4 Seeing as a situated activity: Formulating planes

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In order to focus as clearly as possible on some of the issues involved in the analysis of cognition in the workplace, this chapter will investigate a single, very simple, but very pervasive, activity performed by different kinds of workers in a medium-sized airport: looking at airplanes. Despite the brevity of individual glances, they are in no way haphazard. Workers look at planes in order to see something that will help them accomplish the work they are engaged in. Understanding that looking, therefore, requires analysis of the work activities within which it is embedded.

Powerful resources for the detailed analysis of mundane activities have been provided by the approach to the analysis of human interaction that encompasses Goffman (1963, 1971, 1974), Garfinkel (1967), Kendon (1990), and, most relevant to the work in the present paper, conversation analysis (Atkinson & Heritage, 1984; Drew & Heritage, 1992; C. Goodwin, 1981; M. H. Goodwin, in press; Goodwin & Heritage, 1990; Jefferson, 1973, 1984; Sacks, 1992; Sacks, Schegloff, & Jefferson, 1974; Schegloff, 1968). Moreover, in order to see the airplane in an appropriate, task-relevant way, workers use a range of different kinds of tools. A primary perspective for analysis of how human beings interact, not only with other human beings, but also with a material world shaped by the historical activities of others, can be found in activity theory (Cole, 1985, 1990; Engeström, 1987, 1990; Leont'ev, 1981; Vygotsky, 1962, 1978; Wertsch, 1985) and the work on distributed cognition that grows from it (Hutchins, 1990, 1995; Middleton & Edwards, 1990; Siefert & Hutchins, 1989). Analysis of the situated, technologically mediated, nature of seeing in complex work settings takes up themes raised in recent work in the sociology of science on representational practices (Latour, 1986, 1987; Latour & Woolgar, 1979; Lynch & Woolgar, 1988). One of the themes that will quickly become apparent in this paper is the way in which the ability to see something is always tied to a particular position encompassing a range of phenomena including placement within a larger organization, a local task, and access to relevant material and cognitive tools. Such focus on the embeddedness of knowledge within a plurality of diverse local per-

spectives explores issues raised in recent feminist scholarship on science (Haraway, 1988; Harding, 1986). By looking at how participants actually accomplish relevant seeing within specific tasks in local environments we will provide detailed analysis of what Star and Gerson (1987) call "performances" (see also Woolgar, 1988). Finally, the work provides a detailed investigation of the situated organization of action within the workplace (Suchman, 1987, this volume).

Investigating how airport personnel look at airplanes allows us to see how behavior as minute as a momentary glance is densely structured by larger organizational practices [i.e., how the body of a worker becomes an inscription point for what Foucault (1979) has called a discipline], as well as the tool-mediated organization of participants' access to the objects in their working environment, and the community that sustains such practices.

The work we report here is part of a long-term ethnographic study of work practices in a multiactivity setting – a midsized airport – initiated at Xerox PARC by Lucy Suchman. The project integrated ethnography with methodologies for studying human interaction developed within conversation analysis. In order to focus on what people actually did, rather than their reports about their work, we videotaped extensively, sometimes using as many as seven cameras to record distributed processes occurring in diverse locations. Whenever possible we tried to capture multiple perspectives in a single location, for example, using a wide-angle camera to record the interaction in the room and a close-up camera on the screens and documents with which the participants were working. One site that the project devoted particular attention to was the operations room used by each airline to coordinate ground operations (see Suchman, this volume).

Seeing an airplane as a relevant organizational entity

Atlantic Hawk is a "commuter airline" that uses a fleet of small propeller planes to make flights to nearby airports. All of their planes look exactly alike and they are parked haphazardly (in the order in which they happened to arrive on this particular day) on a large section of runway some distance from the main gates.

Consider the tasks faced by someone responsible for loading baggage on an Atlantic Hawk flight to a specific destination, say Oakland. On the field in front of her are ten identical Atlantic Hawk planes (see Fig. 1). How is she to determine which plane to load, i.e., how can she see which of the ten planes is going to Oakland? Seeing the plane itself is not enough, since the plane she is looking for looks just like all of the other planes in her field of view.

For airport personnel, planes do not stand alone as isolated objects. Instead, they are defined by their positions in larger webs of activity. Thus, for the baggage loader a specific plane must be linked to another organizational entity, a *flight* going to a specific destination. To determine which of the planes in front of her is in fact going to Oakland, the baggage loader uses a tool called a "complex

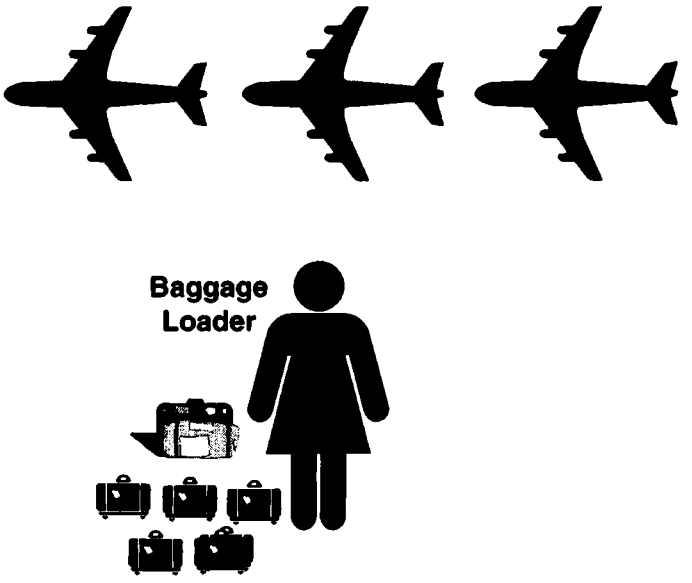


Figure 1.

sheet," a grid that links flights and destinations to unique aircraft identification numbers:[1]

Complex Sheet

Flight	Dest	Plane
5231	MRY	462
5288	OAK	323
5246	SBA	287

The aircraft identification numbers are painted on the plane in several specified locations (for example, near the tail and nose). Thus, in order to find which plane to load, the baggage handler must: 1) look to her complex sheet to find the identification number of the plane going to Oakland and then 2) scan the collection of planes in front of her until she finds the one with that number (see Fig. 2).[2]

In order to see *a* plane in the manner that it is relevant to the tasks that she is engaged in, i.e., as *the* plane she is to load, the baggage handler must embed the object visible to her senses within a relevant organizational network, i.e., attach it to a flight going to a specific destination. Placing the plane in an appropriate network is not, however, automatic but requires both supporting tools (e.g., the complex sheet, the aircraft identification numbers, etc.) and specific situated

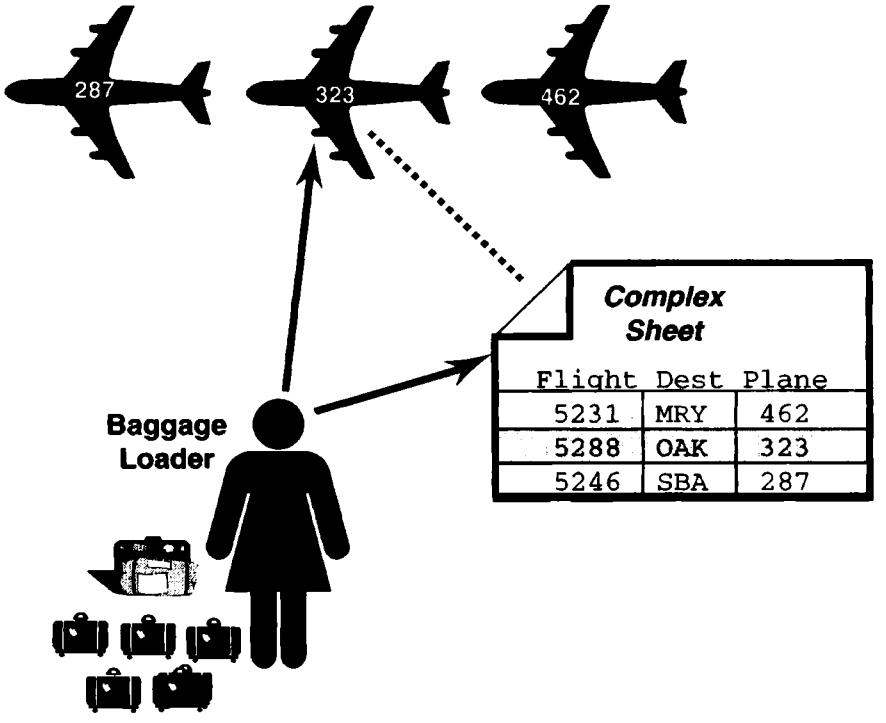


Figure 2.

work with those tools, an active course of seeing that juxtaposes the information on the complex sheet with the numbers painted on the plane.

The routine, but contingent and problematic, properties of this active process of juxtaposition cannot be overemphasized. In 1991, 34 people were killed when two planes crashed on the runway at Los Angeles International Airport after an air traffic controller "mistook another small plane that was halted short of the runway for the plane she had cleared to enter it" (Mydans, 1991, p. 9).

