SKILL CULTURES AND CHANGING METHODS OF PRODUCTION

JOSHUA BRANDFONBRENER
New York, New York
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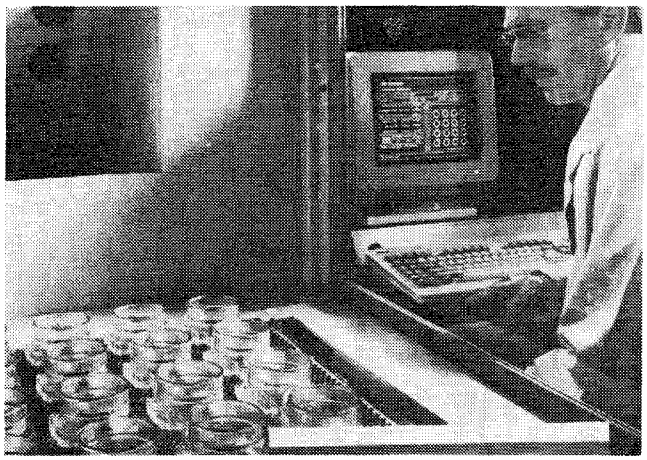

Figure 1: Stereolithography, an example of rapid prototyping

INTRODUCTION

A wide variety of new methods of production are currently available to architects and designers. These methods, such as rapid-prototyping(RP), computer-numeric controlled machining(CNC), various computer-aided design and manufacturing processes(CAD/CAM), are being heralded in the press and in architecture schools as another industrial or "digital" revolution. While their technical and formal possibilities are being explored in many papers and projects, I wish instead to develop a way of questioning and evaluating them which avoids the simple seduction inherent in new technologies.

AESTHETIC UTOPIAS

Architects and designers have been primarily concerned with the formal possibilities that the new processes allow. These complexities and novelties are just now beginning to appear; Gehry's American Center using CAD/CAM and the Dodge Viper with rapid prototyping are well-publicized examples. These new forms are seen as harbingers for future design and production.

By circumventing the intermediary iterations of model, prototype and pattern makers, the designer's original intentions are supposed to reach production undiluted and uncorrupted. This more intimate connection from design to product is thought to elevate the quality and taste of artifacts. The aesthetic benefits of the objects themselves sanctions the application of the methods; the ends sanction and require the means.

TECHNOLOGICAL UTOPIAS

Enthusiasm for these new methods, however, is part of a broader belief that technological innovation, when applied widely, will ameliorate contemporary problems. David Noble has called this an "appeal to technology for deliverance."[1] This faith persists despite the consensus that previous technological "quick-fixes" are to blame for exactly the problems which later innovations are expected to correct.

Despite the perceived failures of industrialized society and the dismantling of the idea of rationalized, progress, the faith remains that technical innovations can and must rectify society's ills. The "march" of technical progress is still so unanimously accepted that new methods receive "the sanction of destiny."[2] Technical innovations are seen as autonomous from societal control, acting with the inexorable force of natural selection.

SHORTCOMINGS OF AESTHETIC AND TECHNOLOGICAL UTOPIAS

These conventional aesthetic and technical frames of reference, however, do not explicitly measure or account for contemporary social effects. Immediate disruptions to the makers' lives are overshadowed by a belief in the postponed benefits provided by the artifacts. This exclusive far-sightedness is exacerbated by a sense of urgency surrounding the application of these technological changes: "the future cannot wait;" "the future is now." This super-charged atmosphere limits the assessment of less easily documented social effects and cuts short social debate.

This climate of anxiety over the application of new technology, however, is not anomalous but is instead characteristic of industrialization. These same issues have been debated periodically throughout industrialization and arguably throughout human productive history. Over the last two hundred years, Adam Smith, Karl Marx, John Ruskin, William Morris and Henry Adams; the Werkbund and the Bauhaus; Wright and Corbusier; Max Weber, Thorstein Veblen and Emile Durkheim and Walter Benjamin; Siegfried Giedion and Lewis Mumford; Heidegger, Baudrillard, Vattimo and Habermas have all in some way addressed the same issues and values, although the specifics have changed.

