



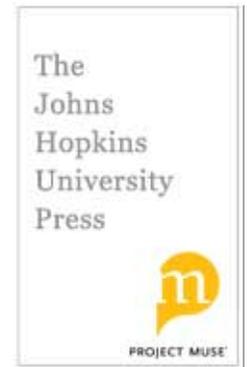
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On Line and On Paper: Visual Representations, Visual  
Culture, and Computer Graphics in Design Engineering  
(review)

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**On Line and on Paper: Visual Representations, Visual Culture,  
and Computer Graphics in Design Engineering.**

By Kathryn Henderson. Cambridge, Mass.: MIT Press, 1999. Pp. x+237;  
illustrations, notes/references, index. \$30.

The introduction of computer aided design (CAD) into modern engineering may bring about the single greatest transformation in the design

process since the “rationalization of sight” during the Renaissance. Hence a book about the changes in engineering design resulting from the use of CAD could be very interesting. Unfortunately, this assemblage of previously published work does not live up to that potential. At the heart of the problem is this: The hard data consists in case studies at only two firms, one making industrial turbines, the other making medical instruments. Kathryn Henderson studied both of them as a “participant observer,” and both firms remain anonymous. The result is therefore potentially valuable only to the extent that the inductive generalizations offered are valid or useful for further investigation. Since two case studies are not sufficient to prove the validity of any generalization, the question becomes whether they can be successfully placed in a conceptual framework or historical context that renders them more suggestive and thus more significant than they would otherwise be.

Those with an interest in conceptual matters will likely be annoyed by the method of theory-building presented in the beginning of the book. This consists mostly in quoting assertions from STS authorities, ranging from Susan Leigh Starr to Bruno Latour, whose concepts are then applied to the case studies rather than being developed out of them. Historians will be annoyed by a potted history of engineering as a series of “coding forays” intended to appropriate the tacit knowledge of master craftsmen and machine-shop culture, replete with the usual citations of David Noble and references to the evils of Taylorism. What “coding” actually means in this context is never really made clear.

Surprisingly, even though Henderson frequently repeats that “cognition must be situated in practice,” there is no history of the development of CAD methods, nor any coherent discussion of the design organization of the firms studied prior to the introduction of CAD systems. Thus we get no sense of the initial promise of the new technology, either in terms of the claims made for it by academics and vendors or in terms of the problems that the firms thought CAD would solve. Without such a contextual “situating of practice,” it becomes very difficult to get a sense of any transformation that the new technology may be bringing about (the grumbling of “informants” aside), because we have no idea of the starting place. Indeed, we are not clearly told when the studies took place, a rather crucial matter when it comes to the performance of computers and software.

Henderson’s case studies do show that the design process is far more complex now than it was in the past, and far more complex than simplistic notions like “visual thinking” can encompass. She notes that drawings are not only useful tools of communication but also help to structure the design-to-completion process. She notes, too, that designers have been hanging on to their pencils and paper despite the introduction of CAD. The trouble is that we knew these things already, and this likewise applies to the two central concepts developed in *On Line and On Paper*. One is that draw-

## TECHNOLOGY AND CULTURE

ings function as “constriction devices,” an echo of Latour that turns out to mean little more than that drawings are so useful and flexible that everyone uses them. The other is that drawings function as “boundary objects,” a label used here to mean that drawings can be read differently by different people. No surprises there.

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*On Line and On Paper* may be most instructive because it nicely illustrates a philosophical problem in the discussion of design. Design is a form of *doing*. But it is persistently treated as form of *knowing*. This continually results in the application of ideas to design that may well have been useful when applied to knowing but are not very helpful and even pernicious when applied to doing. This book starts, for example, with the assertion that design is a matter of “visual cognition.” That people use drawings to communicate and work together then becomes a matter of “distributed cognition,” “group cognition,” then “communal knowing,” then “shared tacit knowledge,” and finally we get the assertion that engineers have a visual culture that makes them all see the world in a particular way. The question of knowing becomes one of psychology, which escalates into the assignment of mentalité in a way that, if applied to all Canadians, say, or all Africans, would immediately be recognized as problematic—but in any event does not help us understand the powerful form of action that is the design process.

The general problem may be nicely summed up by referring to Henderson’s programmatic statement that “knowing is action that requires skill.” Knowing is thereby made central. But surely it is the other way around. Design is an action that requires knowing, and it is to action that we need to turn in order to build up our understanding of drawing and design.

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