The complex sheet used by the baggage loader is the product of many different people's work. While the overall schedule is known well ahead of time, plane swaps are frequent (Jordan, 1990). The plane numbers must therefore be continuously updated as the day progresses. Shortly before each set of arrivals a ramp-crew chief goes into the Atlantic Hawk operations room, checks the computer, and makes a list of the latest aircraft numbers, which he posts on the ramp. Ramp personnel then update their own complex sheets. The glances being performed by each baggage loader thus build upon an elaborate social and technological infrastructure. An observer watching the baggage handler as she approaches the line of planes might see her as an isolated, solitary worker. However, by using the

complex sheet, she builds upon the actions of coworkers who, though not physically present at the moment, provide organization for the looking she is doing.

Through the power of the complex sheet as a socially constituted tool, the actions performed by the baggage loader's body are linked in fine detail to the larger organizational structure of the airline.[3] The sheet mediates not only her access to the plane she is trying to find, but also, and simultaneously, it mediates her participation in the work of her coworkers and the larger organization within which her tasks are situated (see also Forbes, 1990).

One final point: from the perspective of the baggage loader, the plane as a relevant organizational object is defined by its position in the organizational network constituted by a flight. The flight is not, however, the only web that can be used to define a plane as a work-relevant object. Maintenance workers are most interested in the specific history of a particular aircraft, i.e., what work has been done on it in the past, what ailments it has had, when its servicing is next mandated, etc. This historical network is irrelevant to the baggage loader. For the tasks she faces, it is sufficient to know where the plane is going next, not what has happened to it in the past. Different work positions thus place the same physical object, a particular airplane, within different webs of accountability. The work structure of the organization defines a plurality of perspectives that entrain in differential fashion what alternative types of workers are expected to see when they look at an airplane. Quite frequently, perspectives overlap. For example Maintenance will allow a plane with a slight problem in its weather radar to fly as long as its route will not take it near thunderstorms. In such cases, the criterion central to the organization of the baggage loader's work, the plane's destination, becomes relevant to maintenance personnel as well. However, though both groups now attend to the same category, "destination," the detailed nature of the work that each group is doing differentially shapes how that category is to be perceived and what is to be seen in it. "Destination" for Maintenance is a complex object that encompasses multiple attributes (here, local weather conditions; on other occasions, altitude, distance, etc.), all of which are irrelevant to baggage. The situated perspectives of alternative work groups provide objects viewed in common with different horizons of meaning and relevance. Consistent with Wittgenstein's (1953, §66–67) analysis of "family resemblances," a category such as "destination" means different things in the different language games that make up the work life of the airport, though these separate senses have deep and overlapping connections with each other.[4]

Gates and labels

The issues posed for the baggage loader faced with the task of finding a relevant flight are responsive to, and contingent upon, the detailed organization of the environment in which she is working. For example, the fact that the planes are scat-

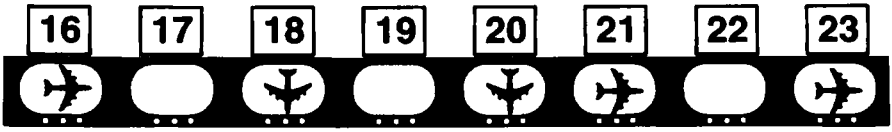


Figure 3.

tered haphazardly on the runway requires that aircraft numbers be used to find the plane that constitutes a particular flight. At Atlantic Airlines, the large international airline that uses the Atlantic Hawk as a local subsidiary, planes are organized in space quite differently. Instead of being scattered on the runway, each plane is assigned to a specific *gate*. Thus, to see if a particular plane is in one does not have to scan the entire set of planes and read the aircraft number of each. Instead, one can look at the gate assigned to the plane and see whether or not it is occupied. Each plane/flight has been assigned a recognizable slot.

A video camera is mounted at each gate pointed at the position for the plane. The output of these cameras goes to the Atlantic Airlines operations room and into a line of monitors positioned on the front wall. Personnel in the Atlantic operations room can thus see the entire set of gates in a single glance (Fig. 3).

How is the task of seeing a plane accomplished in this environment? In the following, Ralph is teaching a new Operations apprentice, Val, how to do radio close-outs. In a radio close-out, an operations agent reads final flight information received over the computer to the pilot. A central piece of this information is the weights and balance report, which can only be computed after all doors to the plane have been closed and exact figures have been obtained for the weights of baggage, fuel, passengers, etc. In order to ensure speedy departures, operations personnel try to check their computers to see if the figures have been computed before the pilots actually call them as they approach takeoff position. Consider the sequence being examined here (see Fig. 4).

1. Ralph says "Let's see who's pushing" and shifts his gaze to the bank of monitors. While glancing at them he says "18." (i.e., a gate number).
2. He then moves his gaze to the computer system that is used to display flight information throughout the airport (i.e., flight, gate, destination, scheduled departure time, etc.). While reading it he says "18 is 1464" (i.e., he links a gate number to a specific flight).
3. He then turns to Val and says "He's off the gate. So let's go and see if 1464 has weight and balance."

Ralph's first task is to identify the gate of the departing plane. The label placed on each monitor (e.g., "18") ties the image on its screen to a particular gate. Linguistic anthropologists have devoted considerable attention to *texts* of various types (Hanks, 1989). However, the mundane, vernacular documents that constitute work spaces have largely been ignored (Goody, 1977). Some of these docu-

Example (1) *WE-9 13-Aug-90 2:01pm*

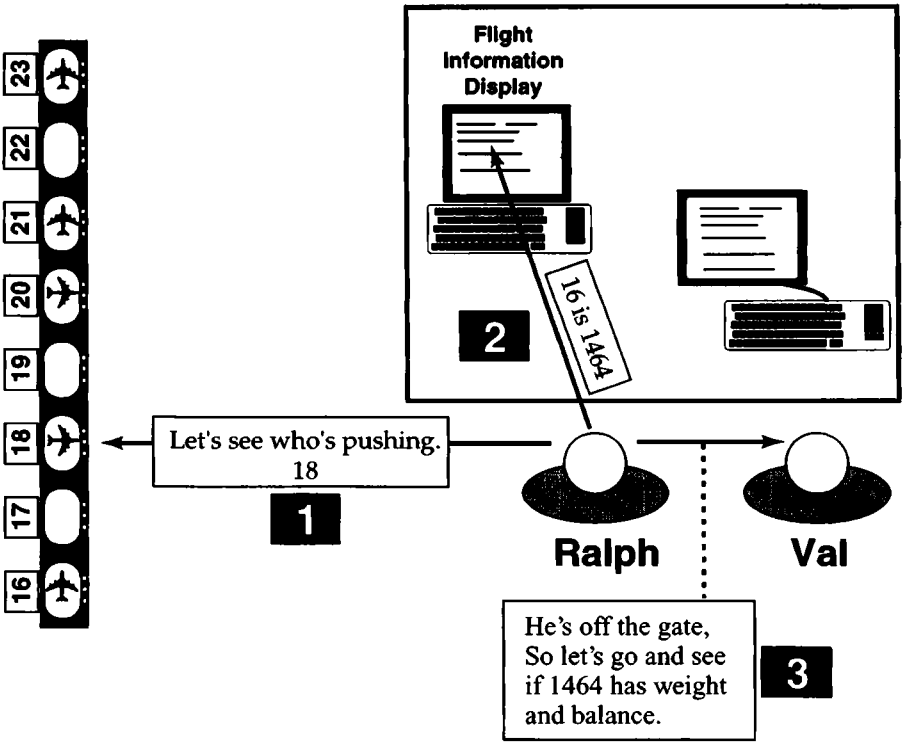


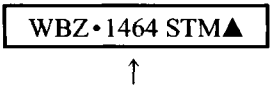
Figure 4.

ments have intricate forms of organization that are as complex as those attributed to traditional literary texts (note for example the complex, multilayered, socially distributed *authorship* of a form such as the complex sheet), whereas others, such as labels, might initially appear too simple and fragmented to merit serious analysis. However, the persuasiveness of such labels in work settings points to a set of complex practices through which workers annotate in locally relevant ways the worlds they inhabit (Engeström, 1990; Suchman, 1987). Ethnographers of science have devoted considerable attention to both the social organization of authorship (Mukerji, 1989; Shapin, 1989) and to a specific class of labels – captions on scientific diagrams (Bastide, 1988; Lynch, 1988). Bastide (1988, pp. 194–195) notes that without the caption to a scientific picture one would not know "what one is supposed to see in [the] Figure," e.g., whether the circular objects visible in the picture are stones in a river, pebbles on a wall, or phosphorus-rich calcium granules incorporated into the muscles of a sea worm. Note that the label under an operations room monitor provides a rather different type of infor-

mation. Instead of identifying the content of the image on the screen, i.e., saying that this is an airplane, it specifies the location within a relevant organizational framework of that image, i.e., its location at a specific gate. The line of monitors is analogous to a row from a grid or spreadsheet and the label functions not to describe the contents of a cell, but to specify its relevant location.