THE HAND/MACHINE PARADIGM

Among these diverse writings on technology and industry in society, there is one dominant characterization of technical change: that the machine supersedes the hand. More

than merely explicating industrialization, this replacement becomes an ideological pursuit in itself. Technology's advance becomes inseparable from the machine. The machine has in fact been the central literary and visual trope for Twentieth Century modernity.

This paradigm has supported arguments both pro and con. Mechanization was espoused for its supposed aesthetic and technical efficacy over the hand. Criticism of the machine generally dealt with the marginalization of the hand and craft. In both support and dissent, social criticism of mechanization was frequently suppressed by aesthetic and utopian preoccupations.

Siegfried Giedion's *Mechanization Takes Command* is a primary summary and consolidation of industrialization. His work, perhaps the most influential of all industrial histories, asserted that:

...the hand is ill-fitted to work with mathematical precision and without pause...[T]he principle of mechanization...[is] replacing, motion by motion, the activity of the hand.[3]

Giedion established the terms by which industrial methods were explained, sanctioned and situated within twentieth-century society. For Giedion, the machine's precision and inherent purity could reform a sick and debased culture. With its autonomy from previous modes of production, the machine was self-generating, free from man's defects or influence. This is what Noble referred to a "technological deliverance."

In order to implement this mechanical utopia, "it was necessary temporarily to forget everything and begin afresh."[4] This break with history, common to many theories of modernity, condoned all changes as necessary, progressive and unquestionable. Giedion was aware that these great changes had social implications but explicitly chose to limit his field of vision:

Not to be overlooked are those aspects which have to do the class struggle. They however lie outside the actual problem of this book, whose task is to describe the impact of a mechanized world on the human organism and on human feeling.[5]

Giedion interpreted technology in relation to humanity while discounting social criteria. He instead reduced mechanization to ostensibly un-stylized objects, processes and their inventors. Disengaged from their social context, the object's meaning had to be wholly contained by the object itself.

Despite theoretical and social revisions, this model, as depicted by Giedion, still pervades the cultural dialogue on production. The very recurrence of the hand/machine paradigm to support industrial applications after 150 years suggests that the paradigm itself is inadequate and false. As much as mechanization has taken command, the hand still persists.

Actual shop floors which I visited, from small machinists to large aerospace contractors, illustrate that hand and machine interact in complex, symbiotic ways. Many processes are still entirely hand performed, while others are fully mechanized. Others, although seemingly mechanical, rely upon critical hand interventions, patterns and tools. I am not contending that automated processes have not displaced hand processes. The reasons for these changes, however, are more complex than those suggested by Giedion's reductive narrative.

