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Liberation Technology?: Workers' Knowledge and the Micro-Politics of Adopting Computer-Automation in Industry

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ABSTRACT

Liberation Technology?:

Workers' Knowledge and the Micro-Politics

of Adopting Computer-Automation in Industry

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Social research on technological changes in industry has tended to focus on their broad consequences for workers' autonomy, power, and job security, or to compare various technical forms along historical and organizational dimensions. What has gone undescribed and under-theorized in this macro-level tradition is the widespread process in which firms transform production systems from within. In this dissertation, an ethnographic case-study of a food processing firm, I follow their construction of a new plant, and the introduction and implementation of computer-automation in several production lines. I document the importance of workers' "shop floor" knowledge throughout this process, and analyze the immediate political and ideological context in which managers obtained from workers flexible cooperation, despite the company's tradition of adversarial, even punitive labor relations. I analyze the process in terms of three *phases of negotiation*--broadly conceived--in which managers gain *access* to and *appropriate* workers' knowledge, and then *redistribute* their discretion to exercise that knowledge in the new factory. I conclude that the effects of the transition were to expand the functional scope and authority of the minority of workers (15 percent of the workforce)in the highly-automated jobs. But, for the majority of workers the new technology has led to an intensification of labor and did not bring the promised relief from close supervision. More broadly, I hope to have demonstrated the benefits of integrating the study of technical change with an ethnographic perspective on organizational culture.

ACKNOWLEDGMENTS

Although it is *de rigueur* for us sociologists to expose institutions as uncaring, rule-bound and arbitrary, when I reflect on my years at Northwestern, nothing could be farther from my mind. I am unable to express, let alone repay, the gratitude I feel toward the department for eight years of intellectual and personal support. I am also grateful to the superb undergraduate students whom I was privileged to teach and to learn from during those years. I extend warm thanks to the department's administrative staff, who are unfailingly professional, patient, and gracious. Cheryl Andrist, Stephanie Leonard, Rosline Gerome, and Julia Harris-Sacony--all made the department a place where friendship and work miraculously got done.

My dissertation research was rather ambitious--seven years from start to finish--and that turns out to be a dangerous thing for a graduate student to do. One's life and identity rise and fall with the status of the project, and after several years the patience and faith of all concerned can be tested. Unplanned delays in access to my case

compounded what, in practical terms, was already a daunting task. When combined with the share of personal adversity I faced along the way, some of these years were a struggle to get through. That I did, and am able to claim friendships and work that I'm proud of, is testimony to those who stayed steadfastly in my corner.

Dale Jaffe and Eleanor Miller, of the University of Wisconsin-Milwaukee, are sociologists who gave me most of what I needed to make my own way. As teachers and mentors, they helped me negotiate graduate school with a strong sense, both of the rewards of teaching and of myself as someone who could be a creative sociologist. Also, their candor about the conflicting demands of academic and personal careers has made it easier for me to weigh choices that, I hope, will enhance my humanity and sanity in the uncertainty of the career to come. And the chance to collaborate with Dale, my first and most important teacher, has been a privilege.

I am hardly unique when I say that Howard Becker's quietly subversive and brilliant voice (which I first heard through his timeless writings) was a powerful reason why I pursued sociology. He leaves original and important imprints on every subject that he touches. And, no rester on laurels, he is just now awaiting responses to *Tricks of the Trade*, a book of stories that I'll bet are not unlike those he shared with those of us lucky enough to do be part of his field methods seminar. It is among the delights of my life, never to be gotten over, to have had his warm friendship and wisdom to draw on. I hope in the future I will have a fraction of Howie's capacity to work hard and--somehow—always to be so calm, available and without cynicism.

My relationship with Bernard Beck began within minutes of my arrival in Evanston, with his invitation (courtesy of the Center for Interdisciplinary Research on the Arts) to do what became a study of work careers in the theater. Bernie's constant presence has been a remarkable blessing to me. Many of my most joyful times have been spent talking/doing sociology with this very fine and brilliant man. Bernie constantly pushes one to dispense with the cant, the rhetoric, vanity, obfuscation, theory-talk, and piety in so much of academic research. His insights into institutions (ivy-covered and otherwise) are so knowing and prescient that, often, I was reduced in his office to fits of cathartic laughter. But his seriousness, about stating ideas honestly and pursuing them creatively to their important implications, will be with me always. Bernie's generosity of time and energy, and his care in helping me to have wonderful and relevant teaching experiences, are blessings that an entire career will be needed fully to reap.

Allan Schnaiberg is a rarity, both as a scholar and a human being. Largely responsible for establishing the growing sub-field of environmental sociology, he also has a remarkable capacity for human empathy and insight. Allan's vocal support of this project, and of my ability to complete it, was right on time and absolutely essential to my success. Allan also helped me see connections between my work and macro-level changes in political economy which I have yet to take full advantage of--but, I hope to in the book to come?! And his lucid and practical responses to written drafts were invaluable.

I freely admit that when I approached Arthur Stinchcombe to chair my committee, I was unaware of how important and relevant his own career's work would be for my own. In a world where so much theorizing and writing about organizations seems hermetically sealed off from anyone's reality, Art has produced work that is stunning for its combination of theoretical originality, elegance, and empirical usefulness. Art is also a person of uncommon intellectual breadth and discipline. During the long months when I was unable to be as productive as either of us wanted, I felt his disapproval as a tangible burden. But I saw in it too a show of confidence, and am fortunate to have had such an eminent and conscientious advisor. I'm glad too, once the chapters started coming, that we had a series of meetings that were as delightful as they were helpful.

Roberto Fernandez' initiative in gaining access and funding for this research, and his willingness to debate concepts at the heart of my thesis, were instrumental in its completion. Our wrangling over methods and interpretation were sometimes rancorous, but never petty, and for that and for his prodigious intellect and heart, I am in debt.

My ability to have the necessary time and administrative support to carry out the field work and, later, to get data transcribed, was much aided by my association with Northwestern's Center for Urban Affairs and Policy Research, which Fernandez sponsored. In my capacity as a graduate fellow (supported by CUAPR and the National Science Foundation) I also benefitted in many ways from the consideration of Christopher Jencks, Rebecca Blank, and William Julius Wilson. Each of them enlarged my understanding of the policy realm, to which I ultimately hope to add with this work.

A final academic debt is to Michael Burawoy, who visited Northwestern from Berkeley during the 1994-95 academic year. At a time when my energy and confidence were at their lowest, Michael graciously agreed to help me clarify and articulate a framework that, until then, was obscured by empirical detail. He grinned and instructed me to write five pages stating the argument, and to return three days later. Those paragraphs, which expanded slowly in response to Michael's detailed questions and encouragement, began to take on some objective strength in my mind. Michael has inspired many with his ability to bring ethnography and theory into significant dialogue. But many also celebrate him for the rare ability to appreciate and to help transcend barriers students face at this excruciating juncture. My debt to Michael is deep and lasting.

Among my graduate school friends, David Shulman is special for his combination of intellectual and personal support. I am grateful to have had him as a willing co-conspirator and benefitted from his distinctive and creative approach to all things sociological. Judith Levine and Edward Sobel sustained me with their friendship, expanded, really, my sense of what that word means. May we have a life-time's more.

Eight years is a long piece of a life, even for a person of 40. My graduate school years saw the end of a marriage. Despite the pain and conflict of those years, it is certainly true that I would never have been able to return to college in my late-20's, let alone pursue graduate work, had it not been for the love and support of Therese Freund-Duffy. While this work is a legacy of happiness we shared, it is also watered by a lot of bitter tears.

In what must surely be a miracle, the entry of Valerie Hinchliffe into my life restored my belief in this project and in so much more.

My parents, Edward and Helen Haggerty Wellin, were my partners for most every step of what seemed at times like an odyssey. My biggest regret is that the price we had to pay, to discover a deepened sense of what familial bonds and love can be, was so much time and good company lost. I feel the same about my sisters, Susan and Sara; I know that you will share a measure of the pride I feel on this day, as I do for the ways you've lived through your own turbulent lives.

My father is a distinguished social scientist and, like a compass pointing to true north, always reminded me of such occupational ideals as an open-minded appreciation for cultural difference and clarity of expression. I hope that, despite some of my scholarly excursions (propelled by the winds of post-modernism), he is pleased and proud of my efforts.

No one reading this will need further evidence of my gratitude to the people whose work lives I studied.

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CHAPTER ONE

Technical Change as Local Process

Capitalism is a dynamic order. Its development has wrought transformations at various societal levels: both large-scale changes in economic and political relations, as well as others, within industries and firms, as individual capitalists seek to compete through innovation in manufacturing processes and products. Many analyses of change under capitalism, from Schumpeter's, of "creative destruction," to Braverman's of the "degradation of labor," stress its dynamism, as well as the role of technology in mediating social relations implicated in capitalist development.

However, scholars who have inherited this concern with work and technology have paid uneven attention to workers' varying kinds and levels of involvement, in particular firms, throughout processes of technical change. Ethnographers of industrial work have perhaps made their signal contribution by concretely documenting and analyzing cultural forms of production relations, and by incorporating this knowledge into the empirical and theoretical understanding of broader trends. In too much contemporary research, however, social relations have been abstracted and disembodied, leaving Simpson (1989) to wonder, "Where have all the workers gone?"

In a metatheoretical critique of research traditions about work, George Ritzer argues that in American sociology's earlier period of growth centered at the University of Chicago, studies of interaction and local culture, and of work, developed in fairly close tandem with one another (Ritzer 1991, 253-269). Indeed, students of the major exemplars of those two topics--Herbert Blumer and Everett Hughes, respectively--went on to produce a large corpus of studies that integrated concerns with work cultures and social organization (see Becker, et al., 1968 for a sampling).

The trend more recently has been a widening gulf between aggregate, often macro-level studies of work (i.e., of wage attainment, labor markets, professions, and organizations), and micro-level, "anthropological" concerns with interaction, local cultures, and particular dimensions of social difference, such as gender, in the workplace. Bridging the gap between micro- and macro-level processes has been a goal of such authors as Burawoy (1985; 1979), Leidner (1993), and others, and is one I assume in my study.

The micro-macro gap has been equally true of studies about technical change in industry. Rather than tracing processes of socio-technical change in existing organizations and productive systems, most have attempted instead either to develop macro-level theories relating technology and human consequences, or to explain the emergence, persistence, or diffusion--the demography, if you will--of technical forms in capitalist enterprises. Consequently, our understanding of relations between skill, technology, and worker-power has been impeded by debates which, often, are resistant to empirical resolution.

By "localizing" the study of technical change under capitalism, as I will here, one shifts the emphasis to the strategic and processual relations between owners, managers, and workers, and to the institutional and ideological contexts that constrain those relations. Also, this approach highlights the importance of shop floor knowledge and skill,[1] as a basis for transforming existing productive processes. Though I will not delve here into the difficulties of employing skill as an operational research construct (see Attewell 1990; Vallas 1990; Harper 1987), I proceed from the postulates that intensive, shared exposure to problems in manufacturing engenders knowledge which is unique to the shop floor and, further, that this knowledge becomes especially valuable to managers during periods of technical change.

Because skill is housed in persons, who are embedded in cultural systems which organize their lives both inside and outside of the workplace, it seems to me necessary to wrestle with the interconnections.[2] In this research, for

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[1] By *knowledge* I mean a holistic understanding--both conceptual and practical--of a productive process; *skill*, for me, is the application of this more general knowledge for the solution of problems as they arise in production.

[2] For example, Stinchcombe (1990) argues that cultural assumptions regarding ascribed statuses like sex influence, even if unconsciously, processes of allocating persons into jobs. In an earlier paper, Hughes (1984 [1946]) makes a

example, workers' willingness to articulate and translate usually "tacit" skill was inspired by economic and political changes that they perceived as far transcending their immediate workplace. And that perception was, in turn, inculcated by entrepreneurs of managerial technique--in my case termed "team management"--whose clients range across a wide spectrum of work organizations.

The roots of the critical analysis of skill are traceable to Marx, who distinguished between *intensified labor* and *simple average labor*--the latter being the generic, reduced form which is the supposed outcome of industrial capitalism (1976).[3] Later analysts of the labor process have maintained the importance of skill, yet in their concern to interpret its ultimate fate in the

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similar point about "The Knitting of Racial Groups in Industry."

[3] In Volume One of *Capital*, Marx alludes to the strategic nature of the definition of skill when he writes, "The various proportions in which different kinds of labor are reduced to simple labor as their unit of measurement are established by a social process that goes on behind the backs of the producers; these proportions therefore appear to the producers to have been handed down by tradition" (1976:135).

industrial order they have often neglected to study how skill may be withheld, expressed, translated, or otherwise negotiated during periods of organizational innovation. Said differently, attempts to establish the cognitive and historical nature of skill tend to obscure its contextuality and contingency, features which are well-traced empirically through case studies.

Neo-Marxian inquiries into the labor process, inspired by Braverman (1974; Zimbalist 1979), have illuminated how skill is shaped by class politics. But the collective conditions for the development of shop floor skill are at least partly independent of the particular forms of control (Edwards 1979) through which owners and managers have sought to profit by that skill. So, in their search for "universal" historical and contemporary trends, researchers have been diverted from a problem central to the understanding of competitive capitalism: How is work reorganized in *existing* firms, given the constraints of prior labor processes and relations?

Rather than aligning myself firmly with any *apriori* position with respect to skill, I hope to clarify its role and importance more *inductively*. By attending to the actions various groups, at particular times and organizational locations, take with respect to shop floor knowledge, one can discern much about its role and importance in the transformation of technical forms. From a *localized process* perspective, then, new questions emerge: *What are the implications of technical change for the exercise of shop floor skill? How is such skill elicited and exploited by management or its agents? How and when (i.e., at what points in transition processes) is skill incorporated? In what ways do firms' formal organization and culture constrain their ability to transform technology from within? Does the transformative process take place within, or outside, those constraints?*

To pose these questions is to develop broader inferences inductively, from concrete accounts of practice, process, and ideology, as these are negotiated in particular firms. By taking this approach, however, I join interactionist authors (e.g., Fine 1984; Maines 1977;

Strauss, et al., 1963) who argue that organizational functioning is always a *negotiated order*, and that abstracting their prescriptive or formal elements tends to gloss over, rather than to reveal, their social structure.[4]

Regardless of one's assumptions about the human trajectory of technical change, several sociological problems appear when one connects it, as a negotiated process, to skill as a collective, political resource. First, highly-skilled workers would seem to be the most valuable informants for management, and yet (as those presumably most threatened by technical displacement) the least likely to cooperate. Second, I will argue that supervisory authority is exerted largely on the basis of the *denial* of shop floor skill, and of the discretion workers claim in its name. How, then, does management elicit worker input without thereby undercutting their own legitimacy in

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[4] This is consistent with the position of Roethlisberger and Dickson who, in their classic (1947) study, Management And The Worker, emphasize the importance of the "informal" work group, whose behavior is, in turn, related to the larger social organization of Western Electric.

the bargain? Third, contractual rules about seniority and job rights pose formal obstacles to the flexible deployment of people and skill. How are these constraints reconciled or overcome in firms undergoing internal technical changes? To address these questions requires that one integrate and contextualize features of industrial work life--technology, organizational culture, job systems--that have often been studied separately. Before taking up that task in the present case, I will more clearly situate my project with respect to prior research.

Studies of Transformation Without Process

By the 1960's--a period of sustained economic growth and relative labor peace--the guiding questions of industrial sociology turned on adaptations to work, often governed by the assumption, as Burawoy (1979,3-12) argues, that problems of inefficiency and labor conflict could be resolved through improvements in "human relations" or technical "advancement."

More recently, researchers have explored dynamics of technology and labor relations, tending to pursue broad historical questions about the *genesis or persistence* of technical and organizational forms. They have addressed process, if at all, by comparing different firms over time, or different labor processes at the same time. Blauners' (1964) study, for example, relates workers' alienation to levels of automation, and found highly-automated factories to be less alienating than the Fordist models that preceded them; Edwards (1979) writes of regimes of managerial control which, he argues, have evolved with the increasing scale of industrial production; and Zuboff's (1988) work on the role of computers in industry stresses their potential to provide workers with expanded and more immediate access to information about production, allowing them fuller expression of their cognitive, if not their manual, abilities. Stinchcombe (1986) shows how the economic and technical resources present when organizations are founded have lasting implications for their social forms (e.g., the persistence of a guild-like system in the skilled trades). Again, these studies either exemplify cross-sectional analyses of socio-technical diversity at given points in time, or, they draw broad conclusions about processes based on particular stages.

Others in this macro-level research tradition have made quasi-determinist arguments linking technical and political featurės of industrial work. Braverman (1974), advances a theory of "de-skilling," a progressive, aggregate disempowerment of workers by capitalists and managers seeking to replace craft knowledge with "dead" (mechanized) labor. Blauner's and Zuboff's work, cited above, is quasi-determinist because they argue that particular technical forms are inherently repressive or liberatory for workers. To extend such research, one can investigate either *stratifying effects*--i.e., how one technical regime may have different impacts of different grɔups of workers --or, *mixed skill effects*--i.e., how a technical regime may simultaneously depend on older craft skills, de-skilling, and new innovations. Neither approach, however, provides a descriptive narrative of how technical change is achieved within firms.

Despite authors' stated interest in relating workers' experience and autonomy to changing technical organization, they tend to fix the trajectory of such change either in terms of historical origins--an idealized past of holistic, craft labor, since degraded--or of a liberated future--which will ultimately restore to workers what they have lost in prior forms of industrial organization (Vallas & Yarrow 1987; Blauner 1964). These important studies, though ostensibly concerned with changing relations between technology and labor processes over time, largely neglect those very processes. This is either because, like Blauner, they infer change from cross-sectional comparison of various productive systems or, like Edwards, because they conflate questions about the *labor process* with those of *managerial control*.

Neglecting process has, however, weakened efforts to develop a truly sociological understanding of work and technology. Even if we agree with theorists in the Marxian tradition that technical innovation leads to de-skilling or to new regimes of control, we still need to describe and theorize the group interactions involved in the translation of existing skills into forms more readily subject to managerial control. As Coser--following Simmel--established, conflict is no less constitutive of social order than consensus (1956). The explanatory burden is equally relevant for those who see in technical developments a more promising future; their conclusions also imply some form of cooperative, shop floor involvement as a pre-condition for the design and implementation of computer-automated systems.[5]

Studies of "Social Choice" Without Process

A more nuanced approach to the dynamics of technical change has been developed in recent decades by British

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[5] For example, in Zuboff's (1988) insightful account of computer-automation across several industries, she appears to have begun her fieldwork only during the *implementation* of the new systems. She has no comparative baseline for assessing prior expression of skill in these settings and, therefore, can only attribute workers' evident conceptual command of labor processes to computer-automation. In subsequent chapters I will show that, in this case, computerized work stations simply allow workers more efficiently to manipulate information and processes they had mastered long before the introduction of CAM.

researchers of the Tavistock Institute and, recently in the U.S., by writers such as David Noble and Robert J. Thomas. Writers associated with the Tavistock Institute, including Trist (1981) and Emery (1969), began with applied interests in the interdependence of manufacturing objectives and the constitution of work groups. On the basis of studying coal mining and other industries, they developed analytic frameworks which departed from assumptions of scientific management and have "...provided support that there can be alternative forms of work organization, or 'organizational choice', within the same technological framework, and that there are advantages...in structuring social relations at work so far as possible in the form of 'autonomous work groups" (Brown 1992, 72). According to Brown (1992, 74), the major contributions of the Tavistock writers was to offer an empirically-grounded framework for relating technology to potential managerial and operating systems (oriented to the firm's "primary task"), and to the firm's external environment. However, perhaps because of their consultative relations with managerial personnel, the Tavistock writers do not elaborate the potentially-conflictual processes through which "socio-technical systems" are imposed or altered within firms over time.

David Noble is among the recent writers whose work best exemplifies and realizes the benefits of a social choice perspective. His (1979) study of the machine tool industry follows Braverman's inquiry into de-skilling, but goes further by fleshing out the strategic choices through which a particular technical change was molded toward managerial ends. Although he documents that management chose to adopt that technical form--numerical control--which would reserve for them maximal control over pacing and discretion on the job, he reports that this attempt to de-skill positions ran up against management's need to retain the application of flexible, craft skill among experienced workers. He concludes that

> ...while it is true many manufacturers initially tried to put unskilled people on the new equipment, they quickly saw their error and upgraded the classification...The point is that the intelligence of production has neither been built entirely into the machinery nor been taken off the shop floor. It remains in the possession of the work force...Machining to tolerances requires close attention to the details of

> the operation and frequent manual intervention through manual feed and speed overrides (1979,42-43).

Noble's work shows that, even where management seems to have gained technical and procedural control over production, this control is checked in practice by their continuing dependence on workers' willing application of skill. Ironically then, management's efforts to realize the potential profit of technical advances tends to expose the presence and value of the very thing they seek to eliminate: discretion on the shop floor.

Though successful in establishing the importance of "social choice," what Noble misses, however, is a full account of the concrete processes and interactions through which the new technology was introduced, invested with social meaning, and reconciled with the pre-existing labor process and with formal organization.

Robert J. Thomas' work (1992, 1994) is perhaps the most instructive in specifying the rationale and agenda for a processual analysis of technical change in industry. According to Thomas, the disctinctive advantages of his "power-process" perspective are that, first, "[it forces] us to pay close attention to the interaction between external developments and the interpretive acts of people in specific social and historical contexts...and suggest[s] that we treat technological change as a *process of translation*. In order to be incorporated as part of routine organizational life, technology must be translated from a physical object into a social one" (1994,226).

More specifically, Thomas argues that choices--both among and within technologies--reflect historical, symbolic and status relations particular to organizations or industries. He concludes, for example, that engineering staff, whose input is critical in framing technical options presented to upper-level management, may promote systems perceived to offer them maximal opportunity to use professional skill (what they term "real engineering"), regardless of such rational criteria as systems' return on investment. And, Thomas argues, there is no hard correspondence between technical and organizational forms; his case studies are intended, in part, to demonstrate the existence and implications of such "de-couplings."

By offering a critique of the prior, dominant perspectives on technical change in industry--those of determinism and social choice--Thomas makes a compelling appeal to process as key to better theoretical understanding of the work/technology nexus. What is problematic for my study is that, in Thomas' comprehensive framework for analyzing "choice," he dilutes the meaning of "power" in the model; reconciling the several case studies that make up his book, and sensitive to the many stake-holders and contingencies involved, Thomas is catholic to a fault. My study uses Thomas' framework by specifying the constellation of factors that were decisive in one firm, "Ace Confectioners." I emphasize the changing sources and strategies, over time, of micro-political and organizational power which, ultimately, overrode the forces of agency that Thomas exposes.

For example, though it's true that technical choices in firms may not *initially* be governed by explicit logics of control over the labor process, *later* phases of transition provide opportunities for management to adapt newlyestablished systems in line with such goals. In sum, Thomas doesn't differentiate phases during "the process" in terms of the nature and extent of formal constraints or negotiations over strategic resources. So, it is less a criticism, than an extension, of Thomas' approach to suggest that the mandate of case studies of technical change be to specify how, when, and which among various contextual factors, matter, and with what consequences for contending groups. In trying to escape the crude determinism of earlier analysts, Thomas may underplay the enduring collective conflicts which have anchored the study of industrial sociology.

The core implication of this discussion is that understanding the technical reorganization of work within firms demands attention to a negotiated process, the course and outcome of which cannot be deduced either from theories of managerial control, or to anything intrinsic to technical forms themselves. Instead, I will describe this process in terms of three phases characterized by distinct configurations of formal organization, managerial ideology, and technical demands. But these can only be explained, in turn, with reference to managerial power, exercised at critical stages to gain shop floor cooperation and skill.

In attempting to characterize "managerial objectives," it is important to distinguish between lower-level supervisors and training personnel, and those company planners and external consultants with greater understanding of CAM and its relation to manual processes. The former largely denigrate the value of shop floor experience or, at least, lack an understanding of its role in automated systems, and so tend to ascribe to the systems almost mystical powers. The latter--especially engineering consultants--know more about the operational principles and limitations of computer-automated manufacuturing, and appreciate that at critical points in the transition, they will be strongly reliant on workers' conceptual and tactile knowledge. This helps reconcile what would otherwise seem to be contradictory claims: that "management" are dismissive about shop floor skill and yet, on the other hand, maneuver to appropriate it. Of course since, early on, most of the production workers' contact is with first-level supervisors, it's understandable that their (workers') perceptions developed in response to the darker portrait.

After a brief introduction to my case study, I will document and analyze this process, concluding with implications of my case study for broader research agendas.

The Case and Research Design: Automating "Ace Foods"

The case from which the data in this dissertation derive is a century-old food-processing plant in the midwestern United States (an extended description of the firm follows in the next chapter). At the time of my first contact with Ace in the fall of 1990, they had secured corporate sponsorship to relocate and to build a new plant, incorporating a computer-integrated manufacturing system which is among the largest of its kind in North America. I was enlisted as a research associate in a longitudinal, multi-method study of the firm, with attention both to questions of changing skill demands, and of differential impacts on workers of the firm's geographic move.[6]

It is important that my conclusions are based on research spanning four years, a period sufficient to encompass the prelude to the change, when technical and organizational initiatives were first being framed by planners and, then, publicly discussed; through the aftermath of the change, when the longer-term effects of the new system had been institutionalized. Thomas argues that prior research has suffered by defining process too narrowly, as the period of implementation (1994,13). My fieldwork confirms that managerial dependence (at various organizational levels) on shop floor skill is critical in the many months prior to and immediately following the plant start-up, but then recedes, giving way for most workers to a reimposition of close supervision.

Although involved in a range of research activities,

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[6] The principal investigator on this project is Professor Roberto M. Fernandez, now on the faculty of the Stanford Business School. I worked with his guidance on the survey component of this research. But I was also free to develop themes of inquiry and stategies of data collection in the field for the ethnographic part of the study.

including a longitudinal survey of the entire (salaried and hourly) workforce, my primary role was as an ethnographer. I came to know and to interview a wide range of participants--across boundaries of race, department, and rank--both in the old and new plants; I spent a total of some eleven weeks, in four, intensive field periods, on the shop floor; administered 40 surveys in the first wave of that project; and conducted interviews--some informal, some intensive and structured--with production workers, supervisors, company planners, and outside consultants. I am especially pleased to have had access to those in higher-level, planning positions, since, as Thomas claims, even "the most insightful field studies...resort to conjecture and theoretical assertion instead of empirical observation when trying to bridge the gap between the social organization of the shop floor and the macrodynamics of capitalist enterprises and economies" (1994,220). Finally, I attended union meetings, examined company and industry documents, and passed social time with many workers outside the gates of the plant.

My guiding interests were in the cultural introduction of the new technology--its practical and perceived implications for various groups--and in parallel changes in the company's formal organization. To assess changing skill demands over time, I observed and analyzed the daily routines of employees in all production departments, among maintenance staff, and among contract employees who, not on the Ace payroll, were centrally involved in the relocation. My goal was to understand their range of skills-in-use, independent of formal job titles. And I documented and sought to interpret their working *aesthetic*[7], by which I mean workers' collectively-shared concepts, images, and language regarding work processes, their connection to the overall production scheme, and their particular, subjective sense of "skill."

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[7] Thomas (1994, 7) uses the term "process aesthetic" to discuss how better to integrate social and technical systems of production in response to global market competition. I use the term more narrowly, to denote the language and images production workers use to describe the production process.

<u>Theorizing Skill and Negotiated Transformation</u>

So far I have suggested, but not specified, an approach to investigating the technical reorganization of work as a process. Here I provide the reader with a framework for the richer ethnographic account to follow. Adopting a strategic process approach, I intend to reconcile issues of political conflict between managers and workers--along a dimension of compliance and control--with a parallel, semi-autonomous negotiation surrounding the appropriation of skill. This case indicates that theoretical and empirical attention should be paid to three successive phases of negotiation surrounding skill: *gaining access, appropriation, and redistribution*. For each phase I will describe managerial objectives; the immediate cultural context or "frame" (Goffman 1974) of organizational discourse surrounding the transition; relevant institutional constraints; and the managerial strategies employed to overcome those constraints. So, the phases are defined by the conjunction and effects of activity in these social spheres.

Accessing Skill

Managerial objectives: The problem of accessing skill surfaces in periods of technical change, because management engineers seek to elicit detailed, practical knowledge about production beyond that which is recognized or expressed within formal designations of skill or authority--that is, within jobs. Although such "tacit skill" is always present on the shop floor (see Kusterer 1978), it is routinely obscured. This is true both because workers tend to perceive the expression of skill in individualistic terms--a tendency reinforced by job "bidding" and other incentives of internal labor markets (Doeringer & Piore 1971; Gouldner 1954,208-214)--and because, in keeping with their rationale for regulating the labor process, management grants it no formal or public recognition. Under normal conditions, then, tacit skill becomes frozen, as an object of explicit, public discourse and action, under the opposing group pressures of "making out" and "keeping control."

For management planners at Ace, there were two major sources of *uncertainty* about skill, and understanding these sheds light on their practical agenda: first, they were uncertain about what the new system would demand of workers and supervisors; second, they had questions about the nature and value of workers'existing skills and their adaptation to the new system. These questions emerged in both collective and individualistic forms, each calling for organizational and ideological "solutions"; early uncertainty about the capability of the workforce, in general, to adapt to a new productive system, later became a "matching" problem, as management sought to place particular employees in newly-defined positions.

Early on, however, in addition to conceding uncertainty about basic technical aspects of computer automation, company planners at Ace openly expressed doubts about the quality of the existing workforce. And workers' resentment of such paternalism was only sharpened by the lack of any specific guidance as to how they might allay those doubts. A quality-control manager, who helped develop and conduct the company's "training" program, explained,

> Overall, we wanted to assure them that they did have a job here, but that they were expected to learn a lot of

> new things. And that covered everything from literacy, to operating the equipment, to doing basic functions on the computer. It was company philosophy, the realization that people had to be literate, had to do simple things on the computer, and that their jobs would be totally different than they were in the old plant (field interview: 7/21/93).

So, for workers as a group, computer-automation was portrayed as a force that would make existing work-knowledge obsolete and require broad, though unspecified, investment in new skills and understandings. Many production workers faced this uncertain future feeling vulnerable, despite company promises of job security.

During the planning and implementation of technical change, manager/planners--in concert with contract consultants and engineers--sought to expose and to mine shop floor skill in order to inform a range of decisions. These included matters of the production process itself (e.g., effects of variation in raw materials on a continuous-flow process; potential extent and limits of automation on particular lines); staffing (e.g., revision of job descriptions and staffing requirements; identifying articulate shop floor collaborators); and translation of manual procedures into terms necessary for the creation of "process flow" diagrams and graphic displays for computer monitors.

Later, during implementation, there was intense pressure to address the innumerable electrical and mechanical failures that accompany installation and coordination of new equipment. Even if one believes that the eventual results of technical change are to transfer skill from bodies to machines, as is often assumed with CAM, managerial access to skill early in the process is nonetheless critical. The project programmer hired by "Ace", with 20 years of experience in computer-automation in many industries, explained,

> We write most of the code [which translates crude, mechanical directives into a continuous-flow system] elsewhere, usually with the client company's engineers, who describe the process for us. And then once we get into the plant for the start up, we deal strictly with the operators from that point on. They're the ones who have to deal with the system; we have a good definition of the process, but they help us refine the controls to the point where they can make it a usable system for themselves [field quotation: 10/5/92].

Whether supervisory relations on the shop floor are bitter or benign, the managerial need for access to skill requires them to create occasions, outside of the production routine, for thorough and detailed interaction with shop floor personnel. Given rules--both traditional and contractual--which limit free exchange of production knowledge, this space is as much ideological as temporal. Gouldner (1954) points out that, where industrial bureaucracies are strongly punitive, tension arises because management prefers merit over seniority as a criterion for reward. Against this backdrop, workers regard as self-serving those in their ranks who consult too closely with planning staff (whose practical knowledge of production is regarded as poor). Managerial invitations for worker input are apt to harden suspicion among workers about the rationale for and effects of discourse across status boundaries. As I will argue at greater length in subsequent chapters, this need to overcome worker resistance drives such ideological projects of workplace "democratization" as team management.

I believe that evidence of management's need for access to skill was their emphasis, early in the planning stages, on discussing broad *principles* of production, and on establishing quasi-egalitarian forums for the on-going discussion of working knowledge. At this point, management planners found outward cooperation from the shop floor, in part because workers suspected a complete shutdown, rather than the loss of seniority or job rights.

Shop floor context: At this early stage--two years prior to the the opening of the new plant--the atmosphere among production workers was fearful. They assumed reduced labor needs in a highly-automated plant. Combined with a history of rigid, arbitrary management at Ace, this convinced many that the firm's hidden intention was to shed workers. That the city in which Ace is located had lost about one-third of its industrial jobs in the fifteen years preceding these events did nothing to lessen such fears. Further, about half of the production workforce were non-white workers, uneasy about a geographic move that would take them from the inner-city--close to familiar neighborhoods--to a predominantly white, higher-rent industrial park on the city's outskirts.

Such information as management did provide about the impending changes were regarded cynically by a workforce that had recently settled a bitter contract dispute. Wayne, a maintenance electrician and union steward, spoke for many: when I asked whether he'd been informed or consulted about company plans he replied, "Well, they think they're talking to us, but they're really not. They walk in and drop some information about it, ask a few questions, but it's really just one-way communication. We don't feel like they've taken our ideas into account. It's what I'd call a dog and pony show. But after all, it's their money and their plant."

Another pervasive source of fear was management's campaign to have workers test and improve their "basic skills" in preparation for the new, supposedly more demanding, jobs in the new plant. The occasion of the first meeting that I and my colleague had with workers was an early morning "diagnostic test," in which they were summoned to a seminar room in a carpeted office building adjacent to the factory, and given timed, paper and pencil tests of arithmetic and reading comprehension. Although assured by the firm and a local technical college that the tests were only "diagnostic"--administered only to identify needs for remedial training, and that scores would not be shared with company personnel--many perceived the test as threatening.[8] The shop floor interpretation of these events was understandably that although their past performance had been acceptable, new competitive and technical pressures--sharpened by the firm's involvement, in the late 1980's, in their parent corporation's reorganization--now demanded more.

Feelings of vulnerability were especially acute because many workers saw themselves facing a general retrenchment in American industrial employment that was severe by the 1990's. The company president echoed this message in his speech at the annual Christmas party--the one occasion that brings all company employees together in one place:

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[8] In a creative partnership with the state and a technical college, intended to stem the loss of industrial jobs, the firm agreed to subsidize employees' remedial training. A tutor and several computerized work stations were made available to employees, outside of their working hours. Mandatory overtime and child care were identified by workers as barriers to fuller use of the program.

> What I want to talk to you about next is rather serious, and that has to do with the issue of retraining and education. We're living in a world which is changing at a frighteningly fast speed. All of us in this company are faced with the need to learn new things and develop our skills. Often there is fear on the part of people to say, 'I don't know how to do something.' But we must confront and overcome that fear...This last year we budgeted [dollars] for retraining all the members of this company...Every member of this company, in every job category, is encouraged and invited to take advantage of this. The economic health of us and of the state is dependent upon a skilled workforce; this has become all the more essential as we're dealing with a competitive world economy. So, there's nothing I can do but to say please, talk to your supervisors and friends, and don't hesitate to go to the human resources department to find out about these opportunities [field quotation:12/15/91].

Mark, another union steward, accepted the legitimacy of the firm's concern with basic skills, though, like management, he lacked any clear understanding of the connection between those skills and productivity in the new technical system:

> There are no surprises here; these people have seen this coming for a long time. The company is picking up the tab, and all you got to do is put in the time and the work. They're putting in 90 million dollars in a new plant and you've got to have people over there with the skills to make it work. Some of our people are stubborn about it; they don't seem to understand what's on the line here. As union rep's, we can explain the situation, we can encourage people to take advantage,

> and we do; but in the end it's their decision [field quotation:12/13/90].

There are two important implications of this cultural context which promoted managerial access to workers' skill. First, the scale of change in the firm, and the historical association of automation with lay-offs, intensified fear of managements' coercive power. It was known that the firm had considered locations elsewhere in the U.S., and that its future as a subsidiary of a diversified multinational corporation was uncertain.[9] In this atmosphere workers had little faith in union protections, and were especially anxious to demonstrate their value to the firm. And those with little formal education felt they could best express their value to the firm by demonstrating and sharing practical knowledge of production.

The second implication is related to the first: managerial rhetoric about global competition, and about the firms' internal reforms in response to such pressures,

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[9] The firm was indeed offered for sale within a year after the start-up of the new plant. In February of 1997 the firm was sold to an international conglomerate.

tended to transcend and to de-politicize the issue of shop floor skill. That is, increasing daily contact between workers and middle managers--rather than with plant supervisors--transcended long-standing conflicts linking skill and control. And the dual managerial emphases on basic skills and a vague, "automated future" called into serious question the relevance of existing shop floor knowledge. Such knowledge was thus transformed ideologically from a source of workers' pride and power, to a "benefit" or "investment" which an enlightened company would provide on workers' behalf.

Despite the importance of these contextual and ideological factors, they were not, by themselves, responsible for managements' greater access to shop floor knowledge during this period. There was also a positive inducement: the introduction of a model of internal managerial reform--here termed "team management"--which promised to change the punitive relations of production and to allow for greater equity and involvement in those relations. For this reason, plant foremen were perhaps the group most fearful of team management, believing its success would make them superfluous (a theme to which I return later, when I deal with barriers to the adoption of TM). But, for production workers, if the meaning of computer-automation was then poorly understood within the firm, there were clearer cultural meanings ascribed to the "social technology" of team management.[10] The company's apparent commitment to a "team concept" altered the cultural frame in which work skills and membership were perceived and discussed.[11] I will conclude this section on accessing skill by discussing team managment more fully.

The context of "team management": accessing skill was not achieved solely, or even primarily, through fear or coercion, nor by any fundamental increase in appreciation for workers' knowledge. It also involved an explicit, well-orchestrated managerial campaign to promote an *internal*

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[10] This concept is quite similar to that of Quality Circles, often associated with Japanese business practices. For a discussion of the principles and practice of QCs, see Cole (1979).

[11] See the brief appendix and Goffman (1974) for elaboration of my use of "frame" in this context.

reform of labor relations, that of team management. The cultural force of this campaign--its credibility, however tenuous, in relation to the preceding adversarial tradition--arose from the belief that it was an essential social corrolary to the technical reorganization of production. Team management (TM) gained credibility as well because its most visible advocates were people with power and responsibility for planning the new factory. Management planners chose, based on their perceived interests and imperfect understanding of computer-automated manufacturing, to frame the technical change in terms of the greater flexibility and autonomy it would demand of workers. From the beginning, then, the new productive technology was perceived and presented as tightly-linked to a change in managerial relations. Among my earliest and most vivid field work impressions is of a slide presentation by an "Ace" engineer-planner. Though given on this day for me and my co-researcher, the same talk had earlier been given to workers at a union meeting. He wore a white lab coat over his shirt and tie:

> Whether we like it or not, our jobs and supervisory styles are going to change in fundamental ways. For the production employees, we must move from being order-takers to being problem-solvers; we can no longer just report problems to a supervisor and say our job is done. We'll have to be prepared to make independent decisions, based on an informed understanding of the production process. For the supervisors, we must move to be order-givers to being facilitators; it will no longer do to issue orders and demand compliance from others. You'll need to be a liason, between independent employees and department heads. We are all required to change here, whether we've been wearing a blue shirt [as had been true of hourly employees] or white ones. In the new plant, we're all going to be wearing brown shirts [field quotation: 9/27/90].

I don't mean by this to impute nefarious or conspiratorial motives to management. They, no less than production workers, project their own hopes and goals on technical systems; and, should the system fail to deliver major technical or fiscal benefits, their culpability is most direct. Having closely studied several such cases, Thomas writes that "...those in dominant positions are as likely to believe--if not more likely to believe--in the determinant nature of technology as anyone else, precisely because the attribution of objectivity to technology underscores the idea that their objectives are indistinguishable from collective objectives" (1994:19).

More concretely, engineers and planners perceived that a "continuous flow" automated system requires operators quickly and accurately to diagnose and respond to problems, lest they ramify through the factory and become costly. They were not opposed, in principle, to intensive supervision, but to conditions in which employees are so reluctant to act that they refuse to intervene during a computer or mechanical break-down. In short, I conclude that managerial allegiance to the team concept was strategic and superficial--a product of what they perceived to be essential requirements of workers to monitor the new system, and of a belief that trust and candor among production workers could best be gained in exchange for relaxation of close supervision.

One gets a flavor of management's rhetoric of social transformation, in an article entitled "Ace's Engineering Marvel," published during the start-up phase in an industry trade publication. The vice president of human resources reported that morale among workers under the old system was

> ...nondescript. You did your job and that was it. People were hired because they were reliable and

> healthy and did what they were told. Now it doesn't work that way because they've been given the technology that takes the physical labor out of it. The people in the factory are different people than they were even a year ago.

The director of engineering underscored the firms' success in promoting responsibilty among production staff, and he alluded to the egalitarian aura of team management:

> They're seeing some of the stresses and problems that are normally associated with management. They're more concerned about output and quality because now they have ownership in the system.

A final point should be made here. The process of accessing skill was more diffuse in focus, and less well-informed by managerial goals than that which followed--appropriation. Since the punitive tradition of labor relations had affected virtually all plant workers, the managerial appeal was also broad, making as yet no distinctions among employees by skill or labor grade. The problem of gaining access required a general, *collective* solution, one which would undercut the (at least potential) solidarity of production workers and enhance their receptivity to cooperative relations with management without, however, specifying consultative roles that might run counter to formal, contractual rights.

Appropriation of Skill is a process which both requires access and transcends it. Having expanded access to skill, it is necessary for managers selectively to gain the cooperation of shop floor personnel, to form stable relations between the latter and appropriate people (including computer programmers) in higher planning positions, and to incorporate and objectify such skill in the new technical system. Taken together, these interactions constitute the appropriation of skill. I use this term because it connotes the distinction, made above, between negotiation over skill and the related, longer-term issues of control; observation of this case reveals that periods of intensive worker involvement in conception and planning may be followed by managerial strategies which undercut worker control later on.

The shop floor context of shared ordeal: The appropriation of skill involved a different "cast of characters" than were prominent in gaining access. Though the preceding phase was orchestrated by enginner/planners, it was facilitated largely by foremen. The appropriation of skill, however, was notable for the absence of a conspicuous supervisory presence. That is, while the process involves intensive consultation between production and salaried employees, in this case the latter group consisted of middle-management and outside consultants, rather than of first-level supervisors. As targets of workers' long-standing resentment, and the group whose status was most threatened by the rhetoric, if not the reality, of "team management," supervisors were largely seen as irrelevant to managerial interests during this phase.

Furthermore, shop floor workers who were involved in these consultations enjoyed reflected status from contact with middle-management and project engineers, and sought to capitalize on this contact as leverage in their conflict with first-level supervisors. Where dealings with foremen were viewed in formal and adversarial terms, those with engineers and programmers were seen as apolitical, spontaneous, and as confirmation of management's good faith in its claims to disavow hierarchy.

The operative cultural frame on the shop floor at this point was one of shared ordeal; the intense practical and financial pressures of simultaneously staffing two plants and filling customer orders, led management to gain the suspension of all contractual provisions which would restrict their ability to deploy production staff at will. Consent was granted by the stewards, without formal input from the members, on the grounds that the firm couldn't be held to the contract under such unusual and dire circumstances. This suspension of contract provisions, including job, seniority, and shift rights, lasted for more than 18 months.

Among the long-term consequences for workers of this increased managerial latitude was the division of workers into two groups: those who would be involved in the installation and start-up of the new plant, and those who would remain downtown to meet customer demand. The first group was especially privileged by their greater role in refining the computer graphics and code, and by more access to training. Controlling selection of workers for installation and start-up--some of whom ranked relatively low on the seniority lists--allowed managers to confer advantages on particular employees who, later on, could formalize their positions through "bidding" into preferred jobs. In short, managements' role in the reorganization of work was not only to appropriate existing skill, but also to distribute opportunities necessary for the development of new skills, later to be institutionalized. Important contractual disputes which would ostensibly be settled later, during the redistribution phase, were thus shaped much earlier.

Though the period of shared ordeal involved extraordinary labor demands--many worked 60-70-hour weeks for several months--these were accepted in good part because of the informal and collaborative nature labor relations during the period. In the words of Rudy, a maintenance electrician, "We really got caught up in it...It was our first taste of the team concept--you know, facilitating versus supervision. It was just, 'You guys know what to do.' The guys took themselves over incredible obstacles."

The content and tenor of these consultations were problem-centered: how to refine process-flow diagrams with maintenance problems in mind; how to eliminate confusing and unnecessary detail from the graphic screens from which the were going to operators monitor and drive the "recipes"; how to devise procedures for responding to maintenance "alarms" so as to minimize downtime; how to re-position conveyor belts to avoid bottlenecks and spills. These and myriad other problems plagued the period of plant re-design and start-up. And solutions to these problems required spontaneous, informal contacts between operators, planners, and outside programmers, tinkering with and "trouble-shooting" problems as they arose. For many production workers, this phase represented an ideal of cooperative work, providing them with new and highly-valued recognition of skills and judgement. A maintenance worker described this period as

> Totally different [than the past]; it was not micro-managing. It was like, 'You guys are adults, you're

> professionals; do your jobs.' Sure, there were times when the group dynamics took a negative effect and some people would start to slack. Well, then they'd step in and kick a little ass. But by and large they left us to our own skills. They were there only when we needed them. It worked just fantastic. And they [engineering] relied on us because they didn't really have a game plan. They tried, but it was a really chaotic atmosphere out here; plans changed, not only day to day, but hour to hour...But then, we'd regroup--union and company--and talk about the problems; and we both tried hard to see the real [i.e., practical] causes of the problems and to stop any major fires from erupting [field interview:8/30/92].

In the context of shared ordeal, then, production workers offered their ideas freely, believing that cooperation at this critical juncture confirmed the reality of the team approach, and would ensure its longevity after the completion of the plant start-up.

Among the most critical instances of appropriation were those involving programmers and machine operatives, during the process of refining ladder-logical "code" by which control of mechanical processes is translated into electrical controls. In computer-automated systems, the pace, extent, and flexibility of automatic control can readily be changed once basic installations are complete. The managerial strategy here was to strive, at the beginning, for maximally-automated systems--that is, to minimize the opportunities for manual intervention. But, as the chief programmer explained, once involved in start up, the needs of the operators take precedence:

> The engineers can only give us an optimized overview of what they want to do, but the operators' discussions with us were and are on a very detailed level, based on their needs as they use the system. A lot of stuff they wanted didn't get incorporated, but much of it is now, now that we can see the installation and can be brought around to their way of doing things. We're faced with a lot of situations we couldn't have anticipated; often they'll (op's) find a way to work around it [A SYSTEM ERROR OR OMISSION], then someone will mention something and we go into the code and solve it. At some point you just have to cut off input, so we can finish the project; but they've already hired a new guy [ENGINEER], and he'll be able to incorporate more refined changes after they're up and running. It never stops; these are dynamic systems, and after they meet their immediate goals, they'll set new ones. [field interview:10/5/92].

Several months after this interview, by which time the firm has assumed a heavier production schedule, I asked the chief engineer about which problems he saw as most pressing. His reply confirms the critical importance of refining the generic CAM system, and this work can only proceed with plant-level input:

> Confidence in the code [is most pressing]; continuing

> to write the code, and instilling confidence in the code, for us and for operators. It should've been pretty much done off-site, separate from the installation of the code. But a lot of code was not completed, and some that was we found out was written improperly and had to be re-written [field interview:12/15/92].

Collaborative relations and input were not limited to those positions most affected by automation; material handlers, machine tenders, and maintenance personnel were also involved in issues ranging from low-level engineering problems, to that of revising "procedure manuals" in the new factory. It is true, then, that incumbents of many jobs volunteered working knowledge--not in the expectation of monetary reward or promotion, but simply to enhance the ease and control of doing their jobs; maintenance workers suggested ways to install machines to simplify access, and machine tenders offered mechanical tips in hopes of reducing down time. Ironically, though managerial rhetoric implies that such attentive labor is a result of formal training, production employees argue instead that these techniques had long been a part of their daily routines, and that the technical transition interrupted a tradition of supervisory indifference to shop floor input.

Having defined the period of appropriation as relatively unstructured by formal rules, I don't mean to overstate the point. Those employees chosen to provide input about the design of graphic screens during early simulations of the control room "work stations," or to travel overseas for advanced training from systems manufacturers, knew they would be advantaged once the new "bidding" process sorted workers into newly-configured departments. In sum, the accessing phase undercut a political framing of events and, thus, collective solidarity, and that of appropriation intensified this by offering workers individual incentives to share knowledge and skill without regard for contractual or cultural constraints.

Overall, the appropriation of skill occured at a unique juncture, in which management's idealized perspectives on technical potential confronted its limitations. Human labor and ingenuity is needed to adapt a generic system for use as one operable for production. As the phase with the greatest demand for close, wide-ranging contacts across boundaries of status and authority, skill appropriation is also that which most sharply diverged from formal, hierarchical routines. Critical consultations take place between people, and in relation to problems, which are perceived to fall outside the existing politics and social relations of production. Although industrial work has always required piecemeal attention to problems and changes in manufacturing, the intensive infusion of shop floor knowledge--its public *articulation* in response to complex conceptual and practical problems as technologies change--is a relatively rare occurrence within particular firms.[12] In this section I have tried to account for this organizational accomplishment in terms of a distinctive conjunction of political, cultural, and technical resources.

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[12] As stated, I believe appropriation of skill is an endemic problem in competitive, capitalist economies. Perhaps the scarcity of research on this problem follows from a lack of intensive observational studies in the sociology of work. Abbott (1993), reviewing *Sociological Abstracts* for 1990-91, reports that field studies represent only aroung 5% of the total.

Formalizing the Redistribution of Skill

As the culmination of the two prior phases, I define the redistribution of skill by managers' attempt to re-impose restrictions on shop floor discretion. More accurately, their objective at this point was to confine shop floor discretion, elicited during prior phases, to those positions and procedures in which they perceived it to be essential in the new regime. In addition, workers who had come to occupy those positions shared an interest in redistribution, though for different reasons. During this phase formal job and status designations, partially suspended during prior phases, were re-imposed, though guided now by broader managerial knowledge of the technical system, the extent of its reach in the firm, and its implications for supervisory oversight.

It is important to point out that possession of such knowledge among management is itself based on the incorporation of shop floor skill during previous stages; it would be mistaken therefore to understand redistribution simply as an intended consequence of earlier managerial designs.

The de facto redistribution of skill was largely accomplished in the appropriation phases, through management's ability to deploy personnel at will. These earlier selections governed which workers took part in critical consultations with outside consultants; and they created skill cohorts, who both provided critical input and enjoyed lasting competitive advantages after the plant start-up. Still, in the absence of organizational mechanisms by which personnel could formally be "re-sorted", the restoration of prior contractual rights would have negated much of the benefit to managers of their personnel strategies.

Understanding redistribution requires that one differentiate between functions and groups *within* the firm--a level of analysis which is generally absent in this research tradition (see Zimbalist 1979:xvi; Baron and Bielby 1980). However, I will argue that problems, both of internal stratification and collective action among workers, that follow from technical change arise and are understandable only in relation to divisions in the work force. In this case, the reorganization of work concentrated skill and discretion--which I analyze in the next chapter as collective resources--in a smaller number of positions. In turn, worker discretion was contained, in fewer bodies and in a system more subject to technical control and oversight from above (see Edwards 1979). The term redistribution then, is not meant to imply any quantitative *displacement* of skill but, rather, a relative change between positions and work groups in discretion and supervisory control.

To the extent that one views the "impact" of technical change upon skill in *individualistic* terms, one may conclude, as did Blauner (1964), that highly-automated plants restore to workers a more holistic, less alienating, relationship to laboring. If, on the other hand, one sees skill and discretion as *collective* resources and interests, then the importance of their relative distribution among the workforce increases. And, the obverse of a relative increase in the concentration of workers' skill and discretion can be seen as expanded managerial control.

Shop floor context: external pressures and a new status system

The immediate shop floor context during skill redistribution was of external market pressures to meet orders, and a mounting perception of vulnerability owing to a corporate announcement that "Ace" was to be sold. Ironically, while in earlier stages these pressures were invoked by management as a rationale for internal managerial reform, now they were presented as reasons why such reforms had to be postponed or abandoned.

For those in the most highly-automated "control room" positions, responsibility for coordination and oversight over "plants" (rather than discrete processes or machines) is already extensive and is expected to increase in the future as managers further refine the system. For machine tenders, whose work changed little during the transition, the perception is of de-skilling, because intensification in supervision and the pace of work have narrowed the limited range of discretion they had previously enjoyed. The passing wave of rising expectations has left them especially bitter.

To understand redistribution more fully we will have to consider, in later chapters, the organizational context. Especially useful will be Stinchcombe's (1990) functional framework for analyzing organizations, in terms of the needs for and flows of information between actors in particular roles. For now, however, the important point is that, having exposed and incorporated shop floor knowledge during the transition, managers were in a more powerful position to control such knowledge. They exercised this control both at the individual level, by determining job-qualifications, duties, and the means of job-mobility (the "bidding system"); and collectively, by re-drawing departmental boundaries and procedures. From a managerial standpoint, the early emphasis on accessing skill as a "liquid asset" was replaced by a strategic problem of institutionalizing a labor strategy in line with growing understanding of the limits and capabilities of an altered productive system.

There are two factors that undercut the likelihood that workers would pose a collective challenge to "redistributive" managerial actions--even though the latter were widely seen as inimical to their interests. First, bargaining procedures concealed the terms and implications of the company's wishes, virtually until the moment when a final vote was called in the union hall. Lacking any clear understanding of the contract's relation to the new technical regime, or of its practical impact for particular workers or departments, workers had little basis on which to develop a counter position, let alone to press it during contract negotiations. Second, the early phases of the transition fragmented prior departments and status groups in the factory, and had given rise to new ones which, often as not, cross-cut traditional sources of common experience and solidarity.

The framework I have developed here is crudely summarized in figure 1. Derived inductively, it is intended to clarify the nature and temporal ordering of important sequences of action. I remind the reader that "context" here refers to the dominant cultural atmosphere, at various periods, on the factory floor. The meanings of "constraints" and "solutions" are oriented to managerial objectives, though I concede that those may be analytical (second-order) constructs, rather than explicitly articulated.

Figure 1:

phase	context	constraint	solution
access	fear of job loss	punitive culture	"team concept" intern. reform)
approp.	shared ordeal	contractual	work="consultation" + external mediators, suspension of contract
redist.	pressure of prod. + labor efficiency; routinization of production	contractual + resistance by status gps.	pseudo-volunt. bidding + procedural control over bargaining

It is important to stress that I see these phases, in practice, as *path-dependent*: as in a conversation, an expression or commitment by one party serves to constrain both their subsequent statements, and the potential range of responses from the other side (see Psathas 1995). This contingency--its content and consequences--must be explored ethnographically in order to illuminate specific cases of cultural change.

Also, though I have and will discussed the process in exchange terms, as the participants do themselves, this implies an equality that is merely formal. One needn't subscribe to a theory of managerial conspiracy to acknowledge that, even when faced with uncertainty or resistance, managers retain the power to suspend or invalidate ostensibly reciprocal agreements with workers/representatives, invoking organizational resources as needed. And since, in this case, management withheld its ultimate power--layoffs or relocation--their exercise of this power was largely accepted as legitimate within the workforce (see Blau 1964, 199-223).

A Brief Appendix: Defining "Frames"

Ethnography is an interpretive endeavor, as much as a descriptive one. To write as I do of the "political context" on the shop floor, or of "communication between workers and engineers," may simplify or obscure the particular theoretical meaning I wish to convey with reference to these events. Interactional "frames," for Goffman (1974; Verhoeven, 1985) are the collective, taken-for-granted scenarios which allow participants to organize experience--that is, to answer questions about "who we are and what we are doing here." Attention to frames allows the researcher to interpret words and actions with greater cultural sensitivity than is possible when such expressions are overly individuated. For example, I came to understand entire conversations and diverse topics encountered in the field as framed, for example, by a discourse of hierarchy and its abuses by management. Later in the research, those same expressions took place--were translated or "keyed" (Goffman: 1974:44, 79-82)--in distinctly different frames, for example, in relation to the failure of fellow employees to assume the new obligations of a team-oriented plant.

In analyzing this case I will make distinctions based on my grounded knowledge of the frames which were operative at the time. This will help me to argue, for example, that an important feature of skill appropriation, at least in this case, is that particular stages differed with respect to whether discourse about skill was or was not perceived to be part of the institutionalized rules and relations of production. Support for such an argument cannot rest only on discrete field statements or events, but requires interpretation of collective cultural frames. My burden is to elaborate and document the empirical anchoring of these frames, and to demonstrate their explanatory usefulness.

CHAPTER TWO

ACCESSING SKILL:

PRACTICAL AND CULTURAL CONTEXTS OF NEGOTIATION

Defining and Comparing Work Cultures

It will help here briefly to provide background about my approach to studying work cultures in various settings. My goal as a sociologist has been to document and theorize tensions between emergent, cultural dimensions of work--consisting of practices and perspectives that workers develop and value--and their formal, ostensibly rational, organization for profit. This tension, a venerable one in sociology, is often obscured by images of modernization defined by *successive* periods of historical change. Bittner, for example, concludes that "one of the most important structural features of modern life is the temporal, territorial, and moral segregation of the sphere of making a living from the sphere of living" (1983:254).