Different airplanes move in and out of the same gate as the day progresses. Knowing the gate does not automatically identify the flight. Ralph thus moves his gaze to the flight information display, locates gate 18 on it, and by reading the other information on that line finds the flight he has been looking at. While actually looking at the monitors he saw a plane, not a flight. The flight information display functions much like the complex sheet of the baggage loader. Indeed, complex sheets are found in the operations room and could have been used to accomplish this seeing. However the flight information display was the relevant tool most at hand, the easiest one to use in Ralph's specific circumstances. Tasks can frequently be performed in a variety of different ways, such that problems (e.g., tying a plane to a flight) have multiple, locally situated solutions (Lave, 1988).

In speaking, Ralph does not in any way mention what was central to the baggage handler – the destination of the flight at issue. He is performing his search for the flight instantiated by the plane at Gate 18 in order to enter a weights and balance query into the computer. That command requires a flight number, not a destination (and indeed, in that the computer network covers the entire nation, there are multiple flights going to the same destination). Thus, a moment later Val types



Though both the baggage loader and the operations agent are faced with the task of tying a visible plane to a flight, the specific nature of the activity within which each of their searches is embedded provides alternative shapes for what will count as an appropriate solution to that query. Once again, the nature of the interconnections that will provide for an appropriate seeing of the plane is shaped in fine detail by the local structure of the activity in progress.

Aircraft operations provide one of the primary examples of rational technology in our society, and the computer networks that tie them together are among the most extensive in the world. However, neither these networks, nor the rational organization that sustains both the technology and the bureaucracy of the airline, provides a single all-encompassing view of what is happening in the airline. Instead of a master overview, one finds multiple, diverse local perspectives, each constituted through the combination of a specific array of tasks, an ensemble of tools for performing those tasks, and an entrainment of workers' bodies that en-

compasses not only their muscles but also phenomena as minute as acts of perception embodied in momentary glances.

Seeing the status of an activity

Discussion has so far focused on the procedures used by airline personnel to tie a visible plane to a specific flight. Ralph's actions raise a second, related issue: finding the current status of the flight from the activities of the plane, i.e., the ability to see the flight as a process and to locate where in that unfolding process events currently stand. Investigation of such issues requires analysis of a local culture situated within the workplace. As a competent worker in the operations room Ralph knows the time frame within which a weights and balance report becomes both possible and relevant. It cannot be computed before all points of entry into the airplane (doors for passengers, baggage, fuel, etc.) have been sealed but must be computed before the plane reaches take-off position at the end of the runway. The gate monitors display both the plane and activity of people around it. By looking at that ensemble of activity a competent viewer can make inferences about how close the plane is to departure. For example, are the passenger stairs still connected to the plane? Are the baggage doors sealed? etc. In the present data, Ralph begins his search with a query about "Who's pushing."[5] Both the use of such seeable inferences as a constitutive feature of operations work and the way in which the ability to make them is developed within the culture of the operations room will be explored further later in this chapter. For the moment, we simply want to make three observations. First, being able to see relevant events on the screen is not in any way a transparent, "natural" ability (Lynch, 1988; Pasveer, 1990), but very much a socially organized element of culture that is instantiated within, and sustained by, a community of practice (Lave & Wenger, 1991). Second, insofar as glances reading the activity at a gate are used to further the work activities that operations personnel are engaged in (i.e., here Ralph looks to the monitors in order to determine which flight to call up on the computer), they are not isolated, individual acts of perception but instead function much like moves in the socially situated forms of life that Wittgenstein (1953) calls language games. Third, both the necessity of getting planes off on time and the regular sequences of action that mark different stages in that process have for those in the operations room a taken-for-granted character. However these phenomena have been actively constructed by larger social processes (e.g., airlines in the United States use "On Time" statistics to compete with each other for passengers). Rather than being natural constraints, these features are socially built and articulated, in part precisely through work such as that being examined here. By timing and tailoring their work to meet the constraints imposed by "On Time" departure, workers in the operations room collaborate in constituting that constraint as a pervasive feature of airline operations.

The reflexive relationship between talk and tool-mediated seeing

Central to the phenomena being investigated here is *context,* as exemplified in the endogenous activities participants are engaged in, the reflexive relationship between those activities, and the material artifacts that make them possible (Engeström, 1990, pp. 77–78). Context also encompasses the deployment of action within human interaction through which participants within a setting build frameworks of mutual accountability as they become environments for each other (McDermott, 1976). The major analysis of context as a phenomenon central to the organization of human interaction has been the study of the organization of talk in interaction provided by conversation analysis (CA). Work in CA differs radically from most approaches to the analysis of meaning developed in linguistics and related disciplines in that it starts from the assumption that sentences cannot be analyzed as isolated, self-contained wholes, but instead are forms of action that gain their intelligibility from the context in which they occur.[6] A major component of that context is the sequence of other talk from which a current utterance emerges and further develops. Thus, a first pair part, such as a question, makes relevant a particular type of next action – a reply – and creates a local environment for the production and interpretation of subsequent action (Schegloff, 1968; Schegloff & Sacks, 1973). The dynamic nature of context revealed by such a perspective cannot be underestimated. Thus Heritage (1984b, p. 242) notes that every utterance in conversation is "doubly contextual in being both *context-shaped* and *context-renewing.*" This dynamic interplay between context, interaction, and mutual intelligibility is found not only in how the talk of separate participants is organized relative to each other, but also *within* the production of single utterances. By including within the scope of analysis not only the talk of the participants, but also the visible displays of orientation, alignment, understanding, etc. provided by their bodies we (C. Goodwin, 1981; M. H. Goodwin, 1980; C. & M. Goodwin, 1987, 1992) have been able to demonstrate that even individual sentences occurring within single turns at talk can be dynamically reshaped as they are emerging through an ongoing process of interaction between speaker and recipient(s).

CA has not, however, included within the scope of its analysis of context the topic that has been so central to activity theory: interaction with a world of historically constituted artifacts. Much is to be gained by bringing these two strands of analysis together. The operations room is an appropriate place for attempting such an integration, since, on the one hand, the work done there is reflexively tied to the tool-saturated environment in which it occurs, while on the other hand, much of that work consists of talk. We now want to expand our previous analysis of how utterances are shaped by processes of interaction between speaker and hearers by looking at how a single strip of talk within the operations room embodies its speaker's dynamic articulation of the artifacts in her working environ-

ment as she attempts to determine the status of a specific plane. In the following, an arriving pilot radios the operations room to try to learn when the gate he is to go to will be free. Julie in the operations room replies. Data is transcribed according to the system developed by Gail Jefferson (Sacks, Schegloff, & Jefferson, 1974, pp. 731–733):[7]

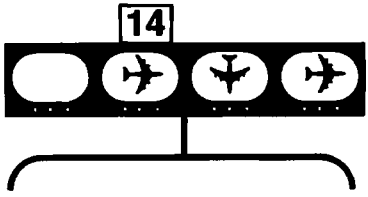
Example (2) *WV-13 3-Nov-89 11:11pm*

1. Pilot: San Tomás Ramp?
2. Atlantic two eighty six?
3. Julie: Two eighty six.
4. This is operations.
5. Pilot: I understand gate 14 is occupied?
6. Do you have any instructions for (it)?
7. (0.3)
8. Julie: Uh::m, (0.1)
9. Should've left 10 minutes ago.=
10. Hopefully,
11. (1.0)
12. They have pulled the passenger stairs.
13. They should be leaving momentarily
14. Pilot: Okay. Thanks.

The operations room comes equipped with a rich array of material artifacts (e.g., computers, radios of various types, documents, telephones, video screens, etc.). However, different tasks require alternative local tool kits,[8] and, moreover, within each task, tools change as the activity progresses. A problem of *tool selection* is thus posed that cannot be solved by an external observer listing the contents of the room (cf. Engeström, 1990, pp. 171–178; Sacks, 1963). The operations room, with its equipment, is like a stage set for multiple courses of action. However, it is not yet action itself; to describe the reflexive relationship between available tools and the actions that constitute the work of the operations room requires analysis of endogenous local activities.

To explore such issues, we will focus on the exchange between the pilot and Julie that begins in line 5, after the call's opening mutual identification sequence. This exchange takes the form of one of the most pervasive types of sequential organization found in conversation – a request for information and its reply – a particular instance of the more general class of two-part sequences that Schegloff and Sacks (1973) have analyzed as adjacency pairs. The pilot's question sets a task for Julie – providing an answer to his request. We now want to look at the situated work Julie performs to provide that answer.

