INTERACTION ANALYSIS:
FOUNDATIONS AND PRACTICE

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1.0 BACKGROUND AND PREMISES

1.1 Interaction Analysis[1]

Interaction Analysis as we describe it here is an interdisciplinary method for the empirical investigation of the interaction of human beings with each other and with objects in their environment. It investigates human activities such as talk, nonverbal interaction, and the use of artifacts and technologies, identifying routine practices and problems and the resources for their solution. Its roots lie in ethnography (especially participant observation), sociolinguistics, ethnomethodology, conversation analysis, kinesics, proxemics, and ethology.

Video technology has been vital in establishing Interaction Analysis which depends on the technology of audiovisual recording for its primary records and on playback capability for their analysis.[2] Only electronic recording produces the kind of data corpus that allows the close interrogation required for Interaction Analysis. In particular, it provides the crucial ability to replay a sequence of interaction repeatedly for multiple viewers, and on multiple occasions.

Interaction Analysis as a distinct method is just beginning to be differentiated from other kinds of video-based analyses. It is not taught *per se* in any university curriculum; however, there is a growing number of practitioners doing video-based Interaction-Analytic work who contribute methods, approaches, and findings to the practices of an emerging community of practitioners of Interaction Analysis. In this paper we describe the work of researchers loosely associated in one way or another with two laboratories dedicated to Interaction Analysis: the first operated at Michigan State University (MSU) between 1975 and 1988; the second functions as a joint venture between Xerox Palo Alto Research Center and the Institute for Research on Learning (IRL) in Palo Alto, California. While the MSU Interaction Analysis Laboratory often focused on medical settings, the Palo Alto group is particularly concerned with

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1   We use the term "Interaction Analysis" (capitalized) to refer to the particular method of analysis we are developing, while "interaction analysis" (lower case) or "analysis of interaction" refers to the domain of interest. This domain, of course, is one which concerns a great many theoretical and practical persuasions, e.g. symbolic interactionism, phenomenology, social psychology, and a variety of schools of therapy.

2   In this paper, we use the term "video" (as in "videotape" and "video recording") to mean both video <u>and</u> audio capability.

the study of human-machine interaction, collaborative design practice, and the situated nature of skill and knowledge acquisition.[3] Both laboratories have had on-going work groups and a policy of encouraging participation by researchers seeking to learn about Interaction Analysis.

1.2 Framing Assumptions

No method is without theoretical assumptions. Methods, far from being neutral tools, promote both concrete working practices and theoretical ideas. Practitioners of Interaction Analysis, though they come from many different disciplines and use the results of their analyses for many different purposes, also share a more or less explicit view of the world that is displayed and reinforced by the work of doing this kind of analysis. Furthermore, they hold a common set of ideas about how to gain access to that world, i.e. what are possible "ways into" the phenomena of interest. A clear formulation of these framing assumptions does not yet exist, and there is likely to be some disagreement about which assumptions are more or less fundamental. Nevertheless, we believe it is important to begin to make the theoretical grounding of our work explicit. The following comments are offered in the hope of stimulating increasing clarity as Interaction Analysis emerges as a coherent way of doing analytic work.

One basic underlying assumption in Interaction Analysis is that knowledge and action are fundamentally social in origin, organization, and use, and are situated in particular social and material ecologies. Thus, expert knowledge and practice are seen not so much as located in the heads of individuals but as situated in the interactions between members of a particular community engaged with the material world. Seeing cognition as socially and ecologically distributed has methodological consequences: Interaction Analysis finds its basic data for theorizing about knowledge and practice not in traces of cranial activity (for example, protocol or survey interview data), but in the details of social interactions in time and space, and particularly in the naturally occurring,

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3 Past topics have included interaction involving hospital teaching rounds, mealtime in alcoholic families, mother-infant communication, waiting behavior in airports, birth in different cultures, psychiatric interviews, pets in nursing homes, toddlers at play, committee meetings, classroom instruction, medical history-taking and physical examination, hearing children and their deaf parents, ethnographic interviewing in different cultures, spirit possession and trance, culture-bound syndromes, crowds in airports and streets, survey interviews, human-machine interaction, work with shared representational media (whiteboards, sketch pads), technology-mediated communication and collaboration, tutoring with and without machine assistance, computer-aided communication of disabled persons, design-group work sessions, and many others.

everyday interactions between members of communities of practice.[4] On this view, artifacts and technologies set up a social field within which certain activities become very likely, others possible, and still others very improbable or impossible. The goal of Interaction Analysis, then, is to identify regularities in the ways in which participants utilize the resources of the complex social and material world of actors and objects within which they operate.

Another widely shared assumption among practitioners of Interaction Analysis is that verifiable observation provides the best foundation for analytic knowledge of the world. This view implies a commitment to grounding theories of knowledge and action in empirical evidence, that is, to building generalizations from records of particular, naturally occurring activities, and steadfastly holding our theories accountable to that evidence. Underlying this attitude is the assumption that the world is accessible and sensible not only to participants in daily human interaction but also to analysts when they observe such interaction on videotape. Analytic work, then, draws, at least in part, on our experience and expertise as competent members of ongoing social systems and functioning communities of practice.

While not yet well articulated, the domain of questions of interest to Interaction Analysis revolves around the achievement of social order (and ordering) in everyday settings. A set of "analytic foci" (see section 6) is emerging that begins to specify the domain of questions that Interaction Analysis asks of the world represented on tape. Predominant among these are questions having to do with how people make sense of each others' actions as meaningful, orderly, and projectable.[5] Since locally sensible interaction is seen as the collaborative achievement of participants, our work as analysts lies precisely in specifying the ways in which participants make this orderliness and projectability apparent to each other and incidentally to us, the analysts. We look for the mechanisms through which participants assemble and employ the social and material resources inherent in their situations for getting their mutual dealings done.

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4   For "communities of practice," see Lave and Wenger (1991), Jordan (1992b), and Wenger (in press).

5   The notion of "projectability" is derived from Conversation Analysis where it was first introduced to deal with contingent relationships between first and second pair parts in such things as reciprocal greetings or question/answer sequences. For example, after a question has been asked, something recognizable as an answer must follow if the talk is to be sensible. Here we mean to indicate simply that participants in the activities we analyze tend to share common assumptions and embodied practices which allow them to "project" if not a specific next, a range of likely next occurrences.

As we apply Interaction Analysis to learning processes, these same kinds of framing assumptions remain relevant. Interaction-Analytic studies see learning as a distributed, ongoing social process, where evidence that learning is occurring or has occurred must be found in understanding the ways in which people collaboratively *do* learning and *do* recognizing learning as having occurred (Garfinkel, 1967). The following sections are devoted to explicating these notions.

1.3 Overview

The next section outlines procedures and ways of working that are typical for the practitioner communities of which we have been members. Section 3 examines the drawbacks and advantages of using video data, that is, our reasons for engaging in this type of analysis. Section 4 looks at the nature of video records in a section on "video and reality", while Section 5 considers the question of camera effects. This is followed in Section 6 by a discussion of some topical foci emerging as central in Interaction Analysis. Appendix A elaborates issues around transcription, Appendix B provides practical advice on how to shoot videotape suitable for Interaction Analysis, Appendix C contains notes on the ethics of recording and playback, and Appendices D through K contain figures referred to in the text.

Throughout this paper, we have worked from the premise that accounts of methods cannot be separated from accounts of findings and that the best way to talk about methods is to show instances of the actual work. While this may be less than elegant, and may, at times, dilute the methodological discussion with substantive findings, we take solace in the fact that emerging fields in general are more likely to disseminate their methods by example and apprenticeship than by formal description.[6]

2.0 WAYS OF WORKING

2.1 The Ethnographic Context

There are various types of research in the course of which videotapes are produced. Our own practice has been to do videotaping *in conjunction with ethnographic fieldwork.* We rely on participant observation, in-situ interviewing, historical reconstruction, and the analysis of artifacts, documents, and networks for providing the framing context. In the course of this ethnographic work, we attempt to identify interactional "hot spots" -- sites of

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[6] Lynch (in press) suggests that there may, in fact, be considerable wisdom in the absence of any separate account of the methods for producing findings in conversation analysis. He comments that for members who are competent and entitled to read them, accounts of findings serve as adequate accounts of how to iterate those findings.

activity for which videotaping promises to be productive. Ethnographic information then furnishes the background against which video analysis is carried out while the detailed understanding provided by the micro-analysis of interaction, in turn, informs our general ethnographic understanding.

2.2 Content Logs

Once a video or audio tape has been made in the field, our first step towards analysis is likely to be a "content log" or "content listing." Content logs are best made as soon as possible after the tape is recorded because then the researcher's memory is still fresh, allowing annotations and explications of events that may not be possible later. Content listings are indexed by tape counter number for audio tape and by time stamp for video tape. They consist of a heading that gives identifying information, followed by a very rough summary listing of events as they occur on the tape. The level of detail is determined by the interests of the researcher and the available time. No attempt is made at this stage to provide either consistency or evenness in coverage. Content listings are useful for providing a quick overview of the data corpus, for locating particular sequences and issues, and as a basis for doing full transcripts of particularly interesting segments (see section 2.4). For an example of a content log see, Appendix D. Depending on the stage of progress towards transcription, either a content log or a transcript may be available for what often constitutes the next step: group work.

2.3 Group Work

Interaction Analysis, as practiced in our labs, makes prominent use of multi-disciplinary collaborative work groups that are assembled for particular projects. While in most video-based research investigators approach the tape with a preconceived coding scheme (for example Bales' categories or task analysis), we attempt to keep our work, to the largest extent possible, free from predetermined analytic categories. We expect such categories to emerge out of our deepening understanding of the orderliness of the interaction as participants on the tape make this orderliness visible to each other. In the course of multiple replayings, finer and finer levels of participants' social competence and their resources for mutual construction of meanings become apparent. At the same time, our working in groups reveals and challenges idiosyncratic biases on the part of individual analysts.

Group work is also essential for incorporating novices since Interaction Analysis is difficult to describe and is best learned by doing. Much in the manner of apprentices, newcomers are gradually socialized into an ongoing community of practice where they increasingly participate in the work of analysis, of theorizing, and of constructing appropriate representations of the activities studied.

Apart from working groups assembled for particular projects, a further resource available to us is the Interaction Analysis Laboratory (IAL), an ongoing

permanent forum where researchers from different projects present tapes. The IAL meets for two or three hours each week. Researchers ("owners") bring tapes, often with transcripts or content listings, from their respective projects and after a brief introduction to the setting of the recorded activities and any special interests the researcher may have, the group works together to analyze the tape.

The tape is played with one person, usually the owner, at the controls. It is stopped whenever a participant finds something worthy of remark. Group members propose observations and hypotheses about the activity on the tape, searching for specific distinguishing practices within a particular domain or for identifiable regularities in the interactions observed. Proposed hypotheses must be of the kind for which the tape in question (or some related tape) could provide confirming or disconfirming evidence. The idea is to ground assertions about what is happening on the tape in the materials at hand. To escape the ever-present temptation to engage in ungrounded speculation, some groups have imposed a rule that a tape cannot be stopped for more than five minutes. This means in practice that rambling group discussions are discouraged and that no single participant can speculate for very long without being called upon to ground her or his argument in the empirical evidence, that is to say, in renewed recourse to the tape.

During group working sessions a large number of observations and hypotheses are produced and audio recorded for later review and more extensive (or intensive) analysis by the owner. Just as often, questions are generated which can only be answered by returning to the field and doing further, now more focused, ethnographic fieldwork or more targeted videotaping.

Collaborative viewing is particularly powerful for neutralizing preconceived notions on the part of researchers, and discourages the tendency to see in the interaction what one is conditioned to see or even wants to see. For example, in certain circumstances we expect people who are smiling at each other and who are in close physical proximity, also to touch each other. Observers have frequently reported that they have seen such touches even though on replay it is clear that none occurred. Similarly, on a tape of interaction between a mother and her small child baking muffins together, analysts were impressed with the mother's easy-going ways that left much of the activity up to the child. After viewing a particular segment, the question arose whether the child had accomplished the entire task of filling the muffin tins with batter by herself. The IAL group of professional observers were quite convinced that the mother, while assuming a supportive and appreciative position, had left the actual task to the child. On replaying the tape it turned out, however, that this was not the case (CAN.90.02.19.IAL).[7]

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[7] This example is from ongoing work by Callanan, Shrager, and Moore (1994). CAN.date.IAL refers to "cannibalized" notes (see section 2.4) from an audio tape of an IAL session on February 19, 1990 made by Jordan. Non-

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Errors of this sort are invisible in a paper-and-pencil record because there is no opportunity to go back and re-examine what happened. In contrast, a tape segment can be played over and over again, and questions of what is *actually* on the tape versus what observers *think* they saw, can be resolved by recourse to the tape as the final authority. This repeated and always jolting experience of having one's confidence in what one thinks one saw shaken, instills a healthy skepticism regarding the validity of observatio:.s that were made without the possibility of rechecking the primary record.[8] Hutchins (1991) refers to this tendency as "confirmation bias," and explains it as the propensity to affirm prior interpretations while discounting or even ignoring counter-evidence. Group work dedicated to collaborative, interdisciplinary analysis is an effective antidote to this problem.

Ungrounded speculation about what individuals on the tape might be thinking or intending is discouraged in Interaction Analysis working groups. However, *evidence* about thinking and intending, such as errors in verbal production or certain gestures and movements, can be cited. For example, on a tape of a working session at a whiteboard, one of the participants stretches way up to reach the upper corner of the board as he begins to write[9].For an Interaction Analysis group, this would probably constitute evidence that he is projecting and orienting to further writing during this working session, for which he wants to leave space. An observation of this sort might be formulated as he "intends" to write a lot on the board.

IAL participants consistently attempt to talk about "mental states" and "mental events" in ways that are grounded in what happens on the tape. For example, in one working session a videotape from a school setting was examined for evidence of differential understandings on the part of students. On the tape, a group of four high school students are checking their math home work in class. One reads out

referenced examples cited in the text come from Jordan's notes of IAL sessions at the earlier MSU Interaction Analysis Laboratory.

[8] One of the outcomes of long-term work with video-based Interaction Analysis is a principled distrust of memory-based data. We see again and again that people (and that includes our group of well-trained professionals) are unable to either report or remember what "really" happened. Such experiences make one extremely humble regarding the value of one's own or others' ethnographic reports, of data such as life histories, stories of the past, answers to survey questions about what happened "in the 6-month period between June 1992 and now" and so on. See Loftus (1991) and Loftus, Korf and Schooler (1989) on the fallibility of eye witnesses in legal cases, Gould (1988) on the institutionalization of false memories, Bernard, Killworth, Kronefeld and Sailer (1984) on informant accuracy.

