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Marching to Different Drum Beats: A Temporal Perspective on Coordinating Occupational Work

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Abstract. In this paper, we contribute a temporal perspective on work coordination across collaborating occupations. Drawing on an ethnographic study of medical specialists—surgeons, pathologists, oncologists, and radiologists—we examine how their temporal orientations are shaped through the temporal structuring of occupational work. Our findings show that temporal structuring of occupational practices develop in relation to the contingencies and materialities of their work and that this shapes and is shaped by specialists' temporal orientations. Further, we show that differences in occupations' temporal orientations have important implications for coordinating work. More specifically, our study reveals how the domination of one temporal orientation can lead to recurrent strain, promoting a competitive trade-off between the different temporal orientations in guiding interaction. This temporal orientation domination is accompanied by a persistent emotional strain and potential conflict. Finally, we suggest that, alternatively, different temporal orientations can be resourced in solving coordination challenges through three interrelated mechanisms, namely *juxtaposing*, *temporal working*, and *mutual adjusting*. In so doing, we show how temporal resourcing can be productive in coordinating work.

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Introduction

Coordinating work between occupational groups remains a formidable management challenge. Challenges arise in part because coordinating such work requires task integration and knowledge collaboration across occupational domains as workers' diverse expertise and understanding are all important in accomplishing the work (Okhuysen and Bechky 2009). For example, academic faculty need to coordinate with university administrators (Huising and Silbey 2013), lawyers need to coordinate work with clinicians (Kellogg 2014), computer scientists with physicists (Venters et al. 2014), and safety experts need to coordinate work with scientists (Huising 2014).

Further, these coordination efforts are costly because significant work is required at the boundary of the occupational domains (Bailey and Barley 2011, Bruns 2013, Kellogg 2014). In part, these challenges arise from a lack of shared knowledge and a dearth of common understanding between groups, which can lead to knowledge boundaries (Carlile 2004). Coordination challenges can, therefore, arise because occupations draw on different assumptions and schemas (Dougherty 1992, Dougherty and Dunne 2012), which can direct actions in diverging ways (Michel 2014). Additionally, challenges of coordination may arise because of power struggles, competing priorities, or jurisdictional conflict (Truelove and Kellogg 2015). Thus, although the need for coordinating cross-occupational work is well established, understanding how best to manage and support the coordination process remains elusive (Okhuysen and Bechky 2009, Anteby et al. 2016).

Work coordination was initially conceived as an organizational design problem and foregrounded formal processes of control, such as schedules, rules, and resources (Faraj and Xiao 2006, Okhuysen and Bechky 2009). However, knowledge work in modern organizations "principally takes place in work groups where coordination is less dependent on structural arrangements" (Faraj and Xiao 2006, p. 1155). This insight highlights the importance of focusing on the dynamic and emergent nature of work coordination. Transcending the assumptions of planned approaches, recent scholarship has, thus, focused on what people actually *do* to coordinate collective work

in carrying out specific tasks (Bechky 2006, Gkeredakis 2014). This more emergent approach focuses on the relational challenges in performing particular coordination tasks (Anteby et al. 2016) while anticipating the nature of tasks associated with specific occupational roles (Bechky 2006) and how explicit linkages between different tasks are established (Kellogg et al. 2006). These forms of coordination can entail developing new means of sharing knowledge, for example, through gestures (Bechky 2003), harmonizing joint assessments (Bruns 2013), or integrating roles (Bechky 2006). Understanding cross-occupational work in this manner also suggests that occupational members' socialization regarding use of tools, schedules, and resources, which also shape action, might influence the coordination of collective work though scholars have not yet examined this directly.

The literature implicitly recognizes the importance of time in coordination processes (Okhuysen and Bechky 2009) as it recognizes that coordination relies on sequencing actions and points to the synchronization required through schedules and timetables. However, there has been little work that explicitly adopts a broader view of temporality in understanding work coordination. Yet Orlikowski and Yates (2002) suggest that organizational practices are temporally structured in diverse ways and that this can lead to the development of distinct temporal rhythms, such as academic entities being organized around semester terms and teaching schedules. Other literature focuses on how temporal dynamics of collaborative work can direct social interactions in conflicting ways, for example, with some entities being short term focused while others take longer term views (Reinecke and Ansari 2015, Kim et al. 2019). Our paper examines the diverse temporal structuring of occupational groups and how this influences work coordination. We link their temporal structuring to the material resources and tools used in practice and their ongoing occupational socialization. In so doing, we add new insight regarding the challenges that occupations encounter when coordinating joint work and offer a broader set of explanations for how coordination challenges can be resolved.

Our ethnographic study shows how the temporal structuring of work across different occupations—radiology, pathology, surgery, and oncology—shapes their particular temporal orientations with consequences for how they coordinate their joint work. We demonstrate how the diverse temporal orientations of occupations lead them to work at different rhythms and to use coordination devices (e.g., schedules, plans, and lists) in different ways. Our paper offers three contributions. First, we show that the temporal structuring of occupational practices develops in relation to the contingencies, including materialities, of work and the way these shape and are shaped by members' temporal orientations. Second, we show how occupations with different temporal orientations may resource conflict and strain in their ongoing work coordination. Third, we show how, with some effort, occupational members may productively resource temporal orientations in developing solutions to challenges in work coordination.

In the following sections, we review relevant literature on work coordination and temporality. We then describe our research setting and methods before elaborating our findings from an empirical study on coordinating specialists' work in hospitals. In our discussion, we develop our key contributions to the literature concerning temporal resourcing and work coordination and conclude with implications for other contexts.

Literature

Coordination of Work

Coordination has been defined as the process of interaction that integrates a collective set of interdependent tasks across a work activity (Okhuysen and Bechky 2009, Gkeredakis 2014). At a basic level, the requirement for coordination arises because of the division of work and the need to fit together the different strands of compartmentalized activity (Okhuysen and Bechky 2009). Early literature emphasizes the role of formal coordination devices and mechanisms, such as schedules, plans, and resources as central to work coordination (Chandler 1962, Galbraith 1974). Time and timing were fundamental to coordination with timetables and schedules foregrounded as critical tools for integrating tasks efficiently with minimal delays. This view on coordination also examines how resources were managed to account for interdependencies between activities.

More recently, the literature focuses on emergent actions in coordinating tasks (Bechky 2006, Kellogg et al. 2006, Jarzabkowski et al. 2012, Gkeredakis 2014). This literature frequently characterizes work as requiring interaction between several occupational groups. An occupation is defined as "socially constructed entities that include a category of work," where the actors are practitioners of this work (Anteby et al. 2016, p. 187). An implicit assumption of this tradition is that the knowledge boundaries that hinder coordination are constituted as social boundaries or cognitive boundaries that exist between occupations. In studying cross-occupational work in teams, Faraj and colleagues (Faraj and Sproull 2000, Faraj and Xiao 2006) develop the concept of expertise coordination to show how common mental models can lead to enhanced performance and point to the importance of shared goals to integrate knowledge. Thus, effective performance often requires timely and adaptive execution (Kellogg et al. 2006) as individuals adjust the

timing and pacing of their work in adapting to others (Leroy et al. 2015).

Further, Bechky (2003) shows how deeply embedded occupational practices influence how individuals work together and how knowledge sharing is dependent on the materiality of work. Here, an implicit assumption is that the material nature of work shapes the social processes of occupational members. Bechky (2006) reveals how occupational roles function to coordinate work by guiding heedful interrelating across occupational groups as roles can maintain patterns of interaction (Heaphy 2013). Deviation from set roles can lead to breaches, which challenge ongoing work (Heaphy 2013). In this sense, roles can function as schemas that occupations draw on to enact their work practices. Scholars (Jarzabkowski et al. 2012, Gkeredakis 2014) have also pointed out how wider organizational objectives can mold coordination processes more generally and that these might be used as situated schemas to help frame and direct action. These insights point to the importance of emerging action and structures in understanding the situated nature of coordination.

Resourcing and Situated Coordination

We connect scholarship on coordination with the resourcing literature, which posits that all action is shaped by and, in turn, shapes schema, whether formal ones, such as roles and timetables, or informal schema, such as occupational norms (Feldman 2004). The nascent resourcing perspective (Feldman 2004, Howard-Grenville et al. 2011, Sonenshein 2014, Weidner et al. 2017) defines resources as "the creation in practice of assets" that allows actors to accomplish schema (Feldman 2004, p. 296). In resourcing for coordination, anything can become a resource, including intangibles, if these are used to enact specific activities as people make sense of and react to coordination of tasks. Coordination scholars have pointed out how individuals may use devices for coordination (such as schedules, timetables, etc.) as resources that are drawn on in practice (Okhuysen and Bechky 2009). Yet resourcing further emphasizes skilfull use rather than the mere presence of potential resources in understanding the accomplishment of action, including for coordination. Thus, a resourcing perspective on coordination leaves open that individuals may use designated coordination devices, such as schedules, in different ways to synchronize activity.

Feldman and Worline (2011) highlight a number of different mechanisms for resourcing that are commonly available in organizations. For example, mutual adjusting is a resourcing mechanism that helps illuminate the link between resources in use and frameworks for organizing by showing how potential resources and an individual's framework become adjusted through action to one another. Juxtaposing (Howard-Grenville et al. 2011) is another important means by which actors in organizations create resources and energize frameworks, for example, in facilitating cultural change. Specifically, organizational events can become a resource as action is taken to juxtapose (i.e., "to place close together or side by side") the old and the new. We suggest that linking resourcing with coordination is important as it foregrounds generative possibilities for action. As explained by Feldman and Worline (2011), generative action can be enabled through positive and ampliative spirals as well as by desirable outcomes.

In particular, new schema may be resourced either through current practices or become available through new practices, often in a way that recognizes and challenges long-standing assumptions (Feldman and Worline 2016). In this way, we highlight the importance of focusing on both the negative consequences of coordinating occupational work as well as the more positive possibilities for improved coordination.

A Temporal Perspective on Coordinating Occupational Work

Although time and timing have been recognized as fundamental to coordination, there has been little focus on how occupational work might shape the way individuals orient to time or the manner in which temporality influences their coordinating of work with others. Additionally, there has been little attention on how the unique contingencies of occupational work might influence the norms of an occupation. This is both important and surprising given the deep-rooted way that occupational work shapes individuals (Pratt et al. 2006; Kellogg 2009; Michel 2011, 2014). Anteby et al. (2016) suggest that this "becoming" aspect of occupational work inducts newcomers into shared norms (e.g., Becker et al. 1961, Van Maanen and Schein 1977) and reinforces social boundaries between occupations. A focus of the socialization literature has been on how status (Freidson 1972, 1988), evolving identities (Becker et al. 1961, Pratt et al. 2006), and skills become tacit (Kellogg 2009, Beane 2019) as newcomers seek entry into a profession (Anteby et al. 2016). The explicit assumption in this literature is that social action is not only shaped in and by the emerging situation, but it has also been shaped by history as social habits form. For example, Ho (2009) shows how job insecurity was ingrained into Wall Street bankers and structured their interaction with clients. Thus, shared patterns of knowing also link to shared patterns of actions, which reproduce over time as habitual action tendencies. As such, action tendencies of organizational members can orient them to respond quickly to organizational change initiatives (Michel 2014).

The temporal structuring of organizational practices gives rhythm and form to everyday action, often subconsciously (Orlikowski and Yates 2002). Temporal structures not only influence the pace of organizational life, but also shape to what we pay attention (Reddy and Dourish 2002, Reinecke and Ansari 2015). For example, shift work and ward rounds in a hospital provide a distinct rhythm for assessing patients and sequencing one's work tasks. Temporal structuring, which has been defined as the social structures that shape people's temporal practices, is here understood as both shaping and being shaped by ongoing human action as people organize their ongoing work (Orlikowski and Yates 2002, Kaplan and Orlikowski 2013, Reinecke and Ansari 2015).

