Design by Anecdote — The use of ethnography to guide the application of technology to practice

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Abstract:

Re-thinking work practice is often done through costly, high-profile "re-engineering" processes. We believe an ethnographically based understanding of the work to be done is necessary to keep such re-thinking relevant to the task and offer a case study of changing work practice. The design resulted from a particular anecdote and developed in conjunction with a field study. The intended users were involved after the initial suggestion but well before any decisions were made. The continuing involvement of users and ethnographer kept the design evolving throughout the period of the project.

Keywords

Ethnography, work practice, radio, design of work.

Introduction

This is a case study, a story, of the design of a project to apply ethnographic findings to the problems of field service. In one sense, the design happened in a meeting scheduled to talk about the possibility of doing something; in another, the design evolved throughout the project and may not be finished yet. We believe that none of the people involved in the initial meeting think of themselves as designers and that they did not think of their actions as doing design. Nevertheless, design happened in the course of invoking their accumulated experience to think about approaches to a real problem and in the subsequent work of planning the application of their ideas.

The project began when a field organization of a major corporation asked for help from parts of the corporation's research and computing organizations. The goal of the project was to try to improve field service practice. The corporation in question manufactures photocopiers and other office equipment and provides professional service for these products in both rural and urban areas.

The Meeting

The District Service Manager for the Denver district had attended a leadership course where he had heard talks on high performance work systems and the power of artificial intelligence, and he wanted to know what these could mean for service now. He organized a meeting in Denver with some of his area managers (most of whom began their

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careers as technicians) and representatives of corporate research and AI. The story of this meeting and subsequent events will be told from the perspective of an anthropologist *[Orr]*, who studies work practice of service technicians and who was present at the meeting, and of an engineer *[Crowfoot]*, who missed the meeting but was then given the responsibility of finding an appropriate technology.

The initial premise of all attending the meeting was that the service technicians are important, skilled, and knowledgeable. (While this may seem obvious, it should be noted that it is counter to the official position of the corporation that a technician only need know how to read and use hand tools; direction of all activities is said to be provided by the service documentation.) There was a shared recognition that the technicians have more contact with customers than any other member of the corporation. There were further recognitions: First, that the corporation has not, historically, recognized either the importance of the technicians' role or the complexity of their work; and second, that the technicians have reason to be wary of the corporation. This seriously complicates the issue of doing anything for the service technicians.

Those at the meeting also recognized that the technicians have been more successful in doing their work than the corporation has been in telling them how to do it. That is, we recognized that the technicians knew most about the arena in which we were trying to help and further had good reason not to trust us when we offered to help. Consequently, we were looking for both ways to learn what help is needed and ways in which to establish some trust that help would be forthcoming.[1] This led us to consider what we could offer the technicians that might be perceived to be useful. It also led us to resolve that, if we found something useful, and if it turned out to help the technicians and possibly increase their efficiency, any advantage so gained would be left to the technicians to use for their own purposes. We would hope that they might use it to think about what else they might need to do their jobs, but ultimately we would have to trust them for them to trust us.

The Story

The most significant moment of the meeting occurred when the District Service Manager told a story. He had recently had his furnace repaired. The technician doing the repair had been carrying a portable radio, with which he maintained a continuous conversation with his colleagues, other technicians repairing other furnaces elsewhere. This use of the radio for constant communications struck the manager as something which technicians in his organization could use. This is rather a minimal story for those not involved in service work; however, even in this form it sufficed to capture the imaginations of those at the meeting and shaped the subsequent development of the project, so it is worth considering how such a story accomplished this.