But this draws the contrast too starkly. Barriers between work and "personal" life are more permeable than this suggests (Nippert-Eng 1996; Stinchcombe 1990). Marxists and managers alike will concede that routinization of work is always more an ideal than a reality. Whether through norms or coercion, people facing the physical and moral demands of work develop skills, meanings, and social attachments that are independent of--if not opposed to--the formal purposes of jobs and firms (Heimer 1992).

This is why too narrow a focus, whether on "the labor process" or "managerial control" leaves one with a stilted version of what Hughes referred to as the "drama" of work (e.g., 1958:42-55). Hodson (1991:72) concurs that "...we need a theoretical model of the worker that is neither anesthetized [by compliance] nor resisting managerial strategies of control. Such a model would have to include central roles for pride in work and for the desire to create autonomous spheres of activity." And David Halle, in his study of work and community in an automated chemical plant, concludes that, "Faced with tedious tasks, men expend considerable ingenuity...to make life at work more tolerable. This involves wresting from management a degree of control over the work situation in order to create time and space for social activities on the job" (1984:146).

Dynamic tension between work semi-autonomous work cultures and formal organization is an important basis for the empirical, comparative study of work and occupations. Though my research opportunities have often arisen without conscious planning, looking back I can recognize this theme as having defined and unified my research over a ten-year period. Since that theme extends to this project, it will help to lay it out plainly.

In my first major project, I studied work organizations in which the objects of labor were human beings. I did more than two years of field work in small, quasi-domestic "group homes" for old people diagnosed as having Alzheimer's Disease (see Wellin 1996). As an employee and later as a volunteer/observer, I investigated residents' subjective ordering and narration of self in response to assaults--both organic and interactional--in their daily lives. As for staff members, I focused on their ethos of "care," a set of therapeutic values and skills which they felt to be at odds with the instrumental division of labor present in nursing homes and other custodial institutions (see Diamond 1992).

Though drawn to work in group homes by the promise of freedom to exercise more authentic "personal care" with residents, staff members instead found themselves with domestic and clerical tasks that made that promise impossible to fulfill. Still, in their emergent work culture, they constructed shared images of residents *as* persons, of the diseases which ostensibly governed resident's behavior, and of care as practical and moral conduct in service of diseased persons (Wellin 1996, 1989; Gubrium 1986). Combining their occupational aspirations with a selective use of medical discourse, staff members sustained a culture that both informed and justified their work.

Next, I studied perspectives on work and career mobility among theatrical technicians--those, such as lighting and scenic personnel, and stage managers, who create productions but do not appear onstage. In this case work culture is defined not by institutional boundaries but, rather, by commitment to a diffuse artistic community (Wellin 1993, Becker 1963:79-114). Lighting technicians, no less than actors, define their work in relation to aesthetic judgements and collaboration. This orientation leads most aspirants to reject a formal, bureaucratic division of labor--and the closure imposed by union affiliation--and instead to renegotiate work roles from one production to the next. A paradox in such careers is that material rewards and stability tend to conflict with creative flexibility. Consequently, careers tend to be short and attrition high.

In my research, then, I have examined work cultures as, at once, practical and ideological, documenting in each case distinctive practices and values, and how workers seek to articulate these in and with contexts of formal organization. Relations at work are negotiated, not determined. Despite its larger scale and technical complexity, I studied Ace much as I had prior research settings.

Two particular tenets, drawn from my prior research, were especially useful in studying technical change in industry. First, I assumed that understanding the social nature and distribution of working knowledge was an empirical problem, and that any "solution" would require me to see the organization's formal job/status system merely as a point of departure. Second, because I have found such knowledge to be highly-valued by practitioners, I expected the technical transition to be an occasion for its public expression. Thus, I viewed technical change not exclusively through the lens of "labor relations," but saw in it opportunities for new social contacts and forms of participation.

Negotiations: Multiple Meanings & Applications

Reviewers of research on the impact of technology on work organization have concluded that findings are contradictory, and that refining theory will require us to specify several sets of contextual variables. Some (e.g, Prasad 1993; Thomas 1992; Form, et al. 1988) suggest that one must take into account the cultural meanings and organizational choices that mediate relations between people and machines. Others (e.g., Sorge and Streek 1990) argue that a firm's particular market niche and history of labor relations are key to understanding the consequences of productive technologies for workers. Building on these critiques requires two things--that one generalize within, as well as across, cases, interpreting actions and events in terms of important empirical conjunctions (Ragin 1987); and that the relations between empirical phenomena be identified and fleshed out. Ethnography, as a methodological approach, is well-suited to this goal.[1]

Because social life is so complex, social researchers often make use of metaphors to capture essential features of social life (Becker 1986:84-89). For instance, Erving Goffman used the metaphor of a con game to analyze the problem of how to placate, or "cool out" people who--either through their own failure, or that of social structure--cannot maintain a valued social identity (1952). More

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[1] Still, Abbott (1993:191) surveys published research on work and occupations indexed in Sociological Abstracts and finds that, "Hughesian-style field study has all but disappeared." Research employing observational methods account for only about five percent of the total.

germane here, Burawoy (1979) uses the metaphor of a game to analyze machinists' efforts to "make out" in compliance with production quotas, a competition which ultimately reproduces their exploitation as labor. Such metaphors are effective because they clarify important empirical features of the settings under study, as well as principles that extend to other settings.

Likewise, I analyze technical change at Ace Foods through the metaphor of negotiation. Though the term applies literally during collective bargaining, I use it here to develop a framework for interpreting perspectives and actions among many groups over a period of several years. So, my purpose in this case study is to advance a theoretical explanation for how technical change was negotiated between workers and managers in a food-processing firm. The initial phase, during which managers sought access to shop floor skill from a resistant workforce, is my focus here.

I have in mind three connotations of the verb to *negotiate*; distinguishing them will help to clarify my argument and agenda in this study. Briefly, the term connotes 1) forms of exchange, 2) responses to adversity, and 3) settings and outcomes for resolving conflict. Next, I elaborate these distinctions and relate them to the three analytical phases that organize this case study.

A standard dictionary states, first, that negotiation is *"to transfer to another by delivery or endorsement in return for equivalent value,"* as in a bank check or contract. Here, too, the meaning is apt. I am asserting that an array of perspectives and joint actions, which in a social sense constituted the transition, are understandable as a kind of exchange. However, though a bank check is negotiated against a standard currency, here the terms of exchange by which the respective parties designate value are culturally, as well as politically, defined. Central tasks for me, then, were to develop and document a subjective understanding of actors' expectations, and of how those inform the terms and outcomes of negotiation (see Blau 1964:143-167). Said another way, to understand the social actions through which skilled was accessed, one needs to know with what political and cultural meanings the actions were invested.

Already I have begun to define the value of consultation for managers: they have technical problems that compel them to elicit workers' involvement. Ironically, most managers, uncertain about changing technical demands of workers, severely underestimated the long-term value of workers' knowledge. Instead, they framed the new demands in terms of formal academic skills, which (as I'll in detail) had important and lasting micro-political repercussions.

Understanding the value of consultation for workers, on the other hand, leads us to reconsider problems of authority. Apart from material benefits, workers value respectful recognition of their talents, and of their contribution to the firm's fortunes. As Sennet and Cobb gracefully argue, the *Hidden Injuries of Class* (1972) result not from material deprivation or rejection of manual work per se, as from the indignity of poverty in the economy of prestige. For production employees at Ace, to be included in significant decisions and to believe this role would become a permanent part of work relations, was redress for bitter grievances. This is why, during the ordeal of running two plants, workers accepted the suspension of contractual protections: They valued highly the equity implied by facing adversity across status boundaries--"person to person"--and believed that sacrifice at a time so critical to the firm's future would help erase the prior history of punitive, "top-down" supervision. Like the Japanese industrial workers discussed by Cole (1979:240), Ace employees wanted to be joined along with managers in a "community of fate," real participation that would implicate them in the successes, as well as the hardships, in the company's future. Ironically, given negative stereotypes about labor commitment in the U.S., it was the company whose allegiance to "teamwork" would prove shallow.

So, in this chapter I offer support for my assertions, first, about Ace's punitive culture and, second, that workers valued consultation for its own sake (in the next I treat the issue of "basic skills"). Recognizing the cultural value for workers of "team management" illuminates many actions which might be obscured by an exclusively conflictual view of workplace politics.

A second definition of the verb to negotiate means *"to get through, around, or over successfully,"* as in a sharp turn or obstacle on the highway. This meaning connotes challenge, even risk, and clearly applies here. Indeed, the significance of skill appropriation (the second analytic phase) emerges only to the extent that one appreciates the adversity facing Ace, as they tried successfully to negotiate the period of relocation. To build a new factory and apply automation in a complex, productive system is fraught with uncertainty, expense, and immense technical and logistical demands. At Ace these pressures affected people in every position and level of the firm. Indeed, a major source of fortitude for employees during the arduous weeks of starting up the new plant was a sense of shared ordeal, manifested in unprecedented work demands and collaboration between people across status boundaries.

Planning decisions for the new plant project were concentrated among representatives of several departments (e.g., quality control, engineering, human resources) making up the "special projects" team. In addition to coordinating efforts within the firm, these people also worked closely with corporate contacts elsewhere, with whom Ace was developing intricate ties. Their overall objective was to coordinate production and business practices among these "sister plants." Yet here, some months after the relocation, a member of the planning team was still preoccupied with complaints about the firm whose engineers were translating Ace's production processes into electronic "code":

> Like many of these companies we've contracted with, we're totally reliant on them. They're learning the ropes, how to be experts, but at our expense. They assured us the plant would be totally operable by early July, but we're into September and we've got a long way to go. Apparently it's a problem with the software; we're trying to integrate a lot of different pieces of equipment, made by different manufacturers, and the programmers have never tackled a project like this, on this scale. So, we have to pay through the nose, even though they haven't delivered what they claimed they could. In the meantime, we've had to cover orders with help from our sister plants [field quotation:9/9/92].

What practical hurdles, more specifically, were managers at Ace facing early in the transition to computer-automated manufacturing (CAM)? First, they were under pressure to meet a changing and expanding production schedule within a global, corporate division of labor. They hadn't the luxury of settling for a long-term return on the new plant investment; instead, their mission was to increase production by 30-40 percent within the first years at the new location. As I will show, that goal required them to have detailed understanding of materials and equipment that could only be gained by close, shop floor consultation. As later chapters will detail, this consultation informs such basic requirements of CAM as designing computer graphics (visual representations of manufacturing lines, used by operators to control the plant) and refining the "code" which regulates production equipment.

Claiming skill to be central to the work process requires one to inquire about its social bases and meanings. Workers' knowledge, whether of discrete tasks or of general processes, is partly a function of organizational careers that cement social ties and expose employees to recurring problems. Their mental images, language, and techniques reflect particular, local ways of organizing and delegating work; these can be formal--like those codified in departmental boundaries and procedure manuals--or as informal as the shifting alliances that appear around tables in the company cafeteria. However, in order efficiently to negotiate changes in productive technology, managers need access to knowledge that is usually hidden or, perhaps, simply unstated.

But what distinguishes shop floor knowledge from the more formal, technical expertise, say, of engineers? The answer has partly to do with secrecy, as a function of hierarchical authority relations. Such early accounts as Chinoy's (1955), about the automobile industry, point out that skilled workers may withhold knowledge, even sabotage production, out of resentment toward plant supervisors. Denied a role in decision-making, or incentives such as profit-sharing, workers have little reason to share hard-earned know-how. Of course, since supervisors--more than engineers or executives--embody authority on the shop floor, it is toward them rather than higher-level personnel that worker resentment tends to be directed. In my case, this helps explain why later, during the appropriation phase, production workers at Ace so freely consulted with salaried employees: In addition to reflected status and recognition, they felt that by doing so they would gain leverage, in the future, over plant supervisors.

More complex and specific answers to the question of what distinguishes shop floor knowledge involve the contradictory goals and practical adaptations endemic to industrial production (and to formal organizations generally [e.g., Perrow 1970:133-181]). Juravich nicely documents such *Chaos on the Shop Floor* (1985), from experience as a mechanic at a wire factory. At Ace, sources of "chaos" were antiquated plant and equipment and a lack of consensus about product strategy which, in turn, disrupted the production schedule. It fell to workers in the factory to reconcile these constraints with daily pressures to meet customer demand.

I analyze shop floor knowledge, then, as a collective and contextual response to the organization of work at higher levels. Accommodations made on the shop floor are then shared and transmitted via peer-training and experience (e.g., Halle 1984:105-144; Lave, 1988), constituting, over time, a semi-independent "craft culture." It is important to note that, while a collective resource among workers, stocks of shop floor knowledge develop in tandem with, and are essential to, managerial aims. But, whether and how workers actually *express* this knowledge is not a function of authority nor (especially for workers) of class interests.

In this connection, Burawoy (1979) has argued that a central research question is how managers secure workers' consent to exploitative regimes of production. Skill and cooperation are analytically separable, but in practical terms they are tightly-intertwined; workers' knowledge is valuable only to the extent that they are willing to articulate and practice it freely--especially during periods of technical change. Though managers may be unclear about how they will incorporate shop floor input, as was true in this case, still, they face the problem of inducing cooperation across cultural and contractual barriers.

Of course, production regimes are not confined to factory buildings. Because production includes firms' broader competitive environments and strategies, I identify features of Ace's history and "white collar" world which shaped practices in the plant. Among these are the nature of customer demands: in the past, these have included both small, local contracts, and large batches for international markets--a mixed strategy which has prevented the company from adopting the streamlined production schedule that would best exploit their investment in computer automation. In later chapters I will expand on how the corporate context is implicated in the work lives of Ace employees, salaried and hourly alike. In this chapter I foreshadow these themes in addressing the bases and organizational uses of workers' knowledge, but in this section I have described some of the practical challenges that faced Ace foods during the period of my research.

A final connotation of negotiation is *"to confer with another so as to arrive at a settlement of some matter,"* or, *"to arrange for or bring about by such conferences."*[2] That is, negotiations take place in recognizable, even routine situations; the situation, or "frame" (to use Goffman's [1974] term), informs the process as well as the moral tenor of the exchange. Consider for example the difference between handling a divorce through third-party mediation or through an adversarial trial: while in both the objective is to terminate a marriage, only in the court is there a legitimate constraint on freedom of speech (favoring the judge and lawyers), and only in the court do we expect and require the assignment of blame. Thus, s/he who defines the setting for negotiation also determines the potential roles for the parties involved. Social psychologists use the term *altercasting* to capture the process by which situated roles may be strategically-imposed: addressed by an accusatory lawyer, one is forced, even if unjustly, into the posture of a defensive witness. The attribution of guilt, buttressed by the encompassing frame, becomes a social fact which

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[2] My source for these definitions is the 1974 edition of the Merriman-Webster Dictionary.

overrides the speakers' preferences.

So too with negotiation over shop floor knowledge during technical change. Consultation takes place in settings which are themselves defined by symbolic and contested meanings. Above I alluded to the fact that managers' framings of worker skill--whether as relevant to the new system, or as being displaced by formal skill demands--shaped power relations. This principle holds across the entire span of my study. Thus, for managers and workers to confer about the installation of a new piece of equipment during contract negotiations is to impose organizational and cultural constraints on both sides: managers are concerned to retain exclusive control over production; workers, to protect existing jobs and the skill distinctions that define them. In the context of Ace's tradition of punitive supervision, or what Gouldner has termed "punishment-centered bureaucracy," the gamut of interactions between managers and workers are ordered by the opposing weapons of discipline and grievance. Joint action is both procedurally and culturally inhibited (Gouldner 1954: 207-228).

However, by suspending contractual rules one does not thereby create neutral or equitable relations. Consultation can be shaped by constraints that are less formal and explicit. In this case, as in contemporary industry more widely, managers have adopted new "social technologies," rooted in the human relations studies begun at Chicago's Hawthorne Electric Plant, and in Japanese labor practices which, correctly or not, are credited with that nation's economic ascendency in the post-war period. Whether termed "quality circles" or, as at Ace, "team management," this approach to supervision contains an uneasy combination--an apparent rejection of traditional hierarchy, along with a paternalistic emphasis on workers' identification with company goals (Grenier 1988; Cole 1979).

The rhetoric of "team management" attributes to workers deficient knowledge and commitment, but assures them that solutions to these problems will occasion a fundamental reform of authority and decision-making. In this context managers sought to remove worker input from long-standing political tensions, and to convert it instead into a defensive response to a diffuse, paternalistic regimen. Grenier, surveying a body of research on team management in the U.S. concludes that "...the new vision of work [reflected in "team-oriented" management initiatives] depends on the ability of managers to psychologize work-related problems and treat the worker as a patient" (1988:xiv). And for Attewell (1994), such "ideological control," intensely-promoted in firms' local cultures, has become typical of authority in modern industry. It has complemented, perhaps supplanted, "bureaucratic control" by which Edwards (1979) argues, labor conflict since mid-century had been regulated through the broader political sphere (e.g., through OSHA regulations).

However, it is no less facile to critique TM generally --as ideological control, an insidious, yet pervasive form of workplace authority--than to celebrate it a panacea for industrial labor relations (e.g., Helfgott 1988). As an ethnographer, my interest is in the particular times and ways TM was invoked by managers, and in how they present it as practically and culturally relevant. This is why I closely examine Ace managers' discourse on skill and managerial reform.[3] I argue that while some in the firm advocated team management sincerely, saw it as an inevitable corollary to the adoption of the new automated system, its significance proved to be tactical rather than genuine. Ironically, rhetoric calling for workers to adopt TM, and "upgrade basic skills," undermined their confidence and solidarity precisely at a time when the overall pattern of managerial behavior demonstrates the value of shopfloor knowledge.

To summarize, the first phase of the technical transition, *accessing skill*, was defined by an overarching conflict: Company planners and outside consultants needed practical input from the shop floor in order to refine and translate their knowledge of production. Managerial understanding of production, though extensive, was not

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[3] In the sociology of work, casual word choices create confusion about types and levels of authority. Here, I will use the word "supervisor" or "supervisory" to refer to authority on the shop floor; by "management" or "managerial" I refer to personnel or decisions involving higher-level planning and decision-making.

sufficiently-detailed for the purpose at hand. Yet production workers, fearing layoffs and resentful of arbitrary authority, resisted sharing ideas which in the past had either been ignored or repressed. So, consultation was held hostage by the prevailing political and cultural organization of the workplace. Introduced against this background, and at this critical cultural moment, the rhetoric of TM served to suspend and realign these political forces, transposing consultation from a zero-sum game, to one in which, in theory, "everybody wins."

Field Work Perspectives and Jobs-in-Context

My early impressions of Ace revealed a lot: about the tenor of working relations and authority, local definitions of skill and production problems, and connections between workers' lives inside and outside of the factory. I formed impressions, for example, during several factory tours when, in addition to learning about practical features of work, I absorbed something of the language and social circles through which work got done. Indeed, important aims of workplace ethnography are to document the contextual complexity of work tasks and, in turn, to use that understanding to analyze work as a collective accomplishment (Darrah 1992; Lave 1988; Harper 1987; Kusterer 1978).

This approach is fundamentally different from conventional managerial and social science discourse, in which "jobs" are treated as static, functional categories, largely independent of particular incumbents. Thus, while survey researchers often use jobs as independent variables, implying some stable constellation of skills and attitudes, for ethnographers jobs are themselves objects of cultural analysis. Seen this way, jobs and work skills are deeply contextual (Darrah, 1992; Garfinkel 1967), shaped by the material environment, (e.g., physical layout and technology), the social division of labor (i.e., task allocation and the succession of experiences by which co-workers gain knowledge), and such organizational and economic conditions as marketing strategies and consumer demand.

At first it was a challenge for me to grasp basic facts about production processes at Ace. Early field work left me with only a fragmentary set of impressions, loosely-tied to analytical themes. In the mid-1960's, long before it became fashionable among field researchers to invoke the value of "reflexivity," Blanche Geer (1964) wrote that one's first days in the field can be crucial for developing such themes, or for discarding preconceived ones. And so they were in my study of Ace. Though, by tradition, reflections on field work are reserved for methodological appendices, Lofland (1994) and others argue that candor about one's assumptions and persona as a researcher helps readers, both to trust factual claims and to assess the development of theory in the field. True of interviewing--usually a succession of "one shot" encounters--this is even truer of long-term, case-study research, in which ties or "rapport" with one group or faction may preclude acceptance by others and access to data may be systematically skewed by one's early alliances.

Fortunately, my contacts with various groups in the firm were strong and long-lasting, so I was never forced to make such trade-offs. Employees throughout the company overcame their initial wariness; during my years of involvement they spoke candidly about work, both its concrete and subjective dimensions, usually under the stress of the work routine. Also, 24 key informants granted me lengthy (1-3 hour) interviews outside of the workplace, several more than once. These I transcribed verbatim.

Initially, the firm's authoritarian culture created a gulf between me and many workers, but over time we discovered common experiences. Though a graduate student when we met, for three years I had worked as a printer across the street from Ace's downtown plant. Several employees were studying to earn high school equivalency, and because I'd gotten a GED before starting college in my late twenties, we had that in common. A few were working, with financial help from the company, toward college degrees and we exhorted one another to continue working toward our educational goals. More often, production workers boasted to me of their children's academic and other achievements; a man, soon to retire, conceded that though the computer age might have passed him by, it would be kinder to his son, who was excelling in high school.

During those first days, I was also attentive to how employees viewed one another across boundaries of status and authority. Some messages seemed to be sent intentionally, as when supervisors or engineers explained work processes to me in an idealized, detached way, neither soliciting nor acknowledging input from production workers present, whose experience was clearly relevant. Though I was hardly a discerning judge of technical matters, in-plant discussions were often occasions for superiors to display their knowledge, distinguishing it from the supposedly more narrow and mundane kind on the shop floor.

Others messages were more subtle, for example: the respect maintenance staff accorded the opinions of machine operators or packers when a line was down or a recipe failed to "roll out," and their shared language and logical approach to troubleshooting mechanical problems; the familiarity workers had of one anothers' job-histories and preferences; the ways working relations and skills extended beyond the boundaries of the job--as with two "molders," who had a small auto repair business together, maintenance men who volunteered off-time to do repairs in a neighborhood church, and people in the packing department who convened in a neighborhood tavern on weekends to play pool and eat barbecued chicken. These everyday, communal aspects of work and life among production workers became a sub-text in my continuing field work.

Workers' ability and resourcefulness in solving production problems led me to look more closely at the conditions that sustained managerial fictions denigrating workers and their abilities. I mean here such practical conditions as the physical plant and production schedule, as well as organizational features like the job system and work contacts between factory and middle-management staff.

Ace's Relocation: The Context of Corporate Expansion

Arriving at Ace Foods in the fall of 1990, the firm looked to me out of place in its surroundings, an industrial anachronism in the midst of a downtown "redevelopment" plan that included riverfront condominiums and specialty retail shops. A nearby tannery had been gutted and renovated to accommodate government offices, but Ace's plant lacked any such architectural charm or utility and has since been demolished.

In their original location the firm occupied two buildings on a downtown street, now dwarfed by a high-rise hotel and a new sports facility. The taller of its two buildings, containing the plant, was a six-story structure, its white-washed facade only partly covering a weathered brick foundation. This building stood where, a century earlier, the family-owned business had made its start. Ace had flourished, especially during the World Wars when, according to a company brochure, they had supplied the U.S. Navy. By the 1950's, they had established a strong industry presence and market share, due in part to the modernization and expansion of their quality control laboratory. It was also during this era that Ace was among the first large employers in the city to undercut competitors' labor costs by hiring newly-arriving African-Americans from the South.

Now, non-white workers (of whom over 40 percent are Black and 10 percent Hispanic) make up half a production workforce numbering 200.

Remarkably, the small family-owned firm, which in 1920 was concentrating on "penny goods" and retail sales of foods for home use, had by 1970 become a major supplier for national brand name food processors. Despite a cramped and outdated physical plant, but relying on a stable, committed workforce, by 1990 Ace's production capacity averaged some 40,000 pounds of various products per day.

In the middle 1960's, the company merged with "Worldcorp," a diverse multi-national corporation,[4] after which it pursued a two-pronged production strategy--cultivating the international, "industrial" market for large (40,000+ pound) batches, while at the same time, expanding their "consumer products division" to supply smaller, private label baking goods in retail outlets. While the first agenda reflected its new position in a world market,

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[4] Like all references to firms, products, and people, this name is fictitious.

the second was a vestige of its earlier, familial tradition of nurturing relations with smaller "specialty" customers.

When in the late 1980's the parent corporation reorganized its worldwide food division, Ace assumed a larger role in industrial production. Though the change was not yet fully accepted by the marketing and sales staffs, Ace had by 1990 completely transcended the eclectic, regional ties that had sustained it in earlier decades. By underwriting a $90 million plant, and automating its central mixing process, Worldcorp was committing Ace to this new market role in dramatic fashion.

This apparent stability however, had masked a more volatile corporate environment. Given Ace's apparently safe niche in Worldcorp's global scheme, no one could have anticipated that in the summer of 1993 the company would be offered for sale. The news was especially demoralizing coming immediately after the stressful two-year plant construction and start-up. Among production workers, reactions centered on the company's pattern of secrecy. They assumed (something I cannot confirm) that Ace's managers were aware of these plans but had concealed them in order to extract the greatest possible effort from production workers during the transition. This interpretation was plausible; it jibed with company history. Also, the cultural appeal of team management--its theme of shared purpose and sacrifice--would surely have rung hollow had the company's future been known to be so uncertain.

Since production workers had by 1993 lived with uncertainty about their jobs for some years, they were partly inured to the news. They were confident that the modern new plant would attract a buyer (as it did three years later), and that the value of their production experience would be recognized by whomever acquired the firm. Anxieties were higher among salaried workers. As one man on the sales staff said, "We're top heavy here; there are about 200 people in production and almost 150 on salary. If we get sold, the new buyer may have their own sales and accounting staff, so we'd be expendable. I'd really planned on a career here, but I'm looking for other options now."

Industrial Retrenchment and a Climate of Mistrust

The openness shown me by Ace employees is remarkable in retrospect.[5] In the months before our research began Ace had a contract dispute so bitter that a strike vote had nearly been taken. Also, since management had not been forthcoming about its plans to relocate, many suspected that they planned to lay off workers.

Coming at a time when similar decisions were being publicized--such as Sears Roebuck & Co.'s, to move from Chicago to suburban Hoffman Estates, 25 miles northwest of that city--Ace's decision to relocate seemed ominous. Though widespread, mistrust was especially high among African-American workers. They represented over 40 percent of the production workforce, yet there were no Black supervisors in the plant in 1990 (still true when I left the field in 1995). And there were only three African-Americans among Ace's salaried employees. On the other hand, Blacks were

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[5] Though I was not universally accepted. During the first field period, on being introduced by a union steward to a group of workers playing cards in the lunchroom, one glared at me, saying in a loud voice: "Oh, I know him. He's helping the company take our jobs."

numerically-predominant in the lowest-paid, most closely-supervised positions. Black women, for example, comprised roughly 80 percent of the workforce of 35 in the packing department.

As later chapters will show, the racial consequences of the transition are not clear-cut: of the 28 workers (15 percent of the production force) who worked in highly-autonomous "control room" jobs when I left the field in 1994, we find that 11 (almost 40 percent) were Black or Latino. Nonetheless, plant-wide, the climate of mistrust reflected the fact that many Ace workers saw the plant relocation and the firm's personnel practices through a racial prism.

Through the middle-1970's many of their parents had known factory work to be a bastion of security and respectability, but by the 1990's Ace employees felt embattled and obsolete in America's increasingly "post-industrial" economy. Their fears were well-founded (see Krogh 1993; Wilson 1987:39-46). Many of their parents, with high-school educations at best, had settled into lucrative factory work, yet these employees felt only a tenuous hold on jobs that were among the shrinking supply remaining in the Midwest. Nationally, as Levy (1987:74-100) shows, the shift had been dramatic: as recently as the 1979 census, workers in the construction trades, 80 percent of whom had high school educations or less, earned an average of over $21,000; semi-skilled machine operatives in common industries, 90 percent having high school training or less, earned nearly as much. At Ace in 1990 those figures were average for production workers, though inflation has continued to erode their buying power.

And the industrial decline was even sharper in Ace's home city than in the country at large: in machinery, long an employment mainstay, almost 23,000 jobs had been lost from 1979 to 1986 alone, representing more than one-third of all the jobs in that industry. In the same time-span, in such core industries as electrical equipment and fabricated metals, more than 37,000 jobs had been lost. And almost 4000 regional jobs in food processing had been lost by the mid-1980's. Finally, in Ace's home city, the replacement of these jobs by those in the service-sector has been heavily suburban; between 1979 and 1987, the city's 2 percent increase in service employment was a fraction of the suburban growth rate of 32 percent.

It was not surprising, then, that Ace workers with children, or mortgage payments, openly expressed their financial worries. Many considered moving closer to the new plant, some eight miles from downtown, but that exposed them to higher suburban rents and housing prices. A company vice-president assured me that, "If you compare us to other food plants, our people are among the highest paid in the industry" (earning an average of $10 per hour). Still, employees rarely declined overtime at Ace, even when it meant working 60-70 hours per week.

Mark: Working His Way Up; "Making it Shine"

During conversations in passing or, more commonly, as I joined them on their shifts, people gave me an overview of their work. They connected their daily tasks to other jobs and departments; often *they could only explain their jobs in* *relation to the overall production process*. For example, starting a shift with Mark, a "pumper and tester" in the old plant, I asked of what his job consisted. He pointed to a maze of pipes overhead, carrying oils and "liquor" (a derivative of cocoa beans used in making finished products) from holding tanks to refiners where ingredients are granulated and, finally, conveyed to "moulding" machines that produce finished foods to be packed or stored in bulk. Mark explained that the pipes or "lines" followed no logical pattern; one simply had to memorize them and hope to avoid confusion when several batches were being "pumped" simultaneously, each at a different stage of completion. Mark directed materials through the lines by using a series of manual valves. Further, he had to memorize "recipes" and know the kinds and percentages of oils, fats, and dry ingredients appropriate for each.

Thus, for Mark, any sensible description of his job required him to discuss materials and processes encompassing the entire manufacturing process--from the qualities of beans and other raw materials entering the plant, to their processing into liquor, mixture with dry ingredients and, ultimately, moulding into finished products.

A tall, wiry, African-American man in his early 30's, Mark, like most production workers at Ace, had been hired as a "temp," working by the day as a packer or a utility man in the maintenance department. Later, he had gotten a full-time position as a "mixer," adding dry ingredients to recipes by dumping them in large "hoppers." His previous jobs at Ace, low-paid and physically-demanding, had nonetheless taught him about the plant lay-out, product types and ingredients, and about the sequence of processes that were required to convert raw materials on the loading platform to finished products for the retail or industrial food market.

He had learned a lot from other employees, two in particular: Cedrick, a pumper-tester from Barbados, took an interest in Mark, glad to fill their late-night shift by explaining what had taken him twelve years in the plant to learn. Another man, Lee, worked as a "depositor operator" and also as lead man on the night shift. He had encouraged Mark to apply for the pumper-tester job, even mediated a dispute between Mark and a supervisor (Mark thought to be racist) who had opposed the promotion. Mark was proud that he had mastered a job that, excepting maintenance work, was considered the most skilled and demanding in the downtown plant:

> Nobody wanted the headache or responsibility, so I said, OK, give it to me. I'll rise to the challenge and I'll make it shine. And I did. After only three months I was able to tell my foreman to send me out alone; I've got more to learn, but it's under control. I haven't had a major spill yet. You see, in this job you got to keep your concentration up--you gotta be pumping oil on one floor, paste on another, and setting up dry ingredients for your next job. Let your mind wander, and there'll be product on the floor somewhere. And usually have to do what's leftover from the first-shift man. I don't mind working, though; I think I've got a good head on my shoulders and I like it when it gets hot and busy [field quotation: 2/1/91].

Mark worked second-shift, from 2:00-10:30pm, and his work kept him running at an exhausting pace. He was constantly in communication with people in every corner of the plant--learning from his foreman of last-minute changes in the production schedule; responding by phone to a "refiner" operator needing more oil diverted to a supply tank; fielding complaints from a technician in the quality control laboratory, about a batch's irregular color;

arranging with the shipping department to divert oil to a truck for a "load out."

I concluded, based on experiences with Mark and others in the factory that, as a group, production workers were articulate, ingenious, well-informed about Ace's evolving objectives. They were proud of a trend of increasing production from ten to fifteen percent annually, despite their outdated factory and erratic production schedule. These conditions (discussed below in greater detail) required workers to be flexible and innovative in coordinating tasks and coaxing machines. As Juravich (1985) notes, in an ethnographic study of a wire and cable factory, what may appear to be *chaos on the shop floor is not a product of workers'* resistance or indifference to company planning. Rather, it often reflects decisions and forces at higher levels, beyond their control. Before discussing those more extensively, however, I will describe the formal job system that shaped the development of working knowledge for Mark and other workers at Ace.

<u>The Formal Job System at Ace</u>

Workers develop knowledge not simply through random exposure to recurring problems, or via friendship ties, but also as a by-product of formal job systems. By considering Ace's job system at the time when this research began, I can clarify features of production and workers' learning process; then, comparing it with later changes in staffing policies will illuminate the role of shop floor skill in technical change.

A brief word about hiring practices: Like many industrial employers, Ace uses a local temporary employment service as a screening agent. The agency handles employer references and administers questionnaires about applicants' job histories. While downtown, Ace was among a few industrial employers located within a mile or less from inner-city neighborhoods. Seasonal fluctuations in demand led Ace to hire extra help, especially during the fall months when they prepared for their peak holiday business. Temporary employees, mostly young African-Americans, were easy to spot in the zippered, disposable "jump suits" they wore to cover their street clothes. Most were assigned to the packing lines, either sealing up cartons moving on a conveyor belt, or "stacking them off" four high on pallets for the shipping department. Less often, temps were used as "utility" workers, helping machine operatives or maintenance workers.

The word "temp" seems a misnomer, since it was common for these workers to remain employed at Ace for many months.[6] At any rate, though it is rare for full-time positions to be offered to seasonal workers, in recent years virtually all the regular hires at Ace have originally begun as temps (an exception was Ace's recruitment some years before of several experienced molders from a nearby cookie factory that had closed down).

For many it was a point of pride to have started out as

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[6] The labor contract in effect at the outset of this project specified that "beyond four months, any future continuance will be discussed with the union." Because the firm exploited this flexibility, labor representatives secured language in the current contract specifying that temporary employees shall not work in excess of 1000 hours in any calender year. A timely examination of the growing numbers of temporary workers in the U.S. labor force is that by Henson (1995).

"just a temp" and later worked up through the production jobs. Corey--now a maintenance mechanic, then considered the best molder on the floor--grinned as he told me, "I started, just out of high school, sweeping the floors here. Now I've worked on almost every piece of machinery in this plant; I can take them apart and put 'em together; the maintenance guys'll back me up on that." While individuals' particular job histories vary according to rules of intra-departmental seniority, the general pattern of promotion from entry-level temporary positions is quite common in the company.[7]

As I began my research in 1990, production work at Ace was divided up into roughly 30 job titles, or (in contractual language), labor grades. As stated in the labor contract then in effect, pay ranged from $4.54 per hour on the packing line, to over $11.00 for skilled operative

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[7] Women, however, have had much less success in rising beyond the packing and sanitation departments. At the outset of this research in 1990, all but 6 out of 48 positions in these two, lowest-paid departments were filled by women. Conversely, combining the refining and molding (machine operative) positions, only 11 out 58 (19 percent) were filled by women. See Cockburn (1985) on the role of technical know-how in maintaining gender inequity at work.

positions. Wage limits were higher yet--$15.00 and more--for maintenance employees, eligible for merit increases awarded at the discretion of the department supervisor. Clear evidence of the managerially-constructed relationship between job titles and workers' skills is that, in the subsequent contract (covering the period 1993-97), the number of labor grades has been reduced from 28 to 8. Knowledge of the old system helps us see the organizational career through which workers develop firm-generic skills and the impact of CAM on stratification within the workforce.

In principle, even if all production workers were interchangeable--capable of performing in all positions--the formal job system would nonetheless concentrate rewards and discretion in particular jobs. Generally, Rosenbaum (1984) shows that, in corporate careers, "ability" is (in sociological terms) a function of the definition and availability of organizational positions. I will argue that CAM allows managers to *concentrate* rewards and discretion in fewer positions. Thus, instead of representing an "upgrading" of skill, as is claimed in managerial rhetoric, I argue that automation reduces discretion in the aggregate and so has expanded the reach of managerial power.

While the imagery of factory work has been defined by fragmentation of tasks and functions, this can be misleading. At Ace, despite contractual distinctions, most production jobs related directly to the central manufacturing process. As Mr. Matthews, an engineer in charge of production planning, explained,

> I think of the refining lines, where we actually mix the products, as long tubes. We only have three of them. If you take a long hollow tube and put something in there, it's got to go all the way through before it comes out the other end. All of the processing--like, roasting raw beans, and grinding beans into liquor--just gives you one ingredient; along with dry mixes, it gets fed into the refiners. After that the product goes to a mixer and then gets stored in tanks so its available for use in the recipes [field interview: 8/24/93].

Later, other mechanical and heating processes are involved; products must be "refined" to the required texture, and "tempered" before moulding. The "paste" from the tanks is moved on a conveyor belt and dropped onto large, steel rollers, turning against one another at high speed, as on a printing press. The operators set the distance between the rollers to achieve the desired granular "fineness" which is then measured with a micrometer. Finally, before molding (when the semi-liquid "paste" is formed into finished products), the paste is "tempered" in order to insure the product's texture, color, and shelf-life. This process creates chemical bonding, by passing the paste through a water-fed heat exchange and exposing it to prescribed variations in temperature and duration. After moulding--in stand-alone machines that, even after automation, are run independently by operators on the floor --the products pass through cooling tunnels before being packaged and shipped.

In the new plant, it is the two core processes--processing liquor from beans, and, mixing and refining the paste--that have been automated. "Control room operators" now coordinate and monitor these processes using computer terminals with graphic screens. As I will describe in detail in the next chapter, the screens are iconic; they provide two-dimensional, color-coded illustrations of the production lines, and of the "transfers" or pipes that move paste between lines, tanks, and molding machines. Still, the components of manufacturing have changed little in the transition. Rather, automation has permitted central control and coordination of steps which, in the past, were handled separately and manually. Matthews' metaphor of production being funneled through "a long tube" is still apt.

Perhaps the easiest way to describe the original job system is in terms of the manufacturing sequence. There were four departments with direct bearing on production: processing, mixing, refining, and molding. Four other departments worked in support of production: maintenance, packing, shipping, and sanitation. Our focus here will be on the production units.

Cocoa beans were made into liquor in the "processing department." Most of the 14 employees oversaw the mills and roasting units (a few, less-skilled workers fed blocks of butter into melters). Competence in this department required knowledge of variation in beans, of the mechanical quirks of roasting machines, of how beans are blended to make liquor and, finally, of how particular liquors are blended in recipes;

The 12 employees in the "mixing department" were responsible for manually adding dry ingredients, so that recipes would "roll out" properly in the refiners. They were required to have broader knowledge of recipes, and of how to use dry goods to compensate for variation in other ingredients (e.g., adding powdered milk to "dry out" a mix that was too oily and thin coming to the refiners).

Of the 34 employees in the "refining department," 28 were machine operatives, responsible either for "stand alone" refiners, or for the more integrated units the firm purchased in the late 1980's as a step toward automation. Here, effective operators are required to have basic knowledge of all the steps that precede refining and, especially, of the recipes themselves. Also, refiners must understand how variations in paste affect the moulding process that follows. Because of the central importance of the refining process, planners of the new factory located the quality-control laboratory next door to the refiners' control room. Involving refiner operators in lab testing is intended to allow them greater discretion in adjusting and testing recipes during production.

In the original plant, 6 members of the refining department (including Mark, discussed above) held the title, "pumper and tester." Once the apex of the skill hierarchy among production jobs, this position would become obsolete in the new location. Because the piping/transport system had been so crude, the pumper-testers had to coordinate the process manually. Along with knowledge of recipes and testing procedures, these men needed sharp computational minds: sending 200 pounds of paste, for example, to a holding tank already filled to capacity, creates a costly and difficult mess.

The 25 workers in the "moulding department" are machine operatives. Though differing mechanically, all the molding units receive paste and produce a finished product (drops, bars, or wafers). In addition to their mechanical aptitude, on which maintenance staff rely heavily, moulders control the tempering process, and most can diagnose the sources--in earlier phases of production--of "bad paste," that which will not mold properly at their lines.

Summarizing the job system in old plant:

Department	**Number**	**Composition Before and After CIM**
Production		
processing	14	6 labor grades reduced to 2; 2 per shift in "control room"
mixing	12	eliminated; personnel either "bid" into refiner control-room or material handler
refining	32	5 labor grades reduced to 1; 5 per shift operate control-room, coordinate plant-wide production
molding	26	6 labor grades reduced to 1; job unchanged; independent of CAM
Support Workers		
packing	32	1 labor grade increased to 2 (reflecting forklift premium); staffing raised to 46
sanitation	18	3 labor grades reduced to 1; staffing reduced by one-third
shipping	16	8 labor grades reduced to 3; addition of on-line inventory system

maintenance	24	4 labor grades reduced to 3; addition of on-line purchasing and parts system.
quality control/ sample dept.	8	some Q.C. tasks assigned to operators
<u>Total</u>	182	stable staffing in most dept's; largest increase (approx. 40%) in packing

I need to point out here, first, the distinction between labor grades and jobs: not all of the contractually-defined labor grades were occupied by workers, and a reduction of labor grades does not equate with a loss of jobs. Second, when we look later (in chapter 3) at redistribution of skill, we can see, for example, that workers staffing the new control rooms gained relevant experience from several, functionally-related jobs. This supports my thesis regarding the value of broad, in-plant experience, versus narrow, job-specific knowledge in the transition to automation.

A clear implication, then, of staffing changes, as management sought to reorganize work in line with CAM, is of an expansion in the functional scope of the core production *positions* (e.g., in the liquor and refining plants). This should be distinguished, however, from assumptions about expansion in the relevant knowledge possessed by particular *workers*. Though associated in managerial rhetoric with investment in training--often called "job enrichment"--for workers at Ace, expansion in the scope of jobs is perceived in two ways: first, in terms of increasing opportunity to integrate and exercise production knowledge gained in the older plant; and second, as tacit recognition by managers that shop floor knowledge and responsibility are greater than had earlier been reflected in the formal job system. In the absence, then, of the paternalistic claims surrounding team management (which define skills as bestowed by enlightened managers), re-drawing the job-system had the potential to confirm workers' long-standing grievances about the redundance of supervision and the fairness of wage determination.

As I will document in the next chapter, workers' learning in the transition to CAM was focused mainly on mastering the computer interface that drives the automatic recipe system, rather than on production itself. Indeed, even during formal training activities, the flow of practical knowledge was often upward, from the shop floor to higher levels. This point is confirmed by an internal progress report, prepared by one of the two plant-wide training coordinators: under "training yet to be completed," he writes,

> In order to complete the training on the new molding and packaging equipment we must first prepare the official operating procedures, and conduct written and practical tests to determine who is most qualified. *Input for these procedures are to be obtained from the better operators* [Internal document:12/11/92, Emphasis added].

The fact that managers were willing to entrust plant-wide coordination of production to employees, some of whom only months earlier were in jobs formally-designated as manual (e.g., "mixer," "bean roaster") further supports my conclusion.

This is not to deny the importance of the training initiative for enhancing the skills of less able employees, and for allowing occasions for communication about production which were central in the appropriation of skill. Rather, I am reflecting on an aspect of the training to make inferences relating Ace's transition to automation and the role of shop floor knowledge. My conclusion is that Ace's personnel strategy for CAM was premised on a collective stock of holistic production knowledge which workers had developed despite the constraints of the formal job system.

Next, I extend this argument, asserting 1) that the formal job system obscured the collective nature of workers' knowledge and 2) that the value of this knowledge to managers was increasing as they anticipated the plant relocation.

Skills-in-Context: the Physical Plant

Ace's original small frame building had, through a series of additions, become a cavernous, confusing place. Because of the increasing value of downtown property surrounding the old factory, Ace had had nowhere to build but up. Several expansions--the most recent in the late 1960's--had produced the six-story downtown plant, with production lines and supply tanks spread over four floors and awkward distances. The resulting plant layout led to serious problems of inefficiency, as well as ingenious solutions among employees. It was inefficient that workers had to stand and wait for the freight elevator, making several trips to complete a routine production task, and for maintenance workers needing to convey tool carts to a work site. Another source of delay was the storage system which required workers to travel several floors to a "tank farm" to confirm the availability of oils or other products before beginning a production run. Ingenuity was constantly required to overcome barriers in the sprawling factory and to meet Ace's expanding production commitments.

Soon after moving to the new site, the company president summarized the limitations of the original plant during an interview for an industry publication:

> You can get very sentimental about [the old plant], but the facts are that it had been developed from its initial beginnings by six or seven extensions, without an overall strategy. What developed was an overall layout that was chaotic. If you look at modern equipment, floor loadings and ceiling requirements, it just was not possible to create a modern factory in the [older] facility.

In the same article, the director of quality assurance, centrally-involved in designing the new plant explains:

> Downtown, we had to fit a line into a location, rather than design a proper flow for it. In one that comes to mind, we had a specific [maximum] capacity downtown. Without changing the equipment associated with the line, but streamlining the distribution of product [through the piping system], it gave us 20-30 percent more capacity on the same unit.

To cope with these problems, engineering and maintenance staff had devised an elaborate system of "gravity-fed" pipes that snaked through several floors of the factory. Manufacturing required materials to be transported between tanks or "hoppers" to mixers or refining machines elsewhere in the plant. Other materials such as liquor, which Ace both uses in its processes and sells in bulk to other producers, were also connected to the piping system which serves, in effect, as the factory's bloodstream.

Though crudely workable, the piping system in the old plant seriously impaired quality and efficiency. First, variations in climate throughout the plant caused materials to freeze in the lines; mechanics used what seemed to me the dangerous practice of thawing them from below with an acetylene torch. Yet more production was lost due to faulty air pumps, which had been installed in some lines in order to avoid blockages. In the old plant, several among the maintenance crew estimated that as much as one-third of an average shift was devoted to solving technical and architectural barriers of the old factory.

These problems were compounded by the lack of replacement parts and tools. Whether doing repairs or catching up on "PM's" (the periodic maintenance schedule), mechanics and electricians were chronically in need of parts. They claimed the problem to be compounded by a short-handed and disorganized purchasing office, and a supervisory strategy which limited their power to allocate labor as they saw fit. It was especially true in maintenance that workers had found efficiencies and zones of discretion through becoming specialists:

> We all have our strong points from working on other jobs, in other plants. Like with me, I'm Mr. stone mill; when those need to be re-cut, that job is mine; Ken is Mr. welder; Jay, he's worked a lot with compressors; Rich has the most experience on the refiners, hell, he even probably installed most of

> them. Charlie takes care of the facility, so he knows best where the PM's are at. And some guys just work together good [field quotation: 12/12/90].

In the old plant, then, meeting customer specifications was, at best, an inexact science: those responsible for later stages of the process--either refining or molding--could not rely on receiving the proper amounts or consistency of "paste" to their equipment. This transport system also made "changeovers" more difficult; because lines were not dedicated to particular products, they had to be cleaned out or "pigged" between batches. Often, after this time-consuming procedure, the color or quality of batches following a changeover were unacceptable and could not be shipped out. So, large fiber barrels containing discarded product, or "re-work," stood on all the production floors. The lack of precision in the transport system, along with the other barriers, undercut Ace's ability to meet customer specifications.

Variations in these specifications which might be tolerated in other processes are less so when one is producing goods for human consumption. It is in more than a metaphorical sense that floor workers at Ace are "cooks." They had learned, when recipes were too dry or failed to "set up" correctly in the molding process, how to compensate in ways which, though not improvised, were hard to codify in a procedures manual. This is not to suggest that the processes or materials here are especially complex; compared to many manufacturing processes they are quite simple. But, such variability in raw materials as the fat or moisture content of cocoa beans, coupled with the lack of mechanical control in the plant, had engendered a range of "tacit skills" among operators which were essential for profitability in the downtown location.

Ethnographic evidence indicates that workers develop functionally-similar skills in manufacturing processes of many kinds and levels of complexity. For example, Halle (1984:104-147) offers a parallel account of how workers in a chemical plant manage variation, both in materials and in the cooperative styles among employees on different shifts. It is sensible to assume tighter uniformity of materials and processes in chemical production, as well as greater mechanical control among Halle's workers than was present in Ace's aged factory. Nonetheless he writes:

> No two batches ever take the same [amount] of time to cook, even if they are from an identical formula. The same alkyd can vary by several hours in the time needed to prepare it, because the ingredients are never of exactly the same quality. Ingredients that are nominally identical vary in strength and consistency. Two fifty-pound loads of cobalt will not have the same potency. This gives a certain unpredictability to production. As an assistant put it: "Every batch is like a newborn baby. They are all different, with different problems" (1984:122-23).

Of course, problems arise in ways that are patterned and recurring. The social transmission of "solutions" is rooted not only in supervisory politics which tend to promote secrecy, or even in workers' desire to minimize stress and wasted effort. Quoting Halle again, "...equipment is subject to a variety of modifications once in operation, many of which are thought too minor to be recorded. Over time these...accumulate, and the equipment moves a considerable distance from the [ideal] design. The operation has then to be learned on the job rather than from a manual" (1988:119-120 Emphasis added).

Industrial workers face conceptual and practical decisions even when the physical plant layout is more "rational" than that which I've described here. Generally, these decisions are imposed by the interdependence of mechanical, temporal, and human factors, and by systems of organizational coordination which operate without reference to those sources of variation. A detailed illustration is provided in Stinchcombe's (1974, 13-31) discussion of "interruptions" and their causes, in a Venezuelan steel plant. He shows that temporal sequences alone can be a source of lost production:

> "...hot rolling machines are very highly interdependent because the permissible time lags between operations are quite small. This means, roughly, that if *any one* of the machines or human operations on the line is slowed down, the whole line is stopped or slowed. That is, the probability that the line will be functioning at any given time is the *product of the probabilities* that each machine will function. Since the machines and furnaces themselves function under relatively great temperature and pressure, the probability that any particular machine will function properly is not terribly high...In the tube factory attached to the steel plant in Venezuela, the percentage of time the various lines were running averaged about 35% of the time they were programmed to run" (1974,14. Emphasis in original).

Stinchcombe concludes that decisions about interruptions in the line could be grouped into four distinct origins: "(1) problems of *design* of the production line, (2) problems of *maintenance* of the machinery, (3) problems of *scheduling*, and (4) problems of *personnel*" (1974,16).

The important implication of this section is that, under "normal" production conditions, shop floor knowledge and cultures can co-exist with managerial practices based on claims to exclusive expertise. Usually, workers translate managerial goals into action on the shop floor *without the necessity for either party explicitly to articulate the nature of the translation*. Under these conditions, it is the outcome, rather than the process, of production that is of central concern. In the next chapter I'll show that casual interactions, especially those between programmers and workers, were critical for the appropriation of skill because they allowed for shared occasions and language for this translation to occur.

In a firm undertaking computer automation, such minute details as the time required to refine a batch, or the problems caused by substituting one oil in a recipe for another, or the proper diameter for piping needed to carry thick "paste" to a refiner, must now be collected in a fairly systematic way. And this information must be made accessible not only to company personnel with extensive experience with the process, but to outside engineers and programmers who have none. So, in preparing for CAM, managers need information about production which is both more specific and comprehensive than is ordinarily called for.

Skills-in-Context: "Shock and Drills" and the Tyranny of Customer Demand

Compounding the technical and corporate pressures at the downtown plant was a production schedule which often changed several times weekly, or even in a single day. This multiplied problems resulting from variation in raw materials and from changeovers, despite efforts of various production personnel to anticipate and control for such variations. The company's "planning supervisor," Paul Matthews, sees his objective as sequencing production orders in ways that are most cost-effective and responsive to customer demand. He spoke to me soon after the relocation, about past problems, future goals, and about what he called the "shock and drills" that had been common downtown. Because he is ideally-positioned to understand connections between Ace's market strategy and workers' shop floor adaptations I quote from this interview at some length. Mr. Matthews first explains that his job is two-fold:

PM: I do the scheduling of the products on all the production lines except for the smaller, retail-packaging lines. Also, though its not really in my job description, I coordinate a lot of the raw materials that go into these products; I work with purchasing to make sure that we have enough milk powders and dry ingredients, and I also order a lot of the oils that go into the compounds we make.

CW: So, you are then responsible for telling production what to make at a certain time?

PM: Right. And I try and track orders and anticipate shortfalls; I move up orders to cover any surges in production that I see coming. This will be much easier with our new on-line MRP [materials requirement planning] system. It'll give me a schedule into the future of when I'm going to run out of a particular product. Then I might decide to make two-months' supply of something that we don't usually make too often. To make sure it's covered with our materials on-hand.

CW: And you didn't have this capability downtown?

PM: No. But a bigger problem was the product mix that came from our sales strategy in the past. There are a lot of products that we make here that sell less than, I don't know, forty thousand pounds. But the operation, especially out here, deals with large tanks and you're very dependent on long, large-size runs--forty-eight thousand pounds minimum. To schedule those ten thousand pound runs is really wasting capacity and hurts the quality of the smaller products we're making. Because you get contamination by products running through the system [in between large runs], and I've seen a lot of waste and a lot of headaches in production.

CW: So, even downtown, you didn't have the flexibility to be efficient with these smaller runs?

PM Exactly, I could see maybe twenty-thousand pound orders, which for some of these products is a year's supply. My theory is why are we still dealing with these products in this business? There is still resistance, in sales, to getting rid of these customers; our relations go back years. But my job is really to increase efficiency...to get rid of the shock and drills we used to do downtown, because that killed our capacity.

CW: I'm sorry, "shock and drills?"

PM: I mean, you know, I get a call saying, "God, we're out of this, but we need a truckload to ship tomorrow morning." Then you've got to interrupt the schedule, throw everything in limbo to get this other product out the door. So, my objective out here is to get a stable, frozen schedule, so we know what we're doing today, tomorrow, maybe part of the third day. Me and some of the supervisors have now installed a 48-hour frozen zone where, if anything comes in late, it'll just have to wait. Now they have to get approval from the V.P. of Operations before they can break into the schedule. You see, downtown I think we were too flexible; we had several options [with a less automated system] of how to make a given product. But I think it disrupted the

> morale of the people in production, because no matter how well-prepared they were, it was like, "What are you gonna change now? If we stage everything for this set of products, it'll only be pushed aside anyway." But I worked closely with them downtown; I'd say, "I need this." And they knew how to get it done. We'd have to look at the formula, see what liquors we had in storage, and coordinate with the people at later stages, molding, packing, shipping. So we had a lot of interface. They are ingenious, very inventive, in the production area I think [field interview:8/24/93].

There is a sharp contrast between this account, of shifting company objectives, and the supervisory perspectives that I found to be prominent during the early months of this research. The perspective Mr. Matthews offers here, and those I reported above of the company president, provide an overview connecting production problems to limitations of the physical plant and to inter-departmental differences in marketing strategy. However, these views were not, in my experience, publicly-shared with those on the shop floor. That is, while factory and maintenance staff were intimately *aware* of such limitations, they were not privy to conflict at higher levels, nor to managerial recognition of how inadequate the physical plant had become for Ace expanding corporate role. Instead, on the floor and in presentations about the relocation, managers emphasized increased effort and employee training as keys to meeting company goals. If they acknowledged limitations imposed by the physical plant, managers seemed oblivious to the role production workers had played in circumventing those limitations and in helping Ace to increase its profitability.

From an "aerial view," it is understandable that this accomplishment was attributed to tight supervision, rather than to workers' creative application of skill. This distance from the realities of production is evident in the following excerpt of an interview with Steve Oliver, the vice president in charge of human resources. It too is partly retrospective, taking place a few months after the relocation:

CW: In contemplating the move to a new plant, you must have formed opinions about the working atmosphere and level of performance of workers in the downtown plant.

SO: Well, I think you understood the paradigm under which we operated down there, that people [workers] approached things with an attitude that "It's a crappy old plant and therefore I can only do things in a very laborious, difficult sort of way; that making candy is an art, not a science, and if I've been doing things a

> certain way for twenty years, it must be right." Well, that was a natural point of view downtown, and they were very loyal to that kind of system. And we had foremen who were used to giving directives--"You, go and do these three things, and when you're done with those, come back I'll give you three more." But we were going to a facility that in total was fast-approaching $90 million in capital equipment, and with a work force that...Well, we really didn't know what their training and skill levels were.
>
> So, we invested in training and development--you can't really separate the two. We dealt with listening skills, for supervisors as well as production people, and I hope those efforts will be ongoing. If you talk to some of our people today--you know a lot of them and what they're doing--you couldn't have envisioned three years ago what they'd be capable of doing today. I think had we told people "There's going to be a massive amount of new information for you to swallow" they'd have choked on it. But we tried simply to dole it out like little pieces of bread, so it wasn't as overwhelming [field interview 9/3/93].