The literature on temporality in organizations leaves open the notion that structuring of practices held by diverse occupational groups may temporally orient occupations in different ways with consequences for work coordination as people adapt to the needs that emerge during interaction. An explicit focus is to examine how diverse temporal orientations of occupational groups might influence collaborating occupations and their coordination processes. In particular, how work practices are accomplished may be related to how agents are being temporally orientated to the past, present, or future (Emirbayer and Mische 1998, Kaplan and Orlikowski 2013, Kim et al. 2019). Orlikowski and Yates (2002, p. 261) suggest that temporal orientation is "an emergent property of the temporal structures" being enacted at a given moment. Further, the temporal structuring of an occupation's practice will seem normal and taken for granted whether working apart in the silos of their communities or together with other groups. Therefore, being directed to work at a different rhythm or pace can become a breach in their expectations, an interrupted social order (Heaphy 2013), and may lead to relational strain in ongoing social interaction.

We draw on these theoretical developments in building our temporal perspective and adopt a situated approach to examine two interrelated questions: In what ways are occupational members' contingencies, including their materialities, related to their temporal orientations? What coordination challenges emerge from these different temporal orientations, and how may they be productively drawn on as potential solutions to these challenges? To start, our approach examines how the various material elements—such as microscopes, scalpels, and hair loss—of situated work practices shape a worker's temporal orientation. We then examine situations in which the resourcing of temporal orientations shape emerging coordination of joint tasks and lead to strain and conflict in cross-occupational work. Finally, we examine situations in which agents are able to productively resource the differences of temporal orientations as they address cross-occupational coordination challenges.

Methods

Research Setting and Case Context

This research was undertaken within multidisciplinary cancer teams (MDTs) in two UK tertiary care university hospitals. The teams' clinical focus was breast cancer in one hospital and in the other it was urological cancers; both were considered high-performing teams in terms of their clinical outcomes. We collected data that focused on the diverse independent work practices of surgeons, oncologists, pathologists, and radiologists and how they coordinated their work in delivering interdependent patient care activities.

To understand work coordination, we collected data on multidisciplinary team meetings and joint clinics, the primary areas in which the collaborating occupations were required to coordinate their work jointly. The joint meetings (called MDTs) were held weekly and entailed discussing and concluding on the patient diagnosis and outlining subsequent treatment. The joint clinics, also held weekly, entailed assessing patients and discussing treatment options with them. In these clinics, sometimes referred to as "one-stop clinics." several occupational members (surgeons, oncologists, and radiologists) were seeing hospital outpatients in parallel in the same geographic space. For example, women with suspected breast cancer could see a surgeon and then a radiologist and, subsequently, an oncologist as indicated by the presenting symptoms or disease. These clinics minimized delays between referring specialists and ongoing care. To understand the various occupational practices, observations were made by spending time in specialist work areas, namely the pathology laboratory, radiology rooms, oncology clinics, and surgical theaters.

Field Site Access

The first author was the primary fieldworker and received access as an honorary team member for the purposes of this research for 18 months duration. Access was given for observation and interviews as well as inspection of various materials, such as texts and graphs. The fieldworker has a background as a physical therapist though no longer practices this having become an academic with training in ethnographic observation. Thus, she had a good understanding of hospital culture. However, she had no specific knowledge related to cancer care and was unfamiliar with the clinic and meeting processes. Four interviews were undertaken by the second author, who also attended a few MDT meetings at one of the tertiary hospital sites.

Observation of occupational practices allowed us unique insight into the clinical practice, for example, what details were being attended to on screens, how schedules were used to structure the timing of their activity, and how tools and technologies were used. Changes over time were also noted. Observation of the meetings and clinics that required occupations to work jointly and coordinate their action provided us with insight into the relational dynamics between the different occupations as well as how they were oriented to each other. These aspects of coordinating work were further teased out during formal interviews as well as informal discussions. Textbooks and research papers were important in showing the historical materiality of practices, different instruments used, and range of technologies used in diagnosis.

Data Collection

Data that focused on understanding coordination processes across occupational groups included the regular observation of MDTs (55), other meetings (22), clinics (23), and informal discussions and semistructured interviews (40) with members of the team. In addition to interviews with team members, we gained insight into how work was coordinated from interviews with team nurses, visiting doctors, medical secretaries, and ancillary staff (15). All the individuals we interviewed (and observed) were connected in some way to the cancer teams we were studying. The interview protocol is provided in the appendix. The fieldworker took ethnographic notes amounting to a total of more than 900 pages during meetings, clinics, and corridor interactions. Increasing numbers of informal discussions with key informants were held over the 18-month period. Most interviews were recorded and transcribed though, in some cases, notes were taken as interviewees were not comfortable with a recorded interview.

Data were also collected to gain insight into the practices of the four occupations related to patient diagnosis and treatment. Here, the purpose was to understand the tools, artifacts, knowledge, and rhythm structuring their independent work. Although occupational members coordinated interdependent work at meetings and some clinics, most of their work was carried out in the silos of their departments. Thus, the fieldworker immersed herself in the practices of the four occupations, spending time in each of their departments, observing and informally discussing the activities. In Table 1, we provide an overview of where *observations* were made, a breakdown of *formal interviews*, examples of where *informal discussions* were held, and the *texts* that were important artifacts for the various occupational practices. For example, oncologists' texts related to treatment tables, and published research trials were examined as data artifacts.

The multiple primary and secondary data sources were gathered to provide richness and multiple insights (Denzin and Lincoln 1998). They were used to increase study rigor and as a form of cross-validation (Langley 1999). When findings regarding specific practices were found at one site (for example, oncologists' high level of interest in clinical trials and research), these were counterbalanced by probing the same issue at the other site. Although many site features varied between hospitals (for example IT use, trainee supervision, and size of team), these were not the focus of analysis in the current paper.

Data Analysis

We analyzed the data in five stages as illustrated in Figure 1 and drew on three of the sense-making strategies for qualitative data as suggested by Langley (1999), namely narrative, grounded approach, and alternative templates analyses. The first stage comprised open thematic coding during the data-collection process. During this stage, we kept the data from the two sites separate with no expectation that the themes across sites would overlap. This ongoing iterative analysis provided a grounded approach to conceptual development (Golden Biddle and Locke 2009). We gave careful attention to examining the range of data types (e.g., meetings, interviews, observation, texts) to triangulate findings between sources.

In the second stage, we developed narrative descriptions of medical groups (Langley 1999, Golden Biddle and Locke 2009). At this point, strong similarities between sites emerged, in particular with relation to coordinating action within and across occupational groups. Thus, we comparatively analyzed the data between sites according to occupational groups. We examined the way occupational groups routinized their practices and how they tended to respond to emerging work. In so doing, we compared several alternative templates for making sense of interaction, including their orientation to time, socialization, and knowledge. Drawing iteratively on relevant literature, we developed short, focused, narrative stories characterizing their practices, including their key tools and technologies and how they were oriented to temporal artifacts in practice.

The third stage was closely intertwined with our evolving narratives in stage two. Our purpose in this stage was to check with the occupational groups involved to see if the narratives and accompanying descriptions resonated with their own perception and experience. In this way, we obtained feedback on the narratives. In addition to informal feedback, we held four formal feedback sessions. We held the first two with members at each of the research sites toward the end of the fieldwork. The third we held with a group of unrelated medical specialists; this group was

Table 1. Overview of the Data Collected According to Occupational Group

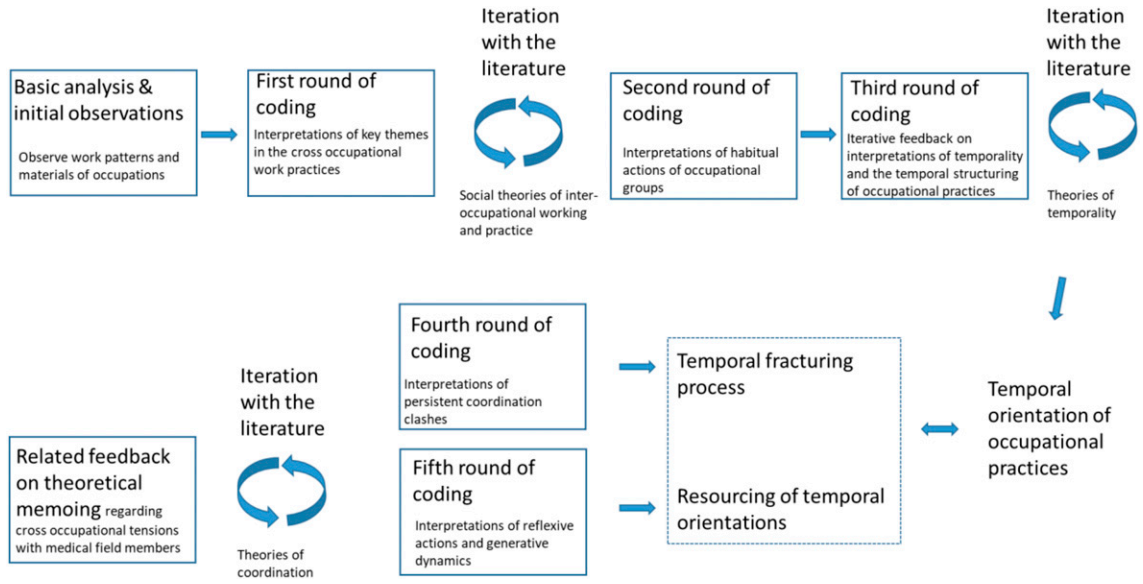
Data	Pathology	Radiology	Surgery	Oncology
Observation, 18 months honorary contract	55 Multidisciplinary team (MDT) (one to two hours each) meetings	19 Joint clinics (held with surgeons and oncologists)	23 Joint clinics (four joint with oncologists, 19 held with oncologists and radiologists)	23 Joint clinics (four held jointly with surgeons, 19 held with surgeons and radiologists)
	Four days in pathology laboratory to observe the pathology preparation and diagnosis process	55 MDT meetings	55 MDT meetings	55 MDT meetings
		Two days in radiology area	Two days in operating theatre	Three days in oncology areas, including chemotherapy and outpatient clinics, oncology library
		Shadowing radiology trainee learning biopsy process	Four grand rounds and five surgery clinics attended	Attended oncology research lectures
			Attended research lectures on surgical trials and surgical audit meetings	
Formal interviews	Seven consultants ("consultant" is a term used in the United Kingdom for the most senior level of doctors, both physicians and surgeons)	Seven consultants Two registrars (senior trainees)	10 consultants Six registrars	Eight consultants
Key areas of informal discussion	Hallway meetings with pathologists before MDTs	Discussions with radiologists while they interpreted images and findings	Discussion over informal dinner	Regular informal discussion at the weekly meetings and joint clinics
	Meetings over coffee in laboratory with pathology team	Informal conversations in coffee shops	Hung out in surgical coffee lounge with surgeons between operations	Lunch with oncologist
	Discussion over informal dinner			
Texts	Medical textbooks on pathology with cellular conditions, normal and abnormal cells	Studied the research papers produced by team and read two textbooks; examined radiology IT database; training protocols	Surgical medical record forms; local audit reports; theater checklist of instruments for operations; studied anatomy texts	Examined academic articles, local protocols, treatment tables and "prognostic indicators"
	Lists of laboratory protocols			

chosen from a number of medical clinicians participating in a university-based management course and who we asked to give reflections and feedback on the descriptions as a case study. We chose the fourth group similarly from senior cancer clinicians participating in an executive management class.

Following this iterative feedback, we focused analytic attention on the situated integration of knowledge and action across groups. We reanalyzed and categorized data segments regarding approaches disciplinary groups had in coordinating actions. We inductively compared groups and contrasted their temporal orientation, working closely and iteratively with the coordination literature. We constructed a data table that linked the different data sources (observation, interview, informal discussion, and texts) about the material elements of occupational practices with the temporal structures of the practices. In Table 2, we provide examples from each of the occupational groups that are linked to each of the data sources (observation, interview, etc.) to show how and where material dimensions of practice are evidenced through our data. In Table 2, we show, for example, how oncologists indicate that they are concerned about the future, long-term outcomes, and patient longevity in their quotes and discussion. On the other hand, surgeons show their focus on the immediate present, what time the meeting will end, and are the patients sitting waiting. Thus, both these groups are focused, for example, on patients, but one is oriented to where the patient will be in several years and the other to where the patient is now.

