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ABSTRACT

A case study of on-the-job training in a factory stockroom took a close look at the working milieu, the way experienced people did their jobs within it, and the means used to induct (train) newcomers into work activities. Stockroom work and stockroom training were considered to represent two different activity systems; the interplay of these two activities in the work environment was explored. The training study was conducted at a manufacturing plant that produced radio-frequency connectors and that had implemented a computerized inventory and production control system known as Manufacturing Resource Planning. As new persons were hired, they were assigned to experienced workers who took on the responsibility for their training. Training was a subsidiary to work and a dynamic construction into which these factors entered: supervisors' views of how to train; level of management implementing the training; composition of the stockroom work force; and union policies. Training was not planned but "took shape." Since training was assimilated into ongoing work practices, trainees were exposed only to routine work events. Analysis of the technical and communicative processes that structured training-and-work within training dyads showed that trainers incorporated talk into the training process and explained the work as it was done. Talk and work performance went on in tandem. (70 references) (Author/YLB)

A STUDY OF ON-THE-JOB TRAINING

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Technical Paper No. 13

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PREFACE

The National Center on Education and Employment is funded by the Office of Educational Research and Improvement (OERI) of the U.S. Department of Education. The Center is based at Teachers College, Columbia University, in New York City. The RAND Corporation of Santa Monica, California, and Washington, D.C., is a partner with Teachers College in this enterprise.

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For purposes of confidentiality, we have changed the name of the factory that served as the field site for this study and the names of the individual people mentioned in this report.

TABLE OF CONTENTS

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Finally, we thank the members of the Laboratory for Cognitive Studies of Work, all of whom contributed to the discussion of issues in this Report.

FOREWORD

This is a case study of on-the-job training in a factory stockroom. In it, we take a close-up look at the working milieu, at the way experienced people do their jobs within it, and at the means they use to induct ("train") newcomers into work activities.

Our objective is to go beyond the level of generality characterizing most descriptions of work and to unpackage the black box glossed by the term "on-the-job training." Educational processes in the workplace, though occasionally acknowledged as ubiquitous and significant, remain largely invisible to the research and educational communities. How does such training fit into ongoing work activities? How does it fit into the system of social relations in the company? What kind of pedagogical practices are involved? How is conceptual and factual knowledge communicated to people who have no notion until they walk through the factory door of what the "subject matter" is about? Most critically, how do we address such questions so that we achieve both the rich description and the rigorous analysis that research requires if it is to be educationally useful?

Our approach to this new research arena was to organize an interdisciplinary team capable of bringing a variety of methods to the enterprise. We carried out data collection through an ethnographic study of the factory as a whole, field observations and interviews in the training locale, audiotaped observations of targeted trainers and trainees on a time-sampling basis, and semistructured trainer and trainee interviews. We applied both qualitative and quantitative interpretive techniques to the data, ranging from discourse analysis to the application of simple descriptive statistics. Since, to our knowledge, this was the first case study of its kind, problems of ethics and methods claimed a major share of our attention. In our concluding discussion we deal with both the substantive and methodological implications of the research.

We begin by introducing and describing the factory in which we worked and the considerations that led us to select stockroom work as our target occupation for a training study. We follow with a description of stockroom work activities and a report on the way training is organized within it. As each new person is hired for the stockroom, s/he is assigned to an experienced worker who takes on the responsibility for training. We first look at how these training dyads functioned

within the stockroom community, and then we analyze in detail the technical and communicative processes that structured training-and-work within the dyads.

STOCKROOM TRAINING IN ITS INSTITUTIONAL SETTING

Why study on-the-job training?

A factory stockroom is not a typical setting for cognitive research. Even less is it a site to which educational researchers are typically attracted. Yet a group of us—from psychology, anthropology, and linguistics—has spent a great deal of time in the last few years becoming acquainted with the inner workings of a stockroom in a high-technology electronics manufacturing plant. We tried to learn the stockroom layout, the logic and logistics of material control, and the way in which the flow of information in the computerized inventory system articulated with the flow of material goods in the plant. We spent many days talking to the people who made the stockroom work, watching them carry out day-to-day routines and cope with problems that, lying outside the routine, yet seemed to recur on a routine basis.

We were not in this research site to become experts in inventory management; nor could we, even if we had so intended, become expert in any aspect of stockroom work without actual immersion in it over a long period of time. We were there to address questions lying just beyond the work itself, namely, how is the work learned and how does the stockroom community organize and support the learning process without disrupting its normal functions? Our aim was to study on-the-job training and learning. We had in mind a research project that would go beyond a general level of description of such training and that would use cognitive science techniques to uncover the mechanics of its production—the "how" of it. We could not begin this project until we ourselves had gained some understanding of the knowledge and skills involved in stockroom work. And we could not carry out this project unless stockroom people knew us, accepted our purpose as worthwhile, and agreed to cooperate in the undertaking.

This report is a preliminary presentation and discussion of findings from this case study. We think it is useful to keep in mind the uncommon nature of this research when we come to assess its contributions and its problems. An attempt to carry out research on educative processes in an industrial work setting strains our methods, and, just as importantly, tests the limits of contemporary theories of work and learning. Research on educational processes has historically concentrated on student populations and has been conducted in settings (e.g., schools) whose institutional goals are explicitly educational, or in settings (e.g., laboratories) that maximize the researcher's control over

events. The industrial community contrasts sharply with these settings. Adults, rather than young people, are involved, and activities are organized to meet production goals, not educational objectives. The factory is an environment that responds to ever-changing needs and circumstances; it is never exactly the same at Time 2 as at Time 1, and thus defies the possibility of "research control," considered in the classic sense of holding conditions constant. The motives of groups within industry—profit for owners, and livelihood for employees—do not coincide directly with the researchers' aims. The conduct of the research must conform to these special circumstances.

Many problems present themselves on a theoretical level. Because research on learning and teaching has focused on the schools, it has fostered a conception of learning as a life activity separate from other life activities and thus susceptible to analysis as an "activity in itself." In studying learning-and-teaching as a segregated activity, one can make certain simplifying assumptions. For example, although it is well accepted (Cazden, 1988) that all speech serves a number of functions simultaneously (e.g., regulative, informative, rhetorical), studies of teacher talk in the classroom typically ignore this multiplicity; they analyze teacher talk largely with respect to how it fulfills its informative function; the instructional intent of teacher talk is presupposed and assigned primacy. The institution of school can be evaluated on the basis of how effectively teachers teach and students learn because researchers presume an isomorphism between the goals of teacher and student activities (to instruct and to learn) and the objectives of the institution (to educate) (see Newman, Griffin & Cole, 1989). When we inquire into the nature of teaching and learning in nonschool settings, these presuppositions do not hold. We are faced with the fundamental problem of "disentangling" educative processes from other ongoing activities in which they are embedded so that they may be studied in the first place.

Until recently, the concentration of educational research in schools seemed a natural state of affairs. Conventional wisdom assumed that school learning and achievement were continuous with out-of-school learning and achievement. Under such a continuity hypothesis, it made sense to think of schooling as the select environment for research on teaching and learning. A new line of research on everyday, or practical cognition, however (Hutchins, 1987; Lave, 1988; Rogoff & Lave, 1984; Scribner, 1984, 1986; Sternberg & Wagner, 1986), has demonstrated that school-based learning has distinctive features that differentiate it from forms of thinking and learning in practical settings—what some investigators refer to as "situated practice". Once a minority position (Scribner & Cole, 1973),

this view of the speciality of school is now gaining ground among developmental theorists (e.g., Wertsch, 1985a) and educational researchers (Berryman, 1987; Resnick, 1987), who are rethinking the role of formal schooling in human development.

If learning in and out of school have certain discontinuities, we need to gain some understanding of what out-of-school learning looks like: what are its characteristic features and how do these compare with school-based learning activities? A first step is to stop lumping all out-of-school learning into one contrastive category. Learning may be related to practice in a number of different ways that need to be identified and studied. One significant advance in this enterprise is Lave's analysis of apprentice models of education (in preparation). Apprentice learning is attracting widespread interest (Collins, Brown and Newman, 1987), but it is only one of a variety of ways in which learning may be related to practice. Moreover, it is not the characteristic way that learning and practice are related in the industrial or corporate work world in the United States today. A fundamental characteristic of apprenticeship is that it takes the form of a master-learner or mentor-learner relationship that tends to occur in crafts and professions. In these relationships, the master typically manages and trains, and also exercises considerable control over the apprentice's work experiences. In a wide range of industrial salaried and technical jobs, however, these conditions do not obtain. For one thing, expertise in complex work environments is distributed over a number of people (Hutchins, 1987) and no one person can serve as the master. For another, there is no linear or clearly-marked pathway toward "expertise." Novice workers/learners must come to understand the complexity of the organization as a whole, comprehend the portion of overall production that their work involves, and negotiate the politics of the workplace at the same time as they master the particular tasks of their jobs. Mastering a particular job in a complex organization carries with it the possibility of "moving up," and hence moving into a position with a new boss, new co-workers and new tasks. Rather than becoming a master of a particular kind of work and kind of production, a worker in corporate industry must often develop expertise in a number of knowledge domains that are differently accessed and used by sets of "experts," who function in a variety of "places" in the production process.

A form of socially-organized educational practice that has arisen to meet these conditions is on-the-job training. We use the term here to apply to a wide range of programs through which people are broken into new jobs by means of guided practice (D'Andrade, 1981). Such programs may vary

widely in the degree to which they are formalized or structured. Our previous research at another industrial site (Scribner, 1984) and in a mining community (Sachs, 1986) suggested the importance of a loosely structured form of on-the-job training that comes into operation when the occasion arises, is relatively short-lived, and is provided by co-workers or supervisors who have not been trained to train. Training arrangements of this kind are widespread and seem to obtain on many skill levels in salaried and hourly occupations. Although they carry a heavy burden of workplace education, these training procedures have been invisible to the educational world at large.

We undertook the stockroom study as a means of exploring the basic features of on-the-job training and its potential usefulness as a model of practice-based education.

Theoretical Perspective. An inquiry into teaching and learning in the workplace requires a conceptual framework within which to pose questions about the relationship of one human project (education) to another (work). Our framework derives from a theory gaining prominence among psychologists and social scientists in Europe and coming to the attention of colleagues here. This theory builds on the work of the well-known psychologist L.S. Vygotsky (1978, 1988), and posits "human activity" as the basic unit of analysis in the study of mind and behavior. Mental and behavioral processes, the theory claims, are embedded in activities that serve particular motives and unfold through goal-directed actions. On a societal level of analysis, activities may be conceived as socially-organized practices that advance culturally-valued objectives (Scribner & Cole, 1981; Laboratory for Comparative Human Cognition, 1983). Individuals acquire motives and master knowledge and skills through their participation in socially-organized activities; conversely, socially-organized activities are reproduced and transformed through individual actions. (For a fuller presentation of theoretical constructs, see Leont'ev, 1978, 1981; more accessible versions by psychologists in the United States include Kozulin, 1986; Minick, 1985; and Wertsch, 1981, 1985a, 1985b.)

Developmental psychologists working within this framework have suggested that certain universal human activities are especially significant in an individual's developmental history. These activities include play (Vygotsky, 1978), learning (Elkonin, 1977; Engestrom, 1987; Hedegaard et. al., 1984; Talyzina, 1981), and work (Hacker, 1985).

In the last several decades, activity theory has become especially prominent in research on work and education. In work research, a fundamental difference between an activity-theory orientation and that of other perspectives is that activity theory analyzes production processes as socially-structured human activities that make use of technological and material means. Work does not exist independently of workers and has to be studied as an activity system, not simply as a technical system. A similar approach is brought to bear in the study of schooling, in which learning and teaching are conceived as constituting an activity system organized around special means (the subject matter to be taught, devices such as textbooks, computers, and the like).

This conceptualization of work and education as activity systems allows us to go further than our initial formulation in specifying some of the central problems in studying on-the-job training. When work and education occur as separate activity systems, conducted in different settings, with different sets of participants, theoretical and empirical analysis is relatively straightforward. When both activity systems co-occur, however, we encounter serious descriptive and analytic problems. In on-the-job training, the same set of participants in the same setting are engaged in activities satisfying two different institutional goals. Analytically, two activity systems are in progress, but empirically there is only one stream of behavior to observe. Should those behaviors be described as "working" or as "training"? How do we know how the participants construe what they are doing?

The strategy we adopted in the present study was to proceed from an analytic stance. We considered stockroom work and stockroom training to represent two different activity systems. With this analytic approach, we could pose questions about the relationship between them for which we could seek empirical answers. For example, do experienced workers consciously accept the goals of training? And if they do, how do they accommodate the goals of work and the goals of training? Throughout we attempted to capture the interplay of these two activities as they unfolded in the busy work environment selected for study. We think this approach proved effective for our study purposes; the development of a more grounded theoretical approach to "mixed" activity systems remains a task for the future to which we hope this research contributes.

Field Setting: The Factory and the Stockroom

This training study was conducted at Kemps Electronics, a family-owned manufacturing plant in New York that employs approximately 500 people. Kemps produces radio-frequency connectors

that are used in items such as videopanels, oscilloscopes, televisions, computers and submarine devices. This kind of connector is small—it is easy to hold a number of them in your hand—and each is composed of several subcomponents that can be used in any number of final products. The small size and great variety of radio-frequency connectors (Kemps produces about 20,000 component parts and 7,000 to 8,000 finished goods) mean that the company has significant inventory to manage.

Four months before our research began, the company "turned on" its new computer system, an inventory and production control system known as Manufacturing Resource Planning or MRP. For several reasons, we were interested in conducting research in a plant that had implemented this sort of system. The introduction of a new technology such as MRP requires employees to acquire new knowledge and, according to some analysts (e.g., Bailey, 1988; Zuboff, 1988), increases the intellectual complexity of many jobs. If this is the case, in-house training and informal on-the-job learning become especially important in such plants. Moreover, since new systems are invariably imposed on older systems, difficulties arise in day-to-day operations that are not anticipated by designers and that workers need to handle on the spot. In trying to make the new system function, employees "externalize" their reasoning about the system and their work, enhancing opportunities for researchers to capture teaching-and-learning processes. Finally, MRP exemplifies the many new information technologies that are becoming widespread throughout industry and that are reputedly creating a demand for a more highly educated work force (Schneider et al., 1985). We thought that public and private interest in these technologies and their educational implications would lend general importance to our research effort and conclusions.

We decided to locate our first study in the component stockroom at Kemps[1] on the basis of substantive and pragmatic considerations. These are intertwined: The introduction of MRP systems has a major impact on inventory management and control, including operations in the stockroom, and Kemps management was planning to hire and train a number of new stockroom workers.

To understand the significance of MRP technology for stockroom work and training, we briefly describe its principal characteristics.

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[1] Two additional studies are under way at Kemps. One focuses on office workers learning to use MRP, the other on learning computer-numerical controlled machining in the machine shop.

MRP. MRP programs, which are marketed generically for any kind of manufacturing firm, are designed to keep an accurate accounting of the location and amount of all of a factory's products and subcomponents.

The introduction of such new systems has largely reorganized how manufacturers "do production." The shift towards "flexible manufacturing" (see Bailey & Noyelle, 1988; Noble, 1984; Piore & Sable, 1984; Shaiken, 1984) has meant a move away from mass production toward custom production. This shift has affected many companies, which are attempting to eliminate the stockpiling of goods and purchase materials as needed, rather than in advance. These changes mean that companies have to keep careful track of what they have on hand. Instead of simply reordering bulk quantities of material when they begin to run low, for example, they must now monitor the use of material on a daily basis, and think ahead when it comes to planning what will be needed in the future. It has been a challenge for companies to make these new systems work well. Indeed, a review of the literature reveals that numerous problems have been reported in the development and implementation of MRP systems, such as how to keep accurate inventory levels and train workers to correct errors as they come up (Hagan, 1988; Naj, 1986; *P&IM Review*).

The significance of MRP systems for our purposes is twofold. First, these systems directly affect how inventory is controlled within a plant. Inventory is, of course, stored in stockrooms. As companies implement policies to reduce stockpiles, the volume of goods in stockrooms decreases and the movement of parts in and out of them increases. In addition, the presence of the computer and new ways of thinking about production make the concern about accounting for parts a more important part of stockroom work. Inventory work becomes more complex and must meet more stringent criteria of accuracy and timeliness.

The second significant point about MRP for our research is represented by our focus upon how new workers are introduced into work activities through various educative practices. The new system of computer-based manipulation of information about inventory (MRP) is grafted onto physical processes of production, storage, and transport of materials that represent an old system; many pre-existing record-keeping systems also remain in force. New workers coming into the stockroom would, therefore, be introduced to both the old and the new. We expected that the new technology would sufficiently perturb existing systems of work so as to generate "problems" that would manifest

themselves in, and become part of, the training process. We hoped to thereby capture ways in which new people were introduced to the "nonroutine" aspects of stockroom work today.

The Stockroom: A Complex Domain. Kemps manufactures most of the component parts that it assembles into final products. It has three stockrooms for components, dispatch, and shipping. The component stockroom houses about 20,000 parts in different stages of production; the dispatch area coordinates the movement of parts through a variety of production operations; and shipping holds a safety stock of some finished products and sends the rest out to customers. Our research focused on the component stockroom.

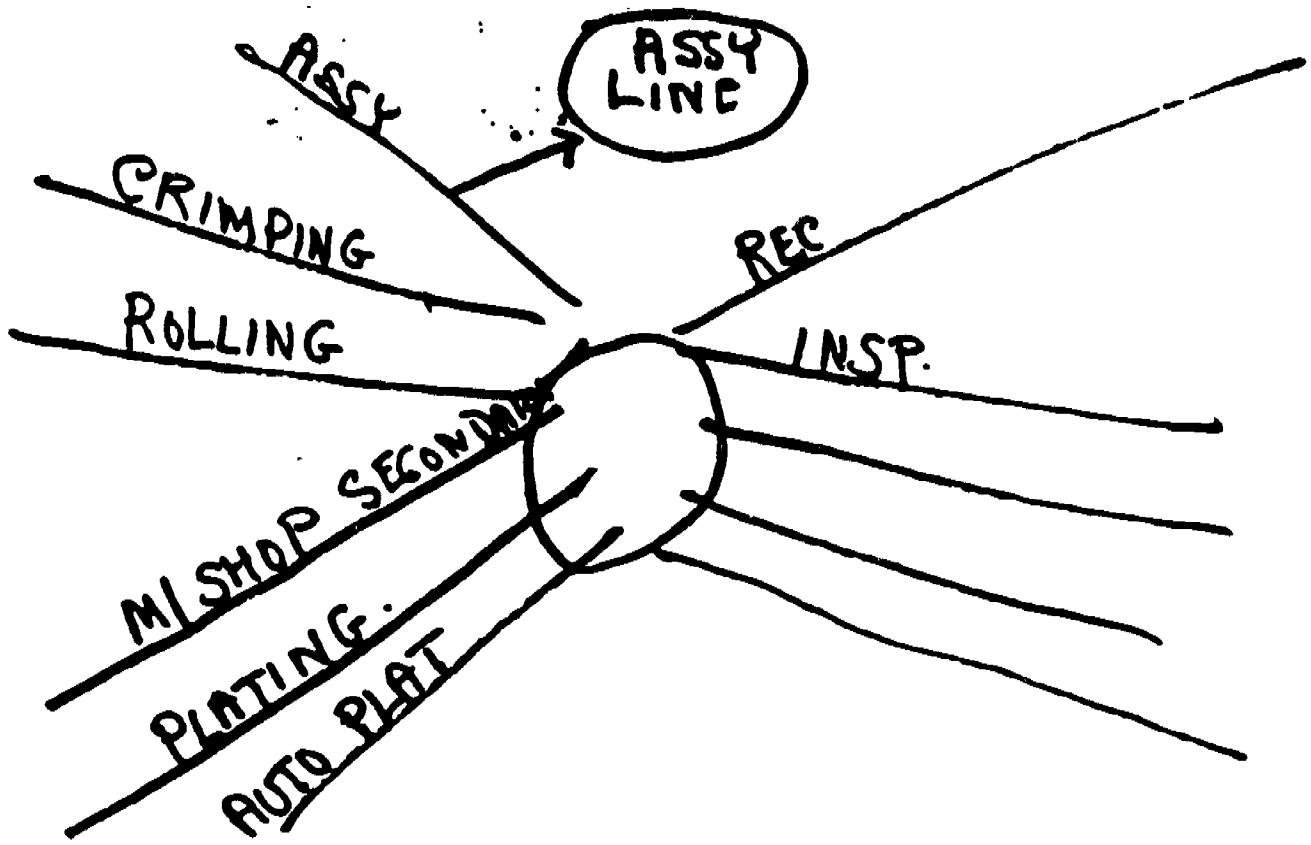
The component stockroom is an environment of considerable physical complexity, and work within it involves a grasp of many knowledge systems, ranging from names and numbers of parts to storage rules and the like. As background for material that follows, we give a brief description here.

