The concept of skill plays an important role in sociological research, from studies of the labor process to debates over equal worth. This article provides a theoretical analysis of the ambiguities and difficulties involved in current sociological conceptions of skill, contrasting four distinct approaches to skill: positivist, ethnomethodological, Weberian, and Marxist. Some of the impasses in industrial sociology arguably stem from the fact that opposed traditions are using very different notions of skill or are blind to their own preconceptions regarding skill. The article draws out the implications of this for empirical research.

What Is Skill?

PAUL ATTEWELL
City University of New York

The concept of skill is important in many areas of sociology, from studies of income inequality to debates on whether capitalism is deskilling work to issues of comparable worth. Underlying all of these topics is the apparently simple idea of "skill." But like so many common-sense concepts, skill proves on reflection to be a complex and ambiguous idea. Some of the conflicts within industrial sociology stem from the fact that opposed theories use very different notions of skill and are blind to their own preconceptions regarding skill.

The purpose of this article is to explore some of the epistemological and conceptual problems of "skill" and to show how these problems affect sociological studies. I trace (and develop) four distinct sociological notions of skill: positivist, ethnomethodological, Weberian, and Marxist. These divergent traditions yield different images of skill, and the juxtaposition of the four throws into relief the ambiguities and problems of each approach.

Sociology is not the only discipline whose substantive concerns demand an understanding of skill. The concept is important in economics, psychology, education, computer science's "artificial intelligence," and in the area known as human factors or ergonomics. This article touches on these disciplines to the extent that they shed light on the conceptual and epistemological issues confronting the sociology of skill.

ETYMOLOGICAL ISSUES

Dictionary definitions of skill reveal the complexity of the concept. At the core of all definitions is the idea of competence or proficiency—the ability to do something well. The word encompasses both mental and physical proficiency (i.e., skill implies understanding or knowledge), but it also connotes physical dexterity. Centuries of Enlightenment thinking have rendered our language rather inarticulate about the physical realm of ability; thus one has to revive archaic expressions like "cunning," "deft," "knack," and "adroit" to even point to it. One reason for emphasizing this mental/physical dualism within skill is that much sociological discourse tends to emphasize the knowledge aspect, while underplaying the physical side of skill or at least relegating it to conceptual obscurity. This has unfortunate theoretical consequences, as we shall see.

Etymological analysis points up an additional ambiguity. Skill is the ability to do something, but the word also connotes a dimension of *increasing* ability. Thus, while skill is synonymous with competence, it also evokes images of expertise, mastery, and excellence.[1] In short, it is ambiguous whether the term indicates mere adequacy or superior, extraordinary ability. This is not just an etymological curiosity: Distinguishing between skill as mundane accomplishment and skill as virtuosity can give us theoretical insights into the mechanisms that underlie skilled activities. Not distinguishing between these two senses of the word can lead to conceptual confusion.

FOUR SCHOOLS

POSITIVISM

I will use the term positivist to refer to those who treat skill as an attribute that is amenable to quantitative measurement and believe that this attribute or quality has an objective character independent of the observer. Given these assumptions, positivists are faced at the outset with two issues: First, should skill be treated as a measurable attribute of persons or of jobs/tasks (Spenner, 1983)? Second, how should apparently diverse or qualitatively different skills be rendered commensurate and hence measurable? Is there a common yardstick that underlies varied skills?

Creating a common yardstick proves to be a very difficult problem, the Achilles' heel of positivist studies of skill. On one hand, positivists seek quantitative skill measures that conform to their rigorous methodological

norms regarding reliability and validity. On the other hand, these measures must meaningfully represent the variety of qualitatively different tasks or skills found in the work world. This tension runs throughout positivistic studies of skill.

The positivist may choose to operationalize skill in a way that enables the researcher to obtain a precise quantitative measure, but this often results in a measure that is so narrow that critics will charge that it is too simplified and fails to present the complexity of skills in the real world. The gap between the theoretical conception of skill and its operationalization has become too wide.

Alternatively, the positivist may seek to bring a wide range of highly varied skills or tasks under a uniform operationalization or measure. To do this, the measure often becomes very abstract. High-level abstractions do not easily lend themselves to rigorous measurement, and so reliabilities and validities tend to suffer. Critics may then argue that what appear to be rigorous measures of skill in fact involve arbitrary or unreliable judgments.

One can see these tensions played out in studies of skill across different academic disciplines. Psychologists whose paradigm stresses experimental control have tended to choose tasks which are narrow enough and stable enough so that in experimental settings, the degree of skill can be measured precisely in terms of error counts, time to complete the task, and so on. Through experimental manipulation, these psychologists then address important issues: Are skills general capacities or specific to the task at hand? How is a skill transferred from one task or setting to another? What are the processes or stages involved in learning a skill? (Singley & Anderson, 1989).

However, this experimentalist approach to skill has come under criticism, especially from a psychological school known as "situated learning" (Rogoff & Lave, 1984.) One part of their critique is that the tasks usually employed in laboratory studies have been made so simple and abstract that they bear little resemblance to those skills in the real world which the study is supposed to represent. One of the most famous series of skill transfer studies, for example, involves the "skill" of identifying and crossing out the letters "e" and "s" in lines of text. Others require highly formalized logic tasks.

Perhaps the most telling evidence that such operationalizations of skill are unrealistic is the finding that subjects who perform poorly in tests of certain skills in the laboratory have been shown to use successfully those same skills in natural settings (Rogoff, 1984, p. 2).

A related epistemological issue raised by the "situated learning" school is the idea that skills are highly grounded or situated in the specific contexts in which they are used, a perspective that makes the typical laboratory study a

questionable enterprise. The terms grounded and situated imply that features of the context in which the work is done play a very important role in how the work is done, such a large role that it is meaningless to talk of a particular skill outside of the situations and practices in which it is used. Thus dairy workers, for example, develop various counting methods and decision algorithms that are tied to the existence of crates and quarts and other objects and procedures specific to their workplace. They do not use the logically optimal solutions of the kind that a logician could work out in an abstract way free from context (Scribner, 1984).

If skills are so domain-specific and so tied to situational features, then experimental abstraction from this context destroys crucial features of what is supposed to be measured (Rogoff & Lave, 1984, pp. 1-3; but note Singley & Anderson, 1989 pp. 2-29, 234-239). In some formulations, "skills" are viewed as so grounded in the contexts of their use that they cease to be the property of any individual worker (who could not take the skill away) but, instead, reside in the interactive work of the group as it unfolds in a particular setting. From such a perspective, skill is distributed across co-workers and only takes effect in interaction: it is quintessentially *social* (Brown & Duguid, 1990). This clearly leads far afield from the positivist paradigm.