During our final stage of analysis, we examined data segments illustrating generative and positive action that enabled coordination. Examples across the

Figure 1. (Color online) Schema of Analytic Process



four occupations of generative action (generative in that positive influences on cross-occupational coordination were noted) were compared in relation to coordination issues. Thus, there was a coordination issue between surgeons (who remove body parts) and pathology (who examine the cell tissue of removed parts) in how to manage the labeling of the body tissue so that, for example, the left and right side of the removed tissue can be identified clearly and correctly. Pathologists developed a quick way of checking the macroscopic structure of tissue immediately on receipt from surgeons. Our insights were iteratively developed through engagement with themes from the resourcing literature. Figure 1 provides a schematic overview of our analytic process.

The vignettes presented in our findings are based on actual events and are typical occurrences in meetings and clinics in which tasks are being coordinated. Further, through our coding process, we identify particular occasions on which positive action in response to the differences in temporal orientations, which were causing strain, successfully enabled work coordination.

Findings

> At 7:30 a.m., in a dark room, a surgeon starts the meeting by asking the oncologists for their views on treatment for an emergency patient that arrived yesterday. One oncologist outlines a number of studies on outcomes. Another oncologist cites statistics from a recent publication, and they both discuss. Another oncologist recommends a suitable research trial. A second surgeon interjects impatiently leaning forward, "So what are we going to *do*?" He goes on to suggest that the tumor looks accessible from a left side approach, and he can fit the operation onto tomorrow's list. The other surgeons nod. They begin discussing the next patient. (field notes)

The data from this MDT meeting highlights a key coordination challenge between surgeons and oncologists in their joint organizing of patient care, which could potentially have important consequences. The coordination of the patient's care is situated within a team meeting in which the patient is not present as is common for much of hospital work that is accomplished behind the scene of patients. Although the oncologists discuss various options and associated research, the surgeons are impatient to make a quick decision and move to action. Although a decision is made in this scenario, coordination that integrates the expertise between groups is lacking. To examine this challenge, the first part of our findings starts by unpacking the temporal structuring of specialist practices. We show how occupational members' temporal orientations are mutually constituted and honed through practice so that the occupations subconsciously work in temporally distinct ways when responding to the emerging situation. The second section of our findings goes on to show how differences in temporal orientations may lead to strain when joint occupational coordination is required, such as in joint clinics and meetings. The third section shows how cross-occupational coordination is achieved by productively resourcing temporal orientations.

Temporal Orientations and Occupational Practice

Surgical Practice. In providing patient treatment, surgical practice entails the use of material artifacts for cutting a live human body. Surgery is undertaken on an anesthetized patient using a series of sharp knives as retracting devices to hold back the layers of body tissue and to expose the body part needing surgical attention. An array of implements, also handled by assistants

Table 2. Data Samples for Material Elements and Temporal Structuring of Practices

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
Surgeon: Material elements of practice	"Before, decisions rested largely on previous experience, not taking notice of what is happening in the research and literature."	"So the guy with the knife, who is replacing your heart, or fixing your heart valve, or doing your brain surgery…he's the only one for 100 mile radius who can do it. Then there's much more of a hero, untouchable, king." (oncologist)	"You just tickle them with a few drugs. I have to carve them up." (surgeon says to oncologists at MDT)	Text book of anatomy, full of pictures of body parts, some schematic, some of live persons, some of cadaver/specimens morphology
	"Some of the things we have to do are truly dreadful."	"The surgeon is the cutter—that is what they are…They see themselves as the most important part." (oncologist)	Initial assessments of diverse examinations of body parts, palpation of lumps, comparing bilaterally, inspecting skin, scanning body parts. Postsurgery, wound inspections, check for skin quality, infection, blood count. Prescribe meds, especially pain control (analgesics)	Protocols of prostate biopsy procedure (which differed between hospitals, and surgeons)
	"When I was a student, the thoracic surgeon used to throw instruments across the theatre."	The [surgeons] emphasized the point that they would not accept unclear margins. Before they were happy with margins that were maybe 1 mm from the edge. They were a bit sloppy about how close they got to getting all the tumor out. The idea was that it would get mopped up in the aftermath [end part of surgery]	[Surgeon explaining to trainee] "There are two methods [to identify nodes], either an isotope or a blue dye can be used, and some have now found it best to use both."	Screen seen of "Da Vinci" robot, depicting surgical view of operation
	"Today in the general surgery theater, I saw some more lumps and bumps."	…very important to scrap the axilla out well.	Use of many instruments in theatre	
	"Surgeons will have very little debate, very little academia, it is just cut it out, cut it out, cut it out, cut it out." (oncologist)		Sudden shift in operation process as patient's blood pressure unexpectedly drops and anesthetist increases control of the operation process. Surgeon repeatedly checks with anesthetist on patient status (theater notes)	
	"Sentinel node biopsy… an attempt to minimize the number of patients who undergo axillary clearance… The disease travels from the breast tissue to the lymph nodes via a few select 'sentinel nodes,' which are located midway between breast and axilla."			

Table 2. (Continued)

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
Surgeon: Temporal structuring of practice	"They sit and talk…while the cancer is growing. [It is best] just to cut it out."	"I don't want to see every core biopsy, which has cancer in it…what I would like to see is the one that is [equivocal]… cause I think it gives me a greater understanding of how to approach the patient." (surgeon)	"This operation would have been a difficult one... But [surgeon] used his method, which he sticks to and works around the difficulties. And he has still finished up in [very fast time]." (visiting surgeon commenting, field notes in theater)	Surgeons' preference for filling in simple, quick "tick" boxes on medical notes
	[I have found looking at pathology slides interesting]…If they don't dwell too much on it. (S)	[In context of high patient volume] I suggest that they would perhaps not be able to meet the two-week wait performance criteria and he says quickly, "Oh but they have to meet that [deadline]" (field notes)	(Field note in clinic) 9:05 a.m. First surgeon has ticked the board to show patient being seen and is in with first patient… They are almost always first to see patients as clinic starts.	Paperwork kept brief and minimal
	More colorectoral cancers present as emergencies first, many of, a third of them, are operated before, you know, you've got to operate on them quickly. So there are certain clinical conditions at play here.	S comments after a meeting that was held very quickly due to shortage of staff, "I hate to say it, but I think we may find these truncated meetings are actually better."	(MDT) R gives his opinion regarding a film being viewed, [the ureter] looks cancerous. S1 responds swiftly, then we had better take [it] out S2 asks S1 if he can do it. S1 promptly replies, yes Tuesday [next week] there is time. S2 walks over to pass on the notes and the decision to operate and when to operate have been completed in a matter of minutes. They move to discussing the next patient.	Extra operating lists and clinic sessions were drawn up when there was sudden increase in patient volumes and wait lists were getting too long.
	[When we refer patient on] you don't see them anymore. You're not really asked if there is something further you can do… [though] they may be referred back a bit too late.	(At research meeting, surgeons explaining a technique)		
	"The surgeons…have a very clear cut approach…They are very organized, highly efficient. They are caring …but very clear on their boundaries" (nurse)	"Get the SLN [body part] and get out of there…I would consider checking out the axilla…"		
Oncology: Material elements of the practice	There is a lot more emphasis on clinical trial that people are going into because of the type of work we do. (oncologist)	"In clinic, I had one lady today, and I showed her this and explained that the chemo would only give her another 2.5% improved chance of survival while hormonal benefit was about 8%. I mean I didn't think that was very much and if it had been me, I would have said I would take my chances. But she said, no	Oncologist 1 suggests the figures indicating prognosis. Oncologist 2 says 3.4 did you say. I guess we should offer her that. Is she eligible for the tango trial do you think? (field notes of MDT)	Folders on one shelf contain details of current studies

Table 2. (Continued)

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
		doctor I want it all." (oncologist speaking)		
	[We] train to deliver chemotherapy and in the future biological therapies or systemic therapies.	"There are clearly big holes in what we are trying to do, and that is why there is room for lots of trials" (oncologist)	(O) demonstrates the database to me, shows me how by putting various parameters in the life expectancy and prognosis of benefit of treatment is displayed with chemotherapy and with hormonal therapy (e.g., Tamoxifen) and combined treatment. He explains the studies on which the algorithm is based. . .Basically it sets the prognosis of patients into five categories (the algorithm is on the handouts that [colleague] gives me. (field notes)	Patient notes on standard proforma sheet (filled in by clinic nurse or medic) asks for details on hair loss, nausea, pain levels, skin sores, ulcers
	Radiation tries to fry the tumor up a bit. . .Physics and complex machinery to fry bits of people.	In oncology, they are concerned about having lots of accurate outcome data, especially because they like to draw on it for research. (radiologist)	"I was just feeling so awful. . .I really just wanted someone to listen and understand. . .'cause my husband couldn't cope with me telling him." (notes from discussion with patient)	Information notes in cancer clinic beside chemotherapy drip stand provides schedule for dosage and where to insert lines (tubes being inserted into body through needles)
	Since the 1970s, we saw the advancement of medical oncology, which was a very research-orientated specialty from the beginning. . .so were interested in the research side of things. (oncologist) -"If you want good clinical info that can support research then you need a robust IT system." oncologist "[Surgeons] chose to be doctors [to help keep people alive], but I chose oncology knowing that the outcomes are poor." (oncologist)	I tried to show (a patient) her the various options...She did not want to see this chart (pointing to the top line on the [database] which indicates her expected 10-year survival was 79%.		
Oncologist: Temporal structuring of practice	"Oncologists [are] dynamic people who [are] moving forward."	[Oncologist] explained that, yes, once they have metastases, then patients want to know how much time they have.	Surgeon asks oncologist, "Do you follow up a teratoma forever? O replies, "Yes, after the data you presented that suggests a 10% reoccurrence." S returns, "Well I guess it lets you keep the data going."	PowerPoint slides from oncologist presentation on current trial being run at local clinic. These outline survival rates and prognosis for first 6 months, 1 year, 5 and 10 years.

Table 2. (Continued)

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
	"Oncology has flourished because the future in cancer treatment is going to be in systemic therapy."	Re: protocols in oncology. "We used to sit around and discuss should we offer chemo, should we recommend a treatment, and we would go around a bit. Now we have a set way of doing it. We used to offer three months of chemo to patients in the 2%–3% range (which is half of the normal chemotherapy package) but after reviewing the studies and looking at the data, we decided that we really were better off doing the whole seven months if it was worth doing at all. And the American data suggests that 50% of women choose to add chemo to their treatment if it adds 2%–3% improved life expectancy, so we feel more confident now [about] the data.	Clinic at 9:20 [nurse] comes in and says that [oncologist] is going to be late, he was drawing up a treatment elsewhere…better go and tell the lady who is waiting.	Patient notes contain follow up recordings of patient visits for ongoing annual check ups following "discharge" from active treatment.
	Re: trials. "The disease has such an attenuating course, you don't get your results promptly, so if you want your results in 10 years' time, you had better start now. Because that is built in to every, um every study. You can't get to end points as quick."		During a meeting about patient treatment, an oncologist discussed a patient they were followed indefinitely with no plans for discharge from clinic. A surgeon commented with incredulity "you mean you keep following them forever?" Several oncologists laughed and looked at each other. (field notes)	Stacks of journals were scattered on shelves reporting on various research trials. Outcome data reported for 10-year survival rates.
	[Gene therapy] is the way of the future…we need [to] support this research. (oncologist)		Oncologist explained to surgeons in a meeting in response to being asked about their long follow up on patients, "Nowadays, there are more chemos being given, with new side effects and these need to be monitored."	
	Those trials need to be tied to tissue collection, storage of the right data so you have got all of the core clinical data... Tie it up and say, "Ah well actually this particular ray profile correlates in responsiveness to this therapy" so that in the future, we go back to MDTs and inform			

Table 2. (Continued)

