Ethnographic Methodology Applied to CSCW Research

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"There is no one method of ethnographic analysis."[1]

The purpose of this paper is to present an overview of ethnographic techniques and methods that can be used to study computer-supported collaborative groups. It was motivated by a study of several software development teams observed by one of the authors and several colleagues during the spring of 1991. That study was done as part of a larger effort by the UNC Collaboratory Project to both build an actual system to support collaborative groups and to build an understanding of the collaborative process itself.

On the surface, a discussion of methodology appears to be a straightforward proposition. However, it is considerably more complex than one might initially presume. The quotation above is from the beginning of the methodology section of a paper by a group of ethnographers. It is remarkable not for its admission that there is no single methodology guiding all ethnographic analyses (a fact all professional ethnographers are already aware of) but rather because of the way in which it reflects the widespread lack of knowledge regarding what constitutes an ethnographic or qualitative study among the intended audience of their paper -- the Computer Supported Cooperative Work (CSCW) community. Before we discuss methodology, we first describe what an ethnographic study is and introduce several concepts central to ethnography.

Background

An ethnographic study is a focused, in-depth study carried out through personal contact and observation of the people or group studied over a period of several months to several years. The ethnographer goes to where these people live and work, and studies them in "natural" environments, rather than creating an environment or defining the conditions under which the study will be carried out. Ethnographic studies usually involve an explicit attempt to understand the "native's"[2] perspective and meaning system, and to relate these to observed events and actions; ethnography is concerned with culture.

Culture

Culture, in anthropological usage, refers to the enduring set of traditions, ways of thinking and ordering our lives, shared by members of a society.[3] The classic definition comes from Sir Edward Burnett Tylor: "Culture...taken in its wide ethnographic sense is that

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[1] Hughes, Randall, and Shapiro 1992.

[2] The term "native" is used here and throughout this paper to mean simply a member of the particular group being considered.

[3] Unfortunately, there is no single definition of culture on which all anthropologists agree. Some emphasize ideas, and beliefs, the mental and attitudinal aspects of culture. For them, culture is not behavior or products, but the set of shared ideas and understandings which guide behavior. Others emphasize the observable behavior and material products resulting from such shared ideas. For our purposes, we adopt the more inclusive definition of culture which embraces both the culturally patterned ideas, concepts, and attitudes, and the culturally patterned behaviors, actions, and material artifacts produced.

complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society" (Tylor 1958 [1871]: Vol. 1, p.1).

Four features of culture (Peacock 1986) are particularly important for grasping its significance in the myriad of things people do, and by extension, in the tasks of anthropologists as interpreters of human action and experience. The first two of these are implicit in Tylor's definition. First, culture is *learned*. Human beings acquire culture by being members of a society, rather than inheriting it biologically. Culture is not instinctual; it is transmitted and mastered through social interaction. Second, culture is *shared*. Culture is not the property of the individual, but of the society of which the individual is a member. Beliefs or actions of an individual are cultural in so far as they reflect -- implicitly or explicitly -- beliefs and customs of a larger social group of which the individual is a member.

The third feature of culture is that it is *taken-for-granted*. The knowledge, beliefs, traditions, and conventions of culture often are held at an unconscious level, and the individuals acting on them are unaware that they are a part of culture. If asked directly, the individuals may claim that they do not hold a particular belief, yet the customs which they have learned through their culture are predicated on this belief, and therefore the individual is acting upon it every time he or she acts in a customary way. Beliefs and knowledge which are a part of culture appear to be part of nature, given by the world. Cultural concepts of time are an excellent example (Peacock 1986: 4-6). In Western cultural traditions, time is conceptualized as linear, stretching from the far distant past, to the more recent past, to the present, and extending into the near, and then the far, future. Seldom do we stop to consider that this concept of time is a cultural convention. To those of us raised in Western cultures, time appears to be part of the natural world; time simply is as it is. Our English language mirrors the division of time into past, present and future in its verb tenses. This conceptualization of time is embedded in our lives in innumerable ways, from our concept of history to the ways in which we exchange labor for resources, and in the value we place on efficiency, on youth, and on the accumulated knowledge gained through so many years of education. Yet members of other cultures conceive of time quite differently. Many non-European languages do not have tenses representing past, present and future. Some other cultures, particularly those associated with Buddhist or Hindu traditions, view time as cyclical, rather than linear. The Trobriand Islanders of the Western Pacific are said to have viewed time not so much as a line along which one travels as a puddle in which one sits or waddles; they imagined time as a directionless configuration (Peacock 1986:5). Far from being given by nature, concepts of time are cultural constructions which structure our perceptions of the world and strongly influence our attitudes -- towards work and leisure, accomplishment and

failure, economic value, and appropriate points in the life cycle for sowing oats or settling down and starting a family, to name but a few.

This brings us to the fourth point to be made about culture. Culture is *real*. Even if it often seems invisible to those immersed in it, it exists as a powerful guide to the everyday actions of every human being. The ways in which we think, speak, eat, work, greet one another, show deference, perceive categories of color, experience emotions, and represent the physical world are just a few of the daily interactions with others, with the environment, and with ourselves which are shaped by culture. Culture is so powerful precisely because it is so universally shared within the social group, so taken-for-granted; there is an aura of being natural -- of being "of nature" -- and thus any other way of seeing, thinking, feeling, doing seems unnatural. Cultural patterns persist even in times and conditions of social upheaval and extreme stress. Moreover, attempts to impose culture change may *bring about* social stress and upheaval. This is not to say that cultures do not change, but rather to underscore the power and resilience of culture, and its integration and embeddedness in every aspect of human life.

Group patterns of seeing, thinking, and acting are not limited to large groups such as nations, ethnic or religious groups. Smaller groups with shared interests and systems of socialization and learning may share a distinct sub-culture -- career military officers, or computer programmers, to name two examples. Understanding and interpreting human action, motivation, belief, and experience requires the systematic study of culture, even when those one wishes to understand seem like the researcher in many ways. This is a central tenet of anthropology. But how does one study that which is taken-for-granted, unconscious, invisible to its bearers? For most socio-cultural anthropologists, the answer is through ethnography.

The term ethnography covers a wide variety of techniques and practices, ranging from in-depth life history interviews focusing on the experiences of one individual to analyses of patterns across a number of communities involving hundreds or thousands of people. Despite the range of specific approaches, there are several principles which underlie the various methods and make them ethnographic.

Personal Contact and Observation

It is difficult to observe culture using scientific instruments; it cannot be detected by an EEG or mass spectrometer, or measured using calipers or balance. About the closest we can come to detecting culture using "objective" methods is to gauge reported attitudes or practices through surveys; and while these may allow investigators to identify correlations between variables, by themselves they offer relatively little help in understanding culture or how it influences the variables investigated. In fact, it may be said that little meaningful

interpretation of these results is possible without deeper knowledge of the culture underlying them. To gain this deeper understanding, ethnographers, in a sense, use themselves as research instruments. Since culture is learned through social interaction, ethnographers endeavor to learn *about* culture through social interaction -- through personal contact and observation. For an ethnography of computer supported collaborative groups, for example, the researcher would be personally involved in observing the group first hand, and interacting with its members as they work. This method, known as *participant observation*, will be discussed below.

Observation in Actual environment

In ethnographic studies, unlike an experimental approach, the researcher does not control the people and situations observed; the environment of the study is "natural" in the sense that the activities pursued by the people involved would have occurred whether the ethnographer was present or not. This does not mean that people will not modify their actions because an observer is present; rather it means that the observer should try to be as unobtrusive as possible in terms of influencing what takes place, and should not channel, suggest, or dictate what people should be doing.

Consider, for example, a researcher studying how members of a small agricultural community cooperate during a harvest. One method of getting this information would be to circulate a questionnaire about how they go about this task to a cross-section of the community. Another would be to get a few people together and have them simulate harvesting a selected crop on a small plot. Neither of these would be the approach taken in an ethnographic study. An ethnographer, simply enough, observes the actual harvest. By doing this she gets at some vital information that may elude a researcher using other methods. She has access to a "native definition" of what a harvest is through both the explanations and the actions of the participants. By observing the actual harvest, the ethnographer will be looking at who does what throughout the whole community, including tasks that she might not have viewed initially as being part of the harvest. This is vital because undoubtedly the ethnographer has presuppositions about what a harvest is and how it takes place.

For the case of research into CSCW issues, observation in the actual environment entails paying attention to informal, everyday work practices as well as the formal organizational structures and practices dictated by institutional regulations. For example, Charlotte Linde's (1988) examination of cooperation between the observer and the pilot of a police helicopter looks at the ways in which the putative hierarchy (pilot formally outranks observer) is fluidly adapted to changing circumstances in actual practice wherein the pilot or the observer takes charge depending on the situation.

The View Over Time

Another characteristic of ethnographic studies is that they take a diachronic as opposed to a synchronic view. Rather than studying an event or phenomenon at one point in time, without reference to its history, ethnographic studies generally involve spending a lengthy period of time with a group of people. This emphasis on obtaining a view "over time" reflects the concern in ethnography with context, including development and change over time.. It assumes that the actions of people will be more understandable if one knows about the events that led up to those actions. For example, an ethnographer observes a working session of a group of programmers collaborating on a project. A design suggestion is made by one programmer and resisted or rejected by another. Why did this take place? Was it simply a bad idea or was there a pre-existing conflict between the two people? How can the ethnographer choose between these two interpretations? A full understanding is difficult to arrive at if this is the only time she has observed the group. However, if she has followed the group over a period of time and knows about the roles and interrelationships of the group's members, then a choice of interpretations is possible.

Multiple Levels of Analysis

A hallmark of ethnographic analysis is the consideration afforded to various levels of analysis and the interrelations between these levels. The same events or actions can be analyzed on a variety of levels, e.g., individual, sub-group, group, institutional, sub-cultural, cultural, or macro-cultural. Take, for example, the everyday case of a group of programmers in a conference room. The manager of the group stands at a whiteboard, writing and speaking, while the others sit at a table, listening and taking notes. The manager's actions -- writing on the whiteboard -- might be analyzed in a number of ways: On the individual level, in terms of the cognitive tasks she is engaged in (producing written and spoken language, problem-solving), or in psychological terms (personality traits or dispositions displayed). At the group level, the act of writing on the whiteboard might be understood as an effort to recruit supporters for an idea, or as a method of emphasizing leadership by controlling an important resource during a meeting. At the sub-cultural level of computer science, writing on the whiteboard can be understood as an accustomed and appropriate activity which can be expected to occur in meetings, with the leader of the group usually the one who does the bulk of the writing. At the macro-cultural level of the United States as a whole, writing at a whiteboard/blackboard (or more generally, using any presentation technology) can be understood as invoking a particular cultural model of the appropriate roles and behavior of the participants which has been ingrained in adult members of the society through 12 or more years of schooling. All these levels of analysis are viable ways to discuss the simple act of writing on the whiteboard. In fact, it is often necessary to examine more than one level at a

time when constructing an interpretation of an observed event, to link, for example, cognitive processes of the individual with group social processes, which, in turn, are located within a larger cultural or macro-cultural context. Because of their emphasis on context, natural environment, and the view over time, ethnographic methods are uniquely adapted to providing rich material for multiple levels of analysis.

Participant Observation and the Ethnographer's World View

While there are many different techniques used in ethnographic studies, one technique used in nearly all ethnographic studies is *participant observation*. Participant observation is the process of studying a community[4] as one takes part in its activities. A discussion of participant observation -- and why it is so important to ethnography -- entails a discussion of the world view of the ethnographer.

It is generally agreed in the field of anthropology that assumptions made in most sciences concerning the subject-object divide between the observer and what is observed does not hold for observations of human beings by human beings. In anthropology, such observations are considered to be a result of the interaction of the ethnographer with the people observed and are therefore mutually constructed by the anthropologist and his or her informants.[5] Roger Keesing has described the problem in this way:

> As European philosophers have pointed out, minds trying to understand other minds, conscious organisms observing conscious organisms, creatures with *moral* (that is, ethical/evaluative) systems studying creatures with (often different) moral systems can hardly be objective. Physicists observing the statistical effects of unseen particles are processing their observations in mammalian brains subject to the foibles of psychology; but they come closer to objectivity than anthropologists observing Brazilian Indians. Though physicists disrupt the particles by observing their effects, they can control for this disruption; but the Brazilian Indians are *conscious* of being observed and may manage their outward behavior so as to create desired impressions (the anthropologist from an alien culture may not get the intended impression in any case). Moreover, our cultural values...and psychological orientations predispose us to see and record selectively (Devereux 1967). At best, minds meeting other minds involve a process of *intersubjectivity* that can too easily be spuriously glossed over and objectified (1976:6, emphasis in original).

While social scientists who set out to study human behavior using a rigorous experimental design and "objective" methods may have quantifiable results describing how their subjects act under controlled conditions when given a limited set of options, real life subjects outside the laboratory do not act under these controlled conditions, or choose from the same limited set of actions or responses. Anthropologists are interested in real-life

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[4] The term community, as used here, refers to any site of ethnographic research or unit studied by an ethnographer.

[5] Anthropologists use the term "informant," rather than "subject," to refer to the individuals they study. An informant is any member of the group being studied who provides information to the ethnographer.

subjects acting in real life, and the best way to study and understand these is through observation in natural settings.

The ethnographer, as an outsider (i.e., a non-native), is often able to *observe*, literally to *see*, things which the native observer cannot. The native observer often has great difficulty seeing things which are, for him, taken-for-granted aspects of how the world is, but are in fact a part of culture. The non-native observer, on the other hand, has a different set of assumptions about what is right and natural, and many of the details which disappear to the native stand out sharply to her.

By *participating* in activities, the ethnographer gains access to information which she could not gain by observation alone. Participation redefines her role in an activity; as a participant she is subject to expectations and responsibilities which a non-participating observer would not be subject to. She becomes a novice in the activity, to be taught appropriate behavior, dress, speech, and even affect for one engaged in the activity. This type of learning approximates the enculturation of a child.

Participant observation provides information which observation alone might miss. However careful an observer is to take detailed notes of all that happens, some things can be seen only through eyes trained to see them. Absences may be extremely significant, but may not be noted unless the observer knows what is supposed to be there. A detached observer may not give much significance to the fact that no one smiles during a particular ceremony, but a participant observer who is corrected for smiling inappropriately will certainly know that this is significant.

Participant observation also provides information which interviews alone might miss. An informant may fail to give information crucial for understanding an event for any number of reasons. He may consider certain details too trivial to mention, for example, or the information may be so basic to him that it is out of his consciousness. Certain pieces of information (e.g., details of ritual, bodily functions) may be taboo subjects which cannot be talked about, or can be spoken of only in the ritual context. Much cultural knowledge cannot be articulated easily by its bearers. When the ethnographer becomes a *participant*, however, no matter how hard she may try, she will undoubtedly fail to meet all of the expectations inherent in participation. Ironically, these failures despite one's best intentions often provide the best information: Even an informant who cannot articulate a basic cultural rule will be able to correct the person who breaks it.