When the videotape is examined, one can see that throughout the course of the exchange Julie makes use of the tools and representations provided by her work environment. Gaze toward these resources can be mapped against developing talk. We'll begin with the pilot's talk in line 5:



5. Pilot: I understand gate fourteen is occupied?

What Julie is gazing at is displayed just above the utterance. One word after the pilot says "gate," Julie shifts her gaze to the row of gate monitors. Even before she knows the precise problem she is dealing with, she begins to orient to tools (i.e., the gate monitors) that will be relevant to the solution of that problem. When she hears the pilot use the term "gate," Julie learns something about the work that the pilot is asking her to do. Even though the complete problem has not yet been specified, the term "gate" itself is enough to locate a particular subset of the tools in the operations room as relevant to the tasks of the moment. As the task becomes more completely specified, further tools may be located as relevant to its accomplishment; i.e., tools emerge as relevant within an expanding horizon of progressive action. The pilot's talk, by virtue of its context-building sequential relevance, sets an agenda for the next actions of its recipient. Dealing with this agenda involves selective operations on the materials in her environment, i.e., the selection of specific tools from a larger set in terms of their relevance to the task of the moment. Only through use of these tools can Julie see the gate that the pilot is talking about.

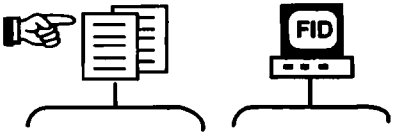
Previous work in CA has demonstrated that recipients do not wait until an utterance comes to completion before beginning to operate upon it; instead, they track its emergence on a moment-by-moment basis (cf. C. Goodwin, 1979; M. H. Goodwin, 1980; C. & M. H. Goodwin, 1987; Heath, 1986; Jefferson, 1973, 1984; Lerner, 1993). The present data shed further light on the complexities of this process. As Julie tracks the word-by-word unfolding of the pilot's talk, she is simultaneously attending to not only the talk itself, but also her work environment, finding the tools that will be relevant to the task she sees emerging. Talk-in-interaction and the tool-saturated work setting mutually inform and delineate each other.

In order to act as quickly as she does, to bring her gaze to just the right tool for the job, Julie is relying upon her *habitual knowledge* of the setting in which she is working. That habitual knowledge encompasses both awareness of how tools and personnel are distributed within her working environment (M. H. Goodwin, in press) and familiarity with the routine request sequences she can expect to participate in as an operations worker. Her glance is the act of a competent member of the setting that provides the home for the activities in progress. Routine ways of dealing with typical troubles, instantiated in the work practices that new-

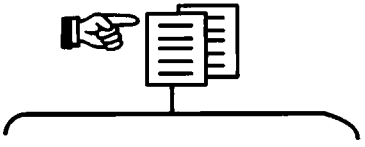
comers appropriate through apprenticeship, constitute a sedimentation of solutions to past problems that earlier inhabitants of the operations room pass on to their successors.

As the pilot continues to talk and she starts her reply, Julie shifts her gaze from the monitors first to some papers on her desk (presumably to her radio log which contains actual arrival and departure times), then to the Flight Information Display (FID) screen (which lists scheduled times of departure), and then back to her papers:

6,7. Pilot: Do you have any instructions for (it)? (0.3)



8. Julie: Uh::m, (0.1)

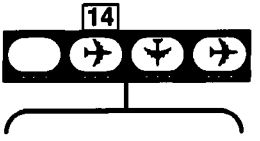


9. Should've left ten minutes ago.

Though our camera is not able to read the papers on her desk[9] the talk she produces explicates the activities she has been performing. By saying "Should've left ten minutes ago," she demonstrates that she has found the flight currently occupying gate 14, located its scheduled departure time, and compared that time with the current local time (clocks are visible in several places, near the flight information display screen and on the wall next to the gate monitors). The different types of technology clustered in her workspace provide structurally different kinds of information about the flight whose status she is attempting to decipher. The gate monitors show the plane itself still occupying gate 14, while the documents provide information about the flight instantiated in the plane, and the clock ties these events to the current situation, i.e., the plane shouldn't be at that gate now. The nature of the problem being dealt with is progressively reshaped as talk, tools, and documents mutually inform each other. Initially, all that Julie knows about the problem is that it concerns a particular gate. By looking at the

monitors, she can find that there is indeed an aircraft at that gate. This then leads to a search for documents that might illuminate that status of that plane. As the representations provided by one tool are brought into play, the problem is reformulated, which leads to a search for further information through the interrogation of other tools.

To get a picture of the object that is the subject of her scrutiny – the status of the plane/flight at gate 14 – Julie must bring these multiple perspectives together. After discovering through her interrogation of the paper and electronic documents in front of her that the troublesome flight at gate 14 "Should've left ten minutes ago," Julie returns her gaze to the gate monitors. She spans the move from the documents to the monitors with the word "Hopefully:," – a term that indexes an optimistic expectation – that the situation projected in the documents will soon become actual:



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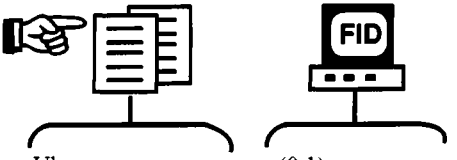
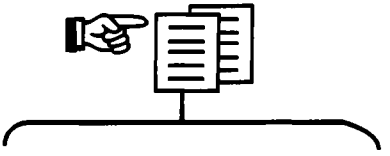


8. Julie: Uh::m, (0.1)



9. Should've left ten minutes ago.

10–12. Hopefully:,(1.0) They have pulled the passenger stairs.
13. They should be leaving momentarily.

Languages provide speakers with a variety of resources that allow them to not only produce statements, but simultaneously take up stances toward what they are saying, for example, to comment on the status of what is being said. Such commentary can be provided in a number of different ways, for example by including in the talk *evidentials,* terms which explicitly mark the speaker's assessment of the reliability of what is being reported (Chafe, 1986), and through use of supersegmental phenomena such as intonation and aspects of voice quality that can provide displays about the speaker's engagement in both the talk she is producing and the tasks that the talk is embedded within.

Because perspective is so central to the work of airline personnel (e.g., workers who use separate tools to accomplish task-relevant perception at diverse locations see the same event from alternative perspectives), it is not surprising that evidential devices pervade their work-relevant talk.[10] Thus, in line 5 the pilot prefaces his report that gate 14 is occupied with "I understand," a preface that allows him to distance himself from full commitment to the accuracy of this statement while simultaneously cueing his recipient that he is not positioned to actually see the gate. For her part, Julie in line 9 uses the modal verb "should" to categorize the departure time 10 minutes ago as an expected or normative state of affairs, while allowing the speaker to distance herself from any claim that this event did in fact happen. By using the term "should" she displays her orientation toward a situation in which there is a marked discrepancy between what should be occurring and what is occurring.

Through the details of her speech production, Julie organizes her talk to explicitly display the way in which she is "catching information on the fly." The linguistic and paralinguistic devices she deploys reveal a progressive horizon of unfolding knowledge as she accesses different tools. When the pilot turns the floor over to her, she is still scanning the documents in front of her. By saying "uh::m" she accepts the floor while producing not the projected next action, an answer to his request, but a display of involvement in a search, a task that may be a prerequisite to providing the answer. Her involvement in the task of trying to figure out what is happening, and her own puzzlement as to why things are not as they should be, are made visible through the details of her continuing speech production. We do not have the technical resources to rigorously describe the sound quality of this speech but will impressionistically note that it seems to be spoken at a higher than normal pitch without the easy fluency that is found in her talk at the end of the sequence.

The term "Hopefully:," in line 10 is another evidential which displays its speaker's involvement in an anticipated state of affairs. It is pronounced with falling–rising intonation (indicated in the transcript by the comma), a contour that characteristically displays that the talk in progress has not yet come to completion. The term thus stands as the preface to an as yet incomplete course of talk. It is spoken as she moves her eyes from the documents to the gate monitors. It appears that what she will see on the monitors is relevant to the further elaboration of the description begun with "Hopefully:," Indeed, immediately after completing the word, she stares intently at the monitors for a second, and sees that the passenger stairs have actually been pushed away. What she says next is produced with a very different voice quality than the talk leading up it. "They have pulled the passenger stairs." is spoken at noticeably lower pitch and with much more authority. An utterance announcing the expected resolution of the problem "They should be leaving momentarily," is immediately latched to it. Its immediate, unproblematic production contrasts markedly with the hesitant, almost falsetto talk used to begin her turn in lines 8 and 9. By stating the expected time of departure as "momentarily" – a term used routinely by airline personnel to fudge exact time specification – Julie is able to display complete confidence in the imminent departure of the plane without specifying when precisely this will occur.

The unit begun with "Hopefully:," is abandoned without being brought to completion. One reason for this might be found in the contrast between the problematic, not yet actual character of the state of affairs that would be found in a description begun with a modal such as "Hopefully," (i.e., "Hopefully they'll be leaving soon") and the actual state of affairs she in fact reports: "They have pulled the passenger stairs." In essence, looking at the monitors enables her to see something that reformulates the epistemic status of the description she is providing the pilot, a state of affairs that requires the use of a different modality. The stress placed on "have" in line 12 not only highlights the fact that the stairs have been pulled, but through its contrast with the reduced verb in line 9, "ve" in "Should've," emphasizes that a change in the speaker's certainty about what she is saying has occurred. Julie's description of the pulling of the passenger stairs makes available the *warrant* she has for her eventual response to the pilot's questions – "They should be leaving momentarily." – in line 13.