While people often think of stockrooms as areas in which large numbers of items sit, they are actually locations through which parts constantly travel, especially under MRP systems. Stockrooms are places of action, and stockroom workers need to keep on top of this continual movement of goods. Indeed, according to the "leadman" in the stockroom (a senior worker assisting the supervisor) who had thirty years on the job, the stockroom was literally central to production; his conception of the stockroom as the hub of the plant is represented in a sketch he drew for us, reproduced as Figure 1.

The component stockroom is a large room about a third the size of a football field. At one end of the room is an area where parts are received from production departments in the plant. At the other end are tables at which workers count out the parts that are needed for production. Large floor scales and tabletop electronic scales are distributed throughout the room (see Figure 2, a map of the stockroom). There are two computer terminals in the room, one at the supervisor's desk at one end of the room, the other located in the center of the room near the leadman.

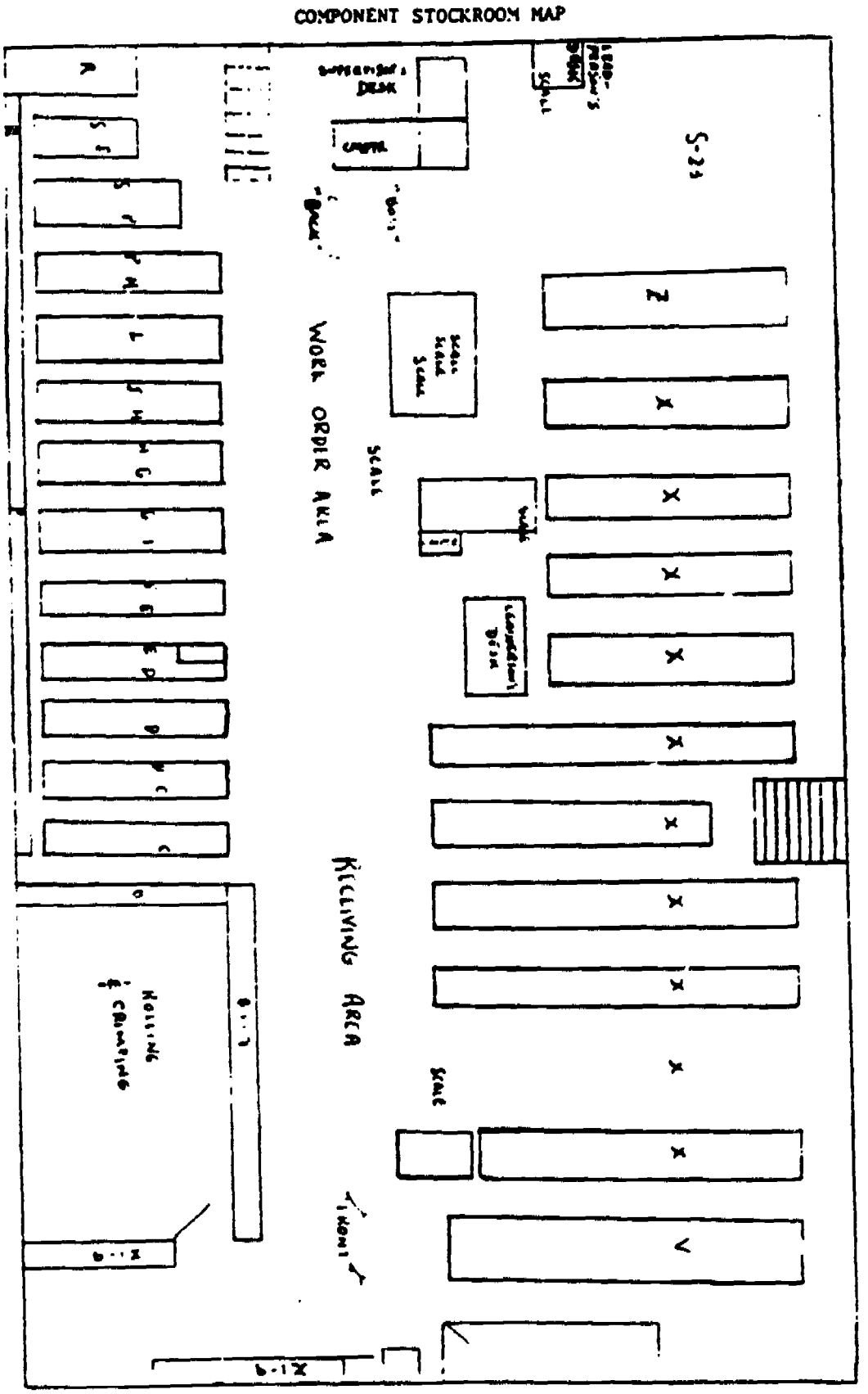
FIGURE 1

Drawing by Leadman in Stockroom
Illustrating the Stockroom as Center of Production



Note: The center circle represents the stockroom; all other production departments funnel into the stockroom.

FIGURE 2


COMPONENT STOCKROOM MAP
WORK ORDER AREA
KITTING AREA
S-23
Z
X
V
A
Map of the Stockroom

The component stockroom resembles a library in certain respects: on all sides are aisles of shelves upon which sit boxes and bins of parts. Component parts are stored in boxes and bins of varying sizes. The storage of parts is partially organized by the weight of the pieces. Large pieces that are used in quantity (5,000 in a bin, for example, can weigh up to 75 lbs.) are unlikely to be stored on top shelves because they are unwieldy to handle and could cause back strain. Before the computer system was introduced, the parts were stored according to kind (the bodies were in one section, for example, and insulators in another). Now, according to workers, storage is "random." Since part numbers and their locations are easily stored and retrieved in the computer system, it is expected that a worker can quickly look up where a part is supposed to be and find it at that location.

Quantities are a fundamental part of stockroom knowledge, since parts are continually counted coming into and going out of the stockroom. Consequently, the parts stored in large bins are "precounted" to facilitate the work of the stockroom people, who will have to count the parts at some point. Each bin holds a standard number of parts, although the "standard" number in each bin is decided by the workers themselves. That is, if a certain part is large and heavy, and only 2,500 fit into a bin without making the bin too heavy to handle, the workers will decide that each bin for such-and-such a part will contain a "standard" of 2,500. Any leftover parts are put into one last bin and that bin is labeled the "master." This system enables workers to assess quickly how many binsful they need to take off the shelves when counting out parts.

Although the vast numbers of parts in the stockroom are differentiated by kind and identified by name (such as body, contact, insulator), these names are far too general to identify any particular part. There can be fifty different kinds of contacts, for example, made of different metals, produced in different sizes, and with different finishes. The great diversity of parts that Kemps manufactures is therefore accounted for by a numbering system, and workers tend to talk about part numbers rather than part names. One wouldn't hear, for example, "Has anyone got the contact?" while "Who's got 59-22-47 M99?" is commonplace. Some part numbers are similar to others (differing, for example, by one digit), so that a misreading could easily occur, and workers need to be alert to such subtle differences. The consequences of errors of this sort are discussed in the next section.

This sketch of the stockroom, although brief, makes it evident that new hires have much knowledge to master and many procedures to learn to become competent stockroom workers.

The Job: Descriptions of Stockroom Work

Official Job Descriptions. Although Kemps people freely talk of stockroom work and stockroom workers, the job-classification scheme actually has no job listed under that title. Employees in the component stockroom, except for the department supervisor and leadmen (see below), are classified as "material handlers." This job title names a generic occupational grouping, just as the titles "machinist" and "assembler" serve as standard codes for a wide range of actual work responsibilities having certain elements in common. In Kemps, as in other plants, the actual activities subsumed under each such job title vary considerably, depending on, among other factors, the department in which they are performed and the technical devices (e.g., the particular kind of machine, such as milling or lathe) involved. Levels of skill range widely as well: at Kemps, these levels are captured to some extent by the classes C, B, and A, into which employees in a given occupation are graded (from lowest to highest).

Kemps's job-classification scheme consists of fourteen grades. The job title "material handler" appears in seven, ranging from Grade 2 to Grade 10. Specific responsibilities of the material handler within these grades are described in job bulletins. These form part of the collective-bargaining contract, in that each description is signed as agreed upon by a member of management and either the shop chairman for the union, another union representative, or both. When a vacancy occurs within these grades, the appropriate bulletin is posted. The job descriptions in the bulletins are also the basis for upgrades and promotions.

Job descriptions for material handler are both plantwide in form (simply "Material Handler C," "B," and "A") and specific to certain departments (e.g., "Material Handler-Dispatch"). The common element, as the name implies, is responsibility for handling, maintaining, and transferring some "material" from one place to another. Specialized descriptions cover various ranks of material handler in the machine shop, assembly, and other production departments, but the largest number of jobs and those with the broadest skill range are in departments whose principal function is to receive, store, or ship parts (finished or component). The operations of these departments are tightly interdependent, and, at the highest ranks of material handler, responsibilities spill over department lines, and central duties include those of interdepartment coordination. Although each department has its own supervisor (or two if a night shift operates), one person (material-control manager) has been appointed to oversee

them and manage all their activities as aspects of the inventory-control plan incorporated into the factorywide MRP system, "turned on" in 1986.

Job descriptions applicable to the component stockroom are concentrated in Grades 2, 3, and 5 and carry pay scales ranging from a minimum of $6.44 to a maximum of $6.98.

The Grade 2 job description, still in effect, dates from 1966, and classifies material handling with the jobs of porter and repetitive, routine inspection. New stockroom workers were hired in this grade. The job description reads:

> Counts, moves, or otherwise handles materials, loads and unloads trucks and performs various other simple duties as directed. Counts and packs parts or products in cartons, cases or other containers. Checks against packing lists for inclusion of all component parts or completed units, applies special labels or stencils where necessary, and performs other duties assigned by the supervisor.

Note that, with the exception of the verb *counts* (otherwise unqualified) and the verb *checks* (against lists), all other specified job actions involve physical behaviors (load, pack, affix labels, etc.). The description follows closely the one used by the U.S. Department of Labor Bureau of Labor Statistics for industry wage surveys (Kemps has on file the October 1977 version). According to this description, a material handler is a laborer whose duties involve moving materials or merchandise.

Grade 3 (Material Handler B) lists duties identical with those of Grade 2, except that, in addition, the jobholder is available to replace absent personnel in the receiving and shipping departments. This description, too, dates from 1966.

Grade 5 (Material Handler A) introduces additional responsibilities beyond the movement of goods. This job description, originally prepared in 1967, was revised during the installation of the MRP system by the director of materials, the top person responsible for implementing MRP at Kemps. The stockroom fell under his jurisdiction (the only nonoffice department to do so) because of the critical role inventory control plays in MRP management. To convey the nature of his revision, we reproduce both short descriptions.

Pre-MRP (1967):

Transfer materials between departments, and to various locations (i.e., shipping, receiving, stockrooms, productions [sic] etc.) as required. Coordinate routing of material through departments as required by applicable shipping order, work orders, etc. Maintain records of finished material and components stock. Assist in shipping department and receiving departments. Responsible for accurate counting, storage and safe handling of material in his care. Expedite material and performs (sic) other duties assigned by the supervisor.

MRP (1985):

Primarily responsible for the receiving and maintaining required records of all incoming and outgoing raw materials.

Will also transfer material between departments, and to various locations (i.e. shipping, receiving, stockroom, production etc.) as required. Responsible for accurate counting, storage and safe handling of material in his/her care. Expedite material and performs other duties assigned by the Supervisor.

A significant shift has occurred here: the first listed responsibility becomes the maintenance of records (i.e., manipulating information about the stock), while the physical transfer of materials has moved to second place.

When we began our fieldwork, eight material handlers worked in the component stockroom on the day shift, together with a supervisor and two leadmen. Two material handlers were classified as Grade 5; the remaining six were in the bottom class of Grade 2. To put it another way, more than half of the stockroom work force was officially considered unskilled laborers for pay and promotion purposes. This was the case even though the materials-control director emphasized in personal conversations the difficult intellectual nature of stockroom work under an MRP system, and other management personnel complained that job descriptions in the lower grades were inadequate because they featured physical aspects of the job and downplayed the mental.

FIGURE 3
Job Bulletin for Material Handler 10

JOB BULLETIN

MATERIAL HANDLER **COMPONENT STOCK ROOM** **GRADE 10**

Transfers material as required between departments and various locations such as Shipping, Receiving, Stock Room, Dispatch Areas, Production, etc. Coordinates routing of material through departments as required by appropriate shipping orders, manufacturing orders and shop orders.

Maintains records of stock room. Responsible for all activities concerning the Component Stock Rooms, such as pulling orders; instructing and assigning others to pull work orders and to carry out other assignments; assisting Dispatch, Receiving, and Shipping Departments. Assures that all parts passed by inspection are entered accurately on bin cards and stored into Component Stock Rooms, at their proper locations. Promptly assures that assembly returns are accurately returned into stock. Furnishes Production Control and Data Processing with an accurate listing of short parts, expedites all work order short parts that are in the Receiving Department. Maintains monthly minimum stock report.

Will be responsible for component stock room security, permitting entry only to those personnel authorized by his direct supervisor.

Responsible for all Receiving Department activities. Assist in Shipping Department and Receiving Department.

Responsible for accurate counting storage and safe handling of material in his care.

1. Responsible for maintaining an accurate component stock inventory notifying production control of any adjustments through proper documentation.
2. Responsible for all changes concerning part numbers, and the proper location of these parts within the stockroom. Notifies Production Control of all changes.
3. Maintains up to date cross reference for all old and new part numbers
4. Coordinates stock room control with data processing system.
5. Will assist all departments by furnishing the appropriate information concerning work orders in process.
6. Must have a working knowledge of the following documents; batch control, inventory adjustments, storeroom location change, parts return form, vendor receiving report, manufacturing receiving reports.
7. In the absence of his supervisor must be able to instruct his men.
8. Expedites material and performs other duties assigned by the supervisor.

Job descriptions for material handlers above Grade 5 (Grades 7-10) more fully reflect the additional coordinating and record-keeping responsibilities required by the company's new central data-processing systems. Figure 3 reproduces the description for the highest-ranked material handler in the component stockroom (Grade 10). Although we know of no incumbent at the present time, this description gives a good idea of the various tasks carried out in the component stockroom. It is heavily weighted toward the record-keeping end and includes as one such particular responsibility the coordination of stockroom control with the data-processing system. This description stands in sharp contrast to those written for Grades 2 and 3 material handlers, although, as we shall see, they also are obligated to coordinate some aspects of their work with the MRP system.

Except for the highest ranks of stockroom material handler, the official job descriptions of the company treat the position essentially as that of an unskilled laborer. Wage rates and hiring practices are in accord with these descriptions. A contradiction arises, however, in that top management personnel stress their need for skilled workers who will do accurate math, keep records, and handle difficult questions and problems requiring coordination with the MRP system. Training is somehow expected to reconcile the "laborer" and "record-keeper," the unskilled, routine aspects and the problem-solving aspects of stockroom work.

Stockroom Workers' Job Descriptions. In contrast to official job descriptions, which list the discrete duties of material handlers, stockroom people describe their jobs in terms of larger, meaningful sequences of activity. A leadman advised us to organize our notes "according to the processing of the work—the receiving of parts and the pulling of work orders" (Field notes, 1986). Other supervisors and workers used similar terms to refer to their work responsibilities, whether talking among themselves or in recorded interviews with us. All "chunked" their work into the two main activities of "receiving" and "pulling." (A third principal work activity, cycle counting, was less often mentioned, since at the time it was carried out on the night shift.) These two chunks of activity reflect the movement of the parts themselves in and out of the stockroom. "Receiving" refers to the process of counting incoming goods, recording their receipt, and putting them into stock. "Pulling" refers to locating and counting goods being taken out of stock for production purposes, adjusting inventory records accordingly. Receiving and pulling, of course, can be further decomposed into smaller units of work, which we will describe shortly, but, for the moment, it is interesting to note that these smaller units, too, are specified in action terms: *counting*, *selecting* parts, *locating* part numbers,

leveling a bin, and the like. As the linguist who carried out the analysis of trainer talk noted, "The talk is full of verbs of movement to describe work."

Stockroom employees, therefore, clearly conceive of their work as activity—as doing—and discuss it in terms close to those of the activity theory perspective that frames this research.

Description of Work Activity in a Research Perspective. The following descriptions flesh out the stockroom workers' basic activities of receiving and pulling; they are based on discussions and interviews, as well as on many hours of observation in the stockroom. (Detailed analyses of these job activities are in the section on technical aspects of training).

The job of *receiving* is carried out by two people who work as a team. Their job is to transport into the component stockroom bins of parts that have been manufactured in the plant's machine shop (or purchased from vendors), unload them, count the parts, record the numbers received, and place the parts in stock. This involves both manual and mental work. Bins that are filled with parts manufactured in the plant tend to be heavy, since these parts are largely brass "bodies." The first task in receiving thus involves considerable lifting of heavy bins (which is the rationale for having two people on this job). These bins can weigh up to 75 pounds, and since as many as 80 bins can be "received in" during the shift, a team may have to carry and transport up to 6,000 pounds in a day.

The receiving process involves a variety of literacy and math skills and use of a computer terminal to access information. A worker on receiving uses the computer to determine the locations in which the received parts are stored and must be careful to distinguish among parts with similar item numbers (see below). Most counting is carried out by weighing parts on mechanical or electronic ratio scales. Workers need some understanding of the ratio principles built into these scales (how they work and sources of error) and must exercise care to accomplish accurate counts of large quantities of parts (in some cases 10,000 or more). When a count has been made, the worker has to complete various written records requiring operations of addition and subtraction; errors made here can become the source of serious discrepancies in the MRP system (see further discussion of the computer system below). Completed paperwork is given to the supervisor, who oversees the entry of information into the computer system. Since one aim of MRP is to keep component stock inventory low, parts need to be received into stock as continually as possible so that they won't run out. This means that

stockroom workers on receiving must bring as many bins as possible into the stockroom from the machine shop in any given day, get those parts into stock, and make sure all paperwork is completed so that it can be entered into the computer.

Pulling, like receiving, involves mental as well as manual work; although the specific tasks differ, the literacy and math operations involved in the two activities are quite similar. Pulling is organized around "work orders."

"Work order" is the customary name used orally to describe the directions for routing the array of component parts that are used in the production of a finished radio-frequency connector. No piece of paper is actually marked "work order." A work order is made up of several computer-generated sheets of paper (the Shop Packet Worksheet, the Material Pick List, a drawing of the connector, a routing sheet, and a set of dispatch cards. See Figures 4, 5 and 6; these papers comprise the "directions" for manufacture. When pulling a work order, the stockroom worker selects an order from the leadman's desk and, following the list of parts on the computer-generated paperwork, locates the component parts on the stockroom shelves, and counts the number of parts required for the order by using the ratio scales. When parts are counted, the worker fills out the computer-generated forms (this may also involve arithmetic operations) and deducts the quantity of each part "pulled" on the part "bin card," which constitutes the stockroom's permanent record of transactions (receives and pulls) for that part. The worker then labels, bags, or bins the parts and sends them on to the dispatch department, which supervises their distribution through various production operations.

During the course of pulling, a worker may need to consult computer screens to check on a part location, to determine whether sufficient parts are available to fill an order, or to reconstruct the history of transactions for a part when discrepancies between stockroom and computer records arise. When parts for an order are pulled, MRP considers that order to be "in production." Since MRP has a production schedule to meet, stockroom workers are expected to pull as many orders as possible during the course of a day, and to be accurate as they count and record "the pull."