Participant observation does not mean that the ethnographer strives to become a native. It merely means that, rather than striving to remain a detached objective observer -- an impossible goal -- she becomes engaged with those whose lives she is interested in studying.

and allows this engagement to be a source of information and active learning.[6]

It is the combination of participation and observation together, the ability to move between a position *inside* and one *outside*, which allows the richness of information and interpretation that is the hallmark of ethnography. Whereas the observing outsider has only his or her own preconceived categories, distinctions, and world view to use in making sense of the "native's" behavior, the *insider* is able eventually to grasp the world as the "native" perceives it, to use *his* categories and distinctions, to understand *his* moral universe. By taking the perspective of the *outsider*, the ethnographer is able to step back, to analyze and interpret the observed behaviors and expressed beliefs in a way in which the individuals enculturated solely into that universe cannot. Ideally, the ethnographer is constantly moving between the two positions, insider and outsider. The knowledge and understanding she gains as an insider informs the meanings attributed by the outsider. The perspective of the outsider allows her to formulate questions not available to the native, and to see connections, relationships, and patterns not visible to one located solely within the insider position. These questions and insights, in turn, further help to focus the observations of the insider. The process is dialectical, one of constant revision, constant questioning of one's interpretations, observations, and research questions, based on one's unfolding understanding. Only when observation is firsthand, personal, local, and sustained through time can this process occur.

So far we have discussed some key concepts for ethnography and described several general principles which underlie ethnographic studies and make them ethnographic. In the remainder of this paper we turn our attention to other aspects of doing ethnography: pragmatics of the process of preparing for and conducting an ethnographic study, and a discussion of ethical responsibility in ethnographic research. Throughout, we draw for examples and illustrations upon an ethnographic study of student software engineering teams with which the authors were involved.[7] Before turning to the process of doing ethnography, let us briefly describe this project.

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[6] We recommend against the researcher undertaking the study of a group of which she is already a member. Just as it is naive to assume that one can gain a true understanding of the motivations, behaviors and beliefs of a person from another culture (or subculture) through objective, detached observation alone, it is equally naive to assume that one can gain the kind of understanding characteristic of ethnographic analysis and interpretation as an insider only. It is exceedingly difficult to observe one's own culture because of the problem of *seeing*. Any culture in which we have been successfully enculturated obscures for us its very existence because it is the nature of culture to appear natural. It is even more difficult to try to observe oneself. For one not thoroughly trained or practiced in ethnography (and sometimes even for those who are) the challenge of "othering the ordinary" and questioning taken-for-granted knowledge when you yourself are among the producers of that knowledge are monumental.

[7] James Reeves was one of three ethnographers on this project. Carole Cain provided administrative support, and assisted with data management and analysis. For a complete list of those involved in the Collaboratory Project, see Acknowledgments.

The Collaboratory Project

The ethnographic study that motivated this description of methodology was part of a larger project to design and build a computer system to support -- in a single system -- cooperative work normally carried out with and without the computer by members of a collaborative team (Smith, Smith, Calingaert, Hayes, Holland, Jeffay, and Lansman 1990). For example, such a system might have teleconferencing capabilities, shared drawing space akin to a whiteboard, shared text space, and the ability to organize and retrieve documents of all types used in the collaborative project. An ethnographic study was conducted in order to learn how collaborative work actually gets carried out in the real world: What resources are used in the process? What artifacts are produced by the group? What technologies are used to create or modify artifacts? What technologies are used by group members for communication and work with one another? Where and how is the work done by the members?

The site chosen for the study was a university course in software engineering. This course, taught annually, was required for graduate students and advanced undergraduate majors. Course emphasis was on giving students "real world" experience working on large scale programming efforts. While class lectures and readings focused on how to conduct programming projects in a business-oriented fashion, students worked in teams to develop real software products for real clients. Clients were members of the university community who had submitted proposals to the course instructor and agreed to act as clients for the course in exchange for free programming labor. The student teams' work was evaluated by both the course instructor (called "boss" for the purpose of the projects), and the client. Each project had to be completed during the course of the semester, and each was of a large enough scale to require the team to work collaboratively in order to meet this deadline.

In keeping with the simulation of a business-oriented setting, team members were assigned roles. Each team was required to appoint members to two leadership roles. The Technical Director was ultimately responsible for all technical aspects of the software engineering project, and the Producer was responsible for administrative aspects of the project. Remaining members of each team acted as programmers.

For the ethnographic study, three anthropologists each followed one project team[8] throughout the semester. The three teams followed varied considerably in the makeup (and expertise) of their members, ranging from one team made up of all advanced graduate students, to another which consisted of one graduate student and two undergraduates. One team worked on developing a 3D interactive modeling program using Head Mounted

[8] The project teams to be followed were randomly selected from among those teams in which all members gave their consent to participate.

Display. Another produced a systems analysis of a large database system, and made recommendations and produced some code for changing the way reports were generated in the system. The third team worked on building and testing a module implementing algorithms for simulating light diffusion in modeled buildings in a Virtual Reality system.

Each ethnographer observed working sessions of his or her project team, as well as meetings with the boss, the client, and the reviewers (a team of graduate students who reviewed drafts of group documents before they were turned in to the instructor). Class meetings were also observed, and interviews conducted with team members and other principals. Most meetings were audio taped while observers took notes. Some meetings were videotaped. In addition, the ethnographers collected "artifacts" produced by the teams during the course of the projects.

The Process of Ethnography

This section deals with the pragmatic considerations involved in preparing for and conducting an ethnographic study. Our purpose is not so much to provide a definitive "how to" manual as to raise issues and point the researcher toward considerations which go into planning and conducting fieldwork. Engaging in ethnographic fieldwork challenges a researcher on a number of levels and can be grueling even when everything proceeds smoothly.[9] Of course, things don't always work out perfectly. One can run into a host of problems covering the gamut from bureaucratic concerns about getting official permission to conduct research, through logistical challenges, to intellectual worries about the research. However, preparation beforehand can keep such problems at the level of minor (or major) nuisances rather than complete disasters. The process of preparing for and conducting ethnographic research can be divided into six steps:

1. **Defining the study.**
2. **Choosing an initial methodology.**
3. **Selecting a site and people to study.**
4. **Fulfilling ethical responsibilities.**
5. **Training ethnographers and doing fieldwork.**
6. **Analyzing the data.**

Step 1: Defining the Study

Identifying a General Area or Problem for Study

While ethnographic methods stress a holistic view, this does not mean that studies are unfocused. Before an ethnographer begins research, she must define a particular problem or domain to study, and establish the boundaries of the study. For example, she might want to

[9] See Wengle 1988.

examine design in the electronics industry. This would be her general area of interest. To set the initial boundaries of the study she must also define a preliminary level of analysis and the general characteristics of appropriate informants or participants. For a preliminary level of analysis the ethnographer must decide whether she will interpret what she observes in terms of individuals, small-groups, entire institutions, sub-cultures, cultures, or some sub-set of these. Her choice will depend in part upon the question or problem her research addresses. The general characteristics of subjects will depend on the level of analysis and on how detailed the problem she is investigating. Returning to the example of the Collaboratory study, the general problem for study was how collaborative work is carried out in "real world" programming projects. Appropriate participants for study were thereby defined as individuals engaged in collaborative programming efforts as part of a project team. For convenience of timing and proximity of the field site, student project teams in a software engineering class were chosen as the groups for study. The level of analysis was set at small groups within the software engineering (and university) sub-cultures.

Generating a Set of Orienting Questions and Concepts

After establishing the problem area and boundaries of the study, those involved with the research should meet and generate a set of orienting questions and concepts to guide the initial phases of the project. This list of questions and concepts represents the initial goals of the study. The set of ideas generated is important for providing a framework for making observations in the first few weeks of a study when the situation observed is strange, chaotic, and difficult to understand. In any observations in a natural environment it would be impossible to note every aspect of every event; the amount of material would be overwhelming, and the observer would be physically unable to attend to everything at once. The orienting questions serve to focus the observer's attention on those aspects of the activities which are expected to have the most bearing on the problem being investigated.

Once the ethnographer has been in the situation for some time, she may realize that this list of questions and concepts needs to be amended or revised, as previous assumptions are challenged, and additional aspects of the situation which she did not foresee become evident. The questions and concepts included in the list generated initially may therefore evolve over the course of the study. Nevertheless, referring to this document (or its evolved form) regularly during the course of the study is useful in focusing the investigator's observations and, if more than one ethnographer is engaged in the project, in making sure that they are gathering comparable data and observations. This list can also be a tool for preliminary analysis of data during the ongoing study, as the researchers consider the data

gathered and generate a set of working hypothesis.[10]

For the Collaboratory study, the researchers began with two major, overarching questions, "What artifacts[11] are [the] groups producing and what technologies do they use to a) modify the artifacts, and b) communicate and work with each other?" and "What are the sites/activities and modes of cultural and cognitive production for the group?" These questions were elaborated into a set of more detailed questions which focused the attention of the ethnographers on aspects of the group's activities expected to be of importance to the major questions. This was particularly important given that three ethnographers were involved in the project. For example, the major question about production and modification of artifacts was elaborated into questions such as: What kinds of artifacts do the teams produce? In what media are these artifacts stored and transmitted? What types of intangible products are produced? At what sites are these artifacts produced? What types of artifacts are disseminated and shared among team members? When is a representation translated from one form to another? What situations foster one method of dissemination over another? The complete list of orienting questions from the Collaboratory study is included in Appendix A.

Step 2: Choosing an Initial Methodology

How does one choose an appropriate set of methods from those available? Theoretical orientation, a set of initial assumptions about the situation, and some pragmatic considerations will drive the choice of methodology. There is not sufficient space here to address the various social theories, theories of culture and group behavior found in anthropology and other disciplines. Fortunately, one does not require an exhaustive theory of society to engage in fieldwork. Presuppositions about the situation to be studied and the set of orienting questions which will provide a guide for initial observations will also help determine initial methods employed. As mentioned above, this set of orienting concepts will change over the course of the study. As one becomes more familiar with the subject of the research, some of the initial ideas will not prove to be relevant, while unanticipated phenomena will appear and need to be accounted for. In turn, the methodology will evolve during the course of the study as important topics to investigate or follow-up become apparent.

Some of the pragmatic and conceptual considerations in choosing a set of techniques or methods include the following:

1. Resources available: How many people and how much funding does the project

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[10] See Step 6: Analyzing the data.

[11] Artifact in this context means both tangible products such as whiteboard drawings, pen and paper sketches, lists of programming assignments, documentation, printouts of code, etc. and intangible products such as lists of tasks, status reports and plans for action expressed verbally only and "airboard drawings" (explanatory gestures made in the air as if sketching on a whiteboard).

have? How much time can the researchers devote to the study?

2. Access to the field site: How much time will the researchers be allowed to spend at the site? Is transportation around the site a factor? Are there limitations on who researchers may talk to or what they may see? Are there restrictions on what equipment can be used at the site?
3. Type of data needed: What kinds of data are needed to answer the research questions? What are the best methods for getting this data?
4. Availability and practicality of equipment: What equipment is available for use? Is use of this equipment practical in the site chosen?

If resources or access to the site are severely limited, the researcher may need to choose methods which gather specific types of information as quickly and efficiently as possible, for example, doing relatively less participant observation, and more interviewing. However, this decision would mean sacrificing some of the richness of information which makes ethnography unique and valuable. It would also mean imposing more of the presuppositions and assumptions of the researcher regarding what is important or how things are done,[12] rather than allowing the native definitions of these and other aspects of the work to emerge.

In choosing methods or techniques, it is always necessary to keep in mind what one wants to know, and what kinds of data one needs to find it out. If one wants to know how groups negotiate leadership roles, participant observation is ideal. But if, in addition, one wants to know what each group member's understanding of the various leadership roles is, then the methods should include individual participant interviews as well. If cultural models of production are a focus of the research, a specialized type of interview designed to elicit native terms and models of production will be very useful in conjunction with participant observation. If the research questions call for a detailed analysis of speech then high quality audio recording is needed.

Choosing an appropriate methodology requires a clear and detailed conceptualization of the goals of the research, and as much information about the fieldwork site as possible. It also requires a realistic appraisal of the advantages and drawbacks or limitations of various techniques or types of equipment, including such things as technical limitations of equipment, the researcher's skills or training in its use, and the impact upon the research participants, the field site, and the situations studied.[13]

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[12] For example, in choosing what activities to devote limited observation time to, or in the questions asked in the interview.

[13] These issues are addressed further in the section on equipment under Step 5: Training ethnographers and doing fieldwork.

Step 3: Selecting a Site and People to Study

The most crucial variable in an ethnographic study over which the researcher can exercise control is the selection of the fieldwork site, and the most important concern in selecting a site is whether or not it has relevance to the goals of the study. Presumably, by the time the researcher begins the process of site selection, she has already defined the problem to be studied and given thought to the general characteristics of the site necessary to investigate the problem. For example, if she is interested in examining how a group of programmers evolves methods of cooperating with each other over the lifetime of a large software project, then she needs to find such a project that is just beginning rather than one which has been in existence for some time. Since the researcher is interested in cooperation, an additional necessary characteristic would be that the group chosen not function within an institution with a very rigid, pre-defined and externally enforced division of labor, such that the members rarely have any need to interact with one another.[14]

As the above example illustrates, in order to choose an appropriate site, one must have a well thought out initial focus for the study to be conducted. Here again, the initial set of orienting questions and concepts is of use. Just as these concepts help to dictate the set of methodologies for the study, they can also be used to evaluate potential sites. Ideally, this set of questions and concerns should be as complete as possible. In the real world, there will be factors that one overlooks. In fact, there may be no site that fits all one's criteria. In that case, the characteristics of the available sites will have an influence on the orienting concepts and questions and on methodology, as illustrated in Figure 1.

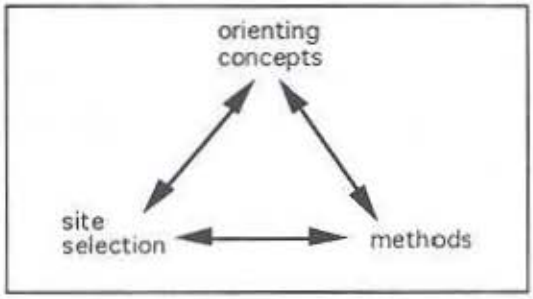

Figure 1. Orienting concepts, site selection, and methodology are interrelated.

Narrowing Down the Potential Sites

The first step in selecting a site is to find a number of places which one believes will fulfill the goals of the project. The list of potential sites is narrowed down by determining which one can get access to at all. Let us take as our example a study of new product development at a U.S. electronics company. We must first get a list of all electronics

[14] Such a case may actually give interesting information about how cooperation evolves despite formal communication structures, but this is not the primary focus of the researcher's initial concerns.

companies which are potential sites, and then determine which companies will allow outside researchers to conduct a study there by speaking with a representative of the company -- usually someone in charge of public relations. Some firms will be amenable to the idea and others will not. In addition, some companies may allow such research, but have general policies regarding it (e.g., restrictions about publication) that might make it less than ideal. This process of elimination will determine the list of sites that need to be evaluated.

Evaluating a Site by Visiting

The best possible way to evaluate a site is to visit that site. But what should the researcher do during a site visit? We recommend one begin by meeting with two sets of people: (1) Those who are empowered to give access to the site, and (2) Those who will be the informants or subjects of the study. In a traditional anthropological situation those empowered to provide access to a field site are generally government officials at the local, regional and national levels, and one usually has to secure permission at all of these levels. In the case of a company or organizational work setting, one will have to secure permission from those in the various levels of management or administration. Assuming that permission at the corporate level has been secured before the visit, one should meet next with regional or divisional level managers who will establish the particular policies for the research which may differ from the general policies of the company as a whole. These individuals are also likely to identify particular groups or places one may study. After securing permission at the corporate and regional or divisional levels, the researcher needs to meet with the particular people who will be the informants or subjects of the study in order to explain the purpose of the study and get their consent. In both sets of meetings, one should make sure that the intended methodology is acceptable. Many companies, for example, are sensitive to the presence of cameras in their facilities. If videotaping is important to the research methodology, then the researcher, the subjects, and the representatives of the company need to reach an agreement regarding who and what can be videotaped, when tapes can be made, and to whom they can be shown.