Through use of particular lexical items (e.g., "momentarily"), evidentials (which are precisely articulated with gaze toward different representations of the plane's status), and the details of her speech production, Julie makes available to her recipient a progressively changing information horizon, one that has been shaped by her articulation of work-relevant tools. By constructing visibly different kinds of talk, Julie is able to display, within this single turn, a range of alternative stances toward the events made visible through her talk.

C. Goodwin (1981) demonstrated that processes of interaction between speak-

ers and recipient(s) can lead to changes in the structure of an emerging sentence; for example, as the speaker shifts from one type of recipient to another she will change the emerging meaning of the sentence so that it maintains its appropriateness for its recipient of the moment. Here we find similar modifications of an utterance that has not yet come to completion. However, now, instead of adapting to her addressee, she changes the emerging structure of her talk in response to her interrogation of the tools and representations in her working environment. By including the work environment within which a query is framed, we gain a much richer understanding of the situated work that goes into the production of an appropriate answer.

Much research into the organization of linguistic and other cognitive processes has made inferences about the information-processing strategies being used by actors. Characteristically, these processes are conceptualized as occurring inside the mind, and thus are inaccessible to direct observation. By looking at how tools in a working environment are deployed to answer a query, we can investigate the articulation of relevant information, and the representations that encode that information, as accessible, visible phenomena.

Finally, these data demonstrate that the work-relevant perceptual event, the thing to be seen in order to accomplish the job at hand, doesn't exist apart from the heterogeneous work involved in assembling a set of relevant perspectives for viewing it, a process that encompasses the material technology that makes such seeing possible.

Seeing absent events

We now investigate in more detail the cultural competence required to appropriately read a scene on a video monitor. The following provides a clear example of some of the issues involved. Stan, in the operations room, receives a query asking whether flight 722 is being fueled. To answer this query he 1) turns to another document to link the flight to a gate (line 1); 2) looks up to the appropriate gate monitor and finds that the place where a fuel truck would be is not visible; (line 3) and then 3) asks for help in using the controls in the operations room that pan and zoom the gate cameras, a move that is anticipated by one of his coworkers, Jay (lines 7–8). When the camera is panned (line 9) and gets to the place on the side of the plane where fueling is done, there is no truck in that place (line 10). Seeing this Stan reports back "No. It's not hooked up" (a ☎ marks talk spoken into the telephone receiver):

Example (3) *WE-73 26-Oct-90 6:32pm*

☎	1.	Stan:	Let's see here. ((*Turns to complex board*))
	2.		Seven twenty two is gate seven.
	3.		(0.8) ((*Looks at Gate Monitor*))

☎	4.	Uh I can't tell if there's a fuel truck hooked up to it.
	5.	Does seven twenty two have a fuel truck
	6.	hooked up to it.
	7. Jay:	[((*Jay gets up and starts to work monitor controls*))
	8. Stan:	[Who's got these controls.
	9.	((*Pan to side of plane where fuel is loaded*))
	10. Jay:	Nope.
☎	11. Stan:	Uh no it's not hooked up.

The fragment begins with another example of how an airline worker, faced with the task of finding the plane that instantiates a particular flight, accomplishes this task by turning to another document in order to link flight numbers to a specific gate (lines 1–3). What we want to focus on at present is how Stan is able to see something relevant when he eventually looks at the monitor. At least two classes of phenomena are relevant to the organization of such looking.

The first is the way in which the media being used for perception shape what can be seen through use of these media (cf. Lynch, 1988; Pasveer, 1990). Workers in the operations room are well aware that their cameras in no way give them a neutral, undistorted view of the events being looked at. As one of them says, when discussing with a coworker the problems involved in trying to direct the movements of plane visible on video: "Looking at the cameras you don't have any depth, or field, or perspective, or anything." For workers in the operations room such problems are practical, not theoretical. The communications equipment in the operations room, including the gate monitors, provides the workers with their primary perceptual access to the world of their work. They see and act upon that world through use of these tools. Thus, whatever the strengths and weaknesses of these tools, operations personnel are faced with the task of coming to terms with them, of learning how to see through them to do their work.

Second, operations personnel must see more in a scene than is actually visible on the gate monitor. This is particularly clear in the present data, wherein Stan and Jay are both able to see something that is quite literally not present, the *absent* fuel truck.[11]

How is such vision accomplished? Competent looking at the monitor is informed by applying knowledge of expected configurations of activity to the materials visible on the screen (the relevant activity being selected with reference to the task in progress at the moment). Thus, in these data both Stan and Jay demonstrate that they know where a fuel truck will be located when fueling is in progress. At the beginning of the sequence they are able to recognize that they cannot yet answer that question because the relevant place is not yet visible. They then move the camera to bring that place into view and use the fact that they see nothing there to see something relevant, i.e., that the plane is not being fueled.

The task of the moment makes particular features of the scene relevant and helps structure how they will be interpreted (cf. Heidegger, 1962, pp. 95–100).[12] To read the scene on the monitor in a work-relevant way, operations personnel bring to bear situated, local cultural knowledge.

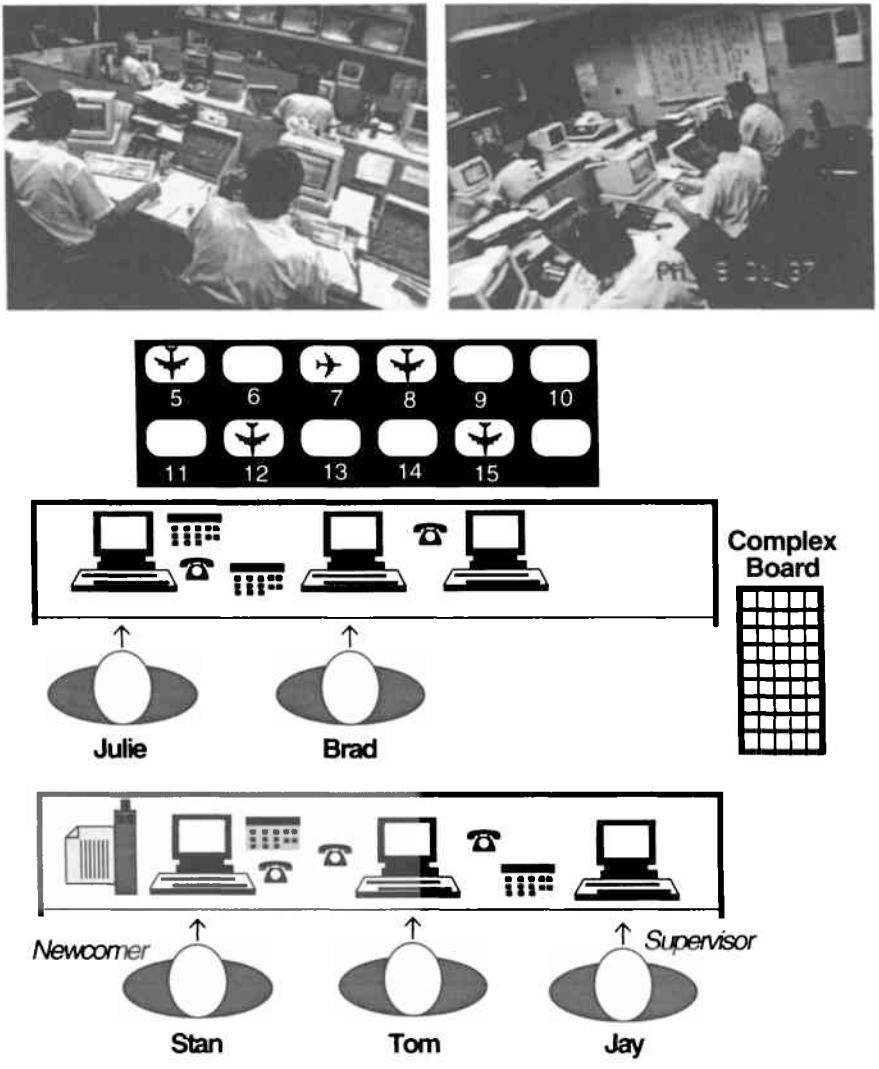
The way in which Stan and Jay are each independently able to see the necessity of moving the gate camera demonstrates that applying activity configurations to the materials being studied is not an individual, psychological process, but a mode of practice, a shared competence implicated in the ongoing work of the room.

Reading a scene as a social process

To further explore the social processes implicated in seeing images in a work-relevant way we will now turn to a more extended sequence. The events to be examined occurred two weeks after the airline had moved into a new terminal. The move to the new terminal involved a change in the way in which passengers boarded the aircraft. In the old terminal, they walked out onto the runway and climbed a set of stairs placed next to the plane. In the new terminal, they board planes directly by going through a tunnel at each gate called a Jet Bridge.

