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**Latitude or Latency? How Occupational Embeddedness and Control Shape
Emergent Coordination**

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ABSTRACT

In this article, we examine how occupational communities that are embedded in organizations exercise control processes to achieve emergent coordination. We compare two types of organizations, equipment manufacturing and film production, and find that while occupational control was important for emergent coordination in both settings, this relationship varied according to two aspects of occupational embeddedness: organizational acknowledgement and occupational interdependence. In the equipment manufacturing setting, occupational control was latent: the communities visibly conformed to organizational control processes while exercising occupational control behind the scenes to coordinate emergently. In the film setting, the organization granted the occupational community significant latitude over its tasks, which enabled members to coordinate emergently the majority of the time. We propose that these two aspects of occupational embeddedness must be analyzed together with occupational control processes to explain how integration unfolds in knowledge-based settings.

The post-industrial economy is increasingly made up of organizations that rely on skilled occupations to accomplish knowledge-based activities (Alvesson 1995; Vallas 1999; Barley 1996; Powell and Snellman 2004; Gorman and Sandefur 2011). As Gorman and Sandefur (2011: 291) note, "the world of work is increasingly divided into two hemispheres: one which requires expert knowledge accessible only through higher education, and one which does not." Indicative of this shift, in the United States, professional and related services are the largest and fastest growing category of workers as of 2010 (Bureau of Labor Statistics 2010). However, the growing prominence of knowledge work in the economy has not been reflected in the literature on coordination, which has largely focused on documenting the impact of changes in the organizational environment.

The presence of multiple groups with expert knowledge in organizational settings has made the accomplishment of collective tasks more challenging (Stark 1999). These challenges have reinvigorated interest in the study of coordination in organizations, albeit with a change in focus. While early organizational design research attended primarily to the role of structures and planning in coordination, recent scholarship conceptualizes coordination as *emergent*: workers achieve collective outcomes through ongoing interactions to manage uncertain inputs. This research suggests that organizations increasingly face unpredictable demands, and as a result, tasks are less routine and cannot be specified fully through design (Kellogg Orlikowski and Yates 2006; Faraj and Xiao 2006; Majchrzak, Jarvenpaa and Hollingshead 2007).

Although we have made progress on understanding the coordination of complex work, scholars have not directly tackled the implications of the underlying trend: the

increasingly complex relationship between knowledge workers and organizations. Emergent coordination, more often than not, depends on occupational or professional workers exercising discretion to integrate complex tasks. Although some prescient scholars noted that occupational embeddedness could cause tensions and dissatisfaction for professional workers (Hall 1967; Edwards 1979; Scott 1965), there has been almost no exploration of how the relationship between occupations and organizations shapes coordination since the recent explosion of knowledge work, despite the growing relevance of this dynamic. In this paper, we directly address this question through a comparative ethnographic study of coordination in two knowledge-based production settings: equipment manufacturing and film sets. We identify two aspects of occupational embeddedness – organizational acknowledgement and occupational interdependence - and show how they must be analyzed in conjunction with occupational control processes to explain how integration unfolds.

Coordination: From Stable to Uncertain Organizational Tasks

Recent research suggests that the ongoing activities of work are as important to coordination as the organizational structures within which they happen. The emergent coordination perspective "considers coordination as it happens, assuming that people in organizations must coordinate the work regardless of the organizational design" (Okhuysen and Bechky 2009: 469). This scholarship has contrasted these practical, interactive, situated activities with the structural approach to coordination described in the organizational design literature.

Doing so is important because organizational times have changed. Shifts in the nature of work, technology, and institutions have precipitated the rise of organizational forms and relationships not considered by contingency theorists (Hargadon 2003; Davis 2003). Post-industrial workplace changes such as the growth of contingent work and outsourcing (Belous 1989; Cohany 1996) and a shift to distributed, network, and project-based work (Bielby and Bielby 1999; Hinds and Bailey 2003; O'Mahony and Bechky 2006) have altered the structure and work tasks of organizations.

Scholars argue that organizations have become less hierarchical, more flexible, and more responsive to the environment (Neff and Stark 2004; Girard and Stark 2003; Klein, Ziegert, Knight and Xiao 2006). For instance, in "fast response" organizations, such as medical trauma centers, members contend with highly uncertain inputs as well as the consequences of failing to cope with those demands effectively (Faraj and Xiao 2006). Organizational forms have also evolved in response to ill-defined problems and the need for continuous innovation, enabling groups of specialists to contribute their diverse expertise to a rapidly evolving final product. These "heterarchies" are characterized by "distributed accountability, decentralized decision making, and multiple (often competing) evaluative principles" (Neff and Stark 2004: 175).

A key implication of these studies is that emergent coordination practices are the "new normal" in settings that routinely face uncertainty and volatility from the environment, in which collective responses to these demands must be timely and error-free (Bigley and Roberts 2001; Faraj and Xiao 2006; Kellogg, Orlikowski and Yates 2006; Klein et al. 2006; Majchrzak, Jarvenpaa and Hollingshead 2007). By attending to

how work is accomplished, these studies uncover how emergent coordination activities allow people to effectively meet the demands of the environment.

Emergent coordination encompasses a diversity of mechanisms (cf. Okhuysen and Bechky 2009), from purposeful interactions that address specific problems, to ongoing activities, like monitoring, updating and substitution, which enable workers to respond to one another's contributions and align tasks as they evolve over time (Hutchins 1991; Klein et al. 2006; Metiu 2006). For example, Kellogg, Orlikowski and Yates (2006) identify display, representation, and assembly practices across community boundaries as crucial to achieving emergent coordination because they reduce the time required for integrating the inputs of diverse specialists. Bechky and Okhuysen (2011) show how members of two different occupational communities engage in rapid role substitution in response to unexpected absences of key personnel, drawing on shared understandings of work tasks to achieve emergent coordination.

In other settings, workers coordinate through a combination of emergent activity and organizational structures to achieve collective outcomes. For example, trauma centers rely on organizational protocols to assemble temporary teams and to manage the unpredictable flow of incoming patients, while relying on the judgment of medical professionals in moments of uncertainty (Faraj and Xiao 2006). Bigley and Roberts (2001) show how fire departments utilize personnel management systems to respond to disasters, but also expect their members to quickly step into their roles as defined by this bureaucratic system (Bigley and Roberts 2001). Emergent coordination is necessary because organizations cannot completely specify coordinating structures in the face of

unpredictable demands, and as a result, workers must coordinate through ongoing activities.

Examining these studies from a different angle, it becomes apparent that these organizations employ workers who can respond to these unpredictable inputs by drawing on their specialized knowledge and skills (Alvesson 1995). Knowledge-based organizations, from professional service firms to digital start-ups, depend on these workers who "think for a living" (Drucker 1957) and who possess the capacity for innovation and problem solving across epistemic boundaries (Brown and Duguid 2001). Knowledge-based work often implies the presence of local occupational communities: "those engaged in the process of creating, communicating, and applying knowledge are identified and identify themselves with recognizable, increasingly organized occupational groups" (Freidson 1994: 67).

From this perspective, recent studies of emergent coordination in knowledge-based settings, more often than not, are implicitly about occupational groups in organizations. Indeed, modern organizations are populated by these communities, and knowledge-based organizations depend on them even as organizational structures have diversified beyond the heteronomous organization or the professional partnership forms (Scott 1965; Hinings 2006). Occupational communities are "bounded work cultures populated by people who share similar identities and values that transcend specific organizational settings" (Van Maanen and Barley 1984: 314) and serve as the producers and arbiters of knowledge-based work through identity-based control processes (Van Maanen 2010). Occupations not only exercise social control over members, but more importantly, deliberately control knowledge through these relationships (Child and Fulk

1982). Unlike the professions, which enjoy institutional support for their exclusive claim to a body of abstract knowledge (Abbott 1988), occupations defend their jurisdictional claims in the course of doing their work, by communally upholding quality standards independent of the criteria of the employer or client (Van Maanen and Barley 1984). Like pre-industrial craft communities, occupations are distinguished from workers who possess technical skill by their collective ability to generate innovative techniques in response to unfamiliar problems (Sennett 2008).

The emergent coordination research analyzes the activities of occupational communities such as doctors, nurses, designers, SWAT officers, software engineers, and technicians (Faraj and Sproull 2000; Klein et al. 2006; Kellogg, Orlikowski and Yates 2006; Okhuysen 2005; Crowston 1997, Crowston et al. 2005; Metiu 2006; Vaast and Levina 2006; Bechky 2003a, 2003b). However, because this research tends to anchor theoretical insights in the link between an unpredictable environment or uncertain tasks and coordination mechanisms, theory that links emergent coordination processes and occupational approaches to accomplishing work remains underspecified.

Specifically, prior research tends to elide the possible tensions that might occur when occupational communities must work under organizational controls. That is, knowledge workers might be torn between the allegiances, standards, and norms of their occupational communities and those of their employers. Organizations may challenge occupational principles, such as the "authority of imputed expertise" in which professional knowledge and skill, and not administrative position, is the determining factor for how work is controlled (Freidson 1994: 64). In addition to affecting governance and worker satisfaction, the tensions between these approaches to control are likely to

shape the ongoing coordination of tasks, but their implications for how integration is accomplished remain underexplored. Although studies have shown how occupations coordinate emergently across various physical and epistemological boundaries within organizations (e.g., Bechky 2003; Kellogg et al. 2006), the consequences of occupational embeddedness for integration merit deeper study given the prominence of knowledge workers in the post-industrial economy.