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
	them, in the next 5 to 10 years. …You are doing it for the future. (oncologist)			
Pathologist: Material elements of practice	"A pathologist may typically spend 60 minutes going over 60 different slides taken from one small biopsy." (pathologist)	P1: Histopathology is a very labor-intensive path or process.	[Pathologist] palpates the tumor and cuts the tissue into unsevered portions so that he can visualize the tumor and surrounding tissue…These are frozen in liquid nitrogen in a nearby canister. [Another pathologist] assists him with getting containers opened, holding paint jars and writing down estimated tumor size… [In another] room [another] stage of the process occurs, a room full of small washing type machines. In here, trays of specimens are given certain cycles of treatment from chemicals, such as xylene, using a set range of computerized programs in order to extract the water from the specimen and replace it with wax. The specimens are left in the machine for the duration of the cycles and then dipped into hot wax. The hot wax then is quickly cooled on a cold tray, making sure that the specimen stuck to the bottom of the tray. Once cooled the specimen could be cut. (field notes)	-Thick textbooks show pictures of various ways to stain cells and indicate what the different stains represent. The pictures contain illustrations of cell nuclei, cellular walls, various transport mechanisms, fluid, blood vesicles, etc.
	"Patients are anxious to know their diagnosis as soon as possible; patients want an answer, is it yes or no, doctor." (pathologist)	P2: Absolutely	The slides contain small samples of body tissue, micromillimeters in size that have been stained pink and blue to highlight cell morphology. Slides on "bench area" (where some 30 people worked on hundreds of slides daily) (field notes)	Each machine in the laboratory is accompanied by a detailed manual of how to operate and how to care for the machine.
	"No one is going to argue with the pathologist about their diagnosis, no one in that room knows as much about it as she does." (oncologist)	P1: Compared with the surgery, the clinic, and whatever the oncologists are doing.		Shelf of journal articles in histology laboratory contain detailed illustration of variations between cells and how cell morphology changes over time in response to various treatments.
	"The specimen is sent up, and we then slice it and put it onto a slide and	There are gray areas, for instance, between atypical		

Table 2. (Continued)

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
	that is then processed. And then we look at those nodes. Four lymph nodes, and we had eight slides...It requires two consultants, we reckon it took us 45 minutes, handing around doing, it, reporting, for those four lymph nodes… because (sentinel node) is a procedure—we have a set protocol, and it is double reading."	and in situ carcinoma. And you get somebody like [pathologist] looking at GI stuff and she will have a smaller number of gray areas, that she can't decide which is which, perhaps fewer in situs and more atypias or vice versa. And the same is true of breast. It comes down to how much experience you have. But you never—I mean there are gray areas that you will never eliminate in pathology because there is a gradation. I mean if something (here she starts drawing for me on a napkin) starts to become malignant, you don't all of a sudden start seeing a cancer like that. A normal cell. So if you have normal cells, a normal duct with normal epithelial cells, that one cell presumably undergoes a mutation and starts to change. (discussion with pathologist)		
	"As I report a case, I put it on a meeting list…but the fact that all MDT meetings rely on pathology is not really right…[but] I track all cytology and histology results on all these patients…I really want it to work—in my heart of hearts (she puts hand to chest)." (pathologist)			
Pathologist: Temporal structuring of practice	P1: You might sit in a meeting and say "Four of the lymph nodes are negative" in seconds, but (P3 interrupts to finish the sentence)	[Pathologist explains the] "routinized processes and protocols need to be followed in order to produce the slide accurately. It is this protocol and procedure that is most negatively affected by the request for a 'rush' delivery that often renders the final product less than optimal or at times unusable. The specimens come out of sequence and do not allow for all the steps to occur in full."	"Certain cellular preparations took 72 hours to process from start to finish, needing set time periods before each step could be undertaken. Other tests took less time to prepare but given the high volumes were organized in a staged fashion so that all readings would be ready for the next relevant reporting meeting. They rely heavily on protocol otherwise the laboratory would be in chaos. (field notes, from path laboratory	Binder in pathology laboratory wrote out the detailed steps for staining tissue sample. Some steps are detailed in seconds, some in minutes, some hours.

Table 2. (Continued)

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
	P2: "But that might have been an hour and half of work—two hours!"	"It would take a while to do the whole case properly…instead of just banging off a list of figures…" a pathologist explain when referring to the MDT.	The pathologist explains to me that the tissue must be brought for staining, which is an automated device that dips the tissue into various chemicals…	Typed notes beside the "centrifugal machine" notes the times in seconds it takes to separate out various cell features.
	"I was really stressed because it was supposed to come up at 10 a.m., there were supposed to be two consultants on hand ready when they came and I had spoken to [another consultant]… We then got a phone call at 10 a.m. to say (surgeons) had been delayed until 11 a.m. It finally arrived at 1 o'clock and [the other pathologist] wasn't around…so I had to find someone else…The second [specimen] arrived after 4 p.m. and [other consultant] had now gone [home]…and I had planned to leave at 4 p.m. [but couldn't]."	P1: The time pressure is such (in MDT), you just fly through it, just the basics.	These different tests and staining take considerable time. The immunostaining takes around eight hours and is carried out in a separate laboratory across the hallway. (field notes, from path laboratory)	Various timing devices are spread across the laboratory for accurate recording and ready to hand.
	Those meetings can be very frustrating because [surgeons want] what they need to treat [patients] and move on to the next case. We want to discuss [details] more…we do not have time to go into any detail about it and we have to move on." (pathologist)	P2: Yes you just fly through	The pathologists make several comments re: their concern that the new techniques which will be requiring a different form of analysis will be time consuming and that they will need to be standardized along with the surgical procedure. (notes, from interoccupational research meeting)	
		P3: You show them just the tissues that they need, they apply the appropriate formula with what they need to treat them with, and we move on to the next case. That is a time factor thing, really.		

Table 2. (Continued)

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
Radiology: Material elements of practice	With all the very early disease, the screen detected disease, there is a lot of liaison [with] the surgeons . . . Because they are having to arrange their guide wire localization, putting the guide wire into the tumor under mammographic control, under [X-ray] control, prior to the patient going off to surgery." (radiologist, discussing a new technique he had started to do)	Radiologist explains when trainees who have little experience with the equipment dome in it is often tricky because you need to juggle their needs, teach them and also minimize any discomfort or misunderstanding the patient might have, who is listening to anything being said. The trainee is often straining to get the handle of the buttons and controls of the equipment and, thus, frown.	"There is a suspicious area but you can't be conclusive. . .There seems to have been a repeat ultrasound done on this person which is important." (field notes MDT)	MRIs, CT, X-rays, PET images, black and white images with etchings and shadows, generally taken by technician. These are sitting within paper folder copies of all the patient notes. These films are regularly removed and viewed by one or more radiologists on bright screen monitors as they point to various structures and discuss in groups.
	"Where the patient had a number of neurological signs and I'd just get up and walk across the corridor and say, 'Look we're going to want an MRI done now.' And he [i.e., other radiologist who is across corridor] says, 'Well we've got to finish [current procedure], but we'll do it.' And then he will, the radiologist, will bring the films over and say 'Okay, well, there's a problem there and that's okay, that's okay, but I think you know...let's have a look at some 1more pictures." (rad)	"[We thought] well the radiologists, they just take the pictures. . .but there he was actually giving her the diagnosis. . .something that I would feel was more part of what I do, break bad news, you know." (oncologist)	Radiologist refers back to the new treatments they have started doing. These had been agreed upon and involve doing papillary lesions and other small radiological suction type removals of lesions that used to be done in theater by surgeons. Radiologists are going to start this procedure in theatre with surgeons. Radiology was taking this role away from surgeons. (discussion, coffee room)	
		"It is very convenient to be able to look up the screen and find out about previous chemo treatment, and to quickly scan it. It is hard to locate this in the notes, if you can find the notes."	Radiologist shows me two different views of an abdomen, one from CT scan and other from MRI. She highlights the different features that the two scans reveal and explains why I am seeing different things. She then takes out a PET scan, which has bright "hot spots" and contrasts a very different view of the body. This is telling me where there is very high metabolic activity, for example if the cancer cells are very active. . . important to compare the scans. (clinic)	

Table 2. (Continued)

Occupational group	Formal interviews	Informal discussions	Observation	Documents and texts
Radiologist: Temporal structuring of practice	It is very convenient to be able to look up the screen and find out about previous chemo treatment, and to quickly scan it." radiologist	A pathologist suggests after a patient meeting (MDT) that they often find the radiologist spent too much time reporting about the past treatment of the patient, for example, for post op patients, "Why do we discuss the initial assessment and then the biopsy…should skip some of that introduction." (pathologist comments to fieldworker.)	Pointing to the CT graph [radiologist] says, "There is a suspicious area but you can't be conclusive…There seems to have been a repeat US done on this person which is important (field notes)… [Later, regarding the next patient] he comments, "There is no large change between early and repeat films." (notes on comments during patient meeting)	Textbook showing radiology images of tumor growth show progression of changes over six monthly intervals, with tumor view getting bigger and changing its contours.
	"There has been a fundamental change in my practice, over the last six months. I used to tick the boxes on the [assessment form] and throw it away on the chart—the secretary would type it up. Now that a new IT system has been set up, I actually have to sit down and think about what I want to say…less meaning gets lost. Interestingly, the other groups have not changed their practice much..."	"[There are] times when you can't correlate the radiology and pathology. There are times when they (radiologists) go back and do another biopsy…if they are really concerned with the radiological features not matching what we found." (pathologist)	Radiologist (during patient MDT meeting) says, "There is no large change between early and repeat films." (field notes)	Research paper shows changes in bone density over time in patients receiving a particular chemotherapy treatment.
	"We should use the [new IT system] more in the [meetings]…[We could] then pull up the required picture, move out [and view] another file…and [then] the patient assessment and a surgical notes can be drawn in, and perhaps an ultrasound view. We could program the system to display the images in this preset order [so we can move between them easily] able to have the access to the file as needed."	[In]a hospital…people [can get] get static in their job…doing the same treatment with the same colleagues. This is not a good situation, ever. They need to change something...it's important to build in dynamism into the work routine, then change of practice [would] be more acceptable. (radiologist)	"This blob [on CT scan] has just caught my eye, and there is probably nothing to it, it has probably been there years and it looks like a blob of fatty tissue. But if you should come across more of these [in next scan], then keep this spot in mind…" (notes of radiologist speaking to others in a patient meeting)	Patient medical notes (digitized) contain folders for series of CT scans and MRI scans from previous decade at several intervals.
		"You need to be able to fall in line, otherwise you wouldn't be able to work in this kind of place." (radiologist)	[Radiologist] puts up three different images of the [kidney] showing one from previous visit two years ago, one from the recent clinic and one from yesterday. He points out various features associated with the changes across these images as he explains his assessment to the surgeon. (Notes on patient assessment meeting)	

and nurses, is used to slow down the leakage of blood, including needles to suture and close the wound. The operative procedures are timed and documented in surgical notes; longer times can have adverse consequences on patient outcomes. Surgery is, thus, a risky craft that can be devastating to the patient; for example, the patient's nerves can be accidently cut, causing irreparable damage; blood vessels can be suddenly nicked by a razor knife, causing blood loss. Regularly, the exposed organs reveal the unexpected, such as ischemic tissue or blockages, forcing the surgeon to improvise and giving intensity to the present. Their procedures are frequently referred to as "salvage" and focus on heroic "saving" of lives.

The material realities of surgery shape the temporal structuring of surgical practice as their situated actions are routed in the immediacy of emerging practice. While watching a surgeon in the operating theater, an assisting surgeon (as surgeons seldom operate alone) commented to the fieldworker that "the hardest part of being an excellent surgeon is learning how to get out of a tight spot." The challenge of mastery is not so much to learn doing the surgical procedure but rather how to adapt a procedure quickly to unanticipated situations, thereby shaping the surgeon's temporal orientation for quick decision making and improvising. In this sense, the surgical skill is less focused on *what* to do but rather on *how* to do it in the emerging present situation.

The surgeon's temporal orientation is focused on the present. They tend to be impatient if they perceive that time is being wasted as the immediate present is precious. During field observation in an operating theater staff lounge, a surgeon explained, "Surgeons are very different from [other doctors]. . .this is reinforced during training. As surgeons, we really like to get in there. That is where the action is; they want to *do* something." The other surgeons in the room nodded in agreement.