[9] This example is from work reported in Suchman and Trigg (1993).

her answer in a doubting, self-deprecatory way. Two others say that they also had trouble with this particular problem. The fourth gives the correct answer, a lengthy statement ending with: "... the two lines contact the same point." Is there anything that can be said about what is going on "in the heads" of these students from the tape? It turns out that there is considerable evidence for the quality of understanding present in three of them in their audible and visible reactions to the correct answer given by the fourth. The first student briefly writes an annotation to her own response and is immediately ready to go on to the next problem. She evidently sees in what ways her answer is deficient and knows how to remedy that deficiency. The other two, however, write extensively. It appears that they are copying the answer verbatim. One asks: "the two lines ... ?" soliciting completion of the statement, apparently unable to rephrase the correct answer for her own purposes (CAN91.07.23.IAL.VPP).[10] Though all four students end up with the correct answer in their notebooks, we would argue from evidence on the tape that the degree to which they "own" these answers differs dramatically.

It is not the case, then, that intentions, motivations, understandings, and other internal states cannot be talked about in Interaction Analysis. Rather that they can be talked about *only by reference to evidence on the tape.*

2.4 The Individual Researcher's Work

After the IAL or similar working group has worked for one or several sessions on a particular tape, we are left with some hours of audio tapes documenting the analytic thinking of the group. A researcher can then extract interesting materials from these audio tapes by partially transcribing them, a process we refer to as "cannibalizing the audio tape." He or she is then left with a number — often very large — of potentially significant observations about the phenomena he or she is interested in. In the process of cannibalizing, some initial observations are thrown out, others are reclassified, and the significance of still others may be understood quite differently from what was originally proposed by the group.

It goes without saying that the very process of looking is informed by some notions of what one is interested in looking *for,* notions which, in turn, are modified by what it is that one finds as one gets deeper into the analysis. Nevertheless, at any one point when promising hypotheses have been formulated, it is incumbent on the researcher to assess which observations are indicative of general patterns, which are idiosyncratic or random perturbations, and which are due to some as yet unexplained (or unexplainable) cause. This is done by finding other instances of the event in question in the data corpus and checking whether the proposed generalization holds. In practice, Interaction Analysts often

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10 These data are from work on the Video Portfolio Project (Frederiksen, Sipusik, Gamoran, & Wolfe, 1992).

make use of "collection tapes," edited videotapes on which instances of the event in question are assembled. Played one after another, these provide a convincing demonstration that the phenomenon identified is or is not robust across instances.[11]

For example, on one videotape of an American hospital birth it was noted that at the beginning of a particular uterine contraction the eyes of all those present -- nurse, husband, medical student -- go to the electronic fetal monitor by the woman's bedside. A behavioral pattern was proposed that when a monitor is present, birth attendants' eyes will move to the equipment when a contraction begins. The pattern was checked against other contractions in this particular labor, against tapes of other American hospital births where monitors were present, and against monitored contractions in European hospitals. It was found that the pattern held overwhelmingly. In the few cases where it did not, evidence for some competing local activity was available to explain the discrepancy. (For example, the woman was very distraught or the doctor was just at that time doing an examination and therefore had his eyes on the patient rather than the monitor.) The next step was to examine videotapes of births where monitors are not used. It was found that cross culturally in the absence of monitoring equipment the focus of attention almost always shifts to the woman when a contraction begins. Finally, a generalization was proposed which states that in the presence of high-technology equipment the attentional focus of medical personnel as well as of non-staff attendants moves from the patient to the machinery. This shift has important consequences not only for how the woman experiences the birth but also for the organization of care giving as it shifts from relying on data generated by the woman's experience to data generated by the machine.[12]

Interaction Analysis thus tends to proceed inductively, attempting to generate statements about general patterns from multiple sets of empirical observations. It heeds Geertz's (1973) warning that theory should stay "rather closer to the ground than tends to be the case in sciences more able to give themselves over to imaginative abstraction" (p. 24).

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[11] Random-access video disks and video annnotation tools allow "virtual" collection tapes to be make where a computer keeps track of what sequences are marked for a given topic.

[12] Realistically, it is important to acknowledge that we don't always have either the extensive data nor the tight definition of the phenomenon of interest which makes this example compelling. In most cases, what can be said about a particular phenomenon is much more restricted and much more provisional.

2.5 Transcription

As particular tape segments emerge as significant, content logs are expanded into transcriptions. These may be more or less elaborate and detailed, depending on the nature of the researcher's analytic interests. Minimally, they contain a representation of participants' talk, since speech is always important in human interaction. They may also contain annotations for nonverbal behaviors, such as changes in body position, gaze, gesture, and the like, or for object manipulation, document processing, and employment of certain technologies. Sometimes it is important to transcribe what participants type on computers, particularly if the computers link interacting participants and provide an alternate or supplementary channel to voice communication. If the interest is specifically in human-computer interaction, then it may be screen-based activity itself that needs to be transcribed, such as cursor movement, highlighting, or mouse button depression. In general, whatever social or material features of the situation might be relevant to the analysis are candidates for inclusion in the transcript. It makes sense, then, for researchers to think very seriously about what kind of analysis they intend to do before launching into full-scale transcription, because the choice of what to transcribe determines what will be available for analysis. Thus, a transcript that does not contain information on pauses in talk, on gaze, or shifts in body position, obviously cannot support an analysis in which those elements play a role. Nonetheless, it is impossible to include *all* potentially relevant aspects of an interaction, so that, in practice, the transcript emerges as an iteratively modified document that increasingly reflects the categories the analyst has found relevant to her or his analysis. Kendon (personal communication) talks about this as "locally relevant transcription."[13]

Some practitioners argue that "everything" should be transcribed because even if, say, pauses or overlaps are not germane to the current analysis, some other researcher might want to use the same materials for checking findings or for novel analytic purposes. In conversation analysis, transcription conventions (see for example, Jefferson's transcription, Appendix E), have often been considered the model for comprehensive transcription. But it is clear that these conventions, too, leave out certain phenomena that could be transcribed.[14] Thus there is no ideal or complete transcript according to any abstract standard. Rather, the question must be: how adequate is *this* transcript for purposes of the analysis to be performed?

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[13] More fundamentally, investigators like Franck (1989) and Bergmann (1985) have pointed to the fact that transcription not only leaves things out but actually does a special kind of violence to the spoken word. It fixates what is *essentially* fluid and ephemeral. It holds talk up for repeated inspection, the very impossibility of which is central to the lived experience.

[14] An explanation of Jeffersonian transcription conventions can be found in Atkinson and Heritage (1984), and Psathas and Anderson (1990).

Because there are substantive analytic insights to be gained during transcription, many researchers choose to do their own transcription. For those who delegate some part of the process the financial cost is substantial. A very rough transcript of a very simple conversation produced by a clerical typist requires on the order of three hours for every hour of tape. To produce a transcript usable for analytic purposes, each hour of audio tape requires something like 10 to 20 hours for transcription, with the ratio depending on sound quality and number of speakers. By the time nonverbal interaction is added, the investment in researchers' time becomes substantial indeed.[15] What has emerged in our practice is that we allow the extent and detail of transcription to be driven by our analytic interests, so that those features of the interaction that emerge as significant in the course of tape analysis are more comprehensively and exhaustively transcribed, while others are set aside until shown to be relevant to the analysis.

At the present time, the form which transcripts take is changing rapidly, in part because of opportunities offered by emerging computer technologies. As technological support for different transcription schemes becomes more widely available, it becomes even more important to pay attention to the implications of committing to one type or another. (For more detail on transcription strategies, see Appendix A: Issues in Transcription and Representation.)

2.6 Video Review Sessions

Apart from the data generated by researchers' reviews of the tapes, both in group work and individually, video records are also useful for eliciting detailed information from participants themselves. Such data represent the participants' perspective, their view of the world, which may contrast substantially with the analyst's.[16]

In practice, the individuals whose interactions have been recorded are asked to come to a viewing session with the research team. Some researchers use the tape to elicit specific information from informants about actions and events whose significance is unclear to them. This often proves more productive than returning to the field for additional data collection, in particular where the informant's comfort is at stake or when publicly sensitive issues are under discussion. For example, Jordan, during fieldwork in Mexico, asked individual village women to look at videotapes of public gatherings in the privacy of her hut,

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[15] See Trigg, Bodker and Gronboek (1991) for estimates of time requirements for a "typical" project.

[16] By anthropologists, the participants' view is often called the "emic" perspective in contrast to the analysts' "etic" view. For a discussion of the significance of emic data for systems design, see Jordan (in press).

a strategy which produced extensive accounts of interpersonal, economic, and ritual relationships in the village.

Other researchers ask informants to stop the tape whenever anything strikes them as significant. This gives some idea of how participants parse the event — where they see significant segments as beginning and ending. It also gives information on troubles that may be invisible to the analyst, on resources and methods used by participants to solve their problems, and on many other issues of importance to participants. For example, Frankel asked patients and physicians who had been videotaped during medical consultations to stop the tape when they saw something of interest. He found that there was a substantial overlap in *where* they stopped the tape; but the explanations patients and physicians gave for *why* they stopped the tape there were widely divergent, indicating substantially different views of what their interactions were about (Frankel, 1983).

Elicitation based on video tapes has the advantage of staying much closer to the actual events than if one were to ask questions removed from the activity of interest. Thus, instead of interviewing designers about their practices (or, even more removed, asking them to fill out a questionnaire) one might ask them to look at a videotape of themselves or of other designers at work and ask questions about that work as they arise from the activity being viewed. Data elicited in this manner are likely to have greater "ecological validity," that is to say, are more readily applicable to real conditions of work than data generated under more artificial circumstances.

3.0 WHY VIDEO?

The work of Interaction Analysis is time-consuming and labor-intensive. In addition to the time spent in group working sessions, Interaction Analysis requires a considerable investment in the effort of transcription and in the painstaking searching of tapes for instances of particular activities and events. Moreover, this work cannot easily be delegated to assistants since a deep understanding of the phenomenon of interest requires proceeding through successive approximations until the relevant analytic categories are identified.

If, then, the production and analysis of videotapes is so expensive in researcher time and effort, why would one want to opt for this type of data? In the following pages we argue that for certain kinds of research (though clearly not for all) video-based Interaction Analysis may be the optimal choice.

3.1 Reconstructing the Event

Selectively employed video analysis is a particularly valuable analytic tool for the study of learning activities and work practices in complex real world settings for a number of reasons. One of these is that by approximating direct observation, video provides a shared resource to overcome gaps between what people say they do and what they, in fact, do. Video provides optimal data when we

are interested in what "really" happened rather than in *accounts* of what happened.

To make the importance of that distinction clearer, let us differentiate between two types of data available for the analysis of social interaction. One type is generated by direct observation, the other, by telling some sort of "story" about an event. The "story" may be expressed in words, in numbers, diagrams, check-marks, or other kinds of symbolic representations produced by informants as they answer researchers' questions, or by researchers themselves when they write down fieldnotes, make sketches, or tally observations. In each case the event of interest is not so much "present-ed" (in the sense of "drawn-into-the-present") but re-presented in processed form. It is reconstructed. As Bergmann (1985) has pointed out, the reconstruction occurs through a variety of methods and interpretive devices that, by transforming and reducing reality, invariably and unavoidably import meaning into events. He notes that retrospective representation assigns a secondary web of meanings to the original events as they happened, so that the past events that once played themselves out according to then-existing relevancies are interpretatively re-created and re-constructed during data collection. As Bergmann suggests, the crucial point here is that secondary interpretation has crept into what we think of as the primary data and the researcher has no chance of reversing this process. In a fundamental sense, the events themselves have disappeared; what passes as data is actually their reconstruction. Practically all of our data, from interviews to field observations to records of experiments, fall into this category.[17]

Video recordings replace the bias of the researcher with the bias of the machine. The recording process becomes, to some extent, automated, and thereby removed to a greater degree than other methods from the reconstructive bias of individual researchers. Videotaping is not shaped by the requirements of a successful story or the demands of a coding sheet -- rather it is subject to the limitations of the technology. It is a process that is essentially passive (but see section 4). Unlike fieldnotes or stories that highlight "important" aspects and pass over "unimportant" ones, video records social events as they occur and with a level of detail that is unattainable for methods that rely on reconstruction. The camera's bias is consistent. Thus we would argue that videotaping, the mechanical audiovisual fixation of an event, produces data much closer to the event itself than other kinds of re-presentation.

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[17] Geertz (1973), the noted ethnographer, referred to these same issues when he said: "this fact -- that what we call our data are really our own constructions of other people's constructions of what they and their compatriots are up to -- is obscured [in our analysis] ... Right down at the factual base, the hard rock, insofar as there is any, of the whole enterprise, we are already explicating: and worse, explicating explications" (p. 9). And Wittgenstein (1953) notes: "We predicate of the thing what lies in the method of representing it" (p. 46).

One reason for relying on video, then, as the preferred kind of data for our analyses is that we would like our theorizing to be responsive to the phenomenon itself rather than to the characteristics of the representational systems that reconstruct it and thereby constrain the direction of the analyst's thinking.

3.2 Permanence of the Primary Record

There are other reasons for favoring video recordings (and the output from other kinds of electronic recording devices) over data generated by non-electronic methods. A key characteristic of such data is the permanence of the primary record in all its richness. This makes possible an unlimited number of viewings and listenings, in IAL-like group settings as well as by individual analysts. It is in the course of repeated viewing that previously invisible phenomena become apparent and increasingly deeper orders of regularity in actors' behaviors reveal themselves. In addition, a videotape can be played in slow or accelerated motion, thereby exposing otherwise unseen patterns in the movements of persons or artifacts. Moreover, the audiovisual record itself can be made available to other investigators who may examine it to extend or refute the original analysis,[18] or for quite different interests of their own. Video recording creates permanent primary records as resources that can be shared between researchers and practitioners whose activities are recorded, facilitating reflective review by both. Video records thus can support true collaborative group work.

3.3 Complexity of Interaction Data

But there are yet more fundamental reasons for favoring videotaping as a method for the collection of primary data. Even a trained observer cannot keep track of the overlapping activities of several persons with any accuracy or any hope of catching adequate detail. Consider an excerpt from fieldnotes, a paper-and-pencil snapshot of childbirth in a Maya village: "midwife bathing baby; mother in hammock; father out to bury placenta; grandmother rummaging in cardboard box." By contrast, the videotape provides an incomparably richer record. The kind of talk (or silence) going on at the time, the procedural details of the bath, the mother's eyes on the infant, the grandmother's rummaging for oil and baby wraps, the looks, the body orientations, all these are lost and are not recoverable from the researcher's memory. Nor are they recoverable from the memory of participants by interviewing after the fact (Jordan, 1992a). In classroom research, ethnographers are forever frustrated by the necessity to decide if they should focus on the teacher, a particular student, or a group of students. Similarly, in complex work settings such as an airlines operations room, a single investigator with paper and pencil is simply overwhelmed by the

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[18] This argument may oversimplify the issues. To whatever extent the ethnography is crucial for the analysis of the tape, working with the tape alone may not be sufficient for either purpose.