In contrast, economists typically treat skill as an attribute of persons. Nevertheless, their positivist methodology leads to analogous problems. Becker's (1975) widely adopted notion of "human capital" exemplifies this approach.

The term human capital encompasses an individual's fund of knowledge and skills obtained through education, training, and on-the-job experience. Within neoclassical economics, human capital can be considered in two ways: either as a monetary investment in training *or* as work skills that create value in the workplace. In either case, wages are linked in direct proportion to human capital. Wages are seen either as a return on an individual's investment in human capital or as determined by the marginal utility of the skill attained.

Theoretical nuances aside, the concept becomes drastically simplified when operationalized. Human capital is typically measured as the sum of years of vocational or formal education plus years of on-the-job experience.[2] Conceiving of wages as a function of skill, and treating skill as proportional to years of education and work experience, has the merit of providing easily measured variables and generates straightforward policy conclusions.[3] However, this treats as given several issues that are problematic to sociological theorists: To what extent is length of education/training related to skill acquisition and job performance, and how in turn do these affect income

attainment? Put another way, it abstracts from such phenomena as creden-
tialism (whether college degrees really provide job skills or function as a
rationing device); (b) the impact of occupational monopolies (unions and
professional and state certification); (c) the relationship of sex-typing of
occupations to their perceived skill; and (d) the effects of ongoing gluts of
certain skills and shortages of others on the social and monetary valuation of
those skills. From a sociological viewpoint, therefore, human capital repre-
sents a shortcut around studies of skill and income attainment by assuming
a fairly direct equivalence between education, skill, and reward, where
perhaps a study of their links would prove more fruitful (cf. Collins, 1979).

Even on purely positivist measurement criteria, the use of years of
education as an operationalization of skill is suspect, even for basic work-
place skills like reading, writing, and arithmetic that are at the core of school
curricula. Recent educational research points to a shocking discontinuity in
America between length of education (or grade level) and the attainment of
basic writing and comprehension skills that one would expect associated with
grade level. The research also documents very large skill difference between
students in the same grade across schools. In a representative national sample
of 17-year-old high school students (excluding dropouts), less than 5% could
comprehend a moderately complex paragraph of writing, only 6% could
solve an arithmetic problem calculating 12% of $850, and only 3% could
write a three-paragraph letter with a simple argument (Appleby, Langer, &
Mullis, 1989). While certainly no test of human capital theory, such findings
suggest, at a minimum, serious problems of measurement error and construct
validity in using years of education as an indicator of, or surrogate for, work
skill. This suggests that positivistic economists have allowed the gap between
the operationalization of skill and the theoretical concept to grow too wide.

Sociologists who follow a positivist approach have tended to treat skill as
an attribute of jobs rather than persons and in particular, to assess *complexity*.
The most significant effort along these lines is the U.S. Department of
Labor's (1965) *Dictionary of Occupational Titles (DOT)*. *DOT* measures are
provided on the National Opinion Research Council's General Social Survey,
have been matched to detailed census occupational classifications, and have
been used in many sociological studies.

The *DOT* is based on the judgments of inspectors who visit workplaces
and observed workers at their jobs. Thousands of occupations are rated on
dozens of attributes. However, many sociological researchers focus on three
major *DOT* measures (complexity with data, people, and things), or combine
these three into a single measure, such as the "overall complexity of the job"
(Kohn & Schooler, 1983).

The *DOT* has been scrutinized by sociologists who found that it suffers from serious flaws as judged by positivist criteria: Sampling procedures for selecting establishments and jobs are unsystematic skill ratings for many jobs are based on only one or two observers' judgments and the reliability of crucial scales (e.g., things) is low and the construct validity of others is suspect (Miller, Treiman, Cain, & Roos, 1980). Nevertheless, Miller et al. (1980) concluded: "Despite the deficiencies in the fourth edition . . . they remain the most comprehensive set of occupational characteristics currently available. As such, their use should be encouraged" (p. 195).

The positivist solution is therefore to use the present *DOT* measures while pushing for better psychometric practices in future editions. However, the problem may be intractable, requiring more than methodological fine-tuning. Rendering thousands of qualitatively different work tasks commensurable in terms of common dimensions is no easy matter. *DOT* coding categories (and arguably *any* catergories) become highly abstract as they try to span many highly diverse work tasks. For example, "comparing" is one particular value on a scale of complexity called data. All kinds of comparison tasks are, by definition, rendered equal in data complexity, and these comparison tasks become, by definition, less complex than the next highest rank of data complexity, the task of "copying."

These categories (copying and comparing) are so broad that the variation in actual complexity of tasks grouped into one of these categories may be greater than differences across categories. And the basis for treating one category as more complex than another is shaky. Is the work of someone who compares a lithographic print against a master to determine its quality demonstrably less skilled than someone who copies a sales agent's written orders into a computer? The *DOT* insists that it is, by rating any comparing task less complex than any copying task.

The *DOT* complexity variables, in addition to (or perhaps because of) being so broad and abstract, are susceptible to social judgments leaking into what are ostensibly objective measures of task complexity. Social judgment can enter in two quite different ways. The first involves culturally generated biases on the part of *DOT* field officers who rate jobs. In such a case, the problem is in the rating procedures (or the raters), not in the *DOT* categories themselves. A second and potentially more serious bias occurs if the *DOT* categories themselves reflect a bias, even where raters apply them in a completely neutral way.

The first kind of leakage of social valuation via rater attitudes has been demonstrated most convincingly for sex-segregated jobs in the third edition of the *DOT*. Howe (1977) was among the first to point out that on the

published *DOT* measures of complexity with data/people/things, the occupation of nurse-midwife ranked below hotel clerk, a child care attendant ranked at the same level as a parking lot attendant, and a nursery school teacher's work scored below that of a handler who "signals or cues trained marine mammals" (pp. 236-240).[4]

These judgments regarding complexity stemmed from a long standing and widespread practice among *DOT* inspectors of rating many "women's jobs" as having "no significant relationship" (the lowest complexity level) to people, data, or things. These judgments were accepted and turned into *DOT* evaluations of the complexity of entire occupations. Thus Miller et al. (1980) found that the job of typist was rated as having no significant relationship to things (the typewriter?) and the job of nursery school teacher had no significant relationship to people (p. 188).