Readers will note a striking incongruity between this rather condescending statement and those made by people more directly involved with production. Clearly, there was a range of perspectives among white-collar staff, about production workers' skills and contributions to the larger enterprise: highly-placed people like Mr. Oliver, though sincere in their support for managerial reform, were remote from production and saw shop floor input as an ultimate goal, rather than a premise, of team management. First-level supervisors--fearing obsolescence were team management to be fully realized--were well-aware of workers' knowledge, yet had an immediate interest in concealing its existence from superiors. Mid-level, "operational" staff (like Miss Anderson and Mr. Matthews), are dependent on shop floor knowledge, yet see their relations with production workers as unrelated to managerial politics. The same is true for external consultants and programmers who later played an important role in appropriating skill.

Shop Floor Practice in Corporate Context

The rising premium of shop floor knowledge at Ace was also a function of the company's new corporate role. Because of an increasingly specialized role in Worldcorp's transnational food processing operation, Ace was being required to streamline and rationalize their business practices. In the new factory, computer automation in the factory is linked on-line to a Business Information System (BIS), allowing such departments as purchasing, sales, and product development directly to "capture" and analyze data about production. Of course, as part of the larger effort toward corporate control, these analyses had to be comparable to those generated in Worldcorp's other plants. Standardizing the administration of production also required shop floor input.

I learned about this, for example, during an interview with the cost-accounting manager. I was surprised, during an "open house" to publicly commemorate the opening of the new plant, to see this woman, Cheryl Anderson, dressed in a grey production uniform and "bump cap," explaining the features of a new depositor (a machine that produces chocolate chips) to visitors. She was knowledgable, both about equipment and manufacturing procedures at Ace. In the days that followed I noticed her out on the floor several times, talking to operators, listening intently. Here, she responded to my question of how the new plant project has affected her work:

> Well, the company has taken a lot on; we've bought a few smaller companies, built a new plant, and are switching to BIS [Business Information System, a company-wide, on-line data and communication network]. Now my job is to coordinate better with our satellite plants. I visit those on a regular basis, because we're

trying to identify costs in the same manner at each plant. Now, three companies have merged with us, and everyone is on their own system. While every company knows the cost of their products, we define costs in different ways in each plant. So, my definition of labor costs here is different from that at other plants. The common question we get is, if you make a product at multiple locations, which one is the cheapest facility to produce at? Well, you have to look at your variable cost bases, but we all define them differently.

CW: I see. What do you need to learn from workers on the floor?

OK. One of our problems is to understand what it costs to make each particular product, and the way you do that is being on the floor and watching and talking to operators. You can't learn it by sitting behind a desk, because you need to look at line staffing. Though you can talk to supervisors, often, when you go out on the floor, what you see is different than what they've told you. So you ask an operator, "How come you've got an extra person working on this line?" They might say, "Because today we're running X product and we have to slow down the line. And we need an extra person to watch the refiners." You couldn't know that without being out there.

We're also looking at the through-puts--how many pounds-per-hour are running through the equipment--set up time, clean-up time, changeovers. You need to watch and talk to operators. Same thing in the liquor plant; we're looking right now at the various yields and fat content from various types of beans. We need to develop a long-term analysis of what it actually costs for different types of beans, versus just the purchase cost of the commodities. We need to standardize these analyses, and the only way to learn how to do that is talking to the operators and seeing for yourself how materials are absorbed in the process.

CW: Did you also confer with shop floor people downtown? [Yes.] And, even if you couldn't perform their jobs, you share a technical language with them? [Yes.] Broadly, how would you characterize the level of knowledge, of technical understanding among the operators?

There are many operators who are very intelligent, very motivated and show a lot of initiative. You can talk to them and find they know everything about the products, and the equipment, the line they're working on. There are others who just don't care. They'll do their job, specifically what they've been told to do, and anything over and above that they'll resist. Sometimes you have questions of them, and you'll hear, "Well, I should be paid for that, if you want that."

This interview also indicates workers' awareness and support of Ace's corporate agenda. I knew Miss Anderson to have a good relationship with production employees and asked her to evaluate their understanding of the rationale for various changes in Ace's production strategy. Speaking soon after the new plant start-up, she reported that for production workers the greatest frustration was a lack of managerial discipline in carrying out promised production reforms:

I was talking to one of the drop-line operators the other day, and she was venting some steam. Basically, and I've heard this from others as well, she said the

> company had promised that in the new plant we were going to be more efficient, production-wise--do longer runs, not mix beans in the silos, stop generating all this re-work--but those things haven't happened yet. I think that management has certainly lost some credibility in that way [Interview transcript 9/14/93].

This illustrates an important source of the appeal, later, of "team management." Managerial rhetoric suggested that a barrier to the success of CAM was indifference to efficiency and quality among factory employees. In fact, workers had long understood and shared corporate interests in improving production planning. An important way managers induced shop floor cooperation was to declare a greater commitment to those improvements in the new location. Miss Anderson's comment reflects an awareness of this dynamic, and it's presence as a recurring topic in her discussions with workers.

As those most directly affected by disagreement between sales and production agendas at higher levels, production workers were strongly interested in the firm's planning. Seeking a voice in such decisions was prominent on a list of grievances which, if not part of contract discussions, were no less deeply-felt. Generally, workers' adaptations were both a response to goal conflict in Ace's executive ranks and, during the transition, part of the arcane knowledge that managers needed to "excavate" in order to fulfill their role in an corporate division of labor.

Workers' resentment toward supervisors was often in response to what they perceived as indifference to their ideas. I was prepared to find the usual tension regarding supervision--such as conflict over working conditions and assignments--and did, especially in the packing and moulding departments in which workers are largely stationary and, so, most open to surveillance.

More salient to me was anger among higher-skilled machine operatives and maintenance employees, about the company's failure to solicit or to accept their suggestions. Their anger had hardened into a mocking disdain, especially for those in the engineering department whom, workers felt, lacked any practical appreciation for the factory floor. From the outset I found dissonance between managers' rhetoric, about the need to "instill a sense of commitment in the workforce," and the conspicuous presence on the shop floor of workers' resentment about their exclusion from a substantive role in solving production problems. Ironically, seen from the shop floor, the new plant project was simply exposing a traditional failure among management to recognize or incorporate workers' knowledge. And that knowledge was a manifestation of the very commitment to company goals which, at higher organizational levels, was said to be missing.

Here, I'm interviewing Corey Kramer, whose career at Ace spans more than ten years and experience in all phases of production. Though speaking after the plant move, his views clarify this traditional problem. I quote him at length:

CK: The idea here [of work in the new plant] was to let employees do their job, and the problem is they're [managers] not doing that. The drops may look like hell, but the machine's got to run; they'll tell you to keep running, instead of having maintenance come in, do the needed repairs. Ninety percent of the time they won't allow you to shut down, even when you can see the product is out of spec. [customer specifications]. Just bubble-gum, bailing wire, and get it going. But that's not the way the intention was put across to us. I got excited when the planning got started; it seemed like building a new plant would be a way to set up the [production] lines in a sensible way, for a change. But the company did not care what we knew or thought.

CW: When you say "the company," do you mean first-level supervisors, or higher-level people?

CK: Well, you got to start from the ground up [with supervisors], but then you get into engineering and the project manager. I've tried to talk to those people, but nobody gives you an answer; I mean, everything's on a blueprint somewhere, and they said that was what they were going with. But, you see the plant was built, basically, around mistakes, because it was a first-time deal for just about everyone here. So, they built the factory around the equipment, instead of getting the overview. And then they didn't even stay with their own plans; changes were made, and that leads to a domino effect. More mistakes were made that way. I think this place could do a good forty percent better than it's doing now. You've got too much management saying "This won't happen" and "This is what we will do." That's not right with the people on the floor; there are a lot of changes that need to be made, and they won't listen. And these aren't costly changes; this is scheduling itself, putting down on paper a reasonable sequence of recipes. There are certain orders that, because of oils, butters, colors, and temperatures, that you run in a certain order. Moving out here, I thought we'd have that licked. But we're not given an option; what they want is what they get, but we're having a lot of contamination problems [field interview, 7/21/93].

In summary, many practices among workers which I first mistook as idiosyncratic, insurgent, or (following managers' complaints) as sheer recalcitrance, I came later to see as accommodations by workers to a firm whose production demands had outgrown its plant and sales strategy. The emergence and social transmission of these accommodations cannot, in my opinion, be explained by supervisory pressure, even less by the manifest rationale of the job-system. Workers at Ace could perhaps have kept in their jobs merely by following the procedures formally delegated to them. Their commitment of mental and physical energies beyond this minimum cannot be attributed to any system of material incentives nor easily squared with managers' description of them as "order-takers."

As a group, production workers had developed "craft pride," rooted in ties of informal apprenticeship. They resented the "top-down" supervision that had defined Ace's supervisory culture in the past. In this sense craft pride was *oppositional*. It was rooted in a conviction that, despite the indignities of arbitrary authority, workers deserved credit for Ace's expansion and for the new plant that was a reward for that achievement.

But, the very conditions that stimulated the development of shop floor knowledge--isolation of planning among salaried personnel, and resentment of punitive supervision--emerged as barriers to cooperation during the transition to automation. In concluding this chapter, then, I address the existence and implications of punitive supervision at Ace. In the next chapter I discuss "team management" (TM) as a political strategy that managers thought would overcome these barriers.

"Turning a Ship in the Ocean": Ace's Punitive Supervision

During my early field work at Ace, a dominant cultural theme among production workers was that of authority relations. Workers attached a variety of adjectives to the word "management," to capture the prevailing culture: "top-down"; "my way or the highway"; "old school"; "in your face"; "heavy-handed"; "I say-you do"--all of these terms they used matter-of-factly in describing the supervisory climate. Although particular supervisors were more or less resented on this score, they were symbolic of a pervasive complex of rules and relations I will call punitive management.

I worked as a printing press operator for several years, separated from my supervisor only by ten feet and a glass partition, so I well understood this preoccupation among workers at Ace. But my work group had been small--fewer than a dozen people--and we had perceived authority largely in terms of the personalities of those involved. At Ace, resentment over authority was both deeper and more densely-woven into organizational life.

I found evidence for the cultural salience of punitive supervision, and its perceived connection with Ace's future, in the fact that both salaried and hourly personnel spontaneously raised the issue as important. This reflective period in the firm was an example of what Morrow, drawing on critical theory, has called "*dereification*, in which nascent forms of awareness are either elaborated in a collective learning process or...silenced as a failed questioning" (1994:267-270). The history and implications of punitive supervision at Ace were openly being discussed as my field work began. Though managers spoke about supervisory reform in ways that were generic or "canned," on the shop floor various groups were attempting to claim this rhetoric, either as confirmation of a repressive history, or as a basis for future political negotiations.

A common discursive theme--voiced by a coalition of workers and progressive supervisors--was that, despite Ace's tradition of punitive supervision, that history was now opposed by an equally powerful force: the socio-technical requirements of CAM. One informant, a union steward, described the firm's attempt to change supervision as,

> ...like trying to turn a big ship around in the ocean; we're going against some strong currents. Many people have built who they are at work on being a supervisor, or being a guy who stands up to them. That's been the name of the game, and a lot of people still play that game. But those people are dinosaurs; some of them are in production and some are supervisors. But I see the world passing them by. The changes [team concept] are getting support from above [Field quotation: 12/13/90].

The same perspective was voiced by a one of the younger, more progressive supervisors, Steve, who would later be promoted to plant supervisor after the move:

> We're coming from an atmosphere, a philosophy where [among supervisors] the idea was, "Since I wear a white shirt, and you wear a blue shirt, you're not capable of having good ideas, having a say." That's what we're trying to move away from now. Some people don't want to accept that; you'll find them in production, and some of the supervisors are fighting it too. But it is going to change. People at higher levels are behind it, 'cause we need people working together to make this new plant happen. From the top down, they [management] want

> us to be facilitators, not to look over their backs, not to babysit, but to help solve problems. But the old guard philosophy is there, and it dies hard; it's going to require a fundamental change in how you supervise people, and that never comes easy. I think we're evolving, but slowly [field quotation: 12/14/90].

Among the important themes in this statement are, first, that supervisory reform was believed to have support from upper-management. This perception, common on the shop floor, engendered faith in team management, despite the absence of any tangible guarantee of such a commitment. Workers tended to regard upper-management as forward-looking, but, (as I've argued about production knowledge) as insulated from the realities of the factory. As Ben, a mechanic, saw it, the supervisors and "old style" department managers had the most to lose under TM, and so out of self-preservation they acted,

> ...like fortress walls; they circle Stanton [the president] and keep him totally out of touch. Like at the Christmas party-- this is the third year that we'll have a company-wide party, and you can bet that if someone was to approach Stanton with a complaint or suggestion, there'll be a whole group of people who'll close ranks around him. They'll say, "Hey, there's a time and place for everything, and this is no time for that kind of talk." They'll surround him like a fortress, from any information that he wouldn't like. But it's more covering their own asses. It's that way

> with changes in the plant; Stanton can't learn about what the lower guys won't let him learn about. They choke off information before it gets to him. If you can get to him, though, I believe he'll listen [field quotation: 12/15/90].

Another important theme, which Steve touched on in the statement above, is that the issue of TM was seen as transcending the traditional split between labor and management. Although it had not attained any social reality by the end of 1990, the concept of TM had become the basis for new divisions and coalitions, cross-cutting older alliances that had formed under punitive supervision. There were foremen, like Steve, whose careers were now linked to a rejection of "old style" management and to reputations as sponsors of the team approach. They were closely tied to workers and union stewards whose relations with management were now strengthened by their common commitment to the future of team management, rather than to the authoritarian "past."

Conversely, many production workers were openly hostile to TM, seeing it as a canard the company was using to wrest new concessions from an already weak union. Still, even though numerically a minority, those workers supportive of TM--who saw in it a bridge to greater equity--lent credibility and the force of peer pressure to what, at first, was an initiative imposed from above (see also Grenier 1988:3-22).

All of this, however, was projective. Meanwhile, punitive supervision continued to be visible, in the *dramaturgy* of the workplace, and in the interpenetration of supervision and workers' personal lives. For example, it was visible in rituals of deference (Goffman 1967:47-96), no less than in company rules. A recurring pattern was for supervisory relations to be enacted in a kind of mock-theater, in which authority was exercised behind a pretext of sarcastic distance:

> Matilda was trying out for a promotion from packing to a third-shift moulding position. When she returned from break, her supervisor was standing in her work station, tapping his foot and making a show of looking at his watch: "I told you I'm going to monitor your breaks; I will not hesitate to write you up if you stretch your breaks like you did today." Matilda, who was already feeling pressured about the shift-change and mechanical demands of the job, gave up on the moulding position soon after. She reported to me that she didn't want to return to packing, because of back trouble and "bad personalities" among workers on that shift. She added,

"I'd take a job in sanitation--anything to get out of packing. I wanted the moulding job to work out, 'cause it's another two-dollars an hour. That would have made up for it being third-shift. But that supervisor got next to me, you know [field notes: 12/10/90].

Mark, a pumper-tester, began his second-shift before the weekend. He was angered to learn that his supervisor, Sid, had allowed the first-shift man to punch-out without having transferred a load of oil. This was a physically-grueling job, and meant that Mark (who had worked overtime the previous night) would have to extend his shift by as much as two hours. Mark complained later to Sid in the smoking room, who grinned and replied, "Well, I think what you should do is to file a grievance on that; maybe that would teach me a lesson" [field notes:12/14/90].

When involving supervisors and the women on the packing line, these rituals could be sexually-tinged:

Molly, a Black woman in her 40's, reported to me that her supervisor, Bert, often announces in full voice, "I'm going to get you alone back there one day lady." Molly says, "I don't know why, since you probably wouldn't be man enough to know what to do with a woman anyhow." She says, "It don't bother me anymore, 'cause I know how to play that game with him. But it used to. I would walk out of this building with my whole body filled with tension. I would get migraine headaches; I would be coming to this place and actually get physically sick [interview transcript: [9/6/94].

As Gouldner points out, "punishment-centered" bureaucracy is structured around two "sub-patterns," which are, in turn, defined by offsetting weapons: the power of supervisors to discipline, and of workers to lodge grievances (1954:207-214). Though this language implies a restriction of conflict to issues directly under union jurisdiction, in practice the conflict is more pervasive. Gouldner notes, for example, that policies on absenteeism grant foremen broader discretion to pass judgement on a range of issues that pertain to workers' lives outside of the factory gates (1954:212-214). Similarly, Ace's "point system" (under which as few as three absences, in a given period, can lead to formal threat of termination) was the target of much anger. Here, Donald, a refiner operator, is venting his anger; though the firm imposed mandatory overtime for some months when beginning to staff two plants, they had not, in his view, shown reasonable flexibility regarding absenteeism:

> First, they said the deal was that during the transition they would give us three days--a grace period--which they wouldn't count under the point system. Well, if they didn't expect us to take the time, why did they give it to us in the first place? Since last November or so, a lot of us have been working 55-hour, even 70-hour weeks. After a few weeks of that your body gets tired. Even if a person missed a day per month, they're still working 10-20 extra hours most weeks. Isn't it interesting? Now they're saying

> [in a public memo from the production manager] the reason the start-up is behind schedule is about worker absenteeism. They should have known people would need that time. This point system is the most strict of anyplace I've ever worked; there's no flexibility; it's like they're dealing with dogs, as far as I'm concerned [field interview:9/22/92].[8]

After the shared pressure and sacrifice that marked the relocation effort, workers' objections to such policies as the point system revealed a sense of injustice, a dashed hope that norms of reciprocity would soften bureaucratic rules. The frustration was lower among the control-room workers, who had gained significantly in autonomy at work. But, for the remaining 85 percent of workers, frustration was deep, as in this statement by a man who had just faced a termination hearing:

> You see, I got into a mishap, lost my cool, by me going through a troubled period of time. I thought they should stand behind me, because of what they had told us prior to building the new plant: that if any employee had complications, or had personal problems on their mind, that they'd sit down with us, one-on-one;

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[8] Ace employees receive no paid sick time; written applications for extended unpaid leaves (of up to 30 days) can be submitted for consideration. However, sudden illnesses or problems with childcare can, if they lead to several days absence, quickly have job-threatening consequences.

> that if the company could do anything to enhance that worker's personality, they would do that. And when you guys came in, to do the study, I was all for that; I felt real good, like they [managers] had nothing to hide.
>
> But they did not keep their promise. In a period when I was exhausted from work, my grandma had got sick. I went and saw my boss. Now's my time to put this trust on the line. So I asked my boss if I could visit my grandma, who'd had a stroke, and his words to me were that he would talk to his boss. Now I thought, right then and there, that he should have said, "Ok, you're under a lot of pressure, and this is close family; we'll do what we can to help." But it didn't quite go down that way. Five days later, I had not heard about his permission, and I learned my grandma had a relapse. So that day I went in, took my fist and broke a window in his office [FOR WHICH HE WAS LATER FIRED]. Now, I think Ace sucks, cause I was working 12-hours a day, only two days off in 14. I was giving them my best, and then they're gonna go by the book, so to speak, when I ask for a little time off? That sort of got next to me [interview transcript:9/18/92].

The same sentiment is expressed here by Pam, a six-year veteran of the packing department:

> I don't see fairness from the company. Last summer I was on leave but I had trouble covering expenses. So I called and asked to take some of the overtime hours that were posted. They refused, even gave the hours to people who had much less seniority in my department. But you see, when the company needed me, when they were trying to get the new plant up, they went to the union and said, "We need to relax the rules about how many hours the people can work. We need these experienced people to get us through the tough times." But the company wouldn't help me out in return, when I wanted

> to come in and earn a check for the following week.
>
> That's why I felt so upset about it. I feel it should be tit for tat. I brought it up with the steward and they told me I might win a grievance on it. But the company told them that if I continued with that grievance--if I wanted to come in and work off my vacation, voluntarily--they [management] would take the right to call people in on the weekend following their vacation, to work overtime. Well, that's blackmail; if I won, everyone would have to suffer. That's how they play it. You see, people may have only two weeks off a year [until accruing more than 7 years' tenure], so they need those weekends to add to the vacation. But the company says a week's vacation is five days, not counting weekends. So they can have their way. It's in the contract book [field interview: 9/6/93].

To the extent that management is punitive, labor tension is characteristically expressed in *contractual* terms. However, the cultural meaning of "the contract" can be metaphorical as well as literal. This is true at Ace, as is evident in Pam's statement about reciprocity, above: though a political fact of life, "the contract" is often invoked as short-hand for a broader set of relations and expectations.

From Durkheim we inherit the principle that, seen as containing purely negative sanctions, contract is insufficient to regulate collective action. There tend to be extra-contractual bonds that both inform and integrate social relations. He writes, "if we were linked only by the terms of our contracts, as they are agreed upon, only a precarious solidarity would result" (1933 [1964]. Behind workers' rancor and rhetoric toward supervisors at Ace, I found a strong desire to transcend adversarial relations and for managerial recognition of their moral commitment to work.

Ironically, this theme first became clear to me in the course of attending union meetings. During meetings, "business" was often comprised of grievances for which no formal resolution was sought; it had instead to do with workers speaking to deeper suspicions, disappointments, and hopes about the workplace as a moral community. What follows are agenda items from a 1990 meeting. Few if any were "actionable", yet everyone involved--members, stewards, and the business manager--behaved as though the agenda were routine and legitimate. Many issues reflected a sense of managerial disregard for basic work protections, and for the spirit of trust implied in company rhetoric about greater interdependence in the company's future:

> A maintenance mechanic expressed concern that temporary employees are being abused--kept past the six-month limit, yet denied any fringe benefits. This was followed by discussion of whether temps, about 40 of whom are now on the payroll, should be involved in safety meetings. One woman, from sanitation, complained that temps were not permitted time to attend such meetings in her department. Another claimed that a rule, stipulating that safety hazards will be addressed by the company within 48-hours of being reported, has been ignored. Finally, another maintenance worker claimed that weight limits on freight elevators were routinely being violated, with disregard for potential harm to employees:
>
> "When they want us to re-grind the stone mills we have to transport them a good distance. Hal [maintenance foreman] says it takes too long to move them one at a time. So, we sandwich them one on top of another in the freight elevator. Two of 'em, along with the steel bearings, probably weigh two and a third tons. So, I told the operations guy, in charge of plant safety, they need to upgrade the capacity of the elevator. I sent that message in writing. I never got a reply. Someone could get killed, but they don't give a shit" [field quotation 2/18/90].

The company's disregard for the physical toll paid by those in production jobs was central, too, in this account by Darlene Riley, a woman from the packing department. In the hallway, following the meeting, she told me of Henrietta, a co-worker whom she felt had been twice-victimized--first, by the firm's casual attention to safety, then by its manipulation of medical facts to avoid a workers' compensation claim:

DR: I believe if you get hurt there (in packing) and the company feels they can't use you, they're going to try and fire you. Henrietta is right now on welfare.

CW: She was injured?

DR: Yes, while she was pregnant. She slipped, while she was stacking boxes, on a wet floor; there was a machine, a cooling tunnel, that leaks water, and we'd told them [supervisors] about it. So, she was out for a while, and was fighting them on the compensation. But when she came back, she got re-hurt again, 'cause they had her in the tank farm, moving heavy oil drums with a forklift. She had two doctors; one was a company doctor and one was her doctor. But the company doctor said nothing's wrong with her, even though she had a hard time just to walk with her back pain. So, her doctor wanted to do a spinal, to put a spinal tap in her back, but he didn't think she should have surgery yet. So Ace said, "We can't use you; our doctors say you're able to come back and do the work in packing, and we're not going to have you be on restriction [exempt from heavy lifting]; so you have to go." And they walked her to the door. And that hurt her so bad; she was crying, that they would do her like that. I said, "Henri, you be sure and keep your paperwork, so you can fight them later." I think it was a disc injury. And this is how they treat a pregnant woman [field quotation: 2/18/90].

This account is typical of a body of folklore among production workers at Ace. Though shared privately in this instance, examples of callousness or deceit were commonly raised in union meetings. Usually, the intent was not formally to resolve contractual procedure or language, as much as to reinforce collective ties and moral boundaries that divide workers and managers. The public airing of one account elicited others, often involving news of how a worker under similar stress prevailed--usually outside the formal grievance system--either with help from co-workers or by getting another job. In such accounts, "formal" grievances were embedded in broader ones that offended workers' sense of honor. In the account about Henrietta, for example, the fact of a safety violation is less significant than the firm's seemingly callous conduct after the injury.

Many workers believed the company capable of dishonesty, for example, in handling personnel records as part of disciplinary actions. During a union meeting, Mary Vargas, a packer, voiced the worry that the human resources office had either altered or misrepresented her evaluation and attendance records, and she complained that union representatives did not make separate copies of these documents to check company misconduct. She claimed that after pressing this issue she was punished:

> Even the temps on my shift are given some variety in the lines they work; Bert had me stacking off all day." Ken, the first-shift steward, replied, "They have the right to direct you; as long as they pay you at the rate for your labor grade, there's nothing I can do. If they put you on the more demanding job for over four hours though, they have to pay you at the higher rate." "But," Mary said, "They pull me off after three and a half." Meeting with us [researchers] afterward, the business manager seemed defensive about his ineffectual role: "You've heard some complaints, but those are from people who will complain about anything. [field quotation: 11/18/90].

During one Sunday morning meeting, attended by fewer than one-quarter of the workforce, business concluded with discussion about the new factory. As stated, workers had not as yet (by late 1990) been informed about how the move might affect their jobs or lives. Cutting across the common sense of insecurity--present in union meetings and in field work generally--were more specific concerns, revealing particular implications of the punitive culture for various groups in the workforce: e.g., maintenance staff especially resented being kept in the dark about the floor plan of the new factory; machine operatives wanted clarification about additional responsibilities rumored to fall under their jobs titles in the new plant; those in packing, many of whom were single mothers, worried about how to juggle changing commutes and shifts with day care arrangements. In none of these cases were there bases of worker involvement which might have softened resentment about punitive aspects of supervisory policy.

Finally here, a prominent theme in rhetoric of team management was the value of open discussion, across status boundaries, of production problems. This was presented as essential at Ace, because of the "learning curve" which the new system was said to impose on all employees, and because of the need, under CAM, to diagnose and resolve problems quickly. The vice-president of human resources wrote a memo to this effect, as part of an effort to publicize the presence of the research team, and to generate interest in a voluntary basic skills program funded jointly by the firm and state government:

> While most of us are preoccupied with our own role in the company, it's important to remember that we are all going to be facing changes in the substance of our jobs, and in how we work with one another. All of us are in a learning process. Production workers will be dealing with new, computer-controlled technologies, which will require them to accept greater responsibility for their work; clerical, managerial,

> and administrative employees will be adapting to the new "Business Information System," in which the sharing of information will be much more decentralized and efficient. Again, in both cases these changes reflect the changing face of work in the U.S., and there is intense interest in many quarters in gaining a clearer understanding of how such changes are adopted. We at Ace are confident that our employees are going to rise to the occasion and, perhaps, by allowing our transition to be studied, we can provide an instructive example for firms throughout the country and overseas [company document: 2/10/91].

This memo illustrates several things. First, it simultaneously aims to de-politicize the internal tensions at Ace--rooted in punitive management--and to *re-politicize* the transition in the context of the superordinate goal of meeting the global challenges of the "new workplace." Second, the memo points up how the presence of researchers can itself become a symbolic or political factor in workplace politics, in this case helping to buttress managers' stated commitment to retaining the existing workforce and to procedural fairness through the transition.

Most relevant here, though, is that the memo was part of a broader attempt to disconnect practical discourse about work processes from the traditional culture of punitive management. Already I have elaborated several reasons why shop floor skill had been largely obscured in Ace's past. It is also true that, under punitive supervision, open discussion about production problems exposed workers to criticism or punishment, particularly when they acted without prior approval from higher-ups. This inhibition among production workers, which managers believe to be especially costly under CAM, was ironically made stronger early in the transition. Some foremen, sensing that their importance under TM would be undermined, missed few opportunities to lord their own, supposedly superior knowledge over workers. This was truest at the extremes of the skill hierarchy--in packing and molding, and in the maintenance department.

In the following example, Laura Jones, a veteran molder, has been approached by her supervisor, Leonard, who has chosen during a hectic shift to quiz her on her understanding of the principles of "tempering":

SV: [Pointing to a graph, produced by a table-top device which monitors heat parameters in the tempering of paste] Can you see this sudden break in the line, rather than a smooth diagonal? You should know from the video we saw--we've talked about this repeatedly. What does sudden break in the graph represent?

LJ: I don't know. Because the temperature changed?

SV: Not good enough; what's happening, specifically? What is changing in the product?

LJ: don't know what you want from me. What are you asking me? It's [the paste] moving through the different temperatures?

SV: [More insistently] No, why the break in the graph at that particular point? This is a chemical process, and if you're going to adjust the unit, you have to know the theory behind this.

LJ: I'm only one person here. I'm watching three lines, and taking counts [documenting the weights of drops]. Is this a time to be testing me?

SV: Don't avoid my questions. This is something that you have to know. You say you want me to get out of your hair; you better show me you know what that graph means. You have to know when and how that heat dissipates, and what that has to do with the consistency of the product. Otherwise, the drops are going to set up like hell [field observation: 9/21/92].

In this exchange, talk about production reflects and reinforces traditional supervisory boundaries and tensions. From Laura's perspective, knowledge of production--which she later claimed to me she understood, but was too flustered to communicate to her supervisor--was wielded like a blunt object against her. She resents the company's failure to invest in job (as opposed to basic skills) training, which would better inform workers about technical principles. And she resented the timing of the "quiz," coming in the midst of a stressful shift, and with the deafening din of several nearby "depositor" machines. Laura also claimed that she and other operators possess a "hands-on" understanding of tempering, but do not share the technical vocabulary used by superiors. Agitated, she raised this objection to Leonard at the conclusion of the discussion above, who tried to calm her, saying, "Well, you see? That's why we're having some operators write the procedures manuals; you don't need to hear it in my language, but in terms you can understand clearly." For his part, Leonard approached me later that day in the lunchroom and asked, "Is it unreasonable for me to expect her to know what she's doing?"

Similarly, discourse on skill was linked to supervisory authority in the maintenance department, a trend which was also becoming sharper in anticipation of the new plant. Whereas in the past, maintenance staff had informally allocated work within work groups, their department manager had decided that productivity would rise were staff members to be permanently assigned to particular production lines. The workers resented this loss of discretion and morale fell among the maintenance crew. Most of them believed the arrangement unworkable because of the unpredictable demand for labor in responding to "trouble calls" (see Stinchcombe 1974) And this change in policy, seemingly at odds with company claims of expanding worker discretion, strengthened the inclination, as one machinist said, "to stand by with our arms folded when their new plant produces shit."

In these and other ways, the culture of punitive management was a prime barrier to the shop floor cooperation which management claimed to be essential to the success of computer-automation and the new "plant concept." Whether seen as a short-term tactic to relax contractual rules during the construction and start-up phases, or as a more genuine, long-term commitment to a new managerial approach under CAM, team management was a crucial element: it neutralized workers' resistance, even as it sanctioned new forms of input. A more detailed look at team management must wait until the next chapter.

Descriptively, my goal in this section has been to describe the texture of punitive management. Beyond this, I've tried to establish that it was such a salient cultural theme that, absent a public managerial commitment to reform, it stood in the way of worker cooperation that managers saw as essential for the relocation to succeed.

Conclusion

In this chapter I traced the development of working knowledge among production workers at Ace, and its relation to the tradition of punitive management that had defined the factory culture for decades. I described and discussed the practical contexts and conditions under which workers developed production skills and knowledge, and argued this knowledge required a holistic understanding that transcends both the formal job-system and the more abstract perspectives embodied by personnel responsible for planning, engineering, and quality control. I found too that workers culturally define this knowledge partly by its independence from managerial and supervisory control.

However, this cultural system of tense accommodation was upset by the demands of the new plant project. Mounting pressures among management planners for worker cooperation and input led to greater public visibility of shop floor knowledge and of its strategic importance in the reorganization of production. However, public recognition of shop floor knowledge by highly-placed managers and consultants undermined (at least potentially) the broader system of authority which had long governed the workplace.

Recognizing this threat, and influenced by management experts from outside the firm, managers rhetorically framed the transition as one in which they were educating workers about principles of production and inculcating in them a heightened sense or personal commitment to work. As I'll trace in the next chapter, over time this general orientation was concretely expressed in two rhetorical campaigns that structured much of the activity in prior to and during the relocation: one touting the importance of remedial "basic skills" training, the other promoting team management. Further, because the relocation created new staffing needs, Ace managers argued early on (to the union's bargaining committee, if not in a public forum) that they needed greater latitude in deploying labor than was possible under the existing labor contract. Thus, with no public fanfare, the political structure for collective voice and action was at least temporarily dismantled.

Consequently, workers' responses to these pressures tended to be defensive and individualistic, rather than adversarial or collective. Their responses were driven both by coercive threats such as a plant shutdown and lay offs, and by positive incentives contained in team management and in a quasi-meritocratic "bidding system" for jobs in the new plant. In effect, managers created access to skill by achieving *detente* with workers; they engaged in concrete activities that lent credibility to their discourse about a more democratic workplace, but made no commitment to instituting reform over the long term. I believe it was the conjunction of these conditions, rather than any by itself, which provided managers with access to shop floor skill.

A useful way to summarize this early phase of the technical transition is in terms of a rupture in both the relations and perceptions of *dependency* between workers and managers. Stinchcombe (1970,95-99) has argued that in most modern societies, organizations--rather than ascriptive castes or private armies--are the social units in which stratification is (in a dual sense) realized. Further, he claims that organizations can be compared on a continuum by the degree of independence enjoyed by "inferiors." Among the factors he identifies as decisive are the degree of task complexity and initiative required of underlings, and

> [t]he nature of the ideology of the superiors. Ideologies differ on the question of how independent inferiors ought to be, on whether or not it is right to use power that falls into one's hands (1970,97).

Similarly, Karsh and Siegman discuss the "functions of ignorance" in the introduction of automation. They conclude that: "In general, the less the knowledge associated with an inferior position, the greater demand of the expert for increased supervision and control" (1964,149).

During the phase of accessing skill at Ace, both of these bases of governance (i.e., the distribution of knowledge and the legitimacy of control) were openly discussed and questioned. To an unprecedented degree, managers were acknowledging the complex, collaborative nature of production work. They did so in the service of a technical system whose demands they did not yet fully understand, but which they believed to require a fundamental change in labor relations. Workers and managers, respectively, viewed the activities I've recounted here with different temporal orientations: workers saw them as vindication for past grievances; managers, as pragmatic adaptations to a technical system that would ensure their market position in the future. Though ultimately it proved to be superficial and ephemeral, there was a convergence of interests between the two groups at this juncture (on the issue of managerial reform). That convergence helped them transcend animosity that, otherwise, might well have prevented the discourse on the labor process which was central to the appropriation of skill and to the accomplishment of computer automation itself.

CHAPTER THREE

APPROPRIATING SKILL IN A "DESTRUCTURED" ORGANIZATION

My premise and evidentiary burden in this chapter is to show that the translation of shop floor skill, necessary for the adoption of computer-automated manufacturing at Ace, was accomplished in a series of encounters between production workers, technical staff, and external consultants (engineers and computer programmers). These encounters, occurring during the two-year period surrounding the start-up of the new plant, were given no formal or ritual recognition by the participants; they consisted of mundane technical discourse and labor in the service of a technical system. The system's logistical and operational demands obscured--at the outset at least--its political implications. Perhaps it is more accurate to say that those implications were defined and pursued differently by workers, managers, and technical consultants. "Skill appropriation," then, is my analytic label for encounters that are not reducible solely to the views or interests of any of the groups involved. This "second-order" construct is ethnographic because it is based on observing how history and local culture informed actions throughout the period of the case study.

In the previous chapter I described the conjunction of organizational and cultural factors which had inhibited the free, bilateral exchange of production knowledge across lines of authority. These included: an antiquated factory requiring idiosyncratic solutions for production break-downs; corporate disputes about market strategy, which made the production schedule unstable; and a management style which tended to inhibit, even to punish, workers' independent initiative. Over time, however, it became clear that there were areas of managerial dependence on that initiative. The challenge for managers was to tap it in ways which were culturally and politically "safe," that is, which neutralized contractual inhibitions and preserved managerial control in the future.

In this chapter I will describe and interpret these encounters, and the major pressures on and perspectives of participants. Though in the next chapter I comment on what I see as their varied, long-term consequences for workers at Ace--which many of them see in retrospect as exploitative--I do not believe these encounters, nor their benefits, were the result of conscious managerial strategy. Nor, however, do I argue that the close informal consultations in which shop floor skill was incorporated in the computer-automated manufacturing (CAM) system reflected any genuine managerial commitment to their public campaign of supervisory reform. Rather, for Ace managers, the advocacy of "team management" (TM) proved superficial, grudgingly accepted as a "human resources" counterpart necessary for successfully adopting a more efficient, profitable technology. This was especially true of several plant foreman, who questioned their role and authority in the future described by the proponents of team management. There were higher-level managers who strongly supported TM, but their reference group consisted of business consultants outside the firm, who touted team management as fashionable, a talisman of progressive thinking (and of anti-unionism [see Grenier 1988, 14]).

Ultimately, even those managers who most wanted to see TM adopted in the plant lacked the practical knowledge of and connections to production necessary to influence supervision in the plant.

Tactically speaking, team management served to induce collective cooperation among workers at a time when labor resistance would have been especially damaging to the firm's plans. Its practice was quickly abandoned once production began in the new plant. Furthermore, company planners were disposed--ideologically, as well as by their reading of "expert" consultants on managing in automated environments (see e.g., Helfgott 1988)--to regard TM as a way to *disseminate, rather than to gather*, manufacturing knowledge on the shop floor.

In sum, I treat the appropriation of skill as the outcome of a particular moment in the history and politics of the firm, as a *conjunction* of perspectives and efforts that was in part incidental to the stated objectives of all concerned. As in the classic film, *Rashomon*, one must try to reconstruct the views of those involved; then, the realistic goal is not to reconcile the various actions, but to place them in an explanatory sequence.

After summarizing the relevance here of background material offered in the previous chapter, I will develop the argument in three ways:

First, by describing the practical and cultural contexts or *frames* in which consultations surrounding the labor process took place. I argue that the content of these interactions (i.e., the translation of detailed production knowledge needed to tailor generic software code to Ace's particular physical plant and "recipes") are best understood with reference to their cultural forms (Simmel 1950, 40-43). Workers perceived these "team-oriented" consultations as repudiating conventional work relations and as helping to constitute new relations. However, the potentially democratizing force of team management was blunted because it was culturally and politically premised on the negation of workers' existing skills, and on the salience of "basic" academic and computer skills about which they felt vulnerable.

Second, I will discuss the content of skill appropriation, the specific kinds of shop floor input that contributed to the adoption of computer automation. In this regard, I discuss the important involvement and views of programming consultants. As outsiders to the firm with crucial expertise, they helped to mediate and to reveal the micro-political nature of skill at Ace.

Third, I ground my discussion of cultural frames and my empirical data in a perspective on organizations. Descriptively, this will justify my focal shift, in this chapter, from the workforce as a whole to encounters involving a small sub-set of that group. Though planners at Ace introduced team management as a general change in labor relations--i.e., one affecting all production employees--the promise of TM became reality only for a minority. Indeed, the critical exchanges I recount in this chapter involved perhaps 30 out of some 200 hourly employees. This raises questions about how representative these employees are of the larger group, and about how an argument concerning the value of shop floor knowledge can rest on a finding that so few of them were directly included. A solution to this puzzle can be found in a functional approach to understanding information in organizations, one that accounts for asymmetries in knowledge which wouldn't be predicted from theories about formal hierarchy or bureaucratic efficiency (Stinchcombe 1990).

Cultural Contexts of Skill Appropriation

Formal versus Practical Knowledge

In chapter two I discussed workers' knowledge of production and tacit skills in terms of the physical, organizational, and corporate conditions relevant for developing this knowledge. An antiquated factory and equipment, along with frequent changes in the daily production schedule, required workers to expand their routine shop floor practices. This involved both mechanical aptitude--to coax and maintain equipment--and more systemic solutions, flexibly and efficiently using raw materials in manufacturing processes joined sequentially across several "departments." For individuals, shop floor knowledge is a legacy of long tenure; often, as at Ace, they work in a succession of jobs which afford a broader view of how discrete tasks fit into broader plant-wide processes.

It is relevant to consider those workers who assumed "control room" positions in the new plant, responsible for overseeing production and coordinating work spanning various departments. As of April 1993, by which time the new factory was approaching full production, control room personnel enjoyed an average of 10.7 years experience at Ace (with a median tenure of 10 years). Length of tenure is roughly equal for those in the liquor and chocolate plants. Looking at the subset of these workers who granted us access to their personnel files, we learn that most had held 3-4 positions prior to bidding into control room jobs. Of these, 12 out of 15, began their Ace careers as "utility" or "relief" workers, gained knowledge on the job and from peers, and gradually broadened their understanding of making chocolate. Of the three workers who had held fewer than 3 jobs prior to gaining control room jobs, 2 had worked as pumper-testers, a job in the older plant which, as I've described, required a detailed understanding of the physical plant, functional relations between departments, and quality control criteria.

As a group, production staff exchanged this knowledge, both to make work easier and to protect spaces of autonomy and discretion from supervisors. Hodson (1991) writes that peer training and control is a central, though often-ignored, mechanism in theories of workplace politics and organization. Finally, I argued that the transition to CAM places a special premium on such knowledge, that is, on its holistic nature and its practical detail. This conclusion is supported by the firm's policy, when they moved to the new plant, of "flattening" the number of labor grades, creating less functionally-fragmented jobs. The question of whether the ability to perform in those jobs is a basis for, or an outcome of, the firm's technical transition is an empirical question central to this study.

It is important to point out here that the manufacturing process at Ace is one with little product differentiation and a high-degree of plant-wide integration (captured earlier with the production scheduler's metaphor of the plant as a large tube). Though different "recipes" require particular combinations of ingredients and processes (both mechanical and chemical, such as tempering and cooking), there are few raw materials and dry ingredients involved. Once these and the generic processes are understood, they apply to all the recipes in the production schedule. This explains the emphasis, in implementing automation at Ace, on refining continuous processes over product innovation.

Also, my observations of the implementation of computer-automation confirmed the high transferability of skills gleaned from various jobs and tasks in the old plant. The particular degree of plant-wide transferability of skill, relevant to a central process, is a variable which sets limits on how much my argument can be generalized to other industrial settings. For example, in the chemical plant described by Halle (1984, 80-104), workers are ranked --from "assistant" to "helper" to "chief"--based on their cumulative experience in specific sub-plants; this suggests an orientation to process, gained in related jobs, similar to that for workers at Ace. The firm-wide applicability of skill and tenure is probably somewhat lower in that setting than at Ace, and much lower, say, in an automobile factory or in those organized around quite diversified product lines trying to achieve "flexible specialization" (see Hyman and Streek 1988, 19-47). The scope, then, of my analysis entails shop floor skills in comparatively simple industrial processes. I hope to capitalize on that simplicity in order clearly to follow the role of these skills, at various stages, in accomplishing automation.

Talking Shop

In chapter two I discussed physical and political conditions to which Ace workers responded through shop floor innovation. In this section I illustrate these practices in greater detail, and give the reader a sense of how workers matter-of-factly talk about this aspect of their jobs. As DeVault (1991) showed about housework, and Harper (1987) did about rural, independent repair-work, valuable and pervasive kinds of working knowledge may be obscured because they fall outside of standard vocabularies of theory and research. But, as these authors show, attention to everyday discourse can reveal stocks of arcane knowledge and their embeddedness in the social organization of work.

These field statements exemplify shop floor knowledge at Ace and the recurring production problems and goals to which it is applied by workers. Here, a machine operative is pointing to a pipe, or "line" overhead, where earlier a mechanic had been called to fashion a new elbow in the line:

> You see that extra joint in the pipe? There are several of them in the plant; they increase the chances for clogs [of paste] to happen, and the amount of energy, or force, it takes to feed the moulders. There are other lines too that are gravity-fed--you just depend on the weight of the paste to propel itself through the pipes. But when you have thick, viscous paste having to travel up several floors, you can't maintain the pressure you need; by the time it gets to the hopper it's only a trickle. I've told them to put some air pumps on those lines to move the product better, but they won't listen. Or won't spend the money. Then, of course, they'll bitch about the downtime we have when there isn't paste running to a drop line, and it freezes up. The pumps would ensure that we could run her steady, and they'd make a lot more money in the long run. But the engineers don't listen to us. [field quotation: 1/30/91].

I spent a day with two maintenance mechanics as they hoisted and cut a new "stone mill" for the liquor plant. The mills, each of which is four feet in diameter and weighs nearly a ton, are hand-cut with a grooved, "sunburst" pattern, installed horizontally, and turn against one another to grind the beans into liquor. Paul explained that the bearings on the stone mill need to be oiled frequently to extend their operation. He explained that the head of engineering, Mr. Hardy, had ordered a new bearing, with a strip of graphite in the middle, which he claimed needed no lubrication:

> But we're finding that the graphite can't hold up under all the vibration the bearings are under, and it chips off. We never had much faith they'd work. So Hardy ordered some sealer glue, to get some more wear out of them, but that's a waste of our time. It takes hours just transporting these mills, suspending them so we can work on 'em. And it's dangerous too, because it overloads the capacity of the freight elevator. Really, it could crash through the floor and kill somebody. But it doesn't matter if we have to report 20 hours a month [labor] on this; Hardy would never admit our judgment was right [field quotation 12/14/90].

Often, such statements are also part of a critique of formal organization and authority. Here, Paul explains how he distinguishes between his working knowledge, and that of the engineering staff who are largely remote from daily shop floor problems. While granting the value of formal engineering, Paul and his co-workers on the maintenance staff resent it when salaried staff pull rank, seeming to place the preservation of their own authority above solving manufacturing problems:

P: Hardy understands the plant, from his point of view, an engineering point of view. There are practical engineers and schoolbook engineers, in my mind. He's a schoolbook engineer. There are a few [salaried] people, like in QC, that take our ideas and utilize them. A lot of stuff that I brought up in the past has come back to haunt them--well, to haunt me and them. Like I told them they needed a higher splash-guard on the stone mill, but they said it'd take man-hours. Well, it looked like hell during the plant tours and created sanitation problems, and so we did it. I was right. Small example.

They used to have something they called a "pit" team [performance improvement team] to get ideas from below. Well, that was a big facade by upper management. We had a pit team in liquor, met on Saturdays. I suggested some things, like about improving the way we order parts. Hardy shot 'em down. And he's real rigid about changing his mind. Well, I don't want him to admit he's wrong, I just want the thing to run right, 'cause I'm the one that'll have the problems with it later on. They can pay me to spend time on bullshit, but I'd just as soon get paid to help them make chocolate.

If they listened to the production people, they could've saved a lot of money. Like for the new factory the engineers went with a plan to have one, giant [bean] roaster. Well, that's the heart of the liquor plant, 'cause if it's down you can't run. And if we can't run the whole plant shuts down. If they'd gone with two smaller roasters, they'd be less subject to downtime. A lot of these small engineering decisions add up. I spent months trying to get them to put a damper in the dust collecting system, before they did.

CW: How did you learn about factory maintenance, Paul, and what was your background before coming to Ace?

P: I've been here 15 years. Before Ace I worked at a car wash, and several car dealerships, working on cars. OK, then I came to Ace and ran refiners for two and a half years on various shifts, then asked the personnel manager how I could get into maintenance. He said I needed to take a welding course, so I did that, and showed him my certificate when I was done. It was mostly on-the-job-experience after that. Now the [job] postings say you have to have prior factory maintenance experience, but I got in under the wire you might say. A lot of the older guys just learned on the job, dealing with work as it comes into the shop [field interview 11/27/92].

During a week I spent trailing the maintenance crew at the downtown plant, Rick, a mechanic, asked, "Hey, how'd you like to take a shitty engineering tour." As one of the men responsible for maintaining the facility itself , Rick had a strong interest in anticipating repairs and ordering parts. Often he fashioned things in the shop, using a lathe, welding iron, table saw, and other tools that competed for space in the cramped, busy area near a freight elevator. While he put in a stint of weekend overtime, I lent my (unskilled) hands as Rick worked on some "...nagging projects. What with putting out fires, and PM's [periodic maintenance], I can never get at this stuff, even though it's probably the most fun for me to do." Rick welded some safety guard rails, and began work on steps to a newly-installed storage tank. He hoped soon to begin work on a vacuum system he had devised, to collect the dust created when cocoa beans are vibrated to separate out refuse before roasting.

Douglas Harper could be describing Rick, rather than Willie, the rural handyman in his (1987) book, *Working Knowledge*, when he writes,

> Many of the repairs seem unremarkable, such as using a cardboard box to make a gasket or a piece of discarded plastic for a small brace. But the knowledge of materials make is possible for Willie to use the odds and ends that are in profusion around the shop...Willie's knowledge of materials helps him understand *why* machines have deteriorated or broken down, and it leads him to see the act of repair as remedying an engineering flaw, rather than replacing a part (1987, 73. Emphasis in original).

Often, mechanical and other skills workers use for trouble-shooting are connected to activities, friendships, and ways of talking which extend outside the plant-gates.

Stinchcombe (1990) argues that, in research, such informal interaction is often treated reductively, as merely residual to the formal organization of work places, and that such a perspective tends to obscure the wider cultural and discursive patterns that inform any explanation of conduct on the job.

Rick and Shawn, respectively, are first- and second-shift moulders who work on the "bar line" (a machine that produces ten-pound bars for industrial consumers). In addition to working on the bar line, they collaborate on a part-time job during their off-hours. Rick explains:

R: See, we're mechanics. We have a business fixing cars on the side. And we know this machine [bar line] inch by inch. We can hear a noise, hear friction in this motor immediately, and most of the time can guess what the problem is. Even though we're not supposed to repair stuff, the guys in maintenance have learned, when they do PM's [periodic maintenance], to take our word for when something needs serious attention.

CW: Are you discouraged, by the foremen, from making mechanical adjustments on the equipment?

R: Oh no! They're fine with it, because that means less downtime; they're in business to make money, and downtime is loss.

CW: Has anyone from engineering talked to you about how to set up the new bar line at the Sylvan Plant?

R: Are you kidding? They think if you don't have a college degree that you're shit. But you can take a guy with all the book smarts in the world, but if they aren't mechanically inclined, they'll never get the production out of this machine that we're capable of. I'm not bragging; aside from the lead man I've got more experience than anyone with all the equipment. I ran the drop lines for three years, a [precision cutting] molding unit, making wafers for two years, and the bar line for three years. That's ongoing time. You don't just baby-sit these machines; like the new drop lines they're going to install, I've seen them [on an overseas visit] running and if they're not timed perfectly you'll get a lousy looking drop. I've tried to show people how to set the timing on this line, but there's not many who understand how to do it. Like I say, mechanics is something that either you have an ability for it or you don't [field interview: 1/28/91].

Such interests among production staff were not restricted to the workings of discrete pieces of equipment. They included recognition of how standardizing operating procedures plant-wide is necessary for consistently achieving output and quality specifications. Here, in the old plant, a moulder is explaining the purpose of graphing weights (of drops and bars), and complaining that managers had, in his view, been too lax about making general policies based on shop floor practice:

> All the moulders should be graphing and monitoring [weights and tempering practices]; that would help us get a much better handle on the sources of customers'

> problems. But now it's a matter of everyone 's personal way of doing things. Like, the third-shift bar line operator, I don't think she really has the common sense to run the line properly; she manages to screw up royally a couple times per week. Even if everything's going fine when she comes on to relieve me, she'll change settings [on the tempering units] because she has her own theory of how it runs best. When everyone takes that approach it leads to a lot of wasted time and effort. Now that we've been graphing on this line, they can look at sheets where the product ran smooth, within spec., for a whole shift, and that gives the other operators something to go on. It can also tell you about problems with the paste, before it even gets to the moulding units. [Field conversation: 1/29/91].

Ironically, at the very time workers were making these statements Ace managers were investing time and money in a campaign, "training" workers to understand production as a plant-wide process, and to standardize shop floor practices. The intensive involvement managers wanted from workers was already present and visible, though most managers were blind to it. In effect, if not by design, they had mystified and undercut the very qualities among workers which they declared to be most critical for the firm's future success. The combination of an ideological stance that justified their authority, isolation from the practical effects of corporate decisions on production, and of shop foremen, many of whom defensively blocked "vertical" communication from above and below--all contributed to this selective blindness. Rather than finding a practical basis for managerial reform by publicly recognizing that workers had knowledge valuable for easing the relocation, Ace managers betrayed a lack of faith in such reform and in the workers themselves. Instead, they presented the business of organizational change such that, for workers, the necessary abilities were defined and bestowed exclusively by managers.

Though years later one can readily fit these events into a conventional scenario of adversarial labor politics, at the time they presented a paradox in local culture: a changing regime in work relations which was, apparently, both more egalitarian and more paternalistic than the preceding one.

Paternalism, Team Management and the Rhetoric of Basic Skills

I presented the ethnographic materials above with two purposes in mind. The first is to describe and contextualize work practices that too often are glossed over by more remote methods of research. This way I can add to a comparative, fine-grained ethnography of skill in industrial settings. Second, these descriptions provide a baseline from which to analyze the particular ways managers defined and acted on the new plant project as a practical organizational matter. If managers were genuinely committed to team management, and to honoring the shop floor involvement they claimed to be the basis for such reform, then such worker initiatives as I've described should have reinforced the long-term adoption of cooperative decision-making. If managers' commitment was genuine, rather than merely tactical, they could have created regular forums for the cooperative resolution of production problems. This was especially important during the start-up phase, when technical and organizational demands were most intense. Finally, a genuine commitment to reform required either that the structure of authority and contractual governance be modified to reflect the team concept (e.g., the loosening of punitive rules, new channels of cross-status communication), or that a new structure of cooperative governance be instituted instead. Since, as it turned out, these and other fundamental long-term changes did not occur, I am focussing on the political motives and lasting implications of managerial conduct during the "appropriation" period.

My retrospective account does not imply a crude teleology of class interests. It does help to explain when and how managers dealt with uncertainty and vulnerability, revealed by the technical change, in ways which ultimately preserved their control. Because both the structure and legitimacy of managerial control were then in abeyance, I am arguing that the cultural frames mediating labor relations during this period are crucial for understanding the political outcome. Generally, this raises the broader problematic, addressed most directly by critical theorists (e.g., Morris 1994; Habermas 1975) of cultural forms of legitimation.

I reported above that the meetings in which skill was appropriated had little public recognition. There had, however, been extensive public attention to encounters involving the same people, months earlier. Beginning in the fall of 1990, there were small and informal, as well as company-wide, gatherings in which executives and managers exhorted production workers to "upgrade" their math and reading abilities, and to "meet the new challenges" of CAM and the new team approach to decision-making. Even though managers' initial statements and actions regarding the new plant project were, by admission, speculative, they nonetheless created public meanings and expectations. Until the new factory actually started up two years later, it was to these *social facts* that various practical and political action was oriented.

Though softened by early company assurances of job security, these early encounters were paternalistic. Ace managers would: evaluate workers' skills and provide remedial (general and plant-specific) training necessary for work in the future; invest in a new plant and equipment which they claimed would transform work, making it more challenging, autonomous, and efficient; introduce a "merit-based" job-bidding system they said would better reward skill and initiative; and, finally, reduce the number of job classifications from 23 to 8. All of these called into question the criteria, as well as the procedures, for sorting people into jobs. Thus, in addition to workers' lingering fears about job security, they faced clear threats to hard-won political and status rights as they prepared for the difficult months of overtime and thin staffing before the new plant would be fully operational.

A *paternalistic framing* of interactions between production and planning staff was also fostered by workers having to take "basic skills" exams, "hands-on" tests of mechanical aptitude, for machine operatives, and training sessions in which manufacturing principles and procedures were presented to workers using industry films and company-prepared handouts. Though ostensibly consistent with the firm's commitment to greater worker involvement, in what the plant manager called a "holistic, plant-wide production concept," the implicit message of these activities was that skilled, responsible workers were *a goal, rather than a basis*, of any successful transition to the new plant.

As I mentioned in the previous chapter, this managerial climate was conspicuous during my first introduction to workers at Ace. On a September morning in 1990 my colleague and I were summoned to a carpeted conference room in the office complex that adjoined the downtown plant. The workers' task was to take a timed, diagnostic paper and pencil test of their reading and math ability. The personnel director, who administered the test, must have been aware of the anxiety in the room. Addressing the group, he explained that the test was "for your benefit." It was not, he said, going to be used against workers in any way--say, as a basis for job re-classifications or layoffs--but instead was intended:

> to help you guys find out about any weak spots you may have, so you can get some help from the tutors over at the technical college. We in the company won't even know how you did on the test; it's just a way for you to focus your studying on those areas where you need help. It's up to you to decide if you want to make time to improve your skills, and totally voluntary. But we all need to be willing to learn so we can have a smooth transition to the new plant. It has probably been a long time since most of you took a test like this, so you probably feel rusty. But you can't make use of the schooling unless we know where you're starting from. Once you know your scores, you can discuss them over at the learning center. They have computers and whatnot, and programs to help you zero in on how to build up your skills [field observation:9/?/90].