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necessity to keep track of multiple operators interacting not only with each other but also with headquarters, pilots, ground crews, maintenance people, baggage handlers, gate agents, and so on.[19]

Furthermore, the essence of most manipulative procedures — be they those of a traditional midwife turning a fetus that is in the wrong position for birth, those of a pair of air traffic controllers arranging flight-status strips on their work panels, or those of a secretary moving a cursor while text editing — resists capture in words, both because of the density of behavioral details and because there is no ready descriptive vocabulary for bodily behavior which could capture such activity in notes. It is for these reasons that we opt for video data for many of our research questions.

4.0 VIDEO AND REALITY

So far, we have made a case for the many advantages of making audiovisual records of the activities we are interested in, and for using these records as our primary data for analysis. This stance requires, at the same time, a lively awareness of the constraints that this approach imports. We find it useful to think of the production of a video tape as a method that transforms the lived-in, real world of people's activities and joint experiences into data of a certain sort. In analyzing a tape, we are then dealing with a *transformation* of that world and not simply with an objective, faithful re-presentation. Transformations are always less rich than the original events that gave rise to them, so that every transformation involves some loss of information in relation to the event it captures. We would argue, however, that video loses less, and loses less seriously, than other kinds of data collection. The losses which video incurs are primarily of two kinds: the first stems from decisions made by the camera's operator; the second is inherent in characteristics of the technology.

4.1 Limits of the Operator

The person operating the camera, by pointing the equipment at one object and not another, by adjusting from zoom to wide-angle views, by setting the audio level and so on, determines who or what is visible and audible and what is not. The camera operator's notions of what is significant and what is not invariably influence the kind of record he or she produces. This points to the importance of supplemental information from concurrent fieldnotes to clarify such issues as

19 Examples referring to airlines ground operations, operations, or "the ops room" are drawn from the Workplace Project, a three-year interdisciplinary study of the organization of work in complex, high-technology work environments that was funded by Steelcase and Xerox Corporations. Collaborators on the Workplace Project were Francoise Brun-Cottan, Kathryn Forbes, Charles Goodwin, Marjorie Goodwin, Brigitte Jordan, Lucy Suchman (PI), and Randy Trigg.

who else is in the room but off-camera. It also points to the advantages of a fixed position for at least one of the cameras, to provide consistent coverage of the scene. Sometimes it is possible to run not only a camera or two but also several supplemental audio tape recorders placed at strategic points in the room to provide additional information. Nonetheless, much of the time, what the camera operator did not capture is subsequently unavailable to the analyst. Some of these deficiencies are due to personal or cultural bias and are remediable with foresight and experience. For example, in her first videotapes of childbirth, Jordan, at the time of the birth, zoomed in on the emerging baby, thus losing the interaction between the mother and her attendants – a biomedical bias that became clear (and remediable at least for subsequent tapes) only during analysis. To counteract such unconscious tendencies, it is often best to leave the camera stationary.

4.2 Limits of the Technology

A second limitation of video is that video equipment is inherently more restricted in its information processing capacities than the human sensory apparatus. It produces, for example, no record of smell or of heat radiation. While human beings have available to them their full sensory capacities (color, full resolution, peripheral vision, etc.) standard video is not even capable of capturing the amount of detail visible on a medium-resolution workstation screen. More subtly, what for a human observer may be at the periphery of attention but still appreciable, may be altogether off screen in a video recording.

No matter how elaborate and sophisticated the recording setup is, the record will always be impoverished in some way or other and it is important for the analyst to be aware of that. Consider, for example, the experience of a helicopter crew who monitor up to twelve audio channels, process visual information from the ground and air, keep a number of instrument panels under surveillance, and, in addition, also talk to each other (Linde, 1988a, 1988b). No amount of instrumentation can fully capture the complexity of this situation and make it available to the analyst. In this example, the number of communication channels is unusually high. It is important to remember that this inherent partiality of the record is, in principle, no less of a problem for less complex interactions in less complex settings.

Another concern is the relationship between the record and the event as experienced by the individual. What the analyst may see or hear via the tape may or may not be what participants hear and see. For example, on a tape of teenagers playing a particularly exciting video game in an arcade, the camera, positioned behind the players, overheard comments made by the audience which were probably inaudible to the players. In the socially and technologically "simple" situations we videotaped in the past (for example a family at dinner, a couple discussing their finances, a doctor talking to her patient), we were reasonably confident that what the camera heard was also what the actors heard. It is not possible to have that kind of confidence when we videotape spatially strung out interactions with multiple actors. Work settings with complex technologies and

multiple activities require multiple cameras or, at least, audio tracks. These give the analyst a privileged compound view of activities that is not necessarily available to individual participants.

5.0 CAMERA EFFECTS

A question often arises about the degree to which people are influenced by the presence of a camera. This is, above all, an empirical question that cannot be decided in principle but must be investigated on each occasion of camera work. Frequently, the tape itself provides evidence that the camera mattered to participants. Such evidence might consist of visible monitoring of the camera or camera person, indications that participants avoid showing their face to the camera, changes in behavior indicating that people habituate to the camera as time passes, and the like. On a tape of toddlers in a nursery school, for example, 3-year olds initially come up to the camera, gesticulating and making faces, but five minutes later they play with hardly a glance in its direction. Linde (personal communication) found that policemen initially cleaned up their talk for the camera by substituting euphemisms for profanity but switched back to profanities and other familiar speech patterns as events heated up.

Experience shows that people habituate to the camera surprisingly quickly, especially if there is no operator behind it. Where people are intensely involved in what they are doing, the presence of a camera is likely to fade out of awareness quite rapidly. This is the case even in very intimate situations like the birth of a baby. Once people become absorbed in the work of getting the baby born, there is no time taken out to check on the camera, a fact that is visible on the tape itself. As a matter of fact, visual acknowledgment of the camera and interaction with the camera person can be taken as evidence that the high point of an event is over and people once more orient to the periphery.

For the participants themselves, different behaviors are on different levels of awareness. As a consequence, some are more readily modifiable if and when people take note of the camera. Gestures and body positioning are difficult to manipulate and control for any length of time, and micro-behaviors such as gaze and head turns are usually out-of-awareness. In talk, people make greater attempts to modify *what* they say than *how* they say it. One sometimes can discern a certain caution exercised by individuals when they are first on camera, but the mechanisms that orchestrate the sequential organization of talk, such as eye blinks or turn transitions, are probably visible whether the person is aware of the camera or not.

In the long run, and in particular as people become involved in tasks other than worrying about the camera, camera effects visibly wear off. As a practical matter we have found it most useful *not* to position ourselves behind the camera whenever possible. Then the camera, rather than being interactionally alive, quickly becomes the proverbial "piece of furniture" that nobody pays much attention to.

Other researchers report similar conclusions. One of the specific objectives of the Video Portfolio Project (Roschelle, Jordan, Greeno, Katzenberg, & Del Carlo, 1991) was to search for evidence of camera effects in classroom interactions. The investigators concluded that after the initial novelty wore off, little if any interference could be attributed to cameras. If anything, the equipment became a resource in this setting, not unlike other pieces of furniture. Similarly, Heath (1986) relates that a careful search of his extensive data corpus of patient-physician interaction produced very few instances of explicit orientation to the camera.

In summary, it might be reasonable to say that the kind and amount of camera interference is something researchers should attempt to assess for each particular project. It should neither be ignored nor considered fatal. Rather, every effort should be made to gauge its course and to control its effects which, judging from past experience, will be possible in most situations. In this, use of a video camera is *in principle* not different from other obtrusive methods of recording. No matter what the method, the analyst needs to take into account to what extent the process of data collection affected the event.

6.0 FOCI FOR ANALYSIS

Interaction Analysis has been used to analyze video records for many different purposes and on a large variety of topics. In the last few years, increasingly, Interaction-Analytic case studies have appeared and there are now some collections that contain such studies, often mixed with analyses that use related conversation analysis or ethnomethodological approaches (e.g., Button, 1993; Chaiklin & Lave, 1993; Engeström & Middleton, 1993; Fisher & Todd, 1983; Greenbaum & Kyng, 1991; Hopper, 1991). However, discussions of the specific *methods* used for analyzing videotapes do not yet exist. This is due, at least in part, to the fact that practitioners are still much more concerned with the practice of doing Interaction Analysis than with the process of describing it. As is to be expected for an emerging field, much of the expertise in and results of Interaction Analysis have circulated informally within a community of practitioners, made available in the doing, not through reading. Nevertheless, we believe that something can be said at this point about what makes Interaction Analysis unique and differentiates it from other kinds of video analysis. In the following sections, we attempt to specify some of the practical expertise, the accumulated body of wisdom regarding productive and not-so-productive ways of looking at tapes that has grown up within our community. We talk about these orientations, these ways-into-a-tape, as "analytic foci," in intended distinction from "analytic categories" or "coding categories." Analytic foci are simply ways of looking that are quite consistently employed in Interaction Analysis because they have turned out to be relevant again and again in our practice. The following sections highlight a limited number of them. Again, we rely on extended citing of examples from our own and our colleagues' analysis work.

6.1 The Structure of Events

Chronological time provides analysts with a standardized time line for the activities they observe on tapes. Yet, people's experience is of time bunched into "events." Events are stretches of interaction that cohere in some manner that is meaningful to the participants. Some events have names and constitute recognizable, culturally significant tokens in social intercourse. In this culture, for example, we recognize meals, tutoring sessions, bedtime stories, medical consultations, design sessions, and so on. In the course of analysis, smaller units of coherent interaction within events are identified, such as "setting the table" or "serving the coffee" in a meal, or "history-taking" and "advice-giving" in a medical consultation. In our practice, we have often called such easily identifiable behavioral units "ethnographic chunks." Identifying ethnographic chunks is a possible first step towards analysis and may often overlap with content logging.

Bamberger and Schön (1991) describe this process as they try to understand the videotaped activities of two adults who are engaged in constructing a tune. They write:

> The most powerful strategy we found as a starting point for our analysis was chunking the protocol. This involved looking for what seemed important boundaries that articulated observable phases or organic chunks within the continuing course of participants' work (p. 187).

In the first few passes they simply tried to mark when "something new" happened, searching for boundaries without trying to be explicit about the criteria they were using or exactly what sorts of behaviors they thought were signaling the boundaries they found. Later they went back and tried to identify the criteria they had spontaneously used.

In the process of identifying events and other ethnographic chunks, analysts clearly draw upon their own cultural knowledge. For tapes from settings with which analysts are not intimately familiar, more extensive and more careful ethnographic fieldwork is necessary. It may also be useful to involve local experts in the analysis. As we have noted, one way of doing this is through video review sessions with the people on the tape (see section 2.6).

6.1.1 Beginnings and endings

Events always have a structure. Minimally, they have beginnings and endings, but generally a more complex structure can be discerned.[20] Frequently, there

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20 The structure of events has always been a central concern in anthropology, but Interaction Analysis allows a much more fine-grained investigation than

are "official" beginnings and endings. For example, a meal may start with a prayer, ladling out of soup, "bon apetit," the guest of honor picking up her or his knife. Work may start with punching in or with a series of rituals that clear the desk and get a cup of coffee on it. A lesson may start with a verbal announcement by the teacher that gets the class' attention and then again the actual start may be unmarked.[21] Official beginnings, however, are themselves preceded by participants' verbal and nonverbal preparatory activities and, after the event is officially over, there is some period of time during which people disengage. We always want to observe the starting up and winding down process since significant interactions tend to happen at these junctures.[22] Beginnings and endings are often marked by re-arrangements of artifacts. Tracking what is turned on, brought in, taken out, or re-arranged prior to the official start reveals what sorts of props and technologies are thought to be necessary for carrying off the event.

Beginnings and endings, though often perceived as externally imposed, are in fact collaboratively achieved by participants. For example, in a school setting, the bell officially ends the class period. But video analysis reveals a much more complex picture (CAN.90.02.19.IAL):

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did paper-and-pencil recording. For an ethnographic classic, see Kenneth Pike's (1967) analysis of a church service.

[21] Eric Bredo, in an unpublished comparative study of a community's private schools, has noted significant differences in the degree to which the official beginning of class activities is more or less ritualized in different types of schools. In his sample, children and teachers in the town's Montessori school slide into the day's activities without explicit markers while the beginning of class in the Waldorf school is highly ritualized with individual handshakes and greetings, communal singing, chanted question/answer sequences and the like.

[22] This insight has been captured in the maxim "things don't begin when they start and they don't stop when they end" (Bob Wilks). The practical corollary to this maxim is that whenever possible the camera should be turned on before the official start and left on after the official closing. One might say that the camera should be the first and last agent on the scene. This, of course, may become a challenge for the video ethnographer when activities are not officially marked. It argues for the importance of ethnographic work *prior* to videotaping.

Actor	Verbal	Nonverbal
	(Bell rings.)	
Teacher:	Sorry to hold you up.	
Students:		remain attentive
Teacher	Let's do one through	[assigning homework]
	fifteen-odd	
	that's not bad.	turns
	Okay, folks.	closes book
Students:	Have a good day.	shuffle, close books
Teacher:	See you tomorrow.	
Students:		begin to leave.

The *de facto* ending of class here is not necessarily signaled by the bell, nor simply imposed by the teacher. Rather, the bell portends an impending closing up of activities. But when the teacher indicates he needs more time, the students refrain from putting away their tools. Instead they remain attentive until after he has finished. The teacher, at the same time, has acknowledged the official ending ("sorry to hold you up") and has kept his overtime to a minimum. In other school situations, of course, the teacher may barely be able to speak after the bell rings and may have to write the homework assignment on the blackboard. In either case, the closing is a collaborative achievement.[23]

6.1.2 Segmentation

Events of any duration are always segmented in some way. They have an internal structure that is recognized and maintained by participants. As analysts we are interested in the ways in which participants make that structure visible

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[23] This example is from the Video Portfolio Project (Frederiksen, et al., 1992).

to themselves and each other, how they "announce" in some sense the fact that they have reached a segment boundary in the work and that the next stretch of interaction will be of a different character.

Kendon (1985) points out that spatial orientation serves as a means of negotiating transitions from one segment to a next. People test out each other's alignments to a given interpretive frame as a means of finding out if the other is willing to change to a new one. Small maneuvers in the direction of a new position are often observable as pre-closings. Finishing food or drink, stubbing out a cigarette, moving into a bodily position for exit, stepping back from the conversational circle are announcements of readiness and proposals to change the frame of interaction.