Once discovered, the *DOT* gender bias was responded to by eliminating the "no significant relationship" category from the complexity variables, data, people, and things, thus forcing a reassessment of those jobs with zero ratings. The result, shown in the fourth edition of *DOT*, is that mean levels of complexity for male-dominated and female-dominated jobs are now very similar, indicating perhaps that the work that women do is no longer undervalued in the *DOT*. This upgrading of female-dominated occupations, by administrative fiat, presents problems to those who wish to use successive editions of the *DOT* to trace changes in job skills.

The second potential source of bias in the *DOT* involves the infusion of social values about skill into the *DOT* scales themselves. Even ignoring gender, "common sense" cultural judgments of the social importance or prestige of various tasks seem to be built into the ranking of *DOT* task complexity. (This problem has *not* been addressed by the various positivistic assessments of the *DOT*.) In particular, any activity implying authority over others is ranked as complex. For example, scheduling tasks (for others) is defined as a more complex data task than fabricating an object from blueprints. This seems an extraordinary derogation of the intellectual skills of certain blue-collar machinists and an untenable elevation of complexity of managers (deciding on others' work schedules). Similarly, counseling people drawing on professional principles is coded as a more complex people task than teaching, which, in turn, is more complex than persuading. Following written instructions or spoken orders is ranked as considerably less complex than issuing them.

Each of these examples deals not with the perception of an individual job rater but with *DOT* definitions that rank tasks in the abstract, which all raters

are enjoined to follow in assessing specific jobs. If these definitions are biased, they affect the entire *DOT* enterprise.

The danger here is one of reification: that relationships defined into the *DOT* via the leak of ideas about social prestige and authority into task rankings on complexity will later be "discovered" as empirical findings and attributed to the "real world" rather than being recognized as measurement artifact. Thus factor analyses of *DOT* scales reveal that "there is a close relationship in the *DOT* between substantive complexity of occupations and managerial responsibilities" (Miller et al., 1980, pp. 177-185). Any work that involves authority over others or autonomy over one's own work is transformed via an ostensibly value-neutral measurement process into the appearance of task complexity.

An equally troubling aspect of the use of the *DOT* by sociologists is that when task complexity measures are collapsed into a single measure for purposes of analysis, cognitive complexity tends to dominate. The well-known Kohn-Schooler (1983, p. 325) scale of "overall complexity of the job," for example, is based on the *DOT* and is essentially a measure of problem solving. Jobs that do not require calculation or planning are defined as simple, while tasks involving the analysis of many variables are defined as the most complex. This compounds earlier problems by adding another level of social valuation, disguised in the aggregation of the three seemingly objective dimensions of skills (data, people, and things).

Given these criticisms, it is difficult to concur with Miller et al.'s (1980) conclusion that researchers should be encouraged to use the *DOT*, while pushing for better practices in future years. To their credit, positivists have issued warnings about use of the *DOT* (Cain & Treiman, 1981; Miller et al., 1980), but these are limited to issues such as the danger of combining data from successive editions of the *DOT*. They have not recommended avoiding the *DOT* altogether.

ETHNOMETHODOLOGY

Ethnomethodology offers a view of human activity, and hence skill, which is completely at odds with the positivists' assumptions about complexity, routine, and conscious analysis. At the core of this perspective is the idea that *all* human activity, even the most mundane, is quite complex. Things that everyone does—such as walking, crossing the road, and carrying on a conversation—are amazing accomplishments requiring a complex coordination of perception, movement, and decision, a myriad of choices, and a

multitude of skills. A large part of ethnomethodological research has been devoted to showing the fine texture, the many steps and contingencies, of activities that are normally thought of as simple (Garfinkel, 1969).

Because these mundane activities are extraordinarily complicated, humans cannot attend to them consciously. On the few occasions when we do become self-conscious about the minutiae of our interactive work, this proves so distracting that we stumble or falter because we are temporarily unable to devote our full attention to those tasks that require conscious deliberation. Kusterer (1978) described bank tellers who count money most accurately when they are talking or disattending: "It is only when they stop to think about it that they miscount or lose track of where they are" (pp. 83, 87).

Partly because of this overload problem, mundane activities become taken for granted (Schutz, 1970). They become socially invisible to both to the actors performing them and to observers familiar with them. We disattend to them.

The skills required to carry out these activities also become invisible: They become buried within their practitioners—either psychologically in the form of habits and non-conscious information-processing or somatically in muscles and neurons (knack, deftness, and cunning). Thus many human capacities are not just a matter of reason, intellect, or knowledge but are unconscious and literally *embodied*.

We only become aware of this treasure of mundane knowledge and skill on unusual occasions when our own or others' capacities are interrupted: when we see a baby struggling to walk and realize how brain and muscles must work in tandem, or watch a stroke victim re-learning language, or try ourselves to cope in a foreign country. In normal times, our fluency in mundane activity, our virtuosity in everyday accomplishment, allow us to totally disregard this level of reality.

It follows, from this perspective, that an activity seems "unskilled" once one can do it easily and well (because the skill "disappears"). But an activity appears immensely skilled if it is strange, if one has never done it oneself or seen it done before (think of one's feelings before and after learning to ride a bicycle).

The ethnomethodological perspective creates some rather difficult epistemological problems for those who would measure skill in an objective positivistic way. First, asking for self-reports from workers about their skill is necessarily incomplete. Since people take for granted much of what they are capable of doing, one obtains a highly truncated account which probably focuses on those things that the worker thinks the questioner will deem skilled or those things that the worker thinks the questioner will understand. If one

adopted Garfinkel's (1969) procedure and interrogated an employee about his or her work, responding to each answer with "But how exactly did you do that?", one would obtain an ever more elaborate listing of the things that the employee knows and does. There is an infinite regress problem: The deeper one looks, the more knowledge and skill one finds.