The temporal structuring of the surgical practice is to be as swift as possible. The rhythm and pace of their practice is marked by "beating the clock." Ideally, they want to keep ahead of the schedule and the clock. One surgeon explained, "I am very conscious of time. It has to finish at 9 a.m. for me. You know, if a meeting is to go to 9, that is it; I don't care how big it is, and if it finishes earlier, so much the better, you know, so it keeps the thing moving on."

Thus, in meetings, surgeons tended to discuss only as much as they felt was necessary to inform their next action, which was whether to cut and how invasive the cutting should be. Their temporal orientation to make quick decisions was ascribed, by surgeons and nonsurgeons, to the immediacy of the surgical task and the high stakes for making mistakes. One surgeon highlighted that surgery is not for "the feeble minded" as you have got confidently (and literally) "to get your hands right in there," which again highlights the intensity of their present.

Oncology Practice. The oncology practice of patient treatment entails either using radiation to burn targeted cancer cells or administer through drip stands toxic chemicals to poison body tissues. Treatments are given to patients in predetermined stages of months with a goal of shrinking the tumor. As explained by one oncologist, the work entails following protocols and monitoring: "[Clinic] is just the process of putting the patients through the treatment. It is not the decision-making process." The treatments usually cause unpleasant side effects (morbidity) for patients, which can last for months or years. Oncology patients have high levels of mortality as all patients have some form of cancer; thus, in their treatment of patients, oncologists are constantly exposed to death and situations in which patients are afraid of suffering and dying. The cycles of treatments allow for ongoing patient contact and rapport as they ponder the patient's progress. The materiality of their practice is rooted in long-term follow-up clinics; research trials; chemical toxins delivered over several months; and nauseated, teary patients. This temporally structures their practice to be future directed as oncologists stretch time to accommodate the work in their situated actions.

Given the patients' suffering and anxiety, oncologists tended to take as much time as needed when they were meeting patients in the clinic. The long-term suffering and empathizing contributes to their temporal orientation for deliberating in their situated action as was repeated frequently by a surgeon: "We make clear decisions; [oncologists] think about possibilities." An oncologist explained, 'The consultation of the oncologists go more in-depth and actually take longer than most of the other physicians. . .Because there are a lot of indications about the patient for the treatment we give in terms of toxicity and how long it is going to take." Another oncologist said, "It is difficult to know how long (an assessment) is going to take," thus making it difficult to stick to a schedule. Rather than limiting their discussion or assessment by the scheduled time, the pace and rhythm was set by the situations surrounding the patient's emerging illness and what the best options were. Unlike surgeons, their focus was on *what* to do rather than *how* to do the treatment.

New drugs and trials are constantly on the horizon. This temporal structuring of the practice further worked to orientate oncologists in their situated actions toward a hopeful future with better cures. An important material aspect of practice is to support new treatments through clinical trials and to engage

in research studies. One oncologist explained, "There is a lot more emphasis on clinical trials that people are going into because of the type of work we do." She pointed out that oncologists are very aware that many of their patient treatments have poor outcomes, "and that is why there is room for lots of trials. . .because, in the future, we will have many new treatments and better outcomes."

Pathology Practice. Pathology practice revolves around obtaining an accurate diagnosis (event) by examining the patient's cells. The pathologist's diagnosis entails attending to a massive amount of minute detail. This practice is conducted in a laboratory, often located in a basement, and typically removed from the hustle and bustle of the hospital activities. Using different microscopes, small glass-covered slides, and diverse laboratory equipment, pathologists work with tiny pieces of tissue samples that are cut and prepared in the laboratory after having been taken from the patient's body by a surgeon. A pathologist may spend an hour examining slides taken from one biopsy specimen. The material elements of the slides contain samples of tissue, micromillimeters in size, that have been stained bright colors to highlight cell morphology and that provide the cellular basis for discussions about patient diagnosis. The pathology practice is methodical, temporally structured to keeping fixed clock times rooted in the present. In the isolated pathology laboratory, disruptions are rare as multiple steps run in parallel, and it is difficult to change one step without affecting the other steps.

Being accustomed to paying close and uninterrupted attention to small details and being relied on for accuracy, a pathologist is oriented to push for precision. A pathologist summarized the rigid importance of accuracy: "We try to be very precise. We do. We push ourselves very hard to try and be precise. . .it is important." A radiologist explained, "We call pathology the palace of truths," and offered that this was because "no one is going to argue with the pathologist about their diagnosis. No one in that room knows as much about it as she does." As such, pathologists' temporal orientation is to be fixed and rigidly detailed around the diagnosis event, aligning with the methodical scheduling of practices. They were frequently referred to as being "stuck behind their microscope" by both surgeons and oncologists, emphasizing their temporal orientation to being "stuck" and inflexible with schedules in their emerging action. The temporal orientation, rooted in the present, is focused on what needs to be done next in a stable sequence of events. They were acutely aware that patients were anxious to have current clarity; "patients want an answer; is it yes or no, doctor," a pathologist explained.

Radiology Practice. Radiology practice can be flexibly specialized either around body organs, such as lungs, or by technical modality, such as using the magnetic resonance imaging (MRI) or computerized tomography (CT) scanners. The practice entails making a diagnosis based on visual artifacts captured on film, which is particularly important when tissue (pathology) diagnosis is unavailable. The practice materially involves dark rooms filled with complex machine technologies and precise methods of positioning patients and body parts to get accurate views and multiple images. In the darkened room, radiologists and their technicians strain to see the buttons and equipment pieces while maneuvering the patient. Most graph series can be digitized or captured on paper like sheets of film that are viewed on brightly lit monitors. The temporal structuring of radiology practice is rooted to present and past, comparing organ features on graphs across time. As such, the practice is system focused and holistic in displaying the relationships between bodily entities. A radiologist explained, "[Surgeons] have seen a lot of cystoscopies. But I have seen more of them. . .You can say there are two roles here. One is. . .to sieve through the normals and the normal variance. . .Second is to look a bit more generally and try to think outside their domain. All they are going to think about is their kidneys or prostate. . .I look around outside and try to see other areas that might be causing the problems, taking a wider look."

New technologies are also rapidly emerging, temporally structuring the practice around ongoing change. The temporal structuring of radiology practice is flexible as their practice is marked primarily by the availability of varying visual pictures of body systems and organs. If more information is needed, patients can be brought in for a repeat scan or an alternative machine procedure, further linking the materiality of the practice with flexible temporal structuring. In addition, radiologists can take pictures of other parts of the body to compare, for example, contrasting left and right sides.

Having had to adapt to rapidly changing diagnostic machines, radiologists are temporally orientated to being flexible and adaptable to the emerging situation, shaping their role over time to accommodate new technologies. One radiologist emphasized, "It's important to build in dynamism into the work routine," notably linking change with ongoing routine. Even during the period of study, radiologists took on new procedures and roles, performed while working closely with other specialists, such as surgeons. One radiologist said, "Radiologists, historically, they used to be back sitting in a dark room—sitting with their glasses on. They didn't speak to people. But actually *now*, they are rather the hub of the hospital and have to be great communicators."

The temporal orientation of radiologists is rooted to present and past as they compare organ features on graphs across time. This orientation to shifting across time complements their tendency toward flexibility and accommodating their roles to the emerging situation.

Summary. Our findings across the four occupational practices highlight how the temporal structuring of occupational practices is formed in part through the different materialities of their work. Table 3 provides a summary of the distinct material and temporal elements of each occupational practice. Each occupational practice has a unique temporal structuring that shapes its rhythm and pace as well as the temporal orientation of those regularly enacting the practice within the silos of their communities. Diverse occupations are, thus, orientated differently to time, such as being focused more on the present or future. The temporal structuring of occupational practice shapes the temporal orientation to be more (or less) rooted in a particular dynamic, such as keeping work fixed to clock time or by being slow and considered, thereby stretching out time around the work.

Fracturing the Coordination Processes of Occupational Work

Our findings indicate how ongoing challenges between occupational groups are rooted in their markedly different temporal orientations, leading to the fracturing of coordination processes. Our analysis highlights how the persistent challenges emerged from the collective work.

Vignette 1A: Coordinating care in a multidisciplinary clinic:

> A surgeon viewed the schedule of patients on the white board and glanced impatiently at his watch. He looked visibly annoyed, muttering about the clinic running very late as influenced by his impatient temporal orientation. He comments to another surgical colleague and then the clinic nurse that three oncology patients are waiting to be seen. "One patient has been there over an hour, waiting," he remarks. The surgeon explains to the clinic nurse that he needs to discuss a patient care challenge with the oncologist and asks her where the oncologist is. "He is with a patient," she replies. "Oh, I thought he was lost," he returns sarcastically. The oncologist has been with a patient—and, thus, absent from the clinic meeting room—for almost an hour, reflecting his deliberative temporal orientation. (vignette based on field notes)

Vignette 1A highlights the temporal orientation clash between surgeons and oncologists, echoing strains from the opening description on coordinating care. The surgeon is expecting to complete the clinic on time and to avoid long wait times for patients. He moves in and out of the patient assessment rooms with a

Table 3. Temporal Orientation and Structuring of Occupational Practice

	Surgical practice	Oncology practice	Pathology practice	Radiology practice
Material elements of practice	Artifacts: Knives, blood, anesthetics, retractors, tables, scalpels Patient work focus: Salvage (life-saving) operations	Artifacts: Toxic chemicals, protocols, drip stands, clinical trials Patient work focus: Teary patients, afraid of dying	Artifacts: Microscope, chemicals, slides, stains, laboratories Patient work focus: Cells, bits of removed tissue	Artifacts: Dark rooms, images, data files, scanning technologies Patient work focus: Body parts and organ systems
Temporal structuring of practice	Rhythm of work: Swift, beating the clock Time focus: The present	Rhythm of work: Stretching time to accommodate work Time focus: The future	Rhythm of work: Keeping clock time Time focus: The present	Rhythm of work: Changes across time Time focus: The past and present
Temporal orientation of occupational members	Quick decision making, impatient, improvising	Deliberating, hopeful for the future	Rigidly detailed, fixed	Flexible, accommodating

quick step and tempo every 10 minutes, keeping to or ahead of the schedule. A nurse explained that the surgeons are "very clear on their boundaries" and, thus, "seldom sidetracked" in their discussions. On the other hand, the oncologist's temporal expectation is that the clinic needs to take the time required to deliberate over the patient's needs, focusing on their situations and not the clinic schedule. The board outlining the scheduling of patients along with their waiting times is clearly displayed, thus the oncologist is aware of the delays but ignores the schedule.

The surgeon in vignette 1A needs to discuss a patient issue with the oncologist as care planning is interdependent on the specialists' views and communicating with each other between patients. Frustration related to the clashes in temporal orientations is heightened by the surgeon's sense that the rhythm of the oncologists' temporal structuring is dominating, forcing the surgeon to work more slowly and behind schedule. In vignette 1A, the temporal structure of coordinating clinic discussions is primarily being set by the oncologist, who ignored the visible clinic schedule, which the oncologist considered as a guideline rather than strict rule. The surgeon's sense of emotional frustration is evident in the comment about the oncologist being lost as he knew very well where the oncologist was.

In this task, the surgeon's temporal orientation toward impatience is further pressed by being made to wait. As the oncologist calmly and thoughtfully took time, the surgeon grew increasingly impatient at the lack of control over the process. In the vignette, the temporal orientation of the oncologist is dominating, forcing the surgeon to align work to the oncologist's cadence, a cadence that is out of step with the surgeon's temporal orientation. As parts of the task (e.g., patient consultation) are completed independently, the specialists could enact part of their work in their normal rhythm as guided by their occupational work schema although other parts needed to be synchronized around the dominant rhythm and flow of another group. The strain that results has unintended consequences of unresolved work challenges emerging from the situation. For example, late clinics have ramifications, such as delays to subsequent clinics, ensuing ward rounds, or operating schedules, which adversely impact patients' waiting lists. Occasionally, surgeons choose to discharge patients before they finalize their visit, which includes meeting up with the oncologist. In these cases, patients may miss important communications that might benefit them.