The negotiation of seamless transitions is particularly important in complex work settings. For example, in the operations room at an airline hub, the data show operators getting ready for arriving airplanes. As a comparatively slow period comes to an end, we see them square themselves up to their desks. One of them closes a magazine she has been reading, but she doesn't just close it casually. She closes it with deliberation and emphasis. The talk in the room begins to take on a different tone. Communication technologies are activated. It almost looks like a reaction to somebody entering the room, though nobody did. Rather, what we see is the group getting itself ready for a new work segment. They indicate to themselves and the rest of the team that they are indeed about to tackle another round of tasks. It is by observing and noting these kinds of changes that the analyst arrives at a statement of the structure of the event as participants experience it.

Sometimes we find that transitions between segments are done badly, in the sense that the transition is not smooth, not seamless. Something happens so that some participants are no longer able to project the ending of one segment and the beginning of a next. For example, in a videotaped episode from an elementary school classroom (CAN.90.02.19.IAL),[24] a teacher tells a student to come up to the blackboard, but when the student does so, the teacher tells her to go sit down again. On other occasions, she cuts a child's answer off with a new idea of her own, though she herself had solicited the child's participation with a question. Progression here is not seamless, not orderly, not projectable. New beginnings, segmentations, and endings of action sequences are not foreseeable, which leaves the students (and the teacher for that matter) confused. As a consequence, kids talk over her voice. Without successful negotiation of turn-taking, productive interaction is impaired.

Analytically, transitions from one segment of an event to another are often indicated by shifts in activity, heralded by changes in personnel, movement of participants in space, or the introduction and manipulation of new objects. For

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[24] The following example is again from the work of Eric Bredo.

example, spatially separated design teams collaborating through individual visits do considerable work to organize and profit from the segmentation resulting from unexpected visits (Minneman, 1991). Similarly, in a meal, the transition from main course to dessert may be marked by pronounced changes in participants' body posture, replacement of dishes on the table, an increase in the volume of talk, and the like. Scientists' collaborative working sessions may be segmented into sedentary periods of discussion, alternating with stretches of writing on the whiteboard. In a study of two graphic designers' collaborative work, it was found that their working sessions were divided into clearly differentiated segments during which different projects were discussed and worked on. One way in which the designers mark transitions between these segments is by closing one project folder and opening the next, accompanied by topic changes. In a palpable way, the work stack in this setting provides the agenda. The visible pile of folders to be worked through corresponds to the number of new topics that has to be discussed (Linde, 1991).

Similarly, the gaggle of kids collecting around a teacher between classes constitutes an agenda, that is to say, structures the available time. The teacher will have to deal with all of the students in the space of the break, a fact which provides a constraint but also a resource for the mutually visible need to do this in an expedient and speedy manner.

Many learning and work activities involve a known (or at least discoverable) projectable sequence of events. Students may know that they have a given number of problems to solve and if that work is to be accomplished together, the transition from one problem to the next must also be achieved together. Similarly, in collaborative work situations, segment transitions and hand-offs between participants are significant issues that are sometimes explicitly recognized (as in procedures for shift changes) but more often are informally achieved. In every case, participants need to make clear to themselves and each other that something is finished and something new is starting. The ability to achieve such transitions in a seamless way is one of the ways in which membership in a community of practice is displayed.

6.2. The Temporal Organization of Activity

6.2.1 The macro level

There exists an extensive sociological literature dealing with the temporal organization of activities on a macro-level. Zerubavel (1981), for example, investigated the hidden rhythms of everyday life and the temporality of professional work in medical settings (Zerubavel, 1979). Dubinskas (1988) has edited a volume of ethnographies of high-technology organizations that deal with the social construction of time within North American professional culture: the world of medical technologists, particle physicists, design engineers, and laboratory biologists whose careers and daily practices are ordered by calendars and business plans, career cycles, and research protocols. Anthropologists have given us extensive culturally and ecologically based analyses of how natural and

cultural periodicities, such as seasons, floods, and migrations of humans and animals, shape the lives of people in other societies. They have also provided insight into entirely different ways of conceptualizing time that contrast with our western linear chronologies (Bohannan, 1967; Fabian, 1983; Leach, 1971).

While social theorists and social historians concentrate on macro-scale temporal patterns in the activities under study, Interaction Analysis examines the temporal organization of moment-to-moment, real-time interaction. Interaction Analysis provides a focus on the shape of an event, its high and low points, the relaxed and frenzied segments, and the temporal ordering of talk and nonverbal activity. Above all it gives access to the ways in which participants experience and make visible the temporal orderliness and projectability of the events they construct.

Interaction Analysis also allows us to see the ways in which externally imposed time-tables organize the activities of many settings. In the modern world, where many enterprises are schedule-driven, things often have to happen at particular points in time (or at particular points in certain action sequences), in order to allow for the finely-tuned coordination necessary for complex production systems, from factories to school operations to the scheduling of surgery and transportation systems. In such settings the selection, spacing, pacing, and completion of activities is sensitive to their positioning vis-a-vis anticipated schedule events. The temporal patterning of externally generated demands makes many of the routine activities that occur in such settings time sensitive or time critical; that is to say, for some activities failure of on-time performance will lead to serious disruption of the ongoing work.

6.2.2 Rhythm and periodicity

Some measure of rhythmicity or periodicity is a feature of many, if not most, human activities. Action sequences that involve repetitively executed tasks or segments have a number of analytic interests. For one thing, one might expect that participants experience boredom and wandering of attention if they have to do the same task over and over again. On the other, however, repetitive sequences allow the development of stable routines as a durable infrastructure against which trouble can be managed and predictability and projectability of action sequences can emerge. Interaction Analysis looks both for the repetitive, routinizing aspects of activity sequences and for their variability.

In a given environment, when there is a string of "same" activities, questions that arise include: In what sense are the repetitive segments identical? How much variability is allowed before a sequence is no longer "the same" and becomes something else for participants? How is such segmentation achieved? For example, a tape of family evening activities focused on a toddler who has been putting spoon to mouth for some period of time, contains the following sequence:

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Father: Is she still eating?
Mother: No, she's just fiddling around.

The participants in this scene have just partitioned repetitive spoon-to-mouth activity into "eating" and "fiddling" segments which, of course, has implications as to further actions that might be taken.

Many, if not most activities people engage in have some sort of periodicity to them, involving some sort of repetition. Some of these periodicities are biologically driven. The necessity to take in a breath affects speech patterns. The appearance of uterine contractions during labor dramatically affects patterns of interaction during birth. In the latter case, there is not only periodicity but also an increasing intensity that builds until the baby is born. Talk and the execution of tasks in labor settings are observably responsive to that periodicity and are organized to take account of it (Grosjean, 1993; Jordan, 1992c).

Rhythm may be an aspect of interaction that is significant in more situations than has been recognized. In social settings where some kind of mutual engagement is ongoing, newcomers to the action must find a break in the ongoing stream of verbal and nonverbal activity in order to gain entry. As Erickson (1991) points out, social participation as management of access and transition appears to be facilitated by members' participation in a shared rhythmic framework.

Similarly, Kendon (1985) has shown that moving into synchrony with another person is one of the devices by which a person can indicate to the other that he or she wishes to establish "an action exchange system" without making an explicit request. By simply picking up on the rhythm of another's movements or talk, people establish a connection which at the same time does not commit them to an explicit initiation. Such co-calibration becomes visible on the tape.

Some rhythms are driven by technology, as for example the activities of installers working on an assembly line. In other cases, the periodicity is provided by the nature of the task as when a group of students has a series of problems to solve. Many workplaces are tightly organized around more or less rigid schedules that impose repetitive activities. For example, at hub airports, one may find interaction in airlines operations rooms organized around "complexes," periods of time during which a flock of connecting planes come in, exchange passengers and baggage, take on fuel and food, and take off again. During these complexes, activity in the operations room is highly energized, only to slow down to a more leisurely level in between.

For workers in ground operations, reiteration of tasks also occurs *within* complexes, since while a complex is in progress, plane after plane has to be brought in, serviced, and sent out again. For each plane, paper documents have to be assembled, fuel and food services have to be provided, passengers have to be deplaned and boarded, baggage has to be loaded, etc. Our recordings show that there is a large number of repetitive activities that are routinely done, and done

over and over again, in response to the periodic demands of complexes or individual planes. There is then a kind of nested periodicity, a visible rhythm to the workday, a predictable recurrence of tasks and events, that itself furnishes resources for the management of contingencies as they arise.

One consequence of periodicity is that it provides for slack times, delivers breathing spaces during which some "other" set of activities is accomplished. These in-between activities are often seen as in some way extraneous, even superfluous. Yet, on analysis, it is usually the case that they constitute a crucial aspect of the undertaking in question. In the operations room, one might occasionally see an operator reading a magazine but there are also numerous job-related activities performed in the space between complexes, such as catching up on paper work, ordering food for later delivery, telling job-related "war stories," and the like.

In some parts of the economy there are jobs that require at least the appearance of continuous engagement in active work, regardless of any natural structuring of demands. This is typical for positions dealing with the public, such as receptionists, but is also true to some extent for pupils in schools. Policies that require the *appearance* of constant task orientation are interesting in that they invite ways of getting around them, so that we see students reading comic books under desks, and airline personnel ducking behind a counter to take a drink of water.

In schools, class periods provide major temporal structuring, but important work also goes on in the space in between class periods A videotape of the transition between classes shows the teacher fulfilling bureaucratic record keeping requirements: he deals with detentions, signs field trip permission slips, and gives information on students' current standing by consulting a grade book -- all of these are activities without which the enterprise of teaching and learning could not proceed.

An important outcome of understanding the temporal organization of activities in the workplace is the identification of resources and constraints for the design of work environments that support learning on the job. A classical issue for training has been that training should happen embedded in the actual activity. Analysis of video tapes shows that the time structure of these activities has a lot to do with their capacity to incorporate newcomers. If the work includes natural periods of relaxation, when workers can pay attention not only to the objects and tasks they have to monitor, but also to the newcomers who need to learn about these, stepwise incorporation through "legitimate peripheral participation" (Lave & Wenger, 1991) is much more easily accomplished. It is important that people be able prospectively to prepare for what is coming up and retrospectively to reflect on what has just happened. They have to be on-line and off-line at various times and able to switch back and forth. An uneven temporality, especially predictable periodicity, is more conducive to learning, more hospitable to newcomers (and, incidentally, ethnographers) than one that has a steady, high-level demand on participants' attention.

While much can be learned about schedules from interviewing and participant observation, the finer details of the temporal organization of activity are recoverable only from videotape analysis (Suchman & Trigg, 1993). We would suggest that the detailed investigation of what Erickson (1991) calls "the shared temporal ecology of social action" in work and learning settings should constitute one of the major foci for Interaction Analysis.

6.3 Turn-taking

Subsequent to a seminal paper by Sacks, Schegloff and Jefferson (1974), much has been written about the complex organization of turn-taking in conversation. For Interaction Analysis the situation is ever more complicated because an Interaction-Analytic turn-taking system has to take into account more than talk: it encompasses the whole range of behaviors through which people can "take a turn," that is, participate in an interactional exchange system. Not only "turns at talk" must be considered, but also "turns with bodies" and "turns with artifacts." For example, a videotape of kids working on a problem in front of a computer screen shows them taking turns with the mouse. Analysis reveals that grabbing and relinquishing the mouse constitute significant moves in collaborative problem solving.[25] The requirement that both talk and physical action must be taken into account if we are to understand complex activity, has come to be widely recognized by conversation analysts as well. For example, Schegloff (1987b) speaks of "talk-in-interaction" and Moerman (1990) has suggested that the distinction between verbal and nonverbal communication is fallacious altogether. He points out that "communication by means of pure language, without context, without body, without time," simply doesn't exist (p. 9).

We can make the complex relationship between talk and physical activity a bit clearer by thinking of social interactions as falling into two distinguishable categories that form the end points of a continuum.[26] In some situations, whatever it is that is to be accomplished in the interaction is primarily accomplished *in the talking*. The interaction is constituted in and by the talk. This tends to be the case in business meetings, police interrogations, conversations (face-to-face or over the telephone), interviews, lectures, story-telling sessions, etc., where talking is what the event is principally about. We can contrast such "talk-driven interaction" with "instrumental interaction," where activities are motivated by the requirements of a physical task that has to be done. This is the case when, for example, surgery is performed, a car is repaired, homework corrections are made, a plane is loaded, and so on -- activities that crucially involve the manipulation of physical objects. These

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25 This example is from work reported in Hall (1992).

26 This distinction was first worked out by Jordan in collaboration with Charlotte Linde several years ago.

objects may be natural objects or human-made artifacts and technologies; in either case, the central business of the activity cannot be achieved by talk alone. In the course of such instrumental interaction, talk may and usually does occur, but it is not central as in talk-driven activities. It is usually ancillary to, supportive of, and sometimes even coincidental to the main business at hand. Thus the conversation of two surgeons about the morning's difficult operation is an instance of talk-driven interaction; but the actual surgery (including the talk that happens in its course) is instrumental interaction. For talk-driven interaction, the most relevant non-talk activities are gesturing and gazing, both of which coordinate the talk. Where interaction is instrumental, the nature of production tools, display spaces, and other aspects of the material environment significantly enter into the interaction and become an important part of the analysis.[27]

Examination of the organization of talk-cum-activity in work or learning environments where physical activities have to be performed, adds to the findings of turn-taking research focused strictly on talk. In situations where a physical task has to be accomplished, talk and physical activity are complexly intertwined in the turn-taking system. We find that action turns may get taken in response to verbal turns and vice versa; that is, somebody may verbally ask for something and, in response, get not a verbal answer, but rather an activity performed. For example, in one of the Workplace Project tapes, when an operator announces that a seat cover on an incoming plane needs replacing, another operator responds by picking up the radio and calling cabin service, without giving a verbal response to the speaker. Conversely, a verbal reply may arise in response to an activity, rather than in response to a prior piece of talk. It seems to be the case quite generally that in most human activities turns are not only made up of turns at talk but incorporate other activities as well. For example, designers at work fluidly mix turns composed of drawing, talk and gesturing activities (Tang, 1989; 1991) even when using electronic media (Bly & Minneman, 1990; Minneman, 1991; Tang & Minneman, 1991).

We have found a series of differences in the organization of talk in instrumental interaction compared with talk as it happens in talk-driven (conversational) situations. For example, in instrumental interaction topics tend to stay alive much longer than in "pure" conversation; often, they are taken up a considerable stretch downstream. The requirement for talking "on topic" may be suspended for long stretches. Pauses show different characteristics. In complex work settings with multiple overlapping activities, documents, monitors, or

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[27] We are not trying to establish a hard-and-fast distinction here between instrumental and talk-driven interaction. In most situations and settings, people move effortlessly and seamlessly from one type to the other and back again. What we *are* intending to draw attention to is that analysis that is strictly focused on talk is unsatisfactory for a large class of activities people routinely engage in.

other informational resources often need to be consulted before a turn-at-talk can be taken. Thus lengthy gaps and pauses are generated.[28] Another reason for differences with talk-driven interaction is the interruptability of many action sequences by peremptory inputs of various kinds. When a radio call comes in, it is lobbed into an ongoing activity and conversational environment, regardless of how it fits. A phone ring's onset is not negotiable -- the phone must be answered and takes precedence over most other activities. A filing task may be abandoned because a beeper beeps, an ongoing conversation may be interrupted by a co-worker requesting information, an operator may not respond to her supervisor because unbeknownst to him she is listening to the radio -- all these are ways in which routinized turn-taking sequences are continuously liable to be disrupted, only to be resumed when the interruption disappears.

