ANTHROPOLOGISTS AND ENGINEERS: PARTNERS IN THE FIELD

By Marietta L. Baba and Donald R. Falkenburg

Occupational subcultures are distinctive patterns of behavior and belief grounded in work-related experiences that are shared by members of an occupational or professional community. For members of such communities, subcultures serve as integrating and orienting frameworks that provide members with an identity, standards of practice, a code of conduct, and a network of colleagues and potential friends (J. Van Maanen and S. Barley, "Occupational Communities: Culture and Control in Organizations," *Research in Organizational Behavior* 6[1984]:287-365).

In applied anthropology, where interdisciplinary or multidisciplinary research and practice are the norm, there is a special interest in understanding and improving relationships that develop between members of *different* occupational subcultures. While the pooling of knowledge and skills by members of different occupational communities is highly desirable in many problem-solving situations, there also is the risk of tension and conflict when different disciplines attempt collaboration. This is particularly true when the occupational subcultures involved are relatively equal in authority and/or power within a particular context.

In this article we present a case study of an effort to establish a co-equal partnership between members of two very different occupational/professional subcultures—anthropology and engineering. Our objectives are to consider 1) the complementary interests and strengths which suggested to us initially that there could be positive synergy between these two professions; 2) critical differences between the professions that presented challenges to cooperative research; 3) actual benefits that enabled us to establish rapport and build bridges across our disciplines; and 4) prerequisites to the creation of co-equal, cross-disciplinary partnerships. Because we believe that our partnership has been beneficial, both to us as applied researchers and to our client, we offer these observations in the hope that they will encourage the formation of other cross-professional teams.

Background

Our partnership has occurred within a major industrial research project funded by a Fortune 500 corporation. The project concerned work cultures at several sites within the organization and the relationship of work cultures to the introduction of new technology. Our methodology required that we carry out several hundred hours of direct field observation and in-depth interviewing with engineers and other technical professionals in the focal organization. Our research team has been led by four senior investigators, one of whom is an industrial anthropologist, one an engineer, and two from other social sciences. The team also included several graduate students, all of whom were drawn from the anthropology, psychology, and industrial/manufacturing engineering departments of Wayne State University.

The role of the anthropologists on our team was to discover inductively the nature of our informants' work cultures. These work cultures were inextricably entangled in a Gordian knot of high and low-technology machines, instruments, and processes. Further, in describing their work, our informants often used an inexplicable (to anthropologists) dialect of English that could be learned only in engineering schools or on the job. We needed interpreters who could help guide us through the complex maze of machinery and jargon—just as the anthropologist newly arrived to study a foreign, exotic culture often needs an interpreter and guide.

Photo by Rick Bielaczyc

Marietta Baba and Donald Falkenburg in the Field

Thus, by including engineers in an interdisciplinary research team we acquired "(quasi)-native guides" in the field.

For engineers, the research presented an opportunity to view the socio-technical system from a unique vantage point, the human side. This is an area of growing interest within engineering. Our engineering colleagues also saw an opportunity to gain a close-up view of technological change in a major corporation. Since our engineers were in short supply (we had only two), they were able to be "co-owners" (with an anthropologist) of only two of the four major field sites. The engineers did participate to some degree in fieldwork at all four sites, and they contributed regularly to weekly team meetings and were integrally involved in data analysis and client reporting. The observations on anthropology-engineering interaction offered here were gathered by members of our research team during fieldwork, in team meetings, and in meetings with our project's steering committee (comprised of client managers).

Contrasting the Disciplines

Both of us had worked on previous projects with representatives of the "other," so we did not begin this project completely naive concerning the differences between our professions. Our personal experience and the literature on occupational subcultures suggested several points of contrast between our disciplinary approaches. (See Table 1.)

Anthropology and engineering have different research goals, and because of this, they diverge in research focus. Anthropologists seek to understand and interpret human behavior, while engineers are more interested in problem solving and control of nonhuman (e.g., technological, informational) parts of the environment. Our disciplines also differ in their intellectual approach to the research subject. While the anthropologist seeks understanding by connecting her human subjects to a broader historical and cultural context, the engineer works by delimiting manageable "chunks" of the environment and subjecting these to an intensive systems analysis (the goal being control of the system).

Also fairly obvious are epistemological and methodological differences between our disciplines. Anthropologists tend to see patterns in human behavior as natural systems that emerge more or less spontaneously from the interactions of people over time. From the anthropological perspective, these natural systems combine both rational and nonrational (e.g., affective) phenomena. Our knowledge and understanding of natural systems are built more upon qualitative than quantitative data, and we most often use words and images to capture and convey the nature of human reality. Engineers, on the other hand, tend to view human and nonhuman phenomena as the outcome of rational planning (or the result of a lack of effective planning, in which case better planning is needed). Further, their methods of data gathering and analysis rely heavily on quantitative data, both to characterize reality and as a means of control.