Stories

Stories are common in the field service world. Orr has argued elsewhere *[Orr 1986, 1987, 1990a]* that war stories, anecdotes of experience, serve as a vehicle of community memory for the technicians, to share information gained in diagnosis with those members of the community who were not there. These stories are particularly apt for this purpose because of their situated quality; they combine facts about the machine with the context of specific situations. *[See Suchman, 1987, for a discussion of situated action.]* The contextual information demonstrates the claimed validity of the facts of the story, guiding the integration of those facts to the hearer's understanding of the machine. The context also constrains the application of that augmented understanding by defining the situation in which those facts are known to be true. War stories may be told during difficult diagnoses, as technicians search for inspiration to integrate the recalcitrant facts before them. Such war stories 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 has much to do with the degree of their usefulness.

The District Service Manager's story worked because the context under consideration in our meeting, field service, was seen to be comparable to the context of the story. That is, the situation of the technician repairing the manager's furnace in his home was seen to be sufficiently comparable to the repair of office machinery in a customer's office that the description of the use of a radio in one made it possible to imagine the use of a radio in the other. In order to see better how this comparison works, one must consider the work of field service.

Service Work

In prior field work, *[Orr op. cit. and 1990, 1991]* Orr found the practice of technicians maintaining photocopiers for the same corporation to be a continuous highly-skilled improvisation within a triangular relationship of technician, customer, and machine. This practice is a response to the fragility of available understandings of the problematic situations of service and the fragility of control over their definition and resolution. Understanding is fragile in that accurate information about the state of the machine is only sometimes available, nor is the meaning of available information always to be found. Control is fragile both in that the technicians come to work when the relationship between customer and machine is already awry and in that the technicians cannot keep the machines working and the customers satisfied; they can only restore that state after the fall.

[1] Implicit in this, and perhaps it should have been explicit, is the obligation to *be* both trustworthy and helpful when the opportunity arises.

This job is done substantially alone and on others' turf. The machines are scattered throughout the district, and each technician is responsible for specific machines in specific places. These places are customers' businesses, however, and the machines are there to serve the customers' purposes. The technicians, then, are not natives of the offices where they work but outsiders, and their very presence indicates that something is wrong. The technicians' communications with their own corporation have been primarily by telephone, usually one borrowed from a customer. Service calls are distributed to the technicians by a central work support group; the technicians are assigned new calls as they call in to report the outcome of finished calls. At this time they may also find out where their teammates are working or receive messages from them. It has rarely been possible for technicians to actually work together, but they do so when the opportunity occurs and do support each other as they can.

This thumbnail sketch describes service work as done before our project and as it is still done in most of the corporation. This understanding of the work was shared by most or all of those at the meeting, and it informed our subsequent consideration of the District Service Manager's story. In some ways, the work of furnace repair seems obviously comparable since it involves doing technical things to a complex device, working alone, and working in someone else's territory.

Consideration of the Story

Given this comparability, the point about the story which seemed most obvious and most appealing is that with the radio, the furnace repair technician was not, in some sense, alone. The radio seemed to provide the ability to maintain a continuous group conversation with some number of other technicians. Considering the role of the community as a resource of information, having better access to that resource seemed clearly desirable. The District Organizational Effectiveness Specialist pointed out that this is even more true for rural technicians who have widely scattered accounts and therefore spend much time driving. Urban technicians can and do meet at lunch spots or parts drops, and they have some hope of reaching other technicians by phoning the account to which they have been dispatched. Such rendezvous are rarely possible for rural technicians, and the proportion of driving time to service time makes the chance of reaching a team-mate by phone equally improbable. It seemed possible that this might change with radios.

The story made radios seems like an attractive tool to consider for service. Two aspects required further consideration. One was technical: are there radios that would cover the territories in which the technicians work? This includes differing segments of the metropolitan Denver area, as well as the rest of the state of Colorado and eastern Wyoming. While it appeared that the respective state police forces, for example, had solved that problem, it was not known if there were commercially available radio systems to cover such a variety of territories.