-WARREN-

NO. 01 SHOP PACKET WORKSHEET DATE 1/22/87 TIME 15.19.23 PAGE 51 AM1AIII

PAGE IN ORDER 1

ITEM NUMBER	UM	DESCRIPTION		ORDER QUANTITY	START DATE	LAST TRANS DATE	DUE DATE
879-16-1	1	SMA ADAPTER	REV04	105	1/22/87	0/00/00	1/22/87

CUSTOMER JOB NUMBER	AREA/USE STOCK LOC	ENGINEERING DRAWING NUMBER	MULTI-ORD REFERENCE	PLANNER	DEPARTMENT	DETAIL RECORD COUNTS OPERATIONS	MATERIAL	MISCELLANEOUS
				1		13	9	0

MATERIAL LIST BY WAREHOUSE LOCATION

COMPONENT ITEM NUMBER	UM	ITEM DESCRIPTION	STOCK LOC	U/M	STANDARD QUANTITY	ISSUED QUANTITY	USER SEQ	OPER USED	DATE REQUIRED
1-1703-1	99	1 BODY	REV08 B0E	EA	105	0		0001	1/22/87
1-17-2	99	1 BODY	REV02 B6C	EA	105	0		0001	1/22/87
1-16-1	99	1 INSULATOR	C1C	EA	105	0		0001	1/22/87
1-1702-1	99	1 INSUL	REV02 C17E	EA	370	0		0001	1/22/87
1-7417-1	99	1 CONTACT	REV== D2F	EA	105 53	0		0001	1/22/87
1 [illegible]-2	05	1 RETAINER RING	[illegible]	EA	105	0		0001	1/22/87
1-[illegible]-1	99	1 GASKET	REV0[illegible]	EA	105	0		0001	1/22/87
1-[illegible]18-1	99	1 CONTACT	REV== [illegible]	EA	105	10		0001	1/22/87
1-55-5	99	1 COUPLING	4B4	EA	105	0		0001	1/22/87

COMPONENT STOCK DEPT. JAN 28 1987 2/2/87 ISSUED

COMPONENT STOCK DEPT. JAN 28 1987 ISSUED

FIGURE 4

NO. 01 MATERIAL PICKING LIST BY ORDER DATE 1/22/87 TIME 15.18.50 PAGE 21 AM1011

PAGE IN ORDER 1

ORDER NUMBER	ITEM NUMBER	UM	DESCRIPTION		ORDER QUANTITY	START DATE	LAST TRANS DATE	DUE DATE
0004613	870-16-1	E	SMA ADAPTER	REV04	185	1/22/87	0/00/00	1/22/87

CUSTOMER JOB NUMBER	WAREHOUSE STOCK LOC	ENGINEERING DRAWING NUMBER	MULTI-ORD REFERENCE	PLANNER	DEPARTMENT	DETAIL RECORD COUNTS OPERATIONS	MATERIAL	MISCELLANEOUS
				00001		13	9	0

SEQ	STOCK LOC	COMPONENT ITEM NUMBER	ITEM DESCRIPTION		DATE REQUIRED	OPER USED	USER SEQ	PICK QUANTITY	U/M
1	[illegible]	1-1703-1	99 BODY	REV06	1/22/87	0001		185	EA
1	[illegible]	1-99-2	99 BODY	REV02	1/22/87	0001		185	EA
1	[illegible]	1-94-1	99 INSULATOR		1/22/87	0001		185	EA
1	[illegible]	1-1702-1	99 INSUL	REV02	1/22/87	0001		370	EA
1	[illegible]	1-2417-1	99 CONTACT	REV--	1/22/87	0001		22 185	EA
1	[illegible]	1-91-2	05 RETAINER RING		1/22/87	0001		185	EA
1	[illegible]	1-93-1	99 GASKET	REV01	1/22/87	0001		185	EA
1	[illegible]	1-2418-1	99 CONTACT	REV--	1/22/87	0001		185	EA
1	[illegible]	1-95-5	99 COUPLING		1/22/87	0001		185	EA

FIGURE 5

20

(9)

COMPONENT STOCK DEPT. JAN 20 1987 ISSUED

COMPONENT STOCK DEPT. JAN 20 1987 1/21/87 ISSUED P.M.

29

30

FIGURE 6

##	MFG NO	COMP PART TO PULL ##	PULL QTY
	FINISH DATE	TO BE USED ON PART # ##	
DEPT	OPER #	LOCATION	QTY PULLED

PLEASE CIRCLE PROCESSES TO BE PERFORMED

STAMP	TR-S	ZONE ANNEAL	.0001 HG	SILVER SOLDER
FLARE	SOFT SOLDER	S.0004	H.T.	STRESS RELIEVE
CRIMP	TO VENDOR	ANNEAL	TO MS FOR SECONDARY	
SEE PRINT				
OTHER				

DISPATCH

Computer Systems and Stockroom Work. Knowledge of the kinds of tasks involved in receiving and pulling allows us to become more concrete about the ways in which MRP computer systems enhance the importance of stockroom management of physical inventory and of its record-keeping functions.

The MRP system maintains an electronic record of all transactions made in the stockroom. These transactions are significant for the functioning of the system, since they represent its raw data on the number of pieces of each part physically residing in the plant. These data are then manipulated by the computer system, which recommends purchases for future production needs and prepares a production schedule. A recording error, such as writing down "100,000" instead of "10,000" parts received, could result in the computer "thinking" sufficient parts are on hand for production, when in reality there may be too few. Such a discrepancy between the actual count and the computer record might not be discovered until the production process is under way, and manufacture cannot continue because of an inadequate number of parts. Similarly, if, in pulling, a worker errs in computing the quantity of a particular part remaining in stock by overestimating this amount, the computer would not "know" there is a shortage and would fail to order more parts. The consequences of inaccurate counting, computing, and recording in the stockroom can be severe, both from the point of view of the immediate effects on the production process and from the point of view of incorrect data in the computer. The results of such errors become compounded as they move through the system. The MRP system, working as it does on low inventory levels and striving for a "just-in-time" production of goods, makes the need to maintain accurate inventory levels more crucial to the functioning of the plant as a whole. Small errors can have consequences that increase exponentially, once entered into the computer.

On the other hand, the computer has also increased the complexity of the stockroom workers' tasks and increased the need for troubleshooting and problem-solving. In the course of receiving and pulling, the worker may encounter numerous instances of discrepancies between stockroom records and computer data. For example, while a bin may be empty, the computer record may show it containing 1,000 parts. Workers need to understand how the computer works, as well as how the stockroom handles empty bins in order to troubleshoot such a problem.

Additional problems present themselves, too. For example, identically--machined parts may have similar part numbers, the differences being only in the "tag" number (called an M-code) that represents operations performed on the part. For example, two parts may be named 1-2567-1 M99 and 1-2567-1 M06; the differences in their M codes mean that the first part (M99) is unprocessed, while the second (M06) is plated. If a data-entry operator does not attend to the M code and mistakenly enters M99 on parts received in under the M06 code, it will wreak computational havoc in the system and also confront stockroom workers with the need to run down the discrepancies in their own and the computer's records for the two parts.

Discrepancies and errors of these sorts can become evident during the course of receiving and pulling. Since errors emerge unpredictably, however, workers who train new employees cannot "choose a problem" to show a trainee. As we show in the section on the training dyad, even when problems arise by chance during training, the trainee is usually not included in the problem-solving process, but instead is left to "pick up" the kinds of problems that occur and ways of solving them on his own.

Organization of Stockroom Training

Training in Theory. Although the job of material handler is ranked at low skill levels in the plant, no one expects a worker to walk in the door and start receiving or pulling stock without training. "Training" is an explicit category of activity within the stockroom and is incorporated in company personnel procedures with respect to new stockroom hires. Experienced workers are not simply told to "keep an eye on" or "work alongside of" new workers, but to "train" them (a fact that led to a senior worker's protest that he was often asked to spend time training, although training was not included in his job description and he was not getting paid for it. Interview, April 9, 1987).

Officially-sponsored training of stockroom workers has been taking place for at least a decade (Interview, April 9, 1987) and is not a recent innovation accompanying introduction of computerized inventory. We do not know the historical reasons for establishing a training program for stockroom workers, but its existence raises interesting questions about management's understandings of the skill requirements of this job and how workers learn them.

If the existence of a training program for stockroom workers is possibly surprising, it is not surprising that supervisors and senior people have constructed their own theories of what that training should look like. None of these has been incorporated in an explicit plan filed in the personnel office; training assumptions and procedures, as far as we know, are an unrecorded form of cultural knowledge. This situation does not imply that views on training are part of an implicit, difficult-to-access knowledge base. On the contrary, we found that they are firmly grounded in Kemp's history and practice. Some supervisory and hourly workers are reflective and explicit about how training "is supposed to be" and bring their views into play in their day-to-day decisions regarding the training of particular individuals.

We learned about training theories and past practices through impromptu discussions and overheard conversations, as well as through formal interviews designed for this purpose. The stockroom supervisor engaged us in several lengthy exchanges on his training philosophy, and senior leadmen volunteered comments from time to time, especially when training was in progress. Our field notes also contained unsolicited or overheard comments from personnel in other parts of the plant, and training issues came up incidentally in interviews designed to explore other topics. For a more systematic appraisal, we conducted a series of semistructured interviews in which we queried individuals on their own experiences as trainees, trainers, or both and on their personal beliefs about what kind of training procedures make for effective stockroom practice. These included interviews with Danny, the manager of material control, who was responsible for the shipping, dispatch, and stockroom departments; with Warren, the supervisor of dispatch; and with five experienced stockroom workers, some of whom were acting as trainers during our study. All interviews were tape-recorded and transcribed.

Our first observation is a methodological one. For certain individuals, we have both incidental and elicited comments, and we can say that nothing in their unsolicited talk about training was at odds with information given us in recorded interview sessions. Although people differed in their views of the "right" way to train, they were consistent in their expression of these views both off and on the record.

We summarize the gist of this material around standard training topics: How long is the training period? Who does the training? What is the nature of the training "curriculum" and what is

the preferred method of pedagogy? What emerges from the summary is a multiplicity of descriptions of current stockroom training practices and a variety of views of what it "ought to be." We follow this presentation with a description of training as it actually transpired during our six-month observational study.

Duration of Training. Training begins as soon as the new worker completes paperwork for the Personnel Department and walks into the stockroom. When it officially ends is not so clear-cut. The probationary period for this job is 60 days, but no one suggested that training covered that entire time. Most supervisory informants cited "two weeks" as the training period, this cutoff apparently being set at the boundary of a new worker's ability to "work with another" and "work alone." Yet two weeks is not set in stone. Danny, the material control manager, noted:

> I base two weeks [for training] that I feel you should be able to do the job on your own after two weeks is up...I won't hold it against you if you can't. And I'll keep you with somebody for another week or so because I got 60 days to really make my decision (Interview, January 28, 1987).

According to Danny, one recently hired worker did a really good job and picked up on how to do everything within the first week and a half.

When the new hire is working alone, he or she continues to be "monitored," according to manager Danny, or "always watched," according to stockroom worker Mickey, for a period of time whose duration is unclear. Danny seems to consider the two months of probation as the monitoring period. Mickey indicated that six months might be necessary, saying at one point that a new worker who is unable to do the job six months from hire, will probably get fired or, if not, "he should look for another job."

Even after that period of time, however, a stockman is not considered fully expert. It may take up to two years, the material-control manager said, until a stockroom worker is "fine-tuned." The period of learning, or gaining expertise, clearly far outstrips the period of training.

Who trains. Since training proceeds in the absence of any written description, how it is carried out depends crucially on the background and views of the individuals who act as trainers.

Supervisors do not themselves engage in training of stockroom workers, and no one in the stockroom carries an auxiliary title of "trainer." What factors then regulate trainer selection? Mickey, one of the more senior workers (he entered the stockroom in 1980), said it was the practice to have leadmen or men with high seniority do the training. Leadmen stand between regular stockroom workers and the department supervisor; they have long and diversified experience in the stockroom, carry special responsibilities, and are paid at a higher rate than others. When we were at Kemps, the two leadmen had 30 years and 13 years seniority respectively.

Although training by leadmen may have been the customary practice (and be still considered the appropriate practice by senior workers such as Mickey), the manager of material control and other supervisors did not refer to such a practice. They said little about considerations affecting their choice of trainers, and what qualifications they looked for—with one exception: the material-control manager on several occasions stressed the importance of putting new workers with men who had "good work habits"—that is, men who put in a "good day's work" and were not "wastes."

One issue concerning trainers disclosed differing opinions among supervisors. The material-control manager said it was good practice to have a new hire work with three or four people because "he will learn how each person does it his own way" (Interview, January 28, 1987). Bert, the newly appointed stockroom supervisor, thought only one trainer should be involved; he believed that a trainee coming into a new job will be nervous and needs the experience of working steadily with someone to "really learn the job" (Interview, April 21, 1987). Clearly, the two people with authority to make decisions about training were approaching the task from different vantage points: Danny, from the point of view of what management needs in the way of an end product, Bert, from the point of view of the learner's requirements.

Training curriculum. By curriculum, we mean the content of training, with the understanding that, for on-the-job training, much of that content will consist of the specific work tasks to which the new person is assigned.

In interviews on training practices with workers, their references to training content dealt exclusively with job sequencing and organization. No informant mentioned the existence of special training materials nor alluded to a need for any. Kemps has no manuals describing principles of

inventory or stockroom procedures, nor are instruction sheets available to new workers on topics such as how to use the computer or ratio scales or how to fill out a bin card. The only written materials a new employee encounters are documents that constitute an integral part of the activities of receiving and pulling in which he or she may be engaged. Prework "orientation" consists solely of a brief discussion in the personnel office in which the new hire is acquainted with employment practices. Although we were given a tour of the plant to prepare us for our research, new workers are not.

The customary and current practice is to have training conducted within the department to which a new worker is assigned. Danny said that he thought this practice should be abandoned in favor of cross-training in the four departments of shipping, receiving, dispatch, and component stockroom; material-handler tasks in these areas, he claimed, have many elements in common. Danny intimated that a higher-management decision was needed to implement this policy; it is unclear with whom this responsibility rested, but the fact that he did not move to put such a plan into operation suggests that, appearances notwithstanding, some general structure of training was operative in the plant as a whole and kept in place by "higher authority."

Is there a commonly accepted course of study? According to Mickey's account, the traditional practice was to assign new stockroom employees to the job of pulling work orders. When he arrived at Kemps in 1980, the day shift worked exclusively on pulling orders (receiving was done at night), so this introduction to the job seems to have been motivated by production, rather than training considerations. All training time was spent on work orders; with experience, workers would be assigned to receiving, and some—the more expert—moved on to cycle-counting. Training was chunked around one principal work activity—pulling—and movement across activities occurred as production requirements necessitated the shifting of workers, not as part of training.

Since 1982, receiving has been carried out on the day shift, and the entry point for new trainees has been optional. Current supervisory personnel theorize that it is best to start a new worker on receiving rather than pulling. The material-control manager said it is better to start with receiving "because you tend to learn parts faster" that way (Interview, January 28, 1987), but either way (pulling or receiving) the trainee will learn. This rather relaxed view of where to start is consistent with his overall scheme for training.

The manager advocates starting a new worker out on receiving for a day or two, then moving the worker on to someone else to do work orders for two days in a row, then on to other specialized components of either pulling or receiving (learning how to pull bulk orders as opposed to regular orders, for example). In this conception, training involves an introduction to all aspects of stockroom work, with the exception of cycle-counting. The recently appointed stockroom supervisor, Bert, agrees that receiving is the way to start, but he explicitly rejects the notion of rotation. Bert says "receiving is the core": while doing it, people learn locations, become familiar with the parts, learn the rudiments of pulling—in short, they are exposed to basic procedures, forms, and principal tasks in the stockroom. The best way to train is to put a person on receiving for two or three weeks with the same person in that area. Then, in another day or two, the trainee can be moved to pulling work orders, and "all he will have to learn is the actual pick sheet." Bert's thesis then is that a new person should "stay put" and remain in the activity that encompasses the greater part of the tasks arising in the stockroom. His views contrast with Danny's notion of a diversified curriculum and a specialized approach to training.

On this topic, too, what is left unsaid merits attention. None of the supervisors pursued the question of job assignment beyond the highest level of generality—namely, concern with which of the three principal stockroom activities should become the context for initial (or total) training. Yet, as we have seen, each of these activities is composed of many actions, ranging from physical tasks, such as pulling loaded bins back and forth to their locations, to symbolic tasks, such as performing written math calculations. Moreover, as we will describe later, ways of performing these tasks are multiple; among experienced workers the order and the way of accomplishing them are fluid and diverse. One might have expected then that some detailed attention would be given to the desirable mode of work organization for a team composed of old hand and new hire. Nonetheless, no one interviewed spoke of the work curriculum on this performative level.

Pedagogy. The manner and method of trainer-trainee interaction received attention from only two informants—Bert, the stockroom supervisor, and Mickey, the experienced stockroom worker who was one of the trainers during our observation period. Indeed, it was Mickey's training method (described in detail below) that was the occasion for his own and Bert's discourse on "good trainers." Mickey provided background information to his trainees, explaining to them in detail about the organization of stock locations, kinds of parts and their distinguishing characteristics, how the stockroom functioned in relation to other departments in the plant, and other basic knowledge.

Mickey justified this "verbal instruction" on the grounds that it gave a new worker some idea of how things worked, even though he knew the worker would not remember the information. Bert, the supervisor, and Fernando, a leadman, went out of their way to tell us that they disapproved of such a teaching method. It confused the trainee with too much information that the trainee would not remember.

Summary. "Training a new stockroom worker" is a recognized activity at Kemps, and supervisors accept the responsibility for overseeing this activity. Since training principles and procedures for this and other jobs at Kemps, including those requiring the most skills, have not been codified or even written, they operate as a piece of oral cultural knowledge. Oral traditions have their common core of consensual opinion with variation by individual and group. The common core we uncovered involved general principles: training would revolve around work, be conducted by experienced workers, and be continued for a period of (more or less) two weeks. Variations involved the exact nature of the work curriculum, what should transpire after the core period of training, and how to define good training.

Training in Practice. We have before us various representations of Kemps's ground plan for stockroom worker training. Now we can see the relationship of these representations to practice.

During the six-month period of this study, Kemps hired nine people as material handlers in the stock room. We received timely notice for five of these new workers and followed their training in great detail. Here we summarize the organization and content of their training. Sources of information for this section included personnel records, interviews with the new hires and their trainers, and systematic observations (see pages 37-43 for a full description of observational methodology).

The trainees. Four trainees (Ed, Joe, Reggie, Tony) were men and outside hires; one (Bess) was a woman working at Kemps as a below-grade packer who bid for the job to earn more money. Table 1 summarizes the educational and employment histories of these trainees and the composition of the stockroom work crew during their training.

We mentioned the contradiction between Kemps's classification of stockroom work as unskilled labor carrying a low rate of pay, and top managers' expectations that such workers should be

TABLE 1
Backgrounds of Trainees

Trainee	Age	Highest school grade completed	Previous work	# of experienced co-workers
Ed	22	4	waiter	6
Joe	53	10	animal caretaker	5
Reggie	24	14	material preparer; sorter/handler; welder	3
Tony	22	12	stockroom worker	3
Bess	26	12	packer	0

competent in record-keeping, show judgment in problem-solving, and be good at math. The Personnel Department appears to have hired on the basis of the official Grade 2 job description rather than on the basis of the actual content of the job under MRP conditions. It set no minimum educational requirements nor sought prior work experience that would demonstrably involve math or literacy and record-keeping skills. However, three of the five trainees had completed either high school or community college.

We have no systematic data that would help us ferret out possible relationships between schooling level and learning experience, nor could we do more than float hunches with the small number of people involved. What we know, however, suggests no straightforward relationship between schooling and the molar level of routine performance observed during training. As far as supervisory and employee attitudes are concerned, no such relationship is apparent. Ed had the least schooling and reported himself low in literacy skills, yet the material-control manager considered him a "quick learner" (as did Mickey, his trainer, and as did we). None of the trainees was fired for failing to learn the job. On the other hand, one (Ed) was dismissed on grounds of absenteeism, another (Tony), on grounds of insubordination. This outcome seems to be in accord with the history of hires in the stockroom in the period immediately preceding our fieldwork. The manager reported three

dismissals of material handlers, all on the grounds of unsatisfactory work habits or attitudes, none on the grounds of incompetence. The one trainee (Joe) who appeared to have difficulty in acclimating himself to the work during this study left of his own accord. Thus, it appears that the social expectation is that trainees will learn the work if motivated to do so. Appraisal of individual cognitive abilities seems to play little role in management's hiring and training decisions.