This comes through particularly clearly in the work of Kusterer (1978), who documented the substantial skills and elaborate working knowledge that ostensibly *unskilled* workers need and use in their daily work (see Garson, 1975; Harper, 1987). Kusterer (1978) described in an interview between himself and an "unskilled" machine operator:

> "I don't know why you want to interview me. You don't have to know anything to do my job." Three hours later, too exhausted to keep writing down all she knew, I brought the interview to a close. As I was preparing to leave, she told me something entirely different, and this too was typical. "This was real interesting. You don't get to stop and think about things like this, usually. . . . It really makes you think, all the things we do that we don't even realize." (p. 187)

Second, ethnomethodology suggests that the observer's point of reference is important in any evaluation of skill. Tasks which the observer can do are likely to appear as relatively unskilled, because these will be taken for granted. Activities with which the observer is unfamiliar may appear more complex than they would to insiders. *Thus widely shared skills tend to become perceptually devalued, while esoteric activities seem complex.*

Third, the emphasis on problem solving and self-conscious cognitive analysis as the most highly complex of tasks, as contrasted to nonreflective or somatized tasks, would strike an ethnomethodologist as arbitrary and perhaps even reversed. For example, Kohn and Schooler's (1983) lowest category: "Not at all complex. Altogether routine and takes no thought" (p. 325)—is a non sequitur for a phenomenologist. One has mastered a skill or complex task when one has somatized it; needing to think about it indicates incomplete training or knowledge. An intern needs to use a mental checklist of symptoms, a master diagnostician recognizes a disease, a violin virtuoso doesn't think about fingering notes, and a good fighter pilot reacts "instinctively" to a threat.

We see here two epistemologies or theories of knowledge: the positivist, which reflects the Cartesian division of intellect and body and regards the former as superior; and the phenomenological, which sees in conscious reflection an indication of (incomplete) learning rather than (completed) knowledge. Phenomenology grants no primacy to consciousness, nor are tasks that require conscious deliberation necessarily more complex.

The contrast may become clearer if one considers the two as opposed models of learning. The positivist model, which is so widespread as to seem "common sense," views learning as a process in which one begins with experience of specific events or situations but lacks generalizable rules or knowledge. The learning process, from this perspective, consists of becoming aware of cross-contextual relationships and articulating these as rules. Knowledge is achieved when one has escaped the particularities of context and can articulate general or abstract principles that link variables together.

For positivists, generating this kind of abstract knowledge is difficult; knowledge creation is therefore quintessentially skilled. Thus Kohn and Schooler (1983) took as their highest category of task complexity, "the setting up of a complex system of analysis and/or synthesis in which little is fixed beforehand, many variables are involved, their relationships are complex, and outcomes are hard to predict" (p. 325).

For the ethnomethodologist, this quotation is both a poor model of knowledge (to be explained shortly) and an amusing form of occupational ethnocentrism. Sociologists are familiar with a phenomenon in which survey respondents, given a list of ethnic groups to rank in prestige, invariably place their own at the top of the list. Kohn and Schooler did something similar with regard to task complexity. Their definition of the highest form of skill matches exactly the kind of multivariate sociological analysis which so often performed.

Based on observation of mundane learning, a phenomenologist would give a very different portrait of learning and skill, one which locates the creation of abstract rules at a much lower level of skill (Dreyfus & Dreyfus, 1986). According to this model, the beginner is initially confronted with a series of confusing unique situations or experiences. To handle this, the novice generates (or is taught) context-free rules to use early on in the learning process. Thus the beginning chess player learns to use equations such as "one knight equals three pawns equals one bishop" as a basis for exchanging pieces. The medical student learns a checklist of symptoms for identifying a disease. The student car driver is told to shift to third gear at 30 mph.

But as one develops experience, these context-free rules are abandoned and replaced by a form of knowledge that is context-bound and context-driven. The master diagnostician doesn't use a checklist but "sees" the disease, recognizing it as something familiar. The chess master can recognize a particular board combination as being close to one of thousands previously played or seen. The car driver shifts gear based on prior experience and the feel of the car.

This is a very different model of learning and knowledge in which the beginner moves away from abstract rules toward context-bound knowledge (mastery) and not (as our academic training has taught us) the reverse. It contrasts the kind of deductive logical pondering that positivists deem the highest skill of humans with an intuitive sense of "recognition" that hardly comes into consciousness. Skills and knowledge that barely require conscious thought (somaticized skills) are therefore not second-rate for the phenomenologist and should not be relegated to an unimportant residual category like "manual skill."

The extent to which positivism and ethnomethodology diverge is similarly underline by their treatments of certainty and routine. Positivists equate certainty in outcome with a lack of skill, often indicated by the routinization of the work process. Conversely, uncertainty is equated with problem solving, a lack of routine, and therefore with skill. In Perrow's (1986) formulation, complex work occurs where there are many exceptions to rules or routines.

However, from an ethnomethodological viewpoint, there are objections. Every social action creates a sense of structure out of uncertainty. It is not as if most events automatically fit a rule, while only a few require problem-solving skills. All events are unique cases; human skills consist of effortlessly translating each unique instance into an example of routine, as falling under a rule (Cicourel, 1974). Suchman (1987), for example, closely scrutinized clerical work and argued that ostensibly routine cases are made routine only by a translation process that identifies them as falling under a rule.

Skill inheres in the ability to do this without thinking about it, in recognizing something new as something old, in acquired or trained "blindness" to uncertainty and ⸺niqueness. Whereas exceptions and conscious problem solving are the essence of skill in the positivist formulation, for ethnomethodology, a virtuoso recognizes fewer exceptions than a learner: The maestro has been there before and has more (nonconscious) routines to apply. Conversely, it is the unskilled tyro who is constantly being confronted with unique cases, high uncertainty, and a lack of available routines.

This different sense of uncertainty, routine, and skill leads the phenomenologist to question whether work that is socially labeled as skilled is really more complex than everyday routine life. Perhaps, it is just esoteric and therefore unfamiliar to the observer. Consider two examples from the field of artificial intelligence (AI). So-called expert systems are computer programs that model the knowledge of human experts. Given certain symptoms, for example, an expert system program will offer a medical diagnosis;

supplied with geological data, another will predict the likelihood of striking oil in a given location. A quite different kind of AI program tries to instruct a figure to find its way around a landscape filled with geometrical figures and to respond to commands like "go to the left of the blue cone, back around the red sphere, to the left of the green cube, and back to the starting point." Programs of this latter type are sometimes known as "microworlds." For our purposes, the microworld program attempts a mundane accomplishment or unskilled task, while the expert systems attempt tasks that are normally (i.e., socially) considered skilled.

When programming these tasks, AI experts discover the ethnomethodological paradox. The expert systems do not require greater complexity, in terms of lines of code or numbers of decision nodes, than the microworld with its mundane activity. If anything, the reverse is true. The diagnostic program takes as its input information about a patient's symptoms provided by a doctor. The program leaves these "unskilled" parts to humans, because the diagnosis is supposed to be the difficult part: It is a multivariate probability optimization problem. Because of this delegation of responsibility, computer diagnosis (and expert systems more generally) prove not to be insurmountable tasks. By contrast, in trying to animate a figure in a microworld (albeit a very simple world), AI researchers try to embed within the program all the knowledge required for the mundane accomplishment of taking a directed walk and recognizing objects. This requires a computationally highly complex program.