The second point is perhaps more critical from the perspective of participatory design: We had had an idea which seemed good to us, but without the participation of the intended users. Moreover, part of the rationale for the meeting was a desire to get the technicians more involved with the corporation; those attending shared a growing appreciation of the technicians' importance which made it seem urgent to learn what they needed. That is, in one sense, the real goal of the meeting was the participation which we had started without, and in fact, part of the motivation for the meeting was that that participation seemed problematic. Given the history of the relations between the technicians and the corporation, it is not clear whether their participation in this meeting could have been gained by a simple invitation.

This left us an interesting dilemma: It seemed clear that a decision by those in the meeting to give the technicians a new tool would not get them any more involved with the corporation than they had been, nor did it provide any more information about what they believe they need to do their jobs.[2] Moreover, given that the technicians tend to be somewhat wary of tools and programs provided by the corporation, it was not even clear that they would be interested in using the radios. Since the goal was one of *rapprochement* rather than the deployment of technology, we realized that we needed to gain the technicians' involvement in this project despite their absence from its inception. It seemed possible that this concern could be addressed through ethnographic field study, although the possibility required a certain amount of rationalization.

That is, if one were going to test the use of radios by the technicians, it seemed necessary to do a preliminary field study to establish a basis of comparison both with earlier work and with what might later be observed of the use of the radios. Doing this fieldwork would provide an opportunity to see if the radios made any sense to the technicians as a tool, and this was deemed critical to the success of the project. Any discussion of tools might also make it possible to see what other tools the technicians felt were necessary. Fieldwork also permitted the ethnographer to assess whether the technicians were receptive to being courted by the corporation, while the ethnographer's presence in the field might be perceived as a token of the corporation's interest in the technicians.

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[2] We did rationalize that enabling communications among the technicians would make it easier for the technicians to think and talk about what else they might need to do their jobs, although those at the meeting also agreed that there was a danger that, if the radios made practice any more efficient, the corporation would simply increase the work load and take away that gain.

The meeting ended with the intent to investigate the radios as a tool and the intent to do a preliminary field study to see if such a tool made any sense. At this point the design of the project diverges into technical and ethnographic endeavors. The ethnographic effort shall be discussed first.

Preliminary Fieldwork

Orr spent three weeks observing technicians from four different work groups. The groups were selected to cover both a variety of machines and a variety of work environments. One team services low volume machines both in Denver and in some of Denver's more rural suburbs, another services a higher volume machine in the same areas, and the contrast of machinery was one of the reasons for choosing them. The first was also chosen because its members were younger and had fewer years with the corporation; moreover, their group processes were said to be faithful to the model the corporation has sought to encourage in recent years. The second group was similar both in composition and in technology to groups previously studied by Orr and so would provide a point of reference. Two rural teams were observed as well. These teams are referred to as having 'geographical' territories; that is, the territory is not a group of similar machines in a more or less contiguous space, but is instead a defined space with all the machines therein. Accordingly, the technicians may service 30 to 40 different types of machine which are, however, apt to be represented in small numbers, sometimes ones and twos. This has profound implications for their practice.

In observing the technicians, particular attention was paid to the complex pattern of their communications, including communications with the corporation as a whole, with Work Support, the call dispatch and reporting organization, with the customers, and with each other. The technicians perceive communications with the corporation to be largely one-way, from the corporation to the technician; these happen in meetings or on paper. Communication with Work Support and some with customers happens by telephone. Other communication with the customer happens in person, while most of the communication with other technicians happens in person and only somewhat by telephone.

Due to the role of personal communication in developing and circulating the expertise of the technicians[3], the group planning this study thought the proposed radios would be useful primarily for the technicians to talk to each other. However, the role of such communications is not widely recognized and is in fact discouraged by the corporation. The technicians immediately thought of using the radios as telephones and only secondarily, if at all, thought of talking to each other. They did, however, appreciate the potential of talking more to each other when it was suggested.