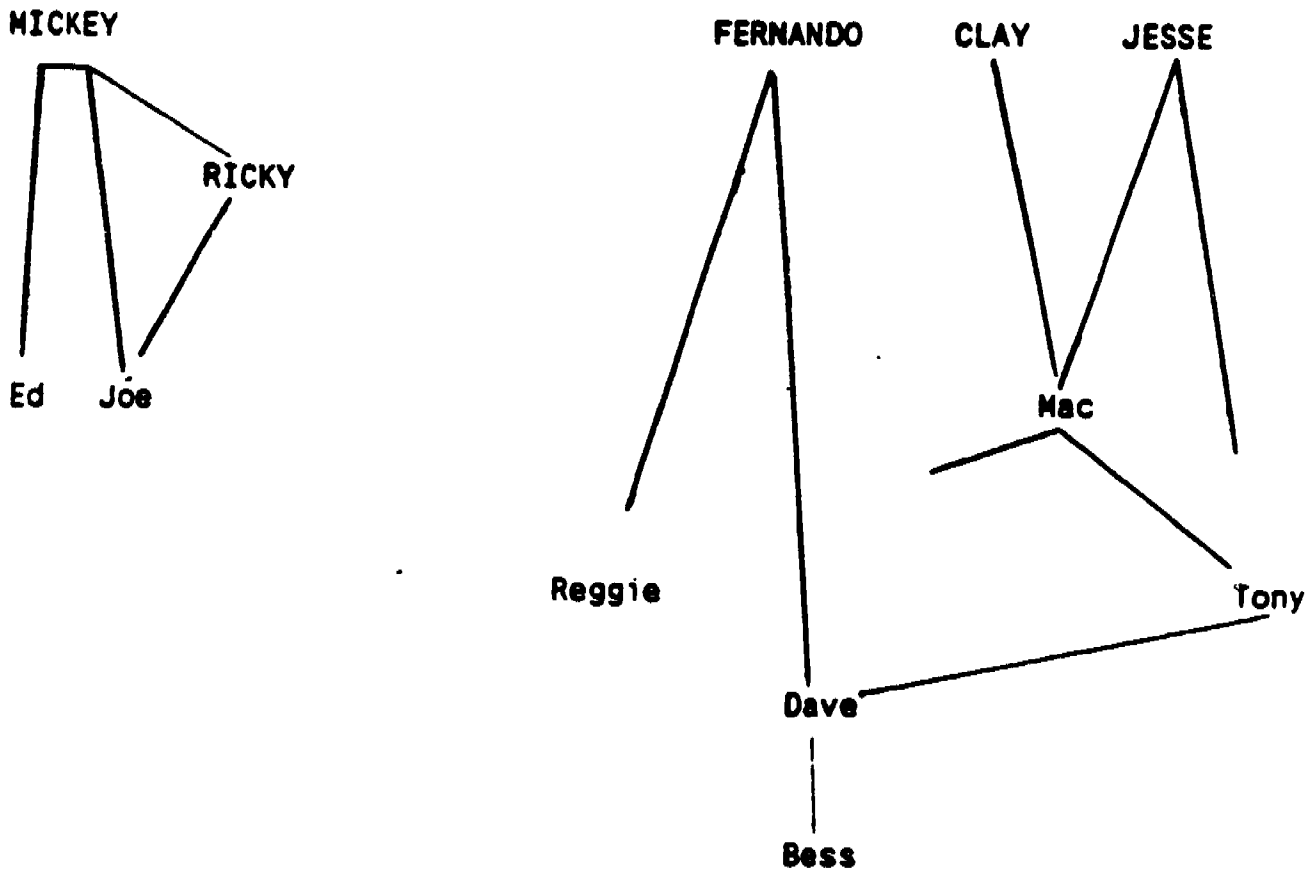
The trainers. As we saw, official procedures call for leadmen or workers classified in Grades 9 and up to "instruct." In the six-month period in which we followed training, however, only one of the two stockroom leadmen participated in training, and he was involved with only one worker for a few hours. The highest-graded workers in the stockroom, Mickey and Jesse in Grade 5, carried fairly extensive training responsibilities, although their job descriptions did not include them. But the most striking occurrence was that, within a brief period of 10 weeks, the bulk of the training passed to brand-new trainees, of whom three had not yet completed their own probationary periods. Figure 7 presents this genealogy of training, graphically portraying the "downgrading" of trainers' experience and skills over time.

The turnaround from use of experienced to inexperienced trainers surprised us but did not seem to occasion much comment within the community. The material-control manager once expressed his discomfort that Mac, with only a month's experience, was training two new people ("Mac isn't fine-tuned yet," he said), but the stockroom supervisor described Mac as a good teacher. The elder statesman of the stockroom, a leadman with 30 years seniority, volunteered his opinion that the new men were doing a good job in training.

In our interviews about training, we found a difference of opinion as to whether one or several trainers should be involved. Observations support the multiple-trainer perspective—all trainees remaining longer than a week were officially trained by more than one person. The involvement of various trainers, however, appeared less propelled by considerations of what the new trainee needed than of how training could be managed given the ongoing workload of the stockroom. Practical considerations, such as who was around, how pressing the work was, and so on, seemed to dictate choices. We suspect that such considerations always intervene, although it seems likely that they took even higher priority during our observational period. In that time, the six experienced workers either left or were transferred out of the stockroom (see Table 1); by summertime, a work force of six to

FIGURE 7

Genealogy of Training



Fully capitalized names denote employees who at the time of the study were senior stockroom people. All others were hired during our observational study.

seven, rather than the ten-worker force projected on the organizational chart, was carrying both work and training responsibilities.

Under these circumstances, the stockroom supervisor, himself a man with low tenure in the job, decided to set "experience" to get out the work and let training take the consequences of fortuitous events. The distance between trainer and trainee, so clear-cut on a policy level, narrowed in practice to a point where the placement of individual workers in one class or another became almost arbitrary. A model of reciprocal teaching (each one helping the other with what s/he knows best) characterizes later training in the stockroom more aptly than an expert-novice model, the framework within which many researchers are now trying to capture domain-specific learning.

Curriculum. Mickey was the only trainer who brought the new person on board with a general description of the stockroom and information about the component parts it stored. All trainees except Mickey's were directly inducted into the work process on their arrival. Again with the exception of Mickey, the work curriculum began with receiving rather than pulling, and the bulk of official training time was devoted to this work activity. Here we see policy and plan taking precedence, even to the extent that the supervisor preferred to interrupt one new worker's training in order to have another trainee spend the first day on receiving. (See Table 2 for analysis of work tasks in training dyads.)

Pedagogy. In interviews and general stockroom conversation, we heard no discussion of specific methods of training. When the first trainees came on, however, and were assigned to Mickey, strong feelings were aroused by his training style. As we have described (and will examine in detail below), Mickey devoted an initial period of half an hour or more to a tour of the stockroom in which he explained storage locations. He assigned the trainee to pulling work orders rather than receiving; when he himself began to pull, he proceeded more in a "teaching" than a "working" mode for another hour or so—explaining in detail what certain codes on documents meant, describing component parts, and the like. Mickey's decision to start on pulling rather than receiving reflected his own trainee experience, and displayed continuity with the customary training practice (see above). According to his own account (Interview, April 9, 1987), Mickey's trainer had also given him a "tour," and he always began his training this way, to give the new worker "an idea of what it's all about." Mickey was reflective and articulate about his training theory.

TABLE 2
Number of Pulls/Receipts
during the Basetime Period

Learner	Pulls	Receipts	Back orders	Total
Ed	7	0	0	7
Joe	7	0	0	7
Reggie	0	12	7	19
Tony	0	6	5	11*
Bess	0	10	9	19

* During the basetime period of Tony's training, his trainer, Mac, was called upon to help find missing parts. The missing parts were related to a job Mac had done the day before with Reggie. The first 45 minutes of Tony's basetime period were spent waiting for Mac to return and begin to train him. The low numbers shown here are roughly half those for Reggie and Bess, who were busy "being trained" during their basetime periods.

Mickey's theory, however, conflicted with supervisor Bert's. It was not only that Bert believed in starting new workers on receiving rather than pulling, but he disapproved of Mickey's extensive verbal explications. He thought these were more than any new worker could grasp: "Mickey's a good worker, but I don't believe in that kind of training." For example, Bert said to Ricky, a stockroom worker:

> Bert: You'd be surprised...I don't believe in talking too much. I believe in walking with the guy, everything you do, do with him. Leave him alone. Just let him sit. You don't automatically grasp, you don't automatically grasp, but if you constantly tell him this is where we keep insulators, this is where we keep...forget it, forget it.
>
> Ricky: It's like an overload.

Bert implemented his own view of how training should proceed when Reggie was hired. He commented to us at the beginning of Reggie's second day of training:

> [If you say] this is an insulator, this is a body...that man is not going to remember all this. The only way to work is to get to the core, and the core of it, as far as I'm concerned is the

receiving...Because you're putting stock away...and you're feeling the parts in your hand. Then you know, when you're working you'll know *this* is an insulator, *this* is a body.

In the light of Bert's decisive action with respect to starting workers on receiving, it is interesting to note that he did not again intervene in what went on between the appointed trainer and trainee on the basis of training considerations. As long as the training began with receiving and the trainer did not appear to talk too much, he appeared satisfied.

Summary. On-the-job training, as exemplified in Kemps's stockroom, is an activity subsidiary to work and a dynamic construction in which many factors enter. Since the stockroom is hierarchically organized, supervisors' views of how to train, and how much leeway to allow trainers, are major ingredients. Other factors may be considered "accidental"—which level of management is charged with decision-making at the time and is thus in a position to implement its theory, the composition of the stockroom work force, its turnover rate and workload, the distribution of stockroom activities across shifts. All influence the social and technical organization of training. Background factors such as union policies play a role as well (the union permitted Mickey and Jesse to train outside of their classification, for example), as do established personnel practices. What does not happen, however, is that a training "plan" is put into operation. Rather, training "takes shape," as supervisors make ongoing decisions on the basis of historical practice, recent precedents, personal theories and pragmatic constraints.

At Kemps, neither the supervisors' theories of training, nor the training procedures that "took shape" reflected top management's views of the importance of intellectual understanding in modern forms of inventory control. Training, with one seemingly accidental exception, was assimilated into ongoing work practices, with the consequence that trainees were primarily exposed to routine, "normal" work events and not explicitly prepared for problem-solving in the context of the data-management system.

PROCESSES OF STOCKROOM TRAINING

Research Questions and Methodology

Thus far, we have described training activities in the stockroom on what may loosely be called an institutional level. This description captures certain organizational aspects of stockroom training in terms of conventional categories (e.g., trainer selection, pedagogy, curriculum), which allow it to be compared to other training programs in and out of the world of work.

In the next section of this report, we move down a level in our analysis and look at training activities from a process perspective; we want to achieve a fine-grained description of the actions and interactions of which training is composed. For this microanalysis, we need a unit of organization that captures the basic training processes, screening out "noise," while providing us with consistent boundaries for our analysis. We find this unit in the trainer-trainee dyad. Much of management's involvement in training concerns the setting up of such teams. Once set up, responsibility for the how and what of training—the actuality of what becomes—seems to pass to the individual appointed to the trainer role in a process of reciprocal interaction with the person in the trainee role.

The training dyad in the Kemps stockroom has a number of interesting and somewhat paradoxical features. Although the role of trainer is transient—no one is permanently classified as trainer nor exclusively assigned to that function—incumbents operate in that role without close or detailed supervision. No institutional power accompanies the role. The trainer does not exercise authority over the trainee with respect to employment status, he can neither hire, fire, nor effect any other change in the trainee's job or working conditions. From the point of view of power relations in the factory, this training dyad can be considered an exemplar of "peer" teaching: trainer and trainee are bound to each other in a co-worker relationship. From the point of view of technical production relations, however, the training dyad takes on the "superior-subordinate" structure characteristic of teacher-student relationships in the classroom, and of master-apprentice relationships in professions and crafts. This hierarchical structure follows from the uneven distribution of knowledge and skills across dyad members. Although exceptions are imaginable, it will almost always be the case that the incumbent trainer will know more about the Kemps stockroom and its work responsibilities than will the trainee. Finally, the training dyad, because it is simultaneously a team performing stockroom work, represents both work-as-usual and work-as-it-is-impacted by the additional function of training.

Thus, by concentrating on the dyad, we can see how the imposition of a training structure affects the organization of work and performance.

Both social and technical processes are interrelated aspects of training and work activities within the dyad. This interrelationship characterizes not only the dyad but all levels of organization within the plant—the stockroom community and the larger system which is Kemps as a whole. Neither the technical processes of production nor the social relationships of production can be understood apart from each other; together they constitute work.

For our analysis of training within the dyad, we adopt three successive perspectives, from which we hope to capture the particular social and technical processes operating in on-the-job training. The first perspective concerns the functioning of the dyad in relation to other members of the social system of which it is a part, namely, the stockroom community. The training dyad does not operate in a vacuum. The stockroom supervisor is almost always present in the room, as are two leadmen and a corps of co-workers. The material-control manager is constantly in and out. This community incorporates the range of social relations at Kemps: on the one hand, the formal division of labor and power characterizing production and management in the modern corporate factory; on the other, the web of informal relationships based on race, kinship, gender, and other factors that our ethnographic study revealed. Our questions concern how the dyad operated within this system: Did it function as a self-contained unit, or did it become involved with others? Did other members of the stockroom intervene in training and if so, were they operating as part of the formal authority structure or as informal peer group?

The second perspective looks within the dyad in terms of the technical processes of work that the workers were directly responsible for performing. As we noted, work activities in large part constitute the training curriculum. In certain traditional craft and apprenticeship teaching activities (Greenfield & Lave, 1982; McLaughlin, 1979), it has been demonstrated that customary work practices are modified to provide simpler points of entry for novice learners and to move them on to more complex and consequential work operations through planned sequences that prepare them for each move. Since our trainers were only transiently in their roles, and few could qualify as experts or experienced workers, it seemed important to determine whether they employed reorganization of the work process as a teaching device, and, if so, what forms this took.

Finally, the third perspective views the dyad as a system of social communication. We analyze the talk that passed between trainer and trainee to see how instruction as a discourse process relates to hands-on doing of the work. Our questions here focus on a comparison between teacher talk in the classroom and trainer talk in the stockroom.

Methodology. Although we had secured sponsorship of both employer and union, we could not simply appear in the stockroom with our recorders and observation protocols. Unlike other "target populations" who are the subject of learning studies (primarily students), adult workers are voluntary participants who have no personal stake in the research (children become participants by authority of parent or teacher; older students have financial or academic incentives for participation). The fact that management and union authorize the investigation is irrelevant if the workers themselves do not wish to take part. A considerable period of time is needed to gain consent; workers need to understand the research aims, and overcome their well-founded suspicions that the research is being conducted for management purposes. On a personal level, they need to become acquainted with, and gain confidence in the researchers. Conversely, researchers need to know who the workers are and what they do before they can presume to organize the project of "data collection."

We took these considerations into account by visiting the stockroom and spending substantial time there, becoming acquainted with its members and their work. First, we met with the stockroom workers as a group during working hours, explained the purpose of our research, and asked their cooperation. Specifically, we asked each individual to sign a permission form authorizing us to carry out observations while they worked and to tape record them while they were training new workers; in return, we pledged ourselves to confidentiality. All stockroom workers then employed on the day shift gave us written authorization.

Research design. Our initial plan was to observe the training of new workers during their first hours on the job, and to continue observing on a once-a-week sampling basis for the first four weeks of their employment. Since we had been told that "training" lasted for two weeks, but monitoring did not end for some (unspecified) number of weeks thereafter, this seemed like a sensible compromise schedule. This longitudinal design would allow us to document both the training procedures and new-worker learning, as evidenced by changes in performance of the job over time. To

assess changes in knowledge and understanding, we planned a series of individual interviews with each trainee to be held after working hours in the privacy of the unused plant cafeteria. Interviews were scheduled at the end of the second day's training and at the end of four weeks. We adopted ethnographic and clinical interview methods (see Ginsburg, et al., 1983; Pelto, 1970; Spradley, 1979; Werner & Schoepfle, 1987), following up questions and comments with appropriate probes and preserving a conversational tone. These sessions were tape-recorded and participants were reimbursed at a modest fee for their time.

Unfortunately, our plan foundered on the contingencies of stockroom life. We accomplished the original schedule with the first trainee; the second trainee quit at the end of the second day. This event gave us a better understanding of what management meant when they spoke of a high turnover rate in the stockroom. Moreover, the stockroom supervisor, disapproving of the training method used with this second man, introduced changes in the training procedure that interrupted the continuity of training. We were uncertain, too, about how many new people would be hired in the stockroom. Initially, management planned to fill two vacancies, but as older workers left or were transferred from the stockroom, it became clear that additional hires would occur. Under these circumstances, we thought it prudent to recast our plan and focus on the initial period of training, which would maximize our chances of securing comparable data on all new hires. We concentrated on the first two days (as we describe below, official training seemed to end at this point in spite of talk about two weeks). We enriched this corpus with additional observations and interviews conducted on an opportunistic basis whenever feasible.

These modifications had consequences. On the one hand, we protected what we could say systematically about the training aspect of the teaching-learning process; on the other, we limited what we could say systematically about changes in worker performance over time, which would allow inferences about learning. We took these circumstances into account and organized our data analyses and this report around our strong suit—the training aspect of on-the-job training.

Methods. Since our fieldwork indicated that stockroom work involves mobility both within the department and occasionally outside it, it was not practical to set up stationary videocameras. Furthermore, we had many indications that cameras would not be welcome. We therefore decided upon audiotape as the primary data source. Each trainer was outfitted with a small cassette recorder

that captured his talk and that of the trainee.[2] The researcher was equipped with a second recorder, into which she entered a running commentary of the physical and behavioral context of the trainer-trainee activity, supplying through verbal description what might have been captured on videotape.

We met each new worker in the Personnel Department immediately after s/he[3] had completed the necessary employment forms. We explained our research project, secured permission to observe and interview, and accompanied the trainee to the stockroom, at which point we began our taped observation. Two researchers were present for the first two trainees, one for the last three. Whether one or two, however, the method of observation was hardly unobtrusive. To assure a detailed commentary, the observer had to follow the training dyad and one of the pair from one place to another, as their work dictated. On occasion, we could not provide a commentary, since we lacked knowledge of the names of things or activities, and we thought it better to ask than produce an uninterpretable record. Although we tried to be discreet and minimally interfering, we made no pretense of not being there.

It may be argued that these observational methods so influenced the phenomena we were there to study (informal modes of training) that they preclude our ability to say anything about it as it "naturally" occurs. This was the opinion of the material-control manager when we described our intended observational techniques: "One thing it will do is whoever's training them is going to do a much better job" (Interview, January 28, 1987). The dispatch supervisor thought that trainers would say, "I'm under a microscope now, I'll show my best" (Interview, January 28, 1987). Although these comments are intuitively compelling, and impose restraint on our interpretation of what we observed, our analyses suggest that observer-introduced distortions may be neither as deep nor as damaging as suspected. If trainers were challenged to show what a good job they could do, they were still acting in a manner consonant with their understandings of what a "good training job" might be. As we shall see, concepts of effective training varied considerably from one trainer to another, yet certain common characteristics prevailed. Observational records were checked against other informational sources (interviews, spontaneous talk recorded in field notes when we were not focused on training, and the

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[2] One trainer did not want to wear the microphone, so each of his two trainees wore it.

[3] One of the new trainees was female. All trainers were male.

like). Such sources could support the validity of observational records, or, alternatively, help us identify observer-induced biases, so that we could take them into account. We will return to this knotty problem in our concluding chapter, in which we assay the strengths and weaknesses of the methodology we employed.

The extent of recorded observations varied with individual trainees in our adjustment to actual training practices. For example, in two cases, the company hired new men one week after another had started; since we could not expand our field staff at will (nor have new researchers accepted overnight, for that matter), we decided to interrupt our scheduled observations of the early hires to take on the new. We consistently observed all new trainees for their first two days; additional days of observation were spaced primarily over the first two weeks, and amounted to 22 days in all. Actual taped hours varied, again, depending upon the actual training practices. Figure 8 displays the observational pattern.

FIGURE 8

Summary of Recorded Training Observations

	Week	1					2					3				
	Day	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Trainee																
Ed		*	*		*		*		*			*				
Joe		*	*													
Reggie		*	*				*	*								
Tony		*	*	*	*		*									
Bess		*	*	*	*											

* Indicates observation made

Note: Day 1 represents first day on the job for each worker, not necessarily a Monday.

FIGURE 9

List of Training Dyads

Dyad 1	Mickey and Ed
Dyad 2	Mickey and Joe
Dyad 3	Mac and Reggie
Dyad 4	Mac and Tony
Dyad 5	Dave and Beas
Dyad 6	Ricky and Joe
Dyad 7	Jesse and Tony
Dyad 8	Reggie and Tony

The five trainees were paired with several trainers, taking part in eight dyads over the first two days (see Figure 9).

Trainer tapes and commentary tapes were transcribed. Observer comments were integrated into trainer transcripts to yield composite transcripts that aligned commentary with trainer-trainee (and other) talk. These composite transcripts constitute the data base for analyses in the sections on the training dyad, pages 43 to 87.

A second data source consisted of documents that trainer-trainee dyads handled during the observation periods. We secured copies of all receiving and work order forms that were part of their work activities during these periods, as well as scratch sheets or other worker-generated pieces of writing.

Finally, with management permission, we secured copies of personnel records that listed the employment and educational backgrounds of new hires.

The Training Dyad in the Stockroom Community

Life in the stockroom bristles with activity; the place is noisy and busy. During the course of a day, seven to ten stockroom workers are on the job, and they talk while working about any number

of things—troubleshooting a job, checking up on who is working on such and such a part, giving each other a hand carrying heavy loads, and so on. Phones ring, and the PA system makes announcements every few minutes. People from other departments come in and out of the room. Some are on their way somewhere else, and swing through with a "Hi, how 'ya doin?," while others stride in purposefully to track down lost parts, fix a computer, pick up parts to take to dispatch, or get extra parts for production. Often, several events go on simultaneously: middle-managers (the material-control people) huddle with the supervisor, who might call over a worker to track down one problem or another. All the while, workers carry bins, pour metal parts from one bin to another, and work on the computer to find locations.