There are a number of other factors that come into play in evaluating a site. Among these are the representativeness of the site, its stability, whether it is appropriate for the methodologies and resources available, and the physical accessibility of the site. Because of the small sample size necessitated by the "cost" of ethnographic studies, if one wishes to generalize the results of the research across an entire community or industry, some sense of whether the site is representative of similar sites or not is desirable. An idea of the representativeness of a site can be obtained by visiting several different sites or by interviewing people with experience in the area one is studying. If generalizability is a goal of the study, sites which are unusual or unrepresentative can be eliminated at this stage. On

the other hand, if one is interested in innovation, sites offering this can be highlighted in this stage.

Ideally the site selected should be stable. In traditional anthropological work, revolutions and major changes in government can mean that access to the field site is no longer possible (both in terms of the researcher no longer having research permission, and in terms of physical danger). In examining organizational or work settings in industrialized nations, another form of stability may be desirable. If the study is to be conducted over a period of several months or more, it would be advantageous not to have the work of the people one is observing disturbed by events such as corporate reorganizations or mergers.

As mentioned above, potential sites must also be evaluated in terms of the methodology to be employed. If, for example, in the course of studying new product development, one wishes to make a detailed conversational analysis of design meetings or an analysis of the use of presentation media such as whiteboards or overhead projectors, then audio and video recordings, respectively, are necessary. A site where such recording was not possible would make such a methodology very difficult to pursue. The question to be asked in evaluating a site in terms of its appropriateness to the proposed methodology is "Can I gather the kind of data that I need in a reasonable fashion?".

Finally, physical access is also a concern. One has to weigh logistical factors such as commute time if the site is distant, and the amount of time that can be dedicated to the study. In the Collaboratory study three researchers participated. All had responsibilities and tasks other than the study, including teaching and taking courses, writing Master's and Ph.D. theses in areas of research not directly related to the study, and (in the case of one researcher) working on co-authoring two books. This limited the amount of time which could be dedicated to the study to about twenty hours per researcher each week. The researchers had identified some potential sites for the study in a research park located about fifteen miles from the university, but concerns about the logistics of physical access made those sites untenable. By doing research on the campus where they were already based, they were able to spend more time actually observing, rather than traveling, and had greater flexibility to observe different events on a staggered schedule, since they could more readily move between events at the site and their individual responsibilities elsewhere.

Step 4: Fulfilling Ethical Responsibilities

Ethnographic research is research about human beings, and the researcher has ethical responsibility to protect the welfare and well being of those whose lives (work, practices, etc.) she studies. These ethical responsibilities are not fulfilled at one point in time, during the process of planning the research. They extend throughout the entire research process and beyond -- to include writing about and publishing the results of the research. In this section

we deal with specific ethical responsibilities and requirements which the researcher must fulfill before the research begins. In a later section of the paper we deal with more general ethical responsibilities of ethnographic research, including potential risks to participants and steps which should be taken to minimize these risks.

Federal Requirements and IRB Approval

Federal legislation requires that all research involving humans as subjects conducted at or sponsored by an institution or agency that applies for federal research grants must be approved by an Institutional Review Board, or IRB. Each agency is required to file an "Assurance of Compliance with HHS Regulations for Protection of Human Research Subjects." As ethnographic research involves humans as subjects, any such research conducted by faculty, staff, or personnel at a university or agency which applies for federal research grants must be approved by the Institutional Review Board, regardless of the *site* of the research or its funding source. The researcher should plan on submitting a proposal for review as soon as she has the project well thought out and planned, but far enough in advance of beginning the actual research that any concerns which arise in the board's review can be addressed, and changes made if necessary. If the researcher's affiliation is with an agency or company which does not apply for federal grants, she should consult the agency's legal advisor about regulations for research involving human subjects.

The exact procedures for obtaining review board approval may differ among agencies or institutions. As a general rule, the principle investigator must submit a proposal and request for review. The proposal must describe the research project in some detail, and must address certain specific issues of potential risk to participants, and the means taken to minimize these risks. Even the seemingly most benign research may have negative effects for participants unless care is taken in the planning stages and throughout the research and reporting processes to protect informants and minimize risk. In addition to providing a legal check on potentially harmful research practices, the review process can help the researcher think carefully through the potential risks and plan how to protect participants.

Obtaining Informed Consent

One of the most basic concerns for research involving human beings, and a primary requirement for approval by the review board, is that all participants give their informed consent to participation in the research. Informed consent means that the nature of the research project, its risks and benefits, the nature of the individual's participation, and the individual's rights have been explained thoroughly, and that the individual freely agrees to participate in the research. Normally, informed consent is obtained by means of a written and signed consent form. In the case that the individual is not able legally, physically, or mentally to give consent for herself, written consent of the parent or guardian is required. In some

special cases, oral consent may be substituted for written consent.

What constitutes informed consent? As a general rule, "potential subjects must be given all information that might reasonably be expected to influence their willingness to participate" (Office of Research Services, UNC 1989:8). This requires a clear description of the research project in language that can be easily understood by a lay person not familiar with scientific or social scientific terms. An explanation of the purpose of the research, and of the procedures to be used, should be included, as well as a clear disclosure that the project involves research. The participant should be told who is conducting the research, how long his participation is expected to last, and the approximate number of people participating as subjects. *All* potential discomforts, risks, or costs to the participant must be clearly disclosed and explained. Potential benefits which can be *reasonably* expected, and any monetary or other inducements to participate should be described. An assurance of confidentiality must be made, and an explanation given of how confidentiality is to be maintained. The participant must be given the name(s) and phone numbers of the investigator(s) conducting the research, and told that he can contact them at any time should he have questions regarding the study. The role of the review board should be explained, and the participant told that he can contact the board's representative if he feels his rights have been violated. The name and phone number of this representative, or the review board's office, should be given for this purpose. Finally, a clear statement that the individual's participation is voluntary, and that he is free to refuse to participate, and free to withdraw from participation at any time, without penalty or jeopardy, is required. These statements must be made in a non-coercive manner, so that the individual feels free to choose not to participant, regardless of his status or position relative to the researcher, or to the institution (agency) conducting the research.

If written consent is to be obtained, the consent form should contain all of the above information, and a place for the signature of the individual indicating consent. Alternatively, some of the above information can be provided to the informants in writing on a separate sheet of paper from the consent form. In this case, this information should be provided and explained at the time consent is obtained. For individuals who cannot legally represent themselves, the signature of the parent or guardian is required. Two copies of the consent form should be provided. One copy is to be signed and returned to the researcher; the second copy is to be given to the participant to keep.

In certain circumstances, oral consent may be obtained. As a minimum requirement for oral consent to be sufficient, the research must be shown to involve no risks to the participants. For oral consent to be obtained, a verbal explanation of the research must be given, which includes all of the elements of informed consent discussed above. In addition, a

written statement including this information and the names and phone numbers of the Principle Investigator (or, in the case of student research, the Faculty Advisor) and review board representative must be given to the participant to keep.

For the Collaboratory study, a written consent form was used. Each member of the programming teams which participated in the study indicated his or her willingness to participate by signing this form. A copy of the Collaboratory Study consent form is attached as Appendix B.

Research Involving Children.

Special considerations and more stringent requirements govern research involving children as subjects. Lower levels of potential risk are acceptable unless the prospect of direct benefit clearly outweighs the risk. Additional regulations govern informed parental or guardian consent, and children's assent (Office of Research Services, UNC 1989). Researchers should consult a representative of the review board or their agency's legal officer before undertaking research involving children.

Step 5: Training Ethnographers and Doing Fieldwork

The task of training ethnographers goes beyond familiarizing people with a range of specific techniques. This task can be divided into dealing with a set of conceptual and philosophical concerns centered on a particular way of observing, and a set of practical concerns such as how to take field notes, handle equipment, and gather, organize, and analyze data. The practical matters are straightforward and simple to address while the conceptual concerns represent a more difficult topic.

Conceptual Concerns: Training Ethnographers in a Way of Perceiving

Ethnographic methods have escaped the bounds of the discipline of anthropology in recent years. Increasingly, other disciplines, such as qualitative sociology, psychology, and education, are exploring ethnography. With this expansion of the awareness of ethnography as a useful tool has come a desire and a need in other disciplines for training in this methodology. For an anthropologist, the notion of explicitly training ethnographers is, we might say, somewhat foreign. Traditionally, anthropologists have learned their trade through a long apprenticeship in graduate school during which they were not so much instructed in a set of techniques as immersed in a world view. Researchers from other disciplines do not typically consider this a very practical training method for their own purposes. From our own perspective, there may not be a good alternative: the practice of ethnography is tied up with a particular way of observing that involves a set of attitudes and values, the acquisition of which is more a matter of inculcation than training. However, some particular features of an ethnographer's perspective can be isolated and discussed in terms of their utility for conducting an ethnographic study.

"Othering" the Ordinary, Questioning Taken-for-Granted Knowledge

One of the key ways of perceiving that an ethnographer must develop is the ability to view the ordinary, everyday and mundane as unusual and in need of explanation. In a sufficiently strange setting this is not difficult because that which is mundane to informants may well be unique and different to the ethnographer. However, in a situation with which one is familiar, it is necessary to question one's taken-for-granted assumptions about social behavior. In the United States, for example, a greeting such as "How are you?", "How are your doing?", or "How are things going?" is expected from friends and acquaintances when seeing them for the first time during the day. The expected response is something like "I'm okay" or "Fine." A response other than this is often considered atypical. One would not, for instance, provide details about the state of one's gastro-intestinal system, though this is a perfectly acceptable response in some cultures. Outside of the United States, typical social greetings may be quite different; for example, one might ask a friend whether he has eaten rice today. In both cases the greeting and the response are examples of a taken-for-granted social interaction on the parts of the participants. An ethnographer can learn quite a bit by examining this, however; for example, by asking questions about the function and meaning of the taken-for-granted behavior in particular contexts. In examining a subject like social greetings, one can ask what information this convention reveals about a society. Among other things, social greetings could tell us about status hierarchies (who greets whom in what order) and about the values of a society (whether the greeting is an inquiry about the health, current activity, or nutritional security of the person greeted).

Learning to be Ignorant

Those who engage in ethnographic research are generally professional academics or researchers and as such they are members of one of the most highly educated sections of the world's population. However, ethnographers often observe situations about which they know little and are therefore neophytes. In fact, the professional ethnographer might well be considered a professional novice. The combination of being both highly educated and expert, and being considerably ignorant and unpracticed, can pose some difficulties for people pursuing fieldwork for the first time. The would-be ethnographer has to learn to accept being a novice in the situation she studies, even though she is an expert in her own academic discipline. Often this means accepting the role of an adult "child" who has to learn all of the social mores and rules of a group, institution, sub-culture or culture. One of the consequences of all of this is that she will ask "stupid" questions that her informants feel anyone with any sense should know the answer to already.

Over time the ethnographer will gain quite a bit of knowledge about the fieldwork situation. In this sense, she will no longer be a novice or child, and she will probably not ask

that many "stupid" questions anymore. However, it is a good idea to cultivate the ability to continue to ask these questions because they tend to challenge taken-for-granted beliefs and behaviors and get informants thinking about subjects which they usually accept as the natural order of things. They also help test one's own developing understanding and knowledge of the culture. In this way one should move from accepting ignorance to learning to be purposefully ignorant.

Practical Concerns: Recording Data

The primary means of recording ethnographic data is field notes. But what exactly are field notes? Simply put, they are a compilation of the ethnographer's observations, analysis of (and reactions to) the activities, actions, and words of the people being studied, and the field site. Such basic aspects of cultural diversity as distinctive smells and sounds, facial expressions, and gestures, as well as the hundreds of details of everyday life, will be most apparent to the ethnographer in the earliest days of the research, before they become part of the fabric of everyday life and fade into the background. For this reason, these observations are recorded in as much detail as possible, even before they can be interpreted or understood by the observer. Observation and detailed recording should continue throughout the fieldwork, as perceptions will change, greater levels of detail be uncovered, misperceptions be corrected, and understanding develop.

Field notes are idiosyncratic in that each researcher will prefer his or her own system of abbreviations, method of offsetting (where possible) observation from preliminary speculation, and ways of coding the identity of individual informants or groups.[15] Despite the individual nature of such records, there are some elements which will be useful to include in all field notes. The *time* and *date* of the events or situation observed is necessary for organizing data. The name, initial, or code of the *researcher* or *observer* taking the notes is necessary if more than one researcher is involved in the study, or if field assistants are helping in the data collection. The *context* of the observation should be described, along with a brief statement of the situation observed, for example, "a design meeting to discuss pasting 3D objects." A list of *who is present* at the event observed is important, and can serve later as an index to the field notes when trying to locate all instances where a particular individual or group was observed. The *location* of the observations (e.g., "in the meeting room outside the lab"), and a description and/or diagram of the *spatial layout* of the location will serve as the basis for analysis of group dynamics. The description should include general information about the surroundings: the building, furniture, presence and location of whiteboards, overhead projectors, or other physical objects, and where people are located. As a particular

[15] See the Ethical Responsibilities section of this paper for a discussion of the necessity of this and other measures for protecting the confidentiality of informants.

Box 1
Example of Field Notes

5:15 Mtg begins: C code written by TD circulated.
5:23 TD explains some about handout and compiling stuff [Producer will compile]

TIME STAMP

5:24 TD: 3rd data structure change for the FED.

5:25 P1 suggests lifting some code from [redacted]'s work

5:27 TD to whiteboard

5:29 TD "As long as it works..." [In reference to Debate on algorithm for calculating area]

5:30 Excellent interaction: not using whiteboard, P2 drawing on handout; everybody gathers around; debate keeps going on; Why not use the whiteboard.

P3: "It's not a design decision, its a coding decision in reference to debate over area calculating

5:33 TD: "As long as it works I don't care..."

5:36 META: code printout brought by SS and others - Mediating device

5:36 P3 asking about what TD might want him to do.
5:38 P1 introduces presentation idea
TD Won't work because it's based on specific device this material won't work with
Producer: "let's get some pictures 1st"

event is observed, any changes to the spatial layout should be noted, such as the movement of participants and their use of various physical objects. Each time something which is observed is recorded in the notes, the time of the observation should be recorded. This *time stamp* of the observations is necessary for any analysis focusing on the timing of actions, and is useful as an index to video tapes. If other forms of data collection are used during the observations (e.g., audio tape, videotape, artifacts collected), this should be recorded in the notes. Depending on the additional methods used, notes may focus on aspects not recorded by the other media. For example, if audio recording is also used, more attention might be paid to body language and facial expression in the field notes; if the events are videotaped, more attention might be paid to what is happening outside of, or obscured from, the camera's view.

Many of these elements can be seen in the excerpt from one ethnographer's observations of a project team meeting from the Collaboratory study, included as Box 1. This example is meant as a model only, and shows only one of multiple pages of notes written during this event. Field notes generally have to be taken very rapidly and in conditions where multiple activities are happening at the same time; therefore each individual should develop his or her own style for quickly and accurately recording observations which incorporates these elements in some way. It is very important that one be consistent in one's note taking style. If notes are not consistent they can become very confusing when one is looking back over them weeks or months later during analysis.

At the end of a set of observations or at the end of the day it is a good idea to look back over notes with the aim of filling in details briefly sketched out during the observation, correcting mistakes, and generally neatening the notes up. Additionally, if time permits, a brief textual synopsis of a day's observations and the observer's initial reactions and analyses should be written up at the end of the day. These steps will help make the notes much easier to work with when trying to analyze data.