In the old terminal, activity around the passenger stairs provided operations personnel with resources for reading events on the ramp (cf. both Suchman in this volume and Julie's talk about the stairs being pulled away in Example 2); they are now going to have to learn how to read the jet bridge in a similar work-relevant way. The data we will now examine provide an extended example of how such seeing is developed by interaction between operations workers as they come to terms with the issue of appropriately interpreting a scene visible on one of their gate monitors. Present in the room are both a number of experienced operations hands and one newcomer, Stan, who is still being given instruction on the job. He is not an absolute beginner and was assigned a position to work on his own. However, whenever he encounters any difficulties, old-timers come to his aid. A particular "ethos" (Bateson, 1936) prevails in the room that greatly facilitates this process. Because of the respectful, and at times playful, way that the people in the room deal with each other, he freely admits the difficulties he is having with new tasks and is never put down as someone whose performance is defective. Figure 5 provides a diagram of how people and equipment are positioned in the room.

In addition to a computer terminal and telephone, each position also contains a new multichannel radio system. On the right side of the room is a complex board that lists plane numbers and gate assignments for all of the day's flights. In the old operations room this board was placed directly under the row of gate monitors.



Seeable trouble

In Fig. 6, Brad gets a radio call (which everyone in the room can hear)[13] about a problem with the jet bridge at gate A-12 (line 6). To separate the radio conversation from other talk in the operations room, boxes are drawn around talk within it and marked with walkie-talkie icons. The others in the room look to the A-12 monitor and then break into spontaneous laughter at what they see there (lines 15–17, and 22; "(h)" is used to transcribe within-word laugh particles).

Example (4) *WE-74 26-Oct-90 9:01pm*

Gate:	Operations, Come in.	1
	(2.4)	2
Brad:	Go ahead Mister Wilson.	3
	(3.5)	4
Gate:	Yeah Pete	5
	We definitely have a problem here on this je:t bridge.	6
	(3.2)	7
Jay:	Which gate.	8
Brad:	What gate.	9
	(2.1)	10
Gate:	A: twelve.	11
	(2.0)	12
Brad:	Do you know what the: problem is.	13
Julie:	Uhoo: : : eh : : :	14
Julie:	It's covering half of the ai(h)rpl(h)ane.	15
Jay:	Eh Heh Huh huh huh huh	16
Gate:	It's not taking ground power to the aircraft.	17
Jay:	Ah man.	18
Julie:	Ou: : : that's bad	19
Gate:	A:nd,	20
Stan:	hh Ha Ha Ha °ha ha ha°	21
Gate:	the power presumably is not cutting	22
	off on it-on the je:t bri:dge.	23

Figure 6.

The operations room is provided with two versions of the trouble at Gate A-12. In lines 17 and 22–23 the ramp worker at the gate provides a description of the trouble he is calling about: power isn't being supplied to the airplane. Meanwhile, the video camera at A-12 allows the operations room to look directly at the gate (see Fig. 7). For most of the people in the room, the problem visible on the gate monitor is absolutely transparent. They break into spontaneous laughter as soon as they see the position of the canopy (and indeed the ethnographers at the back of the room, who included one of the authors of this paper, silently joined into the laughter engendered by the scene).

Such transparent vision is subsequently shown to be deeply problematic. Six minutes later, after a talk with the ramp crew that reported the problem, Stan turns to the rest of the operations room and reports (line 5) that there is no problem whatsoever with the jet bridge. Instead the problem lies with a different piece of machinery, the ground power unit (see Fig. 8).

Julie's incredulous "***That's*** not ***nor***mal!" (line 9) goes to the heart of the anthropological concept of culture, i.e., the specification of what counts as normal within the lifeworld of a particular group. Indeed, in these data we are able to catch a glimpse of the social and historical processes through which a community accumulates experience of the habitual scenes that constitute their working environment, and articulates for each other how these scenes should be

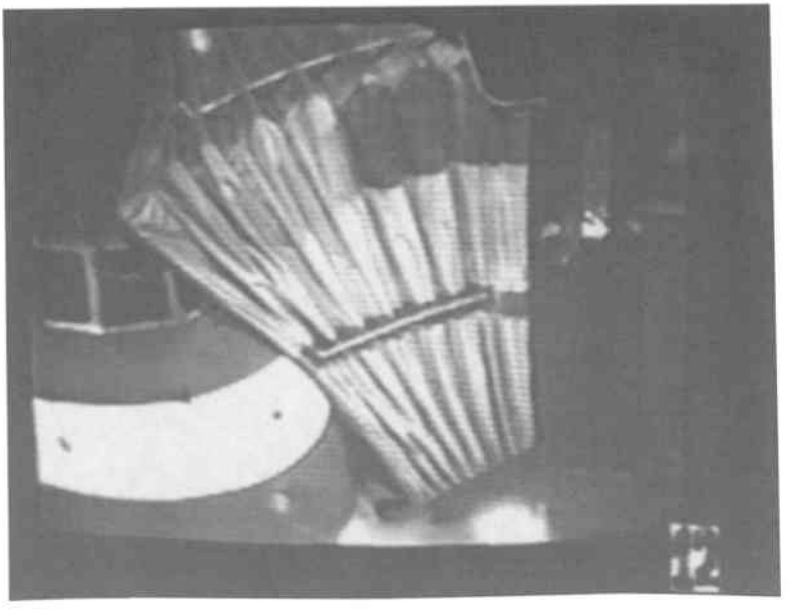


Figure 7.

Example (5) *WE-74 26-Oct-90 9:07pm*

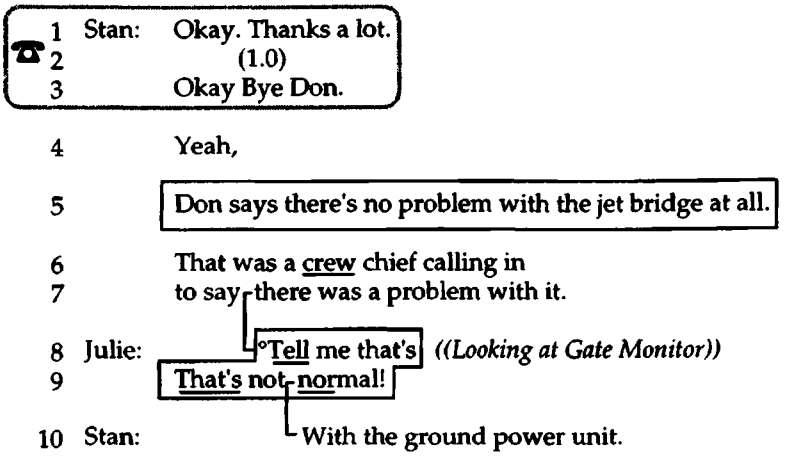


Figure 8.

properly interpreted. Through their work this night they come to see more clearly what constitutes the "normal appearance" of one of the objects that will figure repetitively in their work, the representation of a jet bridge on their gate monitors.

The fact that these very competent workers could so clearly see the image on the screen as abnormal, indeed laughable, poses the question of how such collaborative, multiparty, transparent seeing was accomplished. This process is analyzed in detail in a separate paper (C. Goodwin, in press). Briefly, the term "problem" in gate A-12's report (Fig. 6, line 6) provides instructions for interpreting the scene visible on the monitors. Consistent with what has been analyzed as the documentary method of interpretation (Garfinkel, 1967; Heritage, 1984b), these images in turn are used to elaborate and fill in the sense of "problem." Julie's response cry (Goffman, 1981) in line 14 and the laughter that follows from it not only provides further analysis of the image on the monitor, but also invokes a multiparty participation framework (M. H. Goodwin, 1990, chapter 10) that invites others to commit themselves to her vision of transparent trouble visible in the scene.

In the present paper we want to first investigate how the consensus about the clear visibility of seeable trouble on the screen was challenged, and second, how the status of what was visible there, for example its character as an emergency, was transformed as the representations provided by alternative tools situated the events on the screen within new perspectives.

Multiple domains of expertise within the operations room

At least one person in the room doesn't see the trouble on the screen. Stan repetitively asks "What's the problem with it" (lines 4, 5, 12, and 15) as Jay calls facilities maintenance to ask for a repair crew (see Fig. 9).