We examine here the way in which the training dyad interacted with the rest of the stockroom community. Although we knew that the dyad was constituted as the official training unit, it was not clear whether or how other people in the stockroom also became involved in the training. We assayed the relationship of the dyad with the rest of the stockroom community through a basic unit called the "interaction." This unit was defined structurally as a verbal or performative event in which a third party interacted with one or both dyad members. By including performative events, we hoped to capture such interactions as a worker coming by the dyad's work site and lending a helpful hand with a heavy bin. As it turned out, only six performative events were recoverable from our transcripts and our analysis can therefore be understood as applying to verbal interactions.[4]

The notion of an "interaction" appears, at first, to be a straightforward unit. We realized through successive coding efforts, however, that it was not easy to define the boundaries of these social units in a highly fluid setting. We were able to identify the beginnings of interactions without too much difficulty, but identifying "ends" of interactions was not always possible, because interactions tended to interrupt one another. When one interaction was interrupted by another, we decided to end the first one by default, and begin the second one. Our decision to code the smallest possible size of an interaction has given us a sense of the "texture" of the interactions, which we discuss below.

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[4] Amy E. White spent several months helping us develop coding schemes and carrying out the coding. Meryl Schildkraut entered the data into the computer and ran statistical analyses for us.

The coding scheme (available on request) captured structural features of dyad-other interactions including: a) who initiated an interaction; b) who in the dyad was present and participated; c) who became involved; and d) how long the interaction lasted. In addition, we coded the content of verbal interactions according to the principal topic. A reliability check performed by two independent coders, produced reliability coefficients of .80 or higher.

Results. Principal features of interactions for both the base period and the adjusted corpus data sets are summarized in Figure 10 (the adjusted corpus is the corpus-minus-the-base-period).

With few exceptions, the base period and adjusted corpus yield similar patterns of results and the essential story can be told from either data set. This suggests that the pattern and content of interactions involving training dyads and others in the stockroom are quite consistent over the two-day time period. In what follows, we will use the base period as our reference point, and refer to the corpus for confirmatory or, occasionally, variant results.

During the 90-minute base period, the five dyads participated in a total of 94 interactions (301 for the adjusted corpus). These interactions, of course, were not equally distributed over time; quiet periods were interspersed with periods of dense interactions. However, the average number of interactions per dyad per hour conveys some sense of the level of intensity: these averages are 12.5 for the base period and 15.4 in the adjusted corpus.

Since we do not have comparable measures for interactions concerning worker dyads (or teams) when the training function is not involved, we are limited in our interpretation of these figures. "Low" and "high" are relative to some standard. However, these results do suggest that training dyads did not function as self-contained units. In a dyad's transactions with others, the individual learning to be a worker was exposed to a number of situations in the stockroom, and to the interactive work style that characterizes this job.

Interactions were initiated by people in three roles: trainer, trainee, or other. Trainers and others initiated almost all interactions, and trainees neither initiated interactions nor were addressed by

FIGURE 10

Comparison of Principal Features for Dyad/Stockroom Interactions

	Base period		Adjusted corpus	
	N=94	%	N=308	%
INITIATION				
Trainer	42	44.7	110	36.5
Learner	2	2.1	10	3.3
Third party	36	38.3	138	45.8
Indeterminate	14	14.9	43	14.3
DYAD PARTICIPANT				
Trainer alone	57	60.6	211	70.1
Learner alone	21	22.3	34	11.3
Both	6	6.4	18	6.0
Neither (Bystander)	3	3.2	19	6.3
Indeterminate	7	7.4	19	6.3
NUMBER OF THIRD PARTY PARTICIPANTS				
One	88	93.6	266	88.4
Two	6	6.4	28	9.3
Three and more	0	0	7	2.3
Duration (in conversational turns)				
1 turn	10	10.6	32	10.6
2 - 5	45	47.9	135	44.8
6 - 10	13	13.8	58	19.3
More than 10	12	12.8	48	16.0
Missing/Indet.	14	14.9	28	9.3
CONVERSATIONAL TOPIC (DUPLICATE COUNT)				
Any work	46	48.9	134	61.1
Any training	8	8.5	8	2.7
Any labor	18	19.1	81	26.9
Any social	14	14.9	82	27.2
Indeterminate	14	14.9	21	7.0

others. A breakdown of the "other" category disclosed that individuals in positions of authority (managers, supervisors, leadmen) initiated more than twice as many interactions with the dyad as did workers in peer positions.

Using the same division of third parties into the categories of supervisory and worker personnel, we found that approximately two-thirds of the interactions initiated by trainers were addressed to supervisors. Thus, we see an interesting reciprocal pattern in the interactions of the dyad with the stockroom community, in which supervisors engaged trainers and trainers engaged supervisors.

We defined a dyad participant as one who either engaged in some part of the conversation or performed some action (lifting a bin), regardless of who initiated that particular interaction. Four forms of dyad participation were possible: trainer alone, learner alone, both, or neither. In the overwhelming majority of cases, the trainer was the sole dyad participant in the interaction; the learner alone was the next most frequent category; and, on rare occasions, neither one participated. This last situation occurred when the dyad was bystander to an interaction "spun off" from an earlier one that included a dyad member.

We knew from ethnographic observations that a trainer would occasionally walk away from the learner and talk to other people or be called away to work on a problem; at times these jaunts would last as long as 45 minutes. Since the trainer was the only dyad participant in 60%-70% of the interactions (according to our definition of participant), we wanted to ascertain whether learners were actually present during interactions. Through information provided on transcript commentaries, we were able to count whether a silent dyad member was really there. The learner was present during most of the interactions in the base (84%) and corpus (74.1%) periods, and the trainer was present 89.4% of the time during the base and 87.8% of the time during the corpus. Thus, the low level of learner participation does not signal that the learner "as observer" was not picking up valuable information from the exchange.

Overwhelmingly, interactions took place between one or both dyad members and only one other member of the stockroom community. However, interactions involving two or more third-party participants were more significant than their frequency would indicate. These tended to be of long

duration, and were often linked with other interactions. During these sequences, the topic of conversation might "migrate," causing some people to exit the conversation while others remained or joined. Our content analysis (see below) indicated that these multiple-party and linked interactions were primarily devoted to handling problems arising in the work or dealing with labor relations and were thus pedagogically rich to the learner.

We measured the duration of interactions in terms of turns of talk. We recognize the difficulty of using turns of talk as a device for duration, since one turn might involve a long digression by one individual, while another might simply be a quick greeting. What we aimed to capture, however, was not so much the amount of "real time" spent interacting, as the extent of "back and forth" discussion. Most exchanges were fairly short (2-10 turns of talk) but if they continued beyond five turns they were equally as likely to be very long (more than 10 turns) as to fall into an intermediate (6-10) range.

Coding the initial units of interactions—ending one when it was interrupted by another—had the side effect of fragmenting what might have been essentially unitary events. In an effort to glue together what we had torn apart, we classified interactions as either "initial" or "subsequent." Subsequent interactions shared a common conversational topic with the initial interaction. More than two-thirds (65 of 94) were initial. This finding served to reinforce our early sense of the highly-interrupted quality of stockroom interactions and the degree to which the topics of conversation, or work themes, were difficult to sustain. We can state with confidence that the relationship of the dyad to the stockroom community was permeable, highly interactive, and migrated from topic-to-topic and person-to-person through interruptions. This dynamic social life put members of the dyad in constant, if fluctuating touch with the stockroom community.

We categorized the conversational content of the social interactions into four dimensions: training, work, labor, and so ·ability.[5] Coding was duplicative; each interaction was coded for all topics covered. We present illustrative examples of these categories below.

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[5] We coded the content of interactions with multiple categories (i.e., an interaction might be a conversation that was about more than one topic). Some interactions were marked by only one content category, while others were marked by two or three content categories.

The training category included talk that explicitly referred to how to train or to what-should-be-done-next in the training process. Talk actually commenting on the training process was included here. (Talk of a different nature might serve the purpose of training but it was not included in this category unless it was marked by the speaker as a comment on training.)

Context:	The leadman (Bob) interrupts a trainer (Mickey) who is training a new worker (Ed).
Bob:	Excuse me, Mickey, this is very important. I asked him once whether he understands what you're saying, if he understands the items you're showing him. This is very important.
Mickey:	OK.
Bob:	You know, some people, they're scared, they wouldn't say yes or no, but then they may not understand.
Mickey:	[To Ed] If you don't, if you don't understand something, just...
Ed:	Yeah, well, I understand it.

The category of work referred to the technical aspects of the job (doing a task, seeking technical information, discussing a problem). This included work performed by the dyad, as well as work being performed by others in which the dyad became involved. Here is an example of talk concerning tasks the dyad was working on:

Context:	A novice trainee (Mac) talks to the stockroom supervisor (Bert) about some missing information.
Mac:	A bin card, 99, you know what I'm saying?
Bert:	No, no, no.
Mac:	Five.
Bert:	There should be five.
Mac:	That's what happened, they got put in the...
Bert:	No, but they were put on the computer.

Mac: No, but what I'm saying what happened was, we received them as 99, and they're probably in there, you know? Look for [the history].

Bert: Here it is.

In addition, the training dyad got involved in the tasks of others:

Context: The stockroom supervisor (Bert) pulls a novice trainee (Dave) away from his job of training Bess, an even newer trainee.

Bert: [Interrupting Dave training Bess] I hate to bother you like this. I can't help it. There's one bin that has to go over to the machine shop right away, as a matter of fact, I don't even have an MO number for it, look what I'm using.

Dave: Zero in stock...So where's the part at?

Bert: I got it, hold on, just relax a minute. I got to give you the [paperwork], so hold on a second. They don't want to leave me alone this week, I tell you. Somebody don't like me this week. Am I right, Dave?

The category of labor referred to "being a worker," which included talk about safety issues, union concerns or problems, decisions by management, the organization of the work in the stockroom, and so on. Finally, sociability referred to personal conversations, jokes, and greetings.

The outstanding finding is that the training process was rarely a topic of conversation: in only eight percent of base-period interactions and a bare three percent of corpus interactions was the dyad's training function alluded to in any way. In other words, others in the stockroom did not get involved in training. On the other hand, half of the interactions in the base period and sixty percent in the corpus were about work in whole or in part. More than twice as many interactions concern work as any other content category during the base period.

We analyzed the content interactions by initiator, and found that during the base period trainers initiated more work-related interactions than did third parties (see Table 3).

When we break down the category of "work" into its subcomponents, the majority of interactions concern the task in the dyad, while the rest are split between tasks going on elsewhere in the stockroom, and general questions about the technical system. In general, trainers seemed to "export" their concerns about the particular task-at-hand out of the dyad, while third parties "imported"

the few concerns they had about training into the dyad. Put another way, third parties sought out the trainer in his capacity as co-worker for advice or information about their jobs; they did not tend to volunteer information to the dyad about its work.

TABLE 3
Comparison of Content of Interactions
Initiated by Trainers and Others
(by number during basetime)

Content	Initiators	
	Trainer	3rd party
Any work	23	15
Any labor	12	6
Any training	2	6
Any sociability	4	8

Half the interactions were labor-oriented and sociable during the two-day period, offering some evidence of the important roles these domains play in communicating to the new worker what "learning to work" means in this environment. Note the following conversation:

Context: An experienced trainer (Mickey) talks to a longtime leadman (Bob).

Mickey: This guy wants to put a scale at every aisle and get rid of the chairs, saying that the guys don't have to sit down...So that's his idea, is, like, you know, to keep the guys moving, but what happens is the union says, "Hey, you can't do that, because the people in assembly sit down, the people on the line sit down, the material handlers have to be on their feet all day long, running around like crazy?

Bob: That's discrimination.

Mickey: Yeah.

An Extended Interaction. Several protracted interactions took place in the stockroom during the time we recorded the training of new workers. Their numerical insignificance, however, is overshadowed by the significance of the complex and integrative information they contain and is available for new workers to pick up. Long interactions tend to concern kinks in the routine performance of the work, such as missing bin cards, mislaid master bins, and incorrect locations on the computer. We briefly describe one long, problem-based interaction here. It occurred in Dyad One, when Mickey was teaching Ed to pull back orders. This description helps clarify the nature of social interactions that are organized around the work process rather than around the training itself. While this episode of problem-solving does not directly involve the learner, he was present throughout.[6]

> The problem began when Mickey and Ed needed to pull 60 pieces of a particular part for their work order. When they went to the part location Mickey said, "Looks like we don't have enough" (there were 40 pieces in the bin). When he looked at the record of bin transactions, however, it showed a balance of 4,400 pieces. This major discrepancy—40 pieces in the bin and a bin card reporting 4,400—constituted the problem. This problem was further complicated when Mickey discovered two other bins containing the same part and holding a total of 5,000 pieces. Actual pieces now totalled 5,040, compared to 4,400 on the bin card. Mickey went to the computer to try to clarify this discrepancy, but *it* reported 19,690 parts on hand. At this point, some extensive interactions began. Mickey called upon Bert, the supervisor, to key his code into the computer so that Mickey could look at a particular computer screen that contained a history of all transactions for that part. Mickey found some possible errors in these transactions, and then questioned Ricky, a co-worker, who had "received-in" some parts a few days earlier. Mickey thought that Ricky had made some math errors on the bin card. During this encounter, Danny, the manager, arrived in the stockroom, and Mickey, Ricky, and Bert began describing the problem to *him*. Throughout these discussions, the workers posed two hypotheses about what actually happened. These hypotheses were:
>
> (1) [Ricky implicating Bert]: "I bet [the supervisor] didn't deduct recent pulls on the computer";
>
> (2) [Mickey implicating Ricky]: "This is the one you screwed up...It was 19, I think you sent the receipt [e.g., the M5 form] through for 19 [19,000 parts] instead of 21 [21,000 parts]. You did all the paperwork [the bin card] for 21. I think you let the receipt go for 19."

The second hypothesis, as it turned out, was correct. These hypotheses served to organize possibilities for the workers so they could take certain actions. Mickey re-counted parts, checked the

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[6] For a detailed discussion of the kind of thinking that workers do on the job, see Sachs (1989).

history of transactions on the computer, compared the bin card to the computer history, and "interviewed" Ricky. In addition, he discussed with Danny what the range of possibilities were that might produce such discrepancies. When the problem was resolved, the computer record had to be adjusted to match the physical inventory.

This kind of problem was not unusual in the stockroom. As in other cases, its resolution took precedence over training. During the problem, Mickey stopped training and took on his primary role as worker. Trainee Ed was present, however, during the problem-solving event, but he had to pick up what was going on without benefit of any explanation given directly to him. The problem served as an integrating event for the tasks and operations Ed was being taught: how to use the computer, find locations, and keep accurate records. It could have potentially served as an excellent—and explicitly utilized—training tool, particularly since it required integrating new computer information into ongoing stockroom practices. This is an example of the new mental work that mixes in with manual labor in the stockroom, brought on by MRP systems.

Summary. The training dyad was not isolated from wider stockroom activities but interacted on a continual basis with other people in the community. The community did not go out of its way, however, to lend a hand in training. When others in the stockroom approached the training dyad, it was to talk about work and to talk with the trainer rather than the learner. Involvement of the stockroom community in the training of the new worker was shaped to the process of doing the work and getting the product out; production took priority over training when the trainer talked with others. Most of the interruptions were made by people of superior status displaying authority relations characterizing the organization of work. Whenever the trainer walked away from the learner, or became involved in discussions about work with others, he temporarily forfeited his role as "trainer" and took back his primary function as worker. These findings suggest that the social relations of work in the stockroom were not reorganized to accommodate training. Instead, training was embedded in this preexisting system.

Although the learner was often a silent party in these interactions, s/he was usually on the scene to witness what went on. Since these interactions concerned a variety of work practices, the learner was exposed to pedagogically rich material. Troubleshooting sessions and discussions over problems and work glitches brought the learner into contact with the more intellectually challenging

aspects of stockroom work, as well as with cooperative, collaborative modes of problem-solving. These interactions then provided an additional "learning space" to that operating within the dyad.

The complexity of the industrial setting requires workers to operate within a number of knowledge and practice domains. Training within the dyad addresses some of these domains, but the larger social world through which information flows furnishes an unplanned yet crucial way for workers to learn to be workers and to master the nonroutine, beyond-the-ordinary aspects of their jobs.

Technical Aspects of Training in the Dyad

We have seen that all new workers hired on as material handlers during our observation period were put to work within the first hour of their arrival in the stockroom. Together with their trainers, they began to pull work orders or receive component parts, to engage in the very activities we have identified as the core occupational responsibilities of day-shift stockroom workers. It might appear, then, that the trainee is immediately initiated into the job through participation in customary, ongoing stockroom work. The lively controversy among supervisors and experienced men as to which activity—receiving or pulling—affords the most educative initial experience suggests that they, too, perceive the training process in these terms—namely, that "work-as-it-is-in-the-stockroom" plays the major role in the training program.

There are grounds for taking this to be the case. The specific content of receiving activities during training derives from the normal workings of the factory—the number and kinds of component parts that machining sends down to the stockroom to be counted and stored that day. Whether there are five bins of five different parts to be counted or ten bins of two different parts is, from the training point of view, a matter of chance. Similarly, orders for pulling parts and dispatching them to production departments are generated by normal production considerations, not by training needs. Problems that may arise and disrupt the routine flow of work (for example, a missing bin card) are nonpredictable and contingent on the particular materials being moved into or out of the stockroom on any day. Cross-talk in the stockroom, as we saw in the last chapter, revolves around the routines and dilemmas of normal work. As a participant or as a bystander to these exchanges, the trainee becomes involved in shop talk—talk about the work as it is in the stockroom.

Still, we had reasons for suspecting that, if we probed, we would find that work activities involved in training were not simple replications of work as it is usually performed. One clue came from Lave's (in preparation) pathfinding study of apprentice training among West African tailors. She documented in detail the way master tailors organize the apprentices' work experience through the provision of what she calls "way-in" experiences and the sequencing and parceling out of tailor tasks. Apprentices learn to sew garments before cutting them out and work on simple articles of clothing before they tackle the more complicated. One of the driving forces behind this training agenda is the tailors' desire to reduce costly errors (e.g., mistakes in sewing can be repaired by resewing; a piece of cloth cut to the wrong measurements may be a total loss). Lave also points out, however, that the way-in and task-sequence practices are orderly and effective for the learner, since they first equip him with basic skills and incrementally incorporate the finer aspects of the craft. Much of Lave's description appears to hold for other structured apprenticeship programs, including programs in this country, and it is frequently cited by researchers advocating the development of "apprenticeship models" of teaching in school (Collins, Brown & Newman, 1987). Greenfield and Childs (1977) found that Mexican women inducted young girls into weaving practices through a similar progression from simple to more complex tasks, a pattern that Khan (1988) also identified in the practices through which experienced carpet-weavers in Kashmir initiate children and young people into the intricacies of their craft. Other research supports the generality of this modification of traditional craft practices for educational purposes.

On-the-job training in industry departs from apprentice or craft models in many respects—the range of skills that must be mastered is typically more limited, the period of time required to become a competent practitioner shorter, the social organization of training more distributed, the motivations for entering training and the expectations for future employment more varied. In all of these respects, training for the job of material handler at Kemps stands at a far distance from the master-initiate apprentice model. Nonetheless, stockroom training is a case of institutionalized training, with its own history and relationship to on-the-job training programs in many other industrial occupations. Moreover, short-term as it is and *ad hoc* as it seems, stockroom training, as we learned (see pages 23 to 36), rests on definite conceptions and theories about effective ways of imparting knowledge. It seemed reasonable to expect that these might include notions about how to change the work to enhance its learnability, and that these changes would be manifest in the way work was actually carried on in the training dyad.

To pursue this possibility, we needed a detailed description of how stockroom work is normally done by experienced workers so that we could place it alongside of our training observations. For this comparative analysis, we focused on receiving. Three of the five trainees were initiated into receiving; more to the point, receiving, unlike pulling, is always carried out by a two-person team, and thus its social structure parallels the training dyad. Since pulling is normally performed by a single worker, the two-person structure of the training team would complicate a comparison. We observed a team of two experienced material handlers (Mickey and Jay) for an hour, picking them up as we did training dyads when they returned from the machine shop and began the receiving process. We used the same observational methods, audiotaping talk and contextualizing it through a detailed commentary of what the men were doing. We supplemented these observational records with field notes and our own recall of other episodes of experienced receiving that we had witnessed in our days in the stockroom.

In Figure 11 we portray the sequence of actions that constituted receiving as performed by experienced workers Mickey and Jay, and compare it to component actions of receiving when it was carried out in training Dyads 1 and 3. The trainer in Dyad 1 is the same Mickey who was part of the experienced team; Mac, the trainer in Dyad 2, was a novice worker who had only been in the stockroom one month.

As a guide to the detailed representations in Figure 11, we list here the core actions that are technically necessary component actions of the activity of receiving a part into the stockroom. If circumstances in the stockroom were ideal, these actions would also be sufficient to accomplish receiving. Under actual stockroom conditions, many other steps become necessary for completion of the work, and material handlers routinely incorporate them into their ongoing activity. It is possible, of course, to use different levels of description in identifying and naming these actions—"count parts," for example, can be further broken down into constituent actions (as we display it in Figure 11). We are making no claim that we have been consistent in the level of specificity of all the actions listed here, nor that the resultant list exactly maps the way experienced workers think about the action components of receiving. We are confident, though, that our listing is concordant with stockroom workers' description of their job responsibilities and that it captures the obligatory elements of performance.