This was but one of several meetings set up to test production workers and introduce them to a new remedial training program, funded jointly by the firm and state government. The 40 or so workers present on this day made up around one-fourth of the production workforce. Most had arrived early, before starting work on first-shift; others, fatigued and wearing soiled blue shirts, had reported after working the night shift.

My colleague and I had come to speak about the long-term research project to which the company had consented, and to ask for workers' help and cooperation. We hadn't fully appreciated that using this forum would lead many workers to associate our research with other managerial initiatives that were being announced in connection with the construction of the new plant. Our early reception indicated, however, that despite the firm's assurances of job security and references to teamwork, there was deep suspicion and resentment among factory workers at Ace. These feelings reflected workers' awareness that automation has often been accompanied by layoffs and assaults on union power, in the context of punitive management described in the previous chapter. As a field worker, I was a "lightening rod" for opinions that workers usually shared informally and privately.[1]

Apart from the immediate business of administering the test, these meetings had cultural significance. They took place outside of the spatial and temporal boundaries of routine labor; it is unlikely, for example, that except for their initial hiring interviews, these employees had ever entered Ace's office complex. More important, for workers the meetings were an early part of defining what the new plant project would mean, both for individual jobs and for managerial relations. Ground hadn't yet been broken for the new building, and the plant start-up was still two years away. Still, people were already trying to anticipate and adapt to the new work setting. Understandably, they were anxious for any information which might sharpen the outlines

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[1] Years later, a worker took me aside and said, "I think the smartest thing [the company] did was to bring you guys in for that study. It made them look good, like they was sincere in what they said. Come to find out we [workers] weren't worth a drop in the bucket."

of what was a vague, even threatening, future. The "basic skill tests," among the first public activities connected with the new plant project, thus were closely scrutinized for clues about what was to come.

Culturally, the meetings were significant because they framed the implications of technical change in a particular way: in terms of increasing demands for formal, "classroom" skills, rather than of continuities between the new system and existing, plant-specific skills. Again, this is not to imply conscious company strategy; at this stage managers were unclear themselves about how best to prepare the workforce for CAM.

In any event, it is important that as managers discussed these events early in my field work, the issues of remedial education and supervisory reform were presented as linked together--as twin requirements of meeting the competitive demands of a global economy. This linkage, and the company's commitment to comprehensive organizational change in response to the new demands, were vividly expressed by the company president, Mr. Stanton, in his address (quoted in part in the first chapter) to the annual holiday party in December of 1990. The gathering took place in the ballroom of a downtown hotel, and numbered over 300 people, hourly and salaried workers alike. It is the one occasion per year when the workforce meet en masse, and are invited to dress up and bring spouses or dates. After dinner, the president moved to a podium to speak.

First, he chided the production manager, whose introduction expressed thanks to "the president" for footing the party's bill. "That was a mistake, of course, because clearly it is you employees who have worked so hard and contributed in so many capacities, who've made this company grow. So, it truly is your party." After this, Stanton gave a slide presentation, showing the construction site and the foundation of the new plant taking place. Then, he projected a series of colored maps, indicating the location of Ace's "sister plants" elsewhere in the U.S., in Canada, and in Central America. He continued,

> Although we are part of a very large enterprise, we should feel very proud of our role within it. Despite the limitations of our aged plant, our production output has grown twenty per-cent in each of the last

> two years. We have retained the business of some very visible, national brand names, and have greatly expanded direct retail sales of our specialty products, some of which have been sold since Ace was a family concern at the turn of this century.

Next, Mr. Stanton announced the company was giving awards to "those employees who have shown us by their example a willingness to better themselves, and the company, through uncommon efforts." The first of the three recipients was a foreman in his mid-fifties who, though approaching retirement age after 30 years service, had learned to read from a tutor at the local technical college. He beamed as the company president handed him the engraved plaque, and a crouching photographer recorded the event for the company newsletter. Next, a white woman packer in her thirties, followed by an African-American machine operative, rose to claim their awards, both wearing formal dresses and corsages. "These people," said the president, "in their quiet way, are leaders."

> In addition to their long work hours and family responsibilities, they found the time and energy to invest in skills that will enrich their lives and their value as employees. It can't have been easy for Wally to gain his literacy later in life; and the two women are both on their way to earning their high school

equivalency. We applaud their accomplishments, and have promised to support their tuition, if they choose to continue, during their college studies.

He continued, in a more formal tone:

What I want to talk to you about now is rather serious and that has to do with the general issue of retraining and education. We're living in a world that is changing at a frighteningly fast speed. All of us in this company are faced with the need to learn new things and develop our skills. Often, there is fear among people to say we don't know how to do something. But we must confront and overcome that fear. Even in my position as president of the company it's impossible for me to know everything that is known individually by people I work alongside of. I see my job as knitting together these different sources of knowledge in order to make decisions that are good for the company.

This past year we budgeted $300,000 for retraining for all the members of this company. Every member of this company--every worker in every job category--is encouraged and invited to take advantage of this. I cannot overestimate the seriousness of this challenge. The governor has matched our investment dollar for dollar, realizing that the long-term economic health of the state is dependent upon a skilled workforce. This has become all the more essential as we're dealing with a competitive world economy. So, there's nothing I can do but to say, please, talk to your supervisors, talk to your friends, and don't hesitate to go to the human resources department to find out about these opportunities. Thank you, merry Christmas, and God keep you [field quotation: 12/18/90].

Some months after this gathering Mr. Stanton was interviewed for a feature article in an industry magazine.

He first described the 50-acre building site and the difficulty of "coordinating a project of this size--eight acres of building under one roof." Then, under the sub-heading "Fond Memories," he reported that

> We had to do an enormous amount of training to bring our employees up to speed in new technology. Many of our employees were doing tasks that were physical by nature rather than mentally dexterous. It was clear that the plant of the future was going to have a high degree of computerization, but we found that some of our employees, unfortunately as inner-city employees, had very little education and their ability in reading and basic mathematical work was limited.
>
> That [technical college] training was funded in part by the state, and it has accomplished an enormous amount for our workforce. They're going to be doing totally different jobs than they've ever done before and have developed skill levels that are transferable to any manufacturing organization. So they've increased their own personal value in many ways.

The company president also explained that some two dozen workers had been sent overseas for training, by "equipment suppliers who recognize and share [our] desire to retrain workers." My interviews with other middle and upper-managers reveal the wider currency of Mr. Stanton's perspectives on the meanings and challenges of the new plant project. Steve Oliver, the vice-president for human resources, had worked for Worldcorp in several locations, over a fifteen-year period. In the summer of 1993, he described for me the scope and objectives, for him, of the transition to the new plant, then well into the start-up phase:

SO: It's not, for me, about grievances and those issues; there are others who can handle those quite easily. We're looking at where we are going as an organization --not just Ace in this city, but operations in the mid-South, the East coast, in Canada. So, it's a longer-term strategy that asks, where are we going? What products are we going to deliver? At the same time you bring in technical questions of how do you handle grievances in shops having different unions? How to handle problems in non-union facilities? What laws do you have to comply with. And for us, now especially, how do you increase productivity, to get people to work well and with flexibility, and to own a piece of it?

CW: I see. In practical terms, as you looked at workers moving into the new plant, what did you see you job to be? There has been a lot of attention to assessing formal skills, for example. Given you responsibilities in human resources, how do you see the transition?

SO: You were down there and understood the paradigm at which we operated down there. I think [production] people approached things from the standpoint that, "It's a crappy old plant, therefore I can only do things in a laborious, difficult sort of way; and making [the product] is an art, not a science. I've been doing things the same way downtown for 20 years and it has served the company well." We've had a long-standing work force; they've put in a lot of years and were loyal to that system. With the foremen, they've been used to giving directives--"You, go do these three things, and when you're done with those, come back and I'll give you three more."

Well, we were going to a facility that, in total, was approaching a hundred million dollars in building and capital equipment, with a work force that we really didn't know what their training and skill levels were. So, you're right, we did an assessment; I was very pleased that the union supported it so vigorously and that we got over ninety-percent participation in that voluntary assessment. We did not see any of the [test] results, other than a consolidated summary; then we allowed people to meet with a counselor on company time, who gave them some feedback as to what they should be doing to improve their skills. That was kind of step one, the basic building block.

Also, we were doing things, almost in parallel, [concerning] what I would call the development of the workforce throughout production. Not training, but development. You really can't separate the two; that dealt with listening skills, in supervisory skills; the nature of change in a team-oriented workplace. And many of those are ongoing. I think, had we told people there's going to be a massive gob of information that you have to swallow, I think they would probably have choked on it; but, if you simply doled it out like little bits of bread, they...it wasn't as overwhelming. If you talk to those [workers] today, and certainly you know many of them, you can see the things they're doing, things you couldn't have envisioned three years ago. What we needed was to get to is a plant that's flexible. Now, you can certainly engineer that, but without the people who can make flexibility work, you've wasted your millions of dollars; Worldcorp might as well have put their money in CD's. So, we were very honest with our people, told them where we were going, and that we had no intention of getting rid of people by replacing them with automation. As management, we wanted the company to grow in terms of market share. And, would everyone here produce more pounds through more automation? You bet.

So, the skill assessment was voluntary, and we had a small percentage who elected not to take the test. We said, that's fine, it's up to you. Some decided not to because they're going to retire in the foreseeable future. Others, we simply said that the choice is yours, but with the new jobs there, understand that you may not qualify for them, regardless of how much training we give you. Because you've got to have some basic skills on which to build. And I haven't heard many complaints about that.

CW: As you know, sociologists, economists, and educators who are trying to understand changes in workplaces, have little empirical knowledge of how firms determine, by some independent measure, what is required for new jobs. Have the manufacturers, perhaps, informed you about this, based on their experience?

SO: Some of that, but we also brought in some outsiders [consultants], independent people who the union was very comfortable with, to look at some jobs. Because you want a buy-in all the way around. But what you always want to stress about this process--and I've seen this in my own career, in four locations in 16, 17 years--is flexibility and adaptability. That's not the mold the average person will see as fitting them. Now, you take that person and tell them, "I'm going to make you change," and the first reaction is a negative one, of "What's wrong with what I'm doing now? Don't force me into something uncomfortable." So, if you tell people, "Education today is going to be a continual, ever-changing process," I think they're overwhelmed by that. But, if you say, "I'm going to take the material handlers [a manual job] and show them how to do something new," that's not nearly as threatening [field interview: 9/3/93].

For me, the significant theme in Oliver's statement is how he matter-of-factly accepts and connects several problematic assumptions that informed Ace's labor policy prior to the move: that workers' routines downtown had blunted their ability to deal independently and creatively with work problems; that school-based skills were the "basic building block" on which successful adaptation to the new plant would rest; that the union's role could be only passive--to suspend contractual rules that hampered the firm's ability to deploy labor at will--rather than as an active, collective body helping to mediate the practical partnership so clearly implied in the rhetoric of team management. Ace managers presented the relocation project as quite disconnected from their history of labor conflict, indeed, as manifestation that such conflict no longer had relevance for the future.

This was a portrait that many workers accepted, as is indicated in this statement by a mechanic and union steward, in the winter of 1990 (more than a year prior to ground breaking for the new plant):

> There are no surprises here. These people have seen this coming for a long time. The company is picking up the tab, and all we have to do is put in the time and the work. They're putting tens of millions of dollars in the new plant and you've got to have people over there with the skills to make it work. Some of the people [workers] are stubborn about it; they don't seem to understand what's on the line here. As union reps, we can explain the situation, we can encourage people to take advantage. Which we do. But in the end it's their decision. There's not much we'll be able to do, in terms of union protection, for those people who don't take advantage of the training [Field quotation: 12/13/90].

Another maintenance worker posed this question:

> Who's to say that people don't get the training, on company money, and leave for a different job? There's nothing to stop them. The company's taking a chance, a risk, and you can't make them out to be the bad guy if somebody doesn't make the transition. You gotta wonder about some of these people. Don't they ever want to be more than they are today? Don't they see the opportunity? [field quotation: 12/13/90].

It turned out that many workers "saw the opportunity," because their response to the training program was greater than the firm had planned on, and greater than could be handled by the two instructors and half-dozen computer stations which were available in the budget. Though the firm estimated that twenty or so workers would be regular visitors to the learning center, nearly three-times that number showed up for tutoring or independent study. There were hour-long delays for terminals (to use "self-paced" software programs in math, English grammar, and reading comprehension), and of several weeks before workers could meet with a tutor to discuss the results of their diagnostic tests and plan a course of study. I asked one of the packers whether they too felt included in the company's training effort (given that jobs didn't figure to be affected by computerization in the new plant). She answered, "There's no way of knowing; the company is definitely encouraging everyone to take the classes, and our jobs are going to be changing too. We just don't know how yet. But there's nothing to say that someone in packing can't take some classes and move into a better job."

This meritocratic perspective was in conflict with another, voiced here by a machine operator with ten years' industry experience, most of it with Ace. An African-American man in his mid-30's, reared in Memphis, Sam's genteel and formal speech didn't mask his cynicism about the company's statements:

> I don't trust them at all; there've been too many promises like this in the past, about wanting our input and treating us fairly, and they came to nothing. You see, the bottom line is we'll be doing the same work [in the new plant] that we've always done. We produce chocolate. The materials and machinery are going to change very little. Just because something appears to be more automatic, it's still [true] that changes have to be made on the machines, to get the drops to set right, or after a changeover. The idea, this talk, about a quote-unquote turnkey operation, this idea that you'll be able to set things up, plug in the same pressures and speeds on these lines, have the same liquor and oils react the same way in the recipes--that's a myth. That's never-never land.
>
> But by setting it up that way, it's a situation where when things go wrong, if things go wrong, it'll be our fault, supposedly, the operator who's at fault. I think it's just a way to put more responsibility on us, and to justify having us run more lines [per person]. They'll try to deny that we have the same work as we've been doing in this plant. That makes sense; it makes sense for them money-wise. If people came into this with no history, maybe they'd say wow to all this fancy technology. But we have a history. So, I don't buy all this about new skills and new supervision. We've been doing this work for ten, fifteen years, making money for this company. And all of a sudden we're not supposed to be able to do our jobs? [field interview: 1/29/91].

A third-shift moulder, Gary had a similar view. After reporting his decision not to take part in the survey research, he grinned at me sardonically and said,

> They [the company] give us so little credit. Don't they even see us reading the paper in the lunchroom? Now,

> why would a big corporation invest this kind of money in a new plant here if they didn't have some regard for the labor force? They could just as well have gone down south and gotten labor cheaper. For that matter, they could have laid us off if we are so unskilled. The union couldn't have stopped them. Don't be silly. Many of the workers here came to Ace after Miller's Cookie plant closed down, so we showed up being valuable to them. They [Miller's] didn't have the liquor processing and what have you, but many of the jobs and equipment weren't so different there. So you're telling me, with almost 12 years in this industry, that to make money for [the company] I've got to review my high school math? No, I think this [emphasis on basic skills] is a nice way for Stanton to get his picture in the paper with the governor. And it's scaring a lot of these workers, too [field quotation: 3/20/91].

Finally, another basis for workers' distrust was that the company's plans for the new factory had been kept secret. During a plant tour, a union steward voiced an opinion that I heard often. Responding to my questions about how the lines might be set up differently in the new site, and whether his department had been involved in planning, he offered that, "Well, they think they're talking to us, but they're really not. They'll visit the shop sometimes, ask us some questions, but after that it's just one-way communication; we don't feel like they've taken our ideas into account." It was clear from conversations with other production staff that basic information about impending changes in production--not to mention meaningful input into planning--had been withheld from them. In the plant, workers were resigned to waiting out the uncertainty, but angry at being poorly informed about the overall plan and rationale for changes in employment policies. Many, like Steve, a machine operative, vented these feelings to me:

> We just don't like being kept in the dark. We know the changes are coming, but they should tell us more. Right now, there are 15 bodies in [my department], and in the new plant I hear they want to get that down to 9. That's a big cut. Either they don't know how they gonna run the new stuff, or they're just not telling us. These changes are coming soon, and we don't know except there's going to be more high-tech shit. How come they know enough to tell us how many workers they want on each line, but not enough to explain to us how it's gonna work? Don't get me wrong; it's their company and I don't argue with them wanting to cut costs and raise profits. But I don't like being kept in the dark [field quotation: 1/29/91].

Union Stewards as Mediators

Many among the production staff were skeptical about the future relevance of basic skills to their job performance; indeed, the connection between the two had never been made clear. Most were protective of contractual guarantees of job and seniority rights. But these issues seemed to be absent from the public, union-mediated discussion surrounding the company's immediate needs for labor "flexibility." The most oppositional workers, like Sam and Gary, had long ago stopped attending union meetings and so had no impact on workers' collective response. Those who did attend meetings regularly (between 15 and 20 percent of the hourly staff) were neutral about or accepting of the company position. This helps explain the union's agreement later to concessions that most production workers objected to, but which were never subject to collective approval by vote.

The union was relatively weak at Ace, and will be of only marginal interest in my analysis. Still, it is useful to reflect briefly on why it was not, at least, a more visible forum to air grievances, or a more effective brake on company discretion. This was partly due to the composition of its bargaining committee: Two were first-shift maintenance workers, one was a woman on the verge of retirement, and another, though effective, worked not at the main plant but at a storage warehouse some miles away. It was the two stewards from maintenance who had the most involvement and credibility with upper-level management.

It is understandable that maintenance employees--the highest-paid and least closely-supervised in the factory--were more receptive to the firm's position, and to demands for ongoing training, than were the production staff as a whole. Also, because of their ability to gain "journeyman" status in trade unions, these workers could be more sure than production workers of returns to additional training in the external labor market. Several of them reported having ongoing training in welding techniques, hydraulics, applied mathematics and, for the electricians, in ladder logic and statistical process control.

In short, maintenance workers were receptive to seeing the employment relationship as individualistic, as meritocratic, a principle that was reinforced by a merit pay system unlike that which mandated uniform pay across job grades for the production staff. Their views were consonant with the firm's emphasis at the time on basic skills. It is also worth noting that the two union stewards who then had the most experience and influence were on the maintenance staff; in this position they had a critical role in defining the nature of and response to job and skill changes for hourly workers.

Even allowing for the relative autonomy of maintenance staff, and their greater tendency to see work skills as transferable, their statements represent a striking contrast with the broader distrust of management as punitive. The combination of the firm's public repudiation of "old style" management, along with beliefs that the automated system would bring greater individual autonomy to workers, led more conciliatory workers to adopt perspectives about the nature and requirements of technical change that were largely consistent with those of managers. At this early stage, then, the proximate cultural frames were defined rhetorically--in union meetings, testing sessions, and by supervisors as they spoke with me--in terms of a *downward transmission* of expertise and power. These events took place many months before the practical exchange of skill that attended automation. But, although many saw them as concrete evidence of changing work relations, these encounters between production workers and planners both reflected and reinforced traditional claims about the deep legitimacy of managerial authority.

Critiques of "Basic Skills" and Ace's "Learning Center"

In retrospect, the managerial emphasis on formal skills (and their concomitant negation of shop floor skill), was one of several, equally plausible social constructions that might have given cultural meaning to the new plant project. If (as I will argue below) managers' emphasis on basic skills would later prove to be excessive, it did reinforce hierarchical authority at a time when it was being seriously undercut.

To be fair, managers' concern about workers' basic skills was understandable. It was a product of the broader media and policy discourse about global competition, and of their own limited knowledge of what the new jobs would demand. Further, the hourly workforce at Ace do not, as a group, have much formal education, and almost 40 percent of them, as minorities, are products of inferior schools. Practically speaking, defining the "manpower" challenge in terms of basic skills allowed Ace to claim government support and money earmarked for urban economic development. So, regardless of how the stress on basic skills affected workplace politics, there are several reasons why it appeared to be a sound course of action as managers tried to ensure a successful relocation.

On the other hand, there is a strong case that the mantra of basic skills--its connection to work productivity --has not gotten enough empirical scrutiny in training or research circles. In a series of important papers, Darrah (1995;1994;1992) argues that workplace training programs are usually seen--by researchers no less than by managers and educators--as a one-way, neutral conduit that transmits knowledge and skill (also see Reddy 1979). Instead, Darrah asserts that "workplace training cannot be divorced from workplace learning, and that neither are simply matters of efficient pedagogy: the organization of work and the allocation of power are both implicated" (1995, 3). Still, research and practice oriented toward "future workplace skills" (FWS), "rests on untested assumptions about the relationship between basic, largely academic skills and the ways in which people actually perform their work. "Numeracy," or arithmetic skill, is representative. Although improving classroom performance of computational tasks may be desirable...the relationship between task performance in the classroom and at work is not clear. A growing literature in practical cognition (e.g., Lave 1988; Scribner 1986)...documents how people [at work] develop alternate means of calculation to solve the everyday computational problems they encounter (1992,265). For Darrah, then, "the appropriate analytical unit in the study of skills may be the workplace and not the individual job...Such an analytical shift need not result in highly ideographic studies of individual workplaces, but rather in generalizations about the distribution of skills in workplaces, the conditions that foster or inhibit skilled performances, and the educational reforms that would permit the design of workplaces that support continuous learning" (1994, 82).

Given the public attention focused on basic skills training at Ace (which, at first, seemed to represent just such a commitment to "continuous learning), I followed the program throughout the move to the new plant. Though the original, downtown program--surrounding the diagnostic skills testing in the fall of 1990--took place at a technical college near the old plant, Ace had secured matching funds from the state to operate an on-site "learning center" in the new plant. Located near the first-floor lobby and reception area, the learning center had several computer terminals and self-paced software packages covering grammar and reading comprehension, grade-school through pre-college-level math, and language instruction including "English as a Second Language" for Spanish-speaking workers.

The training grant also included two-year's salary for a tutor, Barb Kelly, who was available one morning and one afternoon per week. The learning center opened late in 1993, when the pressure and mandatory overtime of the start-up had settled down. In the summer of 1994 I sat down with Barb, to find out about employee's longer-term usage of the center, and whether or how the company had tailored it to job performance and productivity in the new site. A specialist in language education, Barb, is a petite white woman in her thirties. Observing her with (often exhausted) workers, I was impressed with her energy, warmth, and close rapport with them. Asked what direction the company had given her before the on-site center opened, she answered,

BK: None. And I don't know whether that's because they were unhappy with what happened [downtown], or if they just wanted to see what I'd do if I was just left alone. Rather than asking me to work on any specific areas, he [personnel manager] asked... I offered, and he took me up on, a monthly report that I'm working on. Not numbers [of students] or anything; just a summary of what people are working on. He wants to know what they're studying. But the only outcome they're looking for is how many hours are put into the center. In a way there's a commitment, because they're paying for the center. But I can't believe a company would put in that kind of money and not want more of a voice in what's going on. I mean, I was really hoping to get an active group here, in management, to have a steering committee. No takers.

CW: Tell me about the attitudes of those workers who've sought you out.

BK: Many were a little scared, like the company was saying, "Either you get the training or you probably will lose your job." So it was voluntary, but kind of heavy-handed voluntary. And those who have put in time have mostly done really well. As you can imagine, it's very hard for many of them; like, the people who are working toward GEDs are single moms, and child care is tough for them to work out. Some of the supervisors have been real good boosters, being flexible about schedules so people can come to planned programs, like word processing, LOTUS spreadsheet.

CW: Which departments have been especially interested?

BK: Packing is the biggest. The next one is getting to be liquor and bean processing. In both they had someone stop in, and that starts the word of mouth. That's why I really try to recruit peer advisors.

CW: Is that your biggest goal? To increase use of the center?

BK: Well, the other thing I really want to work on is that I can be more effective when I can be out on the [production] floor. I need to know what people are doing at work and, I mean, often I don't have a clue. I was given a tour when I started...Well, first, when they opened, they said that I couldn't because it was on a need-to-know basis. But after a few weeks I asked again and got a wonderful tour. But it was too much to information for one day, and I need to go back again, department by department. I've had training in analyzing work skills, and I would love to do that here. I could be so much more effective.

CW: In general then, are workers connecting their study to their jobs?

BK: Even those who are not using computers--like in packing and shipping, they just enter stock numbers into a keypad--are focussing on [computer training]. They don't have computer involvement, but they want to jump the gun; people are working on typing, because they see that as needed for computer work. That's good, but I don't know if that's going to help them here. Most of the people in packing have figured this out. They tell me their work has gotten a lot harder, physically [in new plant], and in so many words they're telling me they want to strengthen skills so they can get out of here. They aren't scared anymore about new skills in these [Ace] jobs, because the new things they're doing are just building on skills they already have. Or a new application of the same skill. That's what they tell me.

CW: Finally, what about the people who are most involved with computer applications: the control room operators? Have you worked with them?

BK: No. The kinds of drag-down menus and graphic displays they're working with I can't even install in these PCS [personal computers]. They work with the programmers and some of the people on the technical staff here. I've been up there, but they've never come to me. It's really something to watch them at work, though [field interview: 8/24/94].

Barb's comments confirm the larger problem to which Darrah and others have called attention. Making a public commitment to basic skills training back in 1990, the company signaled to the workforce and to the surrounding business and government communities that they were serious about retaining the existing workforce. This had several practical benefits: it helped Ace to win educational funding. And it helped in their public campaign to have the city annex the land for the new plant from a neighboring village, which lowered the firm's tax burden. Also, of course, the company's efforts probably led those workers who failed to meet minimum levels of literacy and "numeracy" to get remedial help--a positive outcome for all concerned.

However, the skills training appears not to have been integrated in a way that would allow us to attribute (the firm's avowed goal for the program of) increased productivity to it. Nor does the training appear to have been a route to mobility within the job system. Those whose jobs changed the most in the transition--control room operators--developed their computer skills as an organic part of translating pre-existing skills into the automated environment. Early on, they conferred with programmers during the design period; later, they went through simulations of the control room "interface," learning the graphic screens and rehearsing responses to practical work situations. Further, according to Barb, those employees who were most involved in the learning center, the packers, have jobs in the new plant which do not afford the opportunity to capitalize on the training. Indeed, their jobs are more physically demanding now than they were downtown, and most saw the training as a vehicle for increasing their chances in the external labor market. The pattern overall, then, is of greater continuity of skill demands across the two plants than had been anticipated or claimed by Ace managers.

Clearly, the learning center could have been better tailored to work problems and contexts, in keeping with the firm's portrayal of workers' role in management teams. But, Barb's offer to conduct the necessary job analyses was not taken up. Still, the emphasis on basic skills prior to the move did have the effect of intimidating employees, introducing criteria for regulating job rights which undercut the collective ones spelled out in the labor contract. At Ace, the import of basic skills for the plant relocation was ambiguous simply because it was not clearly or concretely connected, either to jobs tasks or to supervisory relations. More salient to workers was the other theme in the company's public rhetoric: team management.

The Rhetoric and Promise of Team Management

Few topics in the American workplace have received more public and academic attention recently than that of managerial reform. The inroads of foreign industrial competitors, especially the Japanese, whose dominance of the U.S. market for cars and electronic goods reached its peak in the 1980's, made the issue of "quality circles," "team management [TM]," and similar small group models a focus of public interest. Cole (1979, 135) provides a concise definition of quality circles, based on the Japanese case:

> A QC is a relatively autonomous unit composed of a small group of workers, usually led by a foreman or senior worker, and organized in each work unit. It is in principle a "spontaneously" formed study group, which concentrates on solving job-related quality problems, broadly-conceived as improving methods of production as part of company-wide efforts. At the same time, it focuses on the self-development of workers. This includes: development of leadership abilities of foremen and workers, skill-development of workers, identification of natural leaders with supervisory potential, improvement of worker morale and motivation, and the stimulation of teamwork within work groups.

This description contains a basic paradox of QCs and other team-oriented work groups: though ostensibly cooperative and "spontaneous," they also impose new demands of "self-development" on workers, to advance "methods of production" that are not themselves subject to debate. Thus the means, or tools, of small group processes--heightened worker involvement and imitative--are divorced politically from their ends or object, which is the overall production process. This is true regardless of whether the groups' efforts are connected to material incentives because, as my research reconfirms, industrial workers want and need to be functionally-interdependent and to exercise craft skill.

Because small group models have taken root in countries (including Sweden and West Germany, along with Japan) with varying labor histories and cultures, their "translation" across national contexts reveals more about those contexts than about small group models per se. For example, Cole (1979) shows that the simplistic, idealized image of the Japanese work ethic, held up as a standard by many American owners and managers, obscures national patterns like cultural homogeneity and personal identification with organizational goals which have less relevance in the U.S. Consequently, it is important for researchers to study the cultural and political forms TM has taken in American firms against the backdrop of persistent patterns of industrial conflict in this country. In this connection, drawing on his comparative historical analysis of the diffusion of small-group activities in several countries, Cole concludes that

> [academic and consulting] organizations that had small-group activity as part of their agendas were often active exclusively in the unionized sector of the economy. As such, they found that doing something about the strong adversarial relationships between management and labor took priority over small-group activity per se. Consequently, they never "got to" making small-group activity a high priority" (1989,151).

This anticipates my argument about the case at hand: that Ace managers used the promise of supervisory reform--and the assurance of job security--to disengage the formal and cultural machinery of labor conflict, but failed to pursue it in practice once labor and skill had been appropriated in ways necessary for them to start-up the new plant.

Generally, it is telling that the prominent organizational solutions to eroding U.S. industrial performance have emphasized workplace culture rather than corporate behavior. Indeed, there is strong evidence, offered by Bluestone and Harrison (1982) among others, that "deindustrialization" in the U.S. in recent decades has been structurally rooted in increasing international mobility of capital, attempts by American corporations to undercut labor costs and union power by exporting jobs abroad, and in comparatively low investment in domestic plants and equipment (in favor of profit-taking, mergers, and acquisitions).

On the other hand, reforms that connect managerial styles to increased productivity have the practical advantage of seeming to place solutions in the hands of individual firms. This premise, however tenuous, has been the basis for a widespread ideological and entrepreneurial movement involving firms, consulting agencies, and government (Cole 1989). Moreover, quasi-egalitarian small-group management resonates with American cultural themes of workplace democracy and entrepreneurial initiative. And, at a time when layoffs and "downsizing" tend to *intensify* factory work, and the buying power of those who are employed has stagnated since the mid-1970's (Levy 1987), it is understandable that managers try to placate labor at the point of production.

I grant that some of the scholarly research on TM (e.g., Grenier 1988) has been strongly pro-union in its stance, but this has been a corrective to the traditionally managerialist perspective of "mainstream" studies of work organization and worker performance (see Fischer & Sirianni 1984). Reviewing what has become a large body literature and case studies on Quality Circles and TM, Giordano's (1992,200) conclusion is that "...rather than being a transformation of labor relations toward democratic participation, [Q.C.s] are managerial strategies to create a decentralized organizational structure to facilitate workers' cooperation with management's goals." Similarly, concluding his ambitious comparative analysis, Thomas writes that,

> ...new technologies as well as new approaches to social organization may, as the technological determinists argue, emerge as exogenous developments, but *they will attract attention [within a firm] only to the extent that they can be assimilated into an interpretive framework already resident in the organization* (1994, 207. Emphasis in original).

Burawoy (1983) forcefully argues that *hegemonic factory regimes* are characteristic of advanced capitalism, in which regulation by the state (e.g., the minimum wage and OSHA legislation) and by unions curbs the direct, coercive power of managers. He writes,

> Now management can no longer rely entirely on the economic whip of the market. Nor can it impose an arbitrary despotism. Workers must be persuaded to cooperate with management. Their interests must be coordinated with those of capital. The despotic regimes of early capitalism, in which coercion prevails over consent, must be replaced with hegemonic regimes, in which consent prevails, although never to the exclusion of coercion (1983,590).

In a case study I cannot resolve broader debates about the impact of team-oriented management on labor relations. But, I can offer a portrait of the cultural and political meaning of TM at Ace, and of its role in the relocation. More important, for me, than reiterating the finding that managers often regard TM superficially and tactically, is to explain how it was so deeply and authentically embraced by many workers at Ace as a principle for governing work.

Team Management as a Rhetorical Campaign at Ace

In the last chapter I wrote of punitive supervision as the main cultural *barrier* to workers' close consultation with managers. Here, I argue that team management [TM] was the main "positive" cultural *inducement* for this consultation. Introduced at a time when workers feared layoffs, and when practical preparations for the new plant were altering work routines and relations, TM gained more cultural momentum and credibility than would have been possible otherwise.

I treat team management [TM] here as a rhetorical frame because it was in that way that it had social reality and consequences in the case at hand. A more accurate way to discuss TM is as a *rhetorical campaign*, since managers controlled its content, timing, and extent of institutional support. I call the campaign rhetorical because it was never embodied in routine, indigenous workplace practices at Ace. However, to reduce TM to rhetoric would be superficial, and might obscure how the promise of TM drove the hopes and actions of people in various positions.

One key to the *projective resonance* of TM at Ace is that management planners presented it in terms of a dichotomy, encompassing all work tasks and relations, rather than as incremental or specific to particular work tasks and relations. This dichotomy, metaphorically, divided the workplace into a binary classification system denoting functional, historical, and moral dimensions of work. In October of 1990, before my in-plant field work began, my colleague and I were invited to an orientation in which Jim Michaels, the coordinator of the new plant project, discussed the firm's plans and goals for the relocation. We were joined by the plant manager and the director of human resources who had been through the orientation and seen it presented publicly to production workers. They were there to answer our questions, and to learn more about our goals as researchers.

As he spoke Mr. Michaels gestured toward a chart from an overhead projector, which I reproduce below:

FACILITY DIFFERENCES

CURRENT FACILITY	FUTURE FACILITY
Individual Assignments	Work Group Assignments
Supervised	Coached
Paper System	Computer System
Trained for Specific Function	Cross-Trained for multiple Functions
Directed Tasks	Self-Planned Tasks
Data Collectors	Data Entry & Data Interpretation
Information Provider	Decision Maker
Physical Verification	Computerized Verification
Samplers	Testers
Quality (lab controlled)	Quality (self-controlled-lab audit)
Old Technology	New Technology
Problem Identifiers	Problem Solvers
Bag Count System of Weight Control	Actual Weight Control (load cell/mass meter)
Physical Implementation	Computer Implementation

Physical Transport of Materials	Pneumatic Transport of Materials
Primarily Mechanical Equipment	Mechanical & Electronic Equipment
Reactive	Proactive

Beyond its concrete, practical challenges, the new plant stood in for much broader, global changes in production, about which the company president had spoken at the holiday party and which the chart now crudely reflected. As I'll show, the chart's dichotomy--even its language--was echoed as I spoke with workers in the field. While talking about issues ranging from the new plant construction and layout to changes in jobs and interdepartmental relations, Mr. Michaels matter-of-factly placed them in the context of this overarching dichotomy. In addition to signifying a set of work/life changes, the chart promised greater *alignment* between its various instrumental tasks ("physical verification," "sampling," "collecting data") and its collective and discretionary dimensions ("work group assignments," "self-planned tasks."). Although seen by managers as an innovation, the emphasis on teams was, for workers, validation of the informal networks through which they had always learned and exercised job skills.[2]

Along with changing functional relations between jobs--cutting across the salaried and hourly ranks--the chart signified a pseudo-historical shift toward modernity and rationality, and a moral one, from petty authority relations to mature, efficient cooperation for the benefit of the company as a whole. As Michaels explained Ace's relocation, the new plant was both a cause and a consequence of these basic changes, which appeared to "hang together" in his mind as a single configuration of technical, organizational, and human imperatives. During the 90-minute orientation, Mr. Michaels reinforced his sense of the interdependent relationship between the new automated system and the initiative it would require of workers.[3]

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[2] Readers should recall here my discussion in chapter two of expertise and a discretionary division of labor among maintenance workers, and of shop floor innovations in response to frequent changes in the production schedule.

[3] Thomas, who studied technical change in a range of settings, writes of organizational "renewal" in order to

Michaels spoke of the untrustworthy, "sluggish" system of responding to spills and other problems in the downtown plant, and of his fear that

> under those conditions, [when a problem arises] the production people either just report it to the supervisor or maintenance, and wash their hands of [the problem], or they just would rather not know about it. That would be totally unworkable after we move, because the problems have to be detected and addressed very quickly. At the very least, they [production workers] have to make the right decision when there's a malfunction; later on, they'll be increasingly involved in capturing data and testing the product for compliance with quality control considerations. [paraphrase of field quotation 9/28/90]

When referring to team management, Michaels did not speak directly or at length about it as a practical organizational concern. Instead he endorsed the broad concept of TM and reported that a local business consultant had been hired to give "seminars" to the production staff.

Though I was not privy to these meetings, I heard about them during subsequent field periods. Also, after production had started in the new plant I learned that the team meetings had raised workers' expectations, and that there

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capture this phenomenon [1994, e.g., 198-201].

was acute disappointment when team principles had not been applied during the demanding ordeal of the start-up. Also, I have studied company documents and seminar "handouts" from this earlier period (between mid 1990-to late 1991) when team rhetoric and activities were in full flower. My goal here, then, is to reconstruct the role TM played in inducing workers' consent, drawing on these documents and on field observations and interviews throughout the case study.

Earlier, I argued that team management "depoliticized" labor relations during the skill appropriation phase. This is a peculiar claim, since TM appears directly to address decision-making and the distribution of power. But, in practice, it served to neutralize the existing, formal structure of labor conflict, and introduced principles and goals that were so broad that they couldn't be articulated into the formal structure. In the absence, then, of a way to "repoliticize" labor relations according to the principles of TM, its role was to displace the collective rhetoric and terms of conflict, leaving behind others that were ambiguous and individualistic. The critique of hierarchy implicit in this rhetoric made no direct reference to contractual rights, and so allowed everyone involved to project their own image of the future; various groups could and did read the same rhetoric as either transcending or repudiating the firm's history of labor relations. One handout, entitled "Team/Ownership," defined several basic principles underlying TM:

Team is two or more individuals working together to complete a job

Each member of a team brings to it certain skills

Synergy are (sic) created by teams

It is OK to disagree. Constructive open communication is encouraged

Ownership is acceptance of responsibility for goods or tasks

Expect high quality on time from your suppliers and send high quality on time to your customers

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The very generality of such statements hampered their acceptance by workers, who lacked a clear sense of how the principles would be applied in everyday life and who had, in any case, been disappointed in the past by similar supervisory "gimmicks" promising increased worker input. Another in the same series of seminar handouts bears the heading, "Historical Perspective." In it, there is a partial acknowledgment of that contentious past, presented in the context of gradual reform in response to external changes in industrial competition. It read in part:

Historical Perspective

Early 1980's techniques	-	*Statistical Process Control (SPC) introduced into drop depositing area. Charting utilized to monitor/control drop count. Moderate success.*
Late 1980's	-	*Weight Control Program introduced to retail packaging. SPC techniques utilized. Good success. Overweight, product give-away reduced.*
1987/1988	-	*Ace Commitment to Excellence (ACE) multi-discipline groups. "Quality Control" type groups. No control for problem-solving within one area. Not focused. Limited support. Program failed. Lunch room improved.*
1988/1989	-	*Culture Change--Initial Stages Employee Training:* *'The Challenge of Change'* *'Team Building'* *'Communication Techniques'* *'Motivation/Leadership'*

		Educational/skill assessment and training of basic math, reading, and writing begun;
January, 1990	-	*Advent joined Ace with two initial trial areas: North Refining unit and bar line moulding area. Training in problem-solving techniques; basic SPC; team-building; Process Improvement Teams (PIT's) formed. Responsible for and focused on production areas and problems. Excellent success.*
January, 1991	-	*Quality Control, R&D receives Total Quality Management (TQM) basic and advanced training. Production department has 13 active PIT's, meeting & resolving problems within their focused areas. Employee educational training continues; computer training begins.*
March, 1991	-	*Complaint Management System introduced problem-solving techniques to department managers outside operations group.* *Monthly meetings established with a varied group of managers to drive information into their own PIT's.*
May, 1991	-	*Production personnel are 100% trained; Quality Control and R&D personnel 100% trained. Maintenance personnel supporting activities and are in initial stages of formal training. Processes are coming under better control. Charting is utilized.*
July, 1991	-	*Vendor Assurance Program is formalized*
August, 1991	-	*Liquor Plant control system review*

October, 1991 - *New plant transition meetings. Chocolate plant control system review.*

December, 1991 - *Training starts at the new plant. Liquor plant simulation.*

Managers responsible for "special projects" presented this account to groups of workers at training seminars during 1991. As a history of the firm's movement toward managerial practices said to culminate in the new plant, it was more controversial than its bland language indicates. During the period it covers, there had been bitter contract disputes, expansions of punitive supervision (such as a tightening of the "point system" by which workers can be suspended or fired for lateness or absences), and investment by workers in several reform programs that had failed due to indifference by shop foremen and managers alike.

Still, as rhetoric, the handout's revisionist history was powerful for several reasons. First, it acknowledged this organizational history and conflict with some candor, for the first time making them subjects of public discourse. Given a tradition in which such topics had previously been broached only in such partisan forums as union meetings, this was significant. Second, the trajectory of change suggested a convergence between team-oriented practices and overall organizational goals (e.g., closer cooperation between quality control and shop floor personnel to resolve customer complaints). Also, workers suspicious of the firm's commitment to TM and looking for direct involvement in production decisions were encouraged that the increasing success of production teams was linked to their "focus on specific areas and problems." And, third, workers were alert to the message that the same training agendas and procedures they faced in the factory were apparently being implemented as well among salaried employees. This point gained credibility in public memos such as this one, which the vice-president for human resources wrote to introduce the larger research project through which I got access to Ace.

> *While most of us are preoccupied with our own role in the company, it's important to remember that we are all facing changes in the substance of our jobs, and in how we work together with one another. All of us are in a learning process. Production workers will be dealing with new, computer-controlled technologies which will require them to accept greater responsibility for their work; clerical, managerial, and administrative*

> *employees will be adapting to the "Business Information System" in which the sharing of information will be much more decentralized and efficient. In both cases, these changes reflect the changing face of the workplace in the U.S., and there is intense interest in many quarters in gaining a clearer understanding of how such changes are adopted. We at Ace are confident that our employees are going to rise to the occasion and, perhaps, by allowing our transition to be studied, we can provide an instructive example for firms throughout the country and overseas.*

This theme of common purpose was no less salient for those supervisors who supported the idea of team management. During my first field period, a young supervisor sought me out, offered his help in the study, and explained:

> I can see you're getting a tour from Wayne Bauer [a maintenance electrician and senior union steward]. That's great, because he's an excellent guy. We work closely together. You probably have seen already that there are two camps, so to speak, about the team concept. Some people don't understand yet that this is coming, and that it's going to change totally the way things are done around here. To work, it's going to take everyone working together in a cooperative manner. It's not like just 'cause we're [supervisors] wearing white shirts that we have all the answers and the others don't have good ideas. Some people just won't accept this--workers and managers; some will refuse to change, will fight it every step of the way. But there's enough support on both sides to make it happen, and that includes from on top. [field quotation: 12/12/90]

There were other supervisors who were prominent in translating and exemplifying the team concept during this period. They tended to be younger, college-educated men who had been hired as foremen "from the outside" rather than from the production ranks as was true for many of their older counterparts. Hank Wheeler was a third-shift supervisor in the moulding and packing department. Quiet and low-key, he was respected by his employees, including the majority who were African-American, for his unobtrusive style. As one moulder explained, "Hank treats you like an adult. Unless I have a problem on my shift and call him, I won't even see him more than a few times per shift. He's not looking over my shoulder; he trusts me to get the work done as I see fit." Wheeler was among those supervisors who met with workers in "Performance Improvement Teams" in 1990; these groups were touted as precursors to the broader adoption of work teams promised after the relocation. In his small office, where he met with workers to discuss the daily production schedule, I noticed the following handwritten note on the bulletin board:

<u>Ace PIT Teams</u>

> *Millions of dollars of equipment and facilities are only as good as the people using them. Human creativity and inventiveness greatly expands (sic) the effectiveness of any equipment of process. By using group dynamics such as P.I.T. teams we further enhance this power. By finding improved ways and means of operation, we can insure our customers of top quality products that are produced in a timely fashion.*
>
> *Hank Wheeler (10/12/91)*

Expressions of this kind were important as signs that TM was not simply an orchestrated campaign, imported from outside the firm but, rather, that it had supporters willing to lend their own voices and credibility in its name. Because the rhetoric of TM largely lacked concrete referents, support from people like Hank Wheeler buttressed those themes which workers associated with "good management" in the old plant: respectful relations across status boundaries, centered on solutions to production problems. This theme of good management, and the ringing yet vague message in which it was contained, are captured in this training handout on the role of computers in the new factory:

CIM (Computer Integrated Manufacturing)

CIM (pronounced sim) is more like a philosophy than a technology. It does however heavily utilize computer programs. Its purpose is to communicate, in the same language, between people, departments, and machinery. It allows everyone and every machine to talk with one another through a common data base. It allows management and the shop floor to follow the product as it moves through the manufacturing process, from the customer order through the shipping of finished goods. Anyone who needs to know the status of any order or material at any time has direct access, through a computer terminal...The CIM system, however well-designed, is only as good as the people who use it. If they are more interested in controlling their own little empire than fulfilling the customer's needs and satisfaction, or blaming others for problems, this system will fail as badly as any other.

Against this background, management trainers then presented workers with more "practical" descriptions of how team management would operate through everyday work processes. Trainers presented this "team development model," not as abstract or idealized, but as a distillation of experience in many firms and industries over a period of years. The language in this handout is typical of many similar manuals, whether presented by managerial consultants or borrowed through other routes of diffusion. The handout lays out a model of the process through which teams are formed and operate.

Team Problem-Solving & Team Development
are Synergistic and Mutually Reinforcing

Forming:

* *Establishing base level expectations*
* *Identifying similarities*
* *Agreeing on common goals*
* *Making contact/bonding*
* *Developing trust*
* *Members dependent*

Storming:

* *Identifying power and control issues*
* *Gaining skills in communication*
* *Identifying resources*
* *Expressing differences in ideas, feelings, and opinions*
* *Reacting to leadership*
* *Members independent/counter-dependent*

Norming:

* *Members agree about roles & processes for problem-solving*
* *Decisions are made through negotiation and consensus-building*

Performing:

* *Achieve effective and satisfying results*
* *Members find solutions to problems using appropriate controls*
* *Members work collaboratively*

** Members care about each other*
** The group establishes a unique identity*
** Members are interdependent*

The process is developmental, not always linear.
Each step builds on the previous one.
Each step prepares for the performing stage.
Skipping any step affects performing negatively.
The process is situational and long-term.

(Developed by Growing Edge, Inc., from work of Bruce Tuckman & Jack Gibb. Copywrite 1990, Growing Edge, Inc., Challenge Manual.)

Again, at the same time that workers were being exposed to these generic expressions of TM, there continued to be others that were more local, more indigenous to the firm as a quasi-community. I draw here on field observations between the autumns of 1991 and 1992 (when the relocation was complete, but full production had not yet been reached).

During an afternoon break in the lunchroom, soon after the last workers had been transferred to the new plant, president Stanton appeared in shirt sleeves, to present "length of service awards" to workers marking either 5, 10, 15, 20 or more years with the company. He stood near a table bearing gifts that workers had been asked to order from a list: pen sets, overnight bags, small glass-enclosed clocks.

He began by alluding to the months of mandatory overtime workers had faced through the periods of construction and transition, and welcomed the awards ceremony as, "...a way to revive a tradition of saying thanks to those who have contributed so much to the company. This will be the first ceremony here at the Sylvan plant; it's all part of inaugurating this place as our company home." He continued, speaking about a visit to a customer, a cookie-maker in upstate New York, who had praised Stanton for improved quality control in shipments from Sylvan. Then, Stanton spoke about Ace as a community:

> So, you can see, it's a very tough and unforgiving market out there, and each one of us--more than we know--contribute to the overall fortunes of the company. This relates both to the quality of the product, and to the influence we have over one another. I've said many times in the past that we end up spending more time with one another here, as work mates, than we do with our own spouses and children and friends. I think it behooves us to really think carefully about that, to realize that we have that degree of influence and to stop and consider how it is we're affecting those people with whom we work. If we don't keep a commitment to both of these phases--to the best quality product the first time, and to our effects on one another in the quality of our working lives--we really endanger the common enterprise. I don't only mean the company, but each one of you has an important stake personally in what happens within the company.

> So, I just wanted to say a few words, so fitting when we're honoring the longstanding service of these dedicated employees. Phil James, from maintenance, Audrey Williams from packing, and Wanda Ortiz from sanitation--you and all the honorees today deserve more gratitude than the company can easily express. [field quotation: 9/22/92]

The voices which have been conspicuously absent from my discussion of team management are, of course, those of production workers. Partly, this is because my field work access was restricted to particular periods of time when the plant and personnel managers agreed to authorize and coordinate field visits. Also, because they understood the core interests of the study to be the effects on workers of "technical" change and the plant relocation, it was more difficult for me justify requests to observe activities which managers saw as peripheral to those core interests.

However, there are several reasons why I do not believe that the paucity of empirical data on workers' initial reactions to TM weakens my argument about its role in the appropriation of skill. First, workers' initial reactions to TM--which were cynical overall--are less important than the forms and consequences of their subsequent cooperation with managers to solve practical problems. Workers' responses to the rhetorical campaign I described was largely passive and speculative. One can infer much about the force of the campaign retrospectively, for instance, from the fact that workers consented--even if passively--to the suspension of the labor contract for an indeterminate period of time. Also, one can glean much about the pervasiveness of the campaign on the shop floor from the documents and statements I've presented.

Ultimately, what is important is not the reception to this campaign by the entire production workforce--for most of them it had little lasting relevance. More important is that those workers who, by virtue of experience or competitive initiative, were directly involved in implementing the automated system did so without negative sanction by co-workers, and with the belief that they were helping to bring about a lasting change in workplace relations. Thus, after dealing in this chapter with the important forms of skill appropriation, in the next I will illuminate more of the discontentment that followed in the wake of the rhetorical campaign of TM.

In this case, the situational forms--the frames of action--were defined by equal-status, process-oriented work relations promised by "team management." In the rhetorical campaign I've described, managers, whatever their degree of conviction, took on the job of altering the cultural meaning of work practices, many of which were long-established and, indeed, which they had disapproved of in the past.

The general problem, of the tension between inner motivations and their expression in socially-routinized situations, was raised early by Simmel who writes, "...when the life, which pulsates beneath outlived forms, breaks these forms, it swings into the opposite extreme, so to speak, and creates forms ahead of itself" (1950, 386). Goffman also addresses the problem, declaring his goal in *Frame Analysis*, as "...[trying] to isolate some of the basic frameworks of understanding available in our society for making sense out of events and to analyze the special [organizational] vulnerabilities to which these frames of reference are subject" (1974, 10). And, for Stinchcombe, "What is crucial about a situation...is that the same people act differently if they are inside the temporal, spatial, and communicative boundaries of the situation than if they are outside those boundaries" (1993,29). Though abstract, this helps to analyze how practical discourse previously defined by workers as supporting hierarchy was later seen as part of an egalitarian reform.

The kernel of this theoretical tradition is the importance of local contexts for understanding dynamics of meaning, agency, and constraint. Reference to "reality construction" or to "informal organization" is often made with respect to similar empirical questions, but as guides for analyzing routine gatherings, these lack specificity. At Ace, the role of TM in motivating workers to share knowledge is no less important because, in hindsight, their faith proved largely to be misplaced.

To summarize the import of this section, I believe that the rhetorical campaign of TM at Ace derived its power from a combination of cultural and technical factors. First, regardless of its acceptance as a blueprint for work in the new plant, the flurry of written and oral communication from managers to production workers contained something resembling a reflective critique of the company's tradition of labor relations. For workers this was both unprecedented and unexpected, especially so given their perceptions of vulnerability to technical change and to the increasing skill demands managers associated with the new factory.

Second, the "seminars" and other social settings in which the rhetoric was framed were also a departure from routine work situations, and appeared to embody the very principles of consultation and (at least procedural) workplace democracy managers claimed to be goals for future practice.

Third, the rhetoric tapped cultural themes that both "integrated" and transcended tensions in the immediate workplace. These tensions pitted skill and discretion against punitive management. More broadly, they were between what workers saw as irrational approaches to production and the apparent imposition of rationality (or, at least of their image of it) by new competitive pressures in industry as a whole. The rhetoric was "integrative" because it promised to bridge the informal, spontaneous dimensions of work conduct to those of formal organization and authority. As Nippert-Eng has confirmed recently (1996; and see Bittner 1983), this integration runs counter to the historical trend of work as increasingly segregated from other realms of experience. One needn't assume as universal, or positively evaluate, workers desire for such integration, but there is ample evidence here that it was a salient cultural theme. Moreover, variation in people's preference for and experience of work's integration with other realms is not simply rooted in individual subjectivity. Rather, it reflects implicit cultural patterns, and is subject to managerial control.[4] Sociological studies of industrial (more than those of white-collar) work have often simplified

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[4] For example, in corporate careers promotion often requires the aspirant to demonstrate a single-minded concern with work, to the exclusion of family and other demands. This also helps explain the scarcity of women--for whom family demands are stronger than men--in the executive ranks.

or obscured this problem.

In terms of cultural patterns, Stinchcombe (1990) argues that differences in workplace discourse, say, between blue-collar and white-collar employees, or "informal" versus "formal" organization, have often been ascribed to abiding divisions in social structure. However, he asserts that they are "...actually a matter of the style of discourse, a matter of when certain unconscious norms of switching between formal and informal modes have application. We did not understand our own norms of when we talk to people the way we talk in "informal organization" at work, and so we mistook a cultural form for a social organizational form" (1990,100). In this light, the kernel of team rhetoric for workers is not a challenge to re-orient or expand one's personal investment in work, as managers believed, but that discourses and perceptions about work which had been repressed were, after all, relevant and valuable. And, this relevance was not merely to parochial disputes over supervision, but to the societal bases of production and prosperity.

In terms of political control, workers' desire for the cultural integration of work and life can be used as a non-material resource in labor negotiations, broadly conceived. Nippert-Eng points out that, "The use of distinct framings to interpret what happens at home and work is actually key to the degree of segmentation/integration we experience" (1996,26). Whatever their ultimate goals, managers at Ace used the rhetorical campaign and social settings of team management to expand workers' perceptions of the "encompassingness" of work in the new plant, and of their roles and responsibilities as workers. Even in the absence of concrete assurances of how these new roles would be formally recognized in the future, most workers accepted the suspension of a union structure which, given the team rhetoric, now seemed petty and limiting.

Team Management and Shared Ordeal: New Plant Construction and Start Up.

Above I reported that my observations of the early promulgation of team management were limited with respect to workers' perspectives. Still, I do have testimony from workers about the period when the rhetoric of TM seemed to them most credibly to reflect the concrete changes taking place at work: i.e., during the construction and start-up of the new plant. Starting in the fall of 1991, by which time basic construction of the new facility was finished, Ace was faced with the challenge of simultaneously maintaining production in the old plant, and starting to install equipment and prepare for starting-up the new one. It was not until the end of 1992 that the entire workforce was transferred to the "Sylvan" plant. So, the ordeal of the transition lasted fully a year, during which workers averaged 60-hour weeks, faced intensified and expanded jobs and, generally, experienced what was for most an unprecedented sense of collective closeness and interdependence.

This social climate was partly a function of the logistical and technical demands of the plant move, which, despite careful planning, were chaotic, exhausting, and exhilarating. In human terms, the pressure of that year could variously be seen in employees' physical and mental exhaustion, in their family relationships being stretched to the breaking point (and beyond, as in the ending soon after of several long marriages) and, more affirmatively, in the remarkable sense of collective regard and efficacy which grows out of such adversity.

For insight into the practical and political pressures during this period of shared ordeal (Lortie 1968), I will draw especially here on the experiences of Wayne Bauer. A maintenance electrician and senior union steward, Wayne had been with Ace for almost 15 years when my research began in the fall of 1990. It was he who first introduced me to workers when my field work began, and his value to me as a "key informant" only grew during my five-years of data collection. A tall, slender man in his late 40's, with sharp features, graying hair and a mustache, Wayne has a slow, deliberate way of talking. But, despite his inconspicuous manner, Wayne's integrity and intelligence are such that he was among the most highly-regarded and respected people in the entire production workforce. As an electrician, he was constantly working with others to diagnose and fix stalled machinery; as the most able and experienced steward, Wayne was sought after by workers to discuss the gamut of problems, from friction with a supervisor, to promotion procedures, to formal grievances or threats of termination.

Shadowing him during my first week in the field, I came to appreciate that, in his quiet way, Wayne was a leader. Although, as I've indicated, the union at Ace had limited support among workers as a collective body, workers did consult with and value particular stewards who were known to be tough and well-prepared negotiators. Of this group, Wayne was the elder statesman. A woman in packing told me that Wayne's independent legal research had been the basis for several contractual gains, and a second-shift refiner operator explained that, "Even though we're supposed to go to the steward on our shift, I come in early to have Wayne handle my grievances; I would come in at midnight if that's what it took to have him. He's serious and smart."

