern imaging technologies embody the alienation of human subjects from our ecological context. Many have argued that the modern environmental movement derives from recognition of this ontological tragedy. Environmentalists to the Right, or deep ecologists, argue against the probable survival of a world divided into distinctly human and nonhuman realms. In lieu of a dichotomized world stocked with resources which are in turn pursued by consumers, deep ecologists argue for the conscious recuperation of a unified earth. These environmentalists wish for an organic condition of spiritual unity between humans and nonhumans.[3] Such a world remains unpictured. In contrast to such a romantic project, environmentalists to the Left, or social ecologists, argue for the conscious construction of a "sustainable" world picture.[4] These environmentalists suffer no illusion about returning to lost conditions. Rather, their project is the construction of a new world picture based upon the emerging doctrines of sustainability. It is this difficult to define concept that demands new techniques of picturing the world. Just as linear perspective has pictured a world through the ontological lens of modernity, environmentalists to the Left are seeking to construct a lens with which we might picture a still emerging postmodern ontology.

The role that imaging technologies have played in the abstraction and alienation of the natural world is a principal concern of this paper. If one technology (linear perspective) bears some responsibility for reproducing a world of alienated subjects and objects, is it possible that another technology (object-oriented programming, for example) has hope of putting Humpty Dumpty back together again? Although there is considerable irony in applying Heidegger's complaint to advances in computer technology, my intent is to do just that. Such a project is ironic because the philosopher was deeply skeptical of reducing the poetics of language to binary pairs of 0's and 1's.[5] Following a review of Heidegger's attitude toward technology, I will introduce *Icono-metrics* as one example of recent developments in object-oriented programming. This program is now being developed by the Center for Maximum Potential Building Systems of Austin, Texas as a tool for the design of ecologically sustainable environments. Some computer scientists have argued that the use of object-oriented designs to analyze complex systems begins to resolve Heidegger's objections to computing, or what he described as "calculative thinking." However, even if Heidegger's skepticism is overcome, it is not certain that the market will follow.

If our understanding of earth, or world, is to be reconstructed so as to avoid the tragedy of modern ontology, it is necessary for the developers of new imaging technologies to better understand their own ontological assumptions and the politics implicit in the social construction of technological facts. A brief comparison of a mature imaging technology (linear perspective) and an emerging technology *(Icono-metrics)* will help to make the social contingency of technological facts more clear. My point is that the degree to which

developers are aware of the social nature of fact construction will better equip them to contribute to the social renovation of modern ontology. My analysis of icono-metrics is not, however, a simple procedural caution to Pliny Fisk and his colleagues at the Center for Maximum Potential Building Systems. There remain unsatisfied questions regarding the world picture constructed by those environmentalists, like Fisk, who refer to nature as a set of *complex systems*. For some, the term refers to modernist assumptions regarding our ability to succeed in making complex calculations. For others, the term refers to postmodern assumptions regarding the epistemological inadequacy of all calculation. It is yet undecided as to which set of assumptions will guide the further development of *Icono-metrics*. Following such indeterminacy, I find it necessary in my conclusion to ask if the sustainable world picture constructed by icono-metrics is only an instrumental artifact of the technology itself. Before considering that question, however, it is necessary to provide a context concerned with issues of representation.

PART 1: ISSUES IN REPRESENTATION

Martin Heidegger's objection to technological modes of representation is first, that they abstract the viewer from organic context, and second, that they are radically reductive. In this view, Heidegger essentializes technology. He contends that the very essence of modern technology is that it has achieved a previously unknown autonomy from society. Where moderns have commonly adopted a voluntarist attitude toward technology—meaning that it is controlled by social processes—Heidegger adopts a determinist attitude—meaning that he understands modern technology to embody a trajectory that is independent of social processes. On Heidegger's account, modern technology leads to a diminished ontological condition. His concerns are less about the destruction of nature than about the human distress brought about by the technological understanding of Being.[6]

Although sympathetic to Heidegger's insights, Bruno Latour has departed from Heidegger's technophobic essentialism by coining the notion of "inscription." By this term Latour refers to the act of reducing a thing to an inscribed representation of its material state. His point is that inscribed images, such as maps or perspectival drawings, emphasize only selected attributes of nature and that such acts of selection are, as Heidegger contends, radically reductive.[7] Latour argues that the purpose of constructing such a simplified view of nature is to mobilize forces that will support a version of reality that is of benefit to the inscriber. Competing forces would presumably select other attributes of nature as representative of reality. The point here is that inscriptions are made powerful because the reductive image is less confusing than the original material state of things. Support for the inscriber is thus mustered by editing out those details of everyday life that detract from the inscriber's favored world picture.