We lay out the necessary steps using "one kind of part" as the organizing unit. Recall that stockroom workers bring up bins from the machine shop that hold any number of different parts (each part to its own bin or bins). The actions we list would have to be repeated for every part. Note, too, that we list actions here without regard to the two-person organization of receiving; one of our interests will be to see how the work encompassed in these actions gets divided.

FIGURE 11
Comparison of Experienced Receiving Team and Experienced and Novice Trainers

Experienced Receiving Team—Mickey and Jay

SETUP
1. cleanup desk
2. look over bins
3. collect resources
4. sequence the receipt of component parts
5. collect tickets from bins
6. divide labor
7. get locations from computer
8. collect bin cards
9. zero bin at scale
10. resequence order of counting parts

COUNTING

Part number one
1. count parts at scale (M)
2. fill out MS, bin card, tape for bin (J)
3. put bin away (J)

Part number two
1. count parts (M)
2. fill out MS, bin card, tape for bin (J)
3. put bin away (J)

Part number three
1. count parts (M)
2. fill out MS, bin card, tape for bin (J)
3. put bin away (J)

Resolve earlier problems
1. look for locations (J)
2. look for bin cards (M)
3. resolve discrepancy between computer and cards (J&M)

Part number four
1. count parts (M)
2. fill out MS, tape for bin (J)
3. LOOP—back order
   a. count parts (M)
   b. fill out bin card, back order form, dispatch cards (J)
4. put bin away (J)

Part number five
1. collect resources for new scale
2. move bin
3. count parts (J)
4. fill out MS, label bags (M)
5. LOOP—back order
   a. count parts (J)
   b. fill out dispatch card, bin card, back order form (M)
   c. send parts to dispatch (J)
6. put bin away (J)

CLEANUP
Give all MS forms to supervisor
Throw away garbage on desk

Experienced Training—Mickey and Ed

SETUP
1. (missing)
2.
3.
4.
5.
6.
7.
(problem) 8.
(problem) 9.
10.

COUNTING

Part number one
1. collect ticket from bin (M)
2. get location from computer (E)
3. get bin card (M)
4. fill out location change sheet, MS, dispatch card, and bin card (M)
5. cleanup (M)
6. move bin (M)
7. count parts (M)
8. put bin away (M&E)

Part number two
1. collect ticket (M)
2. get location from computer (E)
3. get bin card (M&E)
4. LOOP—pull back order
   a. count (M)
   b. fill out MS, bin card, back order form (E)
   c. bag parts for dispatch (M)
   d. cleanup (M)
   [no parts left to put away]

Part number three
1. collect ticket from bin (E)
2. get location from computer (E)
3. get bin card (E)
4. count parts (E)
5. fill out MS form and bin card (E), make tape (M)
6. put bins away (M&E)

CLEANUP
(missing)

Novice Training—Mac and Reggie

SETUP
1. (missing)
2.
3.
4.
5.
6.
7.
8.
9.
10.

COUNTING

Part number one
1. Collect back order from, MS from supervisor (M), off tape
2. LOOP—back order
   a. move out bin (M)
   b. count pieces (M)
   c. fill out MS and dispatch card (M)
   d. bag parts for dispatch (M)
   e. fill out back order form, bin card, dispatch card (M)
   f. cleanup (M)
   [no part left to put away]

Part number two
1. Collect ticket from bin (M)
2. get location from computer (M)
3. get bin card (M)
4. fill out MS form (M)
5. count the parts (M)
6. complete MS, fill out bin card (M)
7. put bins away (M&R)

Part number three
1. collect ticket from bin (M)
2. get location from computer (R)
3. get bin card (R&M)
4. LOOP—back order number one
   a. fill out MS (M)
   b. count parts (M)
   c. bag parts for dispatch (M&R)
   d. compute filling out back order form, MS, bin card
5. LOOP—back order number two
   a. count parts (R)
   b. put parts in bin for dispatch (R)
   c. fill out back order form (M)
6. count remaining parts (M)
7. fill out MS, bin card (M)
8. put bin away (M&R)

CLEANUP
(missing)

Necessary Components of Receiving. For each part:

1. Collect ticket from bin (ticket has part number).
2. Go to computer with ticket, enter part number to get part location.
3. Go to location to get bin card (to record quantity; find out if back order is waiting).
4. Zero bin at scale.
5. Count parts at scale.
6. Fill out paperwork: M5 receipt, bin card, bin labels.
7. Put parts away at location.
8. Take M5 receipt to supervisor.

The actions listed are related to each other in different ways. For some, there is a necessary sequential order. Numbers 1 to 3 must be accomplished in the sequence shown. Going backwards from the goal to be achieved: you need the bin card to record the number of parts of a given kind that are being received; you cannot get the bin card without locating the bin that holds that kind of part; this means you need to know the location of that part; you cannot use the computer to find the part location unless you enter the part number; you will not know the part number unless you read it from the ticket lying in the receiving bin. On the other hand, actions 4 and 5 do not need to be ordered with respect to each other. One can count parts first or do paperwork first. It is true that the total number of parts can only be recorded after the count has been done, but much of the paperwork calls for filling in information that is independent of, and can precede recording the count (e.g., component part number, manufacturing number, name of worker, date, location of parts). Similarly, action 4—counting parts—can, from a technical point of view, precede the action sequence 1-3. It is not necessary to have the bin card in order to count. However, adopting this course would require the worker to interrupt an action (e.g., doing paperwork after a count) to run through the stockroom to get the bin card, since the information on it is necessary to complete the paperwork. Action 6 must occur after the count is completed and some of the paperwork done, but it could technically be preceded by action 7—taking the M5 receipt to the supervisor. We will not attempt here to give an analysis of all action sequences in which steps entail each other in some sequential ordering and those in which the ordering is optional; our aim is to draw attention to the possibilities that exist for reordering necessary actions.

In addition to the basic actions listed here, a standard "loop" may occur if a worker, in collecting a bin card, finds that there are outstanding back orders for that particular part. It is the receiver's job to fill ("pull") those orders To do this, the receiver has to introduce a new action unit—pulling—into

the receiving activity. The timing of such an action is not technically constrained: one can pull a back order before counting any part, during the counting of the particular part to which it applies, or after all counting has been done. Wide latitude in timing also obtains when other intrusions arise in the ideal sequence—a bin card may be missing, a part mismumbered, or an erroneous location displayed on the computer. How these events are handled also reveals the principles that participants use in organizing their work activities.

Experienced Receiving. We now describe the experienced team's work in some detail, basing ourselves on observational records and using Figure 11 as a guide.

The experienced team's organization of actions has several outstanding characteristics. First, it has a hierarchical structure. Note that Mickey and Jay do not organize all their work according to a principle of linear ordering—one part, one entire sequence of actions, another part, repeat entire sequence of actions, until all parts are counted and put away. Instead, Mickey and Jay preserve an inner core of actions that they repeat for every part, but these cycles are sandwiched between sets of actions that apply to all the parts, to the work-as-a-whole. We call the first phase "setup," since it includes a variety of preparatory actions (discussed below), and the final phase "cleanup."

The setup phase first involved the preparation of the work area—cleaning up the desk, for example, and collecting resources such as pencils, correction fluid, masking tape, and forms. Both men looked over the bins and together decided on the order in which they would count the parts (which would be number one, number two, and so on) and how they would divide up the labor. These steps might be subsumed under the general notion of "planning." Then they engaged in a series of actions that applied to all the counts that would ensue, beginning with "collect [all] tickets from bins" (Step 5 in Figure 11). and including "get [all] locations" (Step 7) and "collect [all] bin cards" (Step 8).[7] What Mickey and Jay did, in effect, was to extract actions 1-3 from the canonical sequence described above and to aggregate them by kind. They broke out of a "receive one part at a time" strategy for certain actions common to all occasions of counting. One might consider this a taxonomic form of work organization, as opposed to an event-based form. In receiving, the "event" is the complete cycle of

[7] The action "zero the bin" can be done as part of setup only if the large, manual scale is used, as it customarily is in receiving; if the electronic scale is used, the container has to be zeroed each time a new part type is counted.

actions needed for counting, recording, and putting away one part at a time. Relations among actions in an event-based form of organization are principally temporal, one follows another by technological necessity or by choice. In this form, an action "collect ticket from bin" is related to another action "find location on computer" simply as a preceder. In what we are here calling the taxonomic form, certain actions are related to each other by class membership or "kind." The action "collect ticket from bin" is related to another action "collect ticket from bin" to form a class of like actions. A leading organizational principle for forming classes appears to center on the tool or device required for an action. Thus, all operations with the computer are grouped together, just as all actions involving the scale are grouped together. A second organizing principle is location: since all bins holding parts for receiving occupy one area, all tickets can readily be collected at once.

Breaking the linear event-based sequence may have facilitated an efficient division of labor that we describe below. It also appears to be an effort-saving strategy. Carrying all tickets to the computer at one time saves walking back and forth to the computer; by collecting several bin cards at one time, you can organize a route through the stockroom storage area that also saves steps (cf. Scribner, Fahrmeier & Gauvain, 1984); and if all the needed records are on hand, the counting itself can be done without ever walking away from the scale. Scribner (1986, 1988) has characterized such reorganizations of practical action as serving personal goals of "elegance" and economy of effort.

The event form was not entirely replaced by Mickey and Jay's organization. The second phase of their work activity consisted of repeated cycles of "counting," one cycle for each of the parts to be received. During each cycle, the team carried out the multiple operations required to determine a quantity by weighing parts on a scale (the actual "count," using the term now in a restricted sense); they filled out the various forms, and completed their involvement with the part by putting the bin away on a stockroom shelf. As Figure 11 indicates, these actions were reiterated in a set pattern for each part counted. The same reiteration applied to the "pulling" of a back order; the parts were counted, paperwork filled out, and parts "put away" (given to dispatch). Although listed sequentially in the figure, all three actions overlapped. Counting and paperwork were performed simultaneously, with Jay doing paperwork while Mickey counted; when Jay went to put away the part, Mickey began to count the next part. The simultaneous and overlapping nature of Mickey and Jay's actions is rooted in their shared understanding of the nature of the work and what it requires.

Mickey and Jay's final count included an expanded set of actions. This part was to be counted on a different scale located in another part of the stockroom, and to accomplish it they had to repeat two actions from setup—"zero bin" and "collect resources."

When all parts were counted and stored, the team cleaned up the receiving area, collected all the MS receipts, and carried them to the stockroom supervisor.

The second outstanding characteristic of experienced work is its fluidity, the outcome of a finely-coordinated, shifting division of labor between the two men. One aspect of this fluidity was the changing configuration of task distribution. Although Mickey and Jay had agreed to a general division of labor during setup, talk about who would do what on a more local level or in the face of new contingencies filtered through the entire receiving process. Mickey and Jay continually and smoothly distributed and redistributed tasks. Here is an example of a mutual arrangement of work that illustrates the brevity of the process and ease of communication between them:

Jay: What you wanna do?

Mickey: [Pointing to small parts] Uh, just gonna bag this up, right?

Jay: Yeah, them'll be a contact.

Mickey: [Pointing to the small parts] We'll do this last, how's that? All right, we'll look through the bin cards. Wanna get the bin cards for all the stuff first, or...

Jay: Yeah, let me get the locations and everything, too.

Mickey: All right, you're gonna get the locations?

Jay: Yes.

Mickey and Jay's shared and implicit understanding of the work was also indicated in the flexibility with which they shifted roles. When Mickey received a phone call, Jay lost no time in beginning to count the next parts to be received in—a task that Mickey had been doing up until that point. When Mickey returned, he performed the paperwork task. No discussion marked this shift.

Both were aware of the many different options available to them at each stage of the work, and they were able to determine what to do with a minimum of effort.

The team's seamless coordination of work and their ability to shift plans in midstream was especially apparent when problems arose. Mickey and Jay first encountered problems during setup, when locations for some parts were unobtainable on the computer and several bin cards were missing. They might have tried to resolve each problem as it arose, maintaining their original plan of work. Instead they set the problems to one side, and reorganized the sequence in which they had planned to count the different parts. They completed counts for the parts that presented no problems and then worked at resolving the problems one after another (consult Figure 11). In effect, this represented deployment of the same strategy manifest in the chunking of "like actions" described above (e.g., collect all tickets): Mickey and Jay extracted problems from the chronological sequence in which they occurred and reaggregated them so they constituted a higher-order unit of action, segregated from other action chunks. During our observation, Mickey and Jay moved so fluidly into the problem-solving phase that we could not mark its boundaries; it looked as though they were beginning the "next count" rather than embarking on a problem-solving event.

Training on Receiving. The two training teams whose work we analyze here include Mickey and a novice trainer, Mac. We lack sufficient space to report in detail on two other dyads (Dyads 4 and 5), which also worked on receiving. We can report, however, that they exhibited organizational features similar to those described here.[8]

The most obvious difference in the experienced and training conditions is that training is entirely organized around single events—the canonical pattern of taking one part and working with it until it is put away, moving on to another part, and so on. The phase we termed "setup" for the experienced team was not carried out, as such, by the training teams. Some of the "setup" actions were completely eliminated (look over bins, sequence the receipt of component parts, and divide labor), while others were partialed into individual counts (collect ticket from bin, get location from computer, and collect

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[8] We have not made a similar detailed analysis between experienced pulling and Mickey's training of Ed and Joe on pulling work orders but we have identified several ways in which training work was reorganized. We think that a story similar to that of receiving can be told for this stockroom activity as well.

bin card). The action "zero the bin," conducted by the experienced team during setup and again for their final count, was done only once by each training team during their first count. Since the training teams worked only on the large scale, using a single bin in which to count all incoming parts, that bin could be zeroed only once. Otherwise, the "zeroing" action would have been reiterated within each individual count.

Because training teams did not include a setup phase in their work organization but plunged directly into "counting a part," the reiterative sequences that they carried out included more steps than did reiterative sequences for the experienced team. The phase called "cleanup" was unsystematically parceled into the individual counts—occasionally occurring in the middle of a count, occasionally at the end of one, and sometimes not happening at all. Cleanup is not a necessary action in the performance of the work activity, even though it frequently occurs.

Considering the vast difference in experience between Mickey and Mac, the fact that they both resorted to an event-based form of work organization is striking. The difference in experience was apparent, however, in the actual doing of the work. Mac sequenced the counting actions somewhat more erratically than did Mickey. Mac would intersperse doing some paperwork, counting parts, and then doing some more paperwork, so that the team would move back and forth between the scale and the table. Mac's first count, for example, began in a fuzzy manner; it had no clear "beginning."[9] The first count for Mac was a back order, which he told Reggie was the "hardest thing to learn." Mac's second count proceeded in a fairly straightforward manner: the first three actions were setup actions, the last four were almost routine receiving. The exception was that Mac filled out the paperwork in two separate actions, moving back and forth between the counting of the part and the doing of the paperwork. Mac's last count was very systematic: the first three actions were setup actions; the next two, "routine" back order loops; and the last, counting the remaining parts. Mac was systematic in pulling back orders, although his manner of proceeding differed from Mickey's. Unlike Mickey (and the only example we can display here is in Mickey's expert receiving), Mac would pull

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[9] This fuzziness may have been due to the fact that Mac refused to wear the tape recorder (Reggie, the learner, wore it), and since the researcher commenting on the actions focused her attention on the learner, when Mac walked away, we lost his actions and discourse. We do know, from commentary talk, that Mac collected some paperwork from the Supervisor for this receipt; but he did not make this apparent to Reggie, whom he was training.

all back orders before doing a full count of the parts. That is, he would pull as many back orders as possible (see Count number three for Mac and Reggie in Figure 11) and then count the leftovers, finally adding on paper the parts pulled and the parts received to get the total number of incoming parts to the stockroom. Mickey, on the other hand, would do a full count of all incoming parts, and then pull back orders. This procedure condensed the paperwork operations, while Mac effectively multiplied them, filling out some of each form on each back order loop, and then again at the end of the entire counting sequence.

In sum: Both trainers used event-based forms of work organization; within the counting event, they combined actions differently, with Mickey somewhat more efficient than Mac.

A final observation is in order with respect to the reorganization of work during training. Trainers did not simply do the work differently from the routine but they took pains to explain to learners that they *were* doing it differently. In other words, there was a reflective aspect to work reorganization. Both Mickey and Mac elaborated the particular respects in which training activities departed from the usual and customary way of work.

For example, Mickey told his trainee Ed:

> What two guys do is they bring the stuff all down [bring bins into stock from the machine shop]. What happens is one guy will clean up the area where you get all the stuff you need, the other guy will take all the white tickets out and leave the hard tickets in [collect tickets from bin] and he'll go to the computer and sit down and get all the locations, while one guy gets the tape, gets the marker, gets whatever he needs. And normally, when the guy gets the locations what they'll do is they'll separate the white tickets and they'll, they'll both get the bin cards out of the masters and they'll stick them with the parts. [Transcripts, February 3, 1987]

Mac also informed Reggie of the "usual" way of receiving:

> So what we're going to do first is just count the pieces. Then, we'll take the rest of the [parts] and make a full bin. First, you write up the M5. Usually, one man writes up the M5 and the other guy counts up the pieces. Until you get the hang of things, I'll show you how. [Transcripts, April 20, 1987]

These general descriptions of "how things normally work" in receiving occurred between each count.

In addition to reorganizing the work, trainers instituted a different form of division of labor than obtains in experienced receiving. The brief negotiations in which the experienced workers engaged were noticeably absent in the training dyads. Instead of parallel, simultaneous and overlapping labor, both workers focused their attention upon the same action. At the onset of training the trainer did everything while the learner watched. Although one would expect such a division of labor with an entirely uninitiated worker, it is interesting that even in the short period of our observations this division of labor became more participatory and collaborative.

The mutual attention that the trainer and learner paid to the actions at hand and the trainer's running commentary facilitated the gradual induction of the learner into task performance over time. Mickey, the experienced trainer, performed all actions during the first count, with the exception of "finding location on the computer" (which Ed had learned how to do the day before), and they both returned the bin to the shelf. On the second count, he had Ed perform two actions himself (get locations, do paperwork), and they both got the bin card. On the third count, Ed did all the actions except doing paperwork, and together they put away the bins. We can see, then, that over the course of the first three counts (a little more than one hour) Ed first observed Mickey, then did some jobs, and finally did all actions under Mickey's watchful eye. Mac's training of Reggie similarly oriented him slowly into the doing of actions. During their first count, Mac performed all the actions. During the second, Mac performed all actions, but Reggie helped him put the bin away. On their third count, Reggie performed three actions on his own (get location from computer, count parts, put parts in bin for dispatch), and together with Mac bagged parts for dispatch. Both the expert and novice trainers, therefore, gradually included the learner in doing the job.

Summary. Putting aside details, our major finding is that the anatomy of work during training is strikingly different from experienced work. In experienced work, the activity of receiving all the parts is the organizing principle for work. This activity is decomposed into types of actions (e.g., collecting bin cards, counting) applied over the aggregate of all parts received. To a large extent, these actions are regrouped around technical devices such as scales, computers, written records. In training, each part functions as the object around which the work is organized, and actions are taken sequentially; technical devices are utilized as the need occurs in this sequence.

Why did all trainers observed on receiving hit upon the same basic method of training, in spite of their differences in personal history and stockroom experience? These trainers were not trained to train. Supervisory personnel, who described the normal way of doing receiving to us in great detail, never commented on the fact that it is reorganized for training. It could be the case that each trainer was merely passing on the method in which he was trained, but such an account begs a more basic question: Would one particular reorganization of work be passed on if it were not perceived to make sense as an effective way to train? And if it is considered effective, why? One possible explanation is that organizing the work around a whole event sequence—handling a part from start to finish—displays for the learner the functional utility, the "meaning" of each component action. Extracting an action from its place in the event makes its utility less self-evident. When an event is preserved and repeated in its entirety, it may be comprehended more readily, and the learner who gradually begins to perform different actions with one part after another may come to appreciate their role in the scheme of things and be able to proceed in a less mechanical manner. This is a speculation; it is, however, potentially testable through controlled experimental training studies.

It may be that the form of reorganization described here is found in other occupations or other workplaces where the actual "stuff," or content, of production is quite different. Whether this is the case or not, our hunch is that reorganization of work for training purposes follows certain (and possibly limited) orderly forms. An important issue for future research on workplace training concerns the various ways in which training work departs from the usual, the considerations underpinning these changes, and their actual effectiveness. To the extent that work constitutes the greater part of the curriculum of on-the-job training, knowledge about these forms and their consequences is important for interventions that seek to improve the effectiveness of "learning in practice" in both workplaces and schools.