Practical Concerns: Gathering Data

While field notes should be written up anytime the ethnographer makes an observation or has an interaction relevant to the study -- in other words, anytime the ethnographer engages in participant observation in its broadest sense -- some mention should be made of other forms of data gathering which accompany and augment participant observation and field notes. Here we will discuss two such methods: interviewing, and collecting cultural products or artifacts.

Interviewing. While much information is best gained through participant observation, many ethnographers find it helpful to supplement this method with interviews. Through observation one sees what the native does. In order to understand this behavior one needs to know what the native sees, thinks, feels, and understands.

Detailed ethnographic knowledge is needed to conduct a good interview, to identify topics of interest or requiring further inquiry, and to formulate useful questions and learn how to ask them in meaningful ways. It is necessary, as well, to identify the individuals one wants to interview, and build rapport with them. For these reasons, ethnographers seldom begin fieldwork by conducting interviews. Rather they become involved in the community through participant observation, and through participant observation establish rapport and begin developing the detailed knowledge needed to design a good interview.

Interviews can be used to get detailed personal information from some group of individuals. For example, the ethnographer may want to interview all of the major participants in an event she has observed. In the Collaboratory project, each member of each of the groups observed was interviewed separately -- after the semester had ended -- about how the project had gone, how the team members had worked together, and how each had performed his or her role.

Alternatively, an ethnographer may want to interview some individuals repeatedly, at different points in time. For example, she may want to interview major participants in a scheduled event before and after the event takes place. The interview before would ask about their expectations, and the one after the event would ask about their perceptions, or about how their expectations were or were not met. Interviews at regular intervals with a focus group can be used to investigate changing understandings, perceptions, opinions, etc., over time.

Another use of interviews is to collect comparable data from a number of individuals. Interviews are used in this case to make sure that all individuals are asked the same questions. If the group being studied is relatively small, it may be possible to interview all members. If, on the other hand, the group is large, a sample may be interviewed.

There are a number of different ways of categorizing types of interviews. Ethnographers often speak of *depth interviews*, interviews which probe at some length and with a great deal of detail issues of interest to the researcher. Ethnographers also distinguish between *formal* and *informal* interviews, a distinction seldom made by researchers in other fields, who generally use only formal interviews. A *formal* interview is a planned encounter, one in which particular individuals are sought out by the ethnographer and asked to provide particular pieces of information. The interviewer comes prepared with a particular set of topics -- perhaps a formal list of questions -- to be discussed or asked. These encounters are set apart from the normal daily activities of the informant. An *informal* interview is one which comes about without being planned in advance, often in a chance encounter (Crane and Angrosino 1992:57; see Nachmias and Nachmias a further discussion of types of interviews).

A word of caution about interviews and the interpretation of responses recorded in them: Beware of naive realism. *Naive realism* is the almost universal belief which

> holds that all people define the *real* world of objects, events, and living creatures in pretty much the same way. Human languages may differ from one society to the next, but behind the strange words and sentences, all people are talking about the same things. The naive realist assumes that *love, rain, marriage, worship, trees, death, food*, and hundreds of other things have essentially the same meanings to all human beings (Spradley 1979:4).

In interpreting interview material, it is all too easy to unconsciously fall into the trap of naive realism and assume that because we have captured the informant's words, and those words (or their translation) are the same as words we use, that the informant is using the words in the same way that we use them, to mean the same thing we mean by them. One need only think of the many ways in which the word "love" is used in our own contemporary culture[16] to grasp the idea that individuals in other cultures may not mean the same things, or use the same words in the same way. In order to combat naive realism, the ethnographer must begin with the conscious attitude of almost complete ignorance (Spradley 1979:4), questioning her taken-for-granted notions of what the informant means in making sense of what the informant is saying.

Collecting Cultural Products or Artifacts. Ethnographers often make use of cultural products or artifacts to learn about the group being studied. These may include physical objects, such as hardware, structures, drawings, or documents, or more ephemeral products, such as folklore, jokes, diagrams or sketches air drawn or marked on a temporary surface (such as a whiteboard) and subsequently erased.

Context is of crucial importance in the analysis of any cultural product. It is a basic principle in archaeology that it is the context which provides the information that the archaeologist must have to reconstruct a culture; an artifact removed from its context reveals little. For this reason, archaeologists record with meticulous detail how the earth and the artifacts and features it contains are arranged in relationship to one another, mapping, sketching and photographing the locations and orientations of each object in three dimensional space, and carefully recording such subtleties as the contours of variations in soil coloration and texture. It is in such details of context that inferences can be drawn about artifacts, sites, and the people who used them. The same principle applies to cultural products collected during ethnographic fieldwork. The objects themselves provide relatively little useful information without details of the context in which they were produced, used, and

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[16] Consider, for example, the meanings of the terms "parental love," "unconditional love," "love thy neighbor," "a lovely view," "falling in love," "making love," and "lover." Furthermore, the concept of romantic love is far from universal, and a relatively recent development in our own cultural tradition.

collected. The list of questions in Box 2 are provided as a guide to recording the context for collected cultural products. These questions only begin to scratch the surface of the possible questions which can and should be asked by the ethnographer about the context of cultural products. Failure to consider such questions can obviously lead to major problems in analyses and conclusions based on the examination of these products outside of their context.

Box 2
Guide to Recording Context of Collected Cultural Products

Context of Collection
- When, where, and how was the item collected?
- How did it come to be in the possession of the ethnographer?

Context of Production
- When and where was the item produced?
- By whom was it produced?
- Was it a solo effort or a group effort?
- For what purpose was it produced?
- In what form was it first produced, and what transformations did it undergo?
- What was the context of its production?
  - If it is a performance, who was the intended audience?
  - Who was the addressee?
  - Who else saw or heard the performance?
- What were the constraints affecting production?
  (Physical setting, time constraints, material constraints, etc.)
- Was the item spontaneously produced in a natural setting, or was it produced for the ethnographer, at the ethnographer's request, or for some other purpose outside of the normal realm of activity?

Context of Use
- How and by whom is the item used?
- Is the item one of many such items in existence, or is it uncommon or unique?
  - If it is one of many, is it a typical specimen, or is it atypical in some way?
- Is the object actually intended for use, or is it a representation or replica, not intended for actual use?
- What other cultural products are used or found in conjunction or in association with the item?
- Are there any prescriptions or proscriptions as to who may have access to the object, how or when the object may be used, viewed, handled, etc.?

Other
- What "lore" is attached to the item or its use?
- What are the reactions of different informants (both experts and laymen within the group studied) to this item?
  - What do they know about it?
  - What significance do they attach to it?
  - How do they evaluate it?
  - How do the responses of various people toward the object differ?
  - How are the differences in responses related to the position or relation of these individuals to one another and to the object?

Equipment for Note Taking and Other Forms of Data Gathering

There are a few pragmatic points to consider about the equipment used to take field notes. Typically one will take a lot of notes, so the first rule is to bring enough paper. The second is to avoid loose paper that might take a while to organize, since ethnographic observation often requires moving around. For the same reason, and because one will not always have access to a convenient surface to write on, a notepad with a stiff back is a good idea. Always have more than one writing implement because they do break and run out of ink.

One might think that having a pen or pencil and a piece of paper covers the issue, but it does not. People *react* to the implements used in note taking. In some circumstances a large notebook or even any notebook at all can be obtrusive. As an example, imagine the best man in a wedding party carrying a large notebook in which he scribbles furiously while the minister conducts the ceremony. This behavior might not be appreciated by the rest of the participants. Additionally, what one writes with can have an effect. There is an amusing story with an important moral which illustrates this. An anthropologist was engaged in a productive interview with an informant who was very eloquent and knowledgeable. During the interview, the anthropologist's pen ran out of ink, so he switched to writing in pencil. About this time the informant started answering questions with single word, single syllable responses. Puzzled, the anthropologist asked why; the informant replied that what he was saying must no longer be important to the anthropologist since he was now writing in pencil and would just erase it all when the interview was over! The point is that those we study react to us in ways that are difficult for us to foresee. An ethnographer must be sensitive to these reactions and adjust her actions accordingly.

Some mention needs to be made of other equipment which might be used as well. The most typical items are an audio recorder, a video camera or a still camera. The first rule about any piece of equipment is to know how to use it before you need to use it. This means practicing with it and understanding the conditions under which it can be used effectively. For example, if one is taping in a large room and the tape recorder's internal microphone cannot reliably pick up voices twenty feet away, it's going to be necessary to acquire an external microphone or two.

Preparation also requires checking the quality, durability, and condition of the equipment one intends to use. Things tend to get abused in the field and often one doesn't have the opportunity to readily replace items that break down. Make sure that the quality of audio and video recordings will be good enough for them to be worthwhile. Check the batteries before the interview or observation begins to make sure they will last throughout the session. Rechargeable batteries or battery packs for equipment are useful because they are

economical, and one can afford to put freshly charged batteries in equipment for each session. Nevertheless, it is a good idea to carry extra batteries, just in case. Try to carry extra audio or video tapes and film as well; invariably some observation sessions or interviews will go on longer than anticipated. Whenever recording, it is a good idea to use a back up method of data gathering. Take notes if possible. Machines do break and tapes do get lost or destroyed. Also, keep in mind that audio recording cannot record spatial layout or capture many of the dynamics involved in social interaction, such as physical movement, facial expression and body language, or what is written on whiteboards or air drawn.

Audio or videotaping and still photography can cause people to react in ways different from simple observing and note taking. Those being taped or photographed may self consciously change their behavior more than they would with other methods. On the other hand, there can be situations where recording or photography is more acceptable than note taking (our wedding example, for instance). One should be aware of the possible effects of different methods of data gathering.

Finally, one should keep in mind that everything recorded must also be analyzed if it is to be useful. Frequently this means that tapes must first be transcribed, which can be very time consuming and expensive. Some methodologies require such data; however, one should be aware of the cost of acquiring and analyzing it at the outset, and avoid using these technologies as a substitute for note taking.

Organizing and Managing Data

Ethnographic studies tend to produce large amounts of data. Some method of organizing, indexing, and managing this information is required. During the course of the study, notes, video and audio tapes, and other material collected should be filed using a straightforward system of observer, event, and date categories. Additionally, some information about each piece of data should be entered into a database. This information would include the observer, the event observed, and the date, as well as keywords describing the event, a list of participants, data types gathered (field notes, audio recording, photographs, physical objects, etc.). The database can then be used as an index to the material. In the Collaboratory study the construction of such a database was facilitated by the use of a "cover sheet" for each datum (Box 3). Each time notes were filed, a cover sheet was filled out. The cover sheet was then given to support staff to be entered in the database, freeing the observers from this task.

The set of keywords used in the database will be drawn from two sources: the initial set of orienting concepts behind the study and actual observations made during the study. Over the course of the study, unforeseen categories will emerge as important, and the researcher's understanding of how the orienting concepts of the study apply to the particular

cases observed will evolve. The result of this is that as the research progresses, the set of keywords will grow and change. The construction of the database should be considered a dynamic process: earlier entries need to be revisited and updated when additional categories of analysis are added or previous categories are modified.

Box 3: Cover Sheet from the Collaboratory Study

SOURCE OF DATA (circle categories in tree)

CLASS	OLD VIDEOS	
	OBSERVATION	E-MAIL
	INTERVIEWS	BOSS MEETING
		CLIENT MEETING
		PROJECT MEETING
		INTERVIEW (with_____)
PROJECT TEAMS	MW GROUP	REVIEW MEETING
	DH GROUP	INFORMAL MEETING
	AC GROUP	OTHER_____
	RR GROUP	
OTHER		

DATE:_____ OBSERVER INITIALS:_____

FORM OF DATA (circle one or more): notes audio tape VHS video 8 mm video tape
tape transcription artifacts other (include other locations of data):

_____

MEDIA USED BY GROUP (circle one or more): whiteboard handouts pen & paper foils slides
other:_____

KEY WORDS: _____

_____

_____

TAPE TRANSCRIPTION: [ ] not needed [ ] needed [ ] done
CONFIDENTIAL MATERIAL (circle one): Y N
FOLLOW-UP BY OBSERVER NEEDED (check box when done [ ]):

_____

DESCRIPTION OF ARTIFACTS:_____

_____

One final comment about organizing and managing data: Field notes and other materials can be stolen, lost, destroyed, or appropriated. Conditions regarding the physical security of research materials may dictate the necessity of making duplicate copies of everything. Copies of these materials should be made at the time they are filed. Duplicate copies should not be stored in the same location as the originals. Many anthropologists working in the field make a practice of sending a copy of their notes and other materials to a trusted colleague or a secure deposit "back home." Wherever copies are deposited, appropriate precautions should be taken to protect the confidentiality of participants.[17]

[17] See the discussion of protecting confidentiality of participants under Ethical Responsibility, below.

Step 6: Analyzing Data

At this point we will turn from the subject of how to gather, organize and manage data to that of how to analyze that data. Virtually all ethnographic analysis is, to some extent, based on comparison. Comparison for an ethnographer can take several different forms. There are comparisons made between what is observed during the study and the researcher's own previous experiences of related phenomena. There are also comparisons between various instances of the same general type of observation. The ethnographer could compare observations made on different occasions of the same student design team working together at the same basic task, for example, debugging. In this case, she might compare how team members' behavior was similar or different across these instances. Finally, she could compare the behavior of individuals across a variety of contexts: Do the design team members act in the same way when meeting with the "boss" as they do when working among themselves?

When two or more ethnographers are working together on a project, another form of comparison is possible: the observations of different researchers can be compared. On the Collaboratory project the ethnographers regularly invested time in telling each other vignettes about the particular groups they were observing as a way of detecting important differences between the three programming teams observed.

Comparisons between sets of observations should lead to a refinement of the ethnographer's theoretical perspective and understanding of the fieldwork situation. When sets of observations appear to the ethnographer to be paradoxical or contradictory, it is usually not the result of poorly executed ethnographic technique, but rather an indication of an incomplete understanding of the fieldwork situation. Making sense of puzzling, inconsistent, or unforeseen aspects of behavior is an ongoing process throughout the study. Often this process leads to the revision of the initial questions or concerns of the study. For example, an ethnographer might begin a study by focusing on a small group of engineers involved in developing a new product, but find that, in actuality, the design of this product is spread over a variety of groups with different responsibilities: a marketing group, a research group, a manufacturing group, etc. In light of this, she might expand the boundaries of her study to include the interaction of these various groups, a factor she did not originally consider to be a part of her study.

During the study preliminary analysis should generate a number of working hypotheses. In the latter stages of the study, particular attention might be paid to gathering data to confirm or disprove these hypotheses. Once a set of hypotheses is formed, one needs to return to the data in a rigorous fashion in order to see if what one thinks was happening actually happened. To facilitate this, one should pull relevant examples from the data and examine them closely .

Summarizing Data

As was mentioned above, it is useful to summarize a set of observations at the end of the day, and to include some preliminary analysis. Similarly, writing a summary of events at the end of the study (or every few months during a long study) can be extremely useful. Summaries serve to place individual observations in a wider context and engage the researcher with the data as a complete set rather than as individual observations. Since these summaries are retrospective, one can include information about links between events that may not have been immediately obvious while the events were taking place. Constructing summaries is also a productive way to go back over the data searching for instances that confirm or disprove preliminary hypotheses.

Summaries can take a variety of forms. In the Collaboratory study, three different types of summaries were produced: a week-by-week account of each group, case studies of particular artifacts, and an artifact database.