Latour's notion of inscription is, however, not a Heideggerian complaint. Although Latour agrees with Heidegger's accusation that technological modes of representation are radically reductive, and therefore dangerous, he rejects Heidegger's general determinism with regard to technology. In contrast to the modern voluntarist position, and to Heidegger's postmodern determinist position, Latour promotes a third possibility. He argues that neither society nor technology fully controls our situation. On his account, technology is the scene of a battle for imaginative supremacy between competing world pictures. It is a simple game of mathematics. Dominance is gained by the technology whose world picture mobilizes the interests of the most supporters.

Latour's insight is that potential supporters of new technologies are not mobilized by abstract knowledge, but by practical outcomes. Those who consider adopting a technology ask themselves, does the system in question promote my interests or doesn't it? The complex web of scientific experiments and production agreements that lie inside the "black box" of technoscience are of little consequence to users. All that matters to those who operate outside the box is the minimization of input and the maximization of output.

I wish to argue here that linear perspective is an example of a technological black box. Although this graphic technology emerged in fifteenth-century Italy, it has been radically enhanced, and made more opaque, by contemporary computing capabilities. The technological process by which three dimensional data is transformed into a two dimensional image is understood by very few. However, millions of users understand the resultant two dimensional illusion to be an accurate and even scientific representation of the original three dimensional object. The public reception of perspectival facts favors, of course, the architects who construct such views and the clients who commission them. Latour's point is that without the confusing presence of those attributes of nature that have been edited out of the picture, support for the constructed image is more easily mobilized. The other species who inhabit the site, the distant locales from where materials were gathered, and the landfills where construction waste is dumped are not present in the perspectival views constructed by architects. These confusing, or competing facts are edited out of the picture by the technology itself. Perspectival drawings heroize the author of the object made present, but conceal the transformed conditions of earth. Although the computerization of linear perspective has enabled viewers to experience a vastly enhanced picture that includes the dimensions of time, sound, and color, the ontological assumptions that guide the construction of that picture have not changed in 450 years.

The degree to which linear perspective is a scientific fact or a socially constructed convention has been exhaustively argued by Panofsky, Edgerton, Damisch and others.[8] To avoid entering that much contested discourse in such a short paper I will simply defer to Edgerton's distinction between linear perspective as "discovered" or "invented:"

"'Discovered' implies that linear perspective is an

absolute scientific truth, universal to all men regardless of cultural background or historical period. 'Invented' on the other hand, suggests that linear perspective is only a convention, the understanding or adoption of which is relative to the particular anthropological and psychological needs of a given culture."[9]

Following Heidegger and Latour, I will join those who understand linear perspective as an invented, or socially constructed convention of picturing the world. To do so is to argue that all modes of representation; x-rays, mylograms, magnetic resonance images, and cave painting are all equally scientific and equally social. In other words, if we must *picture* the world at all, we might do so differently. We might select attributes of nature other than those visual characteristics which can be measured as representative of reality. To do so, however, would require another technology—one that has vastly expanded capability to remember all of those organic complexities of everyday life that are edited out of the modern world picture.

The opportunity presented by recent developments in computing is to retain Martin Heidegger's objection to modes of representation that are radically reductive, yet reject his determinist attitude toward technology itself. Terry Winograd has documented four cases in which Heidegger's critique of technology has been explicitly used to design computational systems. He contends that computing is already moving beyond the selective simulation of objects in Cartesian space toward engagement in activities or *behavior*.[10] Citing Philip Agre, Winograd argues against conventional notions of AI (artificial intelligence) that are "... an artificial effort to construct the world within the agent's head, which must compensate for mentalism's artificially rigid boundaries between inside and outside... Ordinary activity," contends Agre, "is not amenable to such rigid *a priori* circumscriptions of relevance."[11] In this passage, Winograd and Agre are proposing a major conceptual shift. They argue that computing now has the power to escape the artificial limits of mentalism, first conceptualized by Descartes and Kant, that lead to the formalization of linear perspective 450 years ago. If they are correct, it suggests that Heidegger's deep skepticism regarding the impoverishment of digital language might be overcome. An examination of *Icono-metrics* will help to make this prospect concrete.