In his position as steward, Wayne was among those called on to mediate many issues during the plant relocation. Some of these decisions involved informal concessions in which no vote was taken, and were later condemned by many workers. My point here is that, as a worker and union representative, Wayne was widely seen as a credible and fair mediator. More personally, my association with him at the outset of field work is partly responsible for the acceptance and candor that workers extended to me throughout the study.

In the summer of 1992, some eight months after his arrival at the Sylvan plant, I interviewed Wayne at a nearby restaurant. He was part of the first contingent of roughly 40 workers, sent out to help contractors install equipment and to learn new work procedures. I began by asking how work had changed, compared to his years downtown:

WB: We've been out here since November, and the work has radically changed. We were thrown--and this relates to the change in management style--out in the plant on our own. We'd meet in the morning, get broken in, and get our tasks, our assignments. We were really self-sustaining out there. And it worked for quite a while with that smaller group; we got caught up in the challenge of it, taking pride in the work, ordering the stock getting it done. This was our test of the team concept, you know, of [having] facilitators versus supervisors. One good example of our being caught up in it is that the guys would pound out 60, even 70-hour weeks on their own, because at that time they were not asking for overtime. It wasn't management saying, "Can you work Saturday, can you work Sunday, can you work 12-hours tonight?" It was just, "You guys know what to do." The guys put incredible obstacles in front of themselves, just to get that plant up near schedule. That part was real interesting.

CW: At that time, was the equipment mostly installed?

WB: Right. The first task we had coming out, after getting to know the plant layout better and getting stock ordered, was when the main contractor was ready to do I/O (input/output) checks. We had to trace power, like from the computer room to some remote solenoid motor valve, you name it. That's a massive job in a plant of that size. They needed maintenance people for hours. These [contractors] can work for 24-hours straight; they're here to get this job done and rack up the hours, so, they'd keep us late into the night. All the Ace people kind of kept each other alive; we just about forgot what our families looked like.

Then, another task was that a lot of the equipment that came from downtown wasn't new, and it fell on our shoulders to prepare the equipment and ship it out. The general contractor installed it up to a point, and then our guys had to take over a finish a lot of the superficial stuff that wasn't in the bid. Then we had to fine-tune and get it running, all the while working hand-in-hand with the general contractors, sub-contractors, and quite a bit with the software experts from Advent. We established strong bonds with a lot of other professionals, and there's not chain-of-command in that situation; it's using your knowledge to attack this major project. I'm tying all of this into how things changed from downtown. It was radical.

CW: And you also felt more autonomy from Ace supervisors?

WB: Well, in maintenance especially, it was totally different from before. It was not micro-managing. It was like, you guys are adults, you're professionals. Do it. And sure, there were times when group dynamics and fatigue had a negative effect, and some people would start to slack. Well, they'd bear down at times. By and large they left us to our own skills; they were there only when we needed them. It was just working fantastic. Then, over the next months, more and more production people came from downtown, and some conflicts arose. We had very tight quarters; we were [meeting] in trailers, where the operators worked on [computer screen] simulations and we planned our assaults with the contractors. You'd have to slop through the mud, and bathroom facilities were port-a-potties. When you crammed another 30, 40 people in there, it was strained. It was a tough situation. Most people rose to the occasion, but some complained, whined and sniveled. That's where my alter-ego as steward started to feel taxed; they were crying to a deaf ear, because we [who had transferred earlier] had really paid our dues. We said to [the complainers], "Yes, it's tough, and a little muddy, but we're all growing up a bit out here."

CW: So much was new when you arrived here--not only equipment, but also the work procedures in an automated factory. Did you get clear direction from management, or feel that you were all in the dark, so to speak, figuring it out together?

WB: We had that feeling among the people I was working with, which included management people, until more production people came out. The direction was coming from the plant manager, and to me he's pure production. I don't think he has much understanding of engineering or maintenance, but most departments don't. We're like the air-force, a support team. We served in whatever ways were needed, even when we had to burn our brains learning on the fly. Some employees that you worked with to debut something were fantastic; they put all

> the crap aside and got down to business. Others still played what we term as the downtown game, hiding behind their job description or getting or, for the supervisors, trying to save their little kingdom. We've got some people, on both sides, that's really getting with the program, and you have a percentage that just won't let go [of the downtown game].

This part of the interview reflects several important features of the start-up phase. First, the complexity and scale of the project required that the conventional division of labor and "chain of command" be suspended. Wayne reports that there was resistance, among workers and supervisors, to the harsh demands of work at this time. But, they were nonetheless subject to the contractors' authority, expertise, and schedules. And, many production workers--moulders and "operators" as well as maintenance staff--relished the freedom and independence of those days. One mechanic, who had had a running battle with the director of engineering, explained,

> Now, me and the company have are both happier; I used to rag on the supervisors like crazy, be a rabble-rouser. But when we first got out here they gave me the liquor plant and allowed me alone to prioritize and make decisions. In the past, if I needed a part, I'd have to go through [director of engineering], and then he'd translate the problem to purchasing. Or, he'd make me justify my decision. It all took time. Now I just

> get on the phone myself and the supervisors don't even have to be involved. I'm maybe one of the people who has made out the best in the new plant. [field quotation: 9/10/92]

Wayne Bauer, who had worked with this mechanic for more than ten years, singled out the same man, Paul Novak, as an example of how work conditions during the start-up period brought out best in many employees:

> You get employees away from a conflict with a supervisor, of another worker who's stifling him, and you see what they're made of. I'll give you a name, perfect example right here in maintenance--guy by the name of Paul Novak. He was stifled, held under the thumb of the dinosaur mechanics and the head of engineering; picked on and dogged to the point where the maintenance supervisor had totally lost confidence in him. Finally, out here, they cut him some slack, decided to give him an area to himself and see how he did. They gave him the entire liquor plant, and the guy has just blossomed. He's got control now, where his decisions come straight back to his co-workers and supervisor, and he's doing great. His work shows. I couldn't exaggerate his value to the company now, and they'll tell you the liquor plant's been a big success story. [field interview: 8/30/92]

I also spoke with several former refiner-operators, who described their activities and impressions when they were new to the Sylvan plant. One recalled,

> We weren't trained like the first group; they spent time doing simulations and getting quizzed about the [graphic] screens. We won't didn't have any dead

> simulations, so we had to learn a lot quicker. First, we had plant tours, getting a handle on the processing of beans from when they first enter the plant, to when the liquor is ready to be shipped out or sent to chocolate control. We spent a couple of days learning how to trace lines [transfer pipes], which we need to know, even though it's automated. We need to be able to talk to maintenance about clogged lines, and sometimes we may need to recover from a spill or something, so you need to know those lines. To help us remember these concepts, [a manager] had us make our own drawings. Some of them were terrific, like one guy's whose had some mechanical drawing. But, we all had our own symbols and diagrams; mine were filled with circles and arrows and wouldn't have made sense to anyone else. I enjoyed the learning, and the break from routine. I miss that. [field quotation: 1/14/93]

A man who had previously worked as a pumper-tester concurred in his approval of the equal-status work style that prevailed soon after the relocation. But, echoing the preceding statement, he complained about the lack of training available for workers in the second wave of that transition. We spoke in January of 1993, fully a year after the first wave of workers had begun working with programmers and contractors to install equipment and start-up the plant. After only a few weeks at the Sylvan plant, he had concluded that those "pioneering" workers had a deeper understanding of how the plant operated:

> I think the communication is a lot better [than downtown], because more things are getting talked out. I'm more in touch now with people and issues at higher [salaried] levels, and that's interesting. The work itself is in my capacity, even with the lack of training. The only thing that's new, for me, is the computer. Learning all the tanks and lines, that's a lot; but we learned that downtown, in a building that wasn't laid out nearly as orderly as this one. But I'd say--and I hope this reaches the right ears--that I hope management invests the time and money to get us the proper training they promised us. When you're relying on employees to train you, and if they haven't took any kind of course on training, you've got a problem. See, the [workers] who got here first, their training was working side by side with the programmers who developed the system. Those workers got input into whether the [graphic] screens should be changed, and their suggestions got put directly into the code, in some cases. That's what I've heard. [field quotation: 1/14/93]

Another worker, also a pumper-tester in the old plant, overheard this conversation and offered his explanation of why the training and decision-making process had been more prominent during the ordeal of the start-up:

> I think those team activities were only followed right after they got out here, trying to start production. Because at that time they had to get *everybody's* input. I've heard they often sat together, with people from all the departments, talking the same problem through from all the angles. I don't think they need that now. [field quotation: 1/14/93]

A maintenance electrician, Rudy, expands here on the argument that the close, consultative working relations promised by team management were, for most workers, restricted to the period before production started. He explained that preparing for the relocation had given him a new sense of challenge and involvement on the job, and that he welcomed the training he got from contract programmers, "as a way to learn about where factory work is heading in the future; as tired as [I] got, I liked coming to work during those months. And the programmers leaned as much on us, on our knowledge of the equipment, as we did on them." But, speaking nearly a year after arriving at Sylvan, he reported that,

> When we first got out here [Sylvan plant], we had debriefings almost every day. They took suggestions seriously, and you saw them being put into action almost immediately. That was a good feeling. This was before production started, when we were still finishing installation and tracing out power lines. But once the liquor plant was going, and we had usable stuff from the start, everything changed, and fast. As new lines came up, the idea was just get it up and running any way possible, and frustration started to build. Since then, I've seen no sign of quote-unquote team management. It's like the old days, 'cause we're on the receiving end of pressure to get everything going yesterday. What's worse is that we don't have the bodies or manpower to get it done; we've actually had a few experienced people quit because they got sick of

> the pressure. As [management] got nearer to the end of the project, the money was gone, and they were months behind schedule. So, it didn't matter anymore what we want or need. But it's really bad for morale when you're working 60-70 hour weeks, busting ass, and all you hear is how we're behind and have to get into a higher gear. After a while, you don't give a shit--come in one day at a time and deal with the chaos. But the fact is that they were able to get that liquor plant up because we were able to get a hearing and have input into those decisions [field quotation: 9/9/92].

What appeared to workers as the company's abandonment of team management, once production was started, was especially painful for Wayne Bauer to witness. As a maintenance electrician, he was subject to the same pressures Rudy describes above. Indeed, as I'll show in the next and final empirical chapter, maintenance work became more intense and stressful, and less autonomous, in the new plant than was true downtown. Beyond this, as a steward he had been instrumental in granting and defending concessions which greatly expanded managers' freedom to encroach on workers' rights. He had done so believing that it was necessary for protecting long-term employment at Ace, but also because he accepted managers' assurances that union flexibility during the shared ordeal would be rewarded with a lasting increase in workers' discretion, individually and collectively. As the management bargainers presented it, the suspension of the contract was part of a *quid pro quo*: If workers would be flexible about union rules and accept higher standards of performance and accountability, in return, they would be relieved of the pressures of close supervision. Workers had major questions about how the changes in jobs and personnel policy would ultimately be squared with the bargaining process, and with basic seniority and job rights. Some told me they believed the company might use the new plant project to bust the union, though the local was then regarded as so weak and compliant that many expressed the view, voiced here by a moulder of 8 years that, "Management wouldn't *bother* to bust the union, 'cause they (stewards) carry their water." Still, given Ace's history of labor relations, the company's demand that workers give up--even if temporarily--basic contractual protections during the move to the "Sylvan Plant," angered many; it was, at the least, a symbolic threat.

The countervailing, positive inducement presented to workers was that work would be more autonomous and cooperative in the future, and that the company was committed to providing the (voluntary) academic training said to help "vulnerable" employees make the transition. Paradoxically, this framing tended to place the burden of bringing about a more egalitarian workplace on workers' investment in the individualistic, competitive arenas of skills training and job bidding. Understandably, this tended to divert attention from the value of on-the-job knowledge, and from the union, as the instrument for protecting that knowledge in the form of job and seniority rights.

By the summer of 1992, though, as Ace managers celebrated being able finally to meet production targets in the new factory, Wayne, and those whom he'd represented, felt duped. During our 1992 interview, he said that he didn't "...totally blame management for the loss of the team concept. Some workers have refused to change, cling to that downtown game, and that perpetuates the problems." I asked him to elaborate on management's role:

WB: Somewhere along the line It [team management] just took a back seat. They fell behind schedule; they fell behind budget and it slipped big time. And they, or the ones who'll talk to me, they acknowledge that. They say, "Oh, yes, we have to get back to that." Like it's a project. They say, "We just have to survive now; we're losing money; we have the other [corporate sister] plants to contend with, because they can't pick up the slack for us anymore."

CW: Last winter, during start-up, there were those pressures too. But at that time you had a lot of communication--seminars, memos updating workers, production meetings. Are you still having that communication?

WB: No. Shutdown. Total shutdown. You see, at that time, they needed that communication. It was a very chaotic atmosphere; everything was changing, day to day if not hour to hour. They couldn't plan a whole lot. It seemed like incredible disarray for a time, and everything, every project, depended on something else, someone else. Most people worked incredibly hard, but several times we re-grouped, union and company, and talk the problems out. At that time, each side made a big effort to see where the real problems were, rather than sniping at each other, and stop major forest fires from spreading. Things got really volatile for a while; we had some supervisors cracking, I think, under the pressure. They were misquoting the team concept along the lines of "Get with the team or hit the door."

CW: Were these tensions being vented at union meetings?

WB: Yes, attendance and energy increased a lot. The steward, the business agent, we took an incredible ass-whipping. I mean, we took it bad. So, naturally we passed that right on to the company. We [bargaining committee] told the managers we had gone to the wall for them, and were now being the target for all this animosity. After some of those meetings my wife begged me to give up this [steward] position.

CW: Tell me more about the nature of the beating you were taking. For what were members holding you responsible?

WB: For being flexible. For allowing the company to bend [union] rules during the move. They were given *carte blanche* for moving people around, in terms of training, and how they delegated people to the two work sites. We [stewards] took the company message, that they shouldn't have to adhere strictly to the language of the contract, because the contract didn't fit this situation; this was a unique situation. I told members we had to be intelligent enough to realize that, if we tried to break their [the firm's] backs over this [contract issue], we'd lose in the long run. We [stewards] said, let's accommodate them now and we'll all come out with better pay and better jobs. We made management's case, and now the [workers] feel burned. It's tough to try and explain to an individual employee why you made a decision for 220 others.

CW: Tell me, more specifically, the kinds of liberty the company wanted to take. Did this involve job rights? Shift rights?

WB: They bounced employees from shift to shift at will. We gave them leeway regarding how to bring people out [to Sylvan] and then they based shift assignments on what group you were [brought out] with. But they changed shifts without even consulting the union, worse, without consulting the employee. We came back with, "What's happened with these feedback meetings, these group seminars? You're taking women who are working mothers, single mothers, and putting them on a night-shift that throws their lives totally out of kilter. You're taking people who ride the bus and putting them on nights when the bus has stopped running. You're not taking real-world factors into consideration." Really, I think they had made decisions about what people they wanted in what jobs, regardless of seniority or what have you, and that drove management decisions. When we tried as a union, or individual workers tried to get some relief, they stonewalled. It was, to us, stereotyped, old-style management. We were flabbergasted.

CW: So, are you saying that in addition to the company's rejection of team practices, they've reverted to the old authoritarianism? I don't want to put words in your mouth.

WB: No, you're summing it up pretty accurately. We [stewards] took offense, because we had offered our hand to [managers], and some of them see the world as it really is and realize that. You have others, calling the shots, who we feel are biting our hand. They took our flexibility as a sign of weakness and took full advantage. In that way, I understand members' anger.

CW: It sounds like a lot of the good will that you had before the move, the hopefulness that workers brought to it, have been undermined.

WB: At that point, it was shattered.

CW: Did you approach [the plant manager] with your concerns? He's not a company negotiator, and, because he was in the plant every day during the start-up, he must have understood the practical benefits of the team approach. And what of the [president] Stanton's role? He was a very public advocate for team management.

WB: I became frustrated with [the plant manager], because I'd tell him about the need to get the [external] TM trainers back, and he'd nod, but it never happened. I told him, "But this is when we need them most, when the pressure's really on." He sees the team concept in terms of management versus labor and, to him, team means labor wants goodies. I've discussed this with him and get the same message every time. Also, with the supervisors, during production meetings, whenever they

> felt labor wasn't giving enough, they'd say, "What about the team?"
>
> As for Stanton, he's let me down, too. I saw in the lunchroom and made a remark about the stress in the plant, about all the overtime and pressure to get production started. He seemed surprised by this and asked if there was anything he could do. I said, "Yeah, OK, I'll take you up on that. We need the team trainers back; it's chaos out there and we're reverting back to the worst part of the old ways." He said the budget was tight, that there wasn't enough money to spend on non-essentials. I told him it didn't have to be expensive, because I'd heard of a consultant at a local college that'd come in for twenty-five dollars an hour. [Stanton] had no interest. That scared me, because I thought he really believed in it, and that helped me to believe in it. He's never followed-up; I think he means to be straight, but he's simply unaware of what's happening on the floor. I think the plant manager and department heads keep Stanton in the dark, 'cause it'd be their asses if he knew that their projections and ideas were off. [Field interview: 9/9/92]

Team Management: The View from Above

From Wayne Bauer's account, it is hard to avoid the conclusion that managers used team rhetoric tactically, to expand their control over the deployment of labor, and then abandoned it once production was achieved at Sylvan. As I will argue in the final chapter, divisions emerged between production departments, such that some--the 15 percent of whom are directly implicated in automated functions--

continued to operate in accordance with team principles, while most--including semi-manual jobs, and higher-skilled machine operative positions--reverted back to the prior, authoritarian style of supervision.

Here, however, it is useful to explore the managerial perspective on the critical period of shared ordeal. As Wayne concedes, there *were* influential managers who subscribed to the team approach. And, as technicians and planners, they had a limited role in union affairs and in differentiating the implementation of TM among particular groups on the shop floor. Therefore, it is important to clarify their views on this period, perhaps to see what common ground they might have had with workers in maintaining a commitment to managerial reform. My source here, once again, is Jim Michaels, the planning coordinator for the Sylvan project.

I learned about Michaels' perspective on TM in December of 1992, in the first of two lengthy interviews, conducted three months after my interview with Wayne Bauer excerpted above. Again, because he was centrally-involved in both technical and personnel planning, his decisions and views influenced those of many others. Talking soon after the new plant had begun production, I asked Mr. Michaels how the seminars and other TM activities downtown had been applied during the intense pressure of relocating:

MM: I very much agreed with the problem-solving approach that we tried to define in those meetings. For example, what happens when you have a finished product that is inconsistent with customer standards? Maybe the product is supposed to have a darker color. You have several different potential sources for a problem, and taking a shot-gun approach--maybe putting more cocoa in the recipe--might achieve that customer's desire, but you might be upsetting other specifications of the product, which in turn could affect the labeling. Do you want to take that approach, or do you want to utilize a scientific method, collect the relevant information, and devise a more permanent solution? ...That's been communicated to the operators, and it's still on my priority list. I need to take a methodical approach to finding solutions, which isn't as quick as they'd [operators] like. The TM approach helped us to convey to production staff how their decisions ripple throughout the process.

CW: And being able to analyze the process, in terms of ingredients and overall specifications--is that an explicit benefit you paid for in automating? [JM: Correct.] When you were first incorporating the team concept, which was new in this company, what influences or models did you use?

JM: I went through a facilitator training assistant thing for quality circles. But my contention is still that a QC or structured TM approach is typically necessary only when you've got a crummy manager. If you have a manager who's concerned about his employees, communicates with them on a regular basis, you don't need the structured approach to problem-solving or to have employee involvement in what's developing in the process. Because the operators are close to [the process] on a daily basis. The supervisor is close to those people and will be hearing the various problems, and he is still the decision-maker for that work group. So, if the managers are doing a good job, the supervisor is doing a good job, the group is going to work well regardless of any structure or label you put on the system. Where QCs or TM work better, or are needed, is when you have a manager who is autocratic, who doesn't look for alternatives, or jumps to a reaction without taking input from the people with relevant experience. In that case, the structure is good because you have a better chance of getting that input. The problem is that the autocratic manager is probably the kind of person who isn't going to be receptive to input anyhow. So, if you go through the lip-service and don't validate or use that [worker] input, or just blow it off, not indicating why you made a given decision, then TM is useless, time-wasting, and is going to alienate more people than it's going to help. And you can even create more problems with a team concept if it isn't clearly delineated who the decision-maker is. Because a group decision is typically not the best decision; someone has to be held accountable. Though I believe input from a team is valuable, you have to clearly identify who the person is who is responsible for the decision.

CW: I'm curious about the broader history of and reception to TM among your colleagues in management. Were a lot of managers and first-level supervisors included in the training you had?

JM: No. Ace had started an employee involvement program, P.I.T. teams [production improvement teams]. When I was

> moved from the cake-blending facility that I'd started up, to the downtown plant, that was one of the first things they wanted me to get involved in. It was really by decree, by corporate [Worldcorp], that we start this...When I started the training I was not convinced that TM was necessary or even desirable. I came away from the training thinking that for TM to work, in the true experience of people giving input to solve problems in a specific area, is a pretty good thing. But, getting back to how Worldcorp mandated involvement in the program, what they did was take people who hadn't shared any common background--someone from shipping, someone from quality control, someone from production, from sanitation, and others--and had them working together to identify and solve a problem. Well, that's a root problem in itself: that's a task force, rather than a work group or production team. The only thing they had in common were common problems in the organization--or what they perceived as common problems--none of them having a direct effect on production or productivity. They addressed things like how often the wash rooms got cleaned, or the food in the cafeteria. A better structure would have been, say, to have all the refiner operators as a work group, dealing with everyday problems with the products. Anyway, set up as it was, I recommended that we nix TM; I didn't think it was going to fly. I came away feeling that team activities are ways to make [workers] feel involved, but don't have meaningful connections to production. [Field interview: 12/9/92]

Practical Roles of Shop Floor Knowledge: Systematic Ambiguities in Who Teaches Whom

In the months before I began my case study of Ace, a team consisting of upper-management, quality control engineers, and the plant manager had decided on basic technical objectives and construction parameters for the new plant. I have quite limited data on this "pre-history" of the new factory, and struggled at times simply to keep informed about events occurring between field visits. Clearly, tracing the history and politics determining which, among a set of technical alternatives, a firm ultimately chooses is essential for a rounded understanding of technical change. Thomas' (1994) ambitious, comparative analysis is an enormous contribution to this line of research. But his emphasis on macroscopic inferences requires him to devote less empirical attention to the how workers and managers collaborate to implement new technologies. His case-studies do reveal issues which are consistent with my focus here, however, such as the limits of managers' knowledge about the practical applications of technical options and the importance of workers' input, for example, in developing and implementing a flexible machining system (1994, 166-198).

Here, given my interest in the distinctive role of shop floor knowledge, I will gloss over other important issues, bearing on the challenges of technical change from a managerial standpoint.

Production workers' knowledge became "activated," so to speak, in three main ways: *First*, as discussed in chapter 2, production staff helped inform cost accountants and company planners, responsible for integrating production in an expanded, corporate division of labor. *Second*, after engineers had provided consultants with basic "process flow" diagrams, production staff helped to develop graphic screen displays for controlling both the liquor and refining plants. *Third*, during the plant start-up, they worked with programmers to "de-bug" transfers and sequences, further refining the graphic displays. And, importantly, the ladder logical nerve system or "code" that drives the recipes automatically, was much refined through operators' input. Having already discussed the first role in chapter 2, I turn now to the second and third.

Graphic Models and Sequences of Production

My access to people--both Ace employees and outside consultants--most centrally involved in designing the new plant was understandably limited at the outset. Then, during 1991 and much of '92, my task was to get a descriptive handle on jobs and skills in the old plant, and the planning teams were too busy to grant interviews. But, soon after the start-up began I sought out interviews and resumed a schedule of field work. Among my first interview subjects was Jim Michaels, who was the operational project coordinator for the project. That's a fancy way of saying that he had primary responsibility for carrying out plans that had been reached at higher levels. In late 1992 we spoke. I wanted to learn what roles production workers had played in the planning and construction of the new factory, and about his perspective of the value of their efforts. I also asked about the difficulties--technical and organizational--from his view, of coordinating such an ambitious project.

Though there were clearly corporate pressures to abide by a schedule that was already months behind, he claimed that Worldcorp had little technical expertise to offer. I asked Michaels whether any of his sister companies in Worldcorp had completed a similar project:

JM: Nobody to the same extent that we've automated. One of them advised us, during initial planning, to make sure we do a lot of documentation and prep work. We thought we had, but not to the extent they said we should. But that was a matter of the amount of resources available and still being able to progress with the project.

CW: Can you define "prep work?"

JM: When they developed their software, "Acme" put together, off-site, for six weeks, an operations person, a R&D person, a data processing person, and an engineering person. They cloistered them so they could develop the sequence of operations by which the plant was supposed to be designed and to function. So, you had experts from each of those disciplines that had to interface; they had their input and developed a system that was basically designed by those four people. You had those experts be expendable from doing their day-to-day activities. But we didn't have that luxury. So, that's had repercussions.

CW: Were production people involved, then [at Ace], and if so, how were they involved?

JM: Their input was utilized initially in helping assist in development of the sequence of operations from Ace's standpoint; supervisors and actual operators reviewed how they thought that sequence should occur. That was a base document with which a systems integrator developed a more detailed sequence of operations, and which programmers used for developing the software. Once the initial format was in place, we visited the systems integrator during the construction of the software, with operators, to review various steps in a kind of simulation. At that point the operators, where we thought a transfer, say, should work in a certain fashion, they had the chance to say what they'd like to see on the screen, how they'd like to be able to maneuver through the screens to get to the points where they make relationships in the process. So, they were involved in critiquing the system once it was somewhat developed, and had a limited but significant amount of input, once there was a basic concept in place.

CW: And did that involve group of production workers?

JM: It was a rotating group. It wasn't the same group of operators in each set of simulations; it had various stages of development, and we wanted to spread around the lost time from production. The more experienced operators in a particular area [e.g., liquor] would've been the first ones chosen, so they could get in as early as possible. And then, as a training tool, we utilized other operators to come up [to city in which programming firm is located] and see how it was evolving, and whether there were additional points they wanted to incorporate [field interview 12/9/92].

A year later, once the software had been written and was being refined, "live," in the new plant, I would learn that the "sequence of operations" is a rather general, even crude, guide for coordinating production lines which involve many separate pieces of mechanical equipment and must accommodate variations in which worker discretion can be exercised. Still, it is important that even this rather abstract and idealized representation of the new plant was informed by those with factory experience. Clearly, this contribution was mediated by the graphic screens which, as they developed, became the practical, operational blueprint for linking conceptions of automated processes and their implementation on the ground. It is important, too, that the visual images and text into which ideas from various participants (in whatever organizational positions) were translated, were iconic, intuitively understandable as two-dimensional reflections of the factory layout.

Ambiguity and Skill Appropriation and In-Plant Training

While managers were having intensive consultations with selected workers (mostly former refiner-operators and liquor processors), production "training" was also being done with packers and moulders. These presentations (building on film presentations and lectured I briefly described earlier) were handled by two men, a quality-control technician named Brian Heath, and a long-time plant supervisor named Larry Foxworth. The meetings were ostensibly meant to provide workers with product and plant-specific knowledge that was broader than they had been able to glean in the "simple" jobs downtown.

But, on closer inspection, the content of these meetings often seemed to be at odds with their publicly-stated purposes. Here I am interviewing Mr. Heath, the quality-control engineer. During our conversation, soon after the plant start-up, it became apparent that he was a student as well as trainer in these sessions. Because the interview conveys much about the early consultations with operatives downtown, I quote from it at some length.

BH: Overall, we wanted them to know that they do have a job here, but that they were expected to learn a lot of new things. And that covered everything from literacy, to operating the equipment, to understanding QC testing, to doing basic functions on the computer.

CW: I know you did some basic skills testing downtown. [Yes.] Did you believe there was a need to upgrade workers' general skills?

BH: That was the general thought. It wasn't my specific thought, but it was company philosophy.

CW: Did you feel that skill deficiencies were hurting productivity, or that the cost of that would be greater in the new plant?

BH: It was the realization that people had to be literate, had to do simple things on the computer, and that their jobs would be totally different than they were in the old plant. So, to ensure success, we had to go through all the basic testing and training.

CW: When you say you wanted to convey "the concept" of the new plant to workers, what was that concept, as you understood and expressed it?

BH: Basically, that people were going to have to be responsible for their own actions. That they were being empowered to do certain things that they'd never been able to do before--they'd be decision-makers; after they'd been carefully trained, they wouldn't go and ask what to do. They'd know and would do it.

CW: In setting out this new philosophy, were there outside consultants, or people from elsewhere in the corporation, who were involved in setting it out?

BH: Oh yes, we had people come in from "New Ventures," a consulting firm, and they did presentations on brainstorming problems, decision-making, taught them [hourlies] how to use flow diagrams.

CW: Did you personally have much contact with them? [Oh yes.] And in what ways were they helpful to you?

BH: Well, I'd been exposed to most of this stuff before, using statistics and flow diagrams and so forth. So that wasn't new to me. But as we went through it with the hourly employees, I got a much better insight into the actual operation of the lines and the equipment. All the new equipment, we had no idea how it'd work under production conditions. And I certainly got more insight into that from working with the operators. So, myself and the other trainers, we had to learn every detail, because we needed to know as much as the hourly employees; we consulted with equipment manufacturers, developed some manuals, and tried to lay it out step by step. So, we had a lot to learn, too.

CW: Did you see excitement or enjoyment on the part of workers during the training sessions? Aside from the stress, that is?

BH: The majority of the people were anxious to learn a new job, because they realized their future, and the company's, depended on that. Some of them did resent certain parts of it, resisted things we wanted them to do. For example, we wanted them to help prepare the procedure manual, for running the new molding line, and some of them said, "Heck, that's just like cutting myself out of a job. There are people downtown [running production in the old factory] who have more seniority, and they'll come out here and take our jobs if we teach 'em how to do it." So, we had to develop some safeguards so that they wouldn't lose their position by training someone. Frankly, some of them [hourlies] resisted opening up to me and Mr. Brown [the other trainer]; he's been their supervisor for years, and a lot of resentment's built up. But we got past the grumbling and the bitching; we specially set aside one afternoon per week, near the end of the day, where we just let them vent all the complaints, you know. They had their chance finally to vent to Brown, but he took it all in stride. He'd say, "Yeah, I've been that way, but I'm changing, and you've got change too." I think he was a great example for them.

CW: You mentioned the manuals: those drew on the experience and even the language of the production staff?

BH: Yes, in some cases we actually had the hourly employees draw the flow diagrams, identify each step, what had to happen. And in some cases they entered it into the computer [word processor] and then discussed it as a group, saying "Hey, it's really like this, you missed a

> step in the process." And, as a group, we'd then revise the manual. We also chose workers to be "peer advisors," helping others along. Like, most of the moulders downtown were basically baby-sitting the machines--they'd keep them running and avoid terrible problems, like paste running out, or running onto the floor. But they didn't understand the principles of it, like tempering, or the mechanical principles of the equipment. So, we tried to separate those who were the most knowledgeable [field interview: 7/21/93].

Roles and Perceptions of Outside Programmers

Before going into greater detail about the form this "translation" took, I need to introduce the people who worked most directly with production workers, incorporating their knowledge as the new plant took shape: the engineer/programmers Ace hired to develop the computer graphics and code which drive the automated recipe system. There are practical and political reasons why these men, and others like them, have distinctively useful perspectives on automation in industry, yet I am not aware of their inclusion as ethnographic informants in prior studies of the topic. In practical terms, they are uniquely situated to understand the relationship between managerial aims and shop floor practice, or, in the language of labor process theory, between conception and execution. Politically, they transcend--by necessity if not by temperament--those managerial assumptions and constraints that exist in the firms they pass through. They are, at once, powerful and dependent in the dealings with client firms. Their power is based on their exclusive possession of technical expertise, which firms rely on for their survival during a risky venture; still, they are dependent on personnel of client firms--at various levels--to educate them quickly about the manufacturing process at hand. In short, understanding the role of shop floor skill, both in planning and starting-up automated factories, is for these people a mundane, daily part of their own "working knowledge."

By late 1992, when I met the project team from Advent, they had been involved with the Ace project for nearly a year. It was with them that Mr. Michaels, the plant supervisor, and the operators had met to develop the sequence of operations I discussed above, and the process and instrumention drawings ("P&ID's") that are the basis for writing software and installing piping in the new factory.

Ken is an electrical engineer and computer programmer. He is "first among equals," working with two younger programmers, Alan and Shane, all on the staff of the "Advent" corporation. These men work under contract, for periods of from several months to several years per job, writing the code by which factory lines are automated. Ken is in his mid-fifties, a tall, casually-dressed man with a deep, drawling voice and a stock of colorful, southern phrases. Upon meeting him I noted a mixture of brisk efficiency and fatalistic humor that I associate with military veterans, and, indeed, learned that Ken had served in the Marines. This persona serves him well in work conditions that are virtually always stressful and hectic.

Ken is as much cowboy as soldier, which reflects a work career in which he has usually operated on the frontiers of established technical applications. Here, I am asking Ken and Alan about their experience on similar projects.

K: I started out in electrical engineering a long time ago, before integrated circuits, then went to work in a research lab. We were way advanced over that the colleges were then teaching, so in a sense I've always been ahead of the industry. I've had all the training I could find, trying to stay in front of this technology, and usually the client pays for it. I got into a lucrative position with one client, and that's all I did--evaluate systems. I went to all the newest technology schools and test sites for them, learning how to evaluate systems and start-up procedures..

CW: By evaluating "systems," do you mean automated manufacturing processes?

K: I started designing power distributions, then switched over to control panels as a natural consequence; they're the first step in automation, and then it's the elimination of control panels.

CW: Once in manufacturing processes, what industries have you worked in?

K: Petro-chemical, breweries, a couple of government projects, that's about it. Then I got into food about six years ago. My partner, Alan, he started in the paper industry, running one of the largest paper-producing machines in the world, petro-chemical, then he worked for Kodak, making film. But he's had less direct work with automation.

CW: You said that this is one of the largest-scale food processing projects you've worked on. Is that true?

K: This is probably one of the largest systems--in the number of points [specific commands] being monitored--that I know of, for this software package. And I believe we're at the upper limit of how many points a graphic and control system such as this can handle.

CW: I've seen, during the start-up, how closely you work with the production workers. How typical is that for you?

K: Oh yeah, we write most of the code elsewhere, usually with the client company's engineers who describe the process for us. Once we get into the plant for the start-up, *we deal strictly with the operators from that point on* [emphasis added]. The operators are the ones who have to deal with the system. We have a good definition of the process, but they help us refine the controls to the point where they can make it usable to themselves. And that's what management wants--to realize the increase in production they paid for by automating.

W: What role, if any, did the production people play earlier on, before start-up?

A: Companies usually assign some maintenance people to be your shadow, to learn all they can from you, but they haven't taken that opportunity yet here. Really, the formal training has been the weakest link on this job; they've pushed it aside almost completely. Now we, and the maintenance guys, are getting nervous, 'cause we won't be here that much longer.

K: But as for operators, Ace did it the proper way: they sent a lot of the operators and supervisors [to Advent], rotated them through demonstrations during the development phase, so those people knew what to expect when the system went live here. It wasn't dropped on 'em cold, and they had some limited input during the development phase. You see, the engineers can only give us an optimized overview of what they want to do. But the operators discussions with us were and are on a very detailed level, based on their needs as they use the system. A lot of the stuff they wanted didn't get incorporated, but some of it is now--now that they're actually using it, and we can see the installation and can be brought around to their way of doing things. We're faced with a lot of situations that we couldn't have anticipated; often they [operators] will find a way to work around our oversights, so we may be unaware of it for weeks. Then, they'll make the problem clearer, and we go in and solve it in the code.

CW: In retrospect, would you have preferred more input from operators, early on? Would that have saved you time and effort now?

A: It's hard to say; before start-up, you can't know the mechanical quirks of the lines, so you can't know how to make them run better.

K: See, now we have to cut off their input, so we can finish; otherwise we'd forever be trying to implement a hundred changes and ideas. We have to shut it off [operator input] during the early, development phase--incorporate some of their ideas in a broad way--and then wait until start-up to deal with finer details. During development, they saw portions of the system being simulated, and we asked them, "If this situation happens, what do you want to be able to do?" And they'd disappear and come back with a scheme that we hadn't anticipated, let alone integrated in the code. And we'd incorporate that, and it'd bring up another problem, so they'd disappear, have a conference, and come back. At some point we had to say, "Whoa, we can't do this anymore; we'll give you a functioning system, and then we can work to refine it later."

This portrait, of factory workers so intent on refining the automation that the programmers place a moratorium on their input, would hardly have been projected given the paternalistic rhetoric eighteen months earlier. Although Ken acknowledged the value of early training, this was set up by Advent (rather than by Ace), and had mostly to do with exposing the operators to simulations of the computerized work stations and graphic screens. That is, for operators, the training focused on translating existing knowledge into new textual and visual terms, rather than on production processes themselves. As for Ace's role in formal training, Ken, his colleagues, and a score of Ace employees all reported that training had been neglected throughout the period after construction of the new plant neared completion (i.e, when the workforce was divided between two work sites).

Also important here is Ken's statement that Ace Foods was the largest, most complex project he had, by then, taken on. The difficulty resulted not only from the scope of the project--the large number of "points" in the code--but also from the fact that, as costs and delays mounted, the firm had to scale back their spending on new equipment. As the new factory took shape, then, the engineers and programmers had to incorporate more of the older, mechanical equipment. Of course, the automated system had also to adapt to these older components, whose operation and idiosyncracies thus became increasingly important for the programmers to understand. One gets a flavor of the frustration among Ace managers, and of the unruly nature of the enterprise of automated manufacturing, in this statement by Chuck Pyle, the Director of Human Resources, during the plant start-up:

> Like, with these companies, Advent and others, they're learning to be experts, but at our expense. They assured us this would be operable by early July [of 1992], but here we are [in September]. It's the same with the software; we're trying to integrate a lot of different machines and systems, made by different manufacturers, and the people who we hired to do this have no experience in making this work on this scale. So, we have to pay through the nose, even though they haven't delivered what they claimed they could. You start out thinking automation is going be, what do they call it...a turn-key systems once the software is installed. But this has been incredible [field quotation 9/9/92].

In any event, I learned more about working relations between workers and consultants, and about the cognitive demands of CAM systems from interviews with Shane Dowd, another senior Advent programmer. Shane, some years younger than Ken, had university training in electrical engineering in the early 1970's. After graduating, he "grew up with the technology, from the time when computers were just entering the manufacturing environment, from electrical and mechanical devices when I was young." Like Ken, Shane's respect and reliance on production personnel is based on having had to learn, represent (through process drawings, text, and computer graphics), and automate a variety of manufacturing systems.

In the past 15 years, I've done 25-30 facilities with computer-graphic operations; Advent has gotten more and more involved in this. We did the first group of chocolate facilities, where the computer is the driving force --recipe manager, operator interface, and so on. So, this project is an evolution from a half-dozen kind of similar facilities, all within chocolate or food-processing. These are all mixing processes of some kind; one happens to be powdered biscuits, another is making printing ink. But the plant concepts and processes are the same. The Ace project is patterned after a smaller one we did, where the mouse is the click-point, in an intuitive system with pop-up windows, using MAC or Windows-type menus and personal computers.

CW: Having worked in so many firms, you've had a range of experiences, in terms of particular firms' awareness of, realism about, what automation can do for them. How would you characterize Ace's technical sophistication?

SD: I think the biggest mistake they made is making their plant and automation too flexible. It was very much what they wanted, but it certainly has added to the problems of the operating staff. Because it gave the operating staff so much control over the facility that they're more prone to make mistakes.

CW: Is that [company preference] linked to changes in product mix--more recipes and changeover?

SD: No, they've actually reduced the number of recipes--from around 2000 down to 400 or so. And the batch sizes have grown; they used to be able to satisfy their customers with 20,000 lb. batches; now, the smallest are twice that size. No, it's that the operators have more control over the equipment; they have the ability to stop processes in mid-stream and then resume them, given available supplies of ingredients; the ability, on the fly, to make modifications of the recipes. They need the operators to be able to make recoveries, to salvage a recipe if there's a problem at an early stage, say, if the fat content in the oil is out of spec. And to allow that flexibility, you have to leave, let's say, holes in the interlocking capability of the system, and so depend on the operator to make valid judgments.

CW: I imagine this issue--of the degree of operators' flexibility--was discussed early in the development of the automated system. Is that right?

SD: Yes, operators and management. They spent a great deal of time going over the screens, tailoring them. And that's where a lot of the flexibility came from. Operators had input in this.

CW: There was great concern, among management here, about what skills were necessary to operate an automated system, and whether their existing work force was up to it. So far, looking at the performance of people in the control room [during start up and early production], workers have appeared to do really well. And the concern about math and reading ability seems to have been unfounded.

SD: Yes, when they asked me, back during the conceptual work, what I thought their operating staff needed to do, I told them they needed to be able to read. The big thing, too, is a feeling for spatial relationships in using the [graphic screens]. I know a facility in the Bay Area, California, that uses a desktop computer terminal that manages their recipes, and steel-panel with lights that represents the graphics. So, it's a blend of the two technologies. And the guy who has become their best operator does not read a word of English. He's of Hispanic background, but he memorized the keystrokes on the computer, knows the numerals. It's laid out, with the light displays, in a graphical sort of way, so he could see visually, intuitively what was happening in the plant. He's their best operator. I think the biggest thing is being able to take flat images on the screen, and doing spatial relationships; being able to take those images, in your mind, and be able to follow the flow, say, of raw materials through the facility, as they pass through mechanical processes. You need to understand those processes. It's a visual, flow kind of knowledge, more than anything.

CW: That seems to hold true as well for the workers' ability to help you refine the code. [Nods in agreement.] That helps explain the fact that some of the production people you've been working most closely with, in refining the code, have, I believe, very modest formal education. For example, John and Deloris--both had a series of jobs downtown. We've hypothesized that such a succession of jobs is the best preparation for work in the control rooms.

SD: I think that's true of most all the operators; the computer is really no more than a window. The computer isn't the issue. The issue is being able to see the facility, through the images, and how they relate. Now, you will find with a computer-graphic system that there's a certain amount of text, and they've got to be comfortable with that. For example, the alarm messages [that signal a mechanical or electrical malfunction] are graphic images that blink at you, but they also provide text that summarize what the problem is. Also, as you know, the screens are color-coded, and they have to incorporate that. On one job I found out that the French-Canadians tend to be color-blind, and so we had to avoid certain combinations.

CW: Aside from the text on the screens, I wonder whether there were textual instructional materials that they studied prior to the plant start-up.

SD: Initially, there were not. They sat at the screen in a hands-on fashion; they were trained by doing. We put together some of what I'd call basic screens, allowing them to move through the system at the same time they were learning the physical plant out on the floor. They learned those relationships, even though it wasn't hooked up yet. But they got an intuitive feel for what it'd be like, say, making a transfer. We actually took the screens and matched them against the pipe flows. So, the *original staff* was trained in that, hands-on, go-play-with-it way. The second wave of people coming from downtown was trained similarly, but by that time we'd put together an operating manual. It's about 100 pages long, with screen images printed in black and white, and textual discussion, not on how the plant operates, but on the operator interface. That's been revised two or three times over the course of the project...so it has been an evolutionary process.

CW: As I watch the operators at work, they are clearly monitoring several things at once: sometimes they're confirming that the correct amount, say, of oil has been transferred; others times they're checking the availability of materials for the next job. There doesn't seem to be any step-by-step process that they share.

SD: That's true. Again, because of the graphic lay out of the screens, they're really not reading, per se. The system moves so fast, it's like a video game. You'll see them bounce through the screens [with the mouse] very rapidly; what they're doing is picking up snap-shot pictures of the plant. Perhaps that's the main problem with the graphic systems today: they can't see all of it at one time. It's more like looking through keyholes at various segments of the plant. But, as they bounce through it, they can almost grab the whole thing in one image, so to speak. They're looking for materials--tank levels--for flashing red alarms, that they have to interpret, and they're integrating this information with a constant flow of verbal information from their partners out in the plant, and from foremen or production schedulers on the phone. You'll see them talking while they're driving the recipes from the screen. Their minds have developed a series of 85 or so images--roughly the number of basic screens--and they're gleaning what's important at a given moment.

CW: There was concern, among the human resources people here, about workers' "numeracy" or math skills. You've likely heard that they gave formal testing and set up a training program. [Yes.] The operators I've watched and spoken to report needing to use less math than before.

SD: Yes, in their old plant, they'd calculate fat percentages, adjust recipes, based on changing work orders, that sort of thing, more than they do here. Here it's laid out: "These are the recipes you're going to make, and here's the target amounts of all the ingredients." Honestly, I think some of the training [the company] has done is of limited value to being a competent operator out here. They [operators] don't need to know what's happening with changes in the molecular structure of the compounds, or that in the conch you're developing long-chain amino acid strings, that the tempering units for the moulders are changing the crystalline structure of fats. Those things aren't that relevant. But [operators] at least have to know, let's call it the black arts kinds of things. I see that in a lot of food processing industries, especially those that have been around for a long time.

CW: Can you illustrate that for me?

SD: Like a miller, in milling flour, he needs to set what's called the break, or the roll distances. So goes up to the first break in the roller mill, opens up the cover, and runs his hand underneath the mill; that's the first step in breaking flour, making wheat. And the more flour you can get off on the first pass, the better the quality of the flour is going to be; that's the finest flour in the mill. And he'll learn, because he started out sweeping floors in the flour mill. Same with these [workers at Ace]; actually, it's more complicated making chocolate because you have a lot of ingredients, heat, and physical processes involved, like adjusting the refiners or recovering from bad paste. So, they've learned the intuitive, hands-on approach to the process, and the company has spent time and money giving [workers] the chemical approach, to broaden people they thought were very narrow in scope.

CW: It seems like that intuitive approach has survived the move to an automated system. [Shane nods.] I've watched many operators, for long periods, and I've seen them move through the screens and monitor recipes in different ways. It would seem hard to teach that through a procedures manual.

SD: Yes, that's true. You can move through the screens in three different ways. If you think of the initial screen, the overview screen, with the text presentation, say, of the chocolate [refining] facility, from that base menu you can get to anyplace in the system. Some of the operating staff switch between the base menu to where they want to be, and then back. You can also move through the screens through what we call the process flow, which follows material through the manufacturing sequence. And, finally, you have an intermediate step, to use an overview screen that allows you to not go back to the beginning, but to the particular step you need to check, maybe a specific transfer or the operation of a particular agitator. They use the screens, then, like pages in a book. They use the initial screen a lot because of where we [programmers] put that as a mouse

> selection point. It happens to be in the lower right-hand corner, and for most Western, reading people, that's a natural motion to end on, because we read right to left. But there's a lot of ways to read a book. [Field interview: 7/22/93]

Something all the programmers reported to me, and which I saw myself in the field, was the gratification, even joy, that control room operators had once the CAM system was responding as it was intended to (i.e., after many weeks of "de-bugging, a term which understandably is frowned upon in a food factory). Berger et al., (1973, 24-40) help explain why. In an (1973,23-40) essay on *Technological Production and Consciousness*, they argue that the fusion of systemic and mechanical thinking is a defining feature of consciousness engendered by technical production. For workers, each task or machine "...derives its complete meaning from the whole [;] it may become difficult to ascribe meaning to his units within the process unless he has some view of the process as a whole. Typically, however, he has no such view, and the end product is not available to him in any concrete experience. At the same time, because he has been socialized into the reality of the production process, he has some sense, however vague, that he ought to have a view of the whole. Thus, his own experience is apprehended by him as incomplete, as somehow defective" (1973,37). In this context, the graphical interface in an automated factory does allow for this holistic overview, as well as for remarkable coordination and control of processes which, in the past, were beyond the physical capacities of even the most skilled worker.

Conclusion: Appropriation & Information Asymmetries in Organizations

It is clear from this interview and from other evidence in this chapter, that company planners and training coordinators had two agendas that were parallel, even, at first glance, contradictory: one, to introduce a broad set of principles and reforms by which the new plant was to be run and, another, to elicit from production workers detailed information required for the operational realization of the general plant-wide strategy. Interviews with Mr. Heath, with Mr. Michaels, the head of "special projects and planning," and with the vice-president of human resources, Mr. Roberts, all contain condescending statements about the firm's need to educate workers about basic factory procedures, along with matter-of-fact allusions to planners' dependence on shop floor knowledge.

Later encounters, then, which might otherwise have been seen as evidence of the distinctive importance of shop floor knowledge, served instead merely to counter managers' doubts about workers' skill and commitment. That managers' perspectives went unchallenged was also a function of the fact that many important encounters during the appropriation phase were not (like those involving team management) socially-visible. At this time the workforce was spread thin, both spatially and temporally. Staffing two plants, during several months of construction and start-up at the new site, dissolved existing work groups and routines; and the suspension of shift rights had the same effects, even for those working in the same location.

This is not to imply that these encounters lacked subjective importance for those involved. It is true, though, that their significance and long-term consequences were perceived by the groups involved in distinctly different ways: For workers, the meetings embodied long-held hopes for fuller participation, for *partnership*, in work. Managers, daunted by the prospect of resuming production in a new plant in a few short months, sought vital shop floor input (the core concern of this chapter), and believed that through close ties with production staff they could orient and educate them about the demands of the new "plant concept." Because the meetings lacked ritual significance and definition, contradictory meanings could be and were attached to them. Greater public recognition would have committed management to the cause of worker participation.

The respective meanings attached to these consultations, and to the team management style they represented, also had a different temporal anchorage in each group; retrospective for workers, a repudiation of past practice, and projective for managers, a hedge against uncertainty and against commitment to more formal, contractual kinds of power-sharing.

That the ritual identity and moral consensus of these encounters was ambiguous is partly explained by their taking place outside of the formal roles, expectations, and routines which have defined industrial work (and, for that matter, much research and theorizing about industrial work). My argument has been that managers' perceptions of the technical demands of computer-automation, along with their belief that those demands required a corresponding innovation in human relations (team management), led them to "destructure," even if temporarily, many formal organizational rules governing production workers. These included the definition and functional scope of "jobs"; the rules by which people staked claims to jobs, such as shift and seniority preferences; the implicit basis on which relations between jobs had been legitimated, i.e. the assumption that discretion should be the exclusive domain of foremen and managers; and the usual hours, rooms, and rhetoric in which these encounters between managers and workers took place.

Who Knows What at Which Points in History?

Usually, the approach in a case study such as this, is to treat the organization as the unit of analysis. But, how is one to analyze the culture and politics of technical change in the absence of stable positions and of formal rules and interests? *How is one to study the process, that is, in a destructured organization?* What sociological constraints or metaphors apply in such a case? I believe that the dynamics of skill appropriation can best be seen by attending to the particular kinds of information needed by particular actors at critical times in the process (Stinchcombe 1990:1-31).

In the previous chapter I looked empirically at the development of skill. Patterned kinds of skill and social relations workers developed under the prior conditions *grew out of the discrepancy between those conditions and the imperatives of getting production out.* This point can be missed by emphasizing functional requirements of the organization, over the kinds of information those in various positions need, at particular times, in order to cope with their versions of uncertainty (Stinchcombe 1990:1-95).

This can also be true of micro-level studies, of networks of workplace affiliation or of cooperation. For example, in ascribing workers' actions to "informal organization" (Schwartzman 1993, Roethlisberger & Dickson 1947), one often illuminates the shadows, as it were, of formal hierarchies and rules. For example, the cultural integrity of "plant-specific skill" consists not only in particular machines and product specifications, but in organizational contexts which "deny" or ignore those skills and relegate them to bodies and discourse rather than to an explicit organizational location. Stinchcombe argues that under normal conditions this local knowledge, and the culture in which it is embedded, "is organized in large measure around an information system that is of little use or interest to anyone else and so is adapted to particular concrete features of the environment, uses an arcane language or system of notation, and resists invasions by standards from larger and more uniform information systems" (Stinchcombe 1990:81).

Under "normal" factory operation, then, such skill--part of the information necessary for production to occur--has generalized *effects* but local *sources*. It can serve production at "higher levels" without, however, having to be translated directly to other people in other parts of the company. This has political, as well as instrumental, results. Under these conditions there can be substantial independence between the public rhetorics of skill--the ideological system attributing knowledge and value to various roles--and the social relations of skill, which may include anomalous kinds of dependence on *ad hoc* local innovation.

Indeed, there is unlikely even to be awareness of the discrepancy described above (between production goals and means), under usual conditions, because problems can be handled or diffused through a sequence of more formalized contacts which, ostensibly, draw upon broad knowledge from above. And even when those in different levels of authority *are* brought together to address a problem--say, of how to integrate a piece of machinery into a production line--the problem is unlikely to be of sufficiently general scope to expose consequential discrepancies between disparate views of the overall production system. This point is borne out clearly in the interview above with Mr. Heath, who simultaneously regards his task as informing production staff of fundamental facts of production, and as mining workers' practical experience to integrate a new piece of equipment and to standardize its operation in the procedures manual.

"Ignorance" of production information will afflict those in various levels of authority in different ways. However, its practical forms are not easily tolerated on the shop floor. There, workers are on the receiving end of (often conflicting) decisions about goals and deployment of resources imposed from above, but must find routinely find ways to circumvent those conflicts and meet external standards and time-tables. The unexpected asymmetry of power which may favor low-level members of an organization can, in an analysis of conflict, be equated with the power to thwart superiors' goals. On the other hand, the same position is conducive to the development of skills which, though "situational," must be understood as part of the larger division of labor.

At Ace, for example, last-minute changes in the work schedule created "change-over" problems in the old plant; since lines were not dedicated to products, one would have to clean or "pig" them out, say, between a white and a dark product. Those in the "pump and test" positions, responsible for manually sending material through the lines, knew how to divert "paste" from holding tanks to the molding lines, so as to minimize production lost in the interim. Or, finding paste too wet to "roll out" properly in the refiners, operators had alternative ways to reduce its moisture content: they could manually add dry ingredients through "hoppers"; or alter the refiner setting, still observing product specifications; or send it to a "conch," (a heated tank with an agitator) before moulding.

There is a gap between the general, supervisory knowledge (that the paste needed to be dried out), and knowledge of the relative advantages of the compensatory measures. Bridging that gap is precisely what may be essential for an electrical engineer, working to program manual adaptations into a continuous process manufacturing line. Furthermore, for production workers, that knowledge is only part of a broader understanding. They may need to know the relative importance of particular customers, the availability and qualities of basic ingredients (beans and liquor), the quirks of equipment (refiners, moulding units, and holding tanks) and of the timing and flow of these elements. They also need to know what specifications must be met so products can be handled by the packaging and shipping departments. This defines their intermediate technical goal.

The respective value or status workers attach to particular kinds of skill is an empirical question. As Burawoy (1979) has shown, workers tend to develop local systems of value, "games" which direct their efforts even as, unwittingly, they serve managerial goals. It is also an empirical question what relation workers' subjective commitments have to those of their superiors; these may converge as well as conflict. Even restricting our attention to the topic of technical change, we can observe a range of employee responses, according to whether and how the changes 1) are seen as increasing or reducing their intensity of effort, 2) incorporate workers' input regarding the ramifications of the changes for the overall work process, and 3) impact on the social relations in and around work.

A contrast, which I developed when discussing team management and the "positive" (rather than coercive) reasons for Ace workers' sharing of knowledge, can be seen in the light of Gouldner's (1954) account of a *Wildcat Strike* at the General Gypsum Company. In his case, the technical change involved the introduction of a discrete piece of machinery (one which presses the soft rock into sheets of wall board [1954:67-72]). As Gouldner reports, this had the effect both of speeding up the line, and of making the work pace unpredictable (since supervisors didn't yet know the optimal speed of the new machine). This, in turn, increased the intensity of supervision, aimed at fixing the optimum speed as a performance standard.

Anxiety was also increased by the presence, after the change, of higher-level supervisors--"brass"--who were seen as reinforcing the stricter supervision imposed on operatives. "All of these pressures," writes Gouldner, "compelled the workers to pay closer attention to their jobs, to *commit* themselves to their work, to psychologically "participate" rather than merely be "active" (1954:68).

There is no evidence that workers were involved in discussions about how best to incorporate the new machine, nor could they anticipate how it would affect other functions down the line. According to Gouldner, workers complained that managers' preoccupation with the narrowly technical effects of the new equipment--its impact on production quotas--"distracted [their] attention from problems in the sphere of plant social organization" (1954:69).

In contrast, at Ace the nature of technical change was systemic rather than discrete; it brought about discussion of the overall production process, calling on and often expanding workers' understanding of how various processes and jobs were coordinated. Also, months before the new plant was a concrete reality, workers were informed of the impending changes and invited--at least symbolically--to capitalize on them in personally-significant ways. For example, remedial education, basic computer training, even tuition support for college work at the local campus of the state university. And, because of managements' tight rhetorical linkage between technical change and team management, there was from the outset a perceived synergy between technical changes and the social relations in the plant.

I wrote early in this chapter that the appropriation of skill at Ace should be understood as a conjunction of political interests, technical pressures, and cultural frames. Though commonly applied to historical or macro-comparative problems, researchers exploring conjunctural causation believe that "It is the intersection of a set of conditions in time and space that produces many of the large-scale qualitative changes, as well as many of the small-scale events, that interest social scientists, not the separate or independent effects of these conditions" (Ragin

1987,25). Though not commonly used as basis for ethnographic accounts, I have used this logic of analysis to relate the main social groups and activities involved in technical change at Ace. Next, in the final empirical chapter, I ask whether the shop floor input that was the basis for the appropriation of skill led, once the new plant was running, to lasting changes in the power and discretion for those who had provided that input.