Referring to blind faith in technical utopias, Manfredo

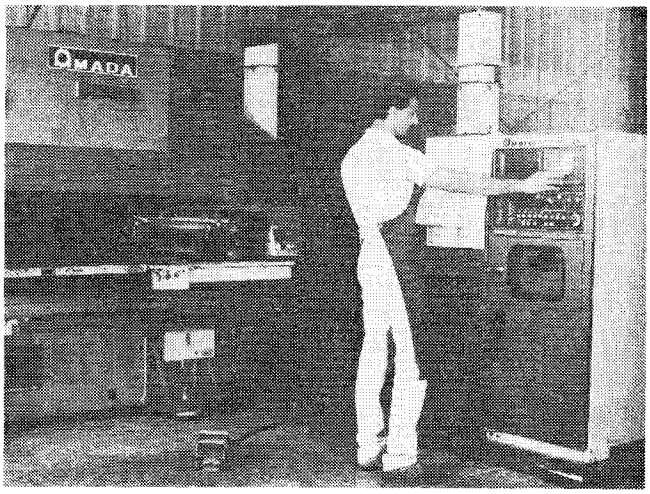

Figure 2: Operating a CNC press

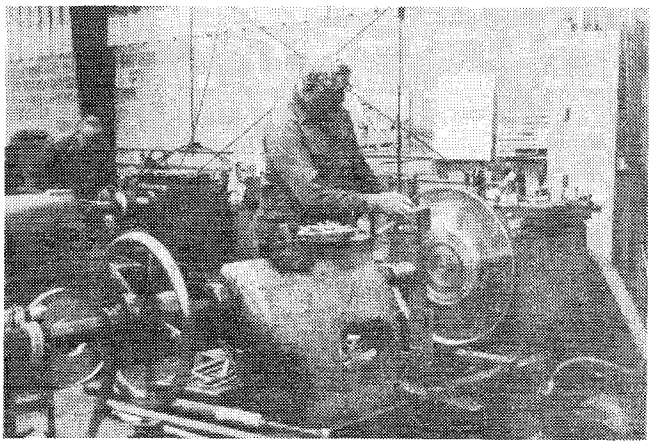

Figure 3: Spinning

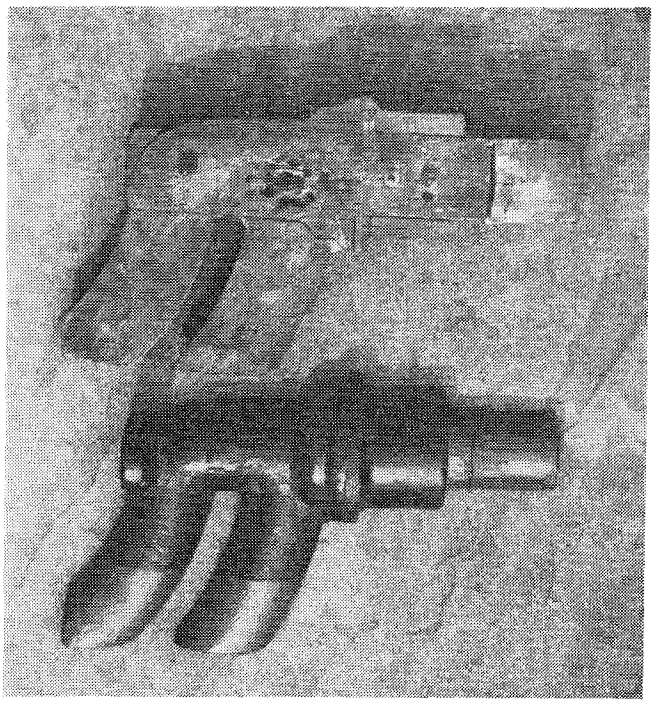

Figure 4: Wood patterns for casting

Figure 5: Piero Di Cosimo, "Building a Double Palace," courtesy of the John and Mable Ringling Museum of Art.

Tafuri wrote that "all those... manifestos in favor of the mechanization of the universe... cannot fail to cause suspicion about their real intentions."[6] A more critical examination of technological applications must recognize this gap between industrial policy and cultural rhetoric like Giedion's. Giedion stressed that the most critical term in his title was "mechanization;" I believe however that it is "command." As an alternative to the hand/machine paradigm, I am proposing a more inclusive frame of reference which will enable industrial production to be more fully understood as socially determined.

THE SKILL CULTURE DEFINED

This alternative way of considering technical change is to situate the skills within a social context: the "skill culture." A skill culture is a social construct in which specific skills develop, adapt, and are transferred from the skilled to the unskilled. In so doing, skills themselves are perpetuated beyond the life-span of a single maker. These accumulated skills become the inheritance of the skill culture while continuing to serve society's material needs.