Occupations in Organizations: From Conflict to Shared Mandate

Occupational control, in its purest form, pivots on communal authority over both the terms and the content of the work (Simpson 1985). In practice, occupational control is a process of gaining and maintaining authority over tasks and setting boundaries around who can perform those tasks – a process which plays out in work interactions as well as through societally-mediated jurisdictional disputes (Abbott 1981; Bechky 2003b). Moreover, while specialization and hierarchy can be found in occupational communities, they emerge from community performance standards and members' ideas of how to organize the work rather than from external standards (Van Maanen and Barley 1984).

Until the middle of the twentieth century, occupational communities largely operated outside of organizational contexts. However, the transition of the Western economy to knowledge work saw formerly independent professionals joining organizations. When members of occupations and professions first migrated to firms, scholars predicted that the incompatible principles of bureaucratic and occupational control systems would create conflict and dissatisfaction (Hall 1967; Edwards 1979; Scott 1965). The rationale for this prediction was that workers in these "heteronomous

organizations" (Scott 1965) would be accountable to managers or administrators who were not members of the occupation. Occupational control would be curtailed by the organization's power to determine the tasks associated with specific jobs in ways that reflected the organization's product or service rather than the occupation's knowledge base and skills (Child and Fulk 1982).

Despite the prediction of scholars that such working arrangements would lead to dissatisfaction and labor conflict (Hall 1967; Edwards 1979), studies have presented more nuanced, inconclusive findings instead, showing that in some cases, members of occupational communities, including professionals, are content to work in organizations (Simpson 1985; Strauss et al. 1963; Hall 1970; Scott 1982). More recent studies help to clarify the reasons why this might be the case. For instance, Briscoe (2006, 2007) has shown that administrative control is not necessarily detrimental to workers' satisfaction when the attendant mechanisms provide personnel with increased temporal flexibility and work-life balance.

In contrast, managerial intervention in how an occupation carries out its substantive work, particularly when the work reflects its collective identity, invokes resistance. Kellogg (2009) found that a new work-hours policy implemented by hospital administrators created conflict among different factions of a surgical community, because the policy challenged the value-laden process of professional socialization. In these situations, administrators' directives may incense expert employees because they are perceived as encroaching on their autonomy (Gouldner 1955; Adler and Borys 1996). At the extreme, managers may grant workers only the semblance of autonomy, because nominal autonomy further serves the organization's imperative to extract productivity

while reducing dissatisfaction and turnover (Braverman 1974; Sewell 1998). The tension inherent in the control of labor plays out in the governance and management of occupations in organizations.

Although these findings about conflict and governance are suggestive that the relationship between occupational embeddedness and coordination is important, this literature does not specifically explore the implications of different forms of embeddedness for the emergent coordination of work. However, as Van Maanen and Barley (1984: 290) assert, organizations are sites of struggle between different approaches to controlling work, because "rational or administrative principles of control (e.g., codification, standardization, hierarchical discipline etc.) compete with traditional or communal principles of control (e.g., peer pressures, work ideologies, valued symbols, etc.)." Unfortunately, little attention has been paid to how emergent coordination unfolds when occupations and organizations share responsibility and authority over integration. Although some recent studies have explored the complementary relationship between organizational structures and informal interaction in coordination (Valentine and Edmondson 2015; Ben-Menahem et al. 2015), their focus has been on explaining the efficacy of particular mechanisms, such as team scaffolds, rather than bringing to bear the implications of occupational embeddedness on coordination theory.[1]

In this article, we provide an alternative conceptual lens for thinking about the integration of knowledge-based work: how emergent coordination relates to the dynamics of occupational embeddedness and control in organizations. We examine how members of two types of organizations, a semiconductor equipment manufacturing firm and film

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[1] Bechky (2006) describes in detail how one aspect of occupational control, role expectations, influences coordination, but this paper is not focused theoretically on the impact of occupational control.

studios, carry out complex production processes. The central insight gleaned from this comparative study is that occupational communities in organizations enact control processes that both constitute and enable emergent coordination in ways that organizational control processes are ill-equipped to manage. We find that the relationship between control and emergent coordination can be further clarified if we decompose occupational embeddedness into two aspects which can be analyzed separately: occupational interdependencies within organizations and organizational acknowledgement and support of occupational control. The particulars of occupational embeddedness tend to vary by organization, and therefore this approach enables a comparative understanding of emergent coordination processes in knowledge-based settings.

RESEARCH DESIGN

Because little theory has been developed about occupational embeddedness and emergent coordination, an inductive approach to studying this problem is appropriate (Lee 1999; Edmondson and McManus 2007).   To generate a grounded theoretical understanding of coordination in organizations, the first author examined production work in two different fields. The analysis presented here is based upon ethnographic studies of two settings, an equipment manufacturing facility and a set of four film production projects. This matched pair comparison was designed to focus on key parameters of commonality in the work, while also exploring differences in process to build theoretical explanations (Bechky and O'Mahony 2016). Both were production organizations with embedded occupational communities of knowledge workers using

technical expertise to interdependently produce complex products. However, the equipment manufacturing organization employed three distinct occupational communities and organized them in a sequential production process, while film studios hired crews who belonged to a shared community and worked on a short-term project basis.

The first author conducted a yearlong ethnography of the new product line at EquipCo,[2] a semiconductor equipment manufacturing company located in Silicon Valley. EquipCo produced a series of standard product models called builds that could be customized to meet the needs of particular customers. The workers built multiple machines of a given type, which often took over six months in production time. The study focused primarily on technical workers, who were organized into three occupational communities: engineers, technicians, and assemblers. The work of these groups was largely performed sequentially, with established processes of feedback and handoffs between the groups.

Film sets, in contrast, are exemplars of temporary, project-based work (Jones 1996; Meyerson, Weick and Kramer 1996). On these projects, studios contract with a specialized crew and cast for the duration of the shoot and then they disband the organization and each member moves on to a new project. Each project is organized to produce just one final version of the product. Production times are relatively short, ranging from a few days to several months, and multiple specialized departments work simultaneously and interdependently on tasks.

The first author conducted ethnographic studies of four film projects: two movies, a music video, and a commercial. The first project, "Alo," was a commercial for a long-distance telephone company, which was shot in several days with a production

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[2] The names of all organizations and projects, as well as all informants, are pseudonyms.

crew of about 50 members. The second project, "Murder Mansion," was an independently funded horror film with a budget of approximately $2 million. Murder Mansion took five weeks to film, and also had a crew of about 50 members. On "Playaz Ball," a rap music video, she worked during both pre-production and the production period itself, joining a crew of 35 members for five days. The fourth project studied, "Talk to the Animals," was a Hollywood studio film with a budget of over $100 million, which was shooting on location in New York. This six-week shoot had a unionized crew of 175 members from both coasts, working in two units.

The first author was a participant-observer of the production process in each of these settings; this allowed her to develop a deep understanding of the work practices and how structures and interactions interrelated to create coordination. Her research role varied depending on the occupational group she was studying. For instance, at EquipCo she helped build machines as well as observed assemblers' and technicians' work, while she observed engineers but did not participate in designing the machines. During the study of film sets she primarily worked as a production assistant, assisting and observing in a variety of areas including the production office and the locations, wardrobe, electric, grip, property, sound, and camera departments.[3] In both settings, she also participated in some social activities, such as meals and parties, with her informants. During both studies, she jotted field notes while at the site and elaborated the notes on her computer at the end of each day. For additional details about research participation in these settings, please see Appendix 1.

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[3] The office department handles all administrative tasks for the set, managing paperwork and supplier relations. Locations is responsible for finding and negotiating access to places to shoot. The wardrobe department is responsible for costumes. Lighting and power needs are supplied by the electric department, while the grip department provides mechanical and construction support. The property department procures and manages the "props" that will be seen on-screen, and the sound department captures and records the sound and dialogue. The camera department films the scenes.

Analytic Approach

We followed a grounded theory approach of comparison and contrast (Glaser and Strauss, 1967; Strauss and Corbin, 1990) in analyzing the data. This approach entailed an iterative process of theoretical sampling, comparing and contrasting examples from the data to build theoretical categories which were then compared and interrelated to form the basis for this paper. Although comparative ethnographies are rare, Bechky and O'Mahony (2016) and Barley (1996) provide some guidelines for comparative ethnographic analysis, which we followed in this study.

This process entailed two stages: emic analyses of each setting and etic analyses generalizing across the settings. In the first stage, the first author conducted separate emic analyses of the field data from each setting in order to develop an understanding of the work practices from the perspective of her informants. In both studies, the broad research question was how complex production work was accomplished. After leaving the final film production set, the first author realized that while the work practices constituting coordination in these settings were not identical to those in the manufacturing setting, they seemed to accomplish similar purposes. Thus, the analytic strategy revolved around analyzing comparative data through several iterations in which she focused on commonalities and differences in the data with respect to coordination practices.

The second author joined the project for the next stage, the etic analysis, which focused on developing the emic understandings of organizing in both settings into more generalizable categories that related to social scientific concepts. In complex multi-sited

ethnographic studies, it is important to move between the local contexts and patterns of

interaction and more general theoretical concepts, through a process of constant

comparison (Nicolini 2009). We began by analyzing instances of coordination problems,

moments where there seemed to be difficulty integrating tasks across groups, and noting

the practices involved in solving these problems. We used charts and tables to facilitate

the comparisons of coordination practices across the two settings (Miles and Huberman

1994).