Interruptability due to the coordination requirements of tasks that must be accomplished in parallel structure turn-taking in instrumental interaction, as does the nonnegotiable onset of technology-based communications. As new communication technologies are introduced in a workplace or educational setting, participants begin to develop a set of expectations about how the technology fits into their ongoing interactions. Our data show actors orienting to the demands of the technologies in their environment in ingenious and inventive ways that minimize the interruption. For example, they close up an on-going conversation just-in-time, rather than simply cutting it off. Again and again we observe the artful production of a sequence as finished, a conversation not so much interrupted as closed down in the nick of time.

In formal educational settings, the rules for turn-taking tend to be highly stylized and ritualized. Officially, the teacher is in charge of turn allocation. The teacher speaks (explains, lectures, demonstrates), and then specifically assigns turns to students by calling on them. Student self-selection is frowned upon, since it is considered disruptive to the sequence of activities planned by the teacher. Against this standard, our data reveal many deviations, some grounded in school philosophy, but also frequently visible as the specific accomplishment of students actively involved in the learning process. Teaching situations are dominated by talk-driven interaction though some physical objects also figure prominently in classroom turn-taking: copybooks have to be handed in, chalk has to be picked up in order to write on the blackboard, models and pictures are brought in by teacher or students -- but note that the activities of which these objects are a part are generally initiated by the teacher. In most school situations students play a passive role.

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28   See Marjorie Goodwin's detailed analysis of what is involved in "assembling a response" to an inquiry in the ops room (Goodwin & Goodwin, in press).

6.4 Participation Structures

Another topic of inherent interest for Interaction Analysis concerns the extent to which co-present individuals share a common task orientation and attentional focus. Mutual availability and alignment become visible in "participation frameworks"[29] — fluid structures of mutual engagement and disengagement characterized by bodily alignment (usually face-to-face), patterned eye-contact, situation-appropriate tone of voice, and other resources the situation may afford. Students of interaction, from Goffman (1963; 1981), to Erickson (1982a; 1982b; 1991), Heath (1986), Kendon (1985; 1990), Goodwin and Goodwin (1992; in press), Goodwin (in press), Goodwin and Heritage (1990), Suchman (in press) and others, have noted that the social "work" that is done through participation frameworks provides the interactional infrastructure for the achievement of coordination and collaboration among co-present individuals. The resources for the production and maintenance of such social structures lie in the mutual visual and auditory availability of participants' bodily activity. Relevant issues for Interaction Analysis, then, revolve around such questions as: how do interactants make their engagement (or lack thereof) visible to each other; what strategies do people employ to gain entry; how do artifacts and technologies support or constrain particular participation structures; and the like.

A study of interaction in a hospital labor room (Jordan, 1992c) provides an example of two parallel but separate participation structures co-occurring in the same setting. On the tapes covering a particular labor and birth, the birthing woman interacts almost exclusively with her husband and the attending nurse but is excluded from the professional participation structures of the labor room within which physicians, nurses, medical students and other official personnel accomplish the delivery of the baby. The staff interacts as a team of which the physician is the focal member. No input is solicited from the woman; talk is not produced for her overhearing or participation. The staff does the business of examining her and preparing her for the delivery amongst themselves, without engaging her in consequential talk or activity. In this setting, the woman is not an active participant but simply the object to be delivered.[30]

In a study of interaction in an airlines operations room, reported in the same paper, participation structures are found to be less exclusionary and more overlapping than those of the labor room. As contingencies arise in projected action sequences and are taken up for notice or action by co-workers, new

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29 This term was originally coined by Goffman (1981) in his discussion of footing in conversation.

30 It goes without saying that not all labors are conducted that way. For an example of labor participation structures that maximally include the woman, see Grosjean (1993).

alignments are constantly created and recreated. Multiple participation structures are generated, maintained, and disassembled in response to the requirements of the business at hand. Here there is no principled exclusion of individuals. All co-workers participate fairly equally, i.e. without structurally provided restrictions, not only in the flow of communication directly related to the work but also in the informal kinds of exchanges that appear in the interstices between tasks and when things slow down between complexes. Stories and jokes involve all those present as tellers, recipients, and commentators, without exclusion.

The notion of participation frameworks was originally developed to describe face-to-face interaction. Work and learning environments that are structured like the operations room provide an opportunity to extend that notion to situations where significant exchanges routinely and necessarily take place with persons in technologically connected remote work spaces. As is the case in many high-technology work situations, people in the airline ops room spend much time maintaining extended linkages and exchanges with co-workers through radios, telephones, and computer networks, only to turn back to interaction with their colleagues in the operations room as they conclude an externally-oriented exchange. Especially during high workload periods, the default activity for operations workers is preoccupation with, and orientation to, their workstation and thereby to the remote co-workers to whom they are connected. This primary involvement provides the background against which interactions with physically co-present colleagues take on a certain time-out character. This becomes visible in the many instances where cross-room communicants assume torque positions (Kendon, 1990; Schegloff, 1990) i.e., turning head and torso towards a co-worker without swiveling around completely, thereby indicating to themselves and their co-workers that they imminently intend to go back to, and indeed are still involved in, their prior activity. In this way, interaction with physically co-present co-workers is often displayed as an interlude in the ongoing work with remotely located co-participants.

The analysis of participation structures is also essential to understanding interaction in formal school settings. To what extent do teacher and students sustain different kinds of participation structures in group work or in lecture format? How do computers, workbooks, table arrangements, and other kinds of artifacts support or destroy such structures? Issues around distributed participation become important for classrooms, as more and more students are networked. How does the orientation to a computer change gaze and body orientation as compared to group interaction around a table?

Analyzing participation structures as they shift in the course of working and learning activities is one of the ways in which Interaction Analysis contributes to the study of "the C-Issues": cooperation, conflict, conviviality, competition, collaboration, commitment, caution, control, coercion, coordination, co-optation, combat, and so on. It is precisely because social life is rarely convivially univalent (Kling, 1991), that the complexity of the

interrelationship between these forms of interaction needs to be better understood.

6.5 Trouble and Repair

Another major focus of analytic interest for Interaction Analysis is the occurrence of "trouble" in a particular activity sphere. Anthropologists have known for a long time to pay particular attention when the normal stream of activity is broken in some way. Careful analysis of the breach can often reveal the unspoken rules by which people organize their lives. As a matter of fact, the analysis of visible breaches of the local rules for social interaction is one of the best methods for coming to an understanding of what the world looks like from somebody else's point of view. Analysis of hitches in interaction may also reveal some of the constraints in the material world that routinely cause trouble.

Much work has been done in conversation analysis on how troubles that arise in talk are repaired (Jordan & Fuller, 1975; Sacks, et al., 1974; Schegloff, 1979, 1987a, 1987b; Schegloff, Jefferson, & Sacks, 1977). For Interaction Analysis the situation is complicated because we need to take into account not only the verbal aspects of repair, but also the ways in which participants draw on their bodily, artifactual, spatial and social resources to mend infractions of projected sequences.

For example, a recording of a couple of high school students struggling to understand how to operate the Envisioning Machine (Roschelle, 1991), shows them resolving hitches in their understanding by recourse to the social and material resources of this environment (Roschelle & Clancey, 1991). Sitting in front of a computer screen, their task is to match the movements of a particle under their control to the movements of a target particle. Just as in many real-world work environments, verbal communication alone is insufficient here to effect the intimate co-alignment to the screen and to the screen-borne representations through which an initial discrepancy in understanding becomes resolved. As Roschelle and Clancey point out, the two students, Gerry and Hal, use a combination of talk, gesture, and screen object manipulation to resolve their difficulties. The pinpointing of the trouble as well as the mutual alignment of the two students occurs in a shared visual and manipulative space. They point to objects on the screen to make references clear, gesture to act out concepts, and synchronize their talk with events on the computer screen (p. 341).

Actor	Verbal	Nonverbal
Hal:	Down?	
Gerry:	Yeah, or else	
Hal:	Like this?	Hal indicates uncertainty and asks for confirmation. He initiates a clarification, using the mouse to demonstrate his current interpretation.
Gerry:	No. Um, that angle I think is ok	Gerry initiates a repair, first by indicating that he was not talking about velocity. He touches the arrow representing velocity on the screen with his finger to make this clear.
Gerry:	But the fat a-, the fat arrow should be pointing downwards	Gerry continues the repair by presenting the correct interpretation; he wants the acceleration vector pointed downwards. Again he touches the vector.
Hal:	Like this?	Hal uses the mouse to ask for clarification, this time dragging the acceleration vector down.
Gerry:	Yeah.	Gerry confirms.

It is obvious that an audio tape of this transaction (or a transcript thereof) alone would be inadequate for doing a full analysis of how they repaired the troubles that had arisen.

In stable situations, people learn by experience which kinds of troubles tend to recur and what range of resources can be assembled and held available for their solution. Practitioners begin to recognize problems for their typicality, recycle them in stories -- thereby making them talk-aboutable (Orr, 1991) -- and otherwise domesticate them, so that their solutions become available on a next occasion. Much of this knowledge is not written down anywhere, nor does it lend

itself to writing down, but resides in the community of practice that forms up around new technologies.[31]

Hitches in interaction are often invisible to the casual observer because participants are very good at fixing them on the fly, without missing a beat. Troubles in ordinary talk, such as mishearing or lack of understanding, are commonly repaired without participants being aware of what they do. Consequently often neither participants nor observers consciously experience the trouble. Yet, during detailed analysis of videotapes, participants' corrections of misunderstandings, of misalignments, of intrusions, and other types of rendings of the social fabric are routinely visible.

A parallel and increasingly interesting area of investigation is the repair of trouble in the interaction between humans and machines (Frohlich, Drew, & Monk, in press; Suchman, 1987). In their interactions, people pretty much assume that they share rules of interpretation. This assumption becomes problematic when computers and other complex machines are involved. Trouble occurs when there is a "miss-match" between the rules and procedures employed by the user and the computer in interpreting meaning from a sequence of symbols. It is precisely through the observable ways in which human-machine interaction runs into difficulties that people discover in the first place how the machine interprets human input. A successful repair of such trouble constitutes learning on the part of the user, if not on the part of the machine. This is one of the many ways in which human/machine interaction differs. visibly and observably from communication between people.

6.6 The Spatial Organization of Activity

A trivial observation about human existence is that people occupy space. And they occupy space in characteristic ways that differ from the ways in which, say, birds or artifacts inhabit their space. Human beings' size, their sensorimotor abilities, and their shared ways of orienting to a social and material world facilitate certain uses of the space around them and make difficult, or prohibit, others. Within these constraints, many variations are possible and different social groups have developed particular ways of being in each others' presence (Hall, 1959). What is considered appropriate body distance or body attitude, how far one's gestures can intrude into another's personal space, how public spaces are used in contrast to private spaces, to what extent a shared focus of activity (for example in joint work on an object) can override otherwise expected behavior -- issues of this sort are resolved differently by different

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[31] Barley (1988) and Koenig (1988) give interesting accounts of the processes by which the operation of initially experimental, unfamiliar technologies becomes routinized and absorbed into the standard practice repertoire of professional medical communities.

social groups and for different activity systems. They are of central interest to Interaction Analysis.

As we work with video tapes, we note that the physical co-presence of persons is *always* managed by socially recognized (though often unstated) expectations regarding occupancy of space, interaction with others, use of objects and resources, display of physical presence, and voice. People make use of these mutual expectations as resources for structuring their interaction with others and for accomplishing the business at hand. As Kendon (1985) has put it, spatial and orientational positioning serve as devices by which expectation and intention can be conveyed. This is a collaborative enterprise in the course of which the grounds on which people take certain actions, occupy space, impinge upon each other, make apologies, and otherwise produce repairs to infractions of expectations, become visible not only to participants, but also to analysts examining the videotape.

Certain activities require, or are customarily done in, settings with particular spatial configurations. Work practices then develop that take these spatial constraints and opportunities into account. In the airlines operations room, for example, the four operators' workstations are placed so that as pairs of operators orient themselves to their video screens, telephones, radios, etc., they have their backs to one another. As a consequence, much interpersonal interaction in the room requires leaning back into the common space while turning the head; often we observe individual operators scooting backwards on their chairs to come into closer physical proximity to a co-worker with whom they need to coordinate. The fact that workstations are centripetally arranged around the perimeter of the room significantly affects the nature of interaction occurring there.

A similar centripetal organization is visible in the workspace of bet takers at cock fights in Northern Luzon.[32] Five or six bet takers face spectators from the cockfighting ring, a kind of focal pit in which they rhythmically prance forward and backward, shouting the name of the owner of the cock for which they are taking bets. At the same time, they wave their hands above their heads towards the audience, exhorting them to place their bets. Bet takers' bodies and faces are oriented to the audience. But on the tape they can be seen to be monitoring not only the spectators for betting action but also each other, if only not to collide if they step back at the same time. In contrast to the division of labor apparent in the operations room, workers here are doing parallel versions of the same activity, taking bets. In operations, there is a periphery, an outside, from which salient information is expected to come through a variety of communication technologies. For bet takers at the cockfight, salient information also comes from the periphery, a spectator indicating a bet by hand movement, but here it is

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[32] These observations are based on videotapes made by Jürgen Streeck.

face-to-face interaction, without mediation through technology. In either case, the management of space is an important, though implicit, concern for actors.

A crucial point to consider for Interaction Analysis is that in any given environment some spaces provide more interactional resources and others less. For example, during a committee meeting the position at the end of a table allows the maximum number of eyes to focus on its occupant as he or she speaks. By contrast, the position next to the main speaker is often visibly experienced as difficult by its occupants, because it is under the constant scrutiny of the speaker's audience. Interaction Analysis of such situations allows us to formulate what otherwise might be seen as intrapsychic phenomena (the person is nervous or uncomfortable) in terms of the interactional resources that become available (or not) depending on observable spatial positioning.

In the operations room we studied, there is a particular space in the center of the room which, by virtue of its centrality, is occupied by the supervisor whenever trouble arises in getting planes in and out. In this spot, he has all of the resources the environment provides at his finger tips: simultaneously, he can take in information by glancing at a bank of video monitors; he has a video camera's controls at arm's length enabling him to zoom in on the situation at a gate; he has easy access to phone and radio and is positioned in close physical proximity to his four operators (Suchman, 1993).