Looking over these differences, one may wonder how anthropologists and engineers could even have a meaningful conversation, let alone collaborate in research. Fortunately, our senior research team was comprised of individuals who had worked together previously. Hence, we believed that "our" group of anthropologists and engineers could surmount disciplinary barriers and forge a new synthesis of divergent perspectives.

The partnership we designed was not a completely equal one. Our core methodological paradigm was ethnographic, and we anthropologists expected the engineers to learn the ethnographic method and to support us in our research goals. Not only were the engineers asked to serve as interpreters and translators, they also were asked (after appropriate orientation and guidance) to gather and analyze data much as an anthropologist would. On the other hand, while we expected the anthropologists to learn a great deal about the work cultures of engineers, we did not expect the anthropologists to work as engineers. Thus, the differences we perceived between the professions during the partnership are based on observation of the distance between what the anthropologists thought the engineers should be doing in their role as ethnographers and what the engineers actually did in the field. If the research had required anthropologists to work as engineers, we might have uncovered other differences in approaches and other benefits of cooperation.

Table One. Contrasting Anthropology and Engineering

	Anthropology	*Engineering*
Theoretical Orientation	Natural Systems	Rational Systems
Research Focus	Human Behavior	Systems Behavior
Research Goals	Understand/Interpret	Solve Problems/Model & Control
Methodology	Qualitative	Quantitative

Engineers as Marginal Natives

While we saw the engineers on our team as insiders in the arcane world of industrial and manufacturing engineering, possessing implicit knowledge of the mysterious ways of our informants, they were not truly insiders at the research site. They were not members of the focal work organization, but researchers and students, just like the anthropologists. Thus, the relationship between researchers and natives was somewhat unusual in that we comprised three cultural worlds rather than two—anthropologists, engineer/ethnographers, and engineer/natives. The engineer/ethnographers were placed in the difficult position of co-existing in two worlds. "Behave like an ethnographer, but think like an engineer!" This demand brought into sharp relief some critical differences between our two disciplines.

At two of the research sites interviews typically involved one representative from each of the three worlds—an anthropologist, an engineer/ethnographer, and an engineer/native. Our engineer/ethnographers experienced various difficulties in these sessions, some of which were to be expected, given their lack of experience with ethnographic theory and method. For example, our engineer/ethnographers had trouble documenting interview content and often failed to pursue what, to the anthropologists, would have been interesting leads in the interview process.

Beyond these expected limitations, however, we faced some additional difficulties. Probably the most serious was the engineers' intense frustration with the laboriousness of the ethnographic protocol. While the anthropologists wanted to draw out informants in long, complicated descriptions of work practices, the extensive domain knowledge possessed by our engineer/ethnographers made detailed discussions of work practice boring and

inconsequential to them. They wanted to move as quickly as possible to the "real interesting" data, i.e., what was wrong at the informant's work site.

The engineers' impatience with the ethnographic protocol caused much frustration and some hilarity on the team. During one early interview, for example, an anthropologist asked the native informant a question. Before he could speak, however, the engineer/ethnographer was giving the answer! Another anthropologist noted that her engineer/ethnographer team mate could turn a ten-minute informant description of work practice into a two-sentence caption written not in the informant's words, but in the words of the engineer/ethnographer.

The desire to rush toward conclusions based on domain knowledge also characterized our data-coding sessions. The anthropologists, of course, wanted the initial phase of coding to be driven by emic concepts. Engineers, on the other hand, did not see emic coding as an appropriate use of time and wanted to move immediately to etic codes. This problem was particularly troublesome since not all social scientists favor emic over etic coding, and members of the team began to chose sides—emic vs. etic.

Impatience with ethnographic protocol and the tendency to jump quickly to (etic) conclusions reflect several interrelated tendencies in the occupational subculture of academic engineering. First, as members of an elite engineering community whose job it is to research and teach better ways to do engineering, academic engineers hold many ideals regarding "best practice" that are not realized in the real world of industry. Further, given the engineers' problem-solving approach to the world, the informant interviews were viewed primarily as opportunities to identify unresolved engineering problems that could be remedied by the engineer/ethnographer-turned-consultant. This "fix-it" approach influenced our interview sessions as engineer/ethnographers ventured into lengthy diagnostic conversations with informants. It was also linked to a tendency to criticize and/or discount what the informants said. Our engineer/ethnographers were "marginal natives"; they knew a great deal about the natives' culture, but they stood apart from this culture and approached it with a critical eye.

For the anthropologists, these attitudes posed a number of problems. First, the anthropologists worried that engineer/ethnographer accounts of native behavior were incomplete because of their tendency to jump over the details and biased as a result of their critical stance. We anthropologists also were concerned that, given our dependence on the engineer/ethnographers for interpretation and translation of native behavior, we would become biased against the natives as well. Finally, as researchers we needed to maintain a neutral posture with respect to the technological changes that were taking place in the focal environment. We feared that the engineer/ethnographers' assumptions that certain changes were "correct" and others were "incorrect" would be sensed by the natives and would jeopardize our independence and the validity of our data.