As we explored differences in the process of coordination across the two settings,

we realized that the organizations contrasted in terms of their direct involvement in task

integration, despite surface similarities in the mechanisms they used to manage

coordination. Workflow formalization, specialization, and hierarchy are key mechanisms

of organizational control (Adler and Borys 1996) and we attended to their use in both of

these settings. In particular, we found that the organizations formalized some aspects of

coordination through schedules and documentation, and monitored production through

these practices.

We also found that although both settings featured knowledge workers who

possessed various types of expertise (e.g., technicians, sound mixers) the contrasting

configuration of these workers into separate or shared communities had major

implications for how occupational control processes played out. Members of

occupational communities learn work behaviors, norms, shared viewpoints, and skilled

practices as they become increasingly active members of a community of practice (Lave

and Wenger 1991; Brown and Duguid 1991). New members are judged by more

experienced members of the community as they perform their roles; these evaluative

processes are the bedrock of occupational control (Van Maanen and Barley 1984). In both of our settings, informal hierarchy, socialization and learning practices, and normative expectations of work quality constituted and enabled emergent coordination.

The comparative analysis demonstrated that the two settings exhibited significant differences in the relative importance of occupational control processes for achieving emergent coordination. At EquipCo, members of the three occupational communities paid close attention to the organization's production schedules and documentation to accomplish their work, and drew on latent occupational control processes to coordinate emergently when these organizational mechanisms did not fully specify integration. However, the organization did not acknowledge these occupational control processes. On film sets, both the studio and the crew were cognizant of the provisional nature of the schedule and often treated documentation as a formality, and the studio granted the crew latitude over substantive work, relying on senior members of the crew to exercise occupational control to accomplish integration. By systematically comparing how organizational and occupational control processes intertwined in these two settings, we explain how the nature of occupational embeddedness differentially shapes emergent coordination in knowledge-based organizations.

OCCUPATIONAL EMBEDDEDNESS AND EMERGENT COORDINATION

Organizational Control at EquipCo: Aligning Three Occupations

At EquipCo, the organization controlled integration through a system of drawings and documentation, and coordination was characterized by "hand-offs" between the engineers, technicians, and assemblers. Documentation allowed the organization to keep

track of each group's progress during a particular build, as well as to systemize information related to building multiple products over time. EquipCo produced multiple customized standard models; production was organized into three separate product lines based on technology differences, but there was significant overlap between the machines across product lines. The production process was geared toward not only manufacturing the product, but also ironing out variability and recording the process for future orders.

Engineers designed a new product and began documenting it by creating a set of preliminary engineering drawings, which they sent to the technicians' lab so they could begin the prototyping, or build verification process. The technicians built the machines from scratch using these drawings, which communicated the way in which the parts should be assembled. One of the technicians' prototyping responsibilities was to change the formal organizational documentation of how the machine was assembled to make the build more manufacturable. They were expected to communicate these modifications to the engineers as they completed building via "redlines," or corrected engineering drawings. After several prototypes were built, members of the new product assembly team (a subset of the assembly community) were trained to build the machines by the technicians. Through this process, the technicians and engineers gradually transformed the engineering drawings into formal organizational assembly drawings.

Engineering drawings were released through the organization's Engineering Change Notice (ECN) process, in which an analyst stamped the engineers' drawings with the organization's official approval of changes to the design. The analyst then packaged updated design drawings for each product and sent them to the groups involved in production to be used in building. The ECN process was the organization's method of

keeping track of changes to the design so that parts could be ordered for prototyping and ultimately, assembly. The documentation helped the organization maintain the long-term replicability of its products, and it was particularly important to coordinate the transition from engineering design to physical building.

Members of the organization attended carefully to the documentation and aligned their tasks with its requirements. For example, while building a cable, Jordan, a technician, noticed that the color of one of the cables seemed to be wrong. He looked on the drawing and called the engineer. "On the drawing I have, it shows both 36 and 37 as violet red. Should one of those be brown red as a return? … Yeah, I'd think so also... I want to be sure because this document is getting incorporated. So could you find out and get back to me?" Jordan was aware that this change, once approved by the engineer, would be a part of the final ECN package, and he wanted to ensure it was free of errors. During the prototyping process, the technicians interpreted the engineering drawings with a keen eye as to how they would translate into physical machines. By recording their observations in the documentation and notifying the engineers, they were ensuring that their work met the expectations of the organization's documentation system.

When the product was released to the assemblers, they were expected to "build to the print" in an effort to ensure that their work matched the official documentation; managers in the technician and assembly groups repeated this mantra frequently. "Building to the print" entailed following specific instructions to put together subassemblies and install them on a frame to create the finished machine. For instance, Tom, an assembler training in the technicians' lab, was attaching a set of cables to the frame of a machine, and noticed a missing label. He asked Greg, a technician, if they

should add the label and put an instruction to that effect on the assembly drawing. Greg replied, "Oh, you can put that on the install procedure instead of the drawing." "No," said Tom, "the procedure has to follow the print. If the print doesn't call it out, we can't label it." As Tom pointed out, once the product was released to final assembly, the assemblers were expected to build exactly what the drawings detailed, a practice that was meant to align the work of the three communities across the lengthy and complex build process.

The organization's system of drawings and documentation shaped how the three communities interacted, both within and across occupational boundaries. From the organization's perspective, this system of documentation was effective for integration because it enabled the firm to meet the demands of multiple customers and ensured the repeatability of builds over time. Yet members of the three occupational communities often departed from this system in the course of production. For example, instead of relying solely on the drawings, technicians often consulted with other technicians who had built a version of the machine before, because the build process frequently changed and the drawings were often inaccurate. The technician community tacitly acknowledged that the drawings were often less instructive than the experience of colleagues whom they could easily ask for advice. To an even greater extent, despite having access to drawings and redlines, most assemblers rarely consulted them. They did not learn the language of engineering documentation and found the drawings difficult to understand, even though they were formally expected to be able to "build to the print."

These disconnects between what the documentation process required and how the groups actually worked can be explained by their membership in three distinct occupational communities with different knowledge, experience and training. Engineers

possessed college degrees, while the technicians and assemblers were only required to have a high school education. As a result of their different work cultures and skills, when engineers passed their drawings to the technicians, they did so with an incomplete understanding of how their prints would translate to physical builds, and they had even less knowledge of how the assemblers worked. Not only did the engineers lack understanding of assemblers' tasks, they often devalued their input – assemblers' knowledge was thought to be "tribal" and their suggestions for new ways of working were often ignored (see also Bechky 2003b). In contrast, the technicians understood the assemblers' tasks because they built the machines before handing off the prints. In addition, a number of technicians had previously worked as assemblers, and understood how they worked, whereas only a single instance of a technician being promoted to engineering was recorded.

These occupational differences affected how work was coordinated but were rarely reflected in the official organizational process, which assumed linear phases of production and hand-offs through the documentation. In addition, the organization reinforced these differences through structural interventions. For instance, a year or two before the first author entered the field, the VP of Manufacturing had moved the technicians out of the workspaces of the three different engineering units and co-located them into a single new product technician laboratory. The goal of this reorganization was to capitalize on the building knowledge of technicians and avoid "reinventing the wheel" across product lines, while maintaining three distinct product lines for both engineering and assembly purposes.

To cope with the incomplete integration afforded by the formal organizational production process, members exercised latent occupational control to coordinate their tasks. Occupational control made it unacceptable for the groups to use the documentation to pass off problems that resulted from the organization's process, because each community possessed a normative sense of responsibility for the quality of their output in relation to the other groups. For instance, both the technician and assembly communities helped members access a shared body of tacit expertise, and by doing so upheld norms around quality. The technicians' knowledge base was broader and included an understanding of how to read and edit drawings, as well as how to build prototypes; within the community, members engaged one another to solve novel problems related to manufacturability and to incorporate these techniques into the design process. In contrast, the assemblers' expertise developed through communal training to transmit the tacit skills and practical knowledge required for building. [4] Furthermore, members of all three communities strove to meet expectations related to the organization's documentation and hand-off system, even if they did not always match how they actually worked. Occupational control thus contributed to the efficacy of the documentation system, even as it went unacknowledged by the organization.

Latent Occupational Control and Emergent Coordination at EquipCo

Members of EquipCo coordinated emergently by activating occupational control processes: a normative concern with work quality, occupational learning and socialization, acknowledgement of jurisdiction, and deference to practical expertise. Emergent coordination that drew on occupational control processes facilitated the hand-

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[4] For more details distinguishing the three occupational communities, see Bechky 2003a, 2003b.

offs between the communities by aligning the documentation process with how they actually worked. In many instances, only after problems had been solved substantively through these interactions did they go back to the documentation and record their progress.

For example, because they were upstream in the production process, members of the engineering community were keenly aware of what they needed to do to keep production in motion while still meeting the requirements of the organization's ECN process discussed earlier. This was because the ECN process sometimes diverged from how members of the engineering group actually got work done. As a result, emergent coordination that related to the production schedule was often aimed at stretching organizational limits on the time they needed to develop fully-realized drawings, thereby enacting their normative concern with work quality. In one meeting, the design engineer, Leslie, was sharing information with the other drafters and engineers on the design team about the various builds they were working on. Leslie announced that she changed the schedule based on new data from the analyst:

> Leslie: The first date is October 17, 8271 is for Customer X, that's
> for two [machines]… They are waiting for us to finish [the
> drawings].
> Clark: Oh, so you'll need that stuff this week.
> Leslie: Yeah, the ECN by next week. I'll just put in bills of materials
> without drawings.
> Clark: You can do that?
> Leslie: Why not? What holds us up is the drawings.
> Clark: Assembly drawings?
> Leslie: Yeah, and then the drawings stay under our control, [our
> group is] the only one building it, [we] are the only ones who need to
> see it, so we can just put a preliminary stamp on it.