Actors often signal their intentions by the ways in which they occupy the available space. In a tape of a committee meeting between two departments vying for hegemony, the chairman of the weaker department was observed to seat himself in the "gallery row" of the meeting room, on one of the chairs arranged against the wall for an expected overflow crowd. The chairman of the stronger department took his place at the head of the table. In many ways, the outcome of that meeting was predetermined.

Similarly, we have noted that of a pair of researchers doing work at a whiteboard,[33] it is the person nearest the board who consistently gets up to write on the board, so that one can see the question of where they choose to sit as speaking to their initial intentions in regard to doing writing on the board. However, once the two researchers have their positions vis-a-vis the board established, writing at the board becomes a much more effortful move for the one who is comfortably ensconced in a chair at some remove, with his feet up on the table. His getting up to write would probably be marked as a significant move in which he actively takes the floor.

The series of videotapes documenting parents and toddlers baking muffins together, shows that the specific physical arrangement of the kitchens is quite

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[33] This example is from the body of data described in Suchman and Trigg (1991).

varied (CAN91.02.05IAL).[34] Parents' attitude towards their child's participation and competence is quite varied as well. What is *common* across parents and different physical arrangements is the requirement to somehow get the child up to the parent's habitual work space. Typically, the preparation of muffin batter takes place at a table or a counter and all families have developed standardized ways of compensating for the short stature of the child. They may pull up a certain chair, or lift the child to sit on the counter, or some other habitual solution to this problem may become evident.

There are further issues related to their spatial configuration, in particular where the mother places herself vis-a-vis the child. In some sequences she stands behind the child, almost cradling him or her within the circle of her arms, a posture that produces a different kind of access to the relevant artifacts than for those cases where she positions the child opposite herself. In the first case, mother and child share the same perspective on the baking operation and they have the salient artifacts equally within reach. Whenever the mother does something, the child sees that action from the same angle as the mother. And the child directly experiences the mother's bodily mobilization for action, as she, say, reaches out for a spoon. By contrast, the second position, where mother and child face each other, invites the child to be an onlooker, an observer, who, when he or she decides to get into the scene, must do it on his or her own.

Another issue that is often relevant in Interaction Analysis is who owns the territory on which interaction takes place. Interestingly, ownership of territory affects the mobility of participants -- whether they can move around at will or have to ask for permission. It also affects rights to structure the event, to initiate the beginning and end, and probably other aspects as well.

For example, Eric Bredo's comparative study of different types of schools shows remarkable differences in the mobility of students. In some schools, they are more or less confined to their desks and other well-defined workplaces; in others they move around rather freely, consulting with other students, the teacher, and the material resources in the classroom. Differential mobility often indicates asymmetrical power relations, as exemplified by the hospital patient who is confined to bed, the guest who has to ask the host's permission to enter certain parts of the house, the child who is not allowed into the parent's study, or the worker who stops in the entrance to the supervisor's office.

Physical arrangements, the spatial layout of a setting, the arrangement of furniture, the open spaces, walkways, coffee niches, doors to the outside, and so on, have an important influence on structuring interaction. Of particular interest to Interaction Analysis is how these physical set-ups affect possible participation structures, that is to say, how they encourage or hinder certain kinds of interaction between people in the scene. Furniture and technology can

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34 This example is from the data described by Callanan, et al. (1994).

have a major effect. A group of students arranging themselves for collaborative problem solving in front of a single computer differs notably from one positioned around a flat work table.

Interaction Analysis thus considers to what extent the spatial layout of the setting is fixed or allows choices; that is to say, to what extent physical configurations and spatial arrangements are imposed and to what extent they are under the immediate control of participants. Facilities layout and technology design always provide specific constraints on what kind of interaction is possible within a given setting and what kinds of activities and interactions particular material objects engender and support. Interaction Analysis investigates how those constraints influence what participants actually do and how what gets done is negotiated.

6.7 Artifacts and Documents

Artifacts are ubiquitously present in all human endeavors. They structure interaction, generate problems, and provide resources for the solution of difficulties as they arise. Sometimes they constitute the focus of an interaction, as when two people work together over a blueprint or at a computer terminal. Sometimes they are co-incidental to it, as when a pencil is used for gesturing and tapping in the course of talk during a working session. For Interaction Analysis, the basic premise is that artifacts and technologies set up a social field within which certain activities become very likely, others possible, and still others very improbable or impossible. One of our central interests lies in understanding what kinds of activities and interactions particular material objects engender and support and how these change as different artifacts and technologies are introduced.

Looking at the role of artifacts from a community-of-practice perspective, Lave and Wenger (1991) note that becoming a full participant involves not only partaking in the social relations of the community but also includes engaging with the technologies of everyday practice and the community's production processes. Lave and Wenger point out that the degree of engagement with technology can be extremely varied and elaborately progressively staged, depending on the form of participation it enables. Interaction Analysis attempts to include material objects as special kinds of participants in its analytic endeavors.

In our analyses of working and learning situations, we have found again and again that it is important to track where people's eyes are, when and how gaze moves between objects, from persons to objects, and back again, sustaining or shifting the focus of attention as the salience of particular objects or displays changes. Gaze clearly plays an important role not only in coordinating

conversational interaction (a topic that has been studied extensively)[35] but also in carrying out physical tasks. Although the role of gaze in the production of talk has been apparent for quite some time, little analytic attention has been paid to the *social* coordination necessary for people to get their work done, as they manipulate objects and move around in space. Workplace studies are only now beginning to explore this important feature.

Given the ubiquity of artifacts in any human environment, it is often difficult to determine where and how to start an analysis. One place is with an inventory of material objects that tracks those objects in the environment that enter into the interaction in significant ways, addressing such questions as: What is their trajectory? How do they get into and out of the scene? Who are their human hosts? Are they uniformly or hierarchically distributed? How do they function in structuring interaction? For example, for students working in front of a computer in small groups, the mouse is an important object because by grabbing or relinquishing the mouse turns at doing work at the screen are taken. It is thus important to understand what kinds of activity ownership of the mouse generates. For a Quality Improvement Team that uses an electronic "liveboard" for consensually producing its minutes in real time, an electrical failure has a debilitating impact. In other groups where records are kept on paper, backup materials are more easily found. The choice of artifacts and technologies to support particular kinds of activities thus deserves considerable attention.

In general, the process of jointly constructing, completing, and revising "inscribed artifacts" -- documents in the widest sense -- provides resources for participants to monitor whether they are in agreement or not. For example, Rogers Hall analyzed pairs of teachers working together at a whiteboard as they were designing instructions for solving algebra problems. One pair constructed a shared drawing that decomposed "rate" into coordinated scenes in a thoroughly collaborative manner -- one would start a scene and narrative, then the other would finish the drawing as the original narrative proceeded, thereby indicating and holding up for verification her understanding of her partner's sense. Except when disagreements erupted, there was very little need to discuss explicitly the quite complex entailments of the drawings being produced. Instead, finishing the other's work synchronized and displayed their mutually shared understanding without much explicit talk.

Objects also frequently serve as territory markers. The marking of workspaces with shifting occupants is typically accomplished with personal items. Who is responsible for (or has rights to) re-arrangements? How temporary or stable are particular arrangements? Are they left in place across shifts? Considering current trends to dedicate office and work space less to

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[35] See, for example, Argyle (1976), Ekman and Friesen (1972), Goodwin and Goodwin (1992, in press), Heath and Luff (1991), Kendon (1985, 1990), and Moerman (1990).

individuals than to tasks and projects, what happens when you remove the possibility to personalize the workspace? Or, conversely, are there technologies and social arrangements that could accomplish the same function?

Some types of artifacts are culturally marked for special functions, but it is also important to look for the ways in which unmarked objects work. A gavel, for example, is recognized as the instrument by which certain kinds of meetings are officially opened and closed. But careful analysis of videotapes shows that unmarked objects may play a similar, though less recognized role. For example, on a videotape of a Ph.D. dissertation defense, the candidate puts on the table the document that has to be signed at the end to certify that she has passed. In the course of the afternoon, this piece of paper wanders through the committee. Sometimes it just lies on the table, sometimes somebody picks it up and studies it idly, only to lay it down again. Though nobody appears to focus on the trajectory of the document, as the meeting draws to a close, and without a word being exchanged, various people collaborate in getting it to the chair, so that it ends up in front of him at the appropriate time.

Sometimes objects are salient not because of their instrumental value but because of their symbolic significance. A stethoscope, for example, has a "use value" as a tool that allows monitoring of patients' heart beat. It also has, however, symbolic value in the sense that, hanging out of the pocket of a white coat in a hospital, it identifies the owner as a clinician who does actual patient care.

An important issue in regard to artifacts and tools is their "ownership." It is often possible to tell from a tape who owns an object because the owner has rights to touch, to manipulate, to display, which are not shared by other participants. For example, in a hospital, patients are not permitted to handle the medical tools of the trade, and in general make no attempts to do so. In medical interactions, then, the use of a major proportion of artifacts available in the setting is restricted to one class of participants. Since knowledge is often tied to particular tools and technologies, this has important consequences for the distribution of knowledge within such settings.

Questions of ownership, interestingly, may arise also in regard to "non-material objects." For example, as designers draw symbols, graphics, and text on a whiteboard, they create objects that re-present the past interaction. These iconographic artifacts then become available as resources for further discussion, as something participants could be pointing to, playing around with, referring to, modifying, or erasing. Thus, for a given work setting or learning environment, one might become interested in questions such as: Who constructs these objects? Who uses them? How are they related to talk? What role do they play in constructing arguments? Under what circumstances are they given names (which make them easy to refer to, in addition to being easy to point to)? Who has ownership of the things a person has constructed in a shared work space? Can somebody else erase them? Can they modify them?

We have been particularly interested in artifacts and documents that function as public display spaces. They are common both in educational settings (in the form of blackboards, overhead projectors, and tack boards) and in work environments (in the form of video monitors of various kinds, papers tacked up on walls, bulletin boards, whiteboards, and computer screens). Such displays often provide a crucial focal point for marshaling a group's attention. They also serve the important function of supporting the public availability of the information they display, as well as of the practices and reasonings that are developed and warranted within a particular community of practice and which systematically inform the work and interaction of participants (Heath & Luff, 1991).

Public information displays compellingly structure interaction. We find it useful to make a distinction between restricted displays, which can be seen only by one or two persons at a time, and unrestricted displays that are available to a whole group. On videotapes of a survey interview, for example, the survey instrument, a hefty paper document from which the interviewer reads questions and into which she writes answers, significantly affects interaction between interviewer and respondent. It requires attending, pausing, turning over of pages, and other kinds of managing that interrupt the normal flow of talk. More significantly, however, since the interview schedule is visible only to the interviewer, much of the information available to her is hidden from the respondent who has no idea of what permissible answer categories are, what the branching structure of the interview is, or even how long the interview is to take in the first place. Manipulating the interview schedule in such a way that the respondent cannot see it (supported by the fact that the respondent makes no attempt to, say, take the schedule out of the interviewer's hands and write down the answers herself) constitutes one of the ways in which participants make clear to each other that they respect the interview as an impartial recording device.[36]

Compare this way of doing work with another situation where access to the information display is not restricted. In industrial process control rooms, large public information displays often not only disseminate information but also provide the resources for making that information available for discussion. While the survey interviewer has to reconcile discrepancies by herself, anomalies that become visible on large public displays tend to generate conversations and thereby draw multiple expertise into the process of explanation and resolution. Understanding that changes in the structure of information displays almost always have consequences in social relations is crucial for the design of new display technologies and for the redesign of work processes (Kukla, Clemens, Morse, & Cash, 1992). While shared display of patient information in the consultation room has never been advocated, we might nevertheless speculate that information systems that display patient records on a

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36 This example is taken from work reported in Suchman and Jordan (1990).

large screen in the doctor's office would radically alter patient/physician interaction. Where now the physical characteristics of the patient chart give the physician privileged access to the patient's condition, a public display of the record would make it a common resource in a collaborative discussion of the case.

7.0 CONCLUSIONS

Video-based Interaction Analysis is a powerful tool in the investigation of human activity that is particularly effective in complex, multi-actor, technology-mediated work settings and learning environments. It is currently undergoing a period of rapid development, driven, in part, by researchers' dissatisfaction with conventional methods, and in part by the ubiquity of video equipment.

In this paper, we have tried to take stock of the accumulating wisdom of one particular community of practice, a community that comes together over particular research problems encountered by its members. Our purpose has been to describe what Interaction Analysis looks like at a particular point in time, from a particular vantage point, i.e. the practices of a group of industrial and academic researchers who are struggling with the requirements of research in complex work and learning environments. The stock of wisdom that has accumulated in this community is difficult to communicate, in part because it is evolving, so that what constitutes accepted practice today may be outmoded three months from now. It is also difficult to communicate because we have not yet developed a mutually agreed upon language for talking about what we do. Our attempt in this paper to delineate a set of "foci for analysis" within video-based Interaction Analysis is a first step in that direction.

In spite of these difficulties, we do believe that Interaction Analysis has come far enough at this point to warrant such a stock taking. Yet we also want to caution the reader that practitioners of Interaction Analysis vary widely in their approaches. Others may report practices that differ substantially from ours. Our hope, and indeed expectation, is that this account will provide the basis for others working in the field to modify, to add, to elaborate, and to question.

Twenty years ago, when Harvey Sacks started the first Interaction Analysis Laboratory in a smoke-filled, windowless room at the University of California at Irvine, it was absolutely unclear to what extent new ways of looking (and listening) had to be forged, or to what extent we could rely on the findings and analytic categories of conversation analysis to guide us in looking at video tapes. Since then we have found, as does every developing research tradition, that certain kinds of principles have emerged, certain kinds of problems have crystallized as important, and, as time moves on, it has become increasingly clearer which parts of the world are illuminated by the new approach and which are not.

As more and more technology emerges to facilitate this way of working, we expect this practice to flourish and take off. We also expect new issues and

opportunities to arise. For example, one of the questions currently emerging asks to what extent success and productivity are directly dependent on the fact that it is a collaborative methodology, and specifically one that, in most of our experience, has capitalized on analysts' face-to-face interaction. The prolific generation of observations and hypotheses, the control of analyst bias, and the ability to draw on comparative materials from other tapes, all depend on the fact that we meet regularly and work together in physical co-presence. Recently, however, members have begun to contemplate the idea of doing this kind of analysis with colleagues who are temporally or spatially removed.

As in any lively field, issues of this sort are rampant and constitute the daily struggles of doing this kind of work. There is also, however, a stable base now, a sound foundation that has been accumulating over the years, that, hopefully, will inform subsequent work by ourselves and a widening circle of practitioners of Interaction Analysis.