The expectation and desire for mastery of skill is a fundamental human characteristic, not simply a nostalgia for antiquated, pre-industrial craft-modes. Durkheim's writings on division of labor, Weber's "calling" and Veblen's "instinct of workmanship," all exhibit the fundamental human need to make, to be *homo faber.*

Some definitions are necessary first. "Skill" is here taken to mean both the intellectual and the manual abilities necessary for making. This conflation of knowledge and dexterity, the verbal and the tactile, is integral to skill. Skill is a human characteristic without specific reference to a material or aesthetic quality.

"Culture" is meant in a limited and specific sense used by anthropologists. The conventional *ethnologic* meaning is the totality of a society's arts, abilities, morals, laws and customs at a given moment in time. In the skill culture, however, I am intending the more precise, *ethologic* sense of knowledge passed on in a social setting.[7] The skill culture is ability and knowledge passed on within a group.

TRANSMISSION AND EXPECTATION WITHIN SKILL CULTURES

Transmission of skill occurs within a symbiotic but exploitive relationship of the skilled and the unskilled, master and novice. This relationship is predicated upon an agreement, either formal or casual, in which the novice performs menial work or assists the master. In return, the master, benefiting from the novice's labor, agrees to teach and pass on his own mastery. Access to a skill, then, is controlled by the masters. Maintaining a skill's authority through limited access has historically tended towards secretive and exclusive skill cultures.

The novice's expectation of eventual mastery balances the inherent exploitation by the master. The relationship is dynamic in that each needs the other, and, over time, the novice becomes proportionately more skilled and less willing to be exploited. As these individuals increase their mastery, they participate in the skill culture from the other side of the equation, transmitting their skills back in return.

The existence of skills beyond an individual's working life makes the skill culture an artifact itself. The act of making, then, produces a "double artifact," object and skill culture.

SOCIAL BINDING AND SKILL

The primary social role of the skill culture is to provide cohesion, binding and *esprit de corps.* Through verbal, visual and tactile communication, skill again acts doubly, providing material goods as well as "social integration" and "group solidarity." This adheres to Jurgen Habermas' belief that

...the human species maintains itself through the socially coordinated activities of its members and that this coordination is established through communication...Reproduction of the species...requires satisfying the conditions of... communicative action.[8]

In transmission, members of a skill culture forge identities and bonds to one another. The social benefits of productive endeavors can outlive the object produced. The physical artifact begins to deteriorate immediately upon comple-

tion. The skill culture, though, potentially adapts and contributes indefinitely to the sum of ability and knowledge. As Veblen stated, "social tradition can continue to exert influence only to the extent that it is continually renewed."[9]

SKILL CULTURES' PRE-HISTORY

While the hand/mechanization paradigm relies upon an historic rupture caused by technical innovation, the skill culture is based upon and defined by continuity through history. As Octavio Paz wrote:

...the history of [skill]...is not a succession of inventions or of unique (or supposedly unique) works...There is not a break but a continuity between its past and its present.[10]

Changing technical conditions cause adaptation and mutation within skill cultures but starting from a common origin. If transmission is a constituent feature of human organization, I should be able to locate this continuous transmission throughout history.

The work of Nicholas Toth and Kathy Schick, disciples of the Leakeys, demonstrates a pre-historic example. They have studied the tool-making skills of early hominids in Tanzania's Olduvai Gorge.[11] While archeologists and anthropologists have long studied the stone flake tools of early hominids, these scientists utilize "actualistic" research methods in which they attempt to re-learn original tool-making skills. Their "new" tools are then used to butcher large mammals. With archaeologically authentic materials and forms, they have attempted to re-create a point of origin, preceding transmission and even language.

This research examines not only the artifacts themselves but also the social constructs necessary for the skills to develop. Their work reveals a complex cooperative social network necessary to collect the materials, make the cores, flake and re-touch the tools and finally butcher the animals. This social matrix, embodied by the skill culture, surrounds the artifact. Artifacts alone were not enough to generate this study.