In sum, for the ethnomethodologist, what actors view as skilled work may just be a pimple atop a submerged mountain of everyday accomplishment. A phenomenologist would not deny the possibility that one pimple is larger (more skill/knowledge) than another but would be quite skeptical of current positivistic attempts to "objectively" distinguish between the two. Evaluations of occupational skill based on short-term observation of work (by sociologists or *DOT* raters) are unlikely to give an objective count of complexity because they discount the mountain and because they will vary according to what the observer takes for granted. Most skills will remain invisible to outsiders, and short interviews with the workers themselves will not reveal the mass of hidden skill, as Kusterer (1978) discovered. Judgments by outsiders as to uncertainty and routine in work tasks similarly reside in the eye of the beholder.

If one adopts the ethnomethodological perspective on skill, one becomes skeptical of the validity of current positivistic approaches for obtaining quantitative measures of skill. Two alternative strategies present themselves. The first involves observational research in which the sociologist becomes

thoroughly immersed in the minutiae of the daily work while resisting the worker's "natural attitude" of allowing the knowledge and skill from becoming invisible and taken for granted. This takes much longer than conventional interviews or *DOT* visits. Kusterer (1978) and Harper (1987) provided models of such work. The second strategy alters the questions asked about skill. For many ethnomethodologists, one should study members' practices for conferring on an occupation the title of "skilled work" rather than accepting the commonsense (and positivists') belief that skill equals complexity.

THE NEO-WEBERIAN OR SOCIAL CONSTRUCTIONIST SCHOOL

In a way, this is what the neo-Weberian or social constructionist approach does: it tries to understand the conditions under which occupations are socially demarked as skilled and the processes by which some jobs come to command higher standing than others.

In Weber's (1971) writings, occupations can act as status groups which vie for power and prestige. The most direct method of enhancing an occupation's power is to remove itself (or its members) from market competition, a process that Weber and his followers called "social closure" (Parkin, 1979, pp. 44-116). From medieval guilds to modern-day credentialism, occupations have sought various monopoly powers from the state: the capacity to restrict entry into the profession, the right to limit competition among qualified practitioners, legal authority to discipline errant members of the occupation, and so on (Collins, 1976, 1979). Even where legal monopolies cannot be obtained by the state, social closure may be partially attainable through trade union insistence on closed shops and control over apprenticeship (Jackson, 1984; Turner, 1962) or via nonlegally mandated educational credentialism.

Once obtained, monopolistic powers enable an occupation to restrict its size and hence force an increase in the price of its services. However, restricting entry into an occupation not only brings economic rewards to practitioners but assists the claims of that occupation to high skill and, thereby, high status (Collins, 1976.) Requiring lengthy periods of apprenticeship or training and slowing (or discouraging) the entry of new practitioners help build a public perception that the work requires exceptional knowledge and preparation.

Secrecy goes hand in hand with mystification in creating the impression of skill: "Backstage" occupational practices are kept hidden, particularly

those that demonstrate the uncertainty or confusion of practitioners or the routine nature of some work, while publicly visible displays are stage managed and portrayed as highly complex.[5] Thus crafts (or mysteries as they are once known) develop jargons with which to impress their customers. Doctors prefer to describe symptoms in Latin; auto mechanics use "technologese."

Many occupations also seek to dignify their activities by removing themselves linguistically from the hurly-burly of haggling and from the language of the workshop, substituting a different vocabulary for describing their own work. The *DOT* mirrors these linguistic conventions or social labels in its categorization and ranking of work tasks: One "consults" with a doctor or lawyer or seeks their advice rather than paying the former to cut and bandage or the latter to write documents or argue a case in court. In essence, the *DOT* accepts the professions' own definition of their work.

In sustaining a public image of skilled work, it is important to prevent occupations of lower pay and social prestige from carrying out one's work. Hence occupations are concerned with jurisdiction, sometimes refusing to allow even their least skilled tasks to be performed by outsiders. British unions have gone on strike against "dilution"—nonmembers carrying out any of the craft's tasks (e.g., physicians conflict with midwives). Keeping even the most mundane of activities within an occupational jurisdiction presents a problem for practitioners who would prefer to rise above these boring and sometimes unpleasant tasks. Historically, the dilemma has been solved either by having apprentices/interns do the "dirty work" (age stratification) or by creating internal hierarchies (e.g., the general practitioner and the specialist) or by the more perilous route of delegating tasks to subordinated occupations whose work can be overseen or supervised by the dominant occupation (e.g., nurses and paralegals).

By contrast, occupations that cannot restrict entry often experience a flood of newcomers who undercut income and claims to social exclusivity as well as devaluing the importance of the occupation's skills. This is the sorry history of clerks, whose status plummeted in the 19th century as literacy brought floods of young recruits into its ranks and undermined its claims to skilled work (Attewell, 1989; Horlick, 1975).

To summarize, Weberian theory emphasizes both market-based (supply and demand) and ideological causes of occupational standing. The latter ideological elements, which make claims to and bolster the social importance and perceived skill of the occupation, are usually viewed as depending on the prior capacity of the occupation to protect itself from market competition

and control training and socialization into the occupation. The important question then arises whether the elevated status and claims to skill of some occupations are *purely* a matter of social construction and supply/demand or whether they rest on *real* technical skills or task complexity (which are then exaggerated for purpose of occupational self-aggrandizement).

This has provoked considerable debate among sociologists and historians of work, who counterpose examples. Some cite occupations like 19th-century British cotton spinners. Worker solidarity and the strategic location of the occupation in a larger work process enabled the occupation to remain well paid and viewed as "skilled" long after technology simplified the work (White, 1978; see also Lazonick, 1979). Others, like More (1982) and Penn (1982) disputed whether the skilled status of present-day craft occupations (e.g., skilled machinists, known in Britain as "engineers") are based on real skills (task complexity) or on union power.