The Week-by-Week Account.

At the end of the Collaboratory project, each researcher wrote a summary of the group which he or she observed in a week-by-week format. This study lasted approximately sixteen weeks. In the week-by-week summary, each event observed during a particular week was described and a preliminary analysis given. Additionally, various types of data were "condensed" in these accounts; provisional lists of important artifacts used in each event appeared after the account of that event. At the end of the account for a particular week, a list of email exchanges for the week was given. An example of the summary of one week for one group's activities is given in Appendix C.

Artifact Case studies

A detailed analysis of a series of linked events constructed as a small case study is another form which a summary of data may take. For the Collaboratory study the researchers examined the ways in which particular artifacts were used over a period of time. In this way, they were able to see more clearly the ways in which the format, use and importance of these artifacts changed as the group's perspective on their task changed. For example, one artifact studied was a function call trace of the code with which the group was working. The case study begins by describing the events and conflicts in the group during the two weeks before the actual production of the artifact, thus outlining the circumstances which led up to one programmer producing the code trace as a hand-written document for his own use. It then traces the forms and uses of the code trace from this hand written drawing for personal use to a laser-printed MacDraw document appropriated by the group as a common tool for understanding the code. The original code trace produces spin-offs, traces of other sections of code. Eventually, as the group realizes that they will not be able to

have their code running by the end-of-semester deadline, emphasis shifts to improving their documentation in the hopes of salvaging the project and bettering their grade. Towards this end, the code traces are updated, expanded and polished to eventually become the central part of the final documentation. The actual case study of this artifact in its entirety appears in Appendix D.

Artifact Database

An analyzed database also summarizes data. This differs from the initial database used to organize data in that it involves developing a set of abstract categories for analyzing the database. In the Collaboratory study, researchers were concerned with all of the tangible and intangible artifacts the groups produced. In order to illustrate some of the differences among the groups observed, researchers analyzed all of the artifacts gathered (almost 600 total) and entered them into a database. The fields for their artifact database included a brief descriptive *name* of the artifact, the *date* the artifact was created or used, the *agent*, or person(s) who created or used the artifacts, the *meeting type* or type of event in which the artifact was created or used, the *data type* or physical form of the artifact, the *subject matter* of the artifact, and the *use* to which the artifact was put in the observed event. The latter two fields were coded using abstract sets of categories, for example, "required product" or "project goals" for subject matter, and "social," "organizing," or "creating shared knowledge" for use. Some of these abstract categories were followed by more information. For the *use* category, more than one use was possible, and the database included fields for up to three uses for each artifact. An excerpt of 20 artifacts from this database is presented in Box 4.

Presenting Results

Presenting the results of an ethnographic study is more an exercise in demonstrating a phenomenon than in proving a theorem or algorithm. This demonstration is accomplished by showing to others an orchestrated presentation of a number of detailed examples which illustrate the viability of the analysis. The form this presentation takes can vary considerably. However, all ethnographies, even the most experimental,[18] typically impart certain categories of information in one form or another.

Some information is given which provides the reader[19] with *background* regarding the conditions in which the study was carried out. This may include, for example, how the research was funded, when and over what length of time the study was conducted, and the preparation of the researchers.

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[18] "Experimental" is used here to refer to a set of post-modern ethnographic texts constructed to convey information about the fieldwork while also commenting explicitly on the problematic nature of writing ethnography. It does not refer to experimental methodology.

[19] The term "reader" is used here and following for convenience; the points made are equally true for other forms of presentation of ethnography, such as oral presentations.

Box 4
Artifact Database

Name of Artifact	Date	Meeting Type	Agent	Data Type	Subject Matter	Use #1	Use #2	Use #3
Scheduling Logs	1/23/91	Group	Producer	Hardcopy drawing and text	Organizing: scheduling mtg	Social: contention over role		
List of meeting times	1/23/91	Group	Technical Director	Whiteboard text	Organizing: scheduling mtg	Social: contention over role		
Introductions/Technical Background	1/23/91	Group	Producer	Talk	Organizing: introductions/background	CSK: group itself	Social: leadership amplification	
Introduction to Walkthrough	1/23/91	Group	Technical Director	Whiteboard drawing and text	Walkthrough	CSK: walkthrough		
SIGGRAPH Papers	1/23/91	Group	Technical Director	Talk	Reference	CSK: subject area		
Introduction to RCS	1/23/91	Group	Producer	Whiteboard text	RCS commands	Organizing	Social: leadership amplification	
Demo of Walkthrough	1/23/91	Group	Technical Director	Program demo	Walkthrough	CSK: walkthrough	Social: leadership amplification	
Introduction to Walkthrough	1/30/91	Client	Client	Whiteboard drawing and text	Walkthrough	CSK: walkthrough	Social: construct/control event	
Pictures of Clarksville's radiosity result	1/30/91	Client	Client	Pictures	Clarksville code	CSK: Clarksville code	Social: motivational	
List of project goals	1/30/91	Client	Client	Whiteboard text	Project goals	CSK: project		
John A's thesis	1/30/91	Client	Client	Talk	Reference	CSK: subject area		
List of project goals	1/31/91	Group	Producer and P3	Whiteboard text	Project goals	CSK: project	Organizing	Social: construct/control event
Format of Clarksville radiosity results	1/31/91	Group	Technical Director	Whiteboard text	Clarksville code	CSK: Clarksville code		
Schedule	1/31/91	Group	Group	Talk	Organizing: schedule of work	Organizing		
User-manual structure	1/31/91	Group	Producer	Whiteboard text	Required documents: user-manual	Organizing	Social: construct/control event	
Project definition draft	2/5/91	Review	Programmer 1	Hardcopy text	Required documents: project definition	Fulfill course requirement		
Foley and van Dam text	2/5/91	Review	Programmer 3	Talk	Reference	CSK: subject area		
Negotiation over documentation	2/8/91	Boss	Producer	Talk	Required documents: all	Organizing		
Status report	2/7/91	Group	Producer	Talk	Status report	Organizing	Social: construct/control event	
John A's thesis/SIGGRAPH paper	2/7/91	Group	Technical Director	Talk	Reference	CSK: subject area		
Clarksville theses	2/7/91	Group	Producer	Talk	Reference	CSK: subject area	CSK: Clarksville code	
Outline of user-manual	2/14/91	Group	Technical Director	Hardcopy text	Required documents: user-manual	CSK: documents	Social: construct/control event	
Information about Clarksville code	2/14/91	Group	Producer	Talk	Clarksville code	Organizing		
Project definition readjustment	2/14/91	Group	Producer and TD	Talk	Required documents: project definition	CSK: project	Organizing	CSK: documents
Documentation adjustments	2/14/91	Group	Producer and TD	Talk	Required documents: all	CSK: documents	Organizing	
Outline of directory structure	2/14/91	Group	Producer	Whiteboard drawing and text	Organizing: disk space	Organizing	Social: construct/control event	
RCS commands	2/14/91	Group	Producer	Whiteboard text	RCS commands	Organizing	Social: construct/control event	
Using playpens	2/14/91	Group	Producer and TD	Whiteboard text	Organizing: disk space	Organizing	Social: construct/control event	
Status report	2/18/91	Boss	Producer	Talk	Status report	Social: impression management		
Discussion of text processors	2/18/91	Boss	Group and Boss	Talk	Required documents: all	Social: impression management		
Documentation	2/21/91	Group	Producer, P1, P2	Talk	Required documents: all	Organizing		
Directory for Walkthrough code	2/21/91	Group	Technical Director	Whiteboard text	Walkthrough	Organizing		
User-manual division of labor	2/21/91	Group	Producer	Talk	Organizing: DoL/Task assignments	Organizing		
Clarksville code	2/21/91	Group	Producer and P2	Talk	Clarksville code	Organizing	Social: construct/control event	
User-manual contents	2/21/91	Group	Technical Director	Talk	Required documents: user-manual	Organizing		
Status report	2/25/91	Boss	Producer	Talk	Status report	Social: impression management		
User-manual draft	2/27/91	Review	Group	Hardcopy text	Required documents: user-manual	Fulfill course requirement		
Task assignments	2/28/91	Group	Producer and TD	Talk	Organizing: DoL/Task assignments	Organizing	Social: leadership amplification	
Clarksville code trace	2/28/91	Group	P2	Handwritten drawing and text	Clarksville code	CSK: Clarksville code	Look up info	
Status report	3/4/91	Boss	Producer	Talk	Status report	Social: impression management		
User-manual comments	3/4/91	Boss	Boss	Talk	Required documents: user-manual	Fulfill course requirement		
Status report	3/18/91	Boss	Producer	Talk	Status report	Social: impression management		
Clarksville code trace	3/21/91	Group	P2	Hardcopy drawing and text	Clarksville code	CSK: Clarksville code	Look up info	
Walkthrough code trace	3/21/91	Group	P1	Hardcopy drawing and text	Walkthrough	CSK: walkthrough		
Standardized error routines	3/21/91	Group	Technical Director	Whiteboard text	Program	CSK: program	Social: construct/control event	
Light list	3/21/91	Group	Producer	Whiteboard drawing	Program	CSK: program	Social: construct/control event	
Implementation document	3/21/91	Group	Producer	Talk	Required documents: internals	Organizing	CSK: documents	
Task assignments	3/21/91	Group	Technical Director	Talk	Organizing: DoL/Task assignments	Organizing	Social: construct/control event	
Design	3/21/91	Group	Technical Director	Talk	Program	CSK: program		

Information on the general *context* of the study provides the reader's entryway to the study, and a framework for interpreting the results and the researcher's arguments. This information includes the theory guiding the research, the general questions addressed in the study, and the methodology used. An introduction to the site -- how it was chosen, its relevance to the research questions, and perhaps some history and description of the site -- is also given.

Results of the study, including the researcher's interpretations of and conclusions about those results are given. *Evidence* from the study is provided to support these interpretations and conclusions. In presenting evidence, some context is given for how the evidence was gathered, both in terms of what methods were used, and the circumstances surrounding the events. For example, were the statements quoted made spontaneously in a discussion among friends which the researcher observed, or were they responses to questions posed by the researcher during interviews? What preceding events led up to the events described as evidence? Who was present at the event, and what were they doing at the time it occurred? This contextual information is important in interpreting the results and evaluating their significance, but it may also form an important part of the argument and part of the evidence itself.

Support for the researchers' conclusion is built up, either through a number of detailed examples, or through an in-depth case study of a particular set of events (e.g., the events of a single meeting) which illustrate the point which the researcher wishes to make and supports the conclusion she wishes to draw. The ethnographer's job is to convince the reader of her conclusions, not just to present them. Finally, the *implications* of the researcher's findings -- for theory, methodology, or perhaps pragmatic applications -- are discussed.

The format of the evidence itself will depend on the type of data gathered (which is to say, it will depend on the methodology). Evidence can be broken down into the following categories:

Textual

Textual evidence can be the researcher's own description of an event or the verbatim reporting of an informant's words or other texts from the field situation. Textual evidence can come from several sources, including transcripts of interviews with informants, transcripts of audio and videotapes of events (e.g., a design group meeting), the ethnographer's field notes, or texts produced by informants or used in the situation studied (including anything from textbooks to graffiti).

Visual

Photographs, film and videotape are all forms of visual evidence. Visual evidence is not limited to film shot by the ethnographer. Photos taken or films made by informants are also important. The subject of visual evidence is not restricted to people--visuals of material objects and buildings can be evidence as well. Examples

range from pictures of a ritual or feast focusing on the actions of the participants to photos of the buildings in a subdivision meant to demonstrate the link between architectural styles and predominant social values.

Graphic

Graphic evidence differs from visual in that graphic evidence is not produced with a camera. Graphic evidence includes such items as artwork, maps, diagrams, and charts. Again, these need not be produced by the researcher, but can be the products of informants. Examples could be a diagram of the layout of a conference room or a chart showing the distribution of some observed event over time.

Numeric

Numeric evidence includes items such as a mathematical models (e.g., of the dynamic changes in prey-predator populations) or calculations (e.g., of calories expended vs. calories gathered in food acquisition tasks), as well as demographic or statistical evidence.

Some general principles apply no matter which forms of evidence one is working with. First, the ethnographer will never be able to present all of the material gathered over the course of the study, both because the amount of the data gathered in an ethnographic study is so vast,[20] and because of the need to maintain the anonymity of informants and the confidentiality of what they tell you. This means that one must be selective about the data used as evidence. The evidence presented must clearly support the conclusions drawn by the researcher, and it must be representative of the data she is not able to show to others. Additionally, the researcher must furnish a context for the evidence: how was it gathered, under what circumstances, and who was involved. Without this context, the reader will not have enough information about the situation to judge whether or not the evidence convincingly supports the interpretation and conclusions drawn.

Ethical Responsibility

As a researcher working with humans, the ethnographer is responsible for guarding the welfare of participants. Responsibility rests squarely with the researcher to make sure that the rights of all individuals taking part in the research are protected. In this section we will discuss some of the major concerns and issues in research involving human beings, including the recruitment of participants without coercion, and the protection of participants from possible risks.[21]

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[20] In a typical ethnographic study lasting several months, several hundred pages of field notes will be produced, and several hundred pages more of transcripts from interviews or videotapes. In addition, questionnaires, artifacts, photographs, and other forms of data will be collected.

[21] This discussion is intended as a supplement to the discussion of informed consent and Institutional Review Board requirements given above.

Human Subjects, Special Populations, and Methods of Recruitment.

Certain populations of individuals to be included as participants require particular attention, and particular care to insure that their participation is not coerced. This is true of any institutionalized population, hospital patients, prisoners, persons with mental or physical disabilities, children, or any population of persons who may be in a relatively less powerful or more vulnerable position at the time of recruitment. Particular care is also required anytime the researcher occupies a position of power, authority or influence over the prospective participant, as when this person is an employee, student, patient, or client. Any of these relationships, or others, may make the individual feel that his participation is not wholly voluntary, or that his decision not to participate may affect his job, grade, care, or the services which he receives. The coercive potential increases as the amount of *perceived* power or influence increases, and the responsibility of the researcher to protect the subject increases correspondingly.

Care should be taken to insure that incentives do not unduly influence decisions to participate or not. Monetary payments, for example, may be offered as a benefit; however, if the entire payment is contingent upon completion of the study, or if the payment is very large, this may be considered coercive (UNC Office of Research Services 1989). The same is true of needed services, such as health care, provided as an incentive to participate.

Minimizing Potential Risk to Participants

Since most ethnographic research is done in "natural" settings, and does not involve invasive or experimental procedures, many of the potential risks normally associated with research, such as physical discomfort or danger, are not associated with ethnographic research. Nevertheless, ethnographic research may entail risks, though, with careful planning, steps can be taken to minimize these risks.

Protecting Confidentiality in Written Reports and Publication of Results.

Anytime the actions, thoughts, or opinions of a person are documented, that person could suffer social, mental, or even physical danger if what they do or say is at odds with what is accepted or expected, and the information becomes known by others. This may be seen most clearly, for example, if the people the ethnographer is observing engage in illegal activities, such as drug use or theft. Even though the ethnographer is not responsible for these actions, should she record these activities and these records fall into the hands of others, the individuals participating in the study may be harmed through prosecution, imprisonment or other punishment, or social discomfort. Even if activities observed or discussed are not illegal, they may be stigmatized or negatively sanctioned by some segments of society. Details of an individual's personal life, such as alcohol use, illness, family conflict, or sexual orientation, could potentially harm the individual if he has chosen to keep them private and

they become known. In a small or conservative community, the individual who expresses to the ethnographer an idea or opinion different from accepted ideas may experience ostracism, shame, or other harm if this becomes known. In organizational or work settings, there are any number of things the ethnographer may observe or become aware of which may harm individuals if they become known. Violations of rules or policies, work accomplished in ways not approved, rumors or negative comments about coworkers or superiors, non-work activities performed during work time, evidence of harassment or discrimination; these are just a few of the possible conflicts which might arise during an ethnographic study of a work setting. And while the study is not directed toward these events, a good ethnographer will take note of them and record them as accurately as possible in field notes. This information might well be crucial to understanding the context or dynamics in which the work that the study focuses on takes place; it might also bring harm to the individuals involved if not handled carefully.