The cycle of clashes in temporal orientations was ongoing with domination by one particular orientation influencing the rhythm and flow of the emerging situation, leading to unresolved aspects of joint working. This was a recursive process emerging across multiple points of the groups' conjoined work. Thus, there was fracturing of task coordination that was not only located at the level of a specific task, but became manifest as a pervasive strain to the ongoing work between specialists with schisms and conflict unfolding between occupations a common issue. With remarkable consistency, such fracturing of the coordination process related to different temporal orientations arises in other tasks as illustrated in vignette 2.

Vignette 2: Planning patient treatment in MDT (multidisciplinary team) meetings:

> As the MDT meeting begins, the lead surgeon announces that he has had to improvise and add an extra patient onto the list. The radiologist deftly pulls up several digital images and elaborates on the tumor and surrounding organs noting a large mass, which has grown since a previous scan six months earlier. The surgeon comments that the best way forward really then depends on the histology. The pathologist reads out the cell types from a printed sheet and says she believes the most aggressive cells are in the core of the tumor and thinks the edges are less aggressive. "I didn't have time to get ready as the patient was only put on my list yesterday." Her voice shows marked irritation. The surgeon thanks the pathologist "for keeping it to the point" and turns to the oncologists, asking for their views on best treatment course. Considerable discussion arises regarding treatment protocols and research trials that the patient might enroll into. Glancing at his surgical colleague, a surgeon interjects impatiently, "We sit here talking while the cancer is growing! Best just to take it [organ] out."

Vignette 2 again highlights a temporal orientation clash between several groups. The pathologist and surgeon clash regarding their expectations around the histology results of the patient who was added late to the list as the pathologist did not have (or improvised) a procedure for impromptu access to results yet wanted to be able to provide full details. The surgeon, on the other hand, was quite pleased by the brief report, thanking her for "keeping it to the point." As highlighted by a pathologist on interview, "Surgeons only want what they need to know to make a decision" and pathologists found the surgeons' lack of general methodical structure frustrating. One pathologist refused to come to MDT meetings for this reason. Surgeons and oncologists also had a temporal clash in the expected length of time needed to discuss patient treatment options. This persistent strain was further embellished by the lead surgeon who commented after one meeting that he was "not sure if bringing the oncologists to the meeting [helps] as they only talk about trials" rather than specifying the treatment plan. During one interview, an oncologist offered, "There is no use discussing a fancy trial with [the surgeons] because. . .they are

not interested." Another oncologist commented about the MDT, "If you want your results in 10 years' time, you had better start now." On the other hand, a surgeon commented, "If we are going to take it out, [then] no discussion is needed."

A sense of impatience and dominance of surgeons' temporal orientation could be inferred from the knowing glances between them while the oncologists deliberated. The atmosphere grew tense as the surgeons sought to maintain control of the flow and temporal structuring of the meeting, closing down side discussions. During interview, oncologists commented, "There is a dominance of surgical opinion" and "I see my role [as] throwing in the latest data, saying what about this [and] that. . .knowing the reaction will be 'oh no, here she goes again,' you know, because what you see them do is hurry the discussion along." The persisting emotional challenge to the oncologist feeling pressured to work at the surgeon's pace is evident in the quote as she articulates that the surgeons' thinking "here she goes again" forces her to expedite her discussions. The pathologist was also audibly frustrated as indicated in her emphatic comment about not "having enough time" in vignette 2. A pathologist explained in interview, "I used to present the macroscopic parts because we thought that was important...They don't want that anymore. They just want (information) for what they are going to decide." Her quote shows her preference for systematic detail and scheduled timing. In sum, by resourcing their temporal orientation, surgeons pressed the whole MDT group to enact a schema that fits the temporal structuring of their occupation, and this subsequently led to conflict and fracturing of the coordination process.

Vignette 2 shows that the MDT was able to resource productive task coordination through synchronizing to the rhythm of one dominating temporal orientation, namely that of the surgeons. Thus, surgeons' quick temporal pace, with which extra patients could be squeezed onto the list, prevailed over the pathologist's preference for a strict prescheduling of lists and structured discussion of cell morphology. The radiologist was able to adjust by quickly bringing up patient history details although the pathologist's discussion was curtailed. And, although the oncologists did take extra time to discuss possible treatment, this was interrupted, and the surgeons pushed to finish the meeting on time. The strain manifest between the occupational groups in vignette 2 indicates the pervasiveness of the fracturing of work coordination. However, the predominant tension was not one of blame, but one of realization that they were wanting to complete the work at a different pace yet were needing to enact the coordination of their collective work at a pace commensurate with the surgeons. One surgeon commented, "We are like different tribes of Indians. . .and each is moving along at a different pace." We also note that the radiologists were consistently flexible in coordinating their work with other occupations across their situated actions. Thus, radiologists seemed seldom challenged in adapting their flexible temporal orientation and, rather, could flexibly enact emerging situations.

Resourcing the strain inherent in the fracturing of the coordination process by the dominating temporal orientation allowed for successful task completion while leaving several aspects of the MDT work unresolved. From the pathologist's perspective, this would be evident that her lack of thoroughness might lead to poor decisions being made. Though rushing the findings for this particular patient is justified by the urgency of the situation, a more systematic method would provide the team with better insight. A pathologist explained that rushing could lead to mistakes: "I think, for a few patients, it might make a difference because, if you never discuss [the case properly], then you are going to miss the occasional cases." Furthermore, the details of the ideal oncology treatment in vignette 2, including which trials might be suitable, are not agreed upon by the group. Although the patient would still be referred to oncology following surgery if deemed necessary, this aspect of the treatment would not get due consideration from a multidisciplinary perspective—only internally and separately by oncologists. Surgeons pointed out during interview that this left oncology treatment less exposed to wider peer scrutiny. Importantly, this could potentially be problematic for those patients for whom it was unclear whether surgery or oncology was the best first line of treatment as surgeons often step in to make decisions more quickly than oncologists and take charge with a surgical option. Although our focus in this vignette is on the different temporal orientations across a wider group (MDT team), our findings would also suggest that coordination was more conflictual when the clashing temporal orientations were particularly incongruous, such as when one was oriented toward brevity and another toward stretching out time. Further, in situations in which temporal orientations could be flexibly enacted (for example, as by the radiologist) the coordination challenges were less problematic.

Summary. In sum, the problems associated with the fracturing of coordination in both vignettes were common across interdependent tasks. The microlevel dynamics we observed were pervasive, persistent, and consistent across tasks and different activities. Their temporal differences can engender conflict given the preferred temporal rhythms for coordinating tasks with one occupational group having quicker or slower temporal orientations in comparison with another group.

These differences can render common coordinating devices, such as schedules and plans, ineffective as they are drawn on in different ways through competing schemas. In some situations, schedules may be rigidly adhered to, easily improvised, or readily dismissed. Further, there is temporal orientation domination as the conjoint situated activity is controlled through one dominating rhythm that is used in resourcing task coordination. This temporal orientation domination is accompanied by a persistent emotional strain and potential conflict, which may leave consequential aspects of work unresolved.

Resourcing Temporal Orientations Generatively in Coordinating Occupational Work

Although strain and fracturing persisted in the coordination processes, we also found that there were situations in which the different temporal orientations were resourced in a generative capacity to coordinate work. The following three vignettes (1B, 3, and 4) show how resourcing temporal orientations of other occupations provides solutions to situated coordination challenges. A summary of the findings is provided in Table 4.

Vignette 1B (continuing from 1A): Resourcing different temporal orientations to develop new practices:

> The surgeon walks over to a radiologist in the room and asks, "Do you have 10 minutes?" The radiologist nods, explaining he has a few minutes before his next biopsy patient is prepped. "Can you see this patient for [the oncologist]?" asks the surgeon, explaining that the clinic is delayed and there is a backlog of patients (as a result of being dominated by the temporal orientation of the oncologists' slower pace). The radiologist knows the patient, having taken her biopsy two weeks ago and, thus, has rapport. He is pleased to hear that the mass is benign. "All she wants is to go home and celebrate," explains the surgeon. "Can you talk to her, so she doesn't have to wait?" The radiologist agrees, glances through the notes and X-rays then goes to tell the patient about her diagnosis. Forty minutes later, he goes to speak to another patient regarding her benign result, helping to clear straightforward patients through the delayed clinic. The radiologist comments, "The clinics are chaotic; people have such different ways of working that it was hard to put it all together. We need to be flexible in how we do things." Though oncologists were initially unhappy with the change, they did agree that the radiologists counseled the patients well.

Returning to the scenario in vignette 1A, vignette 1B shows how the surgeon mobilizes the radiologist's temporal orientation for being flexible to adapt roles and schedules in the clinic to solve a coordination challenge. In vignette 1A, the surgeon was persistently aware of the lateness of the clinic. In vignette 1B, he mobilizes the flexible temporal orientation of the radiologist to improvise and find an alternative, quicker way of coordinating patient care that no longer solely depends on the oncologist, but on the more available and flexible radiologist. In this way, both slower deliberative and flexible temporal rhythms continue to be harnessed in coordinating the clinic.

As noted in vignette 1B, the surgeon juxtaposes the radiologist's flexible temporal orientation with the dominating temporal orientation of slow deliberation. Their mutual awareness of the situation—late clinic, easy diagnosis, known patient—enabled the surgeon to devise and the radiologist to execute a synergistic coordination pattern, one that they then resorted to on other occasions under similar circumstances. This reorders the past way of working, as radiologists do not normally counsel patients about their diagnosis, and envisions a different present. The specialists mutually adjusted to the evolving situations and continued working in a way that minimized relational challenge and helped achieve task coordination. In so doing, they were able to enact a new practice to support coordination as surgeons improvised in resourcing the temporal orientation from another occupation.

This process of resourcing others' temporal orientations can be an important and effective way to facilitate cross-occupational collaboration and coordinating work. Specialists' common goal of optimal patient treatment and service facilitated a relatively straightforward negotiation of task coordination. This involved a new practice, enacted through the radiologists' temporal rhythm, despite patient consultation being a distinctly new role for the radiologist. In vignette 1B, the initial adjustment is successful and is enabled by the synergy between temporal orientations toward improvisation (surgeon) and flexibility (radiologist) in coordinating patient care. The outcome is a positive one as it helps enable the clinic to finish in a timely manner and with fewer patients kept waiting. Furthermore, the ongoing coordination of the clinic was shaped by both the flexible orientation of radiologists to speed up waiting patients as well as allowing for the slow deliberation of oncologists so that both temporal orientations were integral in coordinating work.