The essential point is that the *ways* in which skills are transmitted and adapted over time have remained constant. Henry Adams wrote, "a stone arrow-head is as convincing as a steam engine."[12] Pre-historic artifacts evince the same communicative transmission as modern artifacts.

INDUSTRIAL POLICY IN LIGHT OF SKILL CULTURES

With the hand/machine dichotomy shown to be overly reductive, the skill culture can provide an alternate explanation for the course of industrial production. With Karl Marx's and F.W. Taylor's seminal analyses of nineteenth-century industry, I will briefly elucidate this alternative explanation. While the former was critical and the latter prescriptive, both authors can be understood as identifying methods intended to limit the autonomy of skill cultures.

Marx, considering the primary goal of industrial organization, recognized,

...that the more skillful the workman, the more self-willed and intractable he is apt to become and of course less fit a component of the mechanical system in which... he may do the greatest damage to the whole.[13]

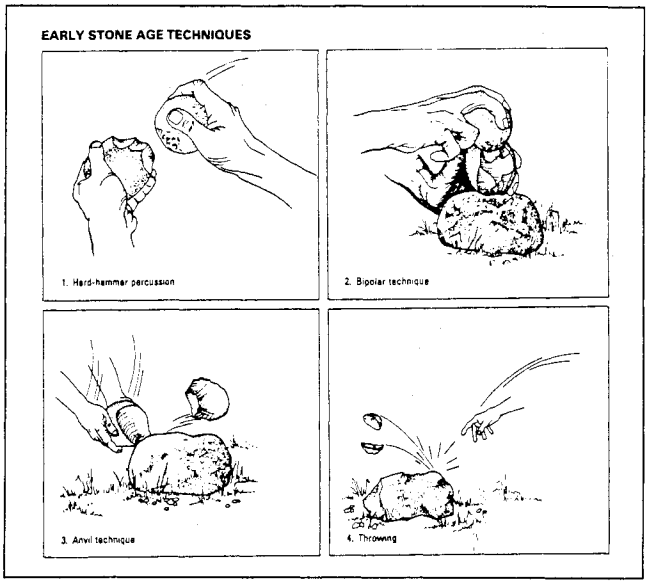

Figure 6: Stone Age Tool Making Methods

Skills gave labor authority over management; transmission maintained and increased this authority. The machine proved management's best tool to diminish this power. The over-arching goal of industry was liberation from "the bondage of labor," meaning that management was freed from labor's leverage, not labor from its drudgery. Marx understood the machine as a technical issue but more importantly as a social tool to control skilled labor.

Although Marx and Taylor could not be more disparate in political orientation, their understandings of industrial organization are remarkably similar. While Marx diagnosed nineteenth-century industrial ills and made predictions for capitalism's demise, Frederick Winslow Taylor codified and formulated steps for magnifying these same conditions.

The goal of Taylor's scientific management was not to supplant the hand with the machine but to control and disassemble skilled labor. Taylor, like Marx, recognized that transmission of acquired knowledge enabled skilled labor to regulate production. To counter this, management assumed:

...the burden of gathering together all of the traditional knowledge which in the past has been possessed by the workman and then by classifying, tabulating, formulating and reducing this knowledge to rules, laws, and formulae...[to] replace the judgment of the individual workman."[14] *Unskilled workers could be easily replaced, reducing labor's threat to management. Concentrated knowledge could thus subvert labor's authority under the guise of increased efficiency, e.g., Taylor's "one best way."*

INHIBITED TRANSMISSION

More significant than the well-documented "de-skilling" of labor under Taylorism, however, is the implicit change in the social contract between the skilled and the unskilled. Because Taylorism advocated the de-composition of skill into knowledge, held by management, and ability, the essential transmission of skills could be inhibited and discouraged by management. Accordingly, the social bonds induced by

production loosened as distinctions between white and blue collar were institutionalized.