PART 2: *OBJECT-ORIENTED PROGRAMMING AND ICONO-METRICS*

Icono-metrics is only one of many object-oriented programs now being developed. The reference to "object-orientation" refers to the understanding that, in digital space, concepts can be made to be recognized as objects. In traditional procedural programming, information could be recognized only by its location. In procedural programs, calculations are completed by seeking out the locations of data in a predetermined sequence. In object-oriented programs, however, "objects" float. Rather than being recognized by their address in digital space, they are recognized by their functional operation. In this sense, an object-oriented program is opportunistic rather than deterministic. It operates as a meta-formula that recognizes the opportunity for a given object to solve stipulated problems.

Object-oriented programs are, of course, still representations of nature. They are still reductive and fail to participate in the poetic complexity of organic context. However, object-oriented programs are not simple calculations of visual objects in Cartesian space. Rather, they represent a complex world of interactive behaviors. It is this shift from the representation of *things* that can be measured to the representation of *behaviors* that is so hopeful. What Heidegger wanted to bring about was just such a challenge to the leveling tendency calculative thinking. His concerns were, always, focused upon human practices in nature rather than on nature itself. It is unlikely then that any computer scientist will yet claim that Heidegger's objection to acts of calculation, abstraction and reduction is fully overcome. They are likely to claim, however, that computation has achieved the presence of nature *by degree*.[12] In other words, object-oriented programs allow humans to consciously interact with natural complexity to a degree never before imagined. Complex computation has made some natural behaviors present to us in a *conversational* and interactive mode. That humans might hold elemental conversation with nature is an event that even Heidegger might find hopeful. Conversation, in the sense that I intend here, is a satisfying human practice, not a calculation intended to predict and control natural resources.[13] *Icono-metrics* is one attempt to facilitate such a conversation between equals.

According to Pliny Fisk III, the principal designer of *Icono-metrics*, the term "... refers to the design method of understanding any process, whether in the natural or human world, through a series of symbolic pictures ... ." These symbolic pictures, or icons, are best understood as a system of signs which contain mathematical approximations of

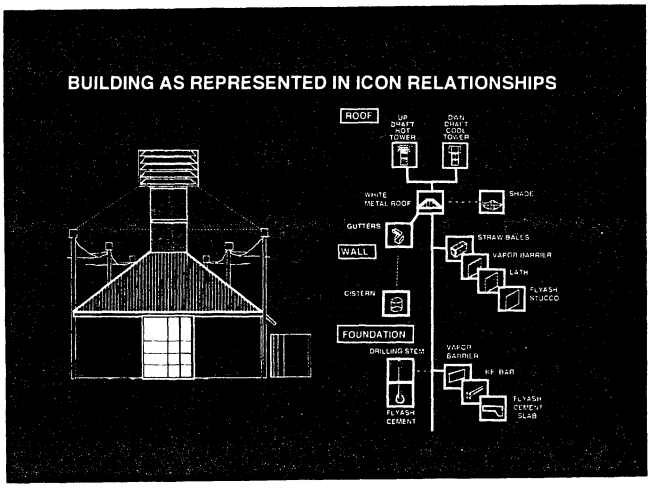

Figure 1: *Icono-metric* model of one structure at Blueprint Demonstration Farm; Laredo, Texas. Courtesy the Center for Maximum Potential Building Systems.