Vignette 3: Resourcing through the new appropriation of patient lists (as coordination device):

> The pathologist thoughtfully notes all the patient laboratory results received since the last MDT meeting. Last week, a patient had been forgotten, and she had had to remind the surgeons about this patient, so he would not "slip through the cracks." The surgeons had appreciated her timely, trusted intervention. She keeps two running lists to organize patient details for this meeting: one list for specimens and requests

Table 4. Resourcing Temporal Orientations Productively for Cross-Occupational Coordination

Vignette	Events	Steps for resourcing
1B Surgeon and radiologist	Surgeon aware of the challenge of late clinic, enacted through oncologists' dominating temporal orientation, and strain being caused	Awareness of coordination breakdown
	The schema for action is that solely clinicians familiar with patients diagnoses provide counsel	Juxtapose different temporal orientation as potential resource
	Surgeon juxtaposes surgical and radiology temporal orientations	Reconsider working in the present by reimagining how flexibility can be engendered in clinics breaking with past roles
	Surgeon reconsiders present concerns while reimagining a future perfect clinic by harnessing the radiologist's flexible temporal orientation	Mutual adjusting by occupations to accomplish a new practice
	Mutual adjustment through empowering relations among occupational team members to organize clinic using a new practice with an expanded role for radiologists because they are also clinicians familiar with patient	
	Overall, more than one temporal orientation is being used to coordinate the emerging clinic as the radiologist flexibly speeds up the flow for some patients and the oncologists maintain their slow deliberation	
3 Pathologist	Pathologist aware of coordination challenge of running the team meeting whereby patients were potentially being missed as different lists became used	Awareness of coordination breakdown
	Juxtaposing two temporal orientations (rigid and improvised scheduling) to envision a new schema for coordinating work	Juxtapose two temporal orientations for resourcing MDT meeting
	Schema shifts from responsible clinicians making sure "their" patients are on the list to pathology taking charge according to all the biopsies they receive	Envisioning possible future meetings using new schema, different from the past schema
	Harnessing surgeon's temporal orientation in improvising meeting schedule to restructure future schedules to become anchored around key pathology events (e.g., laboratory work requests, tissue diagnosis) in resourcing tighter scheduling in meetings;	Mutually adjust through structured schedule in taking action in enacting a new schema
	Mutual adjustment of wider team to new schema's coordination process	
	Overall, team members take up the MDT list in a new way as it now becomes an entity whereby several relevant lists become cross checked	
4 Oncologist	Aware of the groups own frustration for not being able to adequately discuss each case given pace of surgeons	Awareness of coordination breakdown
	Schema shifts from discussing all patient scenarios in MDT meeting to only discussing those who don't fit any agreed protocol	Juxtapose two temporal orientations
	Juxtapose two temporal orientations (keeping brisk pace that extends over to future patients) to envision new coordination process	Shifting focus from the present cases to reimagine possible future MDT
	Mutual adjustment between team members to empower integration of protocols in MDT meetings and a new practice of protocol meetings	Mutual adjustment as team take action to enact new schema
	Overall, they take action by stretching the timing of discussion into different segments so that future coordination could occur through protocols, thus reorganizing the sequence and timing of events	

> coming in and the other for results that have been processed and are outgoing to the referring doctor. Each week, she meticulously cross-checks both lists to ensure they are the same and no one has been missed. She then compares these lists with the list of patients scheduled for the MDT meeting to ensure all relevant patients are included. Having seen too many patients get missed with consequential delays to their treatment, she has volunteered to take charge of a master list. This would entail ongoing cross-checking (detailed fixed temporal orientation) between various lists for the MDT meetings on behalf of surgeons (with dominant temporal orientation of speed and improvisation in running MDT) who do not routinely scrutinize and cross-check their lists. She could then forward this list to the lead radiologist (being flexible) so he can organize radiology scans in advance of the meeting.

In vignette 3, a pathologist has developed a new process to structure the discussion for MDT meetings in a way that ensures patients are not lost in the system, possibly missing treatment. A pathologist commented, that "surgeons are hopeless at getting [list] details right" and indicated that it was "not wise to trust them" with that task. As noted from vignette 2, surgeons readily improvise these lists as patients cancel, get rearranged, or turn up as emergencies, and this results in discrepancies arising as they do not always cross-check the various lists.

The temporal orientation of the pathologist's list checking revolves around a key event, namely getting tissue diagnoses for patients, which anchors the subsequent treatment planning activities of other specialists. Mobilizing the surgeons' temporal orientation for improvising, the pathologist is able to apply a more structured approach in developing the "master" patient list. By harnessing different temporal orientations (rigid and improvised scheduling) the pathologist breaks from the past schema and envisions MDT meetings using schedules and cross-checking lists for coordinating in a new way. The pathologist was, therefore, able to resource two different temporal orientations for enacting a new schema for the practice. The new schema helped to coordinate the organization of the MDT list in a manner that could accommodate ad hoc and late referrals.

Vignette 3 shows how juxtaposing two different temporal orientations to address the coordination challenge enables a new way of organizing patient lists in the clinic. Her temporal orientation focuses her gaze on the lack of rigid detail and fixed method to generating the MDT list. She is able to be generative in reimagining a different future by devising a detailed yet improvised approach to task coordination. In so doing, the MDT list becomes an important coordinating (boundary object) device, which enables the team to mutually adjust to the new schema. Recognizing the useful solution and trusted relationship, surgeons, as the dominant group, were open to adjusting and helped accommodate the meeting to allow for improvisation but in a structured manner. Both surgeons and oncologists commented that with these changes they were "very surprised at how few patients get missed" and that patients slipping through the cracks now "was very rare." This was felt to be quite remarkable given the coordination challenge of communicating across departments in structuring the list.

Vignette 4: Resourcing to stretch time and coordinate work in the present for the future:

> During an MDT meeting, an oncologist noted that common disease profiles were recurring across the discussion of different patients, such that the content of these discussions was overlapping for patients with similar profiles. Frustrated at how this curtailed the ability to discuss adequately and effectively each patient (being enacted through the dominant surgical temporal orientation), the oncologist suggests, "Let's make a protocol for this type of patient." He reasoned that if the team "hashed out the evidence around these common types of patients" now, then it would be quicker to coordinate their care in the future when such patients came to clinic. Others agreed to try this, and regular "protocol development" sessions were set up. The protocols worked across specialist groups. The protocols also flagged patients into relevant research trials, which they all noted would be a good way to integrate research more systematically over the long term.

In this vignette, planning protocols were introduced as a new practice so that when relevant patients were discussed, someone could signal that an existing protocol would cover treatment schedule and relevant trials with little need for deliberation over evidence and fit. Protocols, used frequently by oncologists, are able to organize future activity by apportioning earlier the group's critical thinking needed to structure future actions. Protocols involve careful development of the decision trees around typical cases. Thus, creating protocols requires a lengthy meeting with relevant occupations (now, in the present), which would then form the basis for decisions related to future patients. In this way, the MDT discussion could be sped up by stretching the work coordination across time through protocols and draw on a new schema for meetings. Less time would be required in the MDT to discuss those patients who could be more simply allocated to a protocol with core treatment decisions already in place. This would also mean that there was more time in the meeting for unusual patients who did not easily fit a protocol, a move welcomed by the oncologists. Given the improved potential to support research, surgeons as the dominant group were open to empowering oncologists and the team to try the new approach.

Oncologists, aware of task coordination challenges and strain, mobilized the temporal orientation of the surgeons to envision a faster way of running the meetings. Juxtaposing the two temporal orientations, they envisioned a schema for stretching (present) time to coordinate in the emerging present for the future. The oncologists juxtaposed their future-oriented approach to decision making with the surgeons' orientation to brevity and problem solving in the present to reconsider the present challenges of the meetings. Thus, the team's new practice organized patient types into standard protocols in advance of seeing actual patients and, in this way, had much more time to sift carefully through the evidence across the range of specialist groups and confirm agreement for various courses of action. Although some patients did not neatly fit into any standard protocol, those who did could be swiftly acted upon with several months of treatment plans set up in advance. Further, the vignette shows that the schedules and plans as important coordination devices were not necessarily externally predeveloped and imposed but rather emerged from a new schema and developed through mutual adjusting of meetings in the present in anticipation of future needs.

Summary. In sum, our findings highlight that there were generative situations in which discrepancies in temporal orientations were resourced productively. In these situations, the dominant group empowered others to participate in solutions to coordination challenges. We refer to this productive resourcing of temporal orientations as *temporal resourcing*, whereby occupational members are empowered to enact new schema and new practices as solutions to coordination challenges. By resourcing different temporal orientations to facilitate cross-occupational collaboration, members become aware of how resourcing mechanisms could productively harness differences in temporal orientations. Resourcing approaches involve juxtaposing two or more temporal orientations to understand the temporal dynamics underlying the coordination challenge in developing a new schema for the existing activity or a new practice altogether. It may convene around an action with which the person is directly involved in the current situation, such as the radiologist taking on a new role in the late clinics. Alternatively, it could involve empowering a wider collective level of action, such as the overall process of MDT decision making and how future coordination could be supported through making protocols in advance. Mechanisms of mutual adjusting take place by dominant occupational members recognizing and empowering others in developing new practices to achieve new or existing schemas. These require reconsidering present concerns and linking them to a different future, breaking from the past as they envision improved coordination.

Discussion

Temporal Structuring and the Materiality of Occupational Work

Earlier literature recognizes that time is structured through ordinary activities and people's everyday engagement in the world (Orlikowski and Yates 2002, Reddy et al. 2006). This perspective emphasizes that organizational time is shaped by people's practices (Orlikowski and Yates 2002) with consequences for organizational efficiency and processes of organizational control (Reddy and Dourish 2002, Reinecke and Ansari 2015). We build on this literature by showing how and why *occupations* develop their own unique temporal structuring, which deeply affects the dynamics of how they coordinate work. The temporal structuring of occupational practices not only involves specific tasks of organizational work (e.g., units and departments) and broader temporal rhythms (Zerubavel 1977, Reddy and Dourish 2002), but also how occupational members respond to and the urgency with which they temporally orient themselves to the complexities and emerging situations of organizational life. The temporal structuring of their occupational work shapes the reality of how these occupations experience knowing (Polanyi 1958) and predisposes them to have a certain cadence in their actions without perceiving them as conscious choices. These temporal distinctions sharpen the boundaries between occupational groups as they perceive differences in how each other responds to emerging situations. We suggest that differences in temporal orientation contribute to forming and maintaining occupational boundaries, adding to the hitherto focus on social distinctions between occupational groups. This deeper understanding of occupational work is important because occupational categories of work retain significant prominence in the modern labor market (Barley and Kunda 2004, Gorman and Sandefur 2011), and their practices often span multiple organizational entities (Orlikowski 2002, Beane 2019).

As a related contribution, we add to the literature that highlights how the temporal complexity in many organizational contexts makes it challenging to reconcile the multiple rhythms ordering daily work activities (Reddy and Dourish 2002, Reddy et al. 2006, Lindley 2015). For example, diverse orientations to time have been noted in relation to the urgency of the specific task at hand as well as the temporal horizons around which an individual's activity is arranged, such as the length of an individual's shift (Reddy et al. 2006). Our findings contribute by showing that the temporal structuring of some occupations' work can orient members to be more adaptable to the emerging

temporal needs entailed in coordinating cross-occupational work. Their conscious monitoring of external cues in others' practices can play an important role in how flexible these occupational members are in coordinating work. For example, occupations (e.g., radiologists in our study) may have a flexible temporal orientation to time, developed through the temporal structuring of their particular practices. As these occupational members make sense of the cues in emerging work coordination, their temporal orientation can enable them to synchronize with others more easily and support the entrainment of collaborative activities. However, for other occupations, their members may be more rigid in their temporal orientation with their temporal structuring oriented to being fixed to clock time and thereby having more difficulty accommodating sudden changes to their schedule. Such occupational workers may, therefore, be less able to accommodate multiple temporal rhythms in coordinating cross-occupational work.

Further, recent work has called for a deeper understanding of how objects and materiality influence occupational practices (Orlikowski 2007, Nicolini et al. 2012). For example, diverse materialities can shape dispositional habits so as to exert a form of control over the worker (Michel 2011, 2014). We build on these insights by highlighting explicitly how the distinct materialities of occupational practices shape and are shaped by their orientation to time as occupational members are socialized and subsequently work in silos over extended periods of time. These mundane aspects of everyday work are not necessarily limited to select objects (Carlile 2002) or specific occupations (Sennett 2008), but are integral to all occupational practices. Material artifacts, such as tools, equipment, and technologies, can become extensions of the body (Tsoukas 2005, Chia and Holt 2006) influencing how knowing and actions become temporally connected as materials are used prereflexively during ongoing practice. In this way, the history of how the array of material artifacts has been used in past practice form a continuity for how occupational members orient to time in the present and future. This continuity of material artifacts shapes how ongoing situated practices are enacted in everyday occupational life and rhythms of work.

Temporal Orientations and the Fracturing of Coordination

Previous literature emphasizes how coordination challenges persist in work that spans across multiple occupational groups (Okhuysen and Bechky 2009, Barrett and Oborn 2010, Kellogg 2014, Anteby et al. 2016). A particular focus to date has been on how a lack of cognitive understanding, interpretive insight, or shared meaning (Bechky 2003, Carlile 2004) can hinder knowledge integration and contribute to challenges of boundary work. This type of disruption to coordination is particularly pervasive in knowledge-intensive work (Okhuysen and Bechky 2009), in which insight into meaning is fundamental to integrating a holistic understanding of work (Bruns 2013).