Each of these examples involves information which the ethnographer gains which could harm individuals participating in the study. The best way to minimize these risks is by carefully maintaining confidentiality. Protection of participants requires that no harmful or damaging information be reported with material which could identify the individuals. Even when the information seems benign, however, what appears harmless to one person may not be harmless to another. Confidentiality must be guaranteed for all individuals and all groups, regardless of the content of the information.

Several steps can be taken to insure confidentiality. As a general rule ethnographers are careful to use pseudonyms for the people they mention in reports or publications. Pseudonyms are often used for the name of the community, organization or institution studied as well. The exception is made when individuals or organizations specifically request that their real names be used, however, before reporting real names, the ethnographer should make certain that the individual making the request understands -- in some detail -- what information may be reported, and especially any information with potential negative effects.[22] She should also make sure that by using one individual's real name, no other individuals will be identified who do not wish to be (e.g., Phil's [real name] business partner Alan [pseudonym], or Margaret's [real name] mother-in-law Pat [pseudonym]).

In many cases it is not sufficient to use pseudonyms. It may be necessary to remove identifying information or personal details about individuals, as well. In a small community where everybody knows everybody else, physical description, personal history, or social position may clearly identify an individual even if a pseudonym is used. In the ethnographic study of a work or organizational setting, an individual's position within the organization may

[22] Some ethnographers have sent manuscripts of reports to the people they have studied and asked them to review them before they are published using real names.

be important to understanding his interactions; however it may also be enough to identify the individual, even if a pseudonym is used. If this is the case, it may be necessary to edit out references to both pseudonym and position, if possible, when a sensitive example with potentially harmful consequences is given.

The amount of care which must be taken increases with the potential for harm which the information carries, as well as the likelihood that the reports may be read or circulated among those who know the individuals or have contact with them, and thus are likely to recognize them. It is wise to err on the side of caution. With increasing literacy and cultural contact worldwide, it is no longer unusual for anthropologists who work in other regions of the world to find that the people they have studied have read or heard what the ethnographer has written about them. In working in organizational settings in the U.S., one can expect as a matter of course that such reading will take place -- by members of management, if not by the actual individuals observed. In view of this, it may be necessary in some cases to go a step further to maintain confidentiality. In studies of a particularly sensitive nature, and where there exists the likelihood that reports will be read by those in a position to know and recognize the individuals involved, some ethnographers find it necessary to disguise identifying information where this information is not necessary to understanding or interpreting the events taking place. Clement, *et al.'s* (1978) study of school desegregation, and Cain's (1991) study of Alcoholics Anonymous are two such cases. Not only were references to position, occupation, age, and physical description often dropped; other information was sometimes disguised, for example, individuals were sometimes referred to by their correct sex, while at other times they were not. These measures are somewhat extreme, and in using them one runs the risk of distorting data; however, if one is reasonably sure that the information being disguised is not directly relevant to the interpretation, they may be justified when the material is sensitive.

Despite precautions, there exists the potential for some individuals to be recognized. This potential increases the more information about the individual is given, as when an intensive case study is used. In this case, the ethnographer may be forced to make the decision that some material -- however interesting or enlightening -- may never be published. The ethnographer's paramount responsibility is to those she studies, and where there is a conflict of interest, these individuals must come first (American Anthropological Association 1990:1). If certain information is particularly sensitive or the individual has expressed concern about it becoming known, and if there is *any* possibility that other information given might identify the individual, the ethnographer may have to refrain from reporting it. It is always wise to remember that a friend, colleague, or family member of a participant in the study might just read what you write.

Protecting Confidentiality of Field Notes and Data.

It is important to remember that protection of confidentiality neither begins nor ends with written reports or publications. All ethnographic notes, tapes, photos, questionnaires, transcripts, or any other form of data require security. It is a good idea to remove participants' or informants' names from notes, and replace them with some form of coding. The simpler the code, the better, as the ethnographer will want to be able to use these codes quickly and consistently in taking notes and filing other forms of data. On the other hand, coding with participants' initials or positions (e.g., "manager") may not be sufficient to conceal identities should the notes fall into the hands of someone who knows them. Whatever system is used, audio and video tapes, photographs, questionnaires, transcripts, and any other data should be coded as well. The key to match these codes with the individuals' real names should be kept in a separate location, and under locked security. As pointed out above, however, any individual can be identified if enough information about her is available, even if a coding system is used. Since field notes and data contain far more raw information than anything which will be published from them, the best way to protect the participants' confidentiality is to keep these materials out of other people's hands altogether. All notes and data should be kept in as secure a place as possible, where only the researcher has access to them. Ideally, they should be kept away from the actual site of research. Signed consent forms *must* be kept in a separate location from the data, also in a secure place, and preferably under lock.

Protecting Against Other Risks

In addition to the potential risks to participants posed by damaging information becoming known, certain topics of ethnographic research, or work with certain populations, may entail special risks. For example, mental or emotional distress to participants could be a potential risk in certain research topics. Asking people who have lived through traumatic experiences (refugees, accident victims, Vietnam veterans, survivors of incest or abuse) to recall these experiences may cause them to relive or re-experience the trauma or experience extreme stress. Asking persons with mental or emotional illness to discuss their problems or their lives may cause additional emotional pain or distress. Such potential risks should be thoroughly evaluated before the research begins, and sound plans should be in place to deal with problems should they arise. These plans may involve a designated professional who would be available to intervene in crisis situations, for example. And the ethnographer needs to be prepared and willing to listen empathically to what may be highly distressing accounts; above all, she needs to listen non-judgmentally and non-intrusively.

While ethnographic research may not involve the same obvious risks as medical or experimental research, given that humans live in social and political worlds, it is probably true

that there is no such thing as research which involves no risk to the participants. With careful thought and planning, most risks can be reduced to a minimum. It is incumbent upon the ethnographer to give careful thought to discovering all potential risks -- including those which may not be immediately obvious -- and to ways to minimize those risks and protect participants.

Research Involving Deception.

Federal regulations may permit research involving deception if it can be shown that the deception is necessary, and if other conditions are met. However, most anthropologists take the position that deception of any type in ethnographic research is unethical. The American Anthropological Association's Statements on Ethics assert that the aims of the investigation should be communicated as well as possible to the informant. As a minimum, participants should be given a truthful explanation of the purpose of the research in broad terms. An ethnographer should never use deceit, such as saying she is interested in one topic while actually studying another, or leading participants to believe that she is someone other than who she is. Under no circumstances should research be conducted in such a way that the individuals being studied are not aware that they are participating in a research project.

Principles of Professional Responsibility

Anthropologists are governed not only by federal regulations, but also by the Principles of Professional Responsibility set forth in the Statements on Ethics of the American Anthropological Association (AAA, 1990). These principles were adopted in recognition of the inevitable complexity of involvements faced by anthropologists engaged in fieldwork, and the sometimes competing needs and values of the different groups to whom they relate in the course of their professional activities. Researchers from other disciplines engaged in ethnographic research will face many of these same complex involvements, and we believe that they may benefit from a review of the principles honed through many years of collective experience by the American Anthropological Association. These principles are reprinted in full in Appendix E

While the principles recognize responsibilities to six distinct groups, the anthropologists' first responsibility is to those whose lives and cultures they study. Wherever conflicts of interest arise, the interests of these people must take precedence over other considerations. Anthropologists have the responsibility to protect the privacy, dignity, well-being, and wishes of these people. In addition to the responsibility to deal openly and honestly with these individuals or groups, and to protect their confidentiality, anthropologists have a responsibility to not exploit these individuals. This responsibility entails giving recognition to those providing information to the anthropologist *should these individuals desire to receive recognition*. It also entails giving fair return for the help and services they

receive. Anthropologists have a debt to the people and societies in which they work, and an obligation to reciprocate in appropriate ways (for example, by providing transportation or medical assistance where these are needed, involving professionals from the society studied in the research and providing them with experience or training, or by monetary remuneration).

A discussion of ethical considerations of ethnographic research must necessarily begin with the mechanics of fieldwork and methodology. But it is important to remember that ethics is not just something one does in designing methodology, submitting a proposal for human subjects review, obtaining informed consent, or publishing results. Ethics is a *process*, an ongoing consideration of issues, attempt to resolve conflicting demands, and a realization that practical decisions have ethical implications (Cassell and Jacobs 1987).

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Appendix A
Orienting Questions used in the Collaboratory Study "Sites, Activities, Modes and Artifacts in Student Groups, CS145"

Major Questions:

1. What artifacts are these groups producing and what technologies do they use to a) modify the artifacts and b) communicate and work with each other?
2. What are the sites/activities and modes of cultural and cognitive production for the group?

Elaboration of questions:

A. Sites/activities of production and related technology
   1. Where and in what kind of activities does work get done (e.g., in formal group meetings in the lab, in weekly meetings with the Client, in formal meetings with the Boss/instructor of the class, in conversations between group members working at adjoining computers in the lab)?
      a. What activities are mandated by the instructor (e.g., weekly meeting with the boss/instructor)?
      b. What activities/sites do the groups develop other than those given by the instructor?
   2. What conditions promote the development of and preference of one activity/site over another?
      a. What conditions promote a preference for face-to-face meetings (e.g., perhaps a fast approaching deadline)?
      b. Are workplaces and resources other than those of the university used?
   3. What is the division of labor and degree of group action in each of these activities/sites?
      a. To what extent are the contributions of individuals modified at the site (i.e, to what extent are the products at these activities the product of group action versus the simple addition of individual products)?
      b. What kinds of group coherence are characteristic at these different sites (e.g., is the whole team functioning in a unified manner, are subteams working together, are individuals engaged in individual actions)?
   4. What sorts of mediating devices (cultural artifacts, structuring resources) are used to accomplish work at each of these sites?
      a. What computer-supported processes/procedures are used to produce or modify products?
      b. How and when do individuals use conventional computer tools to do their work? Groups?
      c. What other processes/procedures are used to produce or modify products?

B. Cultural artifacts: their development and dissemination
   1. What kinds of artifacts -- both tangible and intangible -- do the teams produce?
      a. What genres of tangible artifacts are produced, e.g., minutes of meetings, e-mail messages, source code, design specs, flow charts and other diagrams?
      b. In what media are they stored and transmitted, e.g., orally, hard copy, electronically, distribution of hard copies of overheads?
      c. What types of intangible products are produced, e.g., shared vocabulary, social organization of the group, roles of group members?
         i. What sort of vocabulary does the group create and/or draft for its purposes?
         ii. What other sorts of symbol systems or representations are used (e.g., diagrams, charts, videos) to convey knowledge and ideas?
   2. At what sites (in what activities) are these artifacts produced?
   3. What type of artifacts are disseminated or shared among team members (e.g., source code, design specs, computer mail messages), and how (e.g., electronically, face-to-face, on pieces of paper)?
      a. What situations foster one method of dissemination over another? (Under what circumstances are face-to-face meetings necessary and/or preferred)?
         i. When is a representation translated from one form to another (e.g., from verbal to a diagram)?

C. Group interpretations of goals and constraints
   1. How do the groups talk about the goals of the team? (What is the group's conception of the point or purpose of its activities and how is that conception represented?)

a. What sorts of goals are represented or discussed (overall goal vis-a-vis the product, specific goals with respect to intermediate products, interpersonal outcomes)?

2. How does the conception of the goal change over the course of the project?
   a. At what point, if ever, does the conception of the overall goal become fixed or stable?
3. How do the groups talk about the constraints on what they are to produce? (What is the group's conception of the criteria its product must meet, its time limitations, its resource limitations?)

D. Group modes of action
1. Are there distinctive ways in which the groups can organize themselves, e.g., for brainstorming, for making a formal presentation, for addressing interpersonal frictions?
   a. How do the groups talk about these different modes? (How are group modes represented in group talk?)
      i. How do the groups talk about strategies for completing the project? To what extent does an overall strategy of modes figure in group talk? In the individual's conceptualization of the project?
2. When do the groups shift modes? Can these shifts be predicted by shifts in the types of artifacts they are working on?
3. Can the group evoke these different modes, and, if so, how do they? What role does planning (or other preparatory actions) play in evoking these different modes? What happens when members of a group happen to meet spontaneously?
4. Do the groups exhibit the same modes from start to finish, or do they develop different modes over time?
5. How is coherence achieved in the artifacts produced by the group, especially the final or task product?

E. Relationship of the individual to the group
1. How do individuals relate to the project?
   a. How do individuals modulate their participation in and contribution to the group in the face of external demands from their other course work, relationships, etc.?
   b. To what extent are individual members aware of the project work that their colleagues have done?
   c. What are the groups' expectations of the Technical Director vis-a-vis other members of the group? (Do the groups expect the Technical Director to be a facilitator/co-ordinator, an idea generator, or what? To what extent do they expect the Technical Director to be a leader?)
   d. Does a member's position(s) affect his or her view of the group's collaboration?
2. How are members brought (or how do they bring themselves) "up to speed" when the pace of the project has outstripped them for one reason or another?

Appendix B

Consent Form: Software Design Observations

John B. Smith, Principal Investigator (919) 962-1243

The purpose of the Collaboratory Project is to develop computer and communication tools that will help collaborative groups work together. As a first step, we will need to learn more about how groups work together in software design and development. That is the purpose of these observations and interviews.

Should you agree to participate, you and your group will be observed during meetings and working sessions related to your COMP 145 projects. You will be interviewed approximately three times during the course of the semester, and one of the members of our research team will be put on your group mail alias. During the interview, you will be asked questions about how your group works together, what your goals are, and what kind of tools you use. You will not be required to produce a written report or any other artifact. Interviews and observations may be taped and transcribed by a secretary from outside the University, but only the interviewer and the transcriber will have access to the tapes and the transcripts, so the interview will be strictly confidential. In any further analysis of the information provided in the interview, your identity and that of your group will be concealed. We also assure you that (a) participation in this study will have no influence on your grade for the course, (b) the instructor will not be told whether you agree to be in the study and (c) if you do agree, the instructor will not have access to the information from the interviews and observations.

Group participation requires that all members of the group consent. Groups that meet this requirement may or may not be (randomly) chosen for participation in the study.

If, at any time, there is any question that you do not want to answer, you are free to refuse to respond and if, at any time before or during an interview or observation, you should decide that you do not want to continue, simply tell the interviewer/observer.

If you have any questions about the project or the interviewing procedure, please feel free to call John Smith, (919) 962-1792.

You may contact the UNC Academic Affairs-Institutional Review Board at the following address and telephone number at any time during the study should you feel your rights have been violated:

Academic Affairs Institutional Review Board
Mark Hollins, Chair
CB #4100, 300 Bynum Hall
(919) 966-5625

Please fill out the consent information below. If you agree to participate, an interviewer will call you to arrange a time for the interview.