8.0 ACKNOWLEDGMENTS

APPENDIX A:

ISSUES IN TRANSCRIPTION AND REPRESENTATION

When we make transcription choices we need to keep in mind that any transcription convention embodies *a theory* of what is relevant in interaction (Ochs, 1979; Psathas & Anderson, 1990). For example, the traditional conversation analytic transcript shows sequential speakership exchange of the form:

speaker A --> speaker B --> speaker A, etc.

with their talk represented in the form:

A: ....

B: ....

A: ....

B: ....

etc.

This way of transcribing emphasizes the mutual relevance of the talk produced by the speakers. Overlaps are indicated by spatial positioning of the transcribed talk or by special symbols. However, as Ochs (1979) points out, sequential layout of talk favors an analytic interest in the sequential organization of interaction, such as speakership exchange, what follows what, interruptions, new starts, etc. If, on the other hand, one were interested in the parallel nature of activities, as Ochs was when investigating the side-by-side play of children, a different form of transcript might be more appropriate, such as a representation of activities in side-by-side columns.[37]

When more than two or three persons are involved in a conversation the sequential format quickly becomes unwieldy. One solution is to assign a separate "speech line" to each participant, with overlapping talk indicated by placement. For example, Eckert (1990) made a transcript from a group session with six high-school girls, each of whom carried a separate mike. Overlaps here are

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37 Ochs also points to a left-to-right bias. Even when you have two side-by-side columns, the adult in the left column, for example, the child in the right -- by virtue of the fact that we read the left one first, there is an assumption that what happens in the second is contingent on the first, that the first is more important. Sometimes this kind of bias can be exposed by deliberately varying which speaker occupies which column position and then assessing how that changes the analysis.

indicated by spatial positioning of the talk (Appendix F). Alternatively, the six girls could be represented in six parallel columns, in which case overlap becomes more difficult to indicate.

While we have at least some established conventions for verbal transcription, the representation of nonverbal phenomena is in its infancy. The comparatively simple transcription scheme for conversation is inadequate for Interaction Analysis in two ways: first, together with the talk the accompanying non-verbal activities need to be transcribed; and second, since we typically deal with multi-party interactions, multiple activity streams have to be represented. These complexities can be dealt with by two potential solutions: parallel horizontal transcripts and parallel columnar transcripts.

Parallel horizontal transcripts: One way to represent parallel activities is by using multiple horizontal lines that represent talk and nonverbal activities, as in a musical score. In many ways, an "orchestral transcript" where co-participants' actions are represented on parallel horizontal lines is ideal since the relationship of the various lines of activity to each other can be grasped in a glance. For example, Heath (1986) has developed a transcription system which augments detailed verbal transcription with gaze and body movement data such as head nods and hand gestures, posture, and leg and hand movements (Appendix G).

Erickson (1991), in his transcript of a dinner table conversation, shows not only eight different speakers' utterances but also the motions of their hands and arms as they transfer serving dishes across the table and place fork to plate and fork to mouth while eating. This is an extremely complex transcribing scheme that in addition to indicating duration and intensity of movements, also transcribes intonation contours by musical notation that gives pitch and rhythm (Appendix H).

Goodwin and Goodwin (in press) use parallel lines of talk lined up with iconographic representations of the objects at which a worker looks, to show the ways in which environmental resources are used in the course of understanding a question and providing an answer (Appendix I).

Parallel columnar transcripts: Alternatively, multiple analytic streams can be represented in side-by-side columns that include both verbal and nonverbal activities, as Jordan did in representing interaction in obstetric labor rooms (Appendix J). Parallel columns can also be used to track parallel activities in complex, technology-rich work settings where multiple activities happen side-by-side or in classrooms where there may be different small groups working around tables at the same time.

Increasingly, it is becoming important to transcribe the activities of non-human actors in work practices and learning activities. Suchman (1987), in a study of human-machine interaction, juxtaposes human activity with machine activity in a four-column transcript that specifies what parts of these activities are available to human operators and to the machine, respectively (Appendix K).

The question of how to transcribe screen events and machine data is, at this time, wide open. Luff and Heath (1991), Frohlich et al. (in press), Whalen (1993) and numerous others have begun to develop notations for transcribing screen events, but no stable conventions have as yet crystallized.

Word processing has helped tremendously in making such complex representation schemes possible. Unfortunately it is not yet simple to maintain automatic temporal alignment of the various activity streams between either columnar or orchestral representations nor are they easy to print out in a form that makes them easy to read. However, given the increasing need to represent multiple data streams, for Interaction-Analytic work as well as for other kinds of Exploratory Sequential Data analysis (ESDA), it is likely that such support will become available in the future.[38]

In summary, transcription practice at the present time is in flux. We predict that, given the lack of convincing arguments for the benefits of any one particular standard, practitioners will continue to make pragmatic decisions about which transcription convention is best for their particular purposes.

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[38] The idea of ESDA collects a diverse group of practitioners who are united by the fact that they deal with data that preserve the temporal dimension of the phenomenon of interest. ESDA data include video, eye movement data, computer screen sequences, key stroke data and the read-outs from various kinds of physical sensors. ESDA practitioners have a common and pressing need for computer-based data representation and manipulation. (Sanderson & Fisher, 1993).

APPENDIX B:

HOW TO SHOOT A VIDEO TAPE FOR INTERACTION ANALYSIS

Certain characteristics make a tape more or less adequate for interaction Analysis. Ideally, one would want the camera to capture all relevant aspects of the event as it unfolds. But since it is impossible to know ahead of time what, in the course of analysis, will emerge as relevant, compromises must be made for most tapings between what is desirable and what is possible.

The Ethnographic Context A very important consideration for us is the extent of prior ethnographic fieldwork. We feel that ethnographic work is crucial not only for proper contextualization of tapes during analysis, but also for negotiating consent, setting up a relationship with participants within which they are comfortable with taping, gaining their cooperation for review sessions, scouting out the best camera locations, making decisions about pipping (see below), and thinking about what will *not* be visible on tape. As a matter of fact, it is probably desirable to have ethnographic work continue to whatever extent possible during videotaping.

We have found writing concurrent fieldnotes while taping extremely useful. As Minneman (1991) comments: "Notes taken during the event help in any subsequent analysis. It is immeasurably easier to jot down the time at which the group was doing something interesting for closer examination than it is to find that instant in a pile of two-hour videotapes later" (p. 98). Beyond that, such notes may allow one to explain otherwise inexplicable occurrences and avoid false interpretations. In one videotape of a birth, for example, the midwife raises her head every so often, ostensibly looking at the husband of the woman in labor. In fact, she was looking at the clock on the wall behind the husband. Knowing this fact (which was available from fieldnotes, but not from the tape) produces quite a different reading of the significance and timing of those looks.

A sketch of the scene indicating camera position, location of salient objects and technologies, features of the facilities such as windows and doors, and above all, people who are not visible on the tape also aids substantially in arriving at an understanding of what goes on. Ethnographic work may also include collecting crucial artifacts (for example blocks used in design problems) and making copies of important documents such as minutes, design and engineering drawings, math problem solutions, writing exercises, and discards of various sorts, all of which may become important for the interpretation of the tape.

The Physical Setup At the risk of sounding elementary, we offer some oft-neglected cautions. Set up the video and audio recording equipment on stable mounts (e.g., tripods, tables, book cases) so that they will not fall over or have to be attended to during the activity. Make certain that the equipment is positioned so that it does not interfere with the activity. In particular, ensure that participants will not trip over power and interconnection cabling. Do not

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place the camera so that it points into an open window or other strong light source because it will white out the picture. Finally, if the activity will last longer than one recording tape, make sure that you have access to the recorder without interfering with the activity. If possible, set a timer that will remind you that the tape is about to run out.

Shooting Social Scenes We make every effort to have all participants in the picture and to have their whole bodies visible. This generally means using a wide-angle lens. A common temptation is to point the camera at the person who constitutes the center of attention, such as the teacher in a classroom or the surgeon performing an operation. In the extreme, this leads to the phenomenon of "talking heads," a format familiar from television interviews where the camera flips from speaker to speaker, excluding not only other persons in the scene but also the rest of the speaker's body. Such tapes do not provide good data for Interaction Analysis, which is based on the premise that what the speaker says or does is fundamentally a social phenomenon, orchestrated with, and responsive to, other individuals in the scene.

Multiple Cameras In unstaged group interaction, people are generally not orienting in the same direction. Therefore, no matter where one puts the camera, some faces will be turned away. One partial solution to this problem is to use multiple cameras. Two cameras also are effective when the interaction involves artifacts or spaces whose state has to be tracked. For example, one camera can be kept on a computer screen or design work space, while the other records people's activities.

Roving and Stationary Cameras Experience has shown that, if the action is reasonably predictably confined to one particular place, it is best to keep the camera stationary so that a consistent and sustained view of the scene of interaction is obtained. This is preferable to a roving camera, which catches short stretches here and there, but typically does not get the all-important transitions. In addition, a roving camera is maximally intrusive. Much of that intrusiveness is removed if there is no operator behind the camera with whom participants expect to make eye contact. On the other hand, in situations where participants are thoroughly accustomed to a camera and where the ethnographer knows exactly what he or she is after, a roving camera may be the best method for getting maximum information. However, it is important to keep in mind that such a record reflects to a great degree the momentary judgments of the ethnographer. These, in our experience, are often questionable in retrospect.

Pipping PIP (picture-in-picture) is a useful procedure which allows two or more simultaneously recorded images to be merged and recorded onto the same tape, either at the time of taping (thereby saving on videotapes) or later. The secondary images typically appear as small insets in a less important region of the primary image.

However useful it may be to have multiple views appear side-by-side when doing analysis, pipping a tape also has its costs. The pipped-in picture overlays

some piece of the primary tape, losing that piece to viewing. It is often possible to locate the pip in an "unimportant" area of the screen but that requires constant monitoring and moving the pip. In addition, when viewing a pipped tape, the second (or third, or nth) picture is often quite distracting. A screen with several pips is difficult to parse even for experienced analysts and is a liability in review sessions with inexperienced participants. If the pip is done in the field (which means that it cannot be removed later) it should be turned on and left on only for very good reasons. It should never constitute the default.

When selecting camera positions for shooting tape to be pipped, it is well to remember the film makers' rule never to cut to a view that is 180 degrees reversed from the preceding shot because the viewer can't make the transition. We are often tempted to put diametrically opposed views together, such as one shot from the back of a room with another from the front. While such arrangements largely solve the problem of covering the scene adequately, they make the resultant compound image confusing and difficult to parse, especially for participants but even for experienced analysts.

When, then, is a pip useful? We have often found that we need a pip when people are engaged in monitor work. For the analysis of such situations one needs a simultaneous view of how the computer responds to what operators do and how that, in turn, enters into their interactions. It is also useful for situations where one wants to focus on a specific activity and the background for that activity at the same time. For example, one might pip the picture of a teacher and her or his activities in front of the classroom into a whole-classroom shot. By contrast, such times as transition between one class period and the next, when a crowd disassembles and then reassembles, are probably best shot with a single wide-angle camera. In general, if the phenomenon of interest consists of people coming in and assorting themselves in interactional spaces, it is almost always better to use a single camera with a wide-angle lens.

The Importance of Sound   What is often more consequential than multiple cameras is high-quality microphones. We have found wireless mikes particularly useful because they allow mobility. We have also found that placing multiple tape recorders into the scene aids substantially in later disambiguating what people in noisy multi-actor social situations say. Sometimes one may be able to ask a roving teacher or supervisor to carry a tape recorder. Some investigators have made up special packs that can be carried even by small children tearing around in a playground, where their shouts and laughter could never be adequately covered by a stationary mike even when a stationary wide-angle camera covers nonvocal activities adequately.

As with any technology, knowing what the strengths and limitations of the recording equipment are is essential for making tapes that are suitable for studying complex social interactions. In the final analysis, a tape will be as good as the amount of forethought, practice, and careful preparation that has gone into it.

APPENDIX C:

NOTES ON THE ETHICS OF RECORDING AND PLAYBACK

In most conventional research it is comparatively easy to reassure participants that they will remain anonymous and that the data they allow us to collect will remain confidential.[39] With video-records, neither can be guaranteed. Instead of anonymous cases with names changed and identities disguised, we have anonymous case studies with no names changed and identities plainly evident. This problem, which no researcher or lawyer can solve, is completely untractable without the active involvement of the people who will appear on the tape. They need to be involved at the time of taping and for all subsequent use occasions, be that analytic work, editing for particular purposes, or presentations and showings to particular audiences, especially in the participant's own work environment or professional community. Because of these complications, it is incumbent upon the researcher to be much more careful in the use made of video records than is customary for other data.

Institutional Review Boards at universities and their equivalents at corporate research laboratories have adopted a variety of guidelines and procedures designed to protect participants from harm. Yet all videographers know that these regulations are not sufficient. Rather, researchers, educators, designers, managers, and the people being videotaped must actively work together to come to a shared understanding of what kinds of problems are likely to arise in their particular situations and how these can best be solved. While issues of confidentiality, privacy, and legal as well as ethical accountability have been discussed extensively for medical and therapeutic research, the education and design communities are only beginning to think about these issues as they increasingly adopt video-based methodologies.

We believe that what constitutes appropriate ethical practice for our work is currently being worked out within an emerging community of practice that is in the process of constituting itself. Here we aim, therefore, not to lay down hard-and-fast ethical principles, but rather attempt to discuss some of the concerns that have come up for us and our colleagues as we introduce video technology into our various research enterprises.

In our efforts to come to grips with ethical questions in video work, we have found it useful to consider four related problem areas. These revolve around making the tape, analyzing it, presenting the results of the analysis, and non-research uses of the taped materials. For each of these problem areas, questions arise as to who is to make decisions and whose benefit is to be considered. Is it the

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[39] Anonymous (literally "without name"): individuals cannot be identified; confidential: the key for linking data to names and identities of subjects is available only to the researcher.

people (with) whom we study? Or should our decisions be driven by concern for getting the right kinds of data? Should those who pay for our research have a say?

Anthropologists have traditionally adhered to the principle that our first responsibility is to those we study (Blomberg, Giacomi, Mosher, & Swenton-Wall, 1993; Cassell & Jacobs, 1971; Gilbert, Tashima, & Fishman, 1991). The unavoidable disclosure of people's identities on videotape makes this responsibility even more weighty. In turn, it puts an additional burden on informed consent procedures, and indeed makes that very notion problematic.

It is important to realize that agreements are generally given not so much because the participant has read the consent form and has evaluated the proposed activity, but because of some prior established relationship. This may be with the researcher, who has explained the project in a confidence-inspiring way, or, not infrequently, it goes through some person of authority, is endorsed by somebody with higher status, such as a teacher, a physician, or a supervisor. Such consents are often questionable on their face. What can an employee do when his supervisor says, "Listen, we've got these nice people from the research institute here today, and they wanna make a few tapes and talk to you a little. Show them a good time!" and walks out. Even if the researcher explains that people are free to refuse, exercising such freedom may not be an option for the worker. This is a dilemma that is difficult to assess and for which there are no general guidelines much less recipes. Rather, we are dealing here with situations that require careful thinking up front, trying to understand who in the situation is potentially vulnerable, and then, to the best of our abilities, making sure that no harm comes to these persons.