Our insight of fracturing coordination goes beyond a cognitive or knowledge focus in contributing to why coordination is challenging across occupational boundaries. Specifically, we show how and why differences in occupations' temporal orientations influence relational dynamics in a way that reinforces tension and social boundaries between occupational group members. In coordinating work, individuals are challenged to adapt their workflows to the pacing and timing of others. The ongoing interactions of interdependent collaborative work bring to the fore recurrent clashes and potential conflict. In these cases, one temporal rhythm dominates and takes over so that tasks can be synchronized and coordinated. Emotional strain can arise from the sense of domination by one occupational member's temporal rhythm as well as from the various aspects of work that are left unresolved as a result of the disruptions and breakdowns.

The fracturing of coordination arises from the recurrent strain and potential conflict between occupational groups engaged in coordinating collaborative work. These negative coordination dynamics can manifest in ongoing relational strain between the occupational groups and may contribute to conflict as frequently observed empirically in cross-occupational work (cf. Nicolini et al. 2013, Kellogg 2014, Venters et al. 2014, Anteby et al. 2016). Our findings highlight that this ongoing recurrent strain may be a consequence of temporal orientation dominance involving a co-opting of one occupational rhythm without broader awareness of how other temporal orientations might provide insight into a different way of enacting the situation. During this fracturing process, the domination of one temporal orientation arises from the powerful occupational group retaining control of the rhythm of the joint work, having the power to ensure their schema for the task at hand is enacted by all. Such domination ensures a narrow focus on the task being completed with little deviation from the current practice rather than engendering wider circumspection for accomplishing the joint work in another way.

Our insights on differences in temporal orientation and fracturing of coordination contributes also to our understanding as to how breaches occur between occupational groups. Specifically, we show how, as a consequence of an occupation's dominant temporal orientation setting the pace for task coordination, breaches in expectations related to a preferred pace and rhythm of work recur during work coordination. In addition to breaches being linked to specific

role-based activities (Heaphy 2013), our findings show that breaches can also occur when coordination of a work activity is fractured through temporal dimensions of agency (Emirbayer and Mische 1998). That is, coordination in the emerging work situation is necessarily occurring in the present as ongoing adjustments are needed to synchronize activities. Yet the present is not experienced in the same way for all occupations involved in the wider collaborative effort as reinforced by their distinctive temporal orientations. The potential rifts caused by these differences in how temporality is experienced can raise breaches in expectations as to how activity is best accomplished. For surgeons, the present was very precious and should not "be wasted." Their impatience was linked to this precious and intense view of the present. Our insights on impatience connect temporality with a dimension of emotions inherent in strain during cross-occupational work. Impatience arose out of their sense of responsibility because they perceived the (precious) present to be closely linked to the life and death of their patients. Therefore, being directed to work at a different rhythm or pace can become a breach in their expectations arising from their own temporal orientation. This becomes an interrupted social order, which may lead to relational strain in ongoing social interaction.

Relatedly, our findings suggest that unpacking the temporal complexity of how the present can be experienced in situations adds further insight into the role of temporality in coordinating work. We build on recent research that emphasizes the significance of understanding the emerging present as being richer than a compressed "moment" between an expansive past and future (Kim et al. 2019). We highlight the importance of how temporal differences in the emerging present are perceived and enacted by different occupational members. We suggest that fracturing of coordination may arise from a focus on interactions around a compressed present as the dominating temporal orientation constrains the possible experiences of time into a single uniform pattern and may tend to close off alternative schemas for organizing. In these situations, a negative spiral of strain develops with the failure to resource the diversity of temporal orientations in how the present situation is being experienced. Specifically, it does not allow for an expanded and stretched depth of the present to widen the scope of possibilities for coordinating the emerging situation.

For example, both vignettes 1 and 2 demonstrate a competitive trade-off approach to a dominant temporal orientation guiding interaction. Thus, there was a perceived trade-off between the surgeons' pragmatic, hurried approach to running the MDT planning meeting and the oncologists' more protracted and lengthy approach. However, as we discuss, this trade-off may not be necessary. During situations in which there is a productive resourcing of diverse temporal orientations for work coordination, the temporal work involved serves to extend the present into the future, what Kim et al. (2019) call a "long present." In this way, the current concerns can be reconsidered in light of a different possible future opening up potential insight into a new schema and new practice. Instead of a competitive trade-off, coordination may be achieved through an integrative "both-and" approach. Extending the present enables the individuals concerned to apprehend new resources that might be used to enact the same practice in a new way or enact a new practice.

Temporal Orientations and the Productive Coordination of Work

Previous literature focuses extensively on the negative relational dynamics between occupations and how these contribute to the difficulty of coordinating across groups (Kellogg et al. 2006, Okhuysen and Bechky 2009, Anteby et al. 2016). These coordination challenges can be mitigated through the use of objects (Carlile 2002, Bechky 2003) or by attending to the common priorities of conjoint activities (Reddy et al. 2006, Faraj and Xiao 2006).

We contribute new understanding as to how to address these challenges through the productive resourcing of temporal orientations. We develop a temporal dimension to the resourcing lens (Feldman 2004) in providing insight into potential problem solving around processes of disruption. The resourcing lens (Feldman and Worline 2016) is particularly valuable in recognizing and challenging long-standing assumptions. Resourcing can be generative in focusing on how new ways of working arise. More specifically, we demonstrate how temporal resourcing entails *taking action* that turns time orientations into a resource for productive collaboration. Thus, rather than focusing on current strain, resourcing foregrounds how new practices and new schemas become possible. For example, Feldman and Worline (2016) show how long-standing assumptions about how financially viable loans to poor people become challenged. Although the current practice assumes that the poor are unable to access financial loans because they lack material collateral, resourcing can spur access to new schemas that allow for the creation of groups as a community of social collateral whose members are accountable for one another's loans. In our collaborative MDT case, occupational members may become increasingly cognizant of the disruption related to their different temporal orientations and the ongoing coordination of their collective work. Awareness of disruption related to the fracturing of coordination provides an opportunity for members

to consider new schemas or frameworks for action. Through productive temporal resourcing, different temporal orientations can be harnessed using three interrelated mechanisms, namely *juxtaposing*, *temporal working*, and *mutual adjusting*.

New schemas are made possible through the *juxtaposing* of temporal orientations by members in addressing the breakdown of coordination. Juxtaposing, which involves placing "close together or side by side" (Feldman and Worline 2011), can enable a member of one occupational group to mobilize the temporal orientation of another occupation group in resourcing a new schema. In providing a mechanism for resourcing an alternative way of coordinating work, the dominant rhythm synchronizing the coordination effort is not only challenged (as in vignette 3), but may alternatively be complemented by augmenting one or more rhythms running in parallel (as in vignette 1B).

Second, temporal orientations are important to consider as potential resources because they draw from the past (being formed in and through extensive learning) in the emerging present situation to envision a possible future. Means by which actors (re) construct connections between the past, present, and future is a form of temporal work (Kaplan and Orlikowski 2013). Such *temporal working* provides another mechanism for resourcing work coordination. Specifically, by resourcing the discrepancies between the temporal orientations of occupations working together, the dominant temporal orientation is necessarily challenged. This allows for a new schema for the emerging situation to emerge. Thus, not only does the emerging situation provide new resourcing possibilities, but temporal working makes new connections between the past practices, present concerns, and a reimagined future to render possible an alternative schema for work coordination. In so doing, strain caused by the disruptions can be alleviated. In this sense, the temporal working enables inventiveness and reflective choice in relation to possible schemas for action. Further, as our case shows with the resourcing of protocols by oncologists, the coordination of work can become stretched across time so that future work can become partially coordinated in the present.

Finally, *mutual adjusting* is an important mechanism by which the wider team of occupational members adjust their actions to accommodate a new schema for coordinating work and cross-occupational collaboration. Developing new coordination devices (such as lists or schedules) or using existing ones in new ways can help support the ongoing adjustments needed for coordination. In this way, our temporal perspective foregrounds not only the recursive interplay of resources in use and the new schema, but highlights the importance of understanding the wider set of actors involved in the subsequent mutual adjusting to the new schema. Collectively and at different times, they are able to question the current schema for activity and reimagine how work might be coordinated differently. Tuned to other possibilities, therefore, actors can be empowered to take concerted action and enact a new way of coordinating work through an alternative temporal perspective to that of temporal brokerage (Reinecke and Ansari 2015). Instead of focusing solely on mediating between conflicting temporal orientations, attention is paid as to how the recomposing and switching between temporal orientations provides, in and of itself, a resource for coordinating work.

Conclusions

Our paper contributes a temporal perspective to the coordination of cross-occupational work. We add an understanding of how the temporal structuring of occupational practices and their temporal orientation is shaped in part through the different materialities used in the occupation's work. We highlight the varying and competing temporal structures of occupational practices and how these can shape temporal orientations with consequences for work coordination. Although the resourcing of occupational members' diverse temporal orientations can constrain how collaborative work is done and lead to what we call the fracturing of coordination, our study highlights also the potential to resource different temporal orientations to generatively develop solutions to coordination challenges.

Our findings have important implications for management. First, they suggest that those responsible for supporting work in contexts that require coordination between different occupational groups should be aware of how their various temporal dynamics may influence task coordination. Specifically, managers could usefully develop a nuanced understanding of occupations' temporal orientations in their particular context and how the resourcing of their differences may influence coordination processes. Second, they might also consider the temporal orientations of workers when selecting members of an interoccupational team. For example, they can be attuned to the potential clashes in orientations to time and how this can influence team dynamics. Additionally, managers can consider individuals' different temporal orientations when apportioning group-specific tasks; for example, those entrusted to specific tasks (such as reinforcing deadlines) should ideally be from an occupation with temporal orientations appropriate to the tasks at hand.

In closing, we note that, although our study is based on an in-depth case in the healthcare context, future research on temporal perspectives in coordinating cross-occupational work could be usefully expanded

to other professional or craft-based contexts of work. In particular, we suggest that it would be fruitful to study other ways in which differences in temporal orientation can be resourced and how power structures between occupations may shape temporal dynamics of coordination. Furthermore, our study provides some preliminary links between temporality and emotions, such as those discussed around impatience or being hopeful of the future. Further research could usefully develop our understanding of this relationship and its consequences for coordination.

Although the usual caution of generalizability from a single case study holds in our case, we suggest that our insights on a temporal perspective of coordination in cross-occupational contexts may be transferrable to other contexts. For example, in an academic context, these concepts and theoretical developments may be useful to sensitize individuals to the differences in temporal orientations between administrative staff and faculty. Appropriate training on a temporal perspective could be usefully developed to enhance cross-occupational work coordination by understanding different temporal orientations and resourcing mechanisms of *juxtaposing*, *temporal working*, and *mutual adjusting*. Relatedly, the call for impact and responsible research may be better achieved through a nuanced understanding of how differences in temporal orientation can be resourced along with an understanding of power relations between academics, practitioners, and policy makers. These developments can contribute to more effective cross-occupational working, together with engendering improved coordination within our own academic field.

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Appendix. Interview Questions: Template Used in Fieldwork (Emphasis in Questioning Varied According to Timing in Field and Interviewee)

1. Discuss purpose of fieldwork and confidentiality.
2. Professional practice (in varied order):

- How do you perceive your role on the team? What do you do as a [radiologist]? How did you learn [radiology practice], and what makes a [good radiologist]?

- What is the most important part of your work? Are there particular roles/actions that patients (or others) perceive are expected or required?

- How are [other professional group] different from [your professional group]? Why? Where do these differences come from?

3. Multidisciplinary team (MDT):

- What is the purpose of the MDT? Goals? Who do you work the most closely with?

- Which specialties do you work the least with? What boundaries are most evident in this practice/team?

- What are the key difficulties with multidisciplinary teamwork? How would you change this MDT?

4. How has the team changed since its inception (historical reconstruction of team development and critical incidents)?
5. How is knowledge shared between disciplines? What impact has teamwork made on your knowledge and learning?
6. Collaboration in putting together a patient treatment plan and further aspects of knowledgeable practice:

- What hinders good collaboration between professionals on the team? What enables good collaboration between professionals on the team?

- How do you know if a clinician in another specialty is a good one and is effective in their work? How does the MDT affect your [radiology] practice?

- How involved is the whole team in decision making?

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