The party who doesn't see what the others see occupies a special position in the room; i.e., he is the newcomer, the novice who is being trained. This special position provides a plausible, default account, for his failure to see; i.e., he has not yet developed the work-relevant perceptual skills of a fully qualified operations worker. Meanwhile, his coworkers continue to treat the trouble as completely transparent. Julie (line 3) describes the situation on the screen as "good and ugly." When asked to describe the problem over the radio Jay (lines 16–17) says "The canopy has fallen away from the jet bridge on to the cockpit of the aircraft." Most tellingly, Stan's repeated queries about the nature of the problem are

Example (6) *WE-74 26-Oct-90 9:02pm*

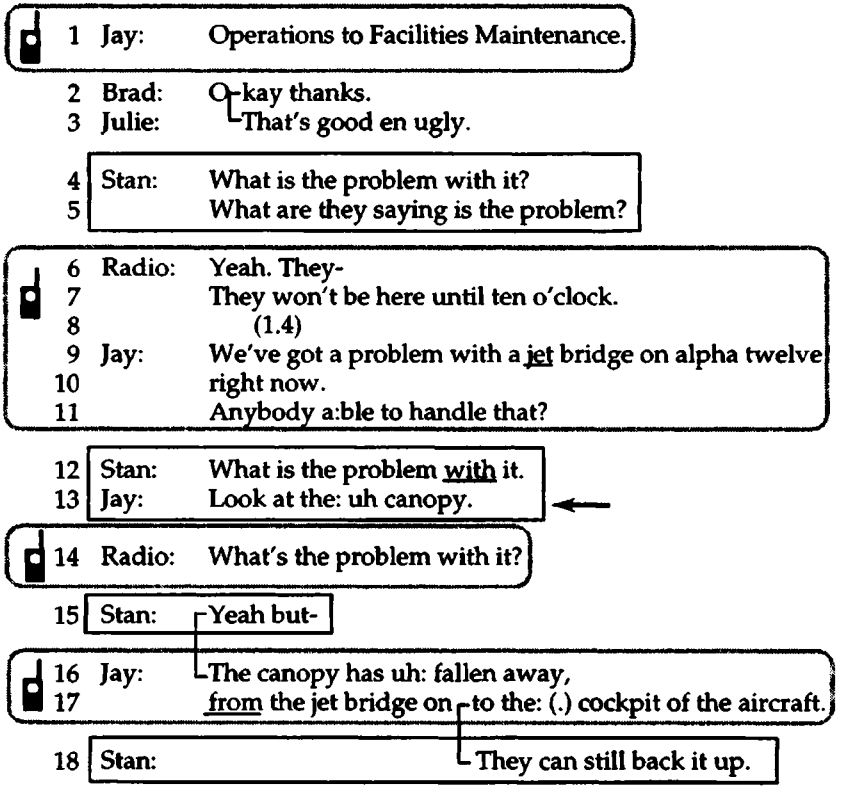


Figure 9.

finally answered in line 13 with Jay's "Look at the canopy," a reply that treats the trouble as transparently visible on the monitor screen.

What Stan says next (lines 15 and 18) casts his failure to see the trouble in a new light. By prefacing his talk with "Yeah but" he offers a challenge to what he has just been told. He then proposes that, despite what can be seen on the screen, "They can still back it up." Subsequently, he and Brad have an extended debate regarding what can and cannot be done with jet bridges. Instead of being incompetent to see the trouble that the others in the room find so transparent, Stan is countering that viewing, actively resisting the interpretation that his colleagues have reached.

Each worker brings to the operations room a different work history and thus a range of different skills, producing a situation in which multiple domains of competence cross-cut the formal hierarchical organization of the work group. Jay is the supervisor for the evening and Stan is the low man on the totem pole, the newcomer who must repetitively ask others for help with routine computer work. However, jet bridges are brand new at this airport and even someone high in the local hierarchy may not have had much experience with them. By debating the details of jet bridge operation Stan displays competence in that domain of expertise. In the local arena of practice clustered around jet bridges, Stan claims expertise that Jay lacks, and challenges his analysis of the events visible on the gate monitor.

What consequences do Stan's claims have for the room's ongoing work with the jet bridge problem? Jay is unable to find anyone at facilities to fix the bridge. After listening to Stan debate the proper operation of jet bridges with Brad (lines 1–2), Jay suggests that if no one else can be found Stan himself should go down to the gate and "take care of it." Stan's expertise with jet bridges is thus not only acknowledged but called upon by his supervisor. What one finds here is an environment in which a plurality of contradictory viewpoints can be voiced. Though "only" a newcomer Stan is able to successfully challenge an interpretation of a situation that his more experienced colleagues treat as transparent. Instead of putting Stan in his place, ignoring the perspective of the most junior person in the room, Jay not only listens to what Stan has to say but draws upon the skills he displays. In view of the disparate problems sent to the operations room for resolution during the course of a workday (flight delays, inadequate meals, broken equipment, etc.) fostering an environment in which anyone, no matter how junior, with competence in a relevant area can make themselves heard can be quite valuable to the organization as a whole.

Looking at such phenomena from a slightly different perspective, it is important that the individual expertise that one party brings to the room be transformed into an element of social practice that can be used by others as well, i.e., that it become part of the working culture of the operations room. By articulating their interpretations of the scene being looked at through talk with their cowork-

ers, workers in the operations room organize their work-relevant seeing within an arena of public discourse, one that is able to encompass multiple perspectives. Such openness to multivocality, and the ethos of the room that permits Stan to freely admit both his ignorance and his expertise without fear of censure, are quite consistent with other aspects of the way in which interaction is organized within the room. Thus operations personnel are expected to monitor what others in the room are doing (a call to one position may well have consequences for the work that others are expected to do) and frequently take action on the basis of such overhearing. The openness and accessibility of work in the operations room, and the inclusion of participants with heterogeneous domains of expertise, are quite relevant to the organization of situated learning by both newcomers and old-timers within it, i.e., it provides a productive arena for what Lave and Wenger (1991) call legitimate peripheral participation.

Reframing the problem

As soon as operations learns about the trouble at the gate, personnel in the room mobilize to remedy it. Jay immediately calls facilities maintenance; when he learns that they won't be in for another hour, he has Stan call the gate itself. On getting no answer on the phone Stan tries to reach them on the radio. In essence, operations treats the trouble with the jet bridge as an emergency, and mobilizes multiple courses of action to fix it as soon as possible.[14] Multiple hypotheses about the precise nature of the trouble are kept alive and entertained by different participants in the room. Thus, at one point Brad points out to Stan that while Jay "noticed" the canopy, and reported that as the problem, the original call that Brad received located the trouble in the ground power unit. The status of the trouble as an emergency is not, however, debated but instead accepted as a default assumption as attention immediately focuses on finding a solution to the problem. Such quick response is valuable and useful for an organization that uses flight delays as one of its main measures of performance. However, as we saw earlier in this chapter, the mere ability to perceive an airplane with one's senses (here mediated through the video apparatus of the gate monitors) does not mean that one is apprehending it in the way that is relevant to the work life of the organization (for example as a flight going to some particular destination). In order to see the relevance of the plane, workers must juxtapose to it other kinds of information embodied in other tools: complex sheets, flight information display screens, etc. So far, that work has not been done for the plane at Gate A-12 (and indeed knowing where the plane is going does not in any way help fix the jet bridge).

After hearing that Stan has not been able to reach anyone at the gate (a location that would certainly be occupied for an outgoing flight), Jay turns to the complex board on the side of the room, queries the status of the flight, and finds

that the plane at Gate A-12 is an "overnighter," i.e., a plane that will not depart until the next morning.

Example (7) *WE-74 26-Oct-92 9:04pm*

((*Jay looks to Complex Board*))

1. Jay: ***What*** have we ***got*** at twelve anyway.
2. Is that an overnighter?
3. (1.5)
4. Oh! It's an over***nigh***ter.
5. There's no uh big deal about it. (0.4)
6. We could wait until Facilities (comes).

Looking at the complex board leads to a change in Jay's understanding of the problem at hand. Note that line 4 begins with a change of state token (Heritage, 1984a), the particle "Oh!" Through Jay's use of the complex board, the scene on the monitor is embedded within a new framework of meaning. Since the plane will be there all night, the emergency status of the work they are doing disappears. Instead, as Jay says in line 6, they can wait until the facilities crew comes on duty. The status of the plane as an overnighter solves other puzzles as well. Thus, a moment later Stan says, with reference to his failed attempts to reach someone at the gate, "So it's no wonder no one's there. They're not even departing." An even more radical reformulation of the trouble occurs three minutes later when, as we have seen, Stan reports that there is no problem whatsoever with the jet bridge (Example 5).

These data demonstrate once again that neither the plane, nor the image of it on the screen, are properly dealt with as isolated, self-contained objects. Instead, workers must use a heterogeneous collection of disparate technology to assemble a set of work-relevant perspectives for its proper interpretation, i.e., to see it in the way that is relevant to the work they are doing with it. What the object being worked with *is,* and their work responsibilities toward it, change as these perspectives change (cf. Lynch, 1982, pp. 516–518). Though situated within the organization of the operations room as systematic practices, the procedures required to place a plane within a relevant network of meaning are by no means automatic. Instead, assembling a set of relevant perspectives, i.e., properly seeing the plane, is an ongoing contingent accomplishment within a particular community of practice.

Conclusion

This chapter has attempted to bring together within an integrated analytic framework phenomena that are typically studied in isolation from each other, including human interaction, tools, perception, and the details of language use. When actual courses of action are examined, it is found that all of these phenomena mutually shape each other. Thus, in Example 2 in order to answer the pilot's

query about the occupied gate, Julie had to interrogate a range of alternative representations embodied in different tools, a contingent process within which her knowledge of what it was that she was working with was constantly changing. Her shifting evidential horizon was visible in the details of her speech production. Despite a few notable exceptions (for example Duranti, Goodwin, & Goodwin, 1991; Engeström, 1990; Hutchins, 1990; Latour, 1987; Middleton & Edwards, 1990; Ochs, Schieffelin, & Platt, 1979; Schegloff, 1992; Smith, 1990; Suchman, 1987) the contemporary social sciences typically conceptualize cognition within a Cartesian framework, as something located inside the individual mind, or in Searle's (1990) elegant phrase in "brains in vats."