Communication with Work Support is crucial to the enterprise. Work Support receives calls from customers needing service, relays those to the technicians, and receives the technicians' reports of what was done on service calls. Work Support also records those facts about service which the corporation wishes to track, and the corporations' understanding of the technicians' work is measured through calls taken, calls closed (and the time required to do so), and parts used. Communications with Work Support thus contribute to an official record which will be part of the technicians' performance appraisals. While this may sometimes inhibit communication with Work Support, such communication is necessary to do the work at all, and so the technicians talk to Work Support at least every two hours.

Communication with customers is another critical part of the work. After technicians accept calls from Work Support, they usually call the customer to tell them when they can get there, to learn more about the problem, and possibly to dissolve it by solving it over the telephone. The technicians and the corporation both believe that the call to discuss time of arrival is very important to the customer s sense of being taken care of; it is, perhaps, more important than the actual time of arrival. Technicians may also call customers after a service call to be sure that the customer is happy and the machine working, particularly for those calls where the problem could not be found or for which the cure is not certain.

At the beginning of the experiment, communication with Work Support or with customers was done entirely through the telephone system. This usually requires the technicians to use customers' telephones, which often irritates the customers. This is particularly true for small businesses who may only have one telephone line. To avoid this issue, some technicians try to use pay phones, which may be hard to find and which may, particularly in Wyoming or the mountains of Colorado, be exceedingly exposed to the weather. The corporation also maintains an assortment of parts drops in Denver and other towns in the district, and these are popular with the technicians both as a private off-stage space where they may meet other technicians and also for the telephones, owned and paid for by the corporation and so available for use without problems.

The field study, then, found that the technicians were most attracted by the potential of the radio as a telephone substitute. For rural technicians, this offers an opportunity to make phone calls during their long drives; for all, this means they no longer have to borrow a telephone from their customers. The radios also could have dial-in capability, which makes technicians much more accessible to their family members and others. This would include the possibility of customers directly calling technicians, a

[3]Mentioned earlier, and in the papers by Orr cited above.

prospect which seemed to concern the service managers.[4] Observation of the technicians' interactions with the Work Support organization suggested that Work Support should also be equipped with a radio; the possibility of Work Support initiating conversation would significantly change their relationship with the technicians.[5]

The Radios

With this set of interests in mind, consider the possible choices of technology to improve work group communication. This work was done by Norman Crowfoot of KBSCC in parallel with the field work described above, so the initial requirements were based on the ideas of those at the original meeting, not on findings from the field. Our principal requirement was that it be easy to converse with all members of the work group at once. A second requirement was for geographic coverage. The Denver metropolitan area is about 50 miles by 50 miles, and some work groups cover it all. The Denver district also includes the entire state of Colorado and eastern Wyoming, and the technology was to be tried in the rural areas too. A third requirement was for the ability to send and receive telephone calls. Other requirements were that the units be portable, preferably handheld, and sturdy enough to take the inevitable falls. It also seemed important that they use rechargeable, interchangeable battery packs.

There were some negative requirements as well. We did not want a central dispatch operator, as is common with police systems *[Rubinstein 1973]*, and we did not know whether this was mandated by the technology used or by the organization of police work.[6] A flat rate fee structure was important to avoid penalizing talk on the air with increasing charges. In the Denver and rural areas it was possible to get unlimited radio time at a flat rate, but this was not possible for the telephone patch.

After fieldwork with the technicians and some discussions with radio vendors, other features appeared desirable. We wanted to buy existing radios, commercial off-the-shelf hardware, which proved to be possible. One-handed, preferably one-button, operation seemed important. Licensing, if required, had to be simple. For purposes of a test, it would not be feasible for the corporation to operate its own radio signal repeaters, essential to the geographic coverage we needed, so repeater space had to be available for rent. The radio vendor would have to supply local support, since the corporation had no resources to do so. The technology had to support multiple discrete groups in Denver as well as supporting dispersed sites in the rural areas. In the long term, a technology which could also support the transmission of digital data in addition to voice would be preferable, although there are no immediate plans to pursue that.