Communicative Aspects of Training in the Dyad

We now shift our perspective to another aspect of the functioning of the training dyad. Excerpts from audiotaped records make it clear that the doing of stockroom work has a heavy linguistic component. Trainers are talking as well as working, and so are learners. The training dyad is a communicative system, and we know intuitively that much of that communication will be carrying the burden of inducting the trainee into the knowledge domains and procedural routines required in the work. We turn, therefore, to an appraisal of how language functions in the training dyad. Although

we employ a variety of linguistic techniques (e.g., speech-act analysis of conversational exchanges), we do so not to make generalizations about language per se, but to gain insights into the educative process in stockroom training dyads.

Research Background. Most research on language in the educative process has been conducted in the classroom. This research has both been propelled by and has contributed to the view that instruction in the classroom is primarily carried by talk. Cazden (1986) makes the claim that "spoken language is the medium by which much teaching takes place and in which students demonstrate to teachers much of what they have learned." In a recent book reviewing studies on classroom discourse and their educational implications, Cazden (1988) concludes that "Lessons...are activities constituted primarily of and by talk." According to Shuy (1988), "Talk in the classroom is the major device for assisting in learning." These statements reflect the widespread consensus among educational researchers on the importance of spoken language in the classroom.

In empirical research on classroom discourse, two traditions with differing philosophical and methodological premises dominate the field. One attempts to link learner outcomes to categories of classroom talk that are identified and coded according to a predetermined scheme. Another approach, in the descriptive tradition, attempts to generate analytic structures from a consideration of the meaning and significance of talk in its context. Much of our undertaking is conducted within this latter approach, which, for the sake of brevity, can be labeled the sociolinguistic, or ethnographic, approach. (Halliday, 1978; Green, 1983, summarizes fundamental constructs and assumptions underpinning this approach.)

In contrast to the study of classroom language, research on language in the workplace remains sparse. One line of inquiry examines language patterns in professions such as psychiatry (Labov & Fanshel, 1977) and medicine (Cicourel, 1970), in which doctor-patient dialogue constitutes much of the "work" of diagnosis and treatment. Recent studies have moved away from preoccupation with two-person conversations to study communication patterns in complex work-settings. For example, Reder's studies (Reder & Schwab, 1988; Conklin & Reder, 1984) examine relationships between media of communication (e.g., face-to-face talk, telephone, electronic mail) and decision-making processes in work groups in a computer system design firm, while Auramaki, Lehtinen, and Lyytinen (1988) analyze offices as systems of communicative action. Research of this kind is motivated in

large part by an effort to understand patterns of collaborative work. In contrast to this burgeoning field, analyses of language in terms of its cognitive as well as social functions are still in their infancy. Lacoste (1981) has undertaken studies of how unskilled workers explain to newcomers how a machine works, and Hetu (1987) analyzes conversations among engineers and workers in the semiconductor industry to investigate how joint understandings about the work are constructed.

Because research on the educative role of language in the workplace is just beginning, theoretical foundations are weak. When we are concerned with work such as industrial production, which is by no means constituted primarily through talk, an initial problem is how to conceptualize in theoretical terms the relationship of talk to other actions. Controversy prevails here among activity theorists (Kozulin, 1986). To the extent that the language-action relationship has commanded the attention of linguists, action has been conceived primarily on the microlevel of gesture, or movements involved in the physical production of speech (e.g., McNeill, 1979). In this nascent state of theory development, we concentrated on a second-level enterprise—that of generating significant questions about how language functions in on-the-job training, and devising and testing exploratory analytic schemes for addressing these questions. For the most part, we proceeded inductively on the basis of examinations of tapes and transcripts, as well as reviews of prior research on discourse functions. In these reviews, we paid special attention to studies of language functions in the classroom. These have identified certain forms of discourse as especially prominent in the school setting, and the question arises as to whether such forms might also be used in on-the-job training. Instruction that takes place in two-person interactions in the workplace obviously differs in myriad ways from group-based instruction in the classroom. Still, to make progress on the broad comparative question of the relationship of school-based and work-based education, it seemed heuristically useful to assess our material with analytic schemes that have proved illuminating for an understanding of classroom talk.

We devoted the greater part of our resources, however, to attempts to formulate questions and formalize schemes of analysis that would capture basic characteristics of language use in the work setting. We think that we have made progress in these endeavors, and that the results we report are of interest, but we want to make clear that we recognize the preliminary and exploratory nature of the analytic models we have devised. (For a probing discussion on conceptual difficulties in characterizing language functions, see Dore & McDermott, 1982.)

We adopted three analytic perspectives, which we report below.

Conversational Exchanges Between Trainer and Trainee. Classroom discourse studies motivated this analysis. A line of research on the way lessons are conducted in the classroom (Sinclair & Coulthard, 1975; Mehan, 1979) has identified a common discourse structure involving teachers and students. This structure has a three-part sequence in which the teacher initiates a conversational exchange (I), a student responds (R), and the teacher evaluates the response (E). A common form of this IRE sequence begins with a question by the teacher (e.g., "Can anyone tell me what country London is in?"), proceeds with an answer ("It's in France."), and concludes with a teacher evaluation of the answer's accuracy or appropriateness ("Nice try. But that's not right."). A special feature of such questions is that the teacher knows the answers; she is not questioning the student in order to acquire information, which is the function of questions in ordinary conversation; rather, she is using the question format as a device to test the student's knowledge. The ubiquity of this form of evaluative conversational exchange in classrooms raises the possibility that individuals who undertake training in the workplace may, as a result of their own experience with this format, resort to its use as a pedagogical technique.

All three components of the basic sequence have been the focus of separate research. Most attention has been given to teacher questions because of their frequency and the pedagogical work they are intended to do (Cazden, 1986). Rather than single out the IRE exchange as the only topic of our analysis, therefore, we decided to apply a comprehensive analytic scheme to all conversational exchanges between the trainer and trainee.

The conversational coding scheme was based on Dore's theory of functional speech acts and is a modification of the scheme used by Cole, Dore and Hall (1978) in their comparative study of situational variability in children's speech.[10]

This scheme was applied to all turns of talk between the trainer and the trainee occurring in the observational base period (one and one-half hours) for the five dyads for whom we analyzed social

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[10] Farida Khan adapted Dore's conversational analysis scheme to our purposes and is primarily responsible for this work. Roseanne Flores participated in the coding and summary of results.

interactions (pages 43 to 54) and technical routines (pages 54 to 66). The basic unit of analysis was an "adjacency pair," namely, an utterance by either member of the dyad, followed by an utterance made by the second member. When three or more utterances succeeded each other in turn-taking sequence (e.g., utterance 1-Trainer, utterance 2-Learner, utterance 3-Trainer), the function of utterance 2 was coded in relation to utterance 1, and the function of utterance 3 was coded in relation to utterance 2. Basic categories of conversational acts included questions, statements, requests, and responses; differentiations based on form and function were made within each category. Definitions and examples are given in a coding manual (available on request). Note that this scheme imposes no requirements for minimal utterance length; every utterance was coded, including monosyllabic responses such as "yeah," "uh-huh," "right."

A reliability check performed by two independent coders on one-third of the Dyad 1 transcript resulted in agreement correlations of 88% on identification of adjacency pairs, and 90% on application of speech act categories to utterances in these pairs. Of the identified adjacency pairs, 7% had responses that were coded as indeterminate because of incomplete information.[11] The two coders who worked cooperatively to refine the coding scheme and determine its reliability went on to code the corpus, working independently.

Results. We first look at results to determine whether talk within the training dyad exhibits the same dialogue structure as do classroom lessons, and in particular whether it exhibits the Initiation-Response-Evaluation sequence.

In listening to tapes and studying transcripts, all five researchers involved in these analyses volunteered the observation that, impressionistically, not much dialogue occurred within these dyads. Transcripts seemed to consist of stretches of trainer talk, only occasionally interspersed with learner talk or comment. When we proceeded systematically to code all exchanges, we identified 849 instances of dialogue in the corpus. Of these, 726, or 85.5%, were coded as two-turn conversations,

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[11] Agreement between the coders may mask some unresolved difficulties in the coding scheme, such as, for example, ambiguity in determining length of a "response utterance." The pattern of results for basic categories of analysis, however, is so clear-cut that its interpretation, adopted here, does not appear seriously threatened by such slippages in the coding system. Absolute numbers, of course, would be affected; those given here should not be invested with authority. Further refinement of analytic schemes would also permit a richer and more detailed interpretation.

111 as three-turn, and 12 as four-turn. Some degree of arbitrariness is involved in segmenting turns of talk and deciding whether a continuing exchange consists of successive adjacency pairs or longer units. We adopted rules that maximize possibilities of two-turn talk.

To give some meaning to these figures, we need to compare the frequency of dialogue in dyad pairs to other forms of discourse in the dyad. As we describe below, we conducted a separate analysis of trainer talk as traditional monologue, using the term here to refer to sequences of utterances made by the trainer excluding those addressed to, or replying to, the learner or others. For reasons of time limitations and data quality, we restricted this analysis to the initial 50 minutes of the base period, and to four of the five dyads. This analysis yielded a corpus of 1,615 trainer utterances that were made outside of a dialogic context. If we make the simplifying assumption that in all dialogues it was the trainer who spoke most frequently (i.e., we count the trainer as speaking twice in all conversations of more than two turns), we secure an estimate of 972 trainer utterances occurring in conversation over a period of 450 minutes (five dyads times one and one-half hours), compared with 1,615 trainer utterances occurring in monologue for a 200-minute period (four dyads times 50 minutes). Extrapolating trainer monologue for a 450-minute time period, we secure an estimated total of 3,633 utterances. Rough as this comparison is, it is sufficient to confirm the initial, impressionistic observations that dialogue is not the primary structure of discourse in the opening period of this on-the-job training situation.

To determine whether trainers made use of the IRE sequence, we identified all conversations that were coded as longer than two turns and that were opened by trainer questions or requests soliciting verbal replies. Twelve met these specifications, and we examined them in detail. None of the instances examined qualified as examples of the testlike questions characteristic of classroom IRE exchanges. Trainers do not interrogate learners with questions that elicit already-known information, which they then evaluate to reach a conclusion about what the learner knows. Most of their questions fell into the category of "requests for confirmation." Here are some example (T indicates trainer; L, learner):

Example 1

Mickey (T): (Explaining how locations are numbered) And you'll see on top how they're numbered up there, OK?

Joe (L): B1 to B7?

Mickey (T): This is all 1 to 7. OK?

Example 2

Dave (T): Now we have to level this off...Understand me?

Bess (L): Do I get this in the center?

Dave (T): Yeah.. See, most likely this will be down here.

In these exchanges, trainers were apparently questioning learners to determine whether their explanations were getting across. Learners often used the occasion, not merely to respond affirmatively or negatively, but to expand on or extend the information trainers had provided. They might accomplish this by replying to a query about their understanding with questions, as in the examples above, or by offering new information for trainer response, as in examples 3 and 4 below. Both conversational gambits are ways that learners may test their understanding without acknowledging possible difficulties:

Example 3

Mickey (T): (Showing Joe different parts and describing them) This is plastic, plastic, OK?

Joe (L): These are all bodies.

Mickey (T): Right. Anything brass is usually a body.

Example 4

Mac (T): ...there, like that, OK?

Reggie (L): You mean you'll take them up later, because you might get more right, so that's...

Mac (T): No, it's just that I just do it all at one shot, OK?

Reggie (L): Um-hmn.

Mac (T): OK.

TABLE 4
Conversational Exchanges
between Trainer and Learner in Base Period

Dyad	Number of exchanges	Initiator			
		Trainer	row %	Learner	row%
1	149	135	(90.6)	14	(9.4)
2	200	197	(98.5)	3	(1.5)
3	223	209	(93.7)	14	(6.3)
4	137	95	(69.3)	42	(30.7)
5	140	81	(57.9)	59	(42.1)
Total	849	717	(84.4)	132	(15.6)

With this introduction to conversations within the dyad, we now move to a summative and positive characterization of all dialogic exchanges. Table 4 lists for each dyad the total number of conversations in the base period, and the number opened by trainer and learner respectively. By definition, of course, all conversations are jointly constructed by both participants—unless there is a "response," no utterance qualifies as an "opener." However, it is illuminating for our purposes to ascertain whether trainers primarily picked up on learners' utterances (i.e., responded to something a learner said) or whether most pickups were the other way around. Table 4 indicates that trainers

initiated the great majority of conversations (84.4%); learners were picking up on them. Within this overall picture of trainer initiative, dyads exhibit considerable variability in the extent to which the trainers dominate. Mickey, the trainer criticized by his supervisor for talking too much in the training situation, virtually monopolized conversational initiatives (Dyads 1 and 2); in Mac's dyads (3 and 4), initiatives were more interactively determined. Only in the fifth dyad, however, did the learner come close to matching the trainer in the number of times she initiated an exchange. It will be recalled that this learner was an experienced Kemps employee, the only one who brought some knowledge of the parts and the production system to the training situation.

Table 5 examines the form and function of conversational exchanges initiated by each member of the dyad. This analysis was applied to two-turn conversations, which constitute more than four-fifths of the corpus and are more amenable to aggr ation than lengthier conversations. Let us first consider the basic categories of conversational openers: questions, requests and statements, as displayed in the last column of Table 5. More than two-thirds (67.2%) of trainer-learner conversations start off with statements—that is, assertions about some fact, belief or need, such as "We need a bin" and "This is what we call an electronic scale." Requests of various kinds and questions are represented in nearly equal proportions in the remaining exchanges (17.3% and 15.5% respectively). When we consider these speech-act categories separately for trainer and learner initiatives, we find (column 1) that the same rank-order pattern holds for trainers, with a greater gap in proportion of requests and questions, but it does not hold for learners (column 2), among whom questions nudge out statements as conversational openers.

Moving down to a more detailed consideration of utterance-pairs, we first examine the nature of questions and responses, as disclosed by the coding scheme we applied. Although many types of questions were included in the initial coding scheme, adapted from Dore et al., questions in our corpus were categorizeable into two main classes: Yes/no questions and Wh-questions. The latter are questions that seek specific factual information, such as "Where do we put this?" and "How many in there?" In training-dyad conversations, these two question-types most frequently were paired with corresponding answers (Yes or No to a Yes/No question; a statement proffering requested information to a Wh-question). Trainers tended to ask Yes/No questions, whereas learners asked both types and received more diversified answers.

TABLE 5
Speech Acts Involved in Two-Turn Conversational Exchanges between Trainer and Learner in Base Period (collapsed across dyads)*

Form of exchange classified by initiating speech act	Initiator					
	Trainer		Learner		Total	
QUESTIONS		row %		row%		column %
Total	47	(45.6)	56	(54.4)	103	(15.5)
Y/N with Y/N answers	27		21		48	
WH- with WH- answers	10		16		26	
Y/N and WH- with other answers	10		19		29	
REQUESTS						
Total	103	(89.6)	12	(10.4)	115	(17.3)
Rq action/compliance	19		0		19	
Rq confirm/confirm	79		8		87	
Other	5		4		9	
STATEMENTS						
Total	412	(92.2)	35	(7.8)	447	(67.2)
S/acknowl/conf	332		13			
S/elaborate	43		13			
S/repeat	25		3			
Other	12		6			
				Total	665	

* Excludes 61 exchanges coded as "indeterminate."

Analysis of request types yields both obvious and surprising information. Not unexpectedly, requests were one-way—from trainer to learner (103, compared with 12)—reflecting the differential distribution of knowledge in the dyad. An unexpected result is in the type of requests trainers made. The two classes into which these openers fell were requests for compliance and requests for confirmation. Requests for compliance include direct commands or instructions ("Put it here.") and

indirect suggestions for action. For example, when trainer Dave was explaining to Bess how to use the computer, he said, "Since 99 is there, you can just push 'enter'," and Bess pushed 'enter' as she said, "OK." Since the action context of teaching-and-learning in the stockroom is that of joint work, one might have expected many such requests from the trainer, whose responsibility was to structure that work. Only 19 instances occurred. In contrast, trainers frequently turned to learners with requests for confirmation of what they were saying. These requests were very like those we described above in conversations of three turns or more: trainers were checking to see if learners were following what they were saying. These requests for confirmation tended to fit the following template:

Example 5

Mickey (T): You see all these tickets have the same order number, OK?

Ed (L): Yeah.

The trainer made a statement, followed by an "OK?" "Understand?" or "You see?" to which the learner replied, typically in the affirmative, confirming that s/he understood.

The preponderant form of exchange in trainer-initiated conversation opened with an assertion of some kind: statements comprised 92% of trainers' openers. Keep in mind that statements do not represent a clear-cut case of conversational opener in the same sense as do questions and requests; they are only "openers" when learners voluntarily choose to speak after them. Statement-response pairs were codable into three principal types:

Statement followed by acknowledgment (or confirmation):

Example 6

Mickey (T): [Explaining locations] We start with B-1, B-1, B-2, B-3, B-4, B-5, and you see on top how the numbers run.

Ed (L): Yeah.

Example 7

Mac (T): Instead of counting them by hand, we use the electronic scale.

Tony (L): Alright.

Statement followed by elaboration:

Example 8

Mac (T): [Explaining how to fill out a form]: 848 dash 1. And the M number.

Randy (L): Number 26, right.

Statement followed by repetition:

Example 9

Dave (T): Now we have to level this off.

Bess (L): Level it off.

The statement-acknowledgment format dominates exchanges opened by trainers: four out of five statement-response pairs take this form. The statement-acknowledgment pair exchange may function much as the requests for confirmation do (compare Examples 5 and 6). In request pairs, the trainer asks the learner to state explicitly whether s/he understands ("OK?"); in some statement-acknowledgment pairs, the trainer asserts that the learner does understand ("you see that..."), leaving it to the learner to affirm, deny, or remain silent. In many cases, a straightforward trainer assertion is followed by a learner's confirmation ("Yeah." "Alright."). Videotape analysis might disclose that on some of these occasions, the trainer accompanied the statement with a nonverbal request for confirmation; on other occasions the learner might be taking the initiative in giving assurance that s/he was on board. Our transcripts do not permit us to differentiate among such occasions, but they clearly demonstrate that trainers and learners were using conversational exchanges in large part to regulate the pace of teaching and to coordinate their respective roles in the training activity. If, ignoring who spoke first, we sum the two adjacency-pair categories—request for confirmation followed by confirmation, and statement followed by acknowledgment—we find they make up two-thirds of all two-turn conversational exchanges.

Summary. In the first hours of on-the-job training, trainers talk less in conversational exchanges than they do in monologic stretches. When exchanges occur, trainers initiate them more often than learners; learners seldom take the lead in directing questions at trainers or making assertions; their role is principally that of picking up on trainer talk. Trainers do not use the classic "teacher" model of testing trainees to find out what they know by asking questions and then evaluating the answer. Rather, their talk is sprinkled with interjections such as "OK?" and "Right?" which provide opportunities for learners to give feedback on the state of their understanding, and which also function as a means of maintaining contact. In turn, learners interpose expressions such as "Yeah," "Uh-hm," and "Alright" to signal that they are keeping up with what trainers are explaining or to maintain contact.

One possible interpretation of the use of these conversational devices is that they function as a mechanism for monitoring the training process. This interpretation goes beyond our evidence, but the evidence supports a more general observation that conversations during this initial training program were initiated by the trainer more in the interests of carrying out training goals than to accomplish the work per se. If resources were available, it would be interesting to extend this analysis to transcripts covering later training periods, to investigate whether the structure and functions of conversations change over time.

Analysis of Trainer Talk in Relation to Work Activity.[12] By far the greatest amount of talk going on in the training process is provided by the trainer outside of conversational exchange. What is the nature of this training talk and how does it contribute to the goal of helping new employees become competent material handlers in the stockroom?

One evident function of training talk is transmission of information. Common sense suggests that trainers will tell new workers about the stockroom and the work tasks involved in receiving parts and pulling work orders. But unless we employ systematic quantitative procedures, we cannot tell how

[12] Analytic schemes described in this chapter were devised by a working study group whose principal members were Sylvia Scribner, John Dore, Rosalie Schwartz, Bruce Dorval, and Patricia Sachs. Dore and Schwartz put forward the idea of coding talk for its timing function and together developed a workable system. Rosalie Schwartz and Amy White did the coding and jointly repaired the major bugs in the system.

much of their talk they devote to imparting technical information of this kind and how much to other matters they consider important for the general education of new workers: letting them know about working conditions and terms of employment, for example, or about norms workers themselves have established and expectations they have of one another. Becoming a worker in any setting involves learning how to function as a member of the working community as much as mastering technical knowledge pertaining to particular job responsibilities. To capture what trainer talk was about in a broad sweep, we identified three general content domains: the particular work activity the training dyad was engaged in at the time (called "task activity" or dyad activity); other work activities in the stockroom and in other sections of the plant (called wider work activity); and a category involving talk about conditions and relations of labor and social life, both in and out of the stockroom (called "other").

