
Review Essay

Researching Technicians' (and Others') Work: The Key to Understanding Is Practice

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Between Craft and Science: Technical Work in U.S. Settings, edited by Stephen R. Barley and Julian E. Orr. Ithaca, N.Y.: ILR/Cornell University Press, 1997. 264 pp. ISBN:0-8014-8366-2 (paper).

Talking About Machines: An Ethnography of a Modern Job, by Julian E. Orr. Ithaca, N.Y.: ILR/Cornell University Press, 1996. 172 pp. ISBN: 0-8014-8390-5 (paper).

I begin with a couple of workplace vignettes involving technicians.

FIRST VIGNETTE—Max, a Printing Press Service Technician:

Before returning to school in my late-20s, I worked for a few years as an off-set printer in a technical college. This was a time, the early 1980s, before the photo-copier had become so dominant, and it was common for businesses and schools to rely on "electro-static" presses for their less fancy, non-color printing. The process, derived from lithography, and the machine are self-contained: the plate-maker uses typed originals and a photographic process to make pink paper plates; these pass on a conveyor belt through a liquid solution before being clamped onto the plate cylinder, where the solution repels ink on all parts of the plate's surface except for the black, embossed ghost of the original's text. We could get some 2000 impressions from each plate, before they tore from the friction of turning against the rubber cylinder which transfers the image onto paper.

I was rarely able to meet my supervisor's daily target of 30,000 impressions, because of the difficulty of coordinating the various mechanical

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settings (like the vacuum tubes that fed the paper, the ink flow, and the cylinder gap) and conditions like room humidity. If any of these culprits were out of whack it led to bad copies or, worse, to paper jams that forced me to take the press apart and clean the ink rollers with toxic solvents.

The one person standing between me and disaster was Max, the service technician responsible for the territory in which the college and my press were located. Over time, the combination of refinements in his scheduled maintenance and in my ability to describe for him in detail the symptoms leading to break-downs, allowed both of us to know (in different ways) and to control our work lives. And also to enjoy them, since each moment not wasted on misguided diagnoses could be spent relaxing or strategizing about the supervisory pressures we both faced.

Max's formal education had stopped at an Associate's degree in electronics, but no brain surgeon could have impressed me more. With total command over the mechanical, electrical, and chemical processes involved—which differed depending on particular machines' model year and type—he seldom even looked at the schematics or other documentation in his tool kit. Though he entered our shop as a "service" representative, everyone, including the supervisor and college dean, treated Max with warmth and deference. We all depended on him to get the work out.

SECOND VIGNETTE—Jean, a Computer Software Support Technician:

A friend of mine, Jean, works for a firm that writes and sells a PC-based medical billing and reimbursement system for hospitals. Her job tasks range widely; she tests new software and programmer edits or "fixes," helps to install systems at client sites, works with programmers and clients to tailor the generic system to particular clients' needs, writes training manuals and does on-site training for users, and handles phone calls from customers when, inevitably, some or all of the above go awry. Though holding a Bachelor's degree, in biology, Jean has had no formal training in computer science, programming, or repair. Entering the firm as a pharmacy technician, she ended up in her current (\$35,000 per year) position through an ability to anticipate and resolve users' problems—which the programmers tend to regard with complacent, even arrogant, indifference—and, in turn, to translate users' problems into terms the programmers understand.

Despite Jean's clear value to her project team and its fortunes she is routinely excluded from planning and other decisions in which, by virtue of expertise and responsibility, she should have a say. Instead, the sales staff and programmers, respectively, continue to acquire more accounts and to complexify the systems' features, blind to the "invisible," care-taking work required to serve those users already under contract. Adding to these frustrating relations with those on her own team, Jean is sometimes treated

badly by clients. She is seen as a threat—by clerical staff who fear redundancy, and by supervisors, wary of changes in work procedures that might undercut their traditional knowledge and authority. Jean is a prophet without honor in any country.

I invite readers to locate these work practices, relations, and troubles in most published sociology on work. This is not an easy task, even though, ironically, academics can hardly pass a day without tripping over members of the technical workforce (when did you last use a photo-copier, or call on a computer network or software specialist?!) Because, though typical for workers who make up the fastest-growing segment of the labor force, Max's and Jean's stories elude analytical categories and empirical questions that are deeply embedded not only in studies of work, but of stratification and organizations to which much of workplace research is now oriented.