As an example of inhibited transmission, during research as a graduate student, I discovered that many Connecticut manufacturers had previously run in-house training schools specifically to prepare machinists and tool makers. As CNC and other methods have advanced since World War II, however, these schools have all been shut. Illustrations 1 and 2 were both taken in the same Connecticut shop, showing retirement-age metal spinners working near unskilled CNC operators. No forum existed however to transmit the spinner's skill to the younger workers. The decision had been made to irrevocably phase out their skills. Similarly, when visiting a pattern making shop full of men over sixty years old, I was spontaneously offered an apprenticeship merely for having shown interest in their skills.

The expectation of mastery and the desire to transmit remained while the opportunities to actually achieve it dwindled. Management's control lay in conditioning the work force to accept their unfulfilled expectation and fixed level of mastery:

[O]wners have a discretionary control of the proficiency of the community as well as the skill of workers...the discretionary control of...[skill] was shifted from the craftsman's technical mastery of the ways of industry to the owners' pecuniary mastery of the material means.[15]

This persistent and unfulfilled need to act as *homo faber* in part caused the characteristic malaise of a fully Taylorized endeavor.

TAYLORISM'S INFLUENCE ON SKILL CULTURES

The exploitation of willing labor was not an invention of Taylorism nor were its effects universal. Because Taylorism stressed quantifiable and measurable knowledge, essential aspects of skill which rely upon visual, tactile and haptic subtleties, "touch" and "feel," were discredited. These intangible, unmeasurable aspects of production were unincorporated by Taylor's scientific managers. Remaining the province of skill cultures, they provided a foothold of resistance to Taylorism.

While both Marx and Taylor demonstrated how management could exploit inherent tendencies of willing labor, the role of the skill culture was only reduced, not effaced. Skill cultures can remain dormant and can even be re-created long after their demise. The workshop at St. John the Divine, where imported masters are re-introducing stone-working skills is one such example. The "post-industrial" aspects of CAD/CAM and rapid prototyping could in this way revive skill cultures. The capability for "desktop manufacturing" might open the means of transmission, apart from corporate control. New skill cultures might then develop from existing ones. The potential, however, that CAD/CAM and RP might obviate the pattern and tools makers' ability entirely looms as a tremendous loss of inherited ability.

The alternative solution of "preserving" skill cultures is also suspect. As at Colonial Williamsburg, skills are frozen at a particular moment in time and maintained as "historical." Without continual adaptation and renewed viability, such skill cultures become museum specimens, isolated from their social context.

Questions about ownership, authorship, originality and replication with regard to CAD/CAM and rapid prototyping are fascinating, just as similar issues were to Walter Benjamin and John Ruskin. With one hundred and fifty years of hindsight, however, the ways in which skill cultures and new productive methods adapt to each other are more pertinent. The task is to understand technical change as socially contingent and complicit, not autonomous.

ARCHITECTS AND SKILL CULTURES

Finally, the role of architects must be related to skill cultures in order to complete this alternate frame of reference. Architecture is itself a skill culture. We acquire, adapt and then pass on a body of inherited knowledge and ability. The implicit contract of the skill culture imposes a moral responsibility to master and to teach what we do. Expectation and exploitation of mastery are as pertinent within architecture as within any skill culture. Architecture has been subject to the same administrative techniques of Taylorism, evidenced by the split between design and production in the largest corporate firms and by ongoing implementation of CAD.

In another sense, however, architecture is not a skill at all. Architecture and construction can instead be considered two halves of a single decomposed skill culture. The complexities of modern building have necessitated the branching off of many construction, engineering and consulting specialties. Architects tend not to physically make buildings themselves but instead design and coordinate verbal and graphic representations from which others construct.

This ambiguity about whether architecture is or is not a skill suggests two possible roles for architects within society. The first embraces the division of architecture into multiple specialties, each with its own expertise. This fracturing has led to simultaneous definitions of architectural practice as high design, as avant-gardist experiment, as exquisite detailing and as coordinated administration. Architectural education and most of western culture for the last fifty years have emphasized specialization exclusively. Narrow specialization I believe has isolated and disengaged architects from building as a fundamentally social act.