In this exchange, Leslie and Clark were trying to figure out how to start building in time to make the customer deadline while still meeting the requirements of the

organization's ECN process. They knew that the technicians working on this build would need both parts and drawings; the parts required that a bill of materials go through the official organizational channels, but the drawings could stay within the new product organization at this stage of the process, and therefore, the engineers could save time by waiting to finish them. The engineers were aware that the bill of materials needed to be approved by the organization to meet a deadline, but they were more concerned with improving the drawings. In this instance, the engineers exercised discretion around an issue – the ECN process – that they felt should not influence their substantive work, the drawings. Keeping in mind the timeline for assembly, they coordinated emergently by changing their drawing schedule, with the ultimate aim of developing high-quality designs within the constraints of the production schedule.

When they received the drawings, the technician community often coordinated emergently during the prototyping process by drawing on one another's expertise, although the organizational system technically assigned them to work independently on their own machines. This communal approach increased the quality of the prototypes and reduced unnecessary errors that would need to be corrected downstream in the production process. Technicians frequently turned to one another to check their work and share their observations about best practices. For instance, one morning while Theresa was building a part of the motor drive, the documentation was unclear, leading to difficulty figuring out which screw sizes to use and in which order to place the washers and spacers. She called another technician, Tom, over several times because Tom was building the same part. In one interaction, Tom said that the part needed a longer screw than what was called for in the documentation. In another conversation, Tom interpreted the diagram,

and demonstrated that if you turned the part a certain way, you could see how it aligned with the diagram. Although the organization did not formally require the technicians to validate their builds with one another, members of the community were constantly engaging in this type of informal learning to decrease errors and increase their collective expertise.

In another instance, in which the first author was building a sub-assembly, a technician commented to her, "Remember that you are the expert on building this once you've finished it. You can make changes [to the drawing]. Well, you can at least send the changes to the engineer, they may not always get made, but you are the one in charge of how to build." By emphasizing her authority over this particular assembly, the technician reinforced the group's collective aim of developing expertise that would be salient through the build process.

Technicians paid keen attention to the quality of both their own work and that of their colleagues because the engineers evaluated their outputs in terms of the group, not the individual. Although the organization did not expect the engineers to judge the technicians' work outputs, informal evaluations of other groups' work permeated the production process (as implied in the prior example). For instance, a technician commented about the level of skill the group as a whole wanted to attain: "We need to maintain our reputation, we don't want to be a group that engineers avoid working with. One 'oh shit' can outweigh a hundred 'atta boys'. We need to get everyone trained up to a certain level of soldering techniques. We don't always solder but everyone needs to know how." In other words, although the organization did not necessarily monitor the

quality of the technicians' work, the engineers were attentive to it. The technicians were sensitive to their opinions, and tried to minimize any negative impressions.

There was also evidence of emergent coordination between the engineering and technician communities, particularly when the engineers were designing for manufacturability, which was also the technicians' domain. Engineers and technicians frequently called on one another to troubleshoot potential problems to solve them before recording them in the organization's documentation. Although the engineers considered the drawings to be their jurisdiction (see also Bechky 2003b), they acknowledged that the technicians had a superior understanding of the realization of their designs into physical machines, and the technicians knew they were welcome to offer their suggestions for improvement during prototyping.

For example, an engineer and two technicians coordinated emergently while prototyping a machine that did not have the proper holes machined into the frame. The technicians needed to add a limiting switch and plate onto the gap drive, the part that loaded the wafer into the chamber. Initially, Terry, a technician, called Pete, the engineer, to find out what the correct modification was, saying, "I need to get the dimensions on the holes... I need the placement on the hole." By doing so, he tried to update the documentation accordingly. But the engineers had not set a specific placement, and Pete came down to the lab, where they were joined by Mark, another technician who had built an earlier version of the same machine. Pete and Mark showed Terry approximately where Mark put the switch on the other machine, and Terry drilled the holes and mounted the switch. The technicians raised several points with Pete how the plate should be mounted. Pete suggested mounting the plate the way Mark had, but Terry disagreed,

saying he should mount it with the holes on the opposite side of the plate. Mark agreed

that Terry's way would be easier, and would not require the adjustments to the plate that

he had to do for his machine. Pete said "Okay, that's fine," and made a note of this

change on his drawing. In this case, the technicians showed the engineer how the

prototype related to the conceptual drawings so that the prototype was manufacturable,

thereby preventing a potential error in the documentation and problems with future

iterations of the build. It would have been much more difficult to convey this

understanding through the redlining process, and by resolving it emergently, the engineer

and the technician smoothed the formal hand-off that occurred later in the building

process.

Broadly writ, emergent coordination between the engineering and technician

communities was often aimed at meeting their respective occupational prerogatives of

realizable designs and manufacturable prototypes. The two communities exercised

occupational control over the quality of their work by proactively drawing on one

another's expertise, and used discretion to judge if documentation was useful to

coordinate hand-offs. In contrast, the assembly community was expected to build the

machines in exact accordance with the steps outlined in the documentation, and they had

little control over this process. In addition, the documentation did not always convey all

the steps of assembly, making it difficult to build from the prints. In this sense, the

assemblers did not enjoy the self-control and autonomy per the classic definition of

occupational communities (Van Maanen and Barley 1984).

However, they did exhibit emergent coordination practices aimed at minimizing

errors and quickly picking up new assembly processes – which they used to compensate

for their departures from the formal organizational system of documentation. One well-understood norm within the assembly community was that assemblers should watch the technicians build prototypes to learn how to perform their tasks. Because this was a new product line, the drawings were not always correct, and even if they were accurate, they were not easy to interpret, and sometimes overlooked small but critical aspects of building. In one instance, a technician, Theresa, demonstrated to an assembler, Arthur, how to put the o-rings on the chamber of a machine, while another technician said (to the first author), "She is telling him things that you can't put on the documentation."

When technicians were not available to help, the assemblers often "copied" their build from the machine a technician had been building. While two assemblers were installing a temperature control module onto a vertical rack, for example, Hao asked Dan, "Which print is it?" Dan looked at the part, flipped through the book of prints, and said, "Maybe we don't have it? Anyway, this (the wrapped part of the module), goes here on top," pointing inside the rack as he finished speaking. Hao replied, "But I need the print, I don't want Tony (the technician who was training them) saying "How come you did this?" Dan joked, "Tell him he didn't give us the print…" but then found it, and Hao took it over to his machine. After a few minutes, Hao realized that the part he had was not listed correctly on the print. Dan left the room, and went to find Tony, who told them to use a redlined set of prints that were in process at his bench. After bringing those back to the machine, Hao and Dan looked at Tony's machine, but Dan warned, "Don't go by it, look but don't copy that, we don't want Tony to get all chewed up."

Because the technicians had built the prototype and knew how the steps of assembly should proceed, they could demonstrate the process to the assemblers on the

spot or leave a material guide through their own work on the machine, saving assemblers the difficult work of interpreting the documentation. While the technicians reinforced the organizational practice of "building to the print," informal acknowledgement of the technicians' expertise between the technicians and assemblers enabled an emergent approach to learning how to perform new builds.

Specifically, the technicians frequently checked the assemblers' builds to ensure that mistakes did not leave the production floor. For example, Alice, a technician, was performing a final check on the finished machines, and asked the assemblers, "Why are we missing a clamp for the harness? Did we miss it on the others?" They all came over and looked, and someone asked if it was the shrink tube one; Alice replied that it was not. Sean, an assembler, said he had put the clamp on the other two machines and Alice pressed him to be sure. Through these occupational control processes, the technicians helped the assembly group meet their standards as well as the expectations of the organization's documentation system.

These instances of emergent coordination show how the three groups enacted a lengthy production process and compensated for the shortcomings of the organizational system which did not fully enable integration across complex new builds. The data also illustrate how latent occupational control processes both motivated and enabled emergent coordination: a normative concern with quality, intra- and inter- occupational learning and socialization, and acknowledgement of jurisdiction and practical expertise enabled and compelled the communities to address problems that the organization was ill-equipped to manage through its formal integration system. Although the organization did not explicitly encourage or discourage occupational control processes as a means of

coordinating work, these processes nevertheless played a critical role in reinforcing the organizational documentation system.

Organizational Control on Set: Granting Latitude to the Film Community

In film production, in contrast to EquipCo, an occupational community (the film crew) also worked at the behest of an organization (the studio), but emergent coordination processes were explicitly acknowledged and dominated integration rather than operating in the background. Similar to EquipCo, the studios relied on documentation and schedules to oversee production. However, on film sets, these processes were negotiated with senior members of the crew, and the studio granted significant latitude to the community in accomplishing its tasks. In order to protect this latitude, members of the crew exercised occupational control processes, including informal hierarchy, normative standards of work quality, socialization, and deference to practical expertise, to ensure that productions were completed under budget and on schedule.

Production studios contracted film crews to shoot a set of scenes that would be put together after filming to make one final, original product. The process of filmmaking started before the crew was assembled, as the script, budget, and preliminary schedule were developed. The unit production manager (UPM), who was the head administrator contracted by the studio to oversee the logistics of the shoot, hired the majority of the production crew with input from production department heads. The crew members worked on a contract basis to shoot the project within a specified period of time, which

ranged from a few days for videos or commercials to a few months for feature-length films.