All of the data examined in this chapter have displayed the interdependence of cognitive processes, tool use, and social organization. Thus, in the last example the conceptual object being worked with, the "problem" with the jet bridge, constantly changed as new representations were brought to bear upon it. These changes affected not only the definition of the problem (e.g., whether it resided in the jet bridge or the ground power unit) but also the work-relevant status of that trouble as an emergency. The cognitive operations involved in the resolution of this problem were not located in any single mind, but instead emerged through time as a contingent social process within which cognitive artifacts, such as the complex board, and historically constituted tools, such as the gate monitors, played a most important part.

For clarity we have focused our analysis on a single, very simple problem: looking at airplanes. However, as all the phenomena examined demonstrate, workers at the airport are never faced with the naked perceptual task of simply seeing an airplane. Instead that looking is always part of larger courses of activity, and it is these that are the focus of a worker's attention. Instead of seeing an isolated object with some attributes – a plane going to Oakland – the baggage loader is looking for the plane that she is required to load. This larger framework is not extrinsic to the act of perception but instead establishes the ground and relevance for such an act, while at the same time giving it shape (for example defining what will count as a solution to the perceptual tasks it poses). From this perspective, the activity of perception is a social rather than a psychological phenomenon.

The operations room constitutes a veritable electronic panopticon. On a scale undreamed of by Jeremy Bentham, it arrays the views of the scenes that are relevant to operations personnel into a single master grid (exemplified in very concrete fashion in the array of gate monitors); the vision provided by its cameras is richly augmented by a heterogeneous collection of computer and communication equipment. Each worker in the operations room has individual access to a nationwide computer network. Different kinds of radios and telephones connect them with planes, fuel trucks, mechanics, caterers, in essence any setting that might be relevant to airline operations. Documents of many different types provide them

with representations of both the ideal, planned schedule and the actual status of each flight.

However, what one finds in this panopticon is not a single master view, but instead a heterogeneous collection of disparate views provided by the different tools for perception that happen to be available. To get a picture of the object that is the subject of her scrutiny, an operations worker must bring these multiple perspectives together. This does not happen in a single moment as the separate views dissolve into a single master perspective, but instead is a process that must be articulated through time as a worker shifts her gaze from the view provided by one tool to that offered by another (see for Examples 2 and 4–7). Her view of what is happening is the assembled product of a course of local action. Though this process is performed from a particular perspective, i.e., her position in the operations room, the seeing it produces is not homogeneous.

Both the objects being worked with, and the perspectival organization that provides relevant access to these objects, are tied to *participation in action*; configurations of participant, tool, perspective, and object are not haphazard but instead systematic components of the work setting that they help to constitute. Seeing in such an environment is not an unproblematic activity. Participants must learn how to see in organizationally appropriate ways the habitual scenes of the work setting.

Workers are continuously faced with the task of juxtaposing perspectives on whatever object is being worked with so as to situate it within a relevant web of meaning. While these perspectives are constituted through an ensemble of tools and positions, articulating a task-relevant view of the object requires active human *agency*. In that the object being worked with is defined in part by the perspectives brought to bear upon it, and in that juxtaposition of multiple relevant perspectives is a contingent, time-bound process, that object, and the responsibilities of workers toward it, change as the activity unfolds. This does not, however, provide evidence for extreme relativism. Instead, these various perspectives are articulated and constrained by the larger patterns of social organization, and the tasks of collaboratively achieving coordinated action, within which they are embedded.

Ethnographers of science (Lynch, 1988; Lynch & Woolgar, 1988) have provided insightful analysis of how graphic representations are used to shape the materials provided by the world into the phenomena of interest to a particular discipline. However, very little attention has been paid to the process through which alternative representations become relevant and are interrogated and tailored as actual tasks unfold contingently through time. A major task faced by workers at the airport is not just the production of such representations (e.g., the social construction of a complex sheet) but more crucially, the local *juxtaposition* of such representations to other phenomena in order to build relevant perspectives for the accomplishment of the work at hand. Analysis of such processes requires look-

ing beyond the representation itself to the course of action within which it is embedded.

The most important representations used at the airport are documents of many different types. Few of these documents take the form of narrative accounts written in complete sentences and paragraphs. They thus differ dramatically from the kinds of texts typically investigated when literacy in the workplace is studied. However, as has been noted by Dorothy Smith (1990) it is such documents that tie local work into larger organizational structures. They thus constitute a most important locus for the analysis of not just literacy, but, more crucially, social organization and practice (Goodwin, 1994).

The mundane routine work of large organizations as strategic a site as rituals in traditional societies for the anthropological analysis of culture. Work tasks in such settings are one place where language, tools, documents, and human interaction interdigitate in such a fashion as to require analysis from an integrated perspective. Not only does this overcome old dichotomies such as that between cultural idealism (Goodenough, 1970) and cultural materialism (Harris, 1968), but, more importantly, it provides an opportunity to investigate dynamically and in detail how culture is constituted as a mode of practice (Bourdieu, 1977). The importance of apprenticeship (Rogoff, 1990) in these processes ties such analysis to current work investigating the relationship between language and socialization (Ochs, 1988; Ochs, Jacoby, & Gonzales, 1994; Ochs & Schieffelin, 1984; Schieffelin, 1990) and to work in linguistic anthropology that analyzes talk and the body as positioned within settings that culturally define a field of intelligibility for the production and interpretation of action (Duranti, 1992; Hanks, 1990). Central to all of these issues are processes of human interaction. In brief, the analysis of mundane action in the workplace constitutes a most important locus for the integrated study of language, culture, social organization, and the historically constituted material world within which these phenomena are embedded.

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Notes

1 The complex sheet gets its name from the way in which it tracks the ground activity that occurs during a *complex*, the organizational entity that encompasses a bank of planes arriving from multiple destinations, staying on the ground while passengers and baggage are transferred, and then taking off again approximately an hour later for new destinations. The complex is a central component of an airline's hub and spoke system in which flights are funneled to a few central locations where connections are made. The *complex sheet* is the central document used to track ground operations during a complex. Because of its centrality, and the way in which different types of workers at the airport use it in quite different ways, it has received considerable study by The Workplace Project (see for example Forbes, 1990; Suchman & Trigg, 1993). For clarity of presentation, a very simplified version of the complex sheet is described in this chapter. There is also a large *complex board* in the Atlantic operations room that tracks gates and times for the entire day's complexes.

2 For analysis of the importance of juxtaposing documents in scientific practice see Latour (1987) and Woolgar (1988).

3 Latour (1990) raises the question of how events that are locally organized (for example, the glances of the baggage loader) are tied to larger structures that bridge local contexts. Forms, such as the complex sheet used by the baggage loader, are one of the systematic tools used to tie diverse local contexts into larger organizational patterns.

4 From another perspective, a category such as this provides an example of a *boundary object* (Star & Griesemer, 1989).

5 See the paper by Suchman in this volume for analysis of very elaborate collaborative disentangling of the scene visible on an operations monitor.

6 See the classic work within conversation analysis on recipient design (for example Goodwin, 1981; Jefferson, 1974; Sacks & Schegloff, 1979; Sacks, Schegloff, & Jefferson, 1974; Schegloff, 1972).

7 In the Jefferson transcription system, punctuation is used to mark intonation rather than grammatical structure. A period indicates a falling contour, a question mark indicates a rising contour, and a comma indicates a falling–rising contour. Colons indicate that the sound immediately preceding has been noticeably lengthened. Square brackets mark overlap onset. Bold italics indicate some form of emphasis. A degree sign marks lowered volume and a dash a sudden cut-off of the current sound.

8 We are using the term "tool" to refer to not only tools in the traditional sense, e.g., objects like hammers, but more generally any socially constituted structure used to accomplish a particular task, including documents and standardized work practices. "Tool kit" refers to the ensemble of materials deployed for the accomplishment of a particular task.

9 Events such as this also had a reflexive influence on our own developing work practices. In subsequent taping, we made special efforts to place multiple cameras so that we could capture both larger patterns of interaction in the room and the documents and computer screens that were the focus of the participants' attention.

10 For analysis of how evidentials are used to establish perspective in calls from the police see Whalen and Zimmerman (1990).

11 Work in conversation analysis has devoted considerable attention to the analysis of how relevant absences are attended to by participants as consequential events in the ongoing organization of their action (Schegloff, 1968; Pomerantz, 1984; Sacks, Schegloff & Jefferson, 1974).

12 See Edgeworth (1991) for very interesting analysis of the embodied looking being performed by a worker on an archaeological excavation.

13 For more detailed analysis of how listening to the talk and work of others is a central component of the work life of the operations room see M. H. Goodwin (in press), Brun-Cottan (1990, 1991), and Suchman (this volume).

14 For other analysis of how operations personnel quickly mobilize multiple trajectories when faced with an emergency see Suchman (this volume).

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