In workplace studies, there are grave concerns regarding the potential evaluative use of videotapes by management. Even if the purpose of the research is to look at work process, any presentation about what is going on would ideally involve showing a piece of tape, and this tape will always have particular people involved in particular kinds of (possibly objectionable) practices. It is then easy to turn around and see the tape as an indictment of the worker and not of the entire ecology of work, even if that is what the researchers intended.

It goes without saying that except in completely public situations (like in the street, an airport, a public park) participants must be asked for permission to record. Participants need to have a fair amount of control over the process of videotaping, including the right to stop the taping at any time. Once taping is completed, they should have the right to review the tapes and have them erased if they so choose, either on the spot or within a reasonable period of time.[40] Getting people to consent to videotaping usually gets the lion share of attention in ethics

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40 In Jordan's cross-cultural birthing studies, all participants saw their tapes. None ever exercised this option. However, we have had an occasional request for erasure in our work place studies.

discussions. This is when "subjects" first face the possibility of being on camera and constitutes their first and most potent opportunity to refuse. Yet it is often surprisingly easy to get people to agree to be videotaped.

For most people, video recording is still, at least potentially, a substantial invasion of privacy. However, it may well be the case that the use of recording devices is not regarded as particularly intrusive in situations where the participants are already highly "wired" into the ambient technology (for example flying a helicopter with flight suit, microphone, ear phones, etc.; or giving birth hooked up to a uterine pressure gauge, a fetal heart rate monitor, an intravenous drip, a blood pressure cuff, etc.). In these situations a video recorder is probably only a small additional burden. In some research laboratories video recording is so routine that people have become quite used to it and no longer feel their privacy substantially invaded. Yet, such exceptions not withstanding, it must be recognized that in most settings and on most occasions a video camera is not a routine presence.

In educational settings, the most common procedure is to have parents sign a consent form in which they agree that their child will be videotaped "for research purposes." They typically sign away all rights regarding later uses of the tapes for analysis, public broadcasting, advertising or whatever. But teachers, too, are videotaped in the classroom and it is by no means clear whether they understand the implications of allowing themselves to be taped. Increasingly, aspects of a teacher's activities in the classroom are captured that were never before open to scrutiny. This may work positively as well a negatively for the teacher. To protect participants, he or she has to have ultimate decision power regarding videotapes, including the possibility of destroying them. Such a stance, of course, raises questions about legitimate interests of the researcher and those who have funded the research.

What emerges here very clearly is that consent is not a singular act that happens at one point in time, but rather a process through which the status of actual or potential tapes is negotiated and sometimes renegotiated. It may be that permission to use should be revocable if the participant's situation changes because it is possible that what was innocuous at one point may become potentially damaging at another. For example, Jordan once received a request to review (and possibly erase) a videotape from a person who was more or less a bystander at the time of videotaping but who became concerned about evidence for a medical malpractice suit later on.

Interaction Analysis depends on collaborative, multi-disciplinary group work. This alone entails that more than one person sees the tapes. Typically, we work on tapes in work groups with varying constituents and use our tapes for more than one type of analysis. It is usually not possible to specify ahead of time in what manner or for what purposes tapes will be analyzed. For example, Jordan told women in labor that she would analyze their tapes for the influence of uterine contractions on interaction patterns, an interest she had at the time she made the tapes. But since then many of these tapes have been analyzed from many

different points of view, such as the role of the husband, interaction with technology, correspondence of the tape recording with women's later accounts of the birth, and many others, none of which could have been specified ahead of time. In a real sense the women were giving unrestricted consent to the use of the tapes for not well-specified purposes.

A particular set of issues arises during video review sessions with participants. At that time, we use the tape to elicit further information about what is happening on the tape from the point of view of the actor. (It also happens on occasion that participants are present at regular Interaction Analysis sessions.) We have found that such presence need be handled with great caution. Participants often come to see things about themselves or a close friend or associate that they were not aware of, that they are embarrassed about, or find frightening. This is not an easy encounter with self. It may be painful to watch oneself engage in behavior patterns that one would object to in others. Cutting people off, invading others' space, not paying attention to someone bidding for participation, saying something "stupid", all these are done by everybody much of the time but we mercifully do eye-avoidance or ignore them in other ways. They organize our lives, but part of their power is that they are normally hidden, invisible, fleeting phenomena. The video makes them freezable, analyzable, displayable -- holding them up for public viewing. One way to think about invasion of privacy is as the presence of the camera and the camera person. Another much more perfidious invasion of privacy comes from the microscopic look at expressions, interactions, and behaviors that are normally out of awareness, that nobody ever has to face unless they have been recorded. Thus, such sessions need to be approached with a great deal of caution, of preparation, and of willingness to work further with participants, to let them come to some sort of resolution and integration about what they saw themselves doing.

Practically, it is important to know if participants coming to analysis sessions have ever seen themselves on a tape before. A person who sees themselves on video for the first time needs some considerable amount of time to adjust to that image of themselves before they can be counted on to participate in the analytic work. It might be advisable not to let that first encounter happen in a public situation where the participant must deal with the real and imagined reactions of others as well.

A general problem when tapes are shown to a public is that researchers and participants may have different ideas about what permission to videotape entails. For example, parents who have signed a consent form allowing the researcher to make tapes for a study of children at play may become upset if they find their toddler starring as the bully of the nursery school in a scholarly symposium on aggressive behavior in preschoolers. Similarly, a researcher or designer may be dismayed at finding herself or himself on public display in front of colleagues who know them well, even though they had agreed to be videotaped "for research purposes."

The critical issue here is that we often would like to show the tape, often in fact *need* to show the tape to make our analysis credible. If this is the case, we should always thinks seriously about the relationship between the audience and the participants. For public presentations it sometimes works to show a series of 35-mm slides taken from the tape, possibly with faces blanked out, and a reading of the transcript. Heath (1986) had drawings made from still photographs off videotapes (Appendix G), not only because he felt the analytic points can be illustrated more clearly that way but also for ethical reasons.

Finally, videotapes are powerful records. They can be used for many things in addition to the research for which they were created. For example, videotapes of classrooms can be used to evaluate teachers. Clips from workplace studies are powerful persuaders in arguments to management. Videotapes of people operating machines, made for improving the design of those machine, are a compelling source of material for advertising. These kinds of uses inevitably have much greater potential than research use for harming the participants.

We have only begun to explore the ethical issues around working with video. They are clearly complex and, furthermore, highly variable between projects. As we look for ways of dealing with them we might find guidance in the Hippocratic injunction: "At least do no harm; and if possible, do some good."

APPENDIX D

Example of a Content Log
(from unpublished content log by Brigitte Jordan, 1990)

Ops-A:	Operator who communicates with jets
PSP:	Passenger Service Planner
BP:	Baggage Planner
Ops-B:	Operator who communicates with commuter planes
SUP:	Operations Room Supervisor
AA:	Atlantic Airlines (pseudonym)

7:12:00   Ops-A talking on radio to flight 194
Fuel readings, flight status report, weights and balances, flaps and passengers.

7.12.40   Ops-A re: 1081- gate clearance
PSP to Ops-B: question about next complex

7.13.04   PSP checking AA computer Screen flight readout/ or adjusting monitors.
Ops-B looking at monitors

7.13.37   Ops-A: "184 gave us an on time "
[monitoring performance].

7.13.52   PSP: "Only thing left on complex 7 is 909 "
[assessment of performance]

7.14.21   BP turns in chair, asks Ops-B what just landed.

7.14.34   "816 is on the ground"
[Is this an answer to BP? How do these operators know who is talking to whom? They often talk without addressing recipient or looking at him/her].

7.15.24   Ops-A report/gossip re: lots of crews bitching about Flying Tigers-incandescent lights- blinding pilots on runway approaches.

7.15.45   Ops-B walks to printer, tears out sheets, tears sheets on table edge, throws part of sheet away. [check garbage cans]
PSP adjusting video monitors

7.16.36   Ops-B returns with styrofoam food box and places it on area between PSP and Ops-A
Ops-A opens box
Ops-B walks toward SUP 's desk

7.16.48   Ops-A requests utensils

7.17.12   General joking around; food talk

Example of Jeffersonian Transcription
(Schlegloff, 1988)

```
123   N:   ⌈Fig  newtons ⌉ ri:ght? ⌉ fig  new(h)tons. ⌉         ← c
124   M:   ⌊They make su-⌋ Y'know-⌋ Y'know how the-⌋
125        ⌈know how they make ⌈JE:LLO on tee:vee:?⌉
126   S:   ⌊No:: (                ⌈                ) ⌉ =         ← c
127   V:                          ⌊NO:::.    BUT     ⌋ =         ← c
128   S:   =⌈I  thought  about  that. ⌉                          ← c
129   V:   =⌊ HE   A:SKED   ME       ⌋ 'E said *should          ← c
130        I get fig new:tons*? he ha= ((*=smile voice))        ← c
131   S:   =What
132        (0.4)
133   M:   Know how they make jello on TV to be: (0.3) great
134        dessert.
           ((7 lines on TV Jello commercials omitted))
142   M:   No what di- what d'ju ge- what'd you ge:t.
143        Is ⌈at  (a pa )⌉
144   V:      ⌊Wai:t.  It's⌋ a surprise.=
145   M:   =( Is  it )  I  be:(h)t
146        (0.3)
147   V:   Ne he he he he=
148   N:   =hm hm hm=
149   S:   =I'll tell ya.
150        (0.2)
151   N:   It ⌈better be good.
152   M:      ⌊What.
153   S:   Oatmeal c(h)ookies (h) (h)=
154   M:   Is it? oatmeal cookies=
155   N:   =Oh::=
```

APPENDIX F

Example of Horizontal Orchestral Verbal Transcript
(Eckert, 1990)

```
IJune:
IMiriam:
IBetty:                                                      hh
IKaren:
ICarol:                    Yes.                 It's the big heads and no personality.
IPamela:     =stand it.
Eckert:                  Why not?              _____
5IJune:
IMiriam:                                            Not all the time.
IBetty:        no comment hh
IKaren:     Yeah                      I-
ICarol:                                   no it's not.  I think that's just a=
IPamela:    mm hmm
IEckert:             Is that really true?        _____
6IJune:
IMiriam:
IBetty:          I think it's a front.  yeah
IKaren:  stereotype                              It CAN be true=
ICarol:           stereotype        I don't have a lot of  oh
IPamela:
IEckert:                                          _____
7IJune:
IMiriam:
IBetty:
IKaren:  =though
ICarol:       a lot of whatchacallit            No uh  well that's the word but=
IPamela:                          interaction        _____
IEckert:
8IJune:
IMiriam:                            relationships   friendships            hh
IBetty:
IKaren:                                        !!                  m ! ! !
ICarol:    =it's not the one I                          Action.  ! ! !  I don't=
IPamela:                          I know                              !!
IEckert:                                            _____           !!!
9IJune:
IMiriam:
IBetty:
IKaren:                                        yeah              oh see I
ICarol:    =have a lot of exposure to a lot of those guys.       I just don't see them.
IPamela:
IEckert:                                            _____
```

Horizontal Orchestral Transcript for Verbal and
Nonverbal Behavior
(Heath, 1986)

Fragment 1:4   Transcript 4

```
leg l/h          _____
posture          _____
gesture l/h  _____                                              __
head                                              _____
gaze                             ........_____
Dr:          Ri:ght(t) fi [ine          [O.kay?----By [e::
P:                       [Thank you very mu[ch          [(-
gaze         ...._____,,,,,,,,,,,........_____
head              _____
gesture r/h        _____  _ _ _ _ _  _____
posture      ____                            _____
leg l/h            _____          __
leg r/h                                _____
             D1                                              D2
```

Fragment 1:4   Drawings 1 and 2

APPENDIX H

Eight-Speaker Horizontal Transcript with Musical Notation
(Erickson, 1991)

APPENDIX I

Horizontal Transcript Relating Talk and Documents Consulted
(Goodwin and Goodwin, in press)
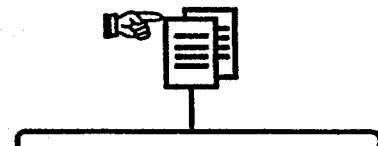

Pilot: I understand gate fourteen is occupied?

Pilot: Do you have any instructions for (it)? (0.3)

Julie: Uh : : m,   (0.1)

Should've left ten *minutes* ago.

Hopefully:,(1.0) They *have* pulled the passenger stairs.

They should be leaving momen*tarily.*

APPENDIX J

Columnar Transcript for Verbal and Nonverbal Behavior
(from unpublished manuscript by Brigitte Jordan, of a Michigan home birth)

Frame # and Camera	Activity	Talk
039 000		G: [laugh] Just like Cinderella, huh?
Camera moves left, off G, K and past H to show living room area	G eats from her bowl, then replaces it on the table	K: Right, right. I know they took it. I just hope something has (........).
		G: Well, what (pause) what about circumcision? How soon do I have to do that if it's a boy?
Camera moves back to G, K, H		K: You don't have to do it at all.
	H is in the background winding and unwinding the cord to the pole lamp	G: Well, no. We're DOing it
040 000		K: Ok, that's how Joe felt, too [giggle] you know how it is.
		K: Umm Joe usually waits (pause) I would suggest eight days and Joe?
		G: Don't the Jewish people use seven days or something?
		K: Eight days
		G: Eight days
		K: They do it on the eighth day and physiologically it seems to have a good base, a good reason for doing it then
041 000	H takes the pole lamp down and exists with it to the left	K: their blood level seems to be up real well, their nutrition is usually pretty good and they've had a chance to kind of settle down from being born and ummm he doesn't realize this but it's HEARTrending. It will KILL you
		G: He wouldn't mind if I wanted to hold the baby?

APPENDIX K

Columnar Transcript for Human-Machine Interaction
(Suchman, 1987)

Human-Machine Communication

THE USERS		THE MACHINE	
Not available to the machine	Available to the machine	Available to the user	Design rationale
		DISPLAY 1	Making two-sided copies from a bound document
A: Maybe I should just lift it up and put it= [		DISPLAY 2	Accessing the Bound Document Aid
B: How do we skip this then?			
A: =down again. Maybe it'll think we're done.			
B: (laughs) Oh, Jean.			
A: There,	OPENS BDA		
		DISPLAY 3	Instructions for placing document
Okay, we've done what we're supposed to do.			
Now let's put this down. Let's see if that makes a difference. (Looks back to display)	CLOSES BDA		
		DISPLAY 2	Instructions for copying a bound document
(laughs) It did something.			
B: (inaudible) Good grief.			
A: Oh, it's still telling us we need to do a bound document.			

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