Rather than a theoretical resolution of this issue, we find a spectrum of views (Littler, 1982 pp. 9-11) with some scholars holding a "strong" version of social determination of skill, in which occupational power and social closure produce skilled status even in the absence of task complexity (Turner, 1962), while others advance a "weak" social determinism, in which some real skill (or work complexity) is a necessary but not sufficient basis for an occupation succeeding in its claims to be skilled status (More, 1980 pp. 163-165; Penn, 1982, 1983; Penn & Scattergood, 1985). Yet a third position suggests that "fake" socially determined skill may actually turn into "real" task-complexity skill over time as powerful unions recast the labor process to increase the challenge and skill of the work (Sabel, 1982; Turner, 1962).

In these examples, some theorists argue that gaining social closure and thereby commanding skilled worker status depends solely or largely on the power of the occupation, while others emphasize the real mastery of the worker over complex work tasks. However, another thread in the Weberian tradition provides a third factor, drawn from theories that try to tease out what distinguishes the professions from other occupations.

For Collins (1976), there is something distinctive about the kind of work done by professions that sets apart from other occupations. On one hand, the classical professions dealt with services that affected central interests of the client: liberty and property (law), health (medicine), and salvation (the church). These provide great leverage in raising the status of the professions because of the central importance of a successful outcome for the lives of their customers—a botched surgery being more consequential than a botched meal.

But Collins also pointed out that these occupations involved interventions whose outcomes were uncertain: A patient may recover or die or a client be jailed or go free. This uncertainty of outcome is an important resource for the skill claims of the occupation as a whole: If everyone were always cured, physicians would lack their special status.

Uncertainty in outcome also places a premium on skill in our second sense: virtuosity. The patient wants a good or exceptional doctor or lawyer rather than just any practitioner because this may influence the likelihood of a successful outcome. Uncertainty in outcome also implies that an effective reproducible method—a routine has not yet been invented to deal with the particular problem (or at least, that such a method is not shared throughout the occupation; virtuosity has often depended on one person's monopoly of a secret technique). This, in turn, affects teaching within the occupation: Uncertainty leads to situations where it matters which virtuoso one studied under and to teaching methods notable for their lack of emphasis on substantive knowledge or for a large discontinuity between what is taught and what is practiced.[6] Thus the Zen master will not answer the student's questions but poses riddles instead, and the law professor uses the Socratic method, insisting that the goal is to make the student think like a lawyer, not to teach legal facts.

This uncertainty aspect of professional work can be applied more widely to the concept of skill across the spectrum of occupations. When viewed in this light, skill becomes paradoxical. It depends on the *absence of an effective technique* or technology to produce the desired outcome. A skilled occupation is one that cannot reliably do what it is called on to do. Work that cannot be carried out effectively every time becomes a resource around which those who are employed at the work build their claims to being especially skilled.

Collins (1976) noted that some occupations that work in highly uncertain environments might, in fact, have no skills: Their decision making or outcomes could be no better than random chance, yet they could still claim great skill. In many cases outsiders would have no way of telling whether these skill claims were valid or not. Successes could be credited to the practitioner's skill; failures to the uncertainty or toughness of the task. Priests and trial lawyers may fall in this category.

This takes us far from the positivist's notion that skill equals task complexity, with its implication that skilled occupations have attained mastery over complex tasks. Instead, task complexity becomes important insofar as it creates uncertainty as to whether and how the task can be accomplished. This then becomes the core around which practitioners build claims to skill, even when their knowledge and techniques are modest.

MARXISM AND SKILL

The issue of skill enters Marxist theory in three areas: in the labor theory of value, in debates concerning the "labor aristocracy," and in the theory of alienation and technological change. However, it would be misleading to suggest that classical Marxism has a well articulated theory of skill as such. Marx and Engels' writings provide theoretical hints, and some neo-Marxists have built upon these. But many contemporary Marxists treat skill as a "common sense" category which does not require explication, while other neo-Marxists treatments of skill frequently shade into either positivist or social constructionist thinking.

The labor theory of value is primarily concerned with demonstrating that value is created in the capitalist production process and not in market exchange, and with showing that capitalist competition creates a tendency for the rate of profit to fall, as capital (in this case, machinery) increasingly substitutes for human labor. Having to distinguish between skilled and unskilled labor in this larger theoretical enterprise is a distraction, hence early in *Capital*, Marx (1987, pp. 51-52, 192) announced that he would treat every kind of labor as "simple unskilled labor."

This raises the interesting (but unresolved) question of whether this was only a convenient theoretical simplification or whether Marx believed that real social processes were, in essence, reducing the significance of special skills (Bottomore, 1983, pp. 1-2) This simplification meant, unfortunately, that the topic of skill became rather peripheral for Marx.

Marx (1987) did reconsider skilled versus unskilled labor in his discussion in *Capital* of the value of labor power (pp. 167-169). There, he argued that the value of labor power (i.e., a wage) is basically the cost of reproducing and maintaining working people, which is largely a matter of their subsistence, modified by a "historical and moral element," namely, the standard of living above mere subsistence that has become customary. Skilled labor commands a higher wage because skills require a "special education or training," which costs an equivalent in commodities (p. 168). The higher wage of skilled labor reflects payment for the costs of creating those skills.

This fragment of an analysis suggests that Marx used a straightforward notion of skill as superior abilities created through special training, and that he anticipated human capital theory in certain respects. Marx viewed skill as the antithesis of specialization, describing a San Francisco workman who held jobs as typographer, slater, and plumber as the exemplar of the "fully developed individual" (p. 458). However, these references are so incomplete as to be of limited use.

A rather different and more complete consideration of skill is found in the long-standing debate among Marxists over the labor aristocracy. In Marx's, Engels' and Lenin's writings, the relative affluence of a skilled stratum of the British working class was used as a partial explanation for the politically reformist (as opposed to revolutionary) orientation of some skilled workers (Bottomore, 1983, p. 265). That debate subsequently broadened into a more general inquiry about the status and behavior of skilled workers in the 19th century: Were they culturally and socially distinct from other proletarians? How and why did their standard of living and life chances differ from unskilled workers? What were their politics? (see Hobsbawm, 1964, 1973, pp. 121-129, 1984a, 1984b).