various life processes. The mathematical approximations that lie behind the icon are linked to local ecological conditions. For example, Figure 1 pictures Blueprint Demonstration Farm at Laredo, Texas. Each icon, on the right, represents the ecological operation of the building component shown in elevation at the left. The gutter icon, in this image, contains a formula that calculates the volume of water which can be harvested, stored, and used by the inhabitants based upon the area of roof constructed in that particular location in a year of average rainfall. The purpose of the icon is not, however, to simply predict the production rate of various resource conservation techniques. Rather, the purpose is to understand how systems will behave when integrated into a constructed environment. To accomplish this task, the designers of *icono-metrics* have relied upon object-oriented programming. In this example of rain water harvesting, the formula behind the gutter icon would interact with all other icons in the project, not simply those which represent the operation of water systems. By arranging and rearranging various icons under the categories of roof, wall, and foundation systems, the designer can model the life cycle performance of discreet systems as well as the life cycle of the interactive environment as a whole. Figure 2 illustrates all of the water system icons, or processes, that the designers understand to be operative at the Laredo project. It is important to recognize that the icons represent human processes, such as washing, in the same computation as natural processes, such as rainfall. It is this hermeneutic, or conversational, quality of the computation that begins to overcome the isolation of human subjects from natural processes that is tragically reproduced in perspectival representations.

Icono-metrics, however, is not yet an operative system. Development has been stalled by funding problems and by the doubts of the developers themselves. For potential funders, the expressed concern is the degree to which the program will be able to mathematically model the life-cycle of proposed projects. The federal EPA, for example, has interest in the program as a tool by which public policy might legislate the consumption of dwindling natural resources. Given current political realities government is likely to consider only quantitative criteria.[14] Understood in Latour's terms, *Icono-metrics* would become a government inscription system, or a black box, that secures the position of the EPA as the public accountants of resource consumption. In other words, EPA's interests are linked to the ability of the program to quantify nature more accurately than other available technologies. If only EPA has control of a technology which will maximize available resources, their interests are best secured by maintaining the opaqueness of the natural relationships in question. Such purely calculative thinking is, of course, just the temptation that concerned Heidegger.

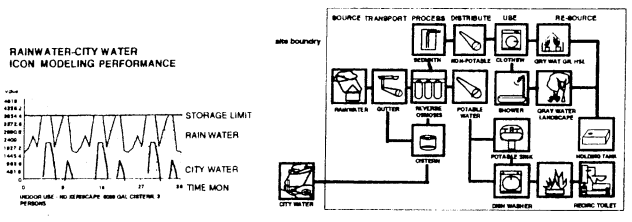

Figure 2: *Icono-metric* model of rainwater systems at Blueprint Demonstration Farm. Courtesy the Center for Maximum Potential Building Systems.

The temptation to quantify is also a source of doubt to the developers of *Icono-metrics* themselves. For example, Fisk has recognized that the very name of his organization; *The Center for Maximum Potential Building Systems*, refers to a modernist attitude that may subvert his intention to construct a "sustainable" world.[15] The term *maximum potential* evokes just the kind of positivist desire to totalize, to maximize quantities, and to edit out organic variables, that drove Heidegger to despair. Fisk's current position is that *Icono-metrics* may contribute most, not as a mode of scientific calculation, but as a teaching tool—a qualitative, rather than quantitative, mode of conversation between communities of humans and nonhumans. In such a conversation, quantities certainly have a seat at the table, but they are no longer the table itself.

CONCLUSION

The temptation to *quantify* and the temptation to *converse* offers two possible development paths for *Icono-metrics*. Government will find their short term interests served by a quantitative, or modernist world picture. They would develop this technology as a measuring device to predict and control natural resource stocks. However, those concerned with our ontological condition, like Heidegger, will find our collective interests served by a conversational world picture. They would develop this technology as a game-like ritual for making design decisions. There is, of course, a third possibility. *Icono-metrics* might simply be ignored. The competition between these three alternative futures—the quantitative, the conversational, or the irrelevant—will be largely determined by forces other than those that have developed the concept to date. Fisk and his collaborators will have influence only to the degree that they can mobilize outside forces in the direction of the conversational world picture they favor.