Though they worked closely with the crew, the producers and accountants were permanent employees of the studio and represented the organization on set. The producers acted as both creative and financial decision-makers. Some producers shaped the creative direction of the film by working with the director, cinematographer, and senior members of the crew like the UPM; others were mainly interested in whether the project was staying on schedule and within budget. Accountants were concerned with how much of the budget was spent every day and how production costs related to the overall budget. Every day, the accountants generated "hot costs" so they knew what the crew had spent; this number was reported back to studio executives.

Documentation of the shooting schedule was the main way that film studios formalized coordination. However, unlike at EquipCo, these documents were subject to continual renegotiation. Representatives of the studio and the crew jointly developed a working schedule for a given project, and the heads of all the production departments met to go over this schedule at the start of shooting. These meetings set out the general expectations for how filming would progress, and informed department heads of their specific tasks. For example, at a meeting on the first day on location of "Talk to the Animals", the production designer, art director, and location manager, who had already scouted many of the locations, raised concerns and questions about how to prepare and dress the set at each place.

Filming began with this schedule, but it evolved on a daily basis as various scenes and shots were changed, moved, or scrapped. During production, members of the crew

received a daily schedule, which explained the locations, shooting order of the scenes, and crew necessary for each day. This schedule was created nightly by the 2nd assistant director and distributed to all crew members on the set, in advance of the following day's work. The studio also stayed involved in the progress of the crew through a report that the UPM delivered to the studio on a daily basis. This report summarized what scenes were filmed, how much film was used in the process, and how many pages of the script were completed.

Because the studio granted the crew flexibility with the understanding that producers were to be informed of both problems and progress, senior members of the crew ensured that the documentation submitted to the studio reflected their work. In one instance, the script supervisor, who kept track of the crew's progress and continuity with the script on behalf of the studio, was producing numbers of completed pages for scenes on "Talk to the Animals" that did not match the numbers reported by the assistant director. The UPM, Don, and the production office coordinator, Casey, were having trouble figuring out what numbers to record in the daily morning report for the studio, which summarized the prior day's work. When they tried to get the script supervisor to talk it over with them, she said she did not have time. Later in the week, Don had a phone discussion with the vice president of the studio, who said, "I am happy to have a three-way call with the script supervisor to ensure that she understands that we need this number." In this interaction, the vice president and the UPM worked together to ensure that the studio received up-to-date information about the progress of the crew. Such interactions with the studio were intended to prevent problems that might interfere with the crew's work.

When issues with serious implications for the schedule and budget arose, senior members of the crew were aware that they needed to work with studio representatives to work out solutions. For example, the crew frequently had to realign filming to suit the constraints of the situation, whether it was the weather, the availability of talent, or creative decisions by the director or cinematographer. In resolving these interruptions, the studios often deferred to the experience and judgment of senior crew members. In one instance, Don, the UPM, heard that a principal actor was sick: he had the flu, and his handlers wanted to take him to the doctor. The production held insurance on the actors in the event they could not work so that they did not lose money by not shooting. Don called the accountant to find out how much it would cost to wrap early, and then he called risk management to see exactly what the insurance policy covered. Then he got together with the producer and 1st AD on the set to discuss what other scenes they could shoot that afternoon. The UPM worked with studio representatives to develop an alternative course of action, saving both the studio and the crew a costly delay, and allowing the crew to switch course and move ahead with shooting.

As a result of this ongoing coordination between the studio and senior members of the crew, crew members were granted latitude to make on-the-spot decisions without involving the studio. For example, Dave, the location manager on "Talk to the Animals", complained to the UPM about a problem his assistants were having with the trash pickup. The night before, they had piled up bags of trash outside the Central Park location to be picked up by a carting company they had hired. Only the company did not show up, so when they arrived in the morning the trash pile was still there. Dave pointed out that "the Park representative would've thrown a fit if he'd seen it," so the location assistant did

"what we always do" in New York City. He flagged down the first Sanitation truck he saw and gave them $50 to haul it away. However, Dave did not receive petty cash for things like this, and complained, "Now I'm out the fifty bucks I repaid my assistant." The UPM called the set accountant and she said there was a form to be filled out to reimburse Dave. This interaction between the location manager, UPM, and accountant captures how members of the crew were empowered to take action in the moment and seek approval and resources from the studio afterward; both the studio and senior members of the crew accommodated these instances of extemporaneous problem-solving, because they shared the understanding that senior members of the crew would work with the studio representatives (i.e., the accountant) to fulfill documentation requirements afterward.

This flexible and skillful approach to managing the organization's concerns around the schedule and budget was possible because the film community shared and reinforced a set of expectations about how they worked. In contrast to the three communities embedded at EquipCo, the film crews identified as members of a single, shared community. This community developed through the common work experiences of film crew members across projects. Most people on film sets started as general production assistants and then moved to a production assistant role in sound, electric, or grip. Eventually, people joined a specific union, but only after they had experienced multiple different roles. Because many people joined the film community as untrained assistants to various technical departments, they learned from more experienced members of the crew, who encouraged behaviors that conformed to the norms and expectations of the occupational community at large (see also Bechky 2006). Senior members of the

crew exercised occupational control, which enabled an emergent approach to coordination. In recognition of this approach, the studios were respectful of and explicitly deferred to the community's authority over its tasks, and allowed their prerogatives of budget and schedule to be negotiated as filming progressed. In return for this autonomy, they expected the community to coordinate internally to produce scenes by the time filming wrapped.

Overt Occupational Control and Emergent Coordination on Film Sets

In contrast to the latent occupational control processes at EquipCo, occupational control within the film community was overt and acknowledged by the organization. For example, the occupational community controlled the hiring and the career progression of its members, and the studios deferred to senior members of the crew in these matters. Senior members of the crew exercised occupational control processes, including informal hierarchy, normative standards of work quality, socialization, and deference to practical expertise, to manage the day-to-day process of shooting scenes. On film sets, an emergent approach to integration characterized both the substantive work of filming scenes as well as ongoing coordination between the crew and the studio.

The studios granted the crew great latitude in deciding how to manage production on a day-to-day basis. When shoots were in progress, the crew coordinated emergently according to the demands of each scene. The tasks involved in shooting a particular scene required many different departments to work together. Working in close proximity during short time frames, crew members built and prepared the set, dressed and styled the actors, set up the lighting, operated the cameras, and recorded the sound. Senior crew members

were aware of when and how they should contribute to the filming of a scene, demonstrating this practical expertise to junior members in the course of work.

For instance, on the set of "Murder Mansion", the key PA, George, was in the tent with the talent and had a question for the director, Bob. On the walkie-talkie, he asked, "anyone have eyes on Bob?" Someone responded, saying that Bob "is right here." George responded over the walkie-talkie, "the actresses want to know why they would go get a lock pick when there is no keyhole in this door to pick." At this moment, Bob stuck his head in the tent and said, "that's a good point" and added that they would make one for the door. In the next room, the property person started to work on this task. Bob then came out and announced that they needed candles for the hallway. The boom operator, Will, who was in the room, asked over the walkie-talkie, "Anyone have eyes on Sarah?" to which Eileen responded yes. Will then said over the walkie-talkie, "tell her she needs a couple of candles for the hall." In response, Eileen called Betty to relay the message to Sarah. Sarah then asked through Betty, "what size candles do we need?" Will clarified which kind of candle, and overhearing this on his walkie-talkie, the Head of Property told Betty to help Sarah with the candles. Such fast-paced, emergent coordination was the norm on film sets, and it was possible because most crew members had a deeply ingrained understanding of how to behave and perform their tasks as a result of their membership in a shared occupational community, despite their varied technical backgrounds.

Junior members of the crew learned how to coordinate emergently because they were constantly coached by more experienced crew members. On the set of "Murder Mansion", for instance, after they filmed the first few takes of a particular scene, the

sound mixer asked Jessica, the 2nd assistant camera operator, "Could you try to do marker every time [they roll camera]?" In this example, the sound mixer taught the camera operator when to place the marker (the placard displaying the scene number and time) before the camera while filming. This interaction reminded Jessica that other members of the crew needed her to mark the beginning of the shot in order to do their jobs properly, and improved her understanding of what an assistant camera operator was supposed to do. Such cross-role learning and socialization were common because the day-to-day work of filming was organized around scenes, not departments, which gave crew members ample opportunity to interact.

Senior members also played a gatekeeping role by maintaining an informal pecking order in which junior members had to demonstrate that they were "go-getters" before they could be considered full-fledged members of the community. For example, during a scene in Central Park that involved hundreds of extras, an accident occurred on set and an extra ran toward the UPM yelling, "We need water, someone lit a trash can on fire!" The UPM had been talking to the assistant location manager, and when one of the location crew members heard the extra, he grabbed a water cooler sitting nearby, and dashed off behind the extra to put the fire out. The assistant location manager joked to the UPM, "Look at my location guys, how they run to get the job done! Don't you think they need a raise?" Senior members understood that the ability to coordinate emergently around unexpected events during filming was a key attribute of being a valuable and effective crew member, and they noticed and informally rewarded junior members who displayed the initiative and willingness to maintain the community's normative expectations of role performance.

Poor execution or lack of initiative was noted as an obstacle to get future jobs. For instance, on one set, the 2nd assistant director (AD) was refusing to do certain tasks, and several other crew members noted their surprise: "He has a reputation for causing trouble, and I don't understand why the UPM hired him again." Senior members of the crew enforced clear expectations related to moving up in the community's informal hierarchy, and they monitored junior members of the crew to ensure that they were performing in line with these expectations. Not only did this reputational hiring system weed out ineffective crew members, it reinforced the authority of senior members by giving them informal power over junior members and compelled junior members to behave professionally while on set.