I agree to participate. _____ Yes _____ No

Signature _____

Print your name here _____

Phone # _____ Date _____

Appendix C
Example of Week by Week Summary

Group #3, Week 13:

I. Project meeting, Tuesday

Events:

Meeting begins with the Technical Director passing out some C code he has written. The Technical Director starts explaining this material. It is his 3rd data structure change for the FED (read design change). Programmer 1 suggests lifting some code from A's thesis. [Check transcription for response to this suggestion.] The Technical Director goes to whiteboard to discuss an algorithm for the calculation of a polygon's area. They want to make sure that this algorithm accounts for all cases, no matter what the orientation of the polygon. [NOTE: this is an excellent example of the use of the whiteboard by some group members and not by others. The Technical Director makes some of his points on the whiteboard. Programmer 2 does not use the whiteboard, he draws on the handout. Eventually, in order to be able to see what Programmer 2 is drawing, everybody gathers around the paper he is writing on. This involves people getting up and moving around the table. There is a desire to view what he is drawing by the group, but there is no suggestion that he draw on the whiteboard. Why not use the whiteboard?] In reference to the debate about calculating the area of a polygon, Programmer 2 makes the statement that it is not a design decision, but a coding decision. The Technical Director responds to this by saying that as long as it works, he doesn't care how it is implemented.

Programmer 1 asks where information about radiosity will be stored in this program. Technical Director replies that it is to be stored in patches. Programmer 3 thinks this is a less accurate way to do things. [Listings of code are being flipped through by Programmer 3 and Programmer 2.] Programmer 2 asks Technical Director what he might want him to do. Programmer 1 introduces an idea for the final presentation which is shot down by the Technical Director. Producer moves the group away from discussing the presentation by saying "let's get some pictures first,".

Technical Director outlines the "critical path" of the project. Programmer 2 reports almost being done with the ASA and Technical Director reports almost being done with the FED. Technical Director goes to whiteboard and draws another design. [NOTE: no one copies this down. Is this because the process of construction is more important than the final product produced or is it because they are not sure whether this design won't be changed also? Or is there another reason?] Programmer 3 (true to the pattern observed) asks some questions clarifying his own interpretation of the code. In response Technical Director makes the remark that "the deeper you go into the Clarksville stuff the worse it looks, now I see why they do so much data-hiding."

Technical Director then asks people what they are doing for the next few days. He assigns himself the task of finishing the FED and asks Programmer 3/Programmer 2 to finish the ASA section. He then informs Programmer 3 and Programmer 2 about a potential problem with the ASA (he writes down some information about a file on the whiteboard). Finishing with that he says, "that brings us to you two," addressing Programmer 1 and the Producer. [NOTE: Technical Director is really running this meeting, why?]

Discussion begins about where color information is stored in the Clarksville code. Programmer 3 wonders whether the client really realized what is involved in doing this project. The Producer compares the situation to a fixed price contract. [The Producer takes the job of interpreting the client's desires to the group.] During this discussion the group has been generating questions for BT, the Clarksville contact-person, to answer. Producer makes a note of these questions.

[Again, it appears that Programmer 3 and Programmer 2 are working together as a sub-unit of the group. The last few meetings have had the character of Programmer 3 and Programmer 2 reporting their progress to and working with Technical Director. I am not too sure just what Producer and Programmer 1 are working on at this point in time.]

There is joking about presentation, amount of work remaining, and getting the Clarksville contact to send down executables or pictures in GIF format for the presentation. There is also a discussion of the poorness of the IBM machine in its current configuration.

The Technical Director, while flipping through a listing of a sub-section of the Clarksville code, makes a discovery about where some of the info they have been searching for is hidden in the code. [This is another indication that Technical Director hasn't worked through the Clarksville code completely.] The Technical Director has found something he and the Producer have been looking for: RAM, or radiosity attribute management.

Programmer 1 makes the remark that now we implement their adjustment to our walkthrough. [Compare to goals/project definition.]

As the meeting ends and people are leaving there is a discussion of preparing the client's expectations about the project. Specifically, downgrading the client's expectations.

Artifacts:

Tangible:

1. C code passed out by Technical Director

C code written by Technical Director and distributed to group members at beginning of meeting. The code is a set of macros which resets counters in the FED model.

2. Algorithm for calculating area of polygons

The discussion of the algorithm was facilitated by the use of the whiteboard (Technical Director) and writing on the handout (Programmer 3).

3. Discussion of the critical path/re-design of FED

Technical Director's latest re-design of the FED was diagrammed on the whiteboard. This is much more a picture with boxes and arrows than the last designs.

4. Potential problem with ASA outlined on whiteboard

Technical Director outlines a potential problem that Programmer 3 and Programmer 2 could have with the ASA.

5. Code listings

Sections of the Clarksville code are now ubiquitous. Check the video-tapes to see this--most of the material spread out on the table is code listings. They are not referred to in a collective manner by the group, but everybody seems to periodically flip through them to confirm things for themselves.

Intangible:

1. John A's thesis

Mentioned by Programmer 1 as a possible place to get some code from. Also mentioned by Programmer 1 in 4/4/91 meeting.

2. Coding vs. Design

Programmer 2 brings up this division of labor and intellectual responsibility in computer programming while arguing with Technical Director about the algorithm to calculate radiosity. This is a powerful mediating device (see my fourth semester paper on the subject).

3. Final presentation

The final presentation is brought up a couple of times. Programmer 1 makes a suggestion about the format for the presentation which is rejected by the Technical Director for technical reasons (hardware problems). The presentation is also the subject of a number of jokes.

4. The theme/concern over getting something up and running

This mediating device appears again when the Producer directs the group away from a discussion of the final presentation by saying, "let's get some pictures first,".

5. Critical path

A term referring, as far as I can tell, to those elements that are necessary for getting the program up and running. The absence of any one of the elements on the critical path will keep the program from operating. Elements can be code or hardware or an algorithm, etc. This is distinguished from things that might be part of the project but are not directly related to getting something running. An example of things which are not on the critical path are time logs, documentation in general, etc. The term is used by the Technical Director when talking about the FED and ASA in particular.

6. Clarksville code

Mentioned in a couple of contexts. One is the Technical Director explaining his difficulties with design by saying that the closer you look at the Clarksville code the worse it is. There is also a discussion of where color information is in the code which segues into talk about the client.

7. Client

The client was discussed at several points. The group was becoming concerned about preparing the client for a let down. They wanted the Producer to start doing some work on deflating the client's expectations.

II. Project meeting, Thursday

Events:

The Producer again asking where people are on their work. The Technical Director still hasn't finished the FED (again, this is pretty much the guts of the project: nothing else will work without it). Because of design changes everything Programmer 1 has been working on is pretty much useless now. Programmer 1 sums this up by saying, "My stuff compiles, but my stuff is useless,". [The Producer is handling this meeting much more, whereas the Technical Director handled the last one more. This ties in with comments made by Technical Director in interview about how he and Producer both produced and directed.] The Producer is attempting to clarify the function of pieces of code and to determine which pieces of code are missing. [They are still trying to figure out what Clarksville code is doing. Mediating devices being used for this discussion are code listings, theses, module names from Clarksville code.] The Producer goes through Clarksville code and identifies parts that can be trashed. The Producer and the Technical Director look through code listing and everyone gathers around. The Technical Director and Programmer 3 discuss energy fall-off light attenuation. The Technical Director notes that without light attenuation jobs (running the program) will never terminate. Programmer 2 asks about hemi-cube (method of calculating radiosity). The Technical Director remarks that it looks like Clarksville is not really doing that. [This

is very interesting, both of the theses that they got from Clarksville say that they are using the hemi-cube method and so does some articles in graphics journals, but the group, after looking through the Clarksville code, doesn't think that Clarksville is actually using this method. Is this why Clarksville has been reluctant to share code with other people?]
The Technical Director asks Programmer 3 to look up information from the rad_shoot routine. The Technical Director comments that, "we're doing a lot of work. We're walking around the building to get to the next room, essentially." Programmer 1 asks about debugging and the Technical Director replies that they have no time for specialized roles of master debugger or master tester (the group eventually handles this time crunch by having a group de-bugging and integrating session).

The Technical Director suggests no less than 6 hours. of sleep on average per night. The Producer agrees with this. To make his point, the Technical Director goes to the whiteboard and graphs his personal productivity over the last week (when he wasn't getting much sleep). The Producer comments that "if you don't sleep you make yourself worthless, if you are worthless you are useless to the group." The meeting begins to adjourn. Programmer 1 recommends that everyone finish up their work for other classes now and leave the last week for hard work on the project. Programmer 2 remarks that he will work on documentation while he waits for everyone else to finish the sections of the program they are working on.

Artifacts:

Tangible:

1. Listing of code

Printout of code group is working with is used to identify the functions of various modules and to weed out those pieces which can be gotten rid of from those that are critical.

2. Module names from Clarksville code

Module names from the code listings.

3. Whiteboard chart of Technical Director's personal productivity

Drawn by the Technical Director to illustrate the effects of lack of sleep.

Intangible:

1. FED

The Technical Director has not completed his conversion of the FED yet. Compare this to his original estimates of how long this task would take.

2. Clarksville theses

Are referred to in order to help group understand the code they have.

3. light attenuation

Technical Director explains the concept of energy fall-off to Programmer 3.

4. Hemi-cube

Originally, the group was lead to believe that the Clarksville radiosity method employed an approach to calculating radiosity that involved the use of the hemi-cube method. After examining the Clarksville code they

came to the conclusion that this was not the case.

5. Scheduling of time

The scheduling of sleep is mandated. The group also concerns itself with managing their time for doing other class work.

Weekly E-mail:

1. April 8th, producer to group

The Producer forwards to group list of questions that he is asking BT. They concern a piece of Clarksville code called the RAM which is used to store radiosity attributes.

2. April 9th, technical director to group

The Technical Director announces a meeting at a non-standard time in a humorous fashion.

3. April 9th, producer to group

The Producer forwards BT's response to the group's questions. This explains the role and structure of the RAM and also why the RAM appears to employ elements of the hemi-cube form factor calculation method.

4. April 10th, producer to group

The Producer forwards to group another communication to BT.
The Producer is asking a lot of questions about the data structures of the Clarksville code that the group has not been able to puzzle out. Especially the relation between FGX and FED.

5. April 10th, technical director to group

The Technical Director has finished a conversion of the FED. This is critical for making the ASA work. The Technical Director has placed the material under RCS.

6. April 11th, producer to group

The Producer forwards BT's answers to the most recent list of questions. Note that BT's responses are quick, in the last two instances the turn-around time has been 24 hours. BT has to have someone else answer some of the questions this time because it is material he is unfamiliar with.

7. April 11th, producer to group

The Producer forwards some more mail from BT. This message includes the answers to the questions BT had to refer to someone else.

8. April 11th, producer to group

The Producer notifies the group that he has remade all of the libraries and that they compile.

9. April 11th, producer to group

The Producer has received some more code from Clarksville and tells group where he has placed it.

10. April 12th, producer to group

The Technical Director has noticed that an annotated version of one of the Clarksville routines is missing some code that was in the original source code. The Producer tells the group that the missing chunk has been replaced and that the rest of the annotated code has been checked to make sure that other pieces aren't missing.

11. April 12th, producer to group

The Producer forwards another message from BT. This one concerns the sharing of vertices in FED and FGX. This message contains an ASCII "diagram". There is at least one other instance of BT attempting to make a diagram with ASCII characters. How would his communication with Producer have been enhanced if they could have very easily sent diagrams? What about a dynamic diagram (a capture of the process of the diagram's construction)? BT also has the following comment: "frankly, i'm [sic] impressed at the insight you've gained from the little bit of code we've given you. your questions have often sent me poring through the code or running to others for answers. i should understand this stuff, but i didn't code any of it. i'm a ray tracing boy, you know."

Appendix D
Example of Artifact Case Study

This case examines the circumstances surrounding the production of a function call trace of the Clarksville code by Programmer 2 and the transformations it goes through as the group appropriates this artifact.

February 14th:

Team receives about 4000 lines of unannotated code from Clarksville. This code contains the algorithms Clarksville uses for computing radiosity, but does not include the adaptive subdivision routines. The result of this is that the project definition will have to be changed because the goal of running Clarksville code with Clarksville data structures no longer makes sense. The group has been reading articles written by some of the Clarksville graphics people and some theses from Clarksville. They think they have some idea of what is in the Clarksville code. After they receive the code they find that it is somewhat different than they expected and the material they had been using to prepare themselves is misleading. The efforts of the group are focused on understanding exactly what the Clarksville code does. A division of labor has been made such that this is primarily the Technical Director's job. The reason for this is that the Technical Director has been a Walkthrough RA for several years and knows more about radiosity and the Home University code than anyone else.

February 20th and 21st:

Group receives some additional code from Clarksville as well as an annotated version of the previous code (in other words, a copy of the code with some notes inside it which tell you what the various pieces of the program are doing).

At the 2/21 project meeting the Director says that they still don't know exactly how the Clarksville code works. He blames this on the fact that the code is too big to read through and see right off what is missing and what the group needs to provide to get it to work. This news is perhaps not received well by the people (Programmer 1/Programmer 3/Programmer 2) who are in the role of workers in the group. Essentially, the project was four to five weeks behind because they were late in receiving the code from Clarksville and now they have had the code for one week but the person responsible for producing a design still does not know what the code does. Consequently, this meeting is the first instance of the workers "pushing" the Producer and Director to get something done: At the end of the meeting the Producer asks everyone if they are aware of the deadlines for certain deliverables on the project (draft user-manual primarily). Everyone says they are aware and Programmer 3 asks the Producer and Director whether they know what the next step on the project is. I interpret this to be Programmer 3 saying "Hey, we know what our job is, now go do yours!". From this point on Programmer 3 continued to push the subject of the design by questioning the approach and effort being made by the Producer and Director.

February 25th:

During the boss meeting at this date Programmer 1c asks about the status of the group. The Producer responds that some material is missing from the Clarksville code that may be necessary in order to adapt it and the task of the group is to figure out what exactly is needed. Programmer 2 offers the opinion that this is not a big job and that it should only take a few hours. I think this comment from Programmer 2 was unsolicited from anyone and could very well be the time at which he decided to produce the call trace of the Clarksville code in order to determine what was missing. He probably undertook this task because he didn't see anything tangible being done about it by the Producer and Director. [Remember, at this point the group has had this code for 11 days and the Producer and Director still keep saying they don't know what it does or what is missing from it.]

February 28th:

During the project meeting on this date, the Technical Director states that he is way behind in producing a design (the group has now had the code for two weeks and still no design). The Producer and Director assign a bunch of tasks to the other group members. I would say that these tasks were devised because the Producer and Director had yet to produce a complete design. This view is supported by the interviews done with the Producer and Technical Director.

In response to this Programmer 3 questions the strategy being used to address the group's tasks. He questions the feasibility of just transferring the Clarksville code to the walkthrough system. The Director states that

some "lower-level stuff" will have to be rewritten, but that the rest of the code transfers pretty well. Note that the Director had just made the statement that he was way behind in the design. Apparently he hasn't exhaustively looked through the Clarksville code yet, but he still feels that he can say it will transfer well.

The discussion about the approach being taken involves all group members. During the discussion Programmer 2 refers to a **hand-written function call trace of the Clarksville code** (hereafter referred to as the Clarksville code trace) in order to make a point with the Technical Director. This is the first instance of the artifact appearing in the group. The group shows immediate interest in the artifact--the discussion comes to a halt when the Director asks Programmer 2 what he is looking at. It is decided that this is a valuable resource for all the group members to have. Accordingly Programmer 2 says he will produce a nicer copy using MacDraw. This is a good example of the change in format that an artifact makes when it shifts categories. It goes from the private domain of an individual group member where it is a free hand drawing and scrawled notes on a couple of pieces of binder paper to a MacDraw document which is laser-printed, photocopied and distributed to all the group members.