What is striking in this literature is the frequency and centrality of social constructionist aspect of skill within Marxism, the idea that the social standing and perceived skill of an occupation stems in large part from the power of those workers rather than from intrinsic complexity of the work itself. For example, Hobsbawm (1984a, 1984b), who viewed himself as a traditional Marxist (1984a, p. 220), identified a series of factors by which labor aristocrats could maintain their skilled status: (a) control over the work process, (b) "skill in the sense of qualification for work that could only be acquired by long training," (c) demand and supply of labor, and (d) bargaining strength and solidarity. Each of these factors affected the ability of an occupation to successfully maintain claims to skill (and to higher wages), but each could operate to some extent independently. Hobsbawm (1984b) reviewed several historical studies of particular occupations and concluded that

> skill . . . was doubtless the best way of establishing and reinforcing scarcity in
> the market in the nineteenth century. . . . It was not necessarily the only one.
> The test was to exclude, never mind how. (p. 234)

Other writers have talked of "contrived [labor] aristocrats" and of processes of "re-aristocratizing" certain occupations: both indications of the view that the pay, social standing, and perceived skill of various jobs are outcomes of struggles rather than straightforward reflections of task complexity or intrinsic skill.

Some Weberian commentators, most notably Parkin (1979), viewed these social constructionist arguments within contemporary Marxist theory as incongruous:

> The fact that these normally alien concepts of authority relations, life-chances,
> and market rewards have now been comfortably absorbed by contemporary
> Marxist theory is a handsome, if unacknowledged, tribute to the virtues of
> bourgeois sociology. Inside every neo-Marxist there seems to be a Weberian
> struggling to get out. (p. 25)

Wit and polemic aside, there are many neo-Marxists who would take umbrage with Parkin's comments and avoid any focus on the construction or perception of "skill" as a social category. Prominent among them are deskilling researchers who embrace all or portions of Braverman's (1974) perspective on skill.

Braverman's book launched a wave of studies that reported deskilling in contemporary workplaces (e.g., Zimbalist, 1979). It also provoked a storm of criticism, both on theoretical and empirical grounds (Attewell, 1987; Form, 1980; Littler, 1982; More, 1980; Stark, 1978; Wood, 1982). These disagreements have not been resolved. For the purpose of this article, however, what is important is not the validity of skill degradation but the conception of skill that underlie this theory. Braverman (1974) provided a "final note on skill" in which he delineates his position from others (pp. 442-447). He was especially critical of any imputation of skill levels based on occupational classifications, noting that the characterization of various machine operative jobs as semi-skilled was an essentially administrative decision rather than an empirically grounded one. He pointed out that various jobs lumped into the (implicitly unskilled) laborer and farm categories contain many skilled workers and that white-collar jobs should not be assumed to be superior in skill to blue-collar ones. He argued that educational attainment tells one little about the skill demands of an incumbent's work.

Braverman then built his own definition of skill, which I believe is quite consistent with Marx's on a characterization of craft work:

> For the worker, the concept of skill is traditionally bound up with craft mastery—that is to say, the combination of knowledge of materials and processes with the practiced dexterities required to carry on a specific branch of production. The breakup of craft skills and the reconstruction of production as a collective or social process have destroyed the traditional concept of skill. . . . What is left to workers is a reinterpreted and woefully inadequate concept of skill: a specific dexterity, a limited and repetitive operation, "speed as skill," etc. (p. 443)

Braverman's and Marx's use of the craft worker as a benchmark for assessing skill is theoretically consequential because it adds a distinctive element to the Marxist concept of skill: *control.* For Marx and Braverman, a craft worker decides how to accomplish a particular piece of work, chooses the appropriate tools and procedures, and is self-directed in the work. This contrasts with, say, a machine operator, who is told what to do, is given instructions, tools, or procedures on how to do it, and is overseen by management.

This historical transition from work that is under the self control of the worker to work that is directed by management is a central feature of Marx's

theory of alienation. Under capitalism, the proletarian not only loses control over the products of labor but loses control over how and when the products are made. The latter stage, which Marx called the real subordination of labor to capital, is a crucial loss of freedom, step in the progressive alienation of labor.

Conceptually, this fuses Marx's historical account of loss of skills with his account of alienation. The language of alienation (loss of control) becomes intertwined with, and ultimately equivalent to, the language of deskilling. Hence a worker who is "an appendage of the machine" is ipso facto deskilled; a specialized worker or someone who carries out a routine set by others is unskilled. Braverman's (1974) description of contemporary clerical work illustrates this:

> typists, . . . receptionists . . . and clerks are subjected to routines, more or less mechanized according to current possibilities, that strip them of their former grasp of even a limited amount of office information, divest them of the need to understand and decide, and make of them so many mechanical eyes, fingers, and voices whose functioning is, insofar as possible, predetermined by both the rules and machinery. (p. 340)

This linkage of skill with freedom from control gives a distinctive cast to neo-Marxist conceptions of what skill entails. Many neo-Marxists follow the positivist conceptualization insofar as they give pride of place to intellect over manual dexterity and decry the loss of conceptual content in work. But they depart from the positivist formulation by characterizing skill in terms of control over one's work process as well as by the complexity of the work. Clearly, skill and autonomy often go together empirically, but to make control/self-direction and skill *logical equivalents* can lead to distortions. Crompton and Jones (1984) put it this way:

> We regard "control" as essential for the existence of "skill." . . . 91% of [clerks] could not be said to exercise any control—and therefore, we would argue, very little skill—in respect of their own work. (p. 59)

For these authors and for some other neo-Marxists, if workers do not decide on what tools or methods to use to accomplish a task and if they cannot schedule what to do and when, they lack not only control but skill. They come to this conclusion through what an ethnomethodologist would view as a highly inflated sense of what rules provide in the workplace. Rule-governed work, for these neo-Marxists, implies that work is completely predictable and therefore in skill: "These workers only require the capacity to read and write, and the ability to follow instructions" (Crompton & Jones, 1984, p. 61).

For the ethnomethodologist, reading and writing are real skills that require years of training; rules—however authoritarian and detailed—provide little more than a schematic for work, a guide into which employees insert their abilities in classifying, choosing, interacting, persuading, and so on.

The danger in opposing skill to rules and routine, is that empirical researchers will use the existence of the latter as grounds for the most cursory overview of the work process, sure that where rules or routines exist, skills have disappeared. If phenomenologists are correct that the closer one looks at any work process, the greater the knowledge and skills identified, then this neo-Marxist conceptualization will guarantee finding that rule-governed workers are unskilled, from which it is but a small step to concluding that they have become deskilled.

There is an irony here. This conceptualization of skill not only reproduces dominant social constructions about what is and is not skill, and thus denies proletarians whatever (undervalued) skills they have, but places an even higher threshold for recognizing skill than the society at large demands. The ideal of the artisan conceiving an object, choosing tools and procedures unconstrained by external rules or routines, and fabricating the object from first to last step is so at odds with the reality of modern work that *everyone* today, from managers down, appears deskilled.