The second role for architecture is what Octavio Paz called the "medial" position. Architecture is neither pure art nor pure science nor pure utility. By being between these spheres of specialty, architecture offends each of these guiding rationales: beauty, reason, economy. This medial role encourages transmission of knowledge between specialties and interests: clients, engineers, contractors, trades-people, officials, theoreticians, students. The architect's medial role supports and engenders the communicative aspect of skill cultures. Interaction with other specialties should not be a search for new aesthetic methods or justifications but instead a way to further understand architecture's social context.

In this sense, architecture can be seen as a "meta-skill." Distinct from individual skill cultures, architecture is still ultimately concerned with and dedicated to the work of skill cultures: perpetuating skills and making artifacts.

Emphasis on the importance of this medial role, however, does not diminish the value of mastering specific skills. Facilitating transmission does not preclude design or limit architecture to managerialism. Understanding skill cultures

does re-balance architecture towards the too-long ignored social potential of making.

In place of looking to the social context for meaningful action, architecture has depended upon the artifact to carry all social meaning. Originating with Ruskin's insistence on the legibility of the maker's imprint in the artifact, analysis of industrial production through the object alone required that all information and meaning be visually legible. Decisions about production based only on visual clues are easily led astray into moralizing predicaments. The appearance of hand-made can be imitated by machine and *vice versa.* The literature, including Ruskin, Corbusier, Giedion, is filled with such moral indignation over simulation of hand-made artifacts by machines. In the object-based analysis, the artifact alone carries all the utopian aspirations; the object acts as a *representation* of social reform. The skill culture, alternatively, is *itself* a social process, not a prototype or a model for social action.

It is in this regard that understanding the social implications of production is so vital for architects as tenders of skill cultures. Addressing new productive methods only on aesthetic, technical or utopian grounds, while ignoring coeval social effects, de-values and directly inhibits skill transmission.

Architectural thinking must expand to allow this broader understanding. Although this analysis has not yet been done, the skill culture I believe can provide a point of reference to encompass more fully architecture's social potential. Framing the question is half the battle.

NOTES

1. David F. Noble, *Forces of Production: A Social History of Industrial Automation,* (New York: Oxford University Press, 1984), p.x
2. ibid
3. Siegfried Giedion, *Mechanization Takes Command,* (New York: W.W. Norton, 1969), pp.46, 147
4. ibid, p.14
5. ibid, p.123
6. Manfredo Tafuri, *Architecture and Utopia: Design and Capitalist Development,* (Cambridge: MIT Press, 1976), p.76
7. Kathy Schick and Nicholas Toth, *Making Silent Stone Speak,* (New York: Touchstone, 1993), p.49
8. Jurgen Habermas, *Theory of Communicative Action,* Thomas McCarthy, translator and introduction, (New York: Beacon, 1981), p.ix
9. Charles Taylor, "Language and Society," *Communicative Action: Essays on Jurgen Habermas' Theory of Communicative Action,* A. Honneth & H. Joas, ed.s, (Cambridge: MIT Press, 1991), P.24
10. Octavio Paz, *Convergences: Essays on Art and Literature,* (New York: Beacon, 1981), p.61
11. Schick.
12. Henry Adams, *The Education of Henry Adams,* E. Samuels, ed., (Boston: Houghton Mifflin, 1973), p.493
13. Karl Marx, *The Marx-Engels Reader,* R. Tucker, ed., (New York: Norton, 1972), p. 262
14. Frederick Winslow Taylor, *The Principles of Scientific Management,* (New York: Norton, 1967), p.36-7
15. Thorstein Veblen, *The Instinct of Workmanship and the State of the Industrial Arts,* (New York: Reprints of Economic Classic, 1964), pp.219, 229
16. Paz, p.58