I think this artifact is appropriated by and becomes important to the group for a number of reasons. First, the group has been hung up on coming to grips with the Clarksville code. While the artifact is not a design for the project, it does provide much of the information needed for the design as it quite clearly shows the structure of the Clarksville radiosity program and it shows what routines are called by that program but which were not given to the team by Clarksville. Second, over the course of time the artifact is referred to in order to solve problems and even "spins-off" other artifacts of a similar nature (Programmer 1's walkthrough code trace). Finally, the code trace becomes a central element of the final documentation which could serve to bolster the group's grades in the course if the adaptation of the Clarksville code is completely unsuccessful.

March 4th:

MacDraw version of Clarksville code trace is distributed to everyone at boss meeting.

March 21st:

Programmer 1 announces that he is working on a code trace of the walkthrough material. It is unclear whether he came up with this idea on his own or whether he was assigned this task. I call this a "spin-off" of the Clarksville code trace. The idea of doing these traces has been taken over by the group and eventually traces are produced of all the code the group deals with. This appears in the final documentation.

March 22nd:

The Clarksville code trace appears in the draft of the implementation document. The framework of the document is the code trace itself. The contents of the document are descriptions of the various modules of the Clarksville code which are listed alphabetically after the trace. Members of the review team ask about the symbols on the code trace. These symbols represent points where the trace is continued on another page. This is not obvious to the review team members who suggest making it clearer.

March 28th:

This is the watershed meeting where Programmer 1/Programmer 3/Programmer 2 "rebel" against the leadership of the group. At this point the project has undergone three design changes and some of the work done by Programmer 1/Programmer 3/Programmer 2 has been rendered useless. It is my interpretation that the three don't see how the project is going to be completed on time and also do not agree with the design approach being taken. Support for this view lies in the way the design the Director outlines during the meeting is questioned by Programmer 1/Programmer 3/Programmer 2 and in the interview with Programmer 1.

During the meeting the Clarksville code trace is used by the group members to answer questions Programmer 2 has about the parameters of the routines he and Programmer 3 are writing.

April 15th:

The outlook for the project is looking grim at this point in time. There is the distinct possibility that the group will not have the code running in time. The group is now firmly in a course requirements frame and is attempting to salvage their project. They are now only attempting to get the most basic functionality out of their program. This is the Quick Pictures goal. To this end, the documentation they will produce takes on much more importance. The Clarksville and walkthrough code traces are described by the Producer as being the "keystones" of that documentation.

April 25th:

The group has managed to show some basic pictures for the demo given in class. Now they turn to producing the final documentation. During the project meeting at this date Programmer 1 asks about further debugging of the code and both the Producer and Director tell him no. While organizing the production of the final documentation, the Producer tells those who have made code traces to update them.

May 1st:

The project is turned in to the instructor. The final documentation consists of 30 pages of function headers, 30 pages of code traces and only about 15 pages of prose. The 30 pages of code traces cover all of the code in the project and were produced by Programmer 1, Programmer 3 and Programmer 2. This is a substantial increase from the original Clarksville code trace produced by Programmer 2 which took up two pages.

Summary:

The original code trace which only included a part of the radiosity function of the Clarksville code was likely produced by Programmer 2 both because it was an aid to his own work and because he was dissatisfied with the progress being made toward identifying missing parts of the Clarksville code. It was adopted by the group as a whole because it was an aid in coming to grips with the Clarksville code and for getting to work on the project.

The artifact undergoes a transformation in format as it moves from the private domain of an individual group member to the shared domain of the group. During this process the artifact is changed and reproduced as a "neat" version. This process involves not only making the artifact more legible and formalized (moving from freehand pen drawing on two sheets of binder paper to a laser-printed MacDraw document) but also involves making the implicit knowledge necessary to make the artifact useful explicit and included in the artifact itself. I tend to call this process "tightening up" an artifact. As an artifact changes domains and its audience moves from an individual to the group and then beyond the group, the artifact tends to get tightened up more and more. Some evidence for this are comments made about the Clarksville code trace during a review team meeting. The review team members didn't understand some of the symbols used by Programmer 2 on the trace. In the final documentation this set of symbols has been amended and a legend included to help explain them.

As difficulties on the project began to mount the idea of a code trace gained importance in a course requirement activity frame. More people began to produce them and they eventually take up about 40% of the final documentation. How would groups using a CSCW system handle an artifact that appears about a third of the way into a project and then begins to gain increasing importance, perhaps even displacing some of the artifacts which were originally guiding the group?

The artifact initially appeared in a hand-written form as someone's private work and was not created using a computer. How would such an artifact come to be entered into a system? It is no answer to say that a person working with a CSCW system would have made the artifact using the system because the person who constructed the artifact probably had no idea that it would be adopted by the group. The point at which this artifact would likely have been introduced into the system is when it changed formats from a hand-written to a MacDraw document. In this case, that works out quite well because everyone in the group wanted a copy so the artifact

changed formats when it changed audiences. However, not all important artifacts change format (see group #1 example?) so this "opening" for getting material into the system does not always exist.

Appendix E
American Anthropological Association
Revised Principles of Professional Responsibility, 1990

Preamble

Anthropologists' relations with their discipline, with the individuals and groups among whom they conduct research or to whom they provide services, with their employers and with their own host governments, are varied, complex, sensitive, and sometimes difficult to reconcile. In a field of such complex involvements, misunderstandings, conflicts and the need to make choices among apparently incompatible values are constantly generated. The most fundamental responsibility of anthropologists is to anticipate such difficulties and to resolve them in ways that are compatible with the principles stated here. If such resolution is impossible, anthropological work should not be undertaken or continued.

Anthropologists must respect, protect and promote the rights and the welfare of all of those affected by their work. The following general principles and guidelines are fundamental to ethical anthropological practice.

I. Responsibility to people whose lives and cultures anthropologists study

Anthropologists' first responsibility is to those whose lives and cultures they study. Should conflicts of interest arise, the interests of these people take precedence over other considerations. Anthropologists must do everything in their power to protect the dignity and privacy of the people with whom they work, conduct research or perform other professional activities. Their physical, social and emotional safety and welfare are the professional concerns of the anthropologists who have worked among them.

A. The rights, interests, safety, and sensitivities of those who entrust information to anthropologists must be safeguarded.

1. The right of those providing information to anthropologists either to remain anonymous or to receive recognition is to be respected and defended. It is the responsibility of anthropologists to make every effort to determine the preferences of those providing information and to comply with their wishes.

a. It should be made clear to anyone providing information that despite the anthropologist's best intentions and efforts anonymity may be compromised or recognition fail to materialize.

2. Anthropologists should not reveal the identity of groups or persons whose anonymity is protected through the use of pseudonyms.

3. The aims of all their professional activities should be clearly communicated by anthropologists to those among whom they work.

4. Anthropologists must not exploit individuals or groups for personal gain. They should give fair return for the help and services they receive. They must recognize their debt to the societies in which they work and their obligation to reciprocate in appropriate ways.

5. Anthropologists have an ongoing obligation to assess both the positive and negative consequences of their activities and the publications resulting from those activities. They should inform individuals and groups likely to be affected of any consequences relevant to them that they anticipate. In any case, however, their work must not violate these principles of professional responsibility. *If they anticipate the possibility that such violations might occur they should take steps, including, if necessary, discontinuance of work, to avoid such outcomes.*

6. Whether they are engaged in academic or nonacademic research, anthropologists must be candid about their professional identities. If the results of their activities are not to be made public, this should be made clear to all concerned from the outset.

7. Anthropologists must take into account and, where relevant, make explicit the extent to which their own personal and cultural values affect their professional activities. They must also recognize and deal candidly and judiciously with the effects that the often conflicting demands and values of employers, sponsors, host governments and research publications may have upon their work.

II. Responsibility to the public

Anthropologists have responsibility to be truthful to the publics that read, hear, or view the products of their work.

A. In expressing professional opinions publicly, anthropologists are not only responsible for the factual content of their statements but also must consider carefully the social and political implications of the information they disseminate. They must do everything in their power to insure that such information is well-understood, properly contextualized and responsibly utilized.

B. Anthropologists bear a positive responsibility to speak out publicly, both individually and collectively, on issues about which they possess professional expertise. That is, they have a professional responsibility to contribute to the formation of informational grounds upon which public policy may be founded. Anthropologists should make clear the bases upon which their positions stand.

C. When engaging in public discourse anthropologists should be candid about their qualifications, and they should recognize and make clear the limits of anthropological expertise.

III. Responsibility to the discipline

Anthropologists bear responsibility for the good reputation of the discipline and its practitioners.

A. The integrity with which anthropologists conduct their affairs, and the rapport that they seek to maintain in the field and in other professional venues must be of an order that justifies trust and confidence. They must not behave in ways that jeopardize either their own or others' future research or professional employment. It is their responsibility to act in ways consistent with commitments to honesty, open inquiry, candor concerning sponsorship and research aims, and concern for the welfare and privacy of all concerned parties. Anthropologists must address such conflicts as do arise among the interests of those parties and attempt to resolve them equitably.

B. Anthropologists must not represent as their own work, either in speaking or writing, materials or ideas directly taken from other sources. Anthropologists must give full credit in speaking or writing to all of their professional colleagues, anthropologists or nonanthropologists, who have contributed to their work.

C. When anthropologists participate in actions relating to hiring, retention and advancement, they should (except in the case of affirmative actions taken to redress historical imbalances) insure that no exclusionary practices should be perpetuated against colleagues on the basis of sex, marital status, color, social class, political convictions, religion, ethnic background, national origin, sexual preference, age, or any other criterion irrelevant to academic performance. Nor should an otherwise qualified individual be excluded on the basis of physical disability. Anthropologists should, furthermore, refrain from transmitting, and resist the use of, information irrelevant to professional performance in personnel actions.

D. The cross-disciplinary nature of the activities of many anthropologists requires that they be informed of, and respect, the requirements of the nonanthropological colleagues with whom they work.

IV. Responsibility to students and trainees

Anthropologists should be candid, fair, and nonexploitative in their dealing with trainees and students, and committed to their welfare and progress. They have continuing responsibility to recognize the changing nature of the discipline, in both its content and its methodology, and further, in novel applications of anthropological knowledge and approaches. They have a further responsibility to convey current understandings to students and trainees.

A. Anthropologists should accept students into their programs in ways precluding and redressing discrimination on the basis of sex, marital status, color, social class, political convictions, religion, ethnic background, national origin, sexual preference, age, or any other criterion irrelevant to academic performance.

B. Anthropologists should strive to improve both their teaching techniques and the methods of evaluating their effectiveness as teachers.

C. Anthropologists should be receptive and genuinely responsive to students' interests, opinions, and needs.

D. Anthropologists should counsel students realistically regarding both academic and nonacademic career opportunities.

E. Anthropologists should be conscientious in supervising, encouraging, and supporting students in their studies, both anthropological and nonanthropological.

F. Anthropologists should inform students of what is expected of them, be fair in the evaluation of their performance, and prompt and reliable in communicating evaluations to them.

G. Anthropologists should impress upon students the ethical problems involved in anthropological work and discourage them from participating in ethically questionable projects.

H. Anthropologists should acknowledge orally and in print student assistance in research and preparation of their work; give appropriate credit for coauthorship or first authorship to students when their research is used in publications or lectures; encourage and assist in publication of worthy student papers; and compensate students justly for the use of their time, energy, and ideas in research, teaching, and other professional activities.

I. Anthropologists should energetically assist students in securing legitimate research support and the necessary permission to pursue research and other professional activities.

J. Anthropologists should vigorously assist students in securing professional placement upon completion of their studies.

K. Anthropologists should beware of the serious conflicts of interest and exploitation which may result if they engage in sexual relations with students. They must avoid sexual liaisons with students for whose professional training they are in any way responsible.

V. Responsibility to employers, clients, and sponsors

In all dealings with employers, clients, and sponsors anthropologists should be honest about their qualifications, capabilities, and aims. Prior to entering any professional commitment, anthropologists must review the purposes of sponsors, employers, or clients, taking into consideration their past activities and future goals. In working for governmental agencies or private businesses, anthropologists should be especially careful not to promise or imply acceptance of conditions contrary to professional ethics. Anthropologists should be especially careful not to promise or imply acceptance of conditions contrary to professional ethics or competing commitments.

VI. Responsibilities to governments

Anthropologists should be honest and candid in all dealings with their own governments and with host governments. They should ascertain that they will not be required to compromise either their responsibilities or anthropological ethics as a condition of permission to engage in

professional activities. Anthropologists are under no professional obligation to provide reports or debriefings of any kind to government officials or employees, unless they have individually and explicitly agreed to do so in the terms of employment.

Epilogue

Anthropological activity requires choices for which anthropologists individually and collectively bear ethical as well as scientific responsibility. This statement is designed to promote discussion and provide general guidelines for ethically responsible decisions. When anthropologists, by their actions, jeopardize peoples studied, professional colleagues, employers, employees, clients, students, or others, or if they otherwise betray their professional commitments, their colleagues may legitimately inquire into the propriety of such actions, and take such measures as lie with legitimate powers of the American Anthropological Association, as the membership of the Association deems appropriate.

Appendix F
Additional Suggested Reading

On Anthropology

James L. Peacock's *The Anthropological Lens: Harsh Light, Soft Focus* provides an introduction to the field of socio-cultural anthropology with an overview of its subject matter, methods, and significance. Not a textbook, this brief and very readable work elucidates the world view or perspective of the discipline of anthropology, and is written for a diverse audience, from neophyte to professional.

Ethnography

Perhaps the best way to understand what an ethnography is is to read ethnographies. Classic traditional ethnographies sought to document and understand a wide range of topics, including social and political organization, subsistence strategies, economics, social life, ritual and belief systems, knowledge and tradition, the life cycle, and language.
One need only look at the classic fieldwork guide *Notes and Queries on Anthropology* (Royal Anthropological Institution of Great Britain and Ireland) to grasp the breadth of topics these traditional ethnographies covered. Classic ethnographies in this tradition include E.E. Evans-Pritchard's *The Nuer*, Raymond Firth's *We, The Tikopia*, and Bronislaw Malinowski's *Argonauts of the Western Pacific*. More recent ethnographies have tended to focus in much greater depth on a particular aspect of the culture studied. Examples from this tradition include Clifford Geertz' *The Religion of Java*, Richard B. Lee's *The Kung San: Men, Women, and Work in a Foraging Society*, James L. Peacock's *Rites of Modernization: Symbols and Social Aspects of Indonesian Proletarian Drama*, and Roy Rappaport's *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People*. Still later ethnographies have tended to become even more focused, for example, Favret-Saada's *Deadly Words: Witchcraft in the Bocage*, or Holland and Eisenhart's *Educated in Romance: Women, Achievement, and College Culture*.

On Ethics in Anthropology

Michael Rynkiewich and James Spradley's *Ethics and Anthropology: Dilemmas in Fieldwork*, and Joan Cassell and Sue-Ellen Jacob's *Handbook on Ethical Issues in Anthropology* are two works which discuss practical dilemmas faced by anthropologists through essays written by these anthropologists, with commentary and discussion of the problems and of the solutions by other anthropologists and professionals from related fields. The *Anthropology Newsletter* of the American Anthropological Association provides an ongoing forum for the discussion of ethical issues and dilemmas through a column of similar format.

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