In more general terms, equating control or autonomy with skill points to the dangers of including analytically distinct phenomena in multidimensional notion of skill. Undoubtedly, jobs which entail giving orders to others have a higher degree of pay and prestige than those where orders are taken. Similarly, jobs that involve responsibility, where carelessness can lead to expensive losses, many enjoy monetary and other privileges. But to treat these as aspects of skill is to reify occupational claims to status via skill. It would be preferable to measure the returns to authority, autonomy, and responsibility, net of skill (or task complexity), rather than to insist that these phenomena define or are components of skill itself (cf. Adler & Borys, 1987).

CONCLUSION

The schools of thought outlined here place a heavy burden on sociological arguments that require "objective" skill comparisons across occupations. But they also provide antidotes against sociological reification and distortion and suggest new questions to ask about skill that would propose new theoretical directions.

Ethnomethodology tells us that there is much finer texture to what people actually do in the workplace than is commonly realized. Most skills and knowledge are taken for granted, especially those which the observer shares with the observed. It also suggests that we place an unwarranted emphasis on conscious analytical, especially quantitative, decision making, where research suggests that this is a small part of any skilled performance. This mode of knowledge is arguably found least among those who are especially skilled at any given task. These phenomenological criticisms do not mean that positivistic measurement of skill levels is a flat impossibility, but they do imply the necessity of a thorough study of workers before categorizing their abilities and knowledge, a level of scrutiny that far exceeds current brief encounters with survey researchers or job raters.

Kusterer (1978) showed that a phenomenological approach can be both practical and theoretically constructive. For example, he was able to show why "unskilled" workers fail to demonstrate the complete alienation expected of them by Marxist theory through his archaelogy of the hidden skills and opportunities for mastery that these officially unskilled workers enjoy. Looking forward, the ethnomethodological vision of work skill seems to have jumped disciplinary boundaries and is informing a burgeoning literature in psychology (the situated learning school) that looks at the myriad of workplace skills in terms of their acquisition and transmission.

The Weberian or social constructionist perspective sensitizes us to the fact that the perceived skill and prestige of various jobs are products of social manipulation by those who fill occupations. Also, market supply and demand and the social incumbents who fill an occupation can drastically affect the social assessment of the skills involved. This places a heavy burden on those seeking an objective assessment of task complexity, for they must overcome their own socially learned prejudices as well as the misinformation provided by the occupation itself. This perspective also suggests, paradoxically, that most honor and perceived skill goes to tasks that are not being done very well, where uncertainty in outcomes is high because of the paucity of reliable routines and transmissible knowledge.

Above all, the social constructionists have made us aware of the importance of *exclusion* in the social creation of skill, the realization that skill is not just a feature of the task itself, but that many persons are shut out of certain tasks/occupations. This presents a profound methodological dilemma: For positivists, measuring skill appears to be gauging the intrinsic complexity of a task (an attribute of the task itself). But Weberian theory suggests that a crucial part of the social concept of skill is the relationship to others not doing that task. For the latter, skill is therefore a *relational phenomenon* (or con-

cept); it depends on the relationship between (a) one kind of task and another, (b) supply and demand for people to carry out those tasks, and (c) the incumbents who fill the job and those who are excluded.

This relational nature of skill has been smuggled into positivist measures, as in the different skill rankings for giving versus taking orders, for professional advice versus teaching, and for male versus female jobs, or the devaluation of literacy in a literate work force. If skill is intrinsically a relational concept that depends on the numbers and kinds of persons who can or cannot do a given task (rather than the complexity of the task itself), then social valuations that seep into objective measures of task complexity are not aberrant biases that can easily be excised but critical aspects of the phenomenon itself.

The social constructionist vision of skill pushes its adherents toward historical studies, often of single occupations, rather than survey research and regression analyses. But this has not shortened its theoretical reach. More (1980), in what is perhaps the most impressive work in this genre, addressed the larger issue of whether there has been a secular decline in skill, as well as critiquing the more extreme versions of social determinism in historical, comparative work. One future direction of the social determinist perspective is to draw together the many historical case studies to develop a general causal theory of the rise and fall of occupations over time.

The relational issue is also a problem for Marxist notions of skill but in a different sense. If the benchmark for evaluating current skills is to be a precapitalist work role (and theorists, like Burawoy, 1979, have argued strongly that such contrasts are epistemologically necessary), then the comparison may become so extreme that most all occupations within capitalism will appear unskilled, by definition. If one goes further and equates rules and routines with a lack of skill, one is blinded to the abilities that subordinated employees use in their workplaces.

The alternative, however, is difficult to absorb within a Marxist framework, for it requires examining the arenas of freedom, self-expression, and skill within the capitalist work process, to treat these as important phenomena in their own right rather than residues or faint reflections from a less alienated past. This alternative agenda can be seen in the work of Burawoy and others, where the idea of "games" within the workplace and the emphasis on different political regimes across workplaces have facilitated comparative studies of consent and conflict at work.

I have portrayed sociological studies of skill as caught within four separate theoretical schools, each with a different understanding of skill and consequently a different agenda for research. Although these differences could be

read as a destructive separation of energies, endangering progress in the sociology of work, that is not my assessment. It has taken the intellectual debates and controversies of the 1970s and 1980s to raise the theoretical consciousness and sophistication of many sociologists of work about fundamental concepts like skill, which they previously tended to use in an unreflective way. This is theoretical progress, and I expect it will show itself in innovative empirical work in the years ahead.

NOTES

1. I am grateful to Lyle Hallowell for pointing this out.

2. My point is not that positivists are conceptually naive. Rather, positivists' methodological commitment to obtain a quantitative measure in ways dictated by disciplinary practice leads them, perhaps unwillingly, perhaps *faute de mieux*, into formulations of skill that disregard important aspects of the phenomenon and produce conceptual elision or displacement (e.g., skill equals education). When an operationalization is so simplified, empirical findings may not mean what they appear to mean.

3. For example, Thurow's (1969) analysis of Black poverty: "Blacks who have less [human] capital than whites earn less" (p. 85).

4. Howe's assertions are buttressed by an evaluation of the *DOT* by Cain and Treiman (1981).

5. Crozier (1964) described mechanics who destroyed blueprints for machines so that no one else could assess how complex (or easy) a given repair might be. Millman (1977) described backstage medical (mal) practices.

6. Zussman (1985) documented the weak links between educationally obtained knowledge and practitioner skills for engineers.

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