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CHAPTER FOUR

REDISTRIBUTING CONTROL IN A "RESTRUCTURED" ORGANIZATION

Conceptual Overview and Chapter Agenda

In this final empirical chapter of the dissertation I follow Ace's workforce into the new factory, through the processes of routinizing production and institutionalizing labor and job policies in line with a partially-automated manufacturing system. I turn my attention, from the appropriation of workers' consent and knowledge in a "destructured" organization, to the business, once the firm had started-up the new plant, of "restructuring" the job and authority system in the light of managers' increasing understanding, over time, of technical and staffing capabilities in the new factory.

My main argument is that *the effect of these processes was to concentrate and confine the benefits of technical change to the small group (roughly 30 workers, or 15 percent of the production labor force) who occupy the "control room" jobs.* For incumbents of these jobs, the company's promises of greater responsibility and autonomy, in an equal-status work environment, have been realized. For the remainder of the workforce, however, the relocation has meant an intensification of the same tasks and routines they had before the move. In the wake of the "tide of rising expectations" surrounding team management, and given the improved fortunes of control room staff (with whom others compare their work conditions), a majority of workers have a greater sense of oppression than they did before arriving at the new "Sylvan Plant."

I grant that Ace's most basic promises were kept. As promised, they did retain the entire production workforce, and at wages no lower than in the downtown plant. Moreover, as part of a contract negotiation in 1993 (the first under their new roof), the firm complied with labor's request to join salaried employees in a 401K pension plan. Also, those workers struggling with poor reading or math performance were able, at no financial cost to themselves, to enhance those skills, perhaps in ways that transcend a narrow conception of job benefits. It is true as well that the physical environment in which they work is now safer, less taxing, and more comfortable by far than before. There are stories of individual workers who had long felt oppressed and wasted who have found new challenges, stimulation, and recognition on the job. So, while my analysis is often critical, I realize that Ace's behavior has been responsible, even enlightened, as compared to many companies.

Still, ultimately my interpretations are not bounded by norms of corporate behavior, so much as by the company's own managerial rhetoric and by considering alternate forms of work organization that would have addressed their core objectives as a capitalist enterprise, while spreading more widely the benefits of team management. My critique in this final section is also rooted in the empirical investigation (throughout this study) of the informal and mostly suppressed role of workers' knowledge in Ace's fortunes in the years before relocation.

On what basis do I interpret the experiences of various groups in the workforce? As Blauner pointed out in his landmark (1964) study, workers' relationship to the labor process, which, following Marx, he defines in terms of their degree of *alienation*, has both objective and subjective dimensions (see also Seeman 1959). He points out that, in objective terms, workers differ in the amount of power they have, to influence both the overall organization of work--the division of labor--and more immediate, substantive decisions regarding individual effort. Subjectively, alienation encompasses workers' "self-estrangement": "Particularly when an individual lacks control over the work process and a sense of purposeful connection to the work enterprise, he may experience a kind of depersonalized detachment rather than an immediate involvement or engrossment in job tasks" (Blauner 1964, 26). Analytically distinct, in practice the two dimensions of alienation are closely intertwined; fragmented work processes tend to engender correspondingly lower investment and gratification.

In this study I cannot disentangle these dimensions of work experience, nor is doing so central to my argument about the role of workers' knowledge in technical change. I will describe some important features of work-life that differentiate work groups, relate those to computer automation, and characterize in broad terms the perspectives of particular workers whose responses I found, in the field. to be typical.[1] I cannot convey these perspectives completely or deeply, even for groups that I examine directly. Instead, I will give readers a flavor of the views and language of these groups, hoping to buttress and enrich the core argument. Because of the theoretical importance of the "control room" workers, and because their jobs have been most affected by technical change, my discussion of them will be longer and more detailed than for the other groups.

In trying to use terms consistently, I have referred to managers *accessing, appropriating, and redistributing skill.* However, now I can refine my definitions: As a collective resource, skill was not appropriated in the sense of being *removed,* but was tapped and applied to solve practical problems. And, in the final phase, what was redistributed is not knowledge of production (which workers retain,

[1] The survey researcher who studied Ace during the same period as I, has constructed sensitive attitudinal measures that, along with data on work practices and wages, will shed important light on the relationship between objective and subjective dimensions of alienation. The advantage of a multi-method team in this effort (versus a single method or the aggregation of survey data) is that the attitudinal data can be interpreted in the context of local, ethnographic knowledge of the case.

regardless of their formal positions), but the authority and discretion to exercise knowledge in a particular work regime. Below I expand my definition of redistribution, as a process that was jointly undertaken by workers and managers.

In previous empirical chapters, my main goals have been concretely to describe two things: the contextual and collective nature of shop floor knowledge, and the cultural tenor of encounters in which workers' knowledge was mined and used by managers to help achieve automation. I placed these two themes in their immediate social and temporal contexts, with attention to the demands that the relocation placed on the entire firm as it was being absorbed into a larger, corporate division of labor. This second theme--the continuing role of workers' knowledge and initiative--will extend into this chapter. For example, I will discuss in detail how "control room" personnel were involved in refining the automated systems, once they were fully installed and operating, and offer informed speculation about what their future roles and value may be in a supposedly automatic, "hands off" production system. I will challenge the assertion--present in folk assumptions and in cruder interpretations of Braverman's (1974) deskilling thesis--that automated and other "expert systems," once programmed with a set of operational parameters, have somehow absorbed the essentials of human intervention and made the humans obsolete (but see Armstrong 1988). The outside programmers, being intimately involved in these processes, yet external to the firm's traditional authority system, will continue in this chapter to offer important testimony about shop floor knowledge and its role in expanding the limits of computer automation.

Despite their prominent role, workers who became control room operators were not unique in providing knowledge and problem-solving that were critical to managers during the relocation. So, I will summarize some contributions of other workers who so far have been neglected.

My emphasis, in the two prior chapters, on ethnographic description should not obscure the more general sociological problem on which, it is hoped, I have shed new light by empirically investigating shop floor knowledge. Indeed, the broader questions in this study ultimately go to stratifying effects or "outcomes" of technological change (including objective and subjective dimensions of work) within the firm. Rather than seeing the introduction of computer automation as an independent variable, with direct or exclusive consequences, I have analyzed it as the object of an unfolding and recursive process of social definition, organizational politics, collective sentiment, individual innovation, and technical constraints. Thus far, many of my questions have been "how" questions: How does shop floor knowledge develop? How was the relocation project defined so that workers overcame their distrust enough to participate actively? How were other actors, such as the programmers, involved? And how did their interactions with production workers help to solve technical problems as they arose?

But, at this point I turn also to "what" questions, concerned with the varied impacts of the relocation for members of social categories, and mechanisms of organizational closure that formalized these changes with some permanence.

Empirically, my main questions in this chapter are:

* What kinds of knowledge and discretion were various work groups able to exercise in the new plant, and how did those conditions compare with their work in the old one?

* Given that some jobs, and the overall job system, in the new plant were revised by managers to capitalize on the automated system, what have been the enduring changes among various work groups?

* Given that the definition of, and rights to, jobs in the old plant were governed contractually, how did managers either accommodate or override such constraints and, thus, institutionalize their preferences? How were those preferences expressed in terms of wages and working conditions?

* What conclusions can be drawn about the overall, aggregate distribution of workers' discretion and autonomy after the automated system was introduced? And finally,

* What were the subjective reactions of various work groups to changes in the new plant, and in what terms did they interpret those changes? What do their various responses portend for the likelihood of collective action by workers at Ace? For example, the packing and molding

department (with over 75 workers) is numerically the largest in production, and more than 75 percent of its staff are African-American. Many of these workers, frustrated by the absence of Blacks in supervision and management, interpreted the changes through a racial prism.

This set of questions implies, first, that whatever the merits of broader, secular conclusions about the impact on workers of technical change, this study has shown how varied those impacts can be, both within the production workforce, and even for particular workers over the period of the relocation. These questions invite comparisons between work groups, comparisons that I will draw in this chapter.

Tracing the development and role of shop floor knowledge has sometimes led me to focus tightly on particular actors and processes during particular periods of Ace's relocation. At times this approach has admittedly interfered with the clearest descriptive narrative of events. Early in this chapter I'll provide a summary to help readers understand the chronology and "cast of characters" in the account. In this chapter I deal with events that occurred in the two years between the autumns of 1992 and

1994. My field work and interviewing schedule was, as always, intermittent; each summer during those years I spent at least two weeks doing full-time field work in the factory, and also conducted in-depth interviews around my field work schedule. After the summary, I'll organize the chapter around the questions I posed above, reserving for a brief concluding chapter what I see as the implications of the case study for theory of the labor process and, more broadly, for a sociological understanding of technical change. In that concluding chapter I'll generalize from the case, rather than within it, as I have thus far.

Summarizing the Relocation

My involvement in the study of Ace began in September of 1990. By that time the firm had rejected options to move out of state and, concluding that it would be too costly to reproduce the skills of the existing labor force, decided to remain in their home city.

The importance of this decision should not be lost. For fifteen years, a dominant theme in research on urban inequality and on economic change more broadly has been the abandonment--both corporate and governmental--of factory production, often in cities whose economies (and urban workers) have historically been dependent upon industry. "Deindustrialization" has rightly been implicated in the growth of urban poverty (e.g., Wilson 1987), and in the wider erosion of U.S. economic stability and competitiveness abroad (Harrison & Bluestone 1982). Against this backdrop, stories of continuity in relations between firms and workers--along with their lessons about work organization and politics--have too rarely been told.

For their new plant, Ace settled on a suburban site some 10 miles from the downtown factory. Basic construction was completed by late 1991, though it took still another year before the entire workforce had moved to the new site. In the interim, particular workers--often hand-picked by managers--were involved in relocation projects. During my early field visits, upper-level managers, led by a planning team that reported to the president) were fully and visibly involved in the relocation. On several occasions, the company president and top planners addressed production workers, defined the goals of the project and linked it to a broad reform of supervision they called team management. At this point (1990-1992) plant supervisors had little public role, nor, as they complained, much information about how the move would affect them. *I have argued that these conditions combined to give the firm easier access to workers' knowledge and cooperation.*

At the same time, consultants, working under long-term contract, entered the scene and began working closely with engineers and (later) production staff to develop basic "process flow" diagrams of Ace's production lines. The programmers used these to design graphic, computer screens that production staff--in small, rotating groups--helped to revise and later used in off-site simulations of work routines in the new factory. Throughout 1992 and '93, selected production and maintenance workers collaborated with the programmers, in a style that was both casual and intense; during these "start-up" months, their main task was to refine and "de-bug" the computer-coded commands that operators use to run the Sylvan plant. *I have treated this period as exemplary of the appropriation of workers' knowledge.*

As the consultants completed their work, the plant supervisors were re-appearing as important players, though often in roles that were new to them. The need to coordinate work across departmental lines (in line with a new on-line "Business Information System") occupied the supervisors in the highly-automated departments, at the very time when the rationale and expertise for more traditional, direct supervision had been displaced. In departments that were little affected by automation, many supervisors, still feeling vulnerable about job security, reverted back to traditional, authoritarian behavior.

I'll deal below with the process and implications of personnel selection and "sorting" during the relocation. But, note here that the process of relocation actually occurred in waves, with some workers--even those in a single department--arriving many months apart, having distinctly different exposure to, and roles in dealing with, problems attending the technical transition. Readers will recall that it was because managers wanted a free hand in deploying labor that they got agreement from the union stewards to suspend the contract; otherwise, workers would surely have resisted these quite disruptive changes in their work-lives, on the bases of job, shift, and overtime rights.

In the fall of 1993, management and labor negotiated a new, four-year contract. In conjunction with the usual bargaining over wages and benefits, the contract was the occasion for imposing a revised job system, and for addressing personnel changes that occurred in the absence of contractual governance. *In this chapter, I will show that the redistribution of workers' knowledge was not merely a function of the new technical system, but also of organizational strategies that formalized (bi-lateral) job selections during the transition.*

The "transition" at issue extended from the beginning of the new plant's construction (early 1990), through the first year or so of start-up and production (in late 1992). The first contract negotiated after the move was ratified in late 1993, meaning that the formal organization of work was in flux for several years. During those months, important preparation for the move occurred at the downtown plant. There, some workers were chosen to help develop and refine the graphic display screens from which operators drive the system. Others had been assigned to run an integrated refining line that was a prototype of the much larger, computer-controlled refining lines that are, in effect, the main arteries of the new factory. Also, excepting those in the more manual jobs of packing and sanitation, workers had basic training in statistical process control (SPC) and, for maintenance staff, in ladder logic and trouble-shooting in computerized factories. Some of this, like the SPC program, was formal classroom training outside the production schedule, in which the firm invested a significant amount of money. But much of the training, as with maintenance staff, was informal, on-the-job, gained by their working closely with the contract engineers and programmers to install and start-up equipment. When discussing authority relations and the appropriation of workers' knowledge, I've already alluded to the casual, equal-status tone of this collaboration. But in this chapter I'll better illustrate the content of this work, which both drew on and increased the stock of knowledge among maintenance workers.

During the transition, workers prepared for the move in various ways I've touched on: some attended the basic skills workshop at a local technical college; many had seminars on team management which were held by outside consultants; and, as described, workers gleaned what they could from occasional presentations by company planners, about general principles of computer automation and how they would be applied to Ace's product lines. So, for roughly two years--between fall of 1990 and early winter of 1992--workers' roles and routines were changing, in ways that varied a good deal across individuals, and which (at that time) had no clear or specific relevance to the long-term reorganization of work that would culminate in the new plant. So, in the absence of formal, contractual rules, this activity was jointly determined by managerial choices (e.g., of which particular operators would take part in software simulations during development), and workers' voluntary choices (e.g., to "bid" into newly-defined jobs, or to sign up for overtime during which informal training with outside programmers took place).

Whether by managerial design, or because of practical demands, the long time span and staggered schedule of workers' assignment to the new plant created enduring cleavages between workers. This was due partly to the disruption of routines that had long organized work and sociability in the old plant; and partly to an individualistic ethos that followed the suspension of the traditional job system and resulting uncertainty about positions and selection criteria in a new one.

Many early activities contained projections into the future, such as when maintenance workers met in teams, in the belief that this (rather than tasks being delegated by the department manager) would be the practice in the new plant. Other opportunities involved new leadership roles; as part of the basic skills campaign of 1991, supervisors recruited "peer advisors" who, having invested in the training, gave information and moral support to fellow workers. These are among the semi-voluntary roles that workers played during the two transitional years. These activities were not narrowly confined to job descriptions, and they lent credence to promises of team management.

In early 1992, the first group of workers arrived at the new plant to help with the start-up. This group included maintenance staff, who helped install and test equipment, and others who --either through bidding or managerial sponsorship--were in line to work in the control rooms. During that year the workforce was split between the two plants, as a reduced staff tried to meet production orders from downtown, even as, all around them, equipment was being either discarded or packed for the move. In December of 1992 the last wave of workers arrived from downtown. Because of problems with the automated systems, however, it was some months before the firm was operating anywhere near capacity.

Earlier, I discussed the suspension of the labor contract, why managers saw this as necessary, and the resentment expressed by workers who concluded that their flexibility had been unfairly exploited by the company. Clearly, once the labor contract--workers' instrument for expressing collective interests and voice--was suspended, many workers saw and pursued individual incentives and opportunities presented by the new plant project.

These incentives were not simply, or even primarily monetary. Indeed, workers didn't know whether these activities would translate into different jobs, nor whether the changed jobs would bring higher wages. Some projects allowed them to apply, in new ways, knowledge that had previously been tacit. For example, Corey, a senior moulder, agreed, when asked by the quality control engineer to write a procedures manual for a new piece of equipment. As he explained to me,

> I don't see it as doing [the company] a favor. In the long run it'll help me--that is, if the other operators follow the guidelines. I was one of three people who helped install and set up the unit, according to manufacturer's spec's, and then I've had several months of running it since. I don't like someone with maybe a week's training even touching it. That will only increase the downtime, and I'll get calls to clean up their messes.

In chapter 2, I discussed accessing skill and the early emphasis on team management. I argued that workers defined their cooperation with managers in terms of collective interests. True, after the plant move was announced there were residual fears about layoffs, despite the firm's assurances that "everyone is welcome." However, more important than this threat, I believe, is that workers saw their efforts, their responses to managers' call for sacrifice, as helping to bring about more independent involvement in work. It is important to add, however, that in a "destructured" organization, workers' efforts (e.g., to help develop computer graphics, or to be peer training advisors) were not linked with formal job status or wages. That is, not being connected to the labor contract--or to any alternative, public procedure--they were not a basis for strong competition between workers. No doubt, some workers took on these assignments with a hope that, later in the new plant, they would have the approval of superiors and be well-positioned for newly-defined jobs. But there were no guarantees. Most workers believed that, after the move, traditional job and seniority rights would be reimposed, a belief reflected in the defiant phrase I heard often at the time: "Seniority Rules."

Because the contract was suspended for such a long period of time (roughly two years), and because workers were deployed in two plants, significant differences arose among workers in terms of training and experience. This led them, in turn, to take different views about whether or how personnel changes instituted during the transition should be formalized once the contract was re-imposed.

My point is that workers' interests evolved in ways that, like managers, were by no means monolithic; and, that those cleavages that did emerge are important for understanding workers' political and social responses to the new plant project: Changes in work roles and routines which for some workers were a nuisance to be grudgingly tolerated, presented, for others, opportunities and benefits that they wanted to preserve. Those in the latter group do not define the situation in such a mercenary way; rather, they emphasize the energy and ingenuity it took to succeed in a trying and often chaotic situation. They represent a tendency that Weber attributed more generally to status communities: an attempt to achieve *closure*--social boundaries that formalize and justify advantage (Parkin 1982; Gerth & Mills 1946). Changes in authority that took place in the new plant were, then, a product both of organizational politics and individual choices.

Job Bidding and Re-Sorting Personnel

A telling sign of the importance to managers of shop floor skill, especially during the technical transition, was their care and sophistication in gauging the abilities of particular production employees and involving them in practical roles. I have discussed at length the collective nature of workers' knowledge. But, as in any workplace, there were particular Ace workers who had shown themselves to be especially articulate or facile in applying work experiences to solve production problems. As it turned out, there was strong consensus in evaluations between co-workers and managers about who were, say, the best moulders, liquor processors, or machine "set-up" people in the plant. When, for example, the time came for Ace to send the first team of workers to the outside design firm to offer comments on prototypes for the graphic screens, I heard no complaints of favoritism; several commented that it was "smart," or "made sense" to send those workers since they were highly-regarded throughout the plant. Likewise, in a conversation with the plant manager, he conceded that there had been "a few surprises" regarding performance in the first cohort of control room operators, but he claimed,

> Overall, our bets came in almost every time. Some [workers] came out as shining stars that were marginal employees before, who became very good employees once they moved out [to Sylvan]. These were people we knew to be good, but [who] didn't get along with foremen, or had some problem. Other people we thought should have performed better than they did turned out weren't team

players. There were more surprises on the positive side.

It is hard to determine whether this nuanced appraisal of production workers by mid-level managers was a product of the relocation, or if it had long been part of the latters' working knowledge and was simply at a higher premium during the transition.[2]

Evaluations of workers' ability were partly filtered through plant supervisors, but, as a group they were not wholly reliable sources. Actually, the task of selecting and involving particular production employees in relocation projects was often accomplished despite, rather than because of, the input of plant supervisors, however aware they may be of the abilities of particular members of a production department. For some supervisors, relationships with the ablest workers were contentious because the latter tend to be confident in their own judgement and so less accepting of authority. Indeed, several of the workers now successfully assigned to the control rooms had had long histories of

[2] I presented evidence in Chapter 2 that the purchasing manager and production scheduler had long had interdependent and preferred working relations with particular hourly workers.

conflict and of filing grievances--a fact to which managers now point with pride, as evidence of the effectiveness of their personnel reforms. Their pride is not without justification; the group responsible for planning during the relocation (including a vice-president for human resources, the plant manager, and a quality assurance engineer) proved to be astute, both in their assessments of ability in the workforce, and in resolving organizational barriers to sorting personnel in order to assure a smooth transition and efficient operation in the new factory.

The awareness of workers' individual strengths among upper-level managers is striking partly because of their rhetoric (during the earlier phase of accessing skill) about workers' *deficiencies*. Managers responsible for adapting personnel policies to the automated system were uncertain about what the new jobs would demand and, understandably, concentrated their efforts on what seemed to them an area within their control: trying to assess the basic skills of the existing workforce and providing remedial help for "marginal" workers.[3] But, as I've argued, that effort was aimed at those regarded as the least-skilled workers, whose ability to function in the new plant was in doubt. Over time, a parallel set of efforts was aimed at appropriating knowledge from workers with particular kinds of experience, as needs for those arose during design and construction.

Of course, "managers" aren't a monolithic group and didn't have a unitary perspective on these issues. As the previous chapter showed, they varied, depending on their particular roles and relations with workers: Salaried engineering staff discussed the location of machines with maintenance workers who would later have to repair them; several moulders traveled with the plant manager to Europe, to visit manufacturers, compare machine specifications, and to see a unit being considered for the Sylvan plant in operation; and the relocation spurred the development of new, reciprocal relations across status boundaries which

[3] In the first chapter, I argued that this took place during the *accessing* phase, a time when managers dealt with the workforce as one, collective body, in order to gain contractual concessions. In the two phases that followed, worker-manager interactions were increasingly individualized, i.e., until the settlement of a new labor contract.

helped, at least temporarily, to weaken assumptions about ability as a function of position. Over time, as managers worked more closely with engineers and programmers under contract, developing process-flow diagrams and computer graphics, the former gained more concrete information about what is required of workers in various jobs.

Problems for Managers of Re-Sorting Personnel

From the managers' standpoint, the problem that emerged during the *redistribution* phase was two-fold: *1) how to place particular workers they wanted in consultative or functional roles, and 2) how to preserve those preferences by keeping the favored workers in those roles in the new plant i.e., when the labor contract and seniority rights were reinstated.*

Under the labor contract in effect during this period, job rights had been tied to departmental seniority which, in turn, was overridden only for such violations as unapproved absences or "being discharged for cause." On the other hand, jobs such as "control room operator," which did not exist in the downtown plant, were treated as promotions. And the contract language on this point gave the firm broad discretion:

> In the event a permanent job vacancy occurs within a department which the Company desires to fill, the Company shall first consider whether there are employee(s) within the department who, in the judgement of the Company, have substantial qualifications for the job. If the company fills the vacancy from within the department, the vacancy shall be filled as follows and the following factors shall be considered:
>
> 1. Seniority (length of service with the Company);
> 2. Qualifications, including attendance, if at final warning stage, and the physical fitness required for the satisfactory performance of the work for which the employee is being considered.
>
> Where, among the employees concerned, factor (2) is substantially equal in the judgement of the company, factor (1) shall govern. The Company may return an employee to his prior job during his first thirty (30) working days if he does not satisfactorily perform his new job....
>
> In the event a permanent vacancy....occurs within a department which the Company determines to fill is not filled from within the department, notice of such vacancy shall be posted for forty-eight (48) hours at the location where the vacancy occurs. During this time, employees outside the department at the location where the vacancy occurs may bid for such a job.

It is likely, however, that even without this rationale the firm could, under the sweeping definition of "management prerogatives," have re-sorted workers into jobs at will. The relevant language in the contract stated that the firm

> retains the right to direct the working forces, to hire new employees, to assign, to promote, to lay off employees due to lack of work, to establish new jobs, to combine jobs, or to change the content of existing jobs with the understanding that the company will inform the stewards of labor grade changes affecting rates of pay, to determine satisfactory performance subject to the grievance procedure, to discipline or to discharge personnel for just cause, to plan, direct, and control plant operations and means of customer distribution, to introduce new or improved production methods, facilities or facility arrangements, to select the amount of supervising and manning necessary.... providing the company discusses such rules or regulations with the union prior to implementation, to determine job duties...are rights vested exclusively with the company.[4]

Even if the company could "technically" have made personnel changes with a free hand, doing so without at least *pro forma* deference to contractual rights would surely have led to stronger worker resistance. Recognition of those

[4] Ace employees were represented nationally by the Teamsters Union. I interviewed the local's business manager, who acknowledged his lack of familiarity with the particular production processes and areas of expertise within the confection industry. However, he listed more than a dozen other work groups (outside trucking) which he had also represented. A sampling included: chemical plant workers, Avis car rental, brewery workers, plumbers, piano movers, and concrete workers. I asked whether he considered his lack of knowledge about jobs and worker expertise to be a liability in collective bargaining. He responded that, "If [the Teamsters] hadn't gotten them [Ace] the best contracts, they'd have gone elsewhere. In wage terms, this is true, since Ace workers were near the top of the wage scale as compared to workers in similar industries nationally.

rights, even where (as at Ace) they are limited and union power is weak, is nonetheless an important part of the etiquette by which managerial authority retains some legitimacy in the eyes of workers.

Besides, it was not sufficient for Ace managers temporarily to suspend job and seniority rights during the transition. They also wanted to implement long-term changes in staffing--holding in general to seniority and the logic of job succession, while reserving flexibility "around the edges" to deal with young favorites, older workers soon to retire (and reluctant to tackle computer procedures), and shift rights that might interfere with achieving comparable performance across work crews. When managers joined these concerns with a desire to cull the most highly-motivated workers, they decided on a revised system of job "bidding." This system combined managers' desire for greater flexibility in making selections, along with voluntaristic features that would afford workers limited job choice and competition.

Rosenbaum has pointed out that this tension, between "sponsored" and "contest" mobility, is endemic to organizational career systems, needing to balance efficiency with equality of access to positions (1984, 16-19; see also Turner 1960). Ace managers did, in effect, sponsor particular workers during the period after the contract had been suspended: By placing workers in jobs and consultative roles such as I've described, the latter had informal job probation when their adaptations to changing working conditions could be assessed. At the same time, those workers were given access to (formal and informal) training that would later make them more confident and competent candidates for jobs as they bid against other workers. The success of the bidding system can be measured by the facts that there were (so far as I am aware) no grievances filed against these personnel changes, and that workers with whom I spoke, who had been "passed over" for promotions to higher positions--mostly for control room jobs--accepted this in terms of their failure to bid into jobs for which most later saw themselves as qualified. One veteran employee explained,

> I was spooked by the computer part of it at first, so I didn't bid, even though I had seniority over some of those guys that ended up in the control room. But now, seeing what they do, it's not that scary; you have to learn more about the recipes and shit. But I've had to

> do that in this job [material handler], and it's a lot more back work than I'd like. And as for pay, the raises went to those [control room] guys. So, I think I should have taken that chance [and bid] downtown. But I wasn't one of the golden boys. Like [names two co-workers], you knew they were going to get those jobs, 'cause [the supervisor] and plant manager wanted them. [field quotation:1/14/93]

The Managerial Rationale for the Job Bidding System

In order to learn more about the rules and rationale for Ace's bidding system, I interviewed one of its authors, Mr. Michaels (a quality control engineer and member of the special projects planning team during the relocation. Asked how the firm made the initial selections of workers into the new plant jobs, he explained,

JM: We rated the skills they had downtown, in their previous jobs, and evaluated how similar their previous job was to the new job; then we graded them A,B, or C, according to how many of the skills they had that we envisioned would be needed in the new job. Some workers had fifty percent of those skills, some workers a different fifty percent, but three of us [managers] went through and made those ratings. It was like trying to go through a curve on a test--finding the natural breaking points where it makes sense to say, 'This is one level; this is another level.' That's pretty much how we did it.

CW: Of course, in setting up an exam curve, you have numerical scores. What were your criteria for rating?

JM: We listed the tasks we expected to be needed [at Sylvan] against the tasks that people had been performing, and basically counted them up--weighted them and found out where the breaking points were.

CW: Was that based exclusively on the paper job histories, in the personnel files, or did you ask supervisors about people's relative abilities and motivation?

JM: Mostly on the paper files. We did have input from people--the plant manager and others--who had worked closely with the production staff, but that was only a factor in marginal cases. The second criteria [after the ratings based on job histories] is that workers were equal as far as the jobs they'd been performing at that specific time. We weren't as interested in plant seniority; like, if someone who used to be a refiner went into shipping, we left them in the shipping pool and evaluated him as part of that group. We said that if people had opted for a given career path, we'd leave them in that career path. Then you could see where their motivations were.

CW: So, your choices didn't always correspond with seniority, is that right?

JM: Where job experience was the same [for competing workers] we used seniority as the second criterion. We didn't utilize the managers' opinion of the person, or his absentee record, or any other criteria other than 'They're doing the same job, and are rated equally.' Then, after that, we'd ask, does Joe have seniority over Mary, regarding that particuar job? If Mary had more seniority, she'd have the right to bid, to indicate she wanted it....We also indicated that, after we were out [at Sylvan], and evaluated that they weren't capable of doing the job, then we would re-position them. By then, we were interested in seniority with a piece of equipment or process, rather than in the job.

CW: And you had no resistance from the union on this?

JM: Really no. The way we structured it we pretty much got what we wanted. And, even if we were not in a union situation, given responsible management, I think we would have used the same process; that is, you need to recognize the rights of senior people, but not be hemmed in by that in terms of selecting people for key positions. The biggest conflicts that we saw were over shift preferences. We told them that, during the move, we needed to select people so that there'd be experienced people downtown and out here, so we could meet production while we finished construction. We asked the union for latitude to select who came out first, second, and third, and that based on the group with which they came out [to Sylvan] they'd have seniority as far as selecting shifts, within that group, for an extended period of time.

CW: So, you displaced people from shifts, as well as from job routines, during those months?

M: We inconvenienced people in terms of shift assignments, and knew that, until the later [arriving] groups of workers got their skill levels up, and got their usual shifts, they'd be irritated. Then, we said, once you catch up on skills, we'll re-shuffle the deck within your work group, in a one-time re-bidding based on seniority. Until then they had to be patient, in terms of getting baby sitters and what have you. But, to maintain productivity we needed to deploy people to various areas of need....Some of the promises [to workers], in terms of personnel and supervision, we couldn't keep. Because we were pushed over the wall--not just back to the wall, but over the wall [by delays and unmet production orders]. And as a result, credibility may have been hurt a little bit. [field interview:12/9/92]

Given that his responsibilities were mainly technical and logistical, I questioned whether Mr. Michaels' account of the smoothness of the bidding system was accurate. I heard no reports of increasing grievances from union stewards, nor was conflict over the bidding system evident in those union meeting I attended during this time. Nine months after the interview with Michaels, I spoke with Mr. Oliver, a vice-president for human resources who also confirmed this placid portrait of job sorting through the relocation. I asked whether, from his standpoint, the bidding process had gone well:

SO: Actually it worked better than I thought it would. The union understood what we were doing--we had the benefit of some very good stewards. Yes, there are some people who looked around after the final cut and felt that there were jobs that, due to seniority, they could and should have bid on. But, at some point we had to cut that [bidding] off, and they had to step back in favor of the go-getters. A lot of [the success of the bidding system] goes back to Jim Michaels, the plant manager, and others who are very good at knowing the people [in the factory] and what their skills are. The key thing, really, that we needed to do was to put the right people in the right jobs initially, get the most out of them and to use those people almost as trainers. Sometimes that conflicted with seniority, or with shift preferences, and I was very happy that the union agreed that we needed to throw the whole contract kind of out the window during this period, and we picked and chose the people we thought would do the best job.

CW: Did you express the company's intentions in those terms, to the workforce?

SO: It was a long process of getting people to buy in. And it was a voluntary system, even back when we did the basic skills testing. We had a small group that elected not to take part, and we said 'That's fine, that's up to you.' And we had individualized support for those who did. My staff and I were available all shifts; I often had people in my office, asking questions. You can't over-stress the importance of communication; I remember, more than two years ago, when the union allowed us to make a presentation at their meeting, we tried to convince them of where we were going, the cooperation we needed from everyone; that they ought to buy into it not out of fear, but out of survival. So, Jim Michaels got up [to the union hall podium], hooked up the computer and had some things on the screen as to what the control room interface might look like. That was clear back in 1990. We talked about accountability in their jobs, and that in order to allow people flexibility--the ability to do different things and take some ownership--you have to have a contract that is very flexible. And that mind-set was also part of the bidding process: the opportunities were there, for people who were ready to take them. [field interview:9/3/93]

In broadly analytical terms, this kind of juncture--occurring in a protracted period of organizational change--reveals how crude it can be to think in terms of a dichotomy between agency and structure. Ideally, in a case study one can remove these terms from the sterility of abstraction and anchor them to empirical referents. In the case of the bidding system, the structure of contractual governance was in abeyance, and the emergence of new work demands spurred individual innovation and ambition. These impulses were reinforced by the early, managerial rhetoric of basic skills which, though later found to be of limited practical relevance for most workers, served culturally to cast the problem of job retention in *individualistic* terms. Once joined to workers' hopes about team management, this individualistic ethos led Ace workers as a group to accept, even embrace, the quasi-voluntaristic work relations of which bidding was a part.

It has been argued, in the historical literature on industrialization following Marx (e.g., Clawson 1980; Edwards 1979; Marglin 1974), that increasing supervisory divisions among workers has served more to enhance managerial control than (as analysts of the "Bourgeoisie" have claimed) to increase labor efficiency. Chapter 2 of this study can be read as confirmation of this conclusion. But, regardless of one's position on this debate, it is true that, at Ace, at a time when contractual guarantees were missing and supervisory authority publicly being undercut, divisions and competition among workers absorbed energy that could otherwise have been focused on their collective concerns. The bidding system channeled and legitimated individual ambitions and solved the firm's problem of achieving a fine-grained matching between people and jobs. This system appears to have produced few casualties; some senior workers lost preferred shifts (with serious disruptions in their family lives), and some who would have bid into control room jobs did not, often because they had been denied the early experiences provided through managerial sponsorship. My point has not been to argue that the bidding system was basically harmful to workers, but that its planning and administration reveal managers' nuanced appraisal of workers' abilities and work styles. This, in turn, reinforces my central thesis regarding managerial dependence on worker knowledge during a period when, as Mr. Michaels reported, the pressure of the relocation had "...pushed the firm to and over the wall."

Ace's Reorganization and the Salaried Workers

Before giving a descriptive overview of work in the new plant, I turn briefly to the broader impact of new work goals and practices among Ace's white-collar personnel. This is directly relevant for understanding job changes for production staff, and updates the earlier (chapter 2) discussion of Ace's attempt to increase organizational synergies between functions in the firm which had been segregated in the past. Although peripheral to the main argument in this study, it is worth pointing out that at the same time shop floor workers were adapting to automated manufacturing, Ace's business division was being changed in equally dramatic ways.

In chapter 2, I discussed the corporate context of changing shop floor practices, and Ace's need to evaluate performance and profit in terms that had standard meanings within their larger corporate network. To achieve this translation, Ace invested heavily in a computerized information and communication system. Some of the sub-systems (e.g., those that handle inventory control and cost accounting) they bought "off the shelf" and tailored to their needs; others they had to develop, along with ways of knitting the various computerized sub-systems together into an integrated "Business Information System" (BIS).

This project was fraught with pressure: It was required by "corporate," and carried short deadlines; it had to be integrated with manufacturing practices and reporting procedures that were only then being worked out; and it cast into doubt the existing job system in the salaried division (as CAM did among hourly workers.) Fears of redundancy among salaried workers were increased when, only weeks after the company had settled into the new location, an announcement appeared in local newspapers that Worldcorp had defined Ace as a "non-core business" and put the firm up for sale. As one middle-manager explained, "That's why I've had corporate auditors in my office all week, checking me out. I guess they're on a cycle and would have been here anyway. But, by classifying this as a non-core business we don't appear on the same line as we did in their profit and loss statement. This will make their profitability look better. Of course, we've come through hell, gearing up for this [move], so the timing's lousy."

As it turned out, some salaried workers confronted work changes after the move that were at least as severe as those in the factory. And after the recent sale of the company that owns Ace, far more salaried than production workers (more than 25 percent) lost their jobs. These events confirmed early predictions by some workers, that sacrifice and initiative during the transition would enhance their long-term value to the firm, and that the salaried staff--three-quarters as large as the production staff--was top-heavy and ripe for cuts.

Computerization and the White-Collar Workers

But how was the BIS system linked to manufacturing? Briefly, I've mentioned that the control rooms are connected to an on-line system that passively "captures" various kinds of production data. Among the data that are recorded: materials used, the time taken for particular steps in manufacturing and for overall recipes, the amount of and reasons for downtime, and any manual intervention in the automatic recipe system. In addition to providing a basis for refining factory procedures--a process in which, ultimately, control room operators may have a role--these data are also grist for the larger business information system (BIS) which includes, e.g., purchasing, sales and forecasting, cost-accounting, and product development. Nancy Mahaffey, a logistics analyst, explained that

NM: Downtown, each department had its own separate system; they didn't have to talk to one another. Now, we're working toward an integrated information system, so that if receiving doesn't get something, someone in production can't issue that material to use it. And if someone in production doesn't receive, like a paste, into inventory, then someone in molding and packing can't use it to make chips. So, they have to talk to one another now, and they realize that. Otherwise, we'll continue to have the same problems--missing parts, low inventory, the inability sometimes even to trace what we've made and delivered to customers.

CW: I know that system isn't yet complete, because later it'll be automatic. [Yes.] But I see operators recording information by hand. How is that connected?

NM: Until it's a passive system, the operators are supposed to enter [the information] on packing sheets. They will be responsible for recording what they use to make something, and how much they've made, and to communicate that to the other parts of the business. That's a drastic change in the culture of the company. I think that, for now, a lot of them are doing things without understanding why, but that's why we've done the training, to give them an overview.

CW: Also, I think some workers are uneasy because they see this potentially as a means of surveillance.

NM: Yeah, because the way [the system] works is that whenever someone enters the system, each person has their own password, and it shows, in the audit trail, who did that transaction. So, if there's a problem, you could go back and see exactly who did those transactions. I don't think they see it as surveillance, as much as just seeing how their actions are connected to the business as a whole.

CW: Are those concerns, and the need to train people on the computer protocol, confined to production people?

NM: No, we've run into that with salaried people. Not as much, because there are so many computers in the office now. But there are [salaried] people who are reluctant to get on a computer except when someone's standing over their shoulder saying, "We need to work this up," and they'll have forgotten how to log on. They do have a motivation to buy-into the [BIS] system, though. In a lot of cases it's making their jobs easier, like in purchasing where we have a program forecasting what they need. Before, they were typing all their purchase orders manually; now, they enter it and the system prints it out, without the buyer having to generate that over and over again. Still, we've run into a lot of problems, resistance, from the upper-level managers saying, "We don't want to be slaves to this; what good does it do for us? [field interview: 9/17/93]

An accounting manager, Lisa Anderson, shed more light, both on the social impact and the benefits of the BIS system:

LA: In our area, actually, we've had a lot more segregation of duties, and that will probably increase once [BIS] is fully in use. So, we're working hard to keep everyone up on what's happening. For example, one of our new people is an analyst who we've brought in for no other reason than to help bring this new system up;

she's totally off on her own. Some of the other analysts are focused only on closing the books and working on commodity pricing trends. In some ways I don't like that, because there's not enough cross-training going on. When the office was smaller, and we didn't have the on-line data concept, people were together more; one was a jack-of-all-trades, I guess. But getting larger you tend to specialize.

CW: Did you have a hand in choosing or adapting the [BIS] system that you ended up with?

LA: Absolutely. We had a big hand in that. We looked at quite a few packages, and decided that, because we're dealing with a commodity market where the prices fluctuate by the minute, we couldn't go with what they call "standard costing." I traveled a lot to sister plants, worked with the East Coast comptroller, as well as with people here. We all learned a lot. The main thing it [on-line system] will do for us is, when we close the books each month, it has very much been a manual process. We've actually used a personal computer for our costing system, which is ludicrous for a company of this size. It's a huge, drawn out process that can take two weeks to complete. That's absolutely unacceptable. Once we're up on the BIS system, all of this calculation will be done automatically, by the system, so we'll have closing reports within a day or two, which we can really analyze. Now, we're spending so much time crunching numbers that there's little time left to analyze what we've done. We're taking a big step forward. But, so far, I'm not happy that everyone's getting more specialized and separate. [field interview: 9/14/93]

In this statement one can see employee involvement in, and impacts of, reorganizing work that are parallel to those I've discussed among production workers. That is, setting up the BIS system required mid-level salaried staff members to reflect critically on work goals and routines, the disparities between the two, and to articulate these in order to inform choices between new, alternative systems. As with production workers, this task ran up against some resistance from those who either misunderstood or felt threatened by the changes. Ultimately, people like Lisa Anderson championed the BIS, believing that it would free them up to exercise more of their knowledge and discretion on behalf of the firm as a whole. That is, her desire to emphasize analysis over computation in her job is very like that of "refiners," (formerly machine tenders) wanting to exercise their broader knowledge of manufacturing as control room operators.

Both of these opposing currents--task integration and resistance to change--ran through my interview with Ace's Bill Parker. Parker was responsible for designing and implementing the BIS system. When I interviewed to him in August of 1993, nearly a year after the first salaried employee arrived at the Sylvan Plant, he was feeling the pressure of staff shortages and missed deadlines:

BP: First, the way our business is run, costing is very difficult. So, we're devising a system that takes into account what the beans really cost, how much storage we have, what the patterns of customer demand are. To make a system like this go, we need to have sponsorship from on high, which we have. But if the executives don't have any confidence in the system, or don't really want it, it's not going to fly. My responsibilities are to handle all the data processing and business information and get this thing implemented. Right now, it's killing me.

CW: You said you've worked with computers since the early '60's. You also said that Ace's commitment to computerizing has been quite narrow?

BP: When I got out of the military I lost my job to a computer, and I swore that'd never happen again. It's been an uphill climb here. When I came aboard they had an old Honeywell system and I threw that out and put in an IBM system. There were managers here who would not shake my hand. They say, "I can make this product better than anyone in the world." What they do not realize is that it's also part of their job to process information on the computer. Slowly, it's coming.

CW: What's your involvement or knowledge with the automation in the production areas?

BP: That has knocked my socks off, because those people have done really well. Downtown, those guys hauled oil and turned valves, and now they're clicking on a mouse. They're running that plant. Maybe the biggest problem has been with some of the foremen; they're too intense, wanting to sit at the screens rather than supervise the work flow. [field interview:8/27/93]

In theory--if not in practice--the BIS system was intended to integrate all organizational functions within

Ace, bridging the factory and office complex, including product development, inventory, engineering, and sales. During the plant start-up, an important barrier to the implementation of the automated system was resistance (or perhaps indifference) among many in the business division regarding this goal. For Ken Roberts, the lead contract programmer, Ace was torn between two agendas and cultures: the potential of a fully-integrated workplace--which he sees as an inevitable goal of computer-automation--and a partial, self-defeating mode of adoption in which the automated factory is shackled in chains of costly and irrelevant bureaucracy. In the midst of the start up, in the fall of 1992, I asked him about the protocol by which he got managerial approval for changes that factory workers sought in the automated system. He complained,

KR: The way it's supposed to work is that Ace was supposed to supply a committee of three--one from BIS, one from engineering, and one from production. These three are supposed to review and schedule all changes in the system. But it hasn't functioned that way yet. And until we can convince [Ace managers] that it has to function that way, so there's some coordination of what's transpiring in the system, we'll continue to deal with the [factory] operators exclusively. The small things, like a change in graphics, we take care of without any higher approval. But when it's something more important, we have to buttonhole them and get an answer.

CW: Why is that so difficult? Wouldn't upper-level staff want to have control over that?

KR: It's partly a matter of expertise; they haven't, as yet, supplied anybody that we can train, to enable them to incorporate their own changes. So we're still doing everything. They [Ace management] feel they need to hire someone. The business division is doing a job description now to hire another engineer, and the engineering production side is also writing a job description. But the distinctions between production, engineering, and the BIS project are so blurred now--there's no clear-cut divisions anymore. And there shouldn't be. This is a big problem with a lot of companies that we've automated: they've traditionally had those staff divisions. But that's harmful in a fully-automated system. If engineering makes changes, it affects BIS, and vice-versa. So, they need people who are cross-trainable--who can sit on the fence; people comfortable with production and with the business and management side. The companies try to keep the individual positions distinct, but they're no longer distinct. The automation has removed that. Otherwise, why did they invest their shirts in it [BIS] in the first place?

CW: Do you see a change in orientation among the production people, toward a business-wide perspective? I doubt that they've been exposed to those problems, or that language, before.

KR: Well, you can't sit in front of the computer and not be exposed now to the whole process. Obviously, they're learning new parts of it, and they have tasks--like recording data for the business division--that are giving them a basis for learning more. But the ongoing conversations they [control room operators] are having now, with engineering and quality control people, are not going to end. They'll meet their production goal and then they'll say, "Why can't we make it go a little faster?" I did a project at a Coors brewery; after they hit 100 per cent of their [production goal] they said, "Why not 130?"

CW: What role is there for operators in that refinement? Will they ultimately be using the data they're collecting now?

KR: An indication of [Ace's] plan is that they built a quality control lab next to the control room. [The operators] will be involved in quality checks, looking at cooking times here, agitation times there, shortening up pipes to make the transfers quicker-- That'll come down directly on the operators, 'cause they're the ones collecting the data instantaneously, knowing what it means in the real world. And with the ability to intervene. BIS will amass a ton of physical data. But with [these products] there's so much... what you might call kitchen evaluation, that you can't do by analyzing the numbers.

My period of field work was not lengthy enough to assess whether this version of the future has in fact come into being. That Ace invested so heavily in the BIS system, and designed it to provide fluid linkages between production and salaried staff, indicates that such integration was indeed an explicit goal, at least for those directly involved in planning the new facility. Also, Ken Roberts' statements take us beyond the discussion in Chapter 2, about how salaried staff selectively canvassed shop floor workers for information about production, to a more practical sense of how the latter might be involved in a more genuine, bi-lateral sort of work participation.

Attempts to explain whether or not this potential, present in computerized production systems, is expressed are at the heart of important recent research. It makes intuitive sense that supervisors are most directly threatened by what Zuboff (1988) refers to as "informating" technologies. By this she means computerized systems that provide data, and therefore tools, for new *conceptions* in and of production across lines of authority. For Zuboff, inherent tensions between hierarchy and benefits of "informating" will tend to favor broader participation (across status boundaries). In computerized manufacturing systems, she writes, "authority is located in the process of creating and articulating meaning, rather than in a particular position or function. Under such conditions, it is unlikely that a traditional organization will achieve the efficiencies, standards of quality, or levels of innovation that have become mandatory in an environment marked by competitive challenges of global markets and deregulation"

(1988, 308).

On the other hand, workers' access to information and decision-making has historically been checked by managerial attempts to preserve control (see Noble 1984; Clawson 1980; Edwards 1979), despite the temporary fluidity induced by periods of technical change. *Within a given process of technical change, then, the degree of worker involvement and interaction across status boundaries is not a constant. Rather, my case suggests, its trajectory follows the changing degree of technical and organizational uncertainty* (Stinchcombe 1990, 1-31); at Ace, this was highest when the new plant was being designed and started-up, and tapered off as manufacturing processes were routinized and attached to job titles and wages.

As I'll expand on below in the conclusions about skill redistribution, my case indicates, first, that within a given firm this potential may be extended only to a small minority of the workforce, leaving open broader questions about the stratifying impacts of computer-automation. Second, even when there is strong commitment to the full implementation of computer-automation--as there was among the planning group at Ace--the goal may be scuttled not only by first-line supervisors, but by other salaried workers who fear encroachment into traditional areas of status and expertise.

In sum, I've meant this detour into the word of salaried workers at Ace to illustrate, as others have (e.g., Garson 1988; Glenn and Feldberg 1979) that managerial and clerical workers are also subject to changing strategies of work organization and control. Historically, they have been torn, as have industrial workers, between greater efficiency and the preservation of functional and status boundaries in the labor process. In some organizational forms, computerization has been a primary tool for fragmenting and routinizing tasks--de-skilling. In others, the same technology has allowed workers to reclaim (as Lisa Anderson says of cost analysis) cognitive dimensions of work that are both more efficient and more gratifying for workers.

Clearly, Ace's decision to relocate was primarily due to obsolescence of the manufacturing plant. But, for different reasons, the firm's business practices seem to have been equally inadequate and harmful to their competitive position. It is likely that there was a reciprocal relationship between the two kinds of inefficiency, a point that has been reinforced as I have considered the move as a firm-wide project.

The Physical Layout and Work Process at the Sylvan Plant

In chapter 2, I described how Ace's original, cramped location had imposed limits on growth and efficiency. This is why, in an interview conducted by my colleague, a company planner reported Ace's desire to find "a greenfield site where we could build the plant around the new equipment." Located on a 50-acre suburban lot, behind rolling hills and a decorative pond, Ace's new plant covers more than 325,000 square feet, or, as the company president reported in a trade article, "8 acres of building under one roof." The building is expansive, with manufacturing contained on two levels.

Readers will recall that in the old downtown plant the adjoining production and office buildings had separate entrances; indeed, for a newcomer it was confusing even to find the inside route from one to the other. The entrance to the production building led to a Spartan lunch room with some vending machines, in which one could hear the humming of moulding machines directly overhead.

In the Sylvan plant, the hourly and production workers share a common entrance into an airy, glassed-in reception lobby. To the right is a suite of offices and conference rooms; to the left, at the top of a wide stairway, is the main administrative area, with cubicles in the center and wood paneled office around the periphery. Traveling straight through the first-floor reception lobby, one passes through doors leading to the quality control labs, employee locker rooms, and a spatious, common lunch room-cafeteria. Though it is rare to see much intermingling between the two groups, many workers told me they felt it was symbolically significant to see smartly-dressed clericals standing in the cashier's line along with mechanics, their uniforms covered with paste and grease. And, perhaps the rather awkward encounters I saw between salaried and production staff, taking place soon after the relocation, have since then become more comfortable and genuine. During noon breaks, I often saw more than 75 people in the lunchroom. Through the wall of tinted windows one can see the pond and a stand of trees beyond. Both lighting and climate are better by far in the new plant, where the work stations are segregated from the heat of the "tank farm" in which liquor and paste are stored before moulding or being shipped out. In the old plant, many workers were located near the tank far, which led to brutal conditions in the summer.

Computer-Automation Job Changes in the Factory

Much that I have to say about Ace's new plant and labor process is organized around a contrast between the jobs in which control over the automated systems is concentrated, which have (in technical ways) changed dramatically, and the remainder of the production jobs, which have changed little. This is not to mystify the role of automation. As I've argued throughout, the role of automated controls for Ace was to coordinate, refine, and accelerate processes that were routine and well-understood among workers in the older facility. Chapter 3 was largely intended as support for this assertion, so I won't belabor it here. However, in this chapter I elaborate and extend the argument with reference to the ongoing relations and business of work in the Sylvan plant. I'll argue that the promises of team management for workers--relaxation of supervisory oversight and expanded discretion over substantive decisions--have been largely fulfilled for the 30 or so control room employees (i.e., 15 percent of the hourly workforce). But, for the remaining 175 production workers, those promises have largely proven to be false.

Rather than introducing new concepts or processes into production at Ace, computer-automation served 1) to integrate a set of formerly discrete processes, 2) to connect those to electrical, mechanical, and hydraulic power, and 3) to centralize control, through symbolic representations of work processes (i.e., graphic images) and through a programmable logic code [PLC] that enables a simple command to activate recurring, sequential processes (i.e., recipes) on the factory floor.

But how typical is computer-automation, of the sort Ace adopted, in American industry as a whole? Although I was unable to find a reliable, recent census, a (1990) study published in *American Machinist*, about adaptation to new technologies, showed that 56 percent of respondent firms either currently using, or planning to incorporate, computer-automation manufacturing; another 30 percent report considering its adoption.

And how typical is my finding that Ace used computerization to integrate and expedite a set of well-established practices? Addressing the question, "What Do Computers Do?" Rule and Attewell (1989) carried out interviews in over 180 private sector firms and conclude that, "The primary pattern here, in firms ranging greatly in size, is computerization by gradual conversion of discrete, delimited practices long carried out by conventional techniques, rather than abrupt imposition of fundamentally new organizational agenda[s]"[5] (1989, 230).

The application of automation in particular cases is a function of managerial design and of available resources. To use the field metaphor of chapter two (offered by the

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[5] Rule and Attewell's conclusions stress the role of computerization as a tool that helps *managers* rationalize and control work processes. But they do not refute my claims about how workers may be directly involved, nor that some may benefit, in this process.

production scheduler), Ace's production process is like a long tube; at the opening, raw materials are processed into liquor, which is blended with many ingredients and heated to produce paste. Then, at the end of the tube are finishing (moulding) and packaging processes that differentiate products for specialized industrial or consumer niches. Ace's investment in automation is concentrated in two functions: 1) the processing of liquor--which is in high demand elsewhere in the industry and, apart from finishing processes, yields high profits from cocoa beans, a rather cheap commodity; and 2) in the mixing and refining of liquor and dry ingredients into paste. There has also been some automation of the packing lines, and may be more in the future. But the variety of products and packaging formats has impeded fuller use of automation, and the labor costs in packing (which during the peak season relies on temporary workers) are the lowest in the plant.

During the planning stages, there was speculation that the moulding lines would also be automated (evidenced by an empty control room in the new plant, located at the foot of several long cooling tunnels), but this plan didn't materialize. So, the moulding jobs continue to require tending of "stand-alone" machines, along with monitoring the "heat exchange units" that temper the paste before moulding. Though new moulding equipment has been installed, and documentation of quality control increased, we'll see that for the moulders the greatest work change has been an *intensification* of familiar tasks.

For clarity sake, I will describe the Sylvan plant in terms of the sequence of steps in production (drawing on prior descriptions in chapter 2, of the formal job system). Raw materials are brought in by truck or by train on a spur that the company built and connected to an existing rail-line. With the new roasting and processing plant, each day Ace workers are able to process the 150,000 pounds of beans that are delivered. There is a ramp in place for an automatic conveyor system that, once completed, will connect the trains and trucks and the unloading dock. The conveyor would relieve the men of having to lift and carry (for 10-15 feet) literally tons of beans per shift, however, it was one of the casualties of cost overruns that Ace confronted during construction. So, the four men per shift on the loading platform continue to have highly strenuous jobs (as I learned first-hand during field work). The burlap bags containing the beans weigh a very unwieldy 140 pounds, and are stacked in piles six feet tall. Each rail car contains some 900 bags, or, over 120,000 pounds of beans. First-shift workers typically unload four or five cars per day. I learned that past jobs for members of this crew included work in a spice factory, a tannery, and a canning factory.

Because of the need to control possible contamination from vermin or refuse shipped with the beans, the unloading area and its workers are kept separate from the plant proper--they have their own entry passes, time clocks, and kitchen--and the workers do have a certain macho bravado, eschewing as restrictive, for example, the braces the plant manager recommended to prevent back injuries. After being cleaned, the beans move to a machine that uses infrared heat to loosen the shells; the "nibs" are roasted and then ground in one of several stone mills, producing liquor that is batch-specific (to particular beans) and stored in holding tanks.

One of the "bean dumpers," Luis, explained to me that he would not be able to keep the job for too long.

> Most of the guys in here are big, but I only weigh around 140 pounds. I'm ready to collapse at the end of a shift. But I came from sanitation, and that wasn't leading anywhere--I need more money, and [the company] is going with fewer people in sanitation. The reason I signed up for this job is that the money's better, but moreseo 'cause down the line we're supposed to get cross-trained for the liquor control room. And those are some of the highest jobs in the plant; learning computers and sitting on your butt for half the shift, I could handle that. [field quotation 7/22/93]

Portraits of Work in Automated Control Rooms

The new "liquor plant" is one of two areas--"control rooms"--in which computer automation has clearly changed the way work is carried out. For a concise description of work as a control room "operator," Blauner's *Alienation and Freedom* (1964,124-165), based on field work in a continuous-process chemical plant, serves well. Because of the enduring importance of Blauner's work, I engage it directly (especially his portrait of the workers' role in automated factories). Of the daily routine of these workers he writes:

> Practically all physical production and materials-handling is done by automation processes, regulated by automated controls. The work of the chemical operator

> is to monitor these automatic processes: his tasks include observing dials and gauges; taking readings of temperatures, pressures, and rates of flow; and writing down these readings in log data sheets...Workers characterize their work as being more "mental" or "visual" than physical (1964,132-133).

Also, operators' perceptions of supervision in control room work, as in this typical quote from Blauner's informants, reflect those of mine, at Ace:

> There's no great pressure. They give you a job to do, and you do it. If things are running smooth, there's no problem. Nobody is pushed around here unless you're lax. There's no real incentive to get out two pounds more than yesterday, nothing like that (1964,135).

However, I take issue with Blauner's attribution of passivity to these workers. Granted, his purpose and achievement was to compare continuous-process work with earlier forms of industrial organization, and to relate those to kinds and levels of workers' alienation. But, I believe his comparisons and typology led Blauner to define "craft" skill by *opposition* to that required in automated settings. He argues that:

> The development of machine and assembly-line technologies greatly reduced the number of traditional craft skills necessary for manufacturing production; *with the emergence of automated, continuous-process technology, traditional craft skill has been completely eliminated from the productive process.* Even the talent

> for unskilled manual work, or "knack," so important on the assembly line, has been eliminated by the automated processes. In the place of physical effort and skill, in the traditional, manual sense, the major job requirement for production workers in continuous-process technology is responsibility. As the French sociologist Alain Touraine phrases it, "Their responsibility is their skill" (1964,133 Emphasis added).