Scholars in the constructivist tradition of Science and Technology Studies refer to such indeterminacy as the "multidirectional model" of technological development. This model holds that certain directions in technological development die-off and others are economically reinforced as members of society come to share a set of meanings, or benefits, attached to the technology in question. "S&TS" scholars argue that the moment at which a technology becomes socially "stabilized" is commonly confused with

the moment of "invention." As T.J. Pinch and W.E. Bijker would have it:

> "Closure in technology involves the stabilization of an artifact and the 'disappearance' of problems. To close a technological 'controversy,' one need not *solve* the problems in the common sense of that word. The key point is whether the relevant social groups *see* the problem as being solved."[16]

In the case of *Icono-metrics,* the moment of "invention," has yet to be claimed. The technical and social development of the program has not yet been stabilized. Neither the traditional positivist at EPA nor radical social ecologists see their problems as being solved by *Icono-metrics* in its current form. If the developers of this technology hope to influence the direction of its evolution, they must first consolidate opposing problem definitions, and second demonstrate a set of meanings, or benefits, that might be shared by competing sets of interests. To date, no unified problem statement has been articulated and no compelling demonstration of benefit has been made. In other words, the concept of sustainability has yet to be defined in a way that will *seem* to make our collective problems go away.

Although Fisk and his collaborators wish to construct a sustainable world picture, very few claim to know what that might mean. Traditional positivists will argue that the term must be scientifically defined before the technology to produce it can be developed. This is the classical research and development model that separates pure science from applied technology. Others, like Latour, will argue that the social development of the technology will itself produce the *scientific* definition of sustainability. In this view, science is always already social. This is a postmodern, or constructivist model of technoscience. It is this model of technological development that I find particularly applicable to the case of *Icono-metrics*. My principal argument then is that *Icono-metrics* may be important because the mechanics of object-oriented programming may help us to experience the epistemological assumptions of the postmodern world, in the first instance, as a picture of sustained conversation with nature.

The debate between the positivist and the constructivist views of technological development will return us to the question that I briefly raised in the introduction. Namely; will sustainability (roughly understood as the balance of complex social and natural systems) prove to be an instrumental artifact of object-oriented programming?[17] Beginning with Galileo, the instrument-enhanced image of the real has been as important for what it conceals as for what it reveals. Instrumental artifacts, or objects apparently *seen*, but which later turn out to be effects of the instrument itself, take on a phenomenological existence of their own. They exist within the artifice of reality-enhancement. In the case of Galileo's telescope, it seems that the churchmen of his time were correct to doubt some of the macro realities picture in through the glass. In this case it is necessary to at least consider if the sustainable ecological order projected by *Icono-metrics* is an instrumental artifact of the technology itself. In other words, we need to question if the instrument-enhanced view of the world as ecologically balanced is only a teleology projected by those who will benefit from such a postmodern world picture?

In contrast to Fisk and his collaborators, some ecologists are prepared to argue that nature is, after all, not a stable system. In this constructivist world picture the order of things is entirely contingent. Should these scientists be *right*—meaning that they mobilize more supporters to this view than do the positivists to theirs—the world picture drawn by *Icono-metrics* is problematized. In this situation, society would first have to reject the concept of sustainability as a revealed natural condition. As in the case of linear perspective, society would have to understand the concept of sustainability as an *invented*, rather than *discovered*, condition. Second, we would then have to decide if it is desirable to construct such a stable relation between humans and nonhumans. Should society decide that such a construction project was desirable, Fisk and his collaborators would have incentives to develop *Icono-metrics* in accordance with postmodern, rather than modern epistemological assumptions. They would then promote *Icono- metrics,* not as a revealed organic truth, nor as a scientific truth, but as a hermeneutic tool with which we might negotiate a state of stability *with* nature. The radical possibility here is to consciously embrace a picture of postmodern life that positivists will claim to be only an instrumental artifact of imaging technology. To do so would be to give up the project of quantifying nature in favor of constructing a conversation with her.

NOTES

I would like to thank my colleagues Don House, Vince Canizaro, and Mark Clayton for their comments which contributed to the development of this paper.

[1] Martin Heidegger, "The Age of the World Picture," in *The Question Concerning Technology and Other Essays*, Translated and with an Introduction by William Lovitt (New York: Harper & Row, 1977). p. 129-30.

[2] Ibid., 130

[3] This is particularly true for deep ecologists exemplified by the works of Arne Naess. See *Ecology, Community and Lifestyle.* (New York: Cambridge University Press. 1989).