Logic Trunked Radio (LTR), in the 800-MHz band, clearly meets these requirements.[7] It supports multiple groups and keeps their conversations separate. It permits some level of interconnection between groups, although there has been no attempt to use this feature. Repeater service is available for rent in Denver and much of the rural area included in the district. LTR provides telephone connections, at a price. The three vendors found all covered metropolitan Denver; rural coverage ranged from none through spotty to fair. Repeater positioning is critical for these radios, since it defines those areas where they will work and where they will not. The company offering fair coverage was a small, regional radio sales and service company based in Denver, which seemed likely to offer improved support.

A feature of Logic Trunked Radio is that frequencies are dynamically assigned, which provides some security from eavesdropping by third party service vendors and others. There can be a second channel which is not automatically broadcast to the whole group. This does not provide privacy, in that any radio in a group can switch to that frequency, but the radios do not automatically do so, permitting one to have conversations which are not broadcast to every location where there is a group member.

This seemed satisfactory, and the results of both the investigation of radio technology and the ethnographic fieldwork proved convincing to management, so we proceeded to buy LTR radios. Five work groups, initially including 21 technicians, were equipped with radios, and it was planned to observe their use over six months. In addition to continued ethnographic observation, the district would track the statistical measures which the service organization uses to see if change could be observed there. One could argue

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[4] To the best of my knowledge, this only occurred once. It seems the technicians also do not want this to happen, except in unusual circumstances. Managers calling technicians proved to be more of a problem, until the District Service Manager ordered that stopped.

[5] This still seems like a good idea, and we still have not done it.

[6] This now appears to be an organizational feature, not a technological one. That is, police departments believe that the organization of police work requires routing communications through a central operator. We found that a central operator was not necessary and believe it would have been undesirable.

[7] We are often asked why we did not choose cellular telephone, perhaps the best known of the wide variety of radio-based products. This service is widely available; however, the lack of group-wide communication presents a serious drawback for our purposes. The basic premise of the consideration of radios at the meeting in Denver was to enable continuous conversation among some or all members of the work group; the lack of this ability and the call-based charges both work against this premise and eliminated cellular telephone from consideration.

that at this point the design of the project was complete. However, changes and adjustments occurred throughout the six month period, and although the test period officially ended on December 31, 1991, the radios remain in the field, and the project clearly is not done yet.

The Continuing Evolution of the Project

Some sociotechnical aspects of design were encountered, fitting the technology to the social world of the technicians. An early question was whether managers would be allowed to have radios, whether, for example, there would be a base station in the district office. There are occasions when a manager does need to be able to talk to a technician, but there would also be the possibility of monitoring the technicians' talk. At the initial meeting, everyone agreed that monitoring was undesirable, that it would be a temptation, and that if it was done even once it would seriously damage the utility of the radios for the technicians. This possibility of surveillance was a major concern of the technicians, particularly those *not* participating in the test. On many occasions during the fieldwork, Orr found it necessary to assure other technicians that managers were not *allowed* to use radios. The district manager also announced this policy at a district-wide communications meeting. It appeared that the technicians involved in the test were not concerned about this, and it is hoped that their trust combined with the repeated assurances that it was not being done, plus the continuing fact that it *is not* being done, would eventually ease the fear of surveillance. At a later meeting with the work groups using the radios, it was decided that they could vote to permit their manager to use a radio, if a spare were available; one group did so, but it has rarely been possible to find a spare radio.

A second issue is connectivity: who gets to talk to whom? The radio vendors talk in terms of 'groups' and 'subgroups' and 'channel allocations', but it is not clear how this maps to the way a district service organization works. For the initial test it was easy, in that there were few radios allocated to unrelated groups of technicians. If one were to equip an entire district, however, there would be questions of teams that wish to talk to each other because there is some overlap in interests, in accounts or equipment that makes it desirable for them to communicate. Even with the small sample in this test, three of the teams have people working primarily in Boulder and its neighborhood, and the Boulder technicians want to talk to each other. Historically, Boulder used to be part of a separate district from Denver, and the technicians working there today feel some distance from the metropolis. This feeling of separation might be emphasized by a common channel, but it is also true that they are more distant from the support of their teammates than those downtown, and they have a tradition of helping each other out to the extent that they are able.