For example, are these jobs primarily mental or manual? Do they, following Freidson (1973) reflect an occupational model, linked historically with crafts and professions, or an organizational one, marked by bureaucratic career lines? Is the subjective class identification of such workers likely to be aligned with labor or management? (in *Between Craft and Science*, Creighton and Hodson conclude that, despite their training and proximity to managers, technicians are receptive to collective action via unionization.) How are we, as researchers or as a society, to evaluate work skills that are largely contextual and gained on-the-job? Do these jobs require that researchers re-think the empirical boundaries of work, as Leidner (1993) does, to recognize triangular relations between workers, managers, and clients?

To sharpen and answer these and other questions about the technical labor force, we have the benefit of two superb new books. Innovative in conception, meticulous and clear in their presentation, they represent the best new scholarship on the technical labor force. More, they can (and I think should) energize the genre of workplace ethnography, both by capitalizing on an older, Everett Hughesian tradition, and by developing empirical and analytic themes that are both creative and widely-resonant.

Between Craft and Science, edited by Stephen Barley and Julian Orr, is a collection of recent papers, most of them based on field work, first presented at Cornell University conferences on the technical labor force. While the book's organization is perhaps most congenial to sociologists—e.g., in its attention in Part One to class and status implications—the contributors share an inductive, anthropological commitment to work *practice* as the source for insights. This unity of purpose and vocabulary is especially striking since the authors come from diverse disciplinary backgrounds and academic niches; these include: departments of sociology and anthropology,

business schools, a veterinary college, and research divisions of such corporations as Xerox and Corning. That is (to borrow a phrase that both books develop), like the technicians they write about, the substance of whose work cannot easily be inferred from job titles or organizational locations, these researchers comprise a *community of practice*. As defined by Barley and Orr, in their introduction to *Between Craft and Science*, such communities “. . . [serve] as a distributed repository for knowledge of relevance to practitioners” (12). That the circle of relevant “practitioners” and audiences to this research includes engineers and managers doesn’t at all detract from the papers’ ethnographic richness or their contributions to theory. Stephen Barley must be credited as a key member of this community, being one of the conference organizers, an author of several of the important articles contributors cite, and the series editor, for Cornell/ILR Press, of the *Collection on Technology and Work* in which both books appear. In its grounded elaboration of typical problems, based not only on lengthy field work, but on survey, census, and historical data, *Between Craft and Science* achieves a rare combination. It is both an authoritative compendium of knowledge on the changing labor force, and a pioneering set of field studies of the sort that draws students into workplace ethnography.

The volume begins with three synthetic, contextual chapters on technicians’ anomalous position in the division of labor, and their relation to dimensions of stratification. The seven remaining chapters (ranging across technical work in medicine, the computer industry, and engineering) pivot on and elaborate problems defined in the introductory section. Core among these are: the nature of workers’ skill/knowledge; their occupational status, identity, and autonomy; and issues of education and socialization which both reflect and reinforce their precarious and (as Keefe and Potosky’s paper shows) generally unsatisfying work lives.

In their reflexive introductory chapter, Barley and Whalley develop an image of technicians as doubly-obscured, by the ways in which they “stand between technology and society”: first, “because technological change has shoved them toward the economic heart of a society not quite ready to leave behind the categories of industrialism, its distribution of power, and its presumed distribution of knowledge” (also see Barley 1996). Further, this intermediate stance is “structural . . . as well, and it is here that their power lurks. They link us to technologies that are nearly transparent when they work and troublesomely opaque when they do not” (14).

Broadly speaking, then, technicians in various work settings can be defined by their role as mediators, between abstract codes or systems of knowledge and the local, concrete particularities of workplaces. Of course, in researching power and practice across various groups of technicians (see pp. 36-39 for a typology) it is important to chart their specific historical

genesis and relationship to established professions, and to identify salient features of the labor process (including whether the primary objects of labor are clients, as with Jean, or machines, as with Max and the Xerox repair staff in Orr’s book).

For most sociologists the topic of technicians’ labor has been overshadowed by that of *technization* (38) of previously manual (industrial or clerical) work processes, which has often had a deskilling effect (Braverman 1974). But, studies of labor process theory have always assumed the added burden of disentangling the changing technical content of work from the formal and political organizations that surround it. For instance, when we discover (as, e.g., did Wellin 1997 and Zuboff 1988) that computer-automation in industry reveals and requires complex cognitive knowledge among ostensibly “manual” workers, the finding may be eclipsed by broader inferences about the aggregate impact for workers of technical change. In contrast, the arguments in *Between Craft and Science* are fresh, partly, because they’re based on kinds of work that are (as the title suggests) only loosely-structured by formal divisions of labor and authority.