Emergent coordination was also possible in part because there was a normative expectation within film crews that senior members would protect junior members from having to interact with the studio. Senior members of the crew advocated for their members' control over the technical aspects of filming through ongoing negotiations with the studio. On most productions, the UPM worked with the studio to get the departments the resources they needed to perform their tasks.

For example, early in the production of "Talk to the Animals," the UPM, Don, coordinated with the studio on behalf of various members of his crew who needed additional equipment. On the second day of shooting, the 1st AD called and said that they'd need a third camera crew for later in the week. However, the third camera crew had not been budgeted so Don said he would call the 2nd camera unit about it. Don then called the studio accountant, and said, "I'm looking at the budget, it looks like we have eight days of additional 1st assistant camera as well as eight days of 2nd. I'm not sure

from the budget what we have for equipment." Don also called the producer for an update, told him, "[the 1st AD] is asking for a third camera crew at 76th Street," and asked if he was budgeted for more equipment. The producer did not know, but almost immediately, Don received a call from the 1st AD, who was now with the 2nd assistant camera operator, who informed him that they did not need another camera package, and what they had reserved already was fine. In this interaction, the UPM communicated with studio representatives to figure out whether his crew might be able to access additional equipment; this request had implications for the production budget, and so the UPM coordinated with the studio to try to accommodate the crew's needs. These requests occurred throughout the production process, and required senior members of the crew to coordinate emergently with the studios to reach a mutually acceptable decision.

In some instances, senior members of the crew conferred with studio representatives to reach a mutually acceptable decision related to filming a scene, particularly when scenes had major implications for either the schedule or the budget. For example, during a shoot that involved an expensive location on top of a skyscraper in New York City, Sam, the cinematographer, and Greta, an executive producer from the studio, discussed whether a particular shot would be possible given the bad weather. Just prior to this interaction, Sam had been discussing the technical feasibility of the shoot with the 2nd camera unit in order to establish whether they might be able to capture the scene. Their opinion was that the shot would not match previously filmed scenes because of changes in weather, but that they could try to shoot the scene regardless.

> Sam: I got a call from second unit. They're going to shoot the shot, they think they've got it. It won't match anything…It is a small unit, why can't we wait until Saturday?
>
> Greta: Isn't it supposed to rain then?

Sam: It should be better. We could book it and go back again.

Greta: We should book it; that is the way we'll get stuff later from the studio, by showing we tried it. And you've been pulling all sorts of rabbits out of your hat here, things I thought would never match.

Sam: I'm always of a mind to try it, you're more than likely to get something, and the studio will know you put the effort in and then let you come back.

Greta: I know what you mean.

In this interaction, while Sam and Greta agree that the current shot is unlikely to be useful, they make the decision to go ahead and shoot it anyway. Senior members of the crew understood that a good-faith effort was important to managing their relationship with the studio, and they were careful to maintain this impression. Examples such as this illustrate the limits of occupational control on film sets; ultimately, senior members of the crew recognized that they needed to meet the studio's expectations, even if the studio's judgment might not be the course of action that their crew would have chosen. However, it was more common that the producers left the crew to exercise judgment about what was technically possible to shoot in a given day while keeping the studio informed about the scene's implications for the schedule and budget.

Members of the crew protected this latitude by rigorously enforcing the high standards of performance within their community. In this sense, the ability to coordinate emergently could be considered a barrier to entry to the film community: senior members of the community socialized new members to coordinate around scenes that were difficult to plan in advance, and rewarded those individuals who were able to operate in accordance with this expectation. By protecting the junior members of the crew from the scrutiny of the studio, senior members accepted responsibility for the performance of the crew as a collective. In turn, the studios expected senior members of the crew to manage

their prerogatives related to the schedule and budget, and to constantly communicate their progress. These expectations were mutually reinforcing; ultimately, the relationship between the studio and the community allowed the crew to overtly adopt an emergent approach to integration that drew on the occupational control processes maintained by the film community as a whole.

These coordination practices contrasted with those at EquipCo, where the organization structured production by requiring all employees to use a documentation system to hand off their work. This documentation system required the three groups to make their work legible to one another and to formally record their progress. However, because this documentation system did not fully enable the coordination necessary to perform their tasks, members of the three groups also coordinated emergently through latent occupational control processes, which occurred without organizational acknowledgement. These occupational control processes were aimed at meeting normative quality standards maintained within the communities, and reinforced the organization's documentation system (see Table 1 for a comparison of examples from the two settings).

Insert Table 1 Here

DISCUSSION

In this article we explore how occupations are differentially embedded in organizations in order to develop insight into emergent coordination processes. The data allowed us to compare two settings that employ occupational communities but ultimately

exhibit different approaches to integration. In both settings a product was developed and produced by knowledge workers with highly specialized skills working interdependently on complex tasks, but the communities exhibited contrasting degrees of occupational control over the coordination process.

By examining occupational embeddedness and control in organizations, we highlight factors that enable and motivate emergent coordination. Prior research has identified the complex nature of tasks and unpredictable inputs from the environment as key reasons for the prominence of emergent coordination (Faraj and Xiao 2006; Kellogg, Orlikowski and Yates 2006; Majchrzak, Jarvenpaa and Hollingshead 2007). These studies have taken a practice-based view of integration, contrasting their approach with the contingency theories in the organizational design literature. They focus on showing how coordination happens when structures are inadequate for fully specifying the integration of complex tasks. Their insight is that workers coordinate emergently through situated, ongoing activities that draw on both formal and informal mechanisms.

Our study acknowledges the central role of situated activity, but emphasizes how these activities are rooted in control processes within occupational communities. By identifying two aspects of occupational embeddedness – how organizations acknowledge and enable occupational control, and how occupational groups are interdependent – we are able to specify why emergent coordination dominates some settings while operating in the background in others. This lens is a vital complement to work that analyzes emergent coordination mechanisms, because it provides a way of thinking about integration that transcends the coordination demands of particular tasks.

Examining Occupational Embeddedness and Control to Understand Emergent Coordination

Our comparative analysis demonstrates the need to take into account occupational embeddedness and control when analyzing emergent coordination processes. In particular, we know that occupational control is critical for doing substantively unpredictable work, whether this uncertainty stems from the environment, the nature of the collective task, or a combination of the two, because occupational communities are particularly effective at applying their expertise and skills to complex or ill-defined problems (Van Maanen and Barley 1984). However, while the coordination literature hints that occupational processes might be relevant to integration, they have yet to be considered a driving force shaping emergent coordination.

Our findings show how these occupational control processes play out differently depending on the organization in which communities are embedded. We show how conceptualizing occupational embeddedness as two distinct aspects – acknowledgement and interdependence – helps us to explain contrasting approaches to integration. Specifically, these aspects provide us with leverage to disentangle exactly how emergent coordination is related to occupational control on the ground in organizations. In both settings, we see how the communities exercised similar control processes, including informal hierarchy, socialization and learning, deference to practical expertise, and normative expectations of work quality, to achieve collective outcomes. However, these occupational control processes manifested differently in relation to the two aspects of occupational embeddedness, and had different implications for emergent coordination, as summarized in Table 2.

Insert Table 2 here

Organizational acknowledgement of occupational control. Whether organizations recognize and legitimate the control of occupational groups over their tasks has implications for how they coordinate. For instance, at EquipCo, occupational control was latent, and emergent coordination went largely unacknowledged by the organization. As a result, the communities' normative expectations drove emergent coordination and increased the quality of the drawings, prototypes, and machines, but the documentation system remained central to integration, and occupational control was not acknowledged by the organization as enabling the hand-off process.

In contrast, film studios supported the crew's emergent approach to coordination, in which senior members of the crew exercised discretion around when and how scenes were filmed in order to develop the product. Studios were flexible around their prerogatives of budget and schedule, and expected the crew to keep them informed about issues that would affect these matters. As a result, film crews exercised occupational control processes to coordinate the majority of the time. The differences between the two settings in this aspect of occupational embeddedness – whether the organization acknowledged and legitimated occupational control – had important implications for how emergent coordination unfolded.

Using this lens to examine other settings further demonstrates the importance of this aspect of occupational embeddedness. Pine and Mazmanian (2016) found that when

occupational communities were not granted sufficient control over their tasks by the organization, the quality of their work suffered and lives were endangered. In their study, when hospital administrators required doctors and nurses to use an electronic health record system, they eroded the emergent coordination process that these occupational groups once counted on to perform their work. Because the organization no longer turned a blind eye to small deviations from official protocol, the communities' coordination processes became fraught with the difficulties of meeting the exacting requirements of the documentation system.

Thus, in some settings, organizations may inhibit occupational communities from exercising control to an extreme degree, thereby creating dysfunction in coordination processes. By examining the relationship between organizational acknowledgement and occupational control, we show that it is important for organizations to pay attention to the ways in which they constrain or enable occupational latitude because the organization's approach affects how occupational groups emergently coordinate their work.

Interdependence of occupational communities. We also find that the interdependence among occupational groups, or lack thereof, is important to understanding the relationship between occupational control and integration. The extent to which occupational control enables emergent coordination may stem from whether all organizational members share an understanding of roles, work practices, and technical expertise, as well as from hierarchical relationships within and across the communities, and the organization plays an important role in supporting or diminishing the extent of differentiation among occupational groups.