Resolving these issues was not accomplished quickly or easily, and we continue to work on some of them. Ways we have managed to address these problems may be summarized as follows:

> Engineer/ethnographers always enter the field with an experienced anthropological ethnographer, so that each may compensate for the other's limitations.
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> Engineer/ethnographers have received on-the-job training in interview technique, note taking, and coding, and they have made excellent progress in these areas.
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> The engineers on the team agreed to allow the anthropologists to take the lead on coding procedures. Emic and etic coding will proceed in tandem, with emic coding in the lead and cross-site (etic) coding following as a second step.
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> Team discussions have highlighted some of the potential bias problems and have led to greater sensitivity and more concerted efforts to guard against them.
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> Overall, we are developing a better division of labor so that anthropologists focus more on work they are trained to do and engineers concentrate more on their areas of strength.

Cross-Disciplinary Synergy

Despite the problems encountered, anthropologists realized many benefits through partnership with engineers. We knew we would be grateful for their help in understanding things like "reverse engineering," "ring gauges," and "post-processors." Beyond that, however, we found that engineers can be very handy in facilitating ethnographic research in an engineering environment.

First of all, our engineers enhanced the credibility of our research team and helped us solve difficult access problems. As we made our presentations to site mangers (most of whom have engineering backgrounds), we often saw eyes roll when we mentioned "ethnographic methods." Our engineers came to the rescue by helping us design a model of the ethnographic process which outlines the core activities of ethnography and estimates the number of person-hours per site required for each of these activities. (See Table 2.) This model convinced managers that our research would not grind their work process to a halt, and it proved to them that we could speak their language and understand their concerns.

Another important contribution provided by our engineers came in the area of "client management." We have had to prove to our project's steering committee during bimonthly report-outs that we are capturing significant data that address key problems faced by our client. With their quasi-insider knowledge, our engineer/ethnographers helped us understand the client's point of view and focus on issues and data the client would find most useful. Of course, we included in our reports significant quantities of additional data that we considered important, but we

Table 2: Personnel Requirements Model. Data Gathering Activities per Functional Area. Wave One

	Orientation Meeting	Interviews	Observations	Questionnaires	Total Time (w/ orientation)	Total Time (w/o orientation)
% Users (T=20)	100%	50%	100%	100%		
% Managers (T=1)	100%	100%	100%	100%		
Time/User (hrs)						
Time/Manager						
Total User Time	Ethnographers Time On Site • 2 ethnographers per site • 2 days per week, 6 hours per day • 1 wave = 6 weeks • 3 waves total = 18 weeks over 6 - 8 months					
Total Manager Time						
Total Time						

always made certain that these were delivered along with client-targeted data.

Finally, we have found the engineers' input invaluable in the process of analyzing our data. Our engineers are also computer experts, and they have helped us manage our enormous data base and organize it in a manner that facilitates computer-aided analysis. In addition, as we have attempted to conceptualize the relationships between work cultures and technology, engineers have contributed as full partners to our understanding of the data and have helped us depict graphically the linkages between sociocultural organization and technology. In modeling our data, we have found that systems theory provides a common language and a conceptual framework that is shared by our two disciplines.

The engineers also have benefited from this partnership. As a result of participant observation, our senior engineer finds that he now has a better command of industrial reality and is less prone to speculative postulation in his own research and writing. Further, this engineer has come to value the anthropological perspective, which provides detailed empirical knowledge of a critical element of the industrial world—human behavior in a work culture setting. Such knowledge traditionally has not been captured by engineering methods, but increasingly engineers are recognizing its value in understanding and modeling industrial environments.

Our senior engineer's belief in the value of ethnographic research recently prompted him to require a doctoral engineering student to study ethnographic methods in preparation for his dissertation research in an industrial environment. Our senior anthropologist is contributing to engineering education as a lecturer in a technology management program for industry and also has been appointed to the adjunct faculty in the college of engineering. Our team seems to be influencing the engineering community in the client organization as well; we recently were invited to present our findings at a meeting of client managers as part of an effort to encourage these managers (many of whom are engineers) to incorporate an understanding of work culture into their planning process.

Conclusion

Co-equal partnership between different occupational subcultures is not easily achieved. In our field project, anthropologists required engineers to follow an ethnographic protocol, a requirement which some may feel resembles a form of disciplinary domination. Of course, as we discovered, one discipline cannot simply submit to the requirements of the other while maintaining its own perspective and integrity. To resolve the actual and potential conflicts that emerged from this struggle required that we trust each other, something that may not have been possible if we had not built up a professional relationship over many years of previous cooperation. It also required that all of us learn to compromise, that we learn to learn from each other, and most importantly, that we learn to respect and rely upon the unique strengths of our intellectual allies.

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