His conclusion is partly a result of Blauner's data sources, which were not primarily observational, and which (even for the "earliest" industry he studies, printing) were ahistorical.[6] Nonetheless, his research shaped images of automated factory work for a generation of scholars, and is still actively debated (e.g., Vallas and Yarrow 1987). So, Blauner's account--as well as his core analysis--warrants scrutiny.

David Halle's more recent (1984) study of chemical plant workers, *America's Working Man*, is a bridge between Blauner's work and my own. Drawing on several years of observations and interviews, Halle concurs with Blauner that control room work (despite its danger) is often dull,

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[6] Blauner (1964,11-14) reports that his main source of data was a national Roper survey, of 3,000 respondents in sixteen industries. He supplemented his data on continuous-process work with 21 interviews and "several days and nights" of observation in a chemical plant.

monotonous, and isolating. But, he uncovers domains of "special knowledge" among workers, about quirks of machinery and procedural short-cuts, as well as patterns of conflict between them and supervisors over how work is to be carried out (1984,119-126).[7] Earlier, I discussed how such knowledge informed abstract renderings of production, for engineers and programmers; now, I'll address workers' transition to control room work, how they operate and enhance the basic automated systems, and their supervisory relations.

At Ace's downtown factory, liquor was made by ten workers, in five job categories, with support from four others in a lower-skilled "melter" position which survives at Sylvan under another name. Where there had been separate job titles including "roaster," "dryer," and "liquor mill," now there are "liquor control operators" and "material handlers." In the new plant, the formerly discrete pieces of equipment have been brought together as parts of an

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[7] Though it deals with the immediate work setting of the chemical plant, the scope of Halle's book is broad, encompassing workers' family and community life, class-orientation, religiosity, and ethnicity.

integrated, continuous process. As a basic ingredient in other finished products, liquor is sold and shipped to customer firms, as well as used in Ace's recipes. The supervisor of the liquor department, a young, college-educated man who was hired directly into his job, informed me that

> With the increases in efficiency out here, we're able to produce everything we need for this plant, plus, have two or three ship-outs on an average day. Usually, ship-outs are maybe 40,000 pounds of liquor, so that gives you an idea of how much we can produce. We're running around the clock, seven days a week, but still we have demand for everything we make. A big thing, aside from the amount, is the consistency we're able to achieve in the [automated] plant; there is no way we could have done that downtown, because we didn't have the control to standardize the products. So, with six operators we've been able to meet our expectations. You can see, it's their [operators'] plant; they give tours, work with the engineering staff to update the code, run the tests. They hardly ever see me [in the control room], which makes them happy. [field quotation 7/7/93]

The liquor plant is run from one of the two control rooms in the new factory. Accessible from a free-standing stairway, the "liquor control room" has windows on three sides, affording a view of the "micronizers" (that heat the beans and separate the nibs), the vibrating "winnower," which separates the beans from their shells, the roasting units, and the stone mills. Inside, a space roughly 12-feet long by 20-feet wide, there are four McIntosh computer terminals with large color monitors; the "operators" use a point-and-click "mouse," clicking on the graphic displays either to "view" (graphically) or to activate equipment in any part of the plant. As mentioned, the graphic screens themselves (numbering 40 or more in liquor control) display icons representing equipment in the same spatial orientation as in the plant itself. Depending on the operator's needs, there are overview screens (that display the entire plant, along with data about the status of a given batch), as well as others, more detailed, that provide greater detail about particular equipment or processes. And the color monitors display process-oriented data; during a transfer of liquor from a stone mill to a tank, for example, the line connecting the two appears in brown. Each piece of equipment on the floor is identified by a numerical code, which aids both production planning and communication with maintenance, as when operators need to report a problem through the phone or walkie-talkie system that links everyone in the plant.

In the previous chapter I quoted interviews with programmers to show that, aside from monitoring the process, operators use the screens in creative ways, to diagnose and anticipate problems. The screens provide operators with data including, for example, weights of beans being held in a hopper or "silo," codes that denote which variety of beans is being processed, temperatures inside roasting units during a batch, and coded "alarms," shown in flashing red, indicating a mechanical or electrical malfunction, which the operator must decide either to ignore or to pass along to maintenance. Such minor decisions, of which there are dozens in a given shift, assume an understanding of all the equipment and processing in the liquor plant. Lacking this, operators would interrupt batches constantly, and needlessly, in response to trivial alarms.

Already in my first field visits to liquor control, only months after start-up, the operators were quite comfortable and facile with the computer interface; the screens had become, as a programmer said they would, "...transparent, a window into whatever part of the plant the operator needs to deal with. The computer itself shouldn't be a barrier, which is why we involved these people in developing the screens, during simulations months before we got out here." According to one operator,

> I was most aware of learning when we were first out here, installing equipment and being runners for the programmers. That's when we got used how the equipment is arranged out here, and how the lines run to tanks. When you look at the [graphic] screens, what you see in your head is what needs to be happening on the floor. [field quotation:9/9/92]

Some of the "targets" for the liquor recipes (fat content, heat levels, etc.) are programmed into the system, often in "feedback loops" that help maintain product specifications. Overall, they have been able to achieve control and consistency in the product which would not have been possible downtown. As Burt, a senior operator explained:

> In the old plant we blended beans, and that was real inexact because the fat content and flavor of beans differs a lot. Here, we roast only one kind of bean at a time, make the liquor, and then we blend the liquors. That gives us much more control than before. It was a struggle to get through the start-up. But the very first batch of liquor we got out of this plant was usable; it was the best liquor we'd ever been able to make, which our customers have told us, too. We have targets for fat content--say 53 percent. Now we can hit that target on the button, and if something upsets that blend, we can compensate for it right here on the screen. Now we can count on that for every batch of liquor, for every kind of bean we use. That makes it possible for the processes down the line [refining and

> moulding] to standardize what they're doing. We always knew how to make liquor, and we knew what the customers wanted, but you didn't have the control. Here, you get the whole picture. And we were lucky to work with the programmers, because they tweaked the code and gave us more of what we needed. Some things we're still trying to get. Like I've been telling [liquor manager] that when the tanks get below a certain capacity, they run inefficient; they could put in weight censors that'd pick that up and we could keep them at the proper level. [field quotation:9/14/92]

Working with operators, programmers made innumerable small changes of this kind in the PLC code, most of which they had discretion to implement without any higher approval. Such changes were beyond the ken of foremen, and (unless they altered the operational sequence of a process or recipe) seen as trivial by the engineering staff. The latter were responsible for *maintaining* the code, once the systems were running smoothly. The project engineer told me, once in the new plant, his concern was

> Final automation. That's been the hard thing to achieve. Some of [the problem] was that we didn't simulate it--not fully. So, once we got into the real plant, there was some intense re-programming. If it's a minor thing, within the same functionality, then we [through programmers] just do it. A major change goes through an approval process, where engineering, QC, and production personnel all sign off. But, a lot of the changes are initiated by the operators. Not changes that involve equipment, like new tanks, but those that build on the existing system.

CW: Out of, say, 10 suggestions or complaints, that operators bring to you, how many end up being incorporated in the code?

I would say all of them, except they may not end up the way [operators] would like to have them, all right? Because we still have the master sequence of operation, and everybody has some input as to how that should be working.

CW: Is your communication with operators on these matters usually verbal, or is there a paper record of the ideas and changes?

Most of it is verbal; there are no pages to describe each step in the changes. We do have a master sequence of operations, and I don't know...They're [programmers] updating it constantly, but as far as new sheets being passed out, no. [field interview: 9/8/94]

Part of the firm's conception of "control room operators" is that they be aware of customers' quality-control standards and able to relate those to the manufacturing process. So, located beneath liquor control is one of two small quality control labs (the other adjoins the "central control plant") in which operators conduct tests formerly done exclusively by technicians. The testing, which takes perhaps 30-40 minutes per shift, expedites the process of sending finished liquor to tanks for shipment or use.

There are two men per shift in liquor control (no women have yet been assigned to this position), and they run the plant around the clock. Coming only months after the plant move, the most controversial change in working conditions--which first affected those in liquor control but has since spread more widely--was the company's decision to move from three, eight-hour shifts, to "continuous," 12-hour shifts. Operators now work four consecutive days, followed by four off days. But, because the staffing rotates, the particular days of the week assigned to a given worker are irregular (i.e., Sunday through Wednesday one week, Monday through Thursday, the next, and so on). Objection to this change was strongest among workers with children, but this was an instance of "management prerogative," aimed at reducing overtime pay, that fell outside the labor contract.

Though there is no formal division of labor, during a shift the two operators on duty alternate between duty in the control room and "running the floor," to confirm information they receive via the screens and to take samples for testing. During the start-up, there were frequent problems with the coded commands and, consequently, a lack of confidence among the operators in the on-line messages. Despite this division of labor, the operators spend the majority of their time together in the control room. They have ample time for casual conversation and other diversions, such as playing video games and (before the practice was detected and stopped) showing pornographic images on a free terminal. Often, particular shift partners come to rely on one another, developing idiosyncratic procedures to ensure continuity and anticipate problems.

The temporal change in work schedules (with continuous shifts) for liquor operators increases their spatial and social isolation from co-workers, as compared to their jobs in the old factory. This is only slightly less true for the "central control" operators, working in the larger control room. Primarily, the isolation reflects a sharp reduction in the amount of communication necessary to schedule, make, and transport products. The automatic recipe system allows the scheduler to forecast and routinize orders, which eliminates most of the face-to-face coordination--not only in liquor, but in all the processes that follow. When problems with a batch do occur, they can be detected and addressed by a single operator (often with the help of the man "running the floor"), rather than, as was true downtown, several people meeting and funneling their input through a foreman. In the past, the components of the liquor plant, e.g., the roaster and stone miller, were separate jobs, separate domains of expertise and responsibility. So, making a transfer, say, from a mill to a tank, required communication and mobility among people on the floor.

A Reduced Role for Supervisors

Downtown, *coordinating* that work, and updating people on the batch schedule, were recurring tasks of supervisors and the plant superintendent. Also, workers needed approval "from above" to call maintenance staff who, in turn, decided when equipment needed to be repaired or "locked out" (i.e., disabled for safety reasons). However, in liquor control, operators' overview and control of the sub-plant is total. Their direct supervisor tends only to make a few, brief appearances per shift in the control room, to confirm the batch schedule or, at times, to report news about raw materials or problems elsewhere in the plant which might require revising the schedule.

It is natural, given their greater involvement in developing the graphic screens (first in simulations and later during the start-up), that the operators quickly became more comfortable and facile than their supervisors are with the computer procedures. This gap was also enforced by explicit norms that prevent supervisors from taking direct roles in running the systems. The force of the norm became apparent to me on an occasion when a supervisor, Dean, unwittingly intervened while an operator was "recovering" from a bad recipe. Believing the recipe was unattended (because both operators were on the floor), Dean initiated a transfer on the computer, into a tank that was already full. The resulting spill took several hours--and thousands of dollars--to clean up. In front of the whole crew, Shane, the programmer, scolded Dean:

> We have got to devise a system where you guys [foremen] don't fuck with [a recipe] while it's running. Otherwise, you end up creating problems that destroy the advantages of an automated system. Unless you've got a serious reason, and you've cleared it with everyone else on the line, it's something you just don't do.

As noted, the rationale for this is that the systems run so quickly, and failure to respond to problems is so costly, that a chain-of-command is unworkable. The programmers were adamant on this point; they collaborated--with managers and operators--on developing operating procedures, and found little resistance from higher-level planners who have no stake in preserving supervisory authority in the factory. This arrangement was quickly reinforced by training and work conditions that segregated operators from supervisors for months during the start-up. As Shane, a programmer, explained, some operators were tentative about assuming control, especially given the proximity of supervisors who were not comfortable with their new role. Also, at first, many operators felt the computer terminal undermined their direct, tactile relationship to their work:

> Now [soon after the start-up] they're pretty lax; they're realizing how automation makes their lives easy, and they get complacent. We're trying to shock them into the fact that automation just increases your chances of making a major screw-up. They don't make little ones anymore [with this system], just great big ones. They know, because of the speed of the system, that they don't have to consult a foreman anymore. But, unlike in the past, when they'd go out and shut off a valve--be right out with the process--now they feel kind of removed. So they'll have a major spill

developing right in front of them, but won't even look out the window; they'll just watch that screen. [field quotation 10/7/92]

Liquor plant operators didn't often raise the issue of supervisory relations, though I did during field work. I spoke with one operator who, while downtown, had been hostile toward his supervisors and filed several grievances over their treatment of him:

I felt like they were fucking with me constantly down there. First, they shifted me around to different jobs because I'm good mechanically and didn't have the seniority to say no. They didn't like it when you went to the maintenance guys, because they [supervisors] wanted to play middle man. But half the time it turned into a contest of who was smart about the equipment. That's bullshit. Why would I chase down maintenance guys--which is more work for me--if there wasn't a reason? Don't [supervisors] think that, if the jobs were running good, you'd be happy? No, this [new plant] is real cool, 'cause we do our thing. Really, the only time I deal with [supervisor] is if I call him, or if the work order changes. But, also I think the company likes this better too. It could be scary for them the old way, 'cause we got the work done, but they didn't always know how. Now they can look at data to see how the machine does it and see what they want to change. And it's nice for the supervisors, because the machine doesn't get happy, doesn't get sad or tired; it does exactly what you tell it to do. So, for us in the control rooms, this is a win-win situation. [field quotation:9/14/92]

In the fall of 1994, more than a year after the start-up, I interviewed several "control room" supervisors to better understand how they'd come to define and enact their new roles. Generally, they shared operators' views about the ideal division of labor in the control rooms, and acknowledged the uncertainty they feel as they face the future. Among my informants was Sid, a young, respected foreman who has also worked in a canning factory:

S: The biggest mistake, I think, was the lack of formal training when we first got out here. What we had mainly was the sequence of operations, how the computer works, and what the flow of products is through the plant. And there were technology problems. When the plant was built, because of cost savings, certain things were cut. And we found out some of them caused problems in running the products. Like, we should have used stainless steel for the pipes, to prevent magnetic interference, but it was cheaper to use black iron. And magnetic interference, or radio frequency interference, interferes with the pigging system [that cleans out lines between recipes], so you get cross-blending of products that you don't want. So, we all had to work together to manage.

CW: But, did you find it was hard for workers to adjust to the computer terminals and the decision-making in the expanded jobs?

S: The transition has been pretty smooth. Part of that is in the outside world--you have so many video games and other computer interfaces, that people have gotten used to it. So, that hasn't been a problem. But [in the control rooms] you need to have a complete understanding of the [manufacturing] process, from mixing through to the finished products. We didn't have enough training, because I think some of the management people actually thought that we'd just come in here, push a button, and everything would fly.

CW: But, you've implied that, even without the training, the transition has been pretty smooth. [Yes.] So, do you credit the operators with much of that success?

S: Yes, yes. The competency is there. It's just a matter of applying it. That, I think, is our biggest challenge as supervisors, to bring out the best in these people. We know they have it, 'cause they've proven that they can run the system. Even those with lesser skills are still able to run the system, and they're learning quickly. We need them to get to the next level of individual responsibility and accountability. What holds them back at times is that they're still under the old way of thinking, where they're suffering from whiplash from the supervisor standing over their shoulder telling them what to do and when and how.

CW: But as the operators gain confidence, where do you fit in? In a sense, the more successful you are, perhaps the less necessary you become, day to day.

S: That is true. I we were to reach the ideal plateau, we wouldn't need supervisors. Our jobs would be obsolete; we'd have such as well-trained and motivated work force that operators would be in charge of all decisions, even changing conditions in the plant. Then, our [supervisors'] role would be as a liaison, a coordinator between different departments, a source for operators when they face an unusual problem. Like, if it's something that involves a lot of time, or committing a lot of company resources. We'd be that resource person. But day-to-day operations will be up to the operators; that's already the case. Coaching is a new ballgame for us in management, and we're still working out the bugs ourselves, in our approach to people. [field interview:9/7/94]

Work Routines and Styles

During more than 30 hours of observations in liquor control, I found the rhythm of work to be set by long periods of monitoring batches in process, followed by quicker and more intense involvement during changeovers, lab testing, or equipment malfunctions. Once, for example, I witnessed a small fire in a roasting unit, the result of dust from bean casings accumulating due to a faulty vacuum tube. As Blauner (1964, 154) observed in continuous process chemical plants, the control room presents a paradox in the experience of work and time: "On the one hand, this work rhythm creates situations that permit a total immersion and present-time involvement rarely found in machine-tending and assembly-line industries; at the same time it also magnifies the problems of boredom and monotony inherent in time consciousness."

I asked the operators what they had found to be difficult in the transition to computer-automation, and what they had learned most about. The response from Paul, who was hired in 1975, was typical:

The beauty of it (the control room) is that you can see

> and control a lot of things that, before, you only had pictures of in your mind. I've worked here almost 20 years; I've known the equipment and process well for a long time. But before, it was guesswork; let's say it has moved from being an art to a science, from the dinosaur age to the modern age. Like, I can tell now if a valve is failing, where the bad valve is, and can decide on other changes in the process to work around it. Downtown, you'd go on time estimates--what it usually took, say, to roast some beans. But you might have a spill, or a bad batch of beans, and I'd be out there with a ruler and a flashlight trying to reduce the downtime. Here I can see the process and think about it better. If a problem keeps cropping up, maybe I can work with maintenance on a fix or, like now, I can work the programmers to improve the code. It's boring at times, but each day what we run changes, so it don't seem repetitious to me. [field quotation:9/19/92]

Sam, another operator, explained his view of competence:

> Some operators, when a problem comes up, get annoyed and call maintenance right away, or [call] the programmers. Before I do that I'll sit and spend time with the problem, try to use the [graphic] screens to visualize in my head what's physically going wrong with a glitch on the floor. You have to understand pre-conditions; the system may be set up where if one valve isn't shut off, then a set of steps prior to that won't happen right. Once you understand the preconditions, you can figure out yourself whether an alarm is real or some bullshit thing you can ignore. One thing I'll tell you that you should not repeat: at times if there's a problem with the code, we'll get Rick [maintenance electrician] and make little changes. He knows the ladder logic, and a small change, in timing or something, saves him a lot of headaches, too. [field quotation:7/6 93]

Paul's and Sam's ability and conception of work is, again, a product of nearly 30 years of combined experience at Ace. Burt, the other liquor operator who, with Paul, was most closely involved in the start-up and refinement of code, had only three fewer years with the firm (the average seniority for first-shift liquor operators, when the move occurred, was nearly 14 years). According to Paul and Burt's supervisor, and the programmers with whom they worked during the start-up, these men exemplify the approach to work that is both assumed and required in an automated setting. Shane, a programmer, explained,

> There are a few who deal with the system in a real passive way, as a way to get out of being involved. But some are catching on really well. Paul's a good example; he'll get up and hit the floor, to see what's actually going on. He spends a lot of time supervising the system, rather than staring at the computer. He's also one who's real astute mechanically; there's no sense in my timing a piece of equipment [in the code] at one speed, if it causes mechanical problems. Paul was real helpful in getting that plant running smoother. I've tried to learn as much as I can from them, about what to expect in given situations. But I just need to know enough of what they know to do my job. You try to reach their level of expertise, but you'll never do it. I mean, all told we'll only have been in the plant for a year and a half or so. [field interview: 10/5/92]

I twice interviewed all three programmers, who worked with operators for more than a year (from the design phase through the refinement of plants in the new factory). Here I've asked one, Alan Patrick, what he found to be the operators' biggest obstacle in adapting to work in the control room:

AP: It has been running the recipes--or, getting operators to trust the automation--because we had a hard time getting recipes to run properly. Then, the operators had to do things that were never meant to be done with an operational [CAM] system. They had to devise work-arounds. If the system locks up, and they don't want to call us to alter the code, they go into manual, disable equipment, and find alternate steps.

CW: Are you saying there are a series of those, that they're supposed to learn and to associate with particular operational problems.?

AP: There are really no written procedures for work-arounds; some are built-in, but you have to find them. As the programmer, I know the system in that kind of detail, but for [the operators], they have to be willing to explore a little bit. They've found work-arounds that I'd no idea were there, because we [programmers] had never considered a particular operational problem. Of course, there's no way we can anticipate everything, especially since our knowledge of the process is superficial. By the time we [programmers] leave, they'll have a system that's flexible enough to meet their needs for a while. And in the meantime, [Ace's] engineering staff can get more comfortable with how to make changes in the PLC code, because right now none of their [engineering] people are very confident in doing that.

CW: Have there been other recurring problems, in helping operators adapt to working at Sylvan?

AP: I'd say, overcoming the unreasonable expectations that [operators] got from higher-ups in the company. They'll have been promised from day one that, once the plant's in full production, we lock the doors and there won't be any changes, and it'll run forever. That's as far from the truth as you can get, but a lot of the operators began with that as the goal of automation. In that view, automation gives you a static system. Well, [management] don't really want to believe in that fairy tale, because that'd mean they couldn't increase their efficiency and profits after the initial investment. But the [higher-level] people haven't gotten that picture. That's one reason why they've dragged their feet on getting their people trained. We want [operators] to start interacting with [Ace's engineers] in making changes, so we can finish our part. Now, [Ace] is getting everything they want on a silver platter, and that creates a false sense of security for them. [field interview:7/12/93]

Despite the evident stress among the programmers (and among late-arriving operators who complained about the absence of formal training, and the lack of time to get oriented to the control rooms), those workers involved in the "pioneer phase" were among the biggest "winners" in the relocation. They developed a unique sense of involvement and identification--with the work process, if not with the company--through the months of collaboration. Moreover, the firm provided workers with important opportunities, during the planning stages, both to learn about and contribute to the operation of the new plant. So, despite widespread complaints about a lack of training *after* the new plant opened (especially by those workers last to arrive from downtown), prior to the move the firm's commitment to training was strong and effective. At that time operators became familiar: with general computer functions, with "reading" the graphic screens, and with the cognitive translation between the graphic images and practical operation of the production lines.

My earlier critique of the rhetoric of basic skills (and of its political impact) should not detract from this lesson, nor from the credit the company is due on this score. The ease with which most operators applied their knowledge in the new plant, and the managers' reliance on informal, worker-to-worker training once the later cohorts arrived, both relied partly on the company's earlier decision to anticipate and prepare for this aspect of workers' adjustment.[8] And, as Shane, the consultant/ programmer, told me, such foresight is not always present in

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[8] Mark Granovetter was helpful in underscoring for me the importance of this point.

firms moving to automation:

SD: Ace did it the proper way; they sent a lot of the supervisors and operators [to our work site], rotated them through various demonstrations during the development phase, so they all knew basically what to expect when the system was installed. It wasn't dropped on 'em cold. They had come out, in groups of five or six at a time, and watched the simulated system run. They got to interact with it, have some limited input even then, and so were able during the start-up to really work with it; it was already a tool for them. [field interview 10/5/92]

Certainly, as stated, much of this "training" was also a function of the hectic, pressured working conditions that the pioneers faced upon arriving at Sylvan. One operator, in central control, recalled that period, along with its advantages for workers:

> At the beginning, during installation, we helped the programmers trace out all the lines [i.e., pipes] from top to bottom, which was a good way to learn. Like, the way the screens relate to the equipment on the floor--you got to understand that really well. We learned the layout of the whole plant, and to see from the ground up how the automated system was linked up. The people who came out later didn't have that kind of training, so we've had to teach them, which I don't mind. They have less time and more stress, because they're learning while the plant is running. I'll share whatever I know, because it'll just make life easier for me down the line. We had a chance they didn't have. [field quotation:7/7/93]

All but one of those who bid into the control rooms eventually assumed those jobs (the exception was a 35-year veteran who was soon to retire). But, operators have spoken of and shown the stress of control room work. One reported:

> Part of it is speed; if you have to make a manual transfer, say. At first, of course you're going to freak out; you're in there trembling 'cause there's so much happening and you're waiting to see some disaster happen. [of] oil, it takes seconds to do what used to take us a half-hour. And you have to trust the weights on the screen, that tell you how much capacity you have in a tank. But you know, too, that it's a spring, some simple mechanical device, that's telling you, and they're not perfect. [field quotation:7/11/93]

For many of the pioneers, early involvement in the factory start-up has led to a stronger identification with their work. An operator, Burt, explained:

B: You were asking before, about the BIS system, how it'll grab data about how much we're getting out per shift. Well, it's not like, "Hey, look here, I ran two more batches than you did." Who gives a shit? We're a team here; we're all in it together, and that's just a way for [managers] to see how things run most efficiently.

CW: I see. So, are you looking forward to the work getting more routine?

B: For me, when everything's running real smooth now, I find the job boring. Then, the only thing you're focussed on is getting everything done on time and confirming that the liquor's been transferred to the right place. That's not too interesting. Right now we're running at a certain capacity, and the fun is in seeing how, with the same equipment, we can get even more out of it.

CW: I wonder if now, with some months of smooth production, the newer operators have a procedures manual to refer to, to help them deal with problems?

B: [Tapping his forehead] Well, mostly it's in our heads. We have a procedure manual--the blue bound book over there--but it's not worth looking at now. We put that together nearly a year ago, and already it has been revised twice.

[At this point Alan, the programmer, interjected:]

AP: Lately our job has been to *simplify* the screens. It became clear that there was too much information, visually, for them to handle, and that was not helping them to make good decisions. Like, right now we've got a lot of spurious alarms, junk alarms; once we clean it up they'll get meaningful alarms, that they'll rapidly learn how to handle. But, we feel like it's easier to remove complexity, after they're used to scanning the screens, than to add it as we go. Few of the problems we've had have been due to operator errors; it's largely been software problems. As a group, they're very conscientious and careful; already, there's a lot more discussion among the operators about how a recipe should be constituted than about how to get the product from here to there. They're in tune with the overview, how to use the system to make a more rollable product.

CW: I've often seen people from other departments asking you questions in the control room, or just looking over your shoulder. Do you try to limit that, or has the company dictated to whom you should speak. At this point [fall of 1992], the employees don't even know how people are going to be assigned to certain jobs, or if there are to be skill grades within job categories.

AP: The least of our worries is how Ace is going to structure their labor force. I'm teaching everything I know to anyone who'll listen, 'cause that way I don't get phone calls in the middle of the night. Besides, we learn from their comments, often, about things that bear on refining the code. What someone's job title is, we couldn't care less.[field quotation: 7/7/93]

Now, I continue my discussion of job changes by turning to the other control room, "central control." During a tour of the Sylvan plant, the plant manager referred to central control as the factory's "nerve center." In addition to controlling all mixing and refining of paste, operators in "central" track the arrival of raw materials, the processing and storage of liquor and, after refining, are responsible for tranferring the paste either to moulding units or to storage tanks.

The current roster of "central control" operators, numbering 18, held six different job titles in the old plant. But, this tends to exaggerate the variation in their work experience: four of the operators had been "pumper-testers"; five had been assigned to a prototype of the integrated refining system that has reached full flower at Sylvan; one held the title "refiner relief" (covering for co-workers during breaks); and the rest were "stand alone" refiner operators downtown. So, the differences in skill and experience among the operators--greatest between the pumper-testers and the others--are attenuated by the common experience and interdependence they brought from the original plant.[9]

An indication of the complexity of work in central control is that operators use almost two hundred graphic screens to "visualize" and control the plant (compared to one-third as many in the liquor plant). Operators seated at one of the five computer work stations in the second-floor booth can see the line of refiners, through a glass partition, in a space that is roughly 180 feet wide. The friction of the refiners' steel rollers emits a dense, high-pitched din, or, a whirring sound when they're started up. These machines are connected by a system of pipes and conveyor belts that transport wet paste to the refiners and, later, the flaky refined or "rolled" product to mixing tanks or moulding units. A major efficiency of the new plant is that the various product lines, or "compounds," are assigned

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[9] See Chapter 2 for a discussion of how this interdependence was embedded in the physical plant and authority relations of Ace's original work-site.

to dedicated lines, eliminating the need for "changeovers," say, between light and dark products.

Still, the variety of products in central control--with three lines running simultaneously--creates more confusion and risk for operators than is true in the liquor plant, where only one batch at a time can be processed. As in liquor, the "central" operators work in pairs (three pairs per shift). One member is stationed at the computer terminal and the other roams the floor, confirming the accuracy of information on the screen and taking samples that the operators test for quality in an adjoining lab. Although teams of control room operators work in close physical proximity to one another, they're responsible for different production lines and so are cognitively separate. Particular recipes can pose specific problems, involving processes handled by various departments prior to or following refinement in "central control," (i.e., in addition to problems in refining itself); the casual banter the operators share can divert an observer from appreciating the complex, independent judgements they routinely have to make.

Ironically, given managers' worries about the formal skills of workers operating the automated system, the requirement for arithmetic computation has *decreased* as compared to the old plant. This has mostly to do with more rational planning and basic engineering in the new plant., For example, as an operator explained,

> Downtown we had some storage tanks that had strange amounts [capacities], like 1,350 pounds. That complicated the math a little bit, because most of the recipes have an even number. Now, the tanks are more standard sizes, but besides, the computer [screen] shows us the capacity of each tank, tells us how much paste has been transferred, and there's a calculator on the screen if you have to confirm something. Or when something goes wrong, and you need to recover, the computer gives us guidelines on how much to compensate. Now, we aren't so caught up in the details of running recipes, which I like. We have more time to deal with real problems out here, and can use more of what we know. [field quotation: 9/17/92]

In summary, control room operators are perhaps best seen as "technicians." Their work fits uneasily into what Barley (1996) has identified as a set of "fundamental polarities" in Western images of work: "mental/manual, clean/dirty, educated/uneducated, white collar/blue collar, manager/worker, and so on. The first and last term of each polarity signifies ranking in a system of status or prestige" (1996,36). Further, he writes,

> Whereas blue-collar and white-collar workers labor more or less exclusively with materials or representations, respectively, studies repeatedly show that technicians work at the interface of the two. Using sophisticated technologies and techniques, most technicians orchestrate links between a larger production process and the materials on which the process depends. Depending on context, relevant materials may be hardware, software, micro-organisms, the human body, a manufacturing process, or a variety of other physical systems. Similarly depending on context, relevant representations may consist of data, test results, images, diagnoses, or even theories....[T]he technician's task at the empirical interface is twofold: to transform and to caretake (Barley 1996,38).

The Latter Cohort of Operators: Confirming & Extending Themes

In concluding my discussion of the control rooms, it will be helpful to share an excerpt of my group interview with the cohort of operators who arrived last at the Sylvan Plant. In January of 1993 (the time of the interview), the original control room operators had had nearly a year of experience, including installation and "normal" production. The impressions of those who followed, captured in the first days of exposure to the automated work setting, bear on three of my basic (and related) assertions about shop-floor knowledge and the technical transition:

1) the continuity, and thus the value, of this knowledge in the automated factory; 2) the firm's reliance on informal, worker-to-worker training (over formal, technical training); and 3) the time-bound nature of managerial dependence on worker input, epitomized by the close collaboration between operators and programmers during simulations and the "de-bugging" of code.

Taking place after a session on controlling in-plant contamination, the interview was, in effect, a *focus group* (e.g., Morgan 1988), an opportunity for these ten workers to share--with one another more than with me--reactions to an intense and significant work initiation.[10] Given the size of this group, I will not assign fictitious names to the respondents.

CW: So far, how much of your old, downtown skills are you using?

-- All of them, I'd say. The refining techniques are really the same; you have to learn the screens and the keyboard, but the concept of running the jobs is the

[10] Morgan (1988) writes that among the advantages of focus groups are that they afford the researcher an intensive amount of group interaction in a short period of time; and that the topics raised are more a product of group interaction than, as with individual interviews, of the researcher's choosing.

same. Learning the screens is about learning the plant lay-out, but we had to learn that downtown, in a plant that wasn't nearly as orderly as this one. Things sure are faster here, but you're just watching one line at a time. As a pumper-tester, I'd have several things on my mind at once.

-- Yeah, it's like getting new tools to do the same old job. There's a lot of the computer that's new to me, but I guess they're gonna give us time to learn. It's tough because the other guys [earlier cohorts] had simulations; they learned the screens before they were connected to anything. So we have more pressure, but, on the other hand, maybe we can gain from their experience.

-- For me, it's not that you have to *know* a lot more; it's that you're *responsible* for a lot more. You got to worry if there's enough liquor in stock; you're dealing with the shipping department, for load-outs; you're dealing with the engineering people, when there'a changes in the [computer] code; you have to figure out the alarms before calling maintenance....To me, they should be paying us twenty dollars an hour, at least, to be responsible for all that. Also--and I hope this reaches the right ears--I wish we'd have more of the training they promised us.

CW: Do you all share that complaint? [Nodding Heads all around.] What did you expect? What kind of training?

-- The classroom training we've had has been about more general things, like hazard control, sanitation, tempering--but that doesn't help when you're in the control room. For that, we have to learn from the guys that have been out here longer. But I've ran into [workers] where their training technique wasn't right for me, 'cause they were going totally too fast in explaining things to me--do this, this, and this--and I didn't know why I was doing things.

CW: I've heard similar things from maintenance people; they helped the contract programmers, but didn't have time to ask questions or take notes.

-- Personally, I don't think that employees training other employees works that well. I think they should have designated trainers. Like [the programmers]--I think they should be in charge of training everyone, 'cause they developed the system, and they have experience in explaining things. Plus, they're not going to play favorites, telling things maybe only to their buddies. You can run across people who don't want to share what they know.

-- As for me, I'd come in weekends, unpaid, to get more training with the programmers. Because it would benefit me as well as the company. But there was a situation where a certain person who want to bid into the control room in the future, came in on his own time, to study the progress of the plant. And, bang, he got wrote up [with a disciplinary letter]. But the supervisors can come in anytime.

-- That's a fact. But if they really want us to act like a family, why not start trusting us and treating us like a family? We didn't even get a tour of this place, for those months we were downtwn, except when [a popular supervisor] drove some of us out one night.

CW: Since your arrival, has the company created any time outside of the production schedule for training?

-- No, none. They're saying we'll have a couple of weeks to learn, before we take more or less normal shifts. But see, the first group [to arrive at Sylvan] had several months of training, and a lot of them will probably be on the same shift. I may be on a shift where the guys with me won't know shit. The question is whether they're gonna give us the time to get better. For the first group, they had bitch sessions with the supervisors and the engineering people, to talk about the procedures and what have you.

-- But that was just working in the first phase, 'cause [managers] had to get everybody's input at that time. I think [during the start-up] they often set together, with people from different departments, tackling a problem from different angles, different parts of the process. They were writing [procedure] manuals and all that. I don't think they need that now.

CW: It is true, though, that you're continuing to have training sessions, like the one you had today. Does that allow for discussion about work problems?

-- At this point, I think we all [workers and managers] just want to get it over with. Because we're all tired of the same voices: we're tired of being rushed into learning this new plant, and they're tired of us complaining about the training. We're not making suggestions, 'cause they've gone in one ear and out the other.

-- This is sounding real negative, Chris, but there are some good things out here. Personally, working in the control room, I have a sense of being more involved in the process, being responsible for something, taking pride in the work.
It's cleaner.

-- Like Tom said, it's more of a feeling of pride in work. Like at the old plant, if someone was to ask what you did for a living, you'd say, pumper-tester. They wouldn't know what the hell you were talking about. At least now, someone asks you what you do, you can make it sound fancy--control room operator, or computer operator, something more technical. It gives you that good feeling. But it's more than a change in title; it's more responsibility, for sure.

-- Yeah, more responsibility, but [Ace] does not want to pay us for what we're doing. The plant superintendent has even said that he thought the refiners, in the old plant, were being paid too much, and that out here the work has to be brought up to the wages [$ 11-12 per hour]. We totally disagree with that. Basically, they're saying that in the old plant it was an unskilled job. If that's true, they could could've brought in anyone from the street, said, "Ok, go to it." But that couldn't be done; it takes training and experience. We've told you: we haven't learned much to operate in this new plant, except for the computer.

-- And they're still paying the supervisors better money, even though, in the control rooms, the workers are in total control of this plant. I mean, [production scheduler] comes in every morning with the recipes for that day. The supervisor's standing there with his hands in his pockets--you could have one supervisor on a whole shift, just to pass you that information and be gone. You can't blame them for trying to hang on to things they used to do. But now, I think part of my pay is just for putting up with them, because, on my shift anyway, they don't help. It's not a fair trade-off; if you're gonna remove that supervision, and give that responsibility to us, then, basically, we're supervision. And the money should follow that. [field interview:1/12/93]

Control Room Work: Discussion and Implications

Overall, this interview lends support to several arguments I have advanced, and (as I'll expand on in the conclusion), indicates limitations of dichotomous thinking about "effects" of technical change and workers' skill which has constrained theoretical debate since mid-century. First, regarding the *continuity of skill*: against the backdrop of controversy (e.g., Hodson 1988a; 1988b; Spenner 1983) over whether the impact of automation is to "upgrade" or to "deskill" workers, this case reveals substantial *continuity* in the practical and cognitive relationship of workers to the core productive process. Despite portraits (in both lay and scholarly discourse) about automation as an exogenous force, transforming work practices, here the computer-interface served primarily to give operators (as well as engineers) a symbolic, graphical view of and direct control over processes they well understood. The meaning of "craft" for these workers has less to do with tactile dimensions of the job, or with membership in traditional occupational groups external to the immediate workplace, than with the challenge of manipulating materials and equipment to increase production (a challenge Barley [1996] links with the work of techicians). Clearly, these goals are shared by managers, who, in dealings *with the control room staffs*, have made good on the promise to relax supervisory authority in exchange for workers' acceptance of greater *formal* responsibility for production.[11]

These findings are anomalous too, with respect to neo-Marxian theories of the labor process. Burawoy (1979,30) who has most powerfully joined this tradition with empirical research, asks,

> How does the capitalist assure himself of surplus value when its production is invisible? Marxist theories of the labor process have frequently referred to fragmentation and atomization of the working class at the point of production--essential features of the obscuring of surplus value--but these theories do not explain how surplus value is secured. Obscuring surplus value is a necessary but not sufficient condition for securing surplus value.

From this view, managerial interests in maximizing profit (surplus value) depend upon increasing fragmentation of the labor process. Conversely--and consistent with the adversarial logic--sustaining this exploitation requires that workers' initiative be coopted and diverted into activities (or "games") to which they attach local values but which contribute only incidentally to securing surplus value. In this connection, Burawoy's argument features an analysis of piece rates, as a mechanism for organizing

[11] i.e., as opposed to the *de facto* responsibility they had in the original plant, often embedded in the informal organization of work.

individual effort and shop floor culture. There was no such system at Ace to cloud the transparency of the labor process or of workers' critical role in the technical transition to a more profitable one.

This case suggests, rather, that the same profit-driven goals may be pursued through technical changes that restore relative "holism" (not fragmentation) to the labor process, and that, for workers, quasi equal-status participation in such a project may be a significant kind of cultural and political expression. This is true notwithstanding researchers' inferences about the broader implications of worker participation, either for economic relations or for the constitution of classes.[12] Put another way, in labor process theories the origins of workers' political awareness and action is the *degradation* of work; such theories leave little room, then, for the situated, the cooperative, the creative expression of workers' knowledge as a basis for action and local culture. Or, if discussed, these impulses

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[12] This problem is reflected in definitional debates over realist versus nominalist, or subjective versus objective approaches to class analysis (see e.g., Kerbo 1991).

are said to arise *against, rather than with or for,* technical change. This is partly due to the historical sweep of Marxism, as well as to its political program. As Attewell points out, "If the benchmark for evaluating current skills is to be a precapitalist [i.e., craft] 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" (1990,445).

In sum, recognizing economic exploitation under capitalism should not blind us to the ways in which there may be harmonious relations between workers and capitalists *around the labor process itself*. For researchers to see this, and to reconcile these relations (in theoretical terms) with changing conditions of managerial control, is a natural research corollary to the critique that the labor process and forms of control need to be studied separately.

That these relations and practices were especially salient during Ace's process of technical change may, on the one hand, be a product of the (team-oriented) managerial rhetoric and strategy I described earlier. On the other hand, they may be present generally but were more *visible* when the formal organization and authority of the firm were in flux.

The other themes the interview illuminates are the firm's *dependence on worker-to-worker training*, for those not included in the initial cohort, and the *time-bound nature of worker involvement* and consultation in the Sylvan plant. Both of these themes, seen as empirical threads, tighten the weave in this tapestry of worker knowledge and adoption of computer-automation. I'll touch on each briefly before summarizing the status of other work groups in the new plant and, finally, discussing the re-imposition of contractual governance which preserved the personnel changes managers preferred.

There is evidence from many sides--mostly in the form of complaints--that in the early months of production at Sylvan, Ace withdrew support for ongoing plant-specific training. This was true even for those who were presumably facing the greatest job changes and the greatest increase in responsibility: control room and maintenance staff. Also, engineering staff, supervisors, contract programmers, and hourly employees--all complained, during the hectic early months in the new plant about a lack of basic technical and procedural training they felt to be necessary for the competent and efficient operation of the plant. Given the firm's massive capital investment, and their earlier emphasis on "human resource development," this neglect of training is puzzling.

My most direct source for the managerial perspective on training is Brian Heath, a research and development technician who was recruited to coordinate training for the new plant project. As I discussed in chapter 3, Heath expressed an uncertain and contradictory mandate during our interview in the summer of 1993. He claimed that workers "are going to be facing jobs that are totally different than they were in the past" and that "We wanted to empower them to do things that they'd never done before, to be decision-makers; after they've been carefully trained, they won't go to a supervisor and ask what to do; they'll know and will do it." However, in reporting to me some details of the actual training, he said,

> ...using the statistics and flow diagrams wasn't especially new to me. But as we went through it, with the hourly employees, I got a much better insight into the actual operation of the lines and the equipment." And, "Much of the new equipment, we'd no idea how it worked. So we [trainers and supervisors] had to learn every detail, because we needed to know as much as the hourly employees, consult with the manufacturer representatives, and work with [hourly workers] to prepare procedure manuals. The workers' complaints were about the environment, the [supervisors], not the equipment; the equipment they took to, no problem. And we encouraged people that were especially interested to train others too, and they took to that quite well. So, the training part, I would say, was the least of the problems. People problems were the most difficult to handle [i.e., with supervisors and with workers wary of sharing knowledge with competitors for jobs]. [field interview:7/21/93]

Clearly, despite such ideological statements as that by Mr. Heath, managers' practical experience at the Sylvan plant was of workers who, along with engineers and programmers, performed efficiently and well during the most demanding part of the transition. During the installation and start-up of Sylvan, it appears that Ace managers took their cues about the timing and allocation of training support from the programmers who, in turn, were working directly and interdependently with shop floor workers. As I've pointed out, the programmers' concerns about training were not centered on production workers but, rather, on *salaried staff* [department heads and engineers], and *maintenance staff* who were to be responsible, respectively, for updating and maintaining the computer coded systems after the programmers' contract was finished.

It appears, too, that the basic integrity and adaptability of the systems during the critical first year of production depended heavily on the ability of the original cohort of operators, both as operators and as trainers. Though Ace's resources were stretched thin during the relocation (as shown by their having to scale back the extent of automation from their initial projections), surely they would have subsidized additional in-plant training of production and maintenance staff if convinced that doing so were essential to meeting production quotas. Instead, the company managed to avoid that loss of money and production through their reliance on informal, worker-to-worker training. This further suggests significant continuities between workers' prior skills and those needed at Sylvan.

By this I don't mean to deny that workers learned a lot through the transition, nor that they drew heavily on technical expertise among their own engineering staff and outside programmers. But, looking at the (consultative) form, short duration, and effect of the training--which, by all accounts, enabled operators to perform at levels that exceeded managers' expectations--leads me to conclude that workers' knowledge proved to be more a resource, than a barrier, during the transition.

No one familiar with Stinchcombe's (1959) analysis of craft (versus bureaucratic) administration in the construction industry will find this surprising. He argues that there are elements of bureaucratic rationality which are not, perhaps cannot be, present in construction work because of the varying nature of materials, needs for communication, and practical problems on particular work sites. He goes on to argue that "...the professionalization of the labor force in the construction industry serves the same functions as bureaucratic administration in mass production industries and is more rational than bureaucratic administration in the face of economic and technical constraints on construction projects" (1959,169).

Stinchcombe does not address training or the acquisition of skills among skilled tradesmen, and he explicitly *constrasts* mass production with the work settings he sees as resistant to bureaucracy. But the principle of apprenticeship is implicit in "blue-collar" professionalization. And, in the process of starting up a factory one creates work conditions similar to those of a construction site. That is, Stinchcombe argues, in mass production, planning and evaluation

> ...take place in specialized staff departments, far removed from the work crew in the communications system. In the construction industry these functions are decentralized to the work level, where entrepreneurs, foremen, and craftsmen carry the burden of technical and economic decision" (1959,173).

So, it is no criticism of Ace managers to claim that, during critical stages in the technical transition, they allowed decision-making authority to devolve to work crews in the plant. Apparently, the managers did so with confidence that the production staff would both *inform* the programmers and engineers (especially when the code had to be revised), and, manage to overcome technical problems for which production workers had no preparation.

A final theme that emerged in the group interview, about consultation between workers and managers during the relocation, has to do with its temporary nature. This dovetails with my argument that the degree of workers' input, and the retention of practices through which it was gained, were positively correlated with the degree of technical uncertainty and challenge over time.[13]

The forum for workers' input, we learned in the group interview, were "bitch sessions." Workers saw these as practical, as connected to daily problems (in a way that formal "seminars," run by outside consultants were not) and as the most tangible expression of team management. As a maintenance electrician (quoted in chapter 3) reported, "When we first got out [to Sylvan plant], we had debriefings almost every day. They took suggestions seriously, and you saw them being put into action almost immediately. That was a good feeling. That was before production started...As new lines came up, the idea was just get it up and running any way possible, and [our] frustration started to build."

[13] This applies to the appropriation phase of the transition, involving focussed, practical problems to be solved by small groups. During the accessing phase, I argued that such consultation was framed collectively and rhetorically, intended to overcome political resistance to the suspension of the labor contract.

Recall too that, in the group interview, responding to my question about the "bitch sessions" and their value during the start-up, a control room operator had this opinion:

> But that was just working in the first phase, 'cause [managers] had to get everybody's input at that time. I think [during the start-up] they often set together, with people from different departments, tackling a problem from different angles, different parts of the process. They were writing [procedure] manuals and all that. I don't think they need that now.

This interpretation was offered more generally some years ago, by W.F. Whyte, who gleaned from his own extensive field work that, "As the technical problems of technology and process become resolved and the operation becomes more routinized, management interactions with workers can be expected to decline in frequency, and the management people are likely to be less responsive to attempted initiation of activity from workers" (1961,232).

Throughout the dissertation I have offered a chain of observations and inferences to the effect that Ace's relaxation of supervisory authority was, in effect, tactical--sustained only temporarily, for those workers whose discretion managers saw as essential for the efficient operation of the automated systems. Indeed, even for these (control room) workers, the managerial commitment to "team-oriented," consultative practices seems to have waned once the plant was running at or near capacity. Jim Michaels, the quality control engineer, admitted as much in an interview soon after the final cohort of workers had arrived from the downtown plant:

JM: The real difficulty is how to have a participatory kind of management--which, of course, we want--with a way to make good decisions and send clear messages. You can be as team-oriented as you want, but ultimately someone has to make decisions, and having confusion about that is hard on everyone, including the production staff. They've got enough pressure without having to make sense of three different game plans.

CW: But I understood that all the seminars and production meetings, like those during construction, were intended to be a dry run, so to speak, of the new process of team management.

JM: I think the team concept is fabulous as a theory, but I think in the transfer from the downtown plant to this facility, I we'd have stayed on schedule, we might have had a realistic chance of pulling it off. As the schedule slipped, I think a lot of the same old management philosophies from downtown started showing through here. I don't think we're in a truly team concept yet; hopefully we can get to that.

CW: So, as you see it, no irreperable harm has been done to this goal, but it has been delayed by unforseen logistical and technical problems? [Nods] What, specifically, about the delays or their pressures undercut the adoption of team management?

JM: Well, they definitely did, because of the need to satisfy customer demand. I think two-way communication --what you called consultation--works out well until you're pushed to the point where you don't have time to do that. The problems [Ace] had probably weren't presented to the people [workers] in a structured way, or even individually, 'till there was conflict, where we had to say, "We can't get to your concerns, because of this." And we also had problems with product specifications, where, rather than engaging in a complicated process of getting workers' input, you want to utilize a scientific method, collect various kinds of information and then, with that understanding of the problem, devise a more permanent solution. [field interview:12/9/92]

This view seems more characteristic of Frederick W. Taylor, the patriarch of scientific management and of the "one right way" to organize production, than of W. Edwards Demming, the American champion of Japanese-style practices that were the prototype of Ace's team management campaign. Once the equipment installations, computer-code, and work procedures were refined at the Sylvan plant and the firm was meeting production targets, managers' weak sponsorship of the team concept seems to have shifted to an effort to concretize the new procedures in the name of efficiency. As the next section will show, this tendency was especially strong for those workers whose jobs changed little through the relocation, and whose expertise was less relevant to the ongoing technical problems posed by computer automation.

"Outside the Loop" of the Automated System: Dismay and the Intensification of Labor

This final section of the chapter concerns the post-relocation job changes affecting workers in two departments outside the control rooms: maintenance, and "packing and moulding," as well as the subjective reactions of the workers to these changes. It also compares their experiences with those of control room staff. The most important objective here is to elaborate the central argument about skill appropriation, by tracing the trajectory of various groups along the dimension of supervisory control.

When they introduced the "team concept" to workers in 1990, Ace managers claimed that it would extend to the entire production staff. It was, they said, a principle basic to good decision-making and assurance of quality, as important for those in manual jobs, such as packing, as for the highest-skilled and highest-paid workers in the plant. However, we have seen that even among the control room staff, the consultative spirit of the team concept appears to have been ephemeral. That is, the original cohort shared, objectively and subjectively, forms of "authorship" of new work systems and procedures, which those who followed a year later did not. Instead, when they were initiated to the control rooms the second cohort found: pressure to meet production demands, with little training; changes in their shift schedules which caused fatigue and disruption of their lives outside work; and a substantial increase in responsibility, which were difficult to justify in wage terms.[14]

Despite these pressures, workers in the later control room cohorts can claim important, non-material benefits in their jobs. As the foregoing discussion illustrated in detail, they are required to use a good deal more of their knowledge and judgement than was true in the past, and are remarkably free of direct supervision. One can argue that they are subject to what Edwards (1979) called *technical*

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[14] This was especially true before the settlement in 1993 of a new labor contract. In it, control room operators were awarded the highest percentage wage increases--over 10 percent--on base salaries of over $11.00.

control, that which inheres in the physical or technical system of production itself. They monitor "automatic" recipes that, though subject to problems, dictate the overall production schedule. And there are "passive" means of data collection which, over time, could be used for supervisory surveillance. But the operators' pace and perception of work allows for a sense of control, of being buffered from the intense pressure and *arbitrariness* of authority and of "speed ups" in the process. Studies such as Gouldner's (1954), of a *Wildcat Strike,* show that these two social variables in factory supervision are among the most potent for inducing workers' resentment and resistance. Thus, we can use these two dimensions, two bases of worker grievances, in comparing groups' work routines and power after the relocation.

However, for workers "outside the loop" of the automated jobs, the contrast with control room staff is striking. These workers include, in descending order of formal skill designations ("labor grades"):

Labor Grade	# of Workers
maintenance mechanics	18
electricians	8
quality control testers	6
machine operatives	19
butter melters	9
material handlers	32
packers	49
seasonal packers	33
sanitation workers	15
	Total
	189

These 189 workers, along with the 18 control room operators, make up the production workforce of roughly 210.[15] I include maintenance staff here, although they have more autonomy than all but the control room operators, a merit pay scale that is the highest in the plant, and power as journeymen in the external labor market. They are included because their work routines and responsibilities in an automated environment have changed, becoming more intense and less independent than was true in the past.

Once an "Elite": Intensification of Maintenance Work

In the downtown plant, maintenance workers (including

[15] There are employees in shipping, sampling, and trainee positons that create slippage in my count.

roughly a half-dozen mechanics and three electricians per shift) were a tightly-knit yet casual group. In addition to their celebration of informal status--based on special expertise or defiance of supervision--they reveled in their independence, in their ability, despite the hardships of the work, to shape the priorities and set the rhythm of their own work. During a day of trailing behind a mechanic on his rounds, I remarked on his deliberate work pace and willingness to talk at length with machine operators about a problem before even opening his tool- cart:

> Listen, I've had my days of busting ass, but that's behind me now. I went to night school to get my certificate in factory maintenance, and went back for advanced work in welding. We've paid heavy dues to make good wages. Besides, it's a long day and I can't afford to be worn out half-way through. I never know what's coming next, but still it's my job to keep the lines running. Even one moulding unit being down for a shift will cost the company real money. So I'm paid to listen to the operators, if that's part of trouble-shooting the problem, and then [I'm paid] to get it fixed right. I'm not going to chase around here, and I don't have to prove anything to [foreman]. He doesn't give a shit if I dog it a little, because over the course of a week he knows I'm going to get the work done. [Field quotation:12/13/90]

I got a similar message from an electrician whom I followed for several shifts during my early fieldwork. I noted the care he took with each encounter or "trouble call," how he began by creating a warm, congenial tone and then asked questions of the operators or packers, respectful of their reports and hunches about where the trouble lay:

> First, I can save time by talking to them because they run the equipment every day. Some operators are really good about describing the problem, how the equipment was running, so [that] I can narrow it down. That's a real nice part of the job for me, because I like dealing with most of them. And they appreciate what I do, because when I get them up and running the pressure goes down. There are days from hell where you're on the run all day, but that' why you take it slow when you can. [field quotation:12/12/90]

Downtown, the means and methods of supervising maintenance staff were relatively relaxed and informal.After spending one day with a team of mechanics working to repair a stone mill, I asked how they recorded or accounted for their time. "Eight hours, stone mill; that's it" was the reply. There, the rhythm and delegation of maintenance work was typical of that for skilled tradesmen; they had broad assignments and broad discretion within the work crew over the specific delegation and sequencing of tasks. This relative freedom was a point of pride, as well as a neccessity, for a small crew juggling trouble calls, scheduled maintenance, and special projects like improvements to the physical plant.

In contrast, maintenance work in the new plant has, for several reasons, been intensified. Ironically, the plant manager had suggested during construction that (with more automation) Ace might be able to *reduce* the expensive maintenance staff; instead, the crew has struggled to cope with the workload with increased staffing (from 25 downtown to 32 in the new) and the stresses have led to higher turnover, further eroding their strength even with more bodies on staff. Walter, A 25-year veteran mechanic explained,

> There's too much work, and too few guys. The idea that we'd need fewer people out here is a joke to me. It's like when you build a new house; it looks real clean and shiny and you think it'll be easy to keep it clean and running, but you find that it's more work than the old house. We should have a couple of guys working only on PMs (periodic maintenance), because we're falling way behind there, due to the trouble calls. But you'll always have those. Down the road, keeping up with PMs is what's gonna keep the stuff running, especially with running production on three shifts. But if I did everything they're throwing at me, plus did the [PM] rounds to my way of thinking, I'd never stop running. [field quotation:7/13/93]

There are several major ways in which maintenance work has been intensified at Sylvan. First, there is simply *more* work due to the larger physical plant, expanded production lines, and greater wear from continuous (round-the-clock) production (not to mention the initial pressure to assist contract employees with new plant installation). Second, these workers have had to learn new pieces of equipment, mostly on their own initiative rather than through formal training. One year after the start-up, I asked an electrician whether there is parity in terms of knowledge within his work crew:

> We're all at different levels. It has been survival of the fittest; whoever asserted themselves, and was lucky enough to be involved in a lot of code work, is better set. We're all competent in that way [with ladder logic], but some you can trust, where others only know enough to be dangerous [laughs]. The people who came out [to Sylvan] later lost out on a lot of good training; that experience with the programmers you just can't duplicate. You can't learn it in book; you can get the basics that way, but it's mostly on-the-job training. Because the science stays the same, but it's the code--how they utilized it in a particular plant, by those particular programmers, that's key. They could have written it in a million ways. So that's where the real skill comes in: just booting it up and changing a contact bit in the code, or changing an address, can be done by hard typing. But what it means, when we refer to code, is how they used it, in what format, and which number system they used to identify particular files. I've really enjoyed that learning; it's a great chance to move ahead into the 21st century. [field

interview:5/12/94]

As this statement makes clear, within the maintenance staff the electricians have been most dramatically affected by the adoption of computer-automation; they've had to shift from a conventional "relay" circuit system, to one that also involves programmable "ladder logic" controls ("code" that periodically is revised subject to approval by engineering staff). Wayne Bauer, for 13 years an Ace electrician, described changes in his job:

WB: We use lap-top computers on most trouble calls, to get in and check the code; 'cause in a fair number of them you have to look at the [ladder] logic. So, that wasn't a myth. Those are skills we're using, if not every day, then several times per week. The new units are sophisticated pieces of equipment; they have their own programmer, their own manual and personality. As for electrical skills, having a solenoid or a motor get fried--I don't know how to put it in percentages--maybe one-third of my calls are the old-fashioned kind, and those will never go away. The other half to two-thirds of my day is more high-tech.