At EquipCo, the three occupational communities exhibited differences in knowledge and skills, and the organization reinforced these differences by granting the engineers some authority over the work of the technicians and assemblers through the drawings. Partly as a result of this formal hierarchy across occupational groups, jurisdictional concerns created normative quality expectations within each community which often drove emergent coordination. These expectations compelled members of the three communities to make sure their work was "good" in the eyes of other groups even if the documentation process did not formally require them to do so, and triggered interactions to resolve problems that were rooted in the jurisdictional boundaries between groups.

In contrast, film crew members belonged to a single, shared occupational community, which was characterized by an informal, internal hierarchy based on tenure and practical expertise. Unlike EquipCo, studio representatives did not impose mechanisms that interfered with occupational control. Instead, senior members of the crew socialized junior people around the norms, expectations, and skills required for proper role performance and quality work, and all members had a deep well of shared understanding of one another's roles and how these roles were related (see also Bechky 2006). As a result, members with different technical roles coordinated emergently the majority of the time, instead of falling back on emergent coordination to compensate for jurisdictionally-rooted gaps in understanding between different groups, as they often did at EquipCo.

This suggests that analyzing the interdependence between occupational groups is key to understanding the relationship between occupational embeddedness and emergent

coordination. Organizations with multiple occupational groups might have problems coordinating if these groups do not perceive themselves as interdependent communities, and the organizations do not impose any structures that compensate for the lack of occupational control. For instance, in an ethnographic study of an interactive marketing firm, Kellogg, Orlikowski, and Yates (2006) show how work was accomplished in an organization comprised of four groups (client services, project management, creative, and technology) that used digital practices to make their work visible, legible, and accessible to one another. The four communities were specialized around particular domains but there appeared to be no formal or informal occupational hierarchy either within or across them, and little understanding or acknowledgement of the other groups' expectations and perspectives. Viewing this study in light of our findings, we see the importance of paying attention to the interdependence of occupational communities embedded in organizations, and how this shapes the relationship between occupational control and coordination. When relationships among interdependent occupational groups are weakly developed or marred by jurisdictional conflict, emergent coordination can be stymied by a raft of issues, including misinterpretation and loss of comprehension.

Occupational control processes and emergent coordination. We see occupational control processes in both settings, but the specific ways in which they enabled emergent coordination varied according to the differences in organizational acknowledgement and occupational interdependence. In both settings, normative expectations of work quality were linked to the ability to manage complex production work that could not be fully specified by documentation or schedules. For example, in the film setting, normative expectations related to work quality were linked to the crew's seamless performance

under temporal and budgetary pressure, and enforcing these expectations enabled the community to coordinate emergently, thereby maintaining their autonomy in relation to the studios. In contrast, at EquipCo, the same occupational control processes were aimed at maintaining each community's reputation in the eyes of the other groups. Thus, normative expectations of work quality and organizational acknowledgement were mutually constitutive in the film setting, while occupational interdependence drove the importance of this aspect of occupational control at EquipCo. However, in both settings, the occupational control process that maintained work quality enabled emergent coordination in response to the problems that occurred regularly during the production process.

Examining other studies, we can see how occupational control processes underlie emergent coordination mechanisms. For example, Okhuysen and Bechky (2009) point to role substitution as an important mechanism of emergent coordination in response to unexpected events. In one detailed example of this mechanism, when a specialized camera operator did not show up for shooting, the head of the camera department questioned each operator in turn to determine who had the needed expertise to substitute for the missing operator, and chose the most qualified member of the camera crew to shift roles (Bechky and Okhuysen 2011). Thus, occupational control processes that both maintained work quality and demonstrated practical expertise underlay this emergent coordination mechanism.

Examining the relationship between occupational control and emergent coordination also sheds light on the broader conditions for integration. As Okhuysen and Bechky (2009) point out, the integrating conditions for coordination must be constantly

recreated within organizations in order to accomplish interdependent work. Our analysis

demonstrates how occupational embeddedness shapes the development and maintenance

of coordinating conditions such as accountability and common ground. For instance, at

EquipCo, the emphasis on organizational control through documentation emphasized

accountability, and reinforced occupational hierarchy, which in turn drove occupational

control underground. On film productions, the studios acknowledged occupational

control and granted latitude to the community, which allowed mechanisms that created

common ground to enable emergent coordination. Our study suggests that the presence

and efficacy of integrating conditions are closely related to the nature and extent of

occupational control in knowledge work settings, and that looking at the interdependence

of occupational communities, as well as organizational acknowledgement, helps to

explain how particular conditions are enabled.

Taken together, these insights suggest that researchers pay closer attention to how

occupational communities exercise control over the coordination of work, as well as the

relationship between occupations and organizations, as a means of better understanding

the enablers and motivators of effective emergent coordination. The ubiquity of

knowledge workers in organizations suggests that coordination will increasingly be

shaped by these dynamics.

Occupations in Organizations: A Pragmatic Accommodation Lens

Our findings are situated within the classic debate about occupations in

organizations. The traditional view in the control literature suggested that members of

occupations employed by firms would be subjected to administrative oversight, even if

such oversight might be detrimental to their professional autonomy and cause dissatisfaction and conflict (Simpson 1985). However, these concerns were largely unsubstantiated by empirical research (cf. Barley and Tolbert 1991). Instead, the trend appears to be increasingly blurry boundaries between communities of knowledge workers and the organizations that employ them (Gorman and Sandefur 2011).

Our findings reflect the empirical reality of increasing occupational and organizational interdependence. Moreover, by reflecting on the implications of occupational embeddedness for emergent coordination, we are reminded that the workplace is a site of negotiated order in which a set of people work together to try and get things done (Hughes 1958). As Strauss et al. (1963: 152-3) note, in their everyday work, knowledge workers make sense of the bureaucratic rules and structures they face, turning them into working arrangements: hospital staff "[dredge] up the rules at convenient moments;" the rules are "as much breached and stretched as honored" as staff go about the work of providing care in a negotiated fashion. Taking this early insight a step further, we suggest that the relationship between occupational communities and organizations may better be characterized as one of pragmatic accommodation rather than struggles over control. Conceptualizing occupational embeddedness in organizations as pragmatic accommodation may help explain the inconclusive findings of past research because it allows for the inevitable variations that will occur across settings (Freidson 1984; Barley and Tolbert 1991).

For example, at EquipCo, although the documentation was not a perfect means of coordination, the three communities accommodated the organization's need for a formal record even as they coordinated emergently behind the scenes. On film sets, the studios

allowed the crews to manage coordination through their expertise-based hierarchy, because such concessions of control actually better enabled them to meet organization's prerogatives of budget and schedule over the course of production. In both of these settings, we see how pragmatic accommodation, in which occupational and organizational approaches to control over work are made compatible by both the communities doing the work and the organization, is critical to managing complex production processes.

An important implication of the pragmatic accommodation perspective is that organizations and occupations explicitly acknowledge their interdependence, and develop interventions to solve the problems that embeddedness might create. For instance, Valentine and Edmondson (2015) demonstrate that when emergency departments introduced a new organizational structure that assigned medical workers to pods (groups of beds) instead of to individual patients, they were able to decrease average patient throughput time and increase accountability between members of different occupational groups, mitigating some of the problems created by administrative control over task allocation and team assignments. Briscoe (2006, 2007) shows how hospitals developed scheduling solutions that accommodated medical professionals' need to maintain work-life balance in the face of demanding work hours.

More broadly, our analysis suggests that we should consider the relationship between occupations and organizations in situations of embeddedness as recursive ones: occupational dynamics and organizational structures are mutually constitutive, as control processes at one level can shape structures at another. For example, occupational concerns about quality at EquipCo made the organizational hand-off system more reliable

by pre-empting documentation errors; on film sets, the demands of the studio's tight schedule accentuated the importance of occupational control within the crew. This perspective may serve as a useful orientation for future research about coordination in knowledge-based settings because it brings into focus the inextricable interdependence of occupations and organizations without specifying particular mechanisms that are effective in these settings. The intertwining of organizations and occupational communities is too complicated to expect that the same types of accommodation would happen in every case.

Conclusion

This study revives long-standing interest in occupational embeddedness and control and brings these concepts to bear on the coordination of knowledge work. We assert that occupational control is critical to emergent coordination because it leverages a community's collective capacity for integrating tasks that organizational structures and routines cannot specify completely. By shifting the research question from "what is driving the apparent dominance of emergent coordination in modern organizations" to "how can we explain emergent coordination in these settings," we extend theory on emergent coordination beyond the recent focus on fast-paced and unpredictable task environments. Instead, we suggest that emergent coordination should also be considered in relation to variations in occupational control over the ongoing process of task integration and the relationship between these workers and the organizations that employ them.