[4] The meaning of the term "sustainable" is, of course, a highly debated topic in many disciplines, including architecture. The definition of "sustainable development" adopted by the World Commission on Environment and Development in *Our Common Future* (New York: Oxford University Press, 1987) p. 42., is "development that meets the needs of the present without compromising the ability of the future to meet its own needs." In second paper delivered at this conference I attempt to define the concept of value in relation to "sustainable" and "regenerative" economy that includes descriptions of competing definitions of "sustainability." See, "Value and Regenerative Economy in Architecture" in *Proceedings* of the 1997 ACSA Annual Meeting in Dallas (Washington, DC: Association of Collegiate Schools of Architecture, 1997).

[5] See Heidegger, "The Age of the World Picture," pp. 136. In this passage Heidegger cites the poet Holderlin as grasping the "incalculable" nature of "truth."

[6] See Hubert Dreyfus, "Heidegger on Gaining a Free Relation to Technology," in *Technology and the Politics of Knowledge*, Andrew Feenberg and Alastair Hannay, eds. (Bloomington, IN: University of Indiana Press, 1965), p. 99.

[7] In the field of Science and Technology Studies, Michael Lynch has articulated a critique of "selection" and "mathematization" that is applicable to linear perspective. See, Michael Lynch, "The Externalized Retina: Selection and Mathematization in the visual documentation of Objects in the Life Sciences," in *Human Science 11* (1988): 201-234.

[8] Panofsky is generally credited with the first challenge to understanding linear perspective as a scientific fact. See Erwin Panofsky, *Perspective as Symbolic Form* (New York: Zone books, distributed by MIT Press, 1991). Edgarton has, however, done most to introduce Panofsky's challenge to our broader audience. See, Samuel Y. Edgerton, Jr., *The Renaissance Rediscovery of Linear Perspective* (New York: Basic Books, 1975) Hubert Damisch has produced the most recent, and perhaps most thorough history of linear perspective. See his, *The Origin of Perspective*, translated by John Goodman (Cambridge, MA: MIT Press, 1995).

[9] See Edgerton, p. 6.

[10] See Terry Winograd, "Heidegger and the Design of Computer Systems," in *Technology & the Politics of Knowledge*, Andrew Feenberg and Alastair Hannay, eds. (Bloomington, IN: Indiana University Press, 1995), p. 125.

[11] Ibid., 112, See also Philip Agre, "The Dynamic Structure of Everyday Life," in *MIT AI Lab Technical Report 1085*, (Cambridge, MA: Massachusetts Institute of Technology, Dissertation, 1988).

[12] I am indebted to Malcolm McCollough for this insight.

[13] The philosopher Michael Oakeshott has argued that reality more resembles a conversation than a fact. It is the partial access to such a conversational reality that complex computation now gives us access. See, Michael Oakeshott, "The Voice of Poetry in the Voice of Mankind," in *Rationalism in Politics and Other Essays* (London:Methuen, 1962), pp., 197-248.

[14] The doctrines and methods of "green accounting" are set forth by Peter Bartelmus in *Environment, Growth, and Development: The Concepts and Strategies of Sustainability* (London: Routledge, 1994). As Officer-in-Charge of the Energy and Statistics Branch of the United Nations Statistics Division, Bartelmus' book exemplifies the calculative thinking that so discouraged Heidegger.

[15] Pliny Fisk II of the Center for Maximum Potential Building Systems; Austin, Texas interviewed by the author 22 November 1994, tape recording and simultaneous notes, office of the author, College Station, Texas.

[16] See Pinch, T.J., and Bijker, W.E., "The Social Constitution of Facts and Artifacts: Or How the Sociology of Science and the Science of Sociology of Technology Might Benefit Each Other," in The Social Construction of Technological Systems, Bijker, W.E., Hughes, T., and Pinch, T., eds. (Cambridge, MA: MIT Press, 1985), p. 29.

[17] For a discussion of the role of "instrumental artifacts" in science, see Don Idhe, "Image Technologies and Traditional Culture," in *Technology & the Politics of Knowledge*, Andrew Feenberg and Alastair Hannah, eds. (Bloomington, IN: University of Indiana Press, 1995), p. 147-158.