Many technical occupations serve as “buffers” (14; 131); they have come about because, to quote Hughes (1958: 135), “The professional group will go through a process of self-consciously studying its work and deciding what functions are really professional and what functions can be delegated to nonprofessional or less-than-professional people.” This “hiving off” of professional work (36) is clearly seen in Nelson’s paper on problems of autonomy and moral authority among emergency medical technicians (EMTs). Hobbled by their origins in the 1960s, as volunteer medical aides treating and transporting highway casualties, EMTs’ “[standards] of care [are] distilled into sets of protocols or written instructions which dictate practically every aspect of on-scene behavior” (164). According to Nelson, EMTs concede their lesser knowledge, as compared to physicians, and so accept, in principle, more limited discretion. However, such formal and moral mandates fail to account for the fact that EMTs work in much more varied and chaotic conditions than those faced by doctors in hospitals. And, Nelson found, “practicing in this chaotic environment necessitated elements of speed, versatility, improvisation, physical and emotional control, and interpersonal finesse which distinguished the practice of EMTs from that of hospital-bound doctors. As a result, the EMTs’ skills and abilities were complementary rather than redundant” (168). This tension between professionals’ desire to control work settings and interactions, and opposing attempts to expand their realm of practice, sets the stage for many of the stresses that plague technicians and the publics they serve.

Other technical jobs, such as staffing computer software support “hot lines,” cast workers as “brokers” (e.g., 14-15; 131-133). These tend to have

emerged through *de novo* creation (37). As the chapter by Pentland shows, in mediating between software users and representatives, technicians find themselves sandwiched between opposing pressures and epistemologies: the practical demands and anxieties of the users collide with the formal, quasi-scientific ethos of the support staff (or, what Buciarelli and Kuhn, in discussing engineers, call the "object world" [211-213]). But, as we saw in the vignette about Jean, it is not only that users care about the local contingencies that software programs may fail to accommodate, but also that programmers and support staff have a vested, occupational commitment to an epistemology that doesn't admit of contingency, that insists that software programs are "human artifacts . . . , in theory, perfectly deterministic and rational" (119). Of course, it is precisely this claim to unqualified rationality that lies behind the power and pervasiveness of computerization.

This is not to suggest any narrow indictment of technicians for the often conflictual nature of their role as mediators. As the authors in Part three (on technical training and careers) argue, education in technical fields follows the science-based, formulaic, textbook approach which has come to define *academic* engineering (especially since the post-war decrease in industrial sponsorship of *applied* engineering). As Berlow and Bailyn lament, training so conceived tends to homogenize the diverse interests and involvements that engineers bring to the field, and which later prove to be crucial for the practical, team-oriented realities of design work. Nor can technicians, whose status and incomes tend to be comparable to many craft workers, be blamed for managerial strategies aimed at deskilling or eliminating workers.

Rather, it is their orientation toward formally-logical, deductive systems, and the ongoing effort to reconcile them with daily social and organizational pressures—often spanning multiple settings—which combine to lend an almost tragic tinge, an "existential despair" (Orr 34) to technicians' work lives (also see Zabusky). So, Pentland's software support staff, in a mordant twist on the cliché of being on the "leading edge" of the software business, speak of the "bleeding edge," of the wounds of trying to manage the runaway complexities of software features, hardware, customers' needs and abilities, while also being "excellent listeners, patient, empathetic, and above all, nonjudgmental" (128). Moreover, he reports, these workers derive subjective satisfaction only in the minority of cases where glitches are truly solved (i.e., traced directly to errors in software design during testing), rather than merely "covered up" (through finding operational short-cuts that allow users to get their work done).

Were we able as field workers to watch these support technicians at length, both with customers and amongst themselves, we might better understand their practical methods of diagnosis and how with co-workers they

jointly construct narrative solutions to recurring problems. Also, given continuing contact between technicians and clients, we would be likely to see how the clients' own cognitive relations to work may be shaped in the bargain. This approximates the situation of Xerox copier ("field service") repair technicians, whose work Julian Orr reveals in his brilliant and original book, *Talking About Machines*. It matters a lot that Orr (a member of the research staff at Xerox' Palo Alto Research Center) spent some years himself as a copier technician, though not one assigned to serve customers in the field. His knowledge and aesthetic appreciation for the language, mental images, and interactional process of copier repair-work constantly elevate and enliven the argument. And the book is written in prose that is always lucid, often eloquent, and which engages thorny analytic problems all the more effectively for rejecting the jargon that can sometimes get in the way (true sometimes of ethnomethodology, whose guiding concerns permeate the book).