CW: But, is there also simply more of that kind of work, than you did downtown, because there is a bigger plant with more equipment?

WB: Oh yeah, there's more pressure here than downtown. The *pace* is really there; the pace is a killer. There really wasn't a high pace downtown; you'd get sweaty and have to take a lot of stairs, but the work pace was

> real even. Out here it's intense--all the time. How should I put it? They're in a global market; apparently they'll make or break their budget on pennies per pound, or fractions of pennies per pound. So down-time, or re-work, instantly creates a loss. So I think that pressure's pushed so hard at the top that, down on the floor, it's a pressure-cooker. You don't have the luxury to stop and talk with people in the plant, which is bad for me as a steward. I find myself taking another route through the plant, so you won't bump into people who you know want to talk to you. And that always makes me feel some conflict in myself, about trying to be a proper steward. So I'm dealing with that, moment by moment. On a personal level, there are friendships I used to feel--where your kids knew each other and you'd spend off-days together--where now you go for weeks without passing a word with the person. [field interview:5/12/94]

Third, the rhythm and pace of work, once dictated mostly by maintenance staff and their foreman, is now largely mediated by the demands of control room operators. These workers alert maintenance staff to "alarms" (indicating equipment or operational malfunctions) that constantly appear on the graphic control room monitors. In short, operators' graphical overview of the production lines, and their awareness (from the alarms) of problems, means that they initiate and define contacts with maintenance staff; *though electricians still have to diagnose and complete repairs, at Sylvan they do so in* *response to calls in which operators' discretion sets the agenda*. While the division of labor was not explicit--especially soon after the plant opened--maintenance workers believe that some operators abuse this discretion. These complaints by Rudy Mendez, an electrician, are shared by many I spoke with:

> [The operators] get lazy in there; some act like the king holding court in that control room. When they see an alarm on the screen, the first thing they're supposed to do is get out on the floor and check out if it's legit or not. Like if an air pump is disabled, it may be that the paste is too wet and clogging the line. They can go find out, but a lot of times they'd rather call and have us chase it down. I think they get almost hypnotized by the video screens and forget there's no short-cut to being involved with the process. Downtown, people had to make sure there was a problem and call the foreman before we'd respond to a call. Now, hell, they don't think twice before calling us, even when they could check it out first. [field quotation:1/15/93]

Finally, the system for delegating maintenance work at Sylvan has been changed from the one in place downtown. In the past (as I mentioned in chapter 2) the only formal job division was that separating electricians and mechanics; other distinctions--whether based on workers' skills, preferences, or staffing needs on a particular project--were made informally, by the shift crew and foreman. At Sylvan however, maintenance workers are assigned exclusively to particular lines or plants, an arrangement that has received a mixed reception among the workers. On the positive side, they like the *efficiency and continuity* of knowing the repair histories of particular machines. And they appreciate being able to refine their knowledge and techniques through repeated exposure to a confined set of problems. Yet, most of the staff object to the greater isolation from co-workers under the new work assignments, and are concerned that, over the longer-term, their skills will become more narrow and specialized, perhaps to the detriment of their value in the external labor market. Brian, a mechanic, told me, "I always enjoyed working alongside different people, on new machines and projects. That kept it interesting. [At Sylvan], unless I'm on something unusual, or they put me on a job where they need an extra pair of hands, I generally work alone."

During a lunch period I shared with Walter and Rudy, an electrician, they recalled the past and drew parallels with their present work routine:

W: In the old plant, you'd start off the day, punch in at the shop, and head to the break room for coffee. We'd come at 6:00am, a half-hour early, just to have that time. Then, back at the shop we'd talk over the [assignment] schedule; you'd kind of roll with the punches, in terms of how a certain job was going and who you'd need, which made it less monotonous. Now, they've got most of the guys working in one department, or one part of the plant, so you don't get to see other people much. Plus, I've spent the last few days putting a replacement roller in a refiner. I'm not getting the help I need, and I'm not learning much of anything about the new lines they put in. So it just feels like I'm working harder.

R: I'd agree with that. Plus, out here the job takes up more of your life. Downtown, you went home and you weren't stressed out at all. You had a skill; you were a fireman; you knew how not to blow up the place, and your calls were simple. Out here, we're being swamped; the computer pumps out hundreds of previous maintenance requests, which we get buried in, and we can't respond to them. And then the continuous shifts kicked in--twelve-hour days, four on, four off--and it seemed that the higher you get in the skill level, the more people walked and the sooner they walked. With mechanics there's almost been a perfect graph, where they lose at least one person per year, while we're losing two. So, that doesn't help camaraderie. [field quotation:1/16/93]

A full assessment of work changes in the new plant should, in my view, also include attention to potential changes in practice made possible by the computerized systems of control and communication. That is, given the resources of a computer- integrated production system, an important question is to what extent its advantages have been applied to problems that workers (as well as managers) deem to be important. For example, at Sylvan, the head of engineering ordered a computerized inventory system for the maintenance staff, to expedite the ordering of spare parts and to help them keep track of the preventive maintenance schedule. Maintenance staff could easily have used this on-line system as well to pool diagnostic and procedural notes. A written record of "trouble-shooting" would have both reflected and complimented the oral culture of "war stories" that mediates the craft of repair work (see Orr 1996). This would have been especially valuable in the Sylvan plant because they were constantly facing problems new to them, and because changes in foremen's delegation of work left the staff more isolated from one another (and, thus, from the practical, in-plant experience of co-workers). But, instead of being used as a craft tool, to enhance verbal communication, the on-line system seems only to have increased workers' daily stress. As Rudy said, in addition to trouble calls and projects, the on-line system automatically generates work orders without regard to other demands on workers' time, or to how much "real time" each request might require. So, even if workers have been relieved of some oversight by foremen, their perception is of more supervisory pressure. Speaking about the on-line system, an electrician, John Padway, complained:

JP: I really don't have the time; I mean, I have a hard enough time, taking hand-written notes on things, to jog my own memory. If there's something important enough to write down, I do that; I have a kind of shorthand, then I make sense of it at my locker at the end of my shift. But I don't have time to sit down at the keyboard and record these things for someone else. Because I don't know whether what I put down will be important to the next guy, and for all I know the foreman will delete it anyway. So, it's not a good use of my time to do that. [A better use] is to pass it along in the lunch room, ask questions if I need to.

CW: Well, is there a connection between your written comments and the work practices or decisions of higher-ups, say, in engineering? Being a devil's advocate, maybe those entries are being taken into account in ways that will help you in the long run.

JP: I don't see any connection. The system defeats itself because we spend a lot less time being productive. It's like a course in creative writing; you fill time just complying with the system, saying what's got to be entered, but it doesn't reflect the reality of what's going on in the plant.

At this point John sat me down at the terminal in the electrical shop, called up a file called "Work Log" and scrolled through what must have been hundreds of outstanding work orders, some dated from months before. Next to some of these entries were workers'initials and the amount of time that had been devoted to each task. In theory, staff members' time could be reconstructed from the log, by adding together the time recorded for a given day or week, but John argued that this apparent accuracy was illusory and misplaced:

JP: Every time there's an overload or a reset on a pump—things that happen a dozen times every day--we're supposed to chase down the [control room] operator to get a work order; that's the proof, so to say, that you did the work or ordered the part. But you can't interrupt your day like that and get work done, so we tend to wait and tap them into the computer all at once, at the end of a shift. All of us get way behind. Well, the foremen don't like that; they're glorified bookkeepers out here, and going over the computer records is about their biggest job out here; they want to show they're running a tight ship. So we'll come in on weekends sometimes, to catch up. Why are you paying journeymen electricians overtime to do make-work on a computer? Downtown, the foremen coordinated work and told people what was going on from one shift to another. If you've got a long or complicated repair, we need to know how it's progressing. We need someone to keep track of what's been done, what needs to be done, and who should do the work. As it is, they've given that job to the computer, where the information sits in files no one can straighten out. That doesn't help anybody. [field quotation:7/14/93]

Expressions like these, while significant for maintenance staff, are only indications of their more general grievances against middle management, especially those in the engineering department. Having had a taste of consultative work relations during the plant construction and start-up (though not of input into material decisions affecting their work), they had hoped at a minimum that their ties with the salaried ranks would endure at Sylvan. When in the new plant they saw those ties atrophy, despite their personal investment and sacrifice during the transition, they found that even their relaxed and close-knit departmental culture had been lost. Their disappointment is tinged with irony, because many changes in their current work routines do afford maintenance staff a greater overview and, potentially, a more important role in production than was possible in the past: graphic displays and alarms can expedite trouble-shooting; revising the programmable code can solve recurring operational problems and even be a tool for innovations in the process; and on-line inventory and purchasing systems could easily be a tool for creating an invaluable detailed, practical record of concepts and repairs for the entire staff (and for new hires). As of September 1994, when I last did sustained field work, none of these possibilities had been realized. Brian Gaines, a soft-spoken mechanic whose father also had a career in factory maintenance, explained his feelings this way:

> Just to be listened to, to have our opinions respected--that would have been good. There's really no communication here; there are problems that come up time and time again and we have good ideas on how to prevent them. But they never get a hearing. Management never gets close enough to the factory to investigate these things with their own eyes. To be truthful, they can't see the whole picture because they've got tunnel vision. So, they see work orders, or a printer spits out some report, but they have no real world sense of what it means. They don't even invest the energy it would take to get up and walk down the hallway to the plant, even though they'd learn something if they did. If they did, spoke to us on our level, maybe they'd see we have an overview of the situation they need. They'd see their ideas aren't so elevated, and then they wouldn't feel in control. Most of these people, they don't mind working hard. We've got the company's interests at heart, because we want to keep it going. But more and more, people don't give a shit. When we learned--from the papers, a lot of us--that Ace was up for sale, a lot of production people felt good about it; like, whoever buys us out, maybe they'll clean house and get rid of some of the arrogant management people. Production people who know their jobs, you figure we've got to last longer than the clowns in management. You can hope that, anyway. [field interview:9/10/94]

Packers and Machine Operatives: Punitive Supervision and the Prism of Race

An important dimension of the changes in maintenance work and supervision at Sylvan is an expansion of what

Richard Edwards (1979, 110-130) defines as *technical control*: that which is "embedded" in the very structure of the production process. Such control is exerted through the automatic recipe system itself, which specifies the pace and content of myriad mechanical processes; through the alarms that indicate (and record, through textual reports to the engineering department) system malfunctions; and, finally, through the on-line system that generates a relentless stream of work orders and demands for time-accounting.

For maintenance staff, these negative pressures have been relieved somewhat by consolations like learning new things (for electricians, using ladder logic), and permanent assignment of workers to domains in the plant (which, though isolating, gives them control and continuity over tasks, which appeals to them as craftspeople).

For the machine operatives and packers, there are no such work changes or gains to deflect their sense of anger--of having "been had" in the transition to the Sylvan plant. They mostly run the same equipment as they did downtown, experience the same close supervision and, though still reliant on mechanical aptitude, they have been excluded from the new discourse of work that finds its most concentrated form in the control rooms.

There *was* a period, during the construction and start-up, when machine operatives played roles and provided knowledge in ways similar to those I've described for control room personnel (and consistent with my argument about the skill appropriation). For instance, a group of three experienced operatives were chosen to help representatives of a West German manufacturer install a new line that produces ten-pound bars for sale to commercial customers. Months later, one of them described to me, with evident pride, what it had been like:

RL: We were the first three people out here, Jack and Ed and I; we actually installed the stuff, worked with the people from Germany that make the equipment. We'd made a trip there a year and a half ago, after we [the firm] decided to go with [company name]. We did some training with them, so by now I've taken this machine apart down to zilch and put it back together twice. Now we feel like we know this equipment really well; no one else in the country has a set up like this.

CW: Did you, or do you, feel pressure to follow strict guidelines, either from the "reps" or from foremen?

RL: Well really, this stuff comes from us. There are certain parameters we found out that the machine runs well at, and there are certain temperatures that have worked consistently in the tempering process, and we

> put them down in this memory book. [He reaches for a loose-leaf notebook, containing some 50 pages of longhand notes, in pencil, that he and the other lead men have compiled.] If you want to change something, if you have good reasons why it's better, [reasons] that you can document, then fine. More power to you. This book isn't God's law, but it's a starting point to work from, rather than having each operator beginning by guesswork. Sometimes, I've trained people on this who have good ideas that we try to expand. We can just go and get out the floppy disk [with procedure manual], plug in the new steps, and make those changes. It's not difficult. Because our products are somewhat different from other companies, we have to calibrate the machine to our needs.

Another moulder reported that:

> The tolerances in [a new] machine are in ten-thousandths of an inch--thinner than a sheet of paper; that machine is tight. Some of us helped install it and set it up. People coming out later won't have that experience and that'll show in how they run the equipment, even after we train them.

But, this kind of involvement was confined, to a few operatives and (temporally) to the installation and setting-up of equipment. Other plans that would have extended some of the new personnel practices to this department didn't materialize. For example, a plan to have moulders "cross-trained" for all the finishing machines and given merit pay raises for increasing mastery was scrapped for lack of training. Also (as I'll illustrate shortly), workers charged that the tests were irrelevant to daily practice and that supervisors conducting the "hands-on aptitude" tests weren't impartial.

Several statements by moulders alluded to their awareness, in retrospect, of how important their efforts had been during the relocation itself, and their anger at perceived ingratitude by the firm. Corey, among the most senior and skilled operatives recalled that, during the final construction,

> We arrived and the inside plumbling wasn't even working; there were no clocks, no phones, not even a PA system in the plant for the workers. I arrived in October--eight months ago. When the office people got here six months later, [Ace] had a quote-unquote welcoming party, catered food and everything. [Production staff] had been here before there was heat, working 12-hour days, but the party just made it seem like that until the office people arrived, the building wasn't even inhabited. They're having an open-house to show-off the new plant this Sunday, and asked for [workers] to give tours. A year ago I would have said fine. Now, forget it. They want me to come in on a day off and show off their fancy new equipment--with the overtime I've been working? I guess nobody volunteered. They want me in here, they can pay me. [field interview:9/18/93]

Moreover, there are on-going, negative pressures in this department that have intensified work more blatantly evem than for maintenance staff. Moulders are now responsible for more lines (per worker) and ancillary tasks than was true downtown: they have to clean up the frequent spills and "re-work" that used to be handled by sanitation workers; they have to keep more paper production records than in the past, which is time-consuming and serves only to confirm for higher-ups that shop floor practices are uniformly followed; and, intertwined with these pressures, workers feel especially resentful of stringent company policies on absences and discipline.

Indeed, while complaints about supervisors and company rules are rare in the control rooms, and indirect among maintenance staff--whose targets are the work pace and procedures at Sylvan--among packers and operatives the theme of punitive supervision appeared to be more salient than ever during my field work in 1992-'94. Workers explicitly connected the return of punitive supervision and the company's rhetoric, before the move, of the team concept. A typical sentiment was offered by the moulder who declared, "Same shit; it's my way or no way." He continued:

> All the fancy speeches, all the awards given at the Christmas party, all the company's presentations worried about the workers can't do these new jobs, all

> that was blowing smoke. They brought out the same damn equipment we had downtown, and didn't reduce the supervisors at all. We're surrounded by new walls, but it's the same job. So, you wonder what all that speech-making and fear was for. Sure, somebody lined their pockets, but I can't tell why or what was gained. [field quotation:9/10/94]

A female operative in her early 40's, who took a job with Ace while in her teens, said:

> If you've talked to people out here, you know that things are really bad. You might've seen some smiling faces downtown, when you first got to know people, but don't expect to see that here. I think what broke our back was that last contract--that was a slap in the face. I've worked here over 15 years, and I make barely over eight dollars an hour--that's about average in the plant--and I'm here to say you cannot raise on family on that. Don't get me wrong, the company brought us out here and they didn't have to. I'm grateful to have a job; and the people in high positions here treat the workers better than they used to. But eventually it comes down to dollars and cents, and they played hardball on that contract. They had the millions to build this plant, and had me on overtime for months to help get the production out that paid for it, but they can't even come up with a raise that'll keep me up with inflation. [field interview:9/8/94]

Workers who had coped for many weeks with mandatory overtime resented what they saw as the company's inflexibility in restricting "personal days" after the relocation. Said one:

> [Management] said we had a grace period of three days that we could take before getting into the [absentee]

point system. Once we were out here people started taking those days, and then the company basically blamed us for delays in getting production out. If they didn't expect us to take the time, why did they give it to us in the first place? Many of us have been working 55-hour, even 70 hour weeks. Your body gets tired. Besides, this affects the other people in your family, your children; you have to coordinate your family's lives. Personal errands build up. So, instead of acknowledging the sacrifices we've made, or showing some trust in us as adults, they blame us; like hitting a bad dog on the snout, they act like we abused the favors they give us. [field quotation:9/22/92]

A 30 year-old woman, a moulder, declared:

I have no power, but all I know is that since June--four months--I've been on second-shift. All my other time with the company was on first. My son and I both have bags under our eyes, because I've got to be dragging him around at night, picking him up at my aunt's after he's asleep. And there's an extra hour of day care that I have to pay extra for, besides. This company don't care about me; they've shown that time and time again. And how can the union give up our rights like that, when we never got to vote or nothing. I don't know who [the union] is talking to, but it sure wasn't me. [field quotation:9/24/92]

It was common for African-American workers in packing and moulding to discuss Ace's objectives and actions in racial terms. Before the move, these perceptions were sharpened because of the firm's decision to move (as so many others had in recent years) from the downtown site to an area that was seen as, perhaps, less hospitable to Blacks, certainly as more expensive in terms of rental or real estate costs. This sentiment subsided somewhat as Black commuters discovered that, for many, driving time to work decreased after the relocation (Fernandez 1993).

But there were serious racial grievances of long standing which the relocation and associated job changes both activated and aggravated. There were, for example, no Blacks among the two-dozen supervisors at Ace during my five years of field work (though there were two Latinos--one a supervisor, the other a "lead man"). Nor, except for two clerical workers, were there any Blacks among the firm's more than 150 salaried employees. But, the absence of diversity among supervisors was especially clear given the racial composition of various production departments that vary, in turn, in wage scale, status, and autonomy.

Individual firms are internally stratified along dimensions of social difference, and these patterns are reflected in workers' consciousness of authority, mobility, and shared purpose. That is, a firm can be seen as a community unto itself, in which citizens assess their conditions in terms of fairness and equity. At Ace, African-Americans have been underrepresented numerically in higher-status roles and concentrated in the lowest-paid, most physically demanding jobs, with somewhat more racial "parity" in the intermediate positions. As of 1994, when I completed my field work, the racial composition in selected production jobs was as follows (in descending order of status):

Job Title	Total #	# of Black Workers	Per Cent Black
Maintenance	33	1	03
Control Op's	26	8	31
Moulders	19	9	47
Mat'l Handler	12	6	50
Sanitation	15	6	40
Packers	51	29*	57*

(* Because I do not know the race/ethnicity of all employees on this revised roster, I have only counted those workers of whose racial status I am certain. It is likely that I have slightly underestimated the number of African-Americans in packing.)

Moreover, between 1992 and 1994, Ace hired 33 additional "seasonal" packers, thus bringing to 84 the number of packers (excluding temporary workers not listed on personnel rosters) on the payroll. Numerically, then, packing is much the largest work group in the firm; it is at the bottom of the wage scale in the firm; it has become a more physically-arduous job in the transition to the new plant; and it is filled by a plurality of African-American women. Though below I describe briefly the intensification of work among packers, my point here is that, given the firm's history and culture of racial stratification, the expansion in packing exacerbated the resentments of those who had long charged that "race-typing" was a central feature of hiring and promotion in the firm.

One operative, a 40 year-old African-American man named Alan Jenkins, was an important source for me throughout the research. A devout Baptist with three chidren, married to a lab technician, Alan was considered a likely candidate to be the first Black production supervisor at Ace.[16] Following the trajectory of his experiences and views helps one to understand the disillusionment of those "outside the loop," as well as the increasingly explicit (at least, as it was

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[16] I don't know whether the firm has made such appointments in the past. During my fieldwork, there was one Latino "lead man" (a position and title that does not exist at Sylvan) and one Latino control room supervisor. Alan, my key informant, had been "lead man" for several years when I met him in 1990, was widely liked and respected, and at age 37 was assumed by many to be an inevitable choice for promotion, to supervisor if not higher.

expressed to me) racial consciousness he developed during the three years between our first and final interviews. When we first spoke, in his second-floor flat, he was working third-shift and taking care of his daughters during the day. Soon after arriving at Sylvan, he learned that his title of "lead man" was being taken away.

AJ: It was a slap in the face at first, because in almost 14 years at Ace I've earned them stripes. And the way I'd seen it happen, being lead man was the way to do it, to get to management. Okay, so I was in this lead person capacity, trying to go to school and further my education, so I can put two and two together and become management. But then you slap me in the face and say, no, we're taking that away. It hurt. But like all things you move on; it woke me up to say, hey, nothing's guaranteed in this world. So, I figure, 'Go ahead, let Ace pay for your schooling, and they'll have an investment in you; if not, you can go somewhere else. Basically, don't let Ace stop you from pursuing life. But also I had gotten a taste of what managing was like in this team concept, where you're called a facilitator. So, you get used to guiding gently, and leading by example, which is what I've always tried to do.

CW: Have you found there to be a two-way conversation with the managers during this transitional time? As lead man, did you have a chance to contribute ideas and make decisions about employees?

AJ: On a one-to-ten scale, I'll say about four. If you can show them savings, in black and white, they'll listen. Verbally means nothing; you have to show them you've got a solution. I'm not intimidated by that; I don't shrink from responsibility. [field interview:8/16/92]

I don't mean here to simplify or idealize Alan's views of opportunity at Ace; during that first interview he made some quite damning comments about the firm's history and atmosphere of race relations. But, as of 1992 he was still investing hope in promotion within the company, and felt that because roughly half the workforce are people of color, "At least a token Black in management will follow from all this talk about team work and what have you. I'm in a good position to be part of that step in the right direction."

After a year's experience in the Sylvan plant, Al seemed to have given up hope for a promotion; instead, he spoke of how he'd been treated by his supervisors, of perceived slights, the most hurtful of which was commited by the man whom Al had seen in the past as a mentor:

> You know I hate to use that word, but Matt [plant manager] could treat me like a good nigger; he knew that I wouldn't fuss or swear a lot, didn't show my tail so to speak, and that I'm a hard worker. And people knew I'd defend Matt even to other Black workers, 'cause he was someone I trusted. So, when other Blacks would criticize him, I'd say, 'No man, he's different.' But now I've wised up. It's like I was telling you about the subtle racism here, and this is the perfect example. I punched in today and Matt puts me on as a relief person. Barbara [white worker] was put on the same shift. Now I've got much seniority over her, but she was allowed to clean the equipment during

> her shift, which means paying her time and a half to do nothing. Which, that would never happen to me as a Black man. When I tried to make my case, he cut me off. [field quotation:7/23/93]

A year later, in a subdued conversation during his night shift, Alan wearily explained that,

> I used to have more hopes, as you know, and was not one to criticize. But at this point the job is simply a paycheck, a way to feed my family. I can't put too much of myself in the job. I don't choose to do that anymore. Because they're just not respectful to their people here. I mean, I've had a hard year; I've lost two members of my family--my father and my brother--and with my brother it really put a big hurt on my family because it was a sudden thing. But I know a person here who just lost her stepfather. And when she requested time off to go to the funeral, they told her she could not go because it was her stepfather and not her natural father that had passed. If she took leave, it would not be with pay. Well, she has children and could not do without the pay. In her mind, that man was as close to her as she could be to anyone else. So, you go through hard times and the company does something like that. You don't forget such a thing. They don't know how deep, how deep that sort of anger goes into your mind and soul, when you work for a company for years and they do you that way. So, I don't know what this team work concept means, when they don't even show human consideration. [field interview:9/12/94]

No longer placing any credence in Ace's claims to adopt team management at this point, Alan, in effect, evaluates the firm's success in reaching their own, traditional supervisory objectives:

> They're weak Chris. Too weak. When there are conflicts among workers they'll just throw it back at them and say, 'You work it out.' It seems to me if there's anything to be gained from having someone in that position, they should move in and help to solve that. These workers get into each others' business too much, and they bring their problems from home. It's not mature or professional. When I was lead man downtown, I tried to provide some leadership, to instill some pride in whatever the work was. But these [supervisors] here, they putting in time, worried that there's not enough room for them with the automation. And they don't make positive efforts with their workers; they'd rather make nasty jokes or write people up. You really wonder if they see the Black workers in the serious way they say the employees should be. [field interview:9/12/94]

Discussing the promise of team management, which, two years earlier had seemed to buttress his hopes for a promotion, Alan reported:

> If anything, it's worse. The president says, "We're all going to wear brown shirts; let's break down the barriers." I don't see that at all. Fact is, if you have a got a white shirt, I can see you coming; if you're a temp, and you're talking to someone in a brown shirt, you might not even be aware that you're talking to a supervisor. Because, believe me, whatever color your shirt is, there are supervisors out here, and they're still watching, keeping the pressure on. If it's all brown shirts, they can get behind enemy lines in a way, then, more easily catch me up doing something they don't like. In that world I've got to be on my guard constantly; in the old one I knew where I stood. [field quotation: 9/23/92]

I found a similarly race-conscious perspective among African-American machine operatives when discussing the process by which particular workers were demoted to the packing line--that is, once the firm decided that with improvements in equipment it could manage with fewer moulders. These selections were made on the basis of a "hands-on" mechanical aptitude test that was administered some months before the move. One of the two men who administered the test was a quite unpopular veteran supervisor, and there were other questions about the tests' relevance and procedural fairness. A first-shift operative argued:

> It was the foreman's test, and besides, look how it has shaken down. Look at how many more Blacks there are in packing. And look at how there still are no Black supervisors, or in maintenance, or hardly any in the office workers. And the only people who lost got demoted from the test were Blacks. I think they're comfortable with Blacks in some positions but not in others. There's almost as many of us as whites, but look where we're working, and what the pay is.

Another moulder joined our lunchroom conversation:

> If they was going to test people on the machines, why didn't they wait until we moved out here? That would have let the workers learn the new equipment and ways of doing things. Ronald worked on that line for over ten years. If he was so poor at his job, why didn't they move him out long ago? Wasn't he good enough downtown? But out here, before they even gave him a chance to learn, he was busted down to packing. How did they expect him to do on a test that was given by a man

> who was on his case for years? The way people do on a test does not tell you what they know. I believe this is prejudice; it's hard to see it any other way. To me, I think they tried to make an example of him; 'cause he had a drug problem and got a final warning from the company. Now they're showing they going to be tough. [field quotation:9/25/92]

Once job assignments and work routines were settled at Sylvan, positive appraisals among machine operatives did not involve changes in the process of work itself. Instead, they were confined either to "life-style" issues such as easier commutes, or to such material benefits as involvement in a pension plan that had previously been offered only to salaried employees. Alluding to a "401K" plan that was part of the 1993 labor contract, one operative said,

> That I must say was a step in the right direction. That's pretty good, makes you feel like you've got a little piece of the company. You can look in the morning paper and see how the stock is doing and feel, maybe, working a little harder will benefit me. They're giving people little gifts on their five, ten-year anniversaries, and that's a nice gesture. [field quotation:9/10/94]

Finally, the work of packers has been intensified even more than for moulders. Positioned at conveyor belts, the packers--60 percent of whom are women--lift boxes weighing up to 40 pounds and stack them four-high on pallets; then, they use forklifts to transport the pallets to shipping docks near the packing lines. Having spent some 12 hours, at both sites, doing the work, I can report that the pace and muscular stress of the work take a heavy toll. Repetitive bending, twisting and stretching motions lead to back pain, and stacking the high boxes often involves bruises as well as cuts from the sharp plastic bands that secure the boxes. Several of the packers are also mechanically-skilled, a necessity for dealing with the automatic taping machines and other devices they rely on to keep up with the work pace. Because of the jobs' physical demands, the packers rotate through various work "stations" in ways that vary, and so reduce, individuals' physical stress. Packers probably have the least spatial mobility of any group in the plant (including sanitation workers, who are able to roam the factory as needed) and so are the easiest targets of supervisory surveillance. The large number of packers on each shift, and their enforced proximity to one another, means that even a five-minute delay from a coffee break is likely to receive notice and comment. Also, the predominance of women in the department, combined with the absence of any female supervisors, contributes to the pointedly sexual banter I described in chapter 2 (as a dimension of punitive supervision).

Many of the women playfully invoke and manipulate their sexuality, as one way of dismissing the power of male supervisors. Indeed, although the women in packing generally wear disposable blue "jump-suits" from head to toe, along with hair-nets and "bump caps," many of them wear their hair nets and apply cosmetics strikingly, in ways that counter the anonymous, sexless appearance required for work.

The women on the packing line have a warm, jocular rapport with one another, and several see each other socially outside of work, exchanging favors such as giving rides, baby-sitting, even bringing home-cooked food for the lunchroom. Many of these workers resent the fact that, despite being targetted with the company's rhetoric downtown, about increased computerization and job changes, their jobs have only become more physically demanding: Cindy, a 42-year old grandmother explained:

> For all that talk about computers, all we have is what they call a redi-pad--a pad with numbers that we use to punch in the stock number. We haven't even had word-

> processing or nothing that you would really want to learn. Shit, it would take me all of about ten minutes to show you how it works. The confusing part is that you got to keep the codes and shipments straight, so you can enter the right numbers. If you make a mistake, they can trace you through a number they have for all the workers. Really, I see the job has just got harder from downtown, 'cause there the men [from shipping] would come over and help us stack off [on pallets], but now we have to do that ourselves. Some of these girls are very small and it's hard to keep that up. And Tonya was pregnant and still supposed to be stacking off, even though we wanted to help her so she wouldn't have to. Well, [Ace] said that if she was to be put on restriction, then she couldn't get overtime or nothing, but she shouldn't be done that way 'cause she's worked here for years. That's why I just see it as a harder job, not like a smarter job like they said it would be. [field quotation:7/22/93]

After gaining a transfer into sanitation, a packer told me:

> I feel good; it's the first time in fifteen years my body isn't hurting, aching, all frowned up. And it's not only the lifting; it's being trapped with the same people all day being watched by the supervisor. Especially after I became a Christian, I'm like, "Just don't give me all that gossip and angry talk all day." Sanitation is like heaven, 'cause the supervisor, he's company, but he's reasonable; he's not looking over your shoulder. If you get the work done, he treats you like an adult. It's not a hounding down. Where, in packing, we women could be talking, smiling--working hard and everything, all the skids unloaded--and still the supervisor be in your face about something. I cannot be stressed out anymore. My kids even told me, "You have to leave that job."

Kyle is among the men who, after the "mechanical aptitude test, was displaced from moulding and transferred (against his wishes) to the packing line. Though he has so far retained the higher wage-rate from his previous job, he expressed a new respect for the women who make up the majority of the packers:

K: Those people are now doing two jobs--the packing and the shipping, with having to drive the trucks [forklifts] and stack-off. Working twice as hard for less money. The people making the money ain't doing nothing, but that's the way of the world. I don't mind packing; I like hanging out with these women--good people--and I'm taking home the same paycheck. [Ace] have more machinery and put that money in, and they trying to reduce the workers costing them money. So, even if they let me keep the moulding money here in packing, by reducing the higher paid people in the long run they're making out. Really, I think they made an example out of me, 'cause I'd had some drug problems. It didn't mess me up at work, but they [company] end up looking good either way: if I made it as a packer, they could say how they gave me a second chance; if not, they'd still make their image shine, even if it screwed me. I bet you some of the people in the office jobs might get high, but they'd never end up with the heat I was in. I was brought back under a full final [warning], one step from being terminated. So I've got to go like two years without missing, to get all my [absentee] points back. [field interview:7/16/93]

My time with packers was filled with talk about conflict--over the distribution of overtime; the use of temporary employees (which the firm pledged to stop after the relocation, but had not as of late 1994); attempts to secure health coverage for accidents incurred on the job and to institute safety measures. Here, I'm talking with two women friends, after their 2-10:30pm shift, at a restaurant near the plant. Though sharing a history spanning years of involvement in such conflicts, Barbara and Rochelle have been politicized, by the intensification of work in the new plant, and by what they see as dramatic improvements in work for the control room staff.

BT: The only way these issues are going to get pushed, instead of pushed aside, is they have to change the union stewards. One of them is bound to retire, and I told Rochelle, I said, "If there's a retirement, I'll put your name up there." Because the steward always come from maintenance, or either from the control rooms, and they're the ones that got what ever there was to get in that contract. I'll put Rochelle up [for Steward], because, first thing, she'll know that book [contract] inside-out, and will talk for us, not for the company. But then, you know, they'll try to force her out of there. That's what scares me: when they have a person who knows that contract book in and out, and wins their cases, they will try to pull them to their [company] side.

RS: I don't know if I could do anything, 'cause the process was real strange, and didn't give us a chance to even study what the company plan. I don't blame the steward for that--because they didn't have any time to make a reaction for the workers. I just knew in that meeting that we were going to strike. But people are intimidated. There were maybe 80 votes to strike, and about 80 packers, that's all.

CW: What do you mean "intimidated?"

RS: Those were the ones who've been here the longest, had years in; they have houses and property to keep. They only making maybe $7 an hour, but with overtime you can make OK money, a lot more than working at the mall. I've only been here one time when they turned down a contract, and I was then maybe 26. The business manager come and says about we had to give up a dollar, and people were saying that wasn't so bad. I said, "Wait a minute; you're old, getting ready to retire. Excuse me, but I'm starting off, with my kids young, and I'm not giving no dollar back; I'm not giving a nickel back." We held that ground. Now the maintenance and [central] control people don't think about the packers, our viewpoint of [having] increased workload with no pay increase. [field interview:9/6/94]

The intensification of packing and maintenance work is a direct consequence of the increased productive capacity computer-automation makes possible. The same technology that affords greater mental involvement and decision-making in the control rooms, has led Ace managers to intensify and rigidify work for virtually all who fall outside those jobs. For some (like moulders), the intensification is defined comparatively, as much by a sense of "relative deprivation" as by an objective change in work routines. For others (like those in maintenance and packing), intensification of labor followed from the firm's attempt to recoup its capital outlay, and to exploit the potential for "technical control" which flow from an integrated production and business information system. A case in point is Ace's imposition of an on-line work-order system to regulate the time and effort of maintenance staff whose routines used to resemble those of other skilled tradespeople. With packers, the firm clearly determined that these employees were near the top of the regional wage distribution for similar jobs, and bet that the packers would either tolerate harder work for the same wage or (in the case of women physically incapable of performing the work), seek jobs outside the firm. Furthermore, workers who are "outside the loop" of the automated system have found supervision to be as conspicuous as ever (and supervisors even more numerous), because supervisors who were displaced and feeling vulnerable in the automated plants sought, overall, to demonstrate their continuing utility in the plant. Ironically, their demonstration has merit, because workers disillusioned by the absence of reform and resentful of co-workers who have benefitted from the technical changes are, apt to be more confrontational than they were in the past.

CHAPTER FIVE

CONCLUSIONS AND IMPLICATIONS

Throughout this study I have wrestled with the paradox of continuity and change in the contemporary workplace. Of course, the paradox can no more be resolved here, on the page, than in the workplace itself. Along with dynamic changes in the scale, methods, and tools of work, we continue to see spaces--both traditional and new--for human creativity and choice. The emphasis in this account, on the multi-level constraints facing workers as they find themselves caught up in the global economy, does not at all detract from my appreciation of workers' local responses to these conditions. Indeed, some will object that I have committed the opposite sin--of *exaggerating* the mental and moral qualities of workers who, after all, do work that many would regard as dull, arduous and repetitious. Despite the seductions of theoretical closure, I think we can only continue to wrestle with this paradox, enriching where we can our understanding of its forms and consequences. As this study has made clear, I believe close, empathic observation of work practices and cultures is vital if social research is to matter, within academic, let alone policy circles.

Throughout this discussion, too, I have explored the role of workers' practical knowledge in the accomplishment of computer automation. In the first chapter I identified a critical gap in the literature on technical change in industry and argued that the concrete processes of collaboration necessary for such change to occur had been obscured. What has been lost in the bargain are accounts of the roles workers and their knowledge play which, even if temporary, seems central to empirical and theoretical understanding of workplace politics and of social stratification. My analytic framework has been processual; differentiates relevant organizational problems and locations over the course of the process (e.g., shifts from macro- to micro-level interactions over time within the firm); and assigns an important place for the bi-lateral uncertainty that is likely to shape many social dimensions of technical change. A complementary organizational perspective appears in Stinchcombe's (1990) work on information as an organizational resource.

The second chapter documents the material and immediate cultural conditions that fostered the development of workers' knowledge of production. IT argued that these conditions were linked and that the firm's punitive culture, though only a partial source for workers' innovation, proved later to be a barrier to the cooperation that was invaluable to managers and consultants facing technical uncertainty. It was a limited appreciation of this barrier, and of its lasting importance to the exploitation of their investment in automation among upper-level managers that gave impetus to the campaign of team management.

The third chapter offered concrete descriptions of the appropriation of shop floor knowledge, in the context of practical asymmetries of information, as well as of the mundane work routines and challenges involving engineers and consultants who "translate" manual practices into abstract, computer code. I argued that managers' access to workers' knowledge as a collective resource (achieved through team management and suspension of union and job rights) gave way, during appropriation, to a more selective, focused set of relations and practices.

The fourth empirical chapter argued that the benefits of computer automation have been confined to a small sub-set of the workforce, those who control and monitor the system from the control rooms, and that traditional supervision has been reimposed for the remainder of the workforce. I reported that the very cognitive categories that order workers' experiences on the job reflect this internal stratification and polarization (of knowledge and practice) following the technical change: Control room operators now have practical reinforcement for, and can better express, a complicated, systemic understanding of production that grew out of their prior experience. Though not sentimentally attached to managers, the operators now share in the latters' discourse and conceptions of production, and feel in that a kind of vindication for past grievances that they value as much as their monetary gains.

For other production groups at Ace, automating the central (mixing and refining) process has led to an intensification of work, both because of expanded production and because an integrated business information system allows for expanded attempts to "rationalize" and monitor effort.

Consequently, for those "outside the loop" of automation, traditional grievance about supervisory authority and workers' rights seem to have increased in salience.

In addition, I go on to argue that such an approach is relevant, not only to critical research on work and the labor process, but in educational and policy circles as well. Third, and finally, I reflect on the concept of workers' *commitment*. I argue that prevailing analytic perspectives that ostensibly are opposed to one another (whether "sympathetic" to the interests of managers or workers) may share a common blindness to workers' affirmative commitments to their circumstances--a commitment which neither ignores nor negates material and political conflicts in the workplace. In short, I argue that a natural corollary to critiques of managerial control is to ask the question, "Whose labor process?"

Here I will sharpen and expand my conclusions in three ways. First, I reassess my inferences about the utility of attending to workers' knowledge as a key to understanding the texture of workplace politics at Ace. Second, I revisit the concept of "skill" and argue that, unlike various perspectives that seek to concretize or essentialize it, my case suggests that skill is both contextually and rhetorically constructed.[1]

Shop Floor Knowledge and Managerial Politics at Ace

Critics of this research may question the interpretation here of managers' behavior during the four years of the case study. That is, my emphasis (described in chapter 2) on phases of negotiation was not merely metaphorical, but refers to countervailing interests and resources which would not be immediately apparent to observers of industrial work. Of course, shop floor knowledge is the "resource" on which the interpretation has turned. Perhaps, one could account for manager's behavior at Ace during the period simply by assuming them to be fair-minded, forward-looking people.

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[1] Beck (1996) has raised objections to the term "skill," in this context, claiming it tends to "trivialize and corporealize activities--like that of twirling a baton--that are more fairly seen as knowledge." Often, those who have the social power to pass judgement on or to measure the activities of others, designate the latter as "skill"; in the process they implicitly deny the actor full responsibility for conceiving and coordinating the activity.

After all, Ace could easily have relocated to another region of the country, with lower labor costs, and left their employees to fend for themselves. Also, they introduced a "labor-saving" device in a way that did not reduce workers (choosing instead to improve their position in the large-batch "industrial foods" market) and guaranteed no wage cuts, even for those workers displaced from their jobs by the automation. Finally, they made a large investment in a "basic skills" program that the firm had no guarantee would lead to increased productivity, and which workers could have used to their benefit in the external labor market. Further, dealing as they were with a weak and unsupported union, the company needn't have engaged in the deferential rituals by which they won concessions. Rather, they could have set out to break the union and avoided the problems described in chapter 4, of reconciling their voluntary bidding system with contractual job rights.

That they did not abandon their workers, and that they invested their rhetorical and monetary resources as they did, suggests that Ace managers took seriously their reliance on workers' knowledge during this time. Ace had hired consultants on personnel policies for automated factories, and they were advised early on by Advent--the firm that employed the programmer/consultants, and that had long experience mediating labor tensions in client firms. So, Ace managers were partly borrowing expertise that they saw as part of the "package" of computer-automation. However, situational and time-bound these managerial initiatives are, taken together they reveal other assumptions and commitments. Thus, the rhetorics of "team management" and basic skills, introduced when they were, allowed the upper-level planners to frame the moral and practical implications of technical change at a time when workers' fears and cynicism were strongest. Also, these broad definitions did not require detailed practical knowledge of what changes the new technology would bring--which, managers didn't have for months after the opening of the new factory. Once having gained contractual concessions and an atmosphere of cooperation, Ace managers followed the lead of outside consultants who worked selectively with production personnel to "customize" the generic "process flow" model provided by Ace engineers. During this period of appropriation, the outside consultants addressed myriad technical problems, acting only incidentally as "agents" of their client company. Although particular workers emerged as important collaborators during the appropriation phase, it would have been impossible for the Advent consultants--let alone Ace managers--to predict in advance who would be important, or in what specific capacity. So, in order to explain managers' early emphasis on the team concept, for example, it is not necessary to assert either that they were "conspirators," nor that they were "soft-headed." It is only important to understand this rhetoric as a provisional solution, both to uncertainty about technical demands and to the threat posed by a recalcitrant workforce.

Also, this account does not require, nor has it claimed, that the rhetoric of team management was accepted by all production workers, or even that it was accepted deeply by some workers. I tried to show instead that the goals of shared decision-making and mutually-respectful work relations had cultural currency among workers, and that those who acted on these motives did not face resistance or ridicule by other workers. At each point in the process, then, managers were receptive to workers' knowledge as a resource; they displaced the culture and rules of plant supervision at critical junctures; and their commitment to changing authority relations themselves proved to be strategic. It is possible that, without the outside consultants acting as matchmakers and as referees, the brief courtship between production workers and managers at Ace would never have blossomed, even for a short period.

Reconciling Constructionist and Critical Studies of "Skill."

Enormous effort has been expended across several disciplines in an effort to define and to quantify skill. Though inherently complex and contextual, skill remains a fulcrum on which analysts have attempted to balance an unwieldy set of social, economic, even political relationships. Attewell (1990) surveys the research domain and offers a typology of approaches, including: positivism (skill is objective, and can be measured), ethnomethodology (skill is deeply complex, contingent, circumstantial--forever "accomplished" anew);

constructionist, or Neo-Weberian (skill is a historical and political outcome of occupational and status groups' attempts to secure market dominance and members' life-chances); and Neo-Marxian (skill, (historically the property of workers, has now been fragmented and degraded by capitalist assaults on the labor process).

Though a caricature of Attewell's review, this summary is intended to signal the major assumptions and fault-lines of debate. The approach in this study draws on all of these, save perhaps for the positivist view (more on this below).

The entire study addresses the labor process debate, particularly as advanced by Braverman (1974), but attempts to extend his empirical questions by differentiating the roles and consequences of technical change *within* the production workforce. I build on his thesis that the labor process is a site of cultural and political conflict, and conclude that managerial interests in control over the labor process leads them, in some instances, to expand or to (re)integrate the relationship between workers and the labor process. Clearly, conditions in the control rooms afford managers greater control over production, at the same time as they bring "enriched" jobs for a sub-set of workers.

Ethnomethodologists document skill as deeply complex and contextual, revealing the language and etiquette required for people to treat as mundane a succession of essentially ambiguous cases. From the ethnomethodologists I take a respect for the fine-grained, contextual nature of decision-making and discourse that (for them) constitute skill. Indeed, a major implication of my argument about skill appropriation is that, rather than "creating" an understanding of production--as managers would claim is true of their training efforts and use of outside consultants--the process is better seen as *the explicit articulation of operational goals and contingencies that human actors confront in order to coordinate their efforts and achieve production day in and day out.* That is fairly direct adoption of ethnomethods in the present case, however I have paid more attention than is usually true in this research tradition to larger-scale organizational and political entities.

Finally, I incorporate the neo-Weberian stance with respect to the strategic construction of skill, though I do so in micro-level terms rather than, as is more typical, in terms of occupations or sectors of employment. As Attewell points out,

> 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 tasks themselves, 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 suggest that a crucial part of the concept of skill is the relationship to others not doing the task. Skill is therefore a relational phenomenon....(Attewell 1990,444. Emphasis in original)

What I find limiting is a blanket application of any one of these approaches, as a comprehensive account of what skill "is" or of how it informs social action. This is true for Ace Foods, of course, because I observed varied and contradictory definitions of skill during the research. Whether they are seen as "folk concepts" or as "frames" (in Goffman's sense), these definitions of skill were both "causes" and "effects" of important interactions.[2]

Because managerial rhetorics constrained individual and

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1. This section draws on many discussions with and insights of Bernard Beck.

collective action for workers, I treat them as (micro)political: *Definitions of who knows what are, at the same time, accounts or myths about who does what in an organization; who should take part, and how, in decision-making; and of what rewards should go to them.* So, I am not interested in the rhetorics purely as narrative, or in an ironic revelation of perfidy among bosses, but, rather in integrating attention to managerial rhetorics with a concrete understanding of technical change as a negotiated process. Whatever limits there were on their power, managers had the authority and the organizational resources to invoke and support these definitions of skill, so I will focus here on their agency (soon to return to workers' agency).

Over the course of my case study, there were three analytically-distinct managerial constructions or rhetorics of skill at Ace. Each of these was, in turn, instrumental in particular phases of skill negotiation. I attach labels to them here and will briefly illustrate each: "basic skills," skill as "de-bugging," and "skill as discipline." Each rhetorical framing contains assumptions about workers' skills, implies what their relation to production is and should be (a moral valence), and each implies relations among people (of authority).

The rhetoric of basic skills implied that workers' knowledge of production, while contextual, was irrelevant to the demands of computer-automation. With this rhetoric, any value of workers' skill, if acknowledged, was treated as obsolete for the future. One gets a flavor of this rhetoric in an trade publication article entitled "Ace's Engineering Marvel." The vice president of human resources reported that morale among workers under the old system was

> ...nondescript. You did your job and that was it. People were hired because they were reliable and healthy and did what they were told. Now it doesn't work that way because they've been given the technology that takes the physical labor out of it. The people in the factory are different people than they were even a year ago.

The director of engineering underscored the firms' success in promoting responsibilty among production staff; and he alludes to the egalitarian aura of team management:

> They're seeing some of the stresses and problems that are normally associated with management. They're more concerned about output and quality because now they have ownership in the system.

And, an engineer responsible for designing worker "retraining" at Ace, told me:

> Overall, we wanted to assure them that they did have a job here, but that they were expected to learn a lot of new things. And that covered everything from literacy, to operating the equipment, to doing basic functions on the computer. It was company philosophy, the realization that people had to be literate, had to do simple things on the computer, and that their jobs would be totally different than they were in the old plant. [field interview:7/21/93]

Even the union stewards came to accept this rhetoric:

> There are no surprises here; these people have seen this coming for a long time. The company is picking up the tab, and all you got to do is put in the time and the work. They're putting in 60 million dollars in a new plant and you've got to have people over there with the skills to make it work. [field quotation:12/13/90]

In this interview, with a personnel manager, one sees that the rhetoric of basic skills was nested in a broader set of assumptions about authority and workers' knowledge:

> You were down there, Chris, and saw the paradigm at which we operated; people approached things from the idea that, it's a crappy old plant, and I can only do things in a laborious, difficult way and, besides, confectionary work is an art not a science. We had foremen who were used to giving directives--you go do these three things and when you're done come back and I've got three more. We were going to a new multi-million dollar plant, had a workforce that we really didn't know what their training and skill levels were. So, we did an assessment, which I'm pleased to say the union supported vigorously...We allowed people to meet with a counselor on company time, who gave them feedback on what they should be doing to improve their skills. And that was kind of step one, the basic building block. [field interview:9/18/93]

These comments dovetail with my discussion in chapter 2, about paternalism and managerial culture.

The rhetoric of skill as "de-bugging," obtained during the period when workers were materially involved in refining the graphic screens and computer code. Here (in contrast to basic skills rhetoric), the relevance of worker knowledge of production was both assumed and regarded as mundane. Of course, the social relations and actors involved at this stage were the outside consultants and some upper-level Ace managers (rather than supervisors), which illustrates that nothing more exotic is at work with these rhetorics than the expression of some groups' common-sense version of the world. Here, the rhetoric of skill as de-bugging is present in a casual account of work by two of the contract programmer/consultants:

> We write most of the code [which translates crude, mechanical directives into a continuous-flow system] elsewhere, usually with the client company's engineers, who describe the process for us. And then once we get into the plant for the start up, we deal strictly with the operators from that point on. They're the ones who have to deal with the system; we have a good definition of the process, but they help us refine the controls to the point where they can make it a usable system for themselves. [field quotation:10/5/92]

> The engineers can only give us an optimized overview of what they want to do, but the operators' discussions with us were and are on a very detailed level, based on their needs as they use the system. A lot of stuff they wanted didn't get incorporated, but much of it is now, now that we can see the installation and can be brought around to their way of doing things. We're faced with a lot of situations we couldn't have anticipated; often they'll (op's) find a way to work around it. [field quotation:10/5/92]

The following field statements exemplify shop floor knowledge at Ace, and the recurring production problems and goals to which it is applied by workers. Here, a machine operative has offered to take me on a "shitty engineering tour." He points to a pipe, or "line" overhead, where earlier a mechanic had been called to fashion a new elbow in the line:

> You see that extra joint in the pipe? There are several of them in the plant; they increase the chances for clogs [of paste] to happen, and the amount of energy, or force, it takes to feed the maulers. There are other lines too that are gravity-fed--you just depend on the weight of the paste to propel itself through the pipes. But when you have thick, viscous paste having to travel up several floors, you can't maintain the pressure you need; by the time it gets to the hopper it's only a trickle. I've told them to put some air pumps on those lines to move the product better, but they won't listen. Or won't spend the money. Then, of course, they'll bitch about the downtime we have when there isn't paste running to a dropline, and it freezes up. The pumps would ensure that we could run her steady, and they'd make a lot more money in the long run. But

> the engineers don't listen to us. [Field quotation: 1/30/91]

And, this from a maintenance utility man:

> If they listened to the production people, they could've saved a lot of money. Like for the new factory the engineers went with a plan to have one, giant [bean] roaster. Well, that's the heart of the liquor plant, 'cause if it's down you can't run. And if we can't run the whole plant shuts down. If they'd gone with two smaller roasters, they'd be less subject to downtime. A lot of these small engineering decisions add up. I spent months trying to get them to put a damper in the dust collecting system, before they did. [field quotation:7/21/93]

Finally, skill as "discipline" is Taylorist; it reflects the managers' assumptions and desires regarding the existence of "one right way" to organize production. Where refining code and other tasks of "de-bugging" assumed and required innovation, that period was followed (during the redistribution phase) by an imposition of "discipline" in production areas outside the control room. Once the automatic recipe system was running fairly smoothly, and other employees viewed with envy the relative freedom and autonomy of the control room staff, many of them sought similar respect for their own work decisions. Instead, in a range of decisions and processes, involving maintenance workers and machine operatives (as well as more "manual" jobs) the supervisory message was, in effect, that having achieved a rational, continuous production routine, they (managers) needed now to eliminate individual, idiosyncratic practices that might upset efficient operation. A veteran moulder offers this critique:

> This idea that the supervisors have to hover over us and slap our fingers if we touch the machine settings, that's silly. We ran these jobs downtown, made money for them in a plant that was falling down around our heads, but now, all of a sudden we can't do our jobs? We could save them money on down-time if they'd let us decide when the machines need attention. The bottom line is we're doing the same work we've always done. Just because something may appear automatic, we still have to make changes to keep things running. They [managers] talk about turnkey operation--the idea that you can set things up, plug in the same pressures and speeds on the machines, and have it work, have the different oils react the same way when the temperature changes...That's never-never land; that is not the real world. But, basically, that's the line they're [supervisors] are taking, and setting it up that way, it's a situation where if things go wrong, it's on our heads, it's the operator who's supposed to be wrong. [field interview:9/22/92]

Though I find such variation and ironic inconsistencies in managerial rhetorics of skill, this is not my ultimate objective. In too much constructionist research--especially that which takes a "radical" posture regarding epistemological doubt--one ends up with accounts that are divorced from coherent arguments about social process and social conflict. I agree with Woolgar and Pawluch (1985), that constructionist arguments always engage in "ontological gerrymandering"; along with their accounts of a constructed world, free from necessity, they proceed from implicit (even unconscious) assumptions about what the social world is *really* like. I interpret managerial rhetorics of skill against the backdrop of an empirical description and argument concerning shop floor knowledge, and find them important in following how various social facts are established around mute, passive machines.

Workers' Commitments and Sociological Blindness

Given the sweeping metaphors of economic and occupational change so dear, apparently, to the hearts of social researchers, the people being swept up in the changing, global economy and workplace are being studied and heard too little. One detects a sense of near futility in the ranks of left-liberals, (and, thus, among many sociologists) in the face of threats to workers, ranging from NAFTA and "fast track" trade policies, to the relentless consolidation of conglomerates in the service, retail, and popular culture sectors. Increasing global concentration and mobility of capital, the expansion of the working day and of work pressures within two-job families, and stagnating buying power and work lives for many are certainly conditions that invite pessimism. In such critical discourse, workers themselves seem to be, at once, exalted and silenced. We hear or read of "The Jobless Future" (Aronowitz and DeFazio 1994) or of "The End of Work."

But, for the workers I came to know during five years of field work, computer-automation was as much a beginning as an end: an adventure, an ordeal, an occasion for reconsidering basic practices and relations through which work is meaningful. At least this was temporarily so. In a capitalist economy, technical change within firms is endemic and widespread. Historically, of course, workers *have* often been *displaced* by automation, a trend that has helped obscure both automation as a social process and workers as active agents shaping the reorganization of work. In the last chapter I foreshadowed the argument that I close with here. I argued that Neo-Marxian critiques of the labor process have, in their way, obscured workers--their agency, subjectivity, and ingenuity--much as have those whom they might accuse of managerialist bias.

Another possible form of blindness has afflicted scholars (e.g., Kohn 1989 [1969]) who premise their analyses of "work and personality" on broad, qualitative distinctions in the nature of work tasks, such as those which supposedly separate blue- and white-collar employees' abilities to be "self-directed" at home and in the family. Too often, these analyses smuggle into survey categories what are central empirical questions, such as whether and how work contexts, authority relations, and organizational politics shape "task complexity" that is not apparent from afar. A hopeful reversal of this trend is the appearance of new case-studies that explore, rather than classify, job features and experiences (e.g., Orr 1996).

Though it may be counter-intuitive, studies such as mine, that afford close-up views and insights into discrete workplaces, can help generate grounds for limited optimism about reform. This is true despite the sobering conclusions

I offer on the questions of technical change and internal stratification. Indeed, even where managers' commitment to workplace reforms is superficial (or tactical), I show they nonetheless find themselves buffeted by broad-based pressures to re-think basic workplace principles and practices. The case suggests, too, that even in a vulnerable firm, with a long-outdated physical plant, many workers do apply their talents in ways that display deep commitments to their tasks and their co-workers, notwithstanding their grievances regarding workplace authority.

It is not fanciful, given the case of Ace foods, to envision a different scenario than I have described here. Greater awareness among workers, of the challenge and stress facing firms during automation and of the critical role of workers' initiative in overcoming those obstacles, might have informed a different political reading by those involved. They might, for example, have used their tenuous union solidarity to gain changes in personnel policies (if not in material rewards) that would have been shared more widely; they might, in effect, have "leveraged" their cooperation during the transition, to ensure long-lasting changes in workplace governance, broadly consistent with the firm's rhetoric of team management. They might have devised methods of job-sharing or worker reciprocity which would have relieved somewhat the pressure of a strict absentee system; that system is especially onerous for single parents and those caring for their own aging parents, which in practice means that it is a burden (along with intensified job demands) borne heavily by women.

But, this more optimistic scenario would seem to benefit from public accounts and analyses of work and of workers that capture their continued value and resilience in a post-industrial economy. Sadly, social scientists have been no better than modern-day journalists in getting this kind of news out. My hope is that this work might join a larger body of research and public discourse dedicated to a better-rounded portrait of the contemporary workplace, and of the nascent local possibilities for enhancing workers' power, dignity, and pleasure.

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