There are apparently simpler examples. One team in the test, for example, was one of three teams servicing a particular machine; it is easy to conclude that all those teams should be able to talk to each other for purposes of backup and sharing parts. However, other teams are servicing related products and share some parts and some of the requisite knowledge, and these teams could also be of help, at least in some situations. Then, there are former members of all teams whose expertise is still useful to their former team-mates. When one considers all of the possible interconnections among a population of 240 technicians, one quickly exceeds the capabilities of the technology. At that point it becomes necessary to choose which links are most important. This is not a question which radio vendors can answer; while it is a question which managers may answer, it seems probable that their answer will be different from one the technicians might give.

There are also issues of perceptions and expectations to be met. On the one hand, the technicians expected nothing, based on prior experience with corporate programs. On the other hand, once the radios materialized, the technicians expected perfect communications everywhere; this is what they have seen of radios in the movies and on television, where communications only fail where such failure serves the plot. The reality of radio communications is rather more problematic, and Denver has its share of dead spots and shielded buildings. All involved had to learn what was possible. It was also necessary to convince the technicians that this was normal, that the corporation had not simply purchased cheap but ineffective equipment. Being able to observe other users of radios, especially police and fire departments, helped with this task, but the suspicion is still there.

Finally, there are issues of support, and what that means with a new tool. From the vendor's perspective, having spare parts and technicians to fix radios constitutes providing support. From the district's perspective, assigning a manager to supervise the project constitutes support. From the technicians' perspective, neither of these sufficed. One initial hurdle was simply knowing when the radio was working. The technicians in the test experienced considerable difficulty deciding whether they were in dead spots more often than others or whether their radio was not working at its full capacity. Ultimately, it required intervention from the ethnographer, suggesting that dubious radios should be taken in for testing, that questions should be asked, that the technicians should demand the level of support which they needed, which was not being offered because its necessity was not known.

A Conclusion

This has been the story of the design of the Denver Project. If it also somewhat resembles *the* story of the Denver Project, that is because the design was interwoven with the practice, and both were a matter of feeling our way. There are no formal results; it has not been possible to measure the effect of the radios in this situation with the tools available. The technicians say the radios are a great

success, some say the radios have greatly changed their work practices, and some have offered to buy them from us to ensure they can keep them. The radios are still in the field; how could we take them away from people who have become dependent on them? We believe the project is a success because the technicians believe it is a success.

Perhaps a consideration of the design process will suggest some reasons for this success. It was a drawback that none of those attending the original meeting were drawn from the intended users, those who now do field service; it is, perhaps, some compensation that those designing the project were acutely aware of that fact. The serendipitous anecdote worked because it appealed to a shared knowledge of service work as it is done, rather than as it is said to be done, and so suggested the radios as a serious tool. In fact, we believe that an understanding of how work is done is crucial to any attempt to change that work and that such understanding is only to be found among those who have done the work or done direct observation of it.

The preliminary fieldwork was an attempt to get the intended users involved. It made those designing the project more aware of the importance of the telephone connection and otherwise encouraged them; it apparently created no sense of anticipation on the part of the technicians because they believed nothing would come of it. It did serve to establish a relationship between the ethnographer and the technicians, which permitted the ethnographer to provide vital support when the radios were deployed. The later periods of observation of the use of the radios kept the ethnographer in the field, available to the technicians.

However, the design is not finished yet. Design must be seen in a case like this as an on-going process. It certainly was not over once we had thought that radios were a good idea, nor was it over when the radios were in place. In fact, design here is indistinguishable from the project, and bounding either would be an artificial exercise. The radios are in place and the technicians now have a year's experience with them. The question is, What are we going to do next?

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