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Tables

Table 1. Comparison of Controls at EquipCo and Film Sets

Organizational control processes	Example at EquipCo	Example on Film sets
Documentation	Assemblers invoke "building to the print" when interacting with the technicians	UPM and VP of studio discuss the script supervisor's report to ensure that the studio is up to date with the crew's daily progress
Schedules	ECN process aligns the work of the engineers with the assemblers and technicians across the production process	Shooting schedule for each day is produced the night before and distributed to all members of the crew
Occupational control processes		
Normative concern with work quality	Technicians train every member of their group up to a certain level of soldering technique to maintain reputation among engineers	Location manager's assistant runs to put out a fire, demonstrating an understanding of how to perform his role effectively
Occupational learning and socialization	Technicians work together to interpret drawings for a new build	Sound mixer instructs the 2nd assistant camera operator to mark the shot each time they rolled the camera
Exercising informal hierarchy/jurisdiction	Technicians and engineers consult one another about mounting a plate on a prototype to ensure it is manufacturable	UPM consults with crew members about their equipment needs and then interacts with the studio to secure an additional camera unit
Deference to practical expertise	Assemblers copy the technicians' machines	Studio consults with the UPM in the case of an actor's illness to see how the crew could reorient shooting that day

Table 2. Occupational Embeddedness, Control, and Emergent Coordination

	Organizational acknowledgement	**Occupational interdependence**	**Occupational control**	**Emergent coordination**
EquipCo	Occupational control processes are not acknowledged; groups are expected to coordinate through hand-offs and documentation	Three communities organized hierarchically by the organization's production system	Latent: occupational control reinforces rather than challenges organizational system of documentation and schedules	Emergent coordination is aimed at managing hand-offs that are imperfectly specified in the organization's system and maintaining reputation in eyes of other groups
Film Sets	Occupational control is acknowledged by the studios, and documentation and schedules are negotiable	One community which exhibits an informal occupational hierarchy	Latitude: members perform tasks according to occupational control processes within the community	Emergent coordination dominates production and also characterizes the interactions between the crew and studio

Appendix 1. First author's participation at research sites.

EquipCo: Semiconductor Equipment Manufacturing

EquipCo's 5,000 employees built the complex machines that other firms, such as Intel, use to fabricate semiconductor devices. Of these 5,000 employees, approximately 1,800 were directly involved in the production process: 570 design engineers, 90 drafters, 60 manufacturing engineers, 140 engineering and manufacturing technicians, 220 assemblers, and the remainder non-technical administrative support such as planners and schedulers.

In this year-long ethnography of the new product line at EquipCo, I focused on the interaction between members of different occupational groups as the product progressed from an idea to a prototype to an established product. Because I was interested in obtaining the perspective of the different groups involved in the production process, fieldwork proceeded in several stages. I started my fieldwork in the technicians' lab, as this was the site for many of the product handoffs in which I was interested, and this provided a base of understanding for the subsequent study of both assemblers and engineers.

Technicians I began my study at EquipCo observing and working in the technicians' lab three to four days a week. I explained my role as a researcher who would be "hanging out" in the lab and assured the technicians that I would maintain confidentiality. Building rapport is not an instantaneous process; after several weeks of working in the lab, however, most of the technicians seemed comfortable with my presence. Each morning I asked to join a specific individual for the day and gave him or her the opportunity to refuse. In the five months that I worked in the lab, only one person (a newly hired technician) said that he would rather not have me along as an observer.

My fieldwork in the technicians' lab comprised observing a different technician each day and working alongside many of them, building subassemblies and making cables. Over the course of the study, I spent at least two to three days with each of twenty-six technicians. Additionally, I cultivated relationships with several people who acted as "key informants" and I worked with those individuals most often, focusing on the projects to which they were assigned. These informants provided me with exhaustive detail about their work and the culture of EquipCo, while teaching me skills ranging from soldering and reading engineering drawings to finding the quickest route to work in 6 a.m. Silicon Valley traffic. Most of the technicians also invited me to lunch and to bars and parties after work, and I often attended.

There were many other people circulating around the lab and interacting with the technicians, including design and manufacturing engineers, assemblers, schedulers, planners, and parts personnel. Therefore, my constant presence in the technicians' lab afforded me access to the two other occupational areas in which I had an interest: final assembly and design engineering.

Assemblers After a few months in the technicians' lab, two of my key informants among the technicians began the process of handing off their projects to manufacturing. When the final assemblers that learned to build the two projects returned to manufacturing after the training period, I moved into the clean room with the six-person team. My role as a member of this group never varied, once they realized that I was willing to help and was relatively capable: I worked building machines every day for four months. Upon entering the clean room, we had fewer interactions with members of other groups. Occasionally a manufacturing engineer, manager, or technician came into the parts staging area (which was adjacent to the clean room and not particle-free) or called to ask a question, but very few people were willing to don a bunny suit to enter the building area.

Engineers Having seen the transition from prototype to manufacturing, I was also interested in the transition from design to prototype. While working with the technicians, I had made the acquaintance of several design engineers, one of whom agreed to let me work with her for a few months. I shadowed four or five members of the engineering team for two to three days apiece, although I spent the bulk of my time with the designer who invited me to join the group. In engineering, my role consisted mostly of observation rather than participation, since most of the work was done on the computer and the phone, or in meetings, and I was not qualified to help.

In addition to the spontaneous, informal interviews that regularly occurred while I was observing the work, I arranged formal interviews with several informants in each occupational group. The use of drawings was obviously an important part of the work of all the occupations involved in the production process, and I felt that I needed to clarify this use through more formal means. I brought two sets of assembly drawings with bills of materials to each interview, and had informants describe how they would use the drawings. The structure of these interviews was slightly different for the designers than for the technicians and assemblers. I asked the designers to describe how they went about creating the drawings from start to finish, and then we discussed what they thought were the most important aspects of the drawing. In contrast, I asked the technicians and assemblers to describe what they would do when they received the drawings. They discussed both the order in which they would examine the drawings and how they would build the parts illustrated by the drawings, as well as explaining what the most important aspects of the drawings were for building purposes.

Other important sources of data were the written material and objects that each of the groups used to support and perform their work. The documents included engineering drawings, bills of materials, and meeting agendas and notes.   As mentioned above, documents, particularly drawings, were a key element in the production process, as they nominally served as the formal inputs and outputs for the different occupational groups in the study. I also closely studied the prototypes and products built by the technicians and assemblers.

Film Production

The aim of this ethnographic study was to understand the work involved in film production, focusing particularly on the interaction of the different departments and the coordination of the work across them. Initially, I met with the deputy director of the Philadelphia Film Office, who expressed his interest in the research and began to connect me with local film crews. I started my fieldwork on the site of a commercial, as my informant in the film office thought that a smaller, self-contained project would be a good introduction to the industry. The fieldwork then extended over a progression of projects, both through snowballing from the initial contact and developing new contacts in other cities.

 "Alo" My first project, in March 2000, was a commercial for a long-distance telephone company with a production crew of about 50 people. My film office informant introduced me to the location manager, who took me under her wing for the two days of the shoot. I explained my role as a researcher who would be "hanging out" in her department and assured her that I would maintain confidentiality. I spent the duration of the project working with the location manager and her two assistants, scouting locations, putting up and removing flyers around the city, and "locking up" various street corners to prevent pedestrians from gaining access to the film site.

"***Murder Mansion"*** My second project, in April 2000, was an independently funded horror film with a budget of approximately $2 million. The same film office informant connected me to a local production manager who was serving as a consultant for the starting phase of production of Murder Mansion. She put me to work as a production assistant in the office immediately, after we obtained the unit production manager's approval for my research project. Murder Mansion took five weeks to film, and had a crew of about 50 members. The extended duration of the project allowed me to develop close relationships with several people who acted as "key informants" and I worked with those individuals most often, focusing on the departments to which they were assigned. These informants provided me with exhaustive detail about their work and the culture of the project. On Murder Mansion, I was able to rotate through many departments including office, wardrobe, electric, grip, property, and sound. My work entailed standard production assistant duties: going on runs for supplies, locking up locations, and running copies of the "sides," the reduced-size copies of the scenes that will be shot on a given day. Additionally, because this was a non-union set, I was able to lend a hand in the more technical departments, and helped to operate lights and create props. I was assigned my own walkie-talkie, which allowed me to monitor communications on different channels for each department. I also occasionally socialized with informants after we finished shooting in the evening, as well as attended the wrap party after filming was completed.

"Playaz Ball" In May 2000, the production office coordinator from Murder Mansion invited me to work as a production assistant on another project, a rap music video. This provided me the opportunity to observe some pre-production work as well as work as a member of the office and set crew once shooting began. I set up the rooms for auditions and assisted the production office coordinator with locating and securing equipment and

transportation. During shooting, I transported the band members, locked up the set, and helped prepare the props. The project lasted five days and had a crew of 35 members.

"Talk to the Animals" In the spring of 2001, I obtained access to a Hollywood studio film, with a budget of over $100 million, which was shooting on location in New York. This six-week location shoot had a unionized crew of 175 members from both coasts, filming as two separate units. My key informant was the New York unit production manager (UPM), who spent a month negotiating access with the studio on my behalf. On this set, I observed the activities of many departments, including the camera, grip, wardrobe, visual and aerial effects, and set dressing departments. Additionally, I informally assisted the UPM on a daily basis, as well as the office production crew once a week. As a result, on the set of Talk to the Animals I learned how to enter payroll, distribute per diems and load a magazine (prepare film for the camera).

In addition to the unstructured interviews I carried out with crew members during work, I interviewed several additional industry informants, including two local production managers in Philadelphia, several independent producers and crew members in Los Angeles and New York, and several studio executives. These interviews provided a broader perspective on hiring and career issues in the industry and their impact on coordination on the set.

Another important source of data was the written material that the crew used to support and perform their work. The documents included call sheets (the daily schedules), crew lists, scripts, sides (the daily scripts), shooting schedules (the listing of scene order for the remaining days of production), and directions to the location. Finally, I supplemented my field work with archival industry perspectives. In addition to my subscription to Variety magazine, I read insider accounts of the industry (Dunne, 1969; Goldman, 1983; Bart, 1999) and viewed movies about filmmaking, such as "Living in Oblivion," "State and Main," and the HBO series "Project Greenlight."