Consistent with his focus on narrative in the work of field service, Orr constructs (and I imitated) a series of vignettes (14-61) made up, at once, of description, technique, inference, and (less fully) points of view. They convey both the concrete *circumstances* and ongoing experience of *contingency* that his informants face. Circumstances include territories and machines that are spatially-dispersed, such that it is hard for workers to get help, even from the technical "specialists" on their teams, even when breakdowns prove intractable, because the needed parts and expertise cannot be known in advance. The contingencies involve, most narrowly, the machines themselves, whose particular features and quirks the technicians come to know and to celebrate (or condemn) with an intimacy borne of repeated encounters. Also variable are the machines' operators and patterns of use, both of which inform workers' diagnoses. If able to manage these variables (as Max partly did by my being the sole operator of my press), those in field service can construct more coherent narratives, based on stable vocabularies and accounts of errors linking them, the machines, and customers.

Instead, this chimera is shattered: by sales-people who sell machines unsuited to customers' needs; by users unwilling or unable to learn basic operational rules and terms; by the daily pressure of improvisation, or *bricolage* (11-12, 120-22; Harper 1987), which often leads to machines "working," without, however, yielding the certainty of understanding which the most coherent narratives require.

All this explains why the talk, or "war stories" that field service workers share is so densely-detailed and attentive to context: each fact, even in a story of failure, may potentially unlock a mystery, if not for the teller then for others in the community of practice. Orr writes (127): "War stories told

during difficult diagnoses are doubly situated, first in the context of their origin and then in that of their telling and possible application, and the comparison of the two situations is the point of the telling."

Orr's analysis of the sources and management of diagnostic uncertainty structures the entire book; his treatment of other topics and actors are mostly support for and variations on this theme. Careers mostly involve only lateral movement, since promotion to manager takes one away from service, and "specialist" positions are rare. Supervisory control is weak; corporate efforts to make technicians abide by "directive documentation" (consisting of decision-rules, devised by designers) falter, because the only performance standard is machines that work, and the documentation, if followed, usually upsets the chain of inferences that allow workers to assure customers that the "real problem" has been resolved (105-113). We don't learn very much about the workers' backgrounds (66-68); many come from rural backgrounds, all have a "propensity to tinker," all were high school graduates and about half had technical degrees from junior colleges or similar training in the military, a few had attended college, though not on technical tracks. Indeed, so tight and steady is Orr's focus on how workers accomplish diagnoses that one finishes the book with oddly little sense of what variations between them there might be, or even of how differences in age, gender, or reference group might shape relations between service workers and customers who, it seems, are regarded solely on the basis of their instrumental role in the "service triangle."

This is a book about, rather than of, talk; there is oddly little direct quotation of informants from Orr's extensive observations, which he did both during training and in field service. Orr's reliance on his own analytic voice, however lucid may, at times, frustrate some readers. But they will shake this off and plunge ahead in what is among the most original and stimulating occupational ethnographies yet published. When late in the book (129) we get an extended, verbatim exchange (between a technician and an expert team "specialist") it is both fascinating and, as evidence, convincing. But then I also felt deprived for not having had similar data flesh out earlier sections.

For those who, for whatever reason, don't find copier repair-work intrinsically compelling, there are detachable ideas and empirical referents in *Talking About Machines*. And they will help us to maximize the value of qualitative research for theory on occupations. Orr's development of narrative as both vehicle and repository of skill in technical work provides a crucial mechanism for understanding work organization in such traditional craft jobs as the building trades, and the pragmatic interpretation of such quasi-formal documents as blueprints (Stinchcombe 1959; 1996). When Stinchcombe (1996: 9 emphasis added) writes that "Far from being con-

trasted to the formality of blueprints, the informal competence of craftsmen and craftswomen is part of the *semantic system* that tells us what blueprints mean," we have an invitation to precisely the kind of thickly-described case-study Orr provides. His treatment of oral culture and work organization is so vivid and penetrating that I predict many others will (like service workers around a lunch table) use his account to analyze diverse occupational groups. In substance and in language, both of these books will be excellent for classroom use; in addition to courses on work, they can well serve others, on knowledge, science, organizations, field work, and human resources.

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