We will focus here on talk about the work activity, especially talk about the tasks the dyad was performing. The principal characteristic of this kind of trainer talk, as distinguished from classroom teacher talk, is that it is going on in the context of the activity it is about. In presenting a math lesson, a teacher is expositing math but is not at that time practicing it (see Schoenfeld, 1986, for a critique of math education as being too far removed from the work activities of professional mathematicians). In the stockroom, however, the trainer is not only talking to the new worker, but is involving him or her in carrying out work tasks; to the extent that trainer talk explains the work and imparts knowledge about it, exposition and practice will be co-occurring in the same setting among the same participants. This observation, however, does not entail any particular conclusion about the manner in which these two functions may interweave on a finer time scale. A worker-trainer has various options available for coordinating what he says and does singly or jointly with the learner: he may talk about some aspect of the work before doing it, talk while working, or talk after the work has been done. When we use the term "aspect of the work," we include not only the actions and operations that accomplish it (for example, counting) but also the states and properties of constituent objects involved in the work process (for example, a bin card). The timing function applies both to statements about past, present, or future actions and past, present, or future states. An examination of how trainers handle this timing function may illuminate the interrel.. J roles of various modalities of teaching-and-learning in the workplace—the roles of language, demonstration and observation, and participation in actual practice.

To scrutinize the timing relationship between trainer talk and work, we must proceed by a method of analytic abstraction. As an analytic device, we will consider speech and work as two separate streams of activity. Use of this device does not commit us to a theoretical position on the controversy over whether or not communication represents an independent activity at all times; nor does it commit us to the proposition that empirically speech and work are independent domains of human functioning. We know that in many occupations much of what is organized as work is constituted by speech (the classroom teacher's job is a good case in point), and conversely that much of the talk in the workplace is organized by the imperatives of task-related actions. We do not know how this relationship plays itself out with respect to jobs such as that of material handler in the stockroom, which has considerable manual and motoric content. However, to begin to address this complex relationship, it is heuristically useful to adopt an "as if" attitude—that is, to proceed as if talking and working are separate streams of activity that coincide or diverge in various ways. We attempted to capture this coincidence or divergence by a coding scheme that categorized utterances as preceding work actions or states, accompanying them, or following them. We further provided a category for statements that were "untimed" with respect to the work. We refer to this last category as "generalized" time and define and illustrate it below.

In sum: We adopted a two-way grid for coding trainer talk. One dimension cut the talk by content area into various kinds of work-related talk and nonwork-related talk; the other dimension timed utterances relative to the work process in these domains.

Method. A research group composed of linguists and project personnel met regularly for several months to develop a coding scheme by means of which we could analyze the content areas and timing function of trainer talk. It was jointly decided that the scheme would use a surface-structure sentence as its basic unit of analysis, and a coding manual was prepared setting forth definitions and coding procedures. (This manual is available on request.)

Coding was performed directly on transcripts, using information from observer commentary, supplemented by work documents and the researchers' knowledge of the plant, the people, and the work process. Coders listened to original tapes while coding; extraverbal features of trainer talk, such as intonation and stress, and background sounds of ongoing work furnished further evidence for decisions to divide the talk into segments and time those segments to action. We have already

described the criteria for coding content domains. Coding for timing presented greater difficulties. In the absence of videotape, it was not always possible to determine what the ongoing action was at every point. Moreover, the determination of talk as co-occurring with the action it was referring to often might involve fine discriminations as to whether a language segment terminated or overlapped with the associated action. Because our data did not allow unequivocal discriminations in many cases, we included combined classes such as before/during and during/after to cover cases in which the time line could not be clearly drawn. Below we provide examples of the coding categories with respect to both content domain and timing.

The corpus for this analysis consists of transcripts of four training dyads; Dyad 1 lacked a commentary of sufficient descriptive detail to support coding decisions. Because of time and resource limitations, we could analyze only the first fifty minutes of trainer talk (although our work with the transcripts suggests to us that trainer talk was consistent in its principal characteristics over the entire base period).

Two researchers independently coded the corpus. Coder agreement on segmentation was 86.7%, on content domain 97.4%, and on the time function 86.6%. The two coders discussed and resolved all disagreements.

Preliminary Results. Table 6 compares total amounts of trainer talk in different dyads and its distribution into content domains within each dyad. Consider the amount of talk first. Mickey, Dyad 1 trainer, again stands out for his talkativeness relative to other trainers. An apparent influence of interactional context is indicated in a comparison of Dyads 3 and 4, which had the same trainer and the same task activity but different learners. Although such variability is interesting to note, we can do little more than speculate about its possible sources with the data we have on hand.

In contrast to dyad differences in amount of talk, there is impressive consistency in all dyads in the distribution of talk across content domains. First, we note for all dyads the virtual nonoccurrence of talk concerning labor, social life, and other general topics. One might have expected trainers to draw attention to working conditions, comment on events such as coffee breaks, and make small talk about sports or other interests as a means of promoting camaraderie and helping new workers feel at home. It is possible that our presence inhibited some amount of talk on these topics, but it seems unlikely

TABLE 6
Content Domain of Trainer Talk in Adjusted Base Period*

	Task in Dyad		Wider work domains		Other topics		Total
Dyad		(%)		(%)		(%)	
2	284	(42.7)	364	(54.7)	17	(2.6)	665
3	371	(82.1)	70	(15.5)	11	(2.4)	452
4	190	(80.9)	33	(14.0)	12	(5.1)	235
5	250	(95.0)	12	(4.6)	1	(0.4)	263
TOTAL	1095	(67.8)	479	(29.7)	41	(2.5)	1615

* Excludes 16 indeterminate cases and 14 errors in computer entries of the data.

that an observer effect alone would account for a major decline. Changing one's manner of speaking for a tape recorder is not an easy thing to do; moreover, three different trainers were involved, and all were not equally interested in or concerned with the research procedures. Even if we multiply our observed amount of "other" talk by an arbitrary factor of five to take account of this possible measurement bias, we still have essentially the same outcome: the overwhelming bulk of training talk in the first period of training refers to the technical content of work activities. Further, the work activity that trainers talk about most frequently is the work that the dyad has the responsibility of performing—either pulling orders or receiving component parts.

As Table 6 indicates, Mac, the trainer in Dyads 3 and 4, and Dave, trainer of Bess in Dyad 5, talked of little else but the dyad's work. Mickey (Dyad 1) is an exception in that he talked more about work domains outside of the dyad than of tasks within it. He was the one trainer who did not begin pulling and receiving work as soon as the trainee arrived; he spent the first thirty-five minutes taking Joe around the stockroom, showing him the layout of locations, and describing the types of parts kept in the stockroom and the use of level bins. In accordance with our coding scheme, these topics fell into the "wider work activity" content domain. The only talk specifically related to the task of work orders, which was the dyad's slated task for the day, occurred when Mickey pulled a part from its location and gave a quick demonstration of how to fill out a bin card. In short, during this

time, the dyad was not engaged in performing stockroom work; Mickey was explaining the organization of the stockroom and other aspects of the work outside the context of actually doing the work. We might say that he had separated exposition from practice and, in classroom manner, was letting exposition take precedence over practice. After the stockroom tour, Mickey and Joe began to pull work orders. It was possible to take advantage of this change in what they were doing to determine how Mickey's activity affected his talk. We extended the coding to encompass the first thirty-five minutes of the pulling activity and, with time equalized, compared volume and content of talk in the two activities—touring the stockroom and performing work tasks.

TABLE 7
Content of Trainer Talk in Nonworking and Working Activities, Dyad 2

	Task in Dyad		Wider work domains		Other topics		Total
		(%)		(%)		(%)	
Nonworking Activity	77	(21.5)	277	(77.4)	4	(1.1)	358
Working Activity	243	(74.3)	83	(25.4)	1	(0.3)	327

Mickey's volume of talk was about the same in the nonworking and working activities (see Table 7), but the proportions of talk relating to the task at hand and to wider production were exactly reversed in these two activities. That is, Mickey talked more about the stockroom and the factory while touring the stockroom (i.e., he was not performing work tasks at the time), and while he performed work tasks he talked more about the work-at-hand. Mickey still tended to talk about the stockroom and the factory systems more than the other trainers but, like them, when he was participating in work tasks with the learner the burden of his talk shifted to the specifics of those tasks. This analysis lends support to our characterization of Mickey's early contact with the new learner as consisting essentially of "exposition."

We now look more closely at how the trainer coordinated talk about the work task with performance of the task itself. As a background for the data summary, we describe the categories and give examples of each.

Before. These are segments of talk that precede an action or state to which they refer. The action or state may take place a split-second after the utterance or at a later point: "I'll show you how to weigh it on the scale," "It'll give us eighteen thousand," "The first thing we're going to do is write the M-5," "you can dump it into here."

During. The referent action or state and talk about it overlap; the action or state onsets before the utterance offsets. The action or state can occur at any point during the spoken segment: "The easiest way I do it is to put them in here [sound of metal] until it levels off," "So you move this all the way over to the last two digits," "Now we get the scoop."

After. Spoken segments refer to an action or state that has taken place and has terminated before the onset of the utterance; the termination may have occurred immediately before or in the extended past: "So we pulled 620 pieces," "So it was X-42?" "Because there was a bin there."

As examples indicate, it is not possible to determine the timing of the talk from the form of the utterance alone. Two utterances with the same tense verb ("Count this") may be, and frequently were, differentially related to their referent actions or states.

General. A language segment not tied to a definite action or state is treated as "generalized" time or a state of "timelessness." Instances of this category include descriptions of habitual procedures ("We don't usually do this down here."), hypothetical formulations ("If we needed 50 pieces we would have scooped out of this one."), explanations ("The reason you can do that is because this is your level bin."), references to or definitions of persons, places, ideas, or things that are not tied to ongoing action ("'RR' stands for Receiving Report").

Table 8 displays the timing function breakdown for trainer talk related to task activity. This table excludes 150 instances (13.7& of the corpus) of fuzzy or combined timing categories (before/during and during/after). We prepared summaries including these instances in which we interpreted them as

augmenting the "during" category; we also prepared summaries in which "before/durings" were assigned to the "before" category and "during/afters" to the "after" category. The proportion of instances in the basic categories shifts with these procedures, but the same pattern obtains. The general observations we make here apply under all conditions of data aggregation.

The principal findings are:

1. The modal category for each individual trainer is "during." Summed over trainers, nearly half of all trainer talk about task activity accompanies the doing of that activity in a very fine-grained manner—a single utterance to a single operation. What this implies is that two sources of information about the task activity are directed at the learner simultaneously. This talk that goes on in tandem with action makes marked use of deictic expressions such as locatives (here, there), demonstratives (this, that) and verbs such as "go" and "come." If the talk were separated from its action context, it would seem unclear, ambiguous, confusing. The ongoing action, however, is part of the message and serves to disambiguate much of it.

2. The most infrequent category of action-timed talk for each individual trainer (and the corpus as a whole) is "after." Trainers only infrequently comment on or sum up what they have done or what has occurred.

3. In spite of the close ties between speech and ongoing action, every trainer at some time states a rule, refers to a habitual routine, poses a hypothetical case, or offers a definition or causal explanation. Since so much of trainer talk is linked to the here and now of work activities, the occurrence of these forms of discourse signifies the trainers' awareness that the learner may need some broader knowledge of how the system functions in order to cope competently with the here and now. Since such awareness is likely to vary from one trainer to another, it is not surprising to find that the best discriminator among trainers is the ratio of untimed to timed talk. Mickey again takes the lead; Dave, the trainer of the one woman learner, has the lowest level of untimed talk. (In passing, it is interesting to note the high proportion of "befores" for Dave; these consist in large measure of direct commands or requests for action ["Count them up," "Put the date," "Come here."], which are infrequent in other training dyads; see discussion on conversational analysis above.)

With the grounding provided by this microlevel analysis, we are proceeding to examine the functions of training talk in terms of such acts as naming, introducing and orienting, defining, explaining and others. The present analysis also provides a firm foundation for a higher level analysis of stretches of trainer talk that will more clearly highlight the factual and conceptual material the trainers were communicating to learners.

TABLE 8
Timing of Trainer Talk Referring to Dyad's Task Activity
(in adjusted base period)*

	Timed to task						General		Total
	Before		During		After		(Untimed)		
Dyad		(%)		(%)		(%)		(%)	
2	46	(18.4)	103	(41.2)	26	(10.4)	75	(30.0)	250
3	77	(23.8)	156	(48.3)	31	(9.6)	59	(18.3)	323
4	36	(21.4)	85	(50.6)	27	(16.1)	20	(11.9)	168
5	82	(40.6)	101	(50.0)	11	(5.4)	8	(4.0)	202
Total	241	(25.5)	445	(47.2)	95	(10.1)	162	(17.2)	943

* Excludes 150 instances of "fuzzy" time categories as well as indeterminates and errors.

Summary. It is an oversimplification to think of "learning by doing" as in some way opposed to "learning by listening and talking." Trainers incorporate talk into the training process and take seriously the responsibility for explaining the work as they do it. Indeed, in the initial period of training, they talk about little else than the work activity. With one exception, trainers did not segregate talk about the stockroom from the activity of actually engaging in the work. They did not engage in long stretches of exposition, nor did they resort to linguistic pedagogical devices characteristic of classroom teacher talk.

The fact that the bulk of task-related talk accompanies the doing of the task suggests that it may not be useful to think of verbal exposition and practical experience as substitutes for one another. Recall that Mickey's specific task-related talk increased rather than decreased when he began to do the work. Further, since talk and work performance are going on in parallel, we have to assume that the learner is in a position to "observe" while s/he is listening. Although it is common in anthropological studies (e.g., Fortes, 1938; Lave, in preparation) to pose "observation" against "talk," or "experience" against "talk" as the privileged mode of learning in nonschool settings, it is unclear how one would disentangle these modalities in stockroom training (and, we suspect, many other practical activities in U.S. society). We do not know whether our trainers deployed these various modalities of instruction

effectively; nor can we say whether, on any given occasion, their use of several techniques (e.g., verbal description and demonstration) or their reliance on a single technique (e.g., engaging the learner in the actual practice) was motivated by training goals or work goals or was largely haphazard. Nonetheless, our findings are important in pointing to the need for a closer look at the mechanisms of teaching-and-learning in the workplace in all their complex interrelationships. Our findings point, too, to the contribution workplace learning studies may make to the vexing pedagogical problem now attracting much attention—namely, how hands-on doing and verbal instruction may most effectively be partnered in various activity and knowledge domains.

Concluding Remarks

We undertook this study because our experience in industry had convinced us of the educational significance of a variety of informal modes of teaching and learning glossed by the label "on-the-job training." We saw this significance as twofold. In the first place, as an empirical reality, on-the-job training is one of the few mechanisms that provide opportunities for workers to develop their capacities and acquire knowledge and skills while gainfully employed. It is both a mechanism for inducting young people into the intricacies of the workplace and for facilitating the advancement of experienced people to more skilled or demanding jobs. In industrial America, on-the-job training covers a wider range of occupations than do apprenticeship programs, and, in this period of rapid technological change, its role may be expected to increase in importance.

On-the-job training is also of theoretical significance because it represents a modality of education that stands in sharp contrast with the modality of schooling. Learning in school is divorced from "practice" (conceiving "practice" here as the use of knowledge in socially organized endeavors). Critiques of this classic school model have prompted a search for alternative educational arrangements that overcome the learning/practice separation. On-the-job training programs offer an array of formats for relating learning to practice that may very well travel to settings other than the workplace. Greater knowledge of these programs and how they function can inform the effort now under way to diversify educational programs for adolescents and adults, both within schools and outside of them.

We were especially attracted to the study of on-the-job training because we thought that efforts to analyze the "messiness" of these informal educational practices would help move educational theorizing beyond generalities and platitudes (e.g., "Learning through doing is an effective way to

learn."). When training is intertwined with working, we need a strong analytic apparatus for distinguishing what the training intervention contributes to the educative function of normal work. Global constructs such as "situated teaching and learning" or "learning and practice" are of little help here. Finally, in probing teaching and learning when they are embedded in work, we are challenged to broaden our conceptions of the kind of social processes and activities that constitute "education."

Our study in the stockroom was an initial effort to make an actual instance of on-the-job training visible to research and educational communities. Since, as far as we know, it is the only study of its kind, its first set of implications concerns the prospects for making informal, workplace education an object of systematic research inquiry.

Our experience demonstrates that ethnographic approaches can be effectively employed to gain the access and trust necessary for on-the-job observational studies. With the support of management, union, and employees, we were able to introduce methods of data collection in the stockroom that captured and recorded training activities in a reasonably detailed way. Observations, documents, and audiotapes supported microlevel descriptions of certain phenomena (e.g., the role of talk in training) that approximate those available for classroom-based teaching. It is reasonable to expect that under the appropriate conditions, richly detailed descriptive case studies can be carried out.

At the same time, our experience brings to the fore certain research problems not fully appreciated when we started. The episodic nature of on-the-job training designed for new workers (it only comes into effect when they are hired and ceases if they leave for any reason) disrupts research time schedules. Its ad hoc characteristics and changeability in response to production exigencies limit possibilities for assessing training effectiveness through controlled research procedures. Moving from description to prescription (from "is" to "ought") is even more difficult here than in school-based studies. Descriptive case studies, however, can suggest hypotheses that might be tested in other settings. In an earlier section, we suggested focused research on forms of work reorganization during training and subsequent experimental tests of their effectiveness. On the other hand, training programs for current employees, rather than new hires, are quite likely to offer opportunities for pursuing questions of learning and training effectiveness within the original setting.

We now turn to substantive matters. Taking all sources of information into account, we can arrive at certain characterizations of stockroom training that raise general questions about this form of educational practice and hint at possible improvements.

1. Stockroom training disclosed a series of paradoxes in the institutional organization of training. Top management emphasized the higher skills required by the new computer system yet failed to change its job descriptions to reflect these skills or to modify its training practices. The increasing complexity of the job may be thought to have increased the difficulty of training; yet workers in the stockroom were still expected to take on this responsibility without being trained for it and without receiving extra compensation.

One inference warranted by this state of affairs is that the training that did take shape served its purpose—namely, to give new workers sufficient grounding to enable them to continue on the job and to assume increased responsibilities. Certain findings support this interpretation: no new worker was fired for incompetence; the new workers we observed did begin to function independently; the stockroom apparently continued to function at some level of adequacy; and we heard no reports of special foul-ups in stockroom or computer records attributable to new workers. In short, stockroom training pragmatically measured up to some level of "effectiveness." It is important to note that this level of effectiveness was achieved:

a) without the imposition of an educational criterion for hiring (educational levels of trainees ranged from fourth grade to community college);

b) with trainers who varied in experience from 13 years to one and one half months;

c) without any special procedures for introducing learners to technical devices (e.g., the computer system) or for acquainting them with general material-control principles.

What these circumstances suggest is that even ad hoc on-the-job training is a powerful educative practice for *initial* levels of competency. (We qualify this speculation below in considering the ways in which workers might be better prepared for long-term careers with promotional possibilities.)

We have identified some of the component processes of stockroom training at Kemps that might contribute to its usefulness: the peer structure of the training dyad; its immersion in the collaborative

problem-solving and joint activities of the stockroom; multiple sources of information from the joint occurrence of talk and physical work actions; and others.

2. Although trainers were not trained to train, we secured objective evidence that all did in fact train, not merely work alongside of the newcomers. Training was not only an institutionally recognized activity but one which stockroom trainers actually took it upon themselves to do. Moreover, when we looked closely at what was going on between trainer and learner, we found a great deal of systematicity: all worked out some form of division of labor that drew the trainee into practice in a way that still got work accomplished; all used verbal communication as a pedagogical technique; trainers on receiving reorganized the work in similar ways for training purposes. This picture suggests the intriguing possibility that ways of guiding others into work procedures and knowledge domains are indigenous in workplace communities and that work settings may contain educational resources with considerable potential.

3. Activities that were demarcated as "training"—that is, those occurring within the dyad—primarily involved what we may call "normal work routines." Learners were introduced to the more intellectually demanding aspects of the work "accidentally" as it were—that is, when the dyad encountered a problem in the course of its routine work or was drawn into a problem-finding or problem-solving discussion in the stockroom. We presume that over a long period of time new employees would "accidentally" encounter a full range of problems in this manner and become adept at handling them. Becoming adept at such troubleshooting calls for a fuller understanding of the production and computer systems than does the routine. To the extent that training does not accelerate or facilitate such learning in an organized way it cannot be considered fully effective from the perspective of the worker's long-term career development, even though it may meet immediate management needs. This consideration points to limitations of on-the-job training practices, which are not designed to fulfill the basic educational goals of maximizing human development.

Our final observations reflect our larger concerns with the theoretical foundations of educational practice. We brought to this research the theoretical perspective of activity theory—a perspective not yet well-known in this country although it has inspired considerable educational research in Europe. We found its constructs useful in helping us analyze the complex and changing relationships of an activity designed to educate (training) and an activity designed to produce manufactured goods

(working). Positing these as different activities for analytic purposes enabled us to identify a variety of relationships between them: normal work tasks were incorporated into training, some aspects of work were modified for training purposes, and work not directly related to training nevertheless served training purposes. Although we think this approach is illuminating, we are a long way from a conceptual framework capable of grasping the enormous complexity of educational phenomena that arise in the course of work.

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