Collaboration in Isolation: Bridging Social and Geographical Boundaries in Two Rural Technology Firms

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Abstract

Little attention has been given to understanding how technology is used to bridge social and geographical boundaries between metropolitan and rural firms in developed nations like the United States. In this paper we draw on theory from social worlds to contrast the introduction and integration of collaboration technologies in two small (23-53 employees) rural technology firms in the Midwestern US. We report on a three-year ethnographic study of the work practices and technologies used to forge relationships between distant offices and customers at each firm. Data include participant observation, field notes, memos and interviews with 71 informants. Based on our data, we identified organizational facets of geography, socio-technical configuration and collaboration practices as instrumental in the formation of working spheres [31] for members of each firm. As the facets of each firm change over time, our data show social, organizational and technical practices lead to different types of virtual organization at each firm. One firm's working spheres coalesce, while the other firm's working spheres split. We show that small firms operating in rural areas experience unique social and geographic boundaries in their development as virtual organizations.

Keywords: rural technology, distributed work, social worlds, CSCW

Introduction

Small technology firms in rural regions are developing new forms of virtual organization by using information and communication technologies (ICTs) to collaborate with metropolitan partners and customers. These firms bridge long standing social and geographic boundaries between metropolitan and rural areas (Williams, 1973). Physical distance is the most defining characteristic, but the social distance between rural society and urban society is an ever present and under examined phenomena (Malecki, 2009; Williams, 1973), that the socio-technical frame of information science is uniquely positioned to address.

There are many case studies documenting the first mechanism of virtual community (Bers, 2001; Blanchard & Markus, 2002; Ellis, Oldridge, & Vasconcelos, 2004; Gabriel, 2004; Healy, White, Eshghi, Reeves, & Light, 2007; Rohde, Reinecke, Pape, & Janneck, 2004), and an equal number that shed light on the collaboration practices of nomadic and geographically isolated individuals who connect to an organization from afar (Gloor, 2005; Gutwin, Penner, & Schneider, 2004; Mark & Su, 2010; Scacchi, 2007; Turner, Bowker, Gasser, & Zacklad, 2006). A small number of studies focus on the influence of ICTs on economic and social development at the scale of a nation or region in the undeveloped world (Ali & Bailur, 2007; Friedman, Kahn Jr, & Borning, 2006; Mark, Al-Ani, & Semaan, 2009). Literature in MIS is replete with studies of large firms outsourcing operations. The use of ICTs to overcome or at least mitigate distance is a theme that runs through each research community (Olson & Olson, 2000). However, there are no prior comparative socio-technical case studies of the uptake and use of ICTs by small firms located in rural areas.

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Small, isolated rural firms are an important type of case for socio-technical researchers because these firms, out of necessity, have to construct complex *working spheres* to span these social and geographical boundaries. A *working sphere* is composed of a collocated team, a distributed team and an organizational structure (2004). The two firms in this study consist of collocated teams located in rural regions of the US, whose customers are distributed teams that are located in both metropolitan and rural areas. How the working spheres in these firms use ICTs to overcome traditional social and geographical boundaries stretches our understanding of virtual organization and the role of geography. More widely, the economic development plans of scores of communities around the world (Maitland & van Gorp, 2009) will benefit from examples of firms connecting metropolitan and rural areas. Understanding how these firms overcome traditional barriers is therefore of immediate value to both citizens and scholars.
In this paper we analyze two ethnographic case studies of rural technology firms in the Midwestern United States. We also describe how understanding distributed work practices in firms with different geographical and economic traits might inform our understanding of virtual organizations more generally.

Related Work

Defining Rural

In this section, we define "rural" more precisely, and contrast the distinct views of technology adoption found in regional studies and organization science literature. Gilligan (2005) critically examines rural adoption and use of ICTs by exploring what we mean when we say "rural", and how rural sociologists define "rural" as at least partly a social construction. "Rural" is a category of thought, viewed as unwavering against the forces of change and time, while "urban" is a category of thought which marches forward and defines the next age. These categories influence perception of a region. Gilligan (2005) found that ICT uptake and use varies greatly in rural areas, and greatly according to the specific technology; but perception of uptake is uniformly lower for rural areas, even in cases where uptake is rapid.

To tease out differences between specific rural areas, regional studies literature focuses on ways to measure and classify degrees of "rural". In the United States, where the two firms we examine are located, a standard measure of rurality is metropolitan influence, which the United States Department of Agriculture (USDA) prescribes as a continuum of 1 (most metropolitan influence) to 12. Comparing Gilligan's social construction of rural on this continuum, we see "1" reflects an "urban" social world, and 2-12 reflect increasing levels of social "ruralness". When we talk about rural, we are referring to these classes, 2-12.

Organization, Region and ICT

With few exceptions (Tapia, 2004), prior studies of collaborative computing tool adoption take metropolitan infrastructures, social configurations and lifestyles as a given. The organization science literature includes analysis of how ICTs are taken up in large, complex organizations (Mark & Poltrock, 2004; Orlikowski & Barley, 2001; Finholt & Sproull, 1990), how this use reframes and restructures power and roles (Barley, 1986; Nardi, Whittaker, & Schwarz, 2002; Eschenfelder, Heckman, & Sawyer, 1998; Lamb, King, & Kling, 2003), and how work groups are constituted in technologically mediated ways (Brown & Duguid, 1991; Keisler & Cummings, 2002; Olson & Olson, 2000; Muller & Gruen, 2005).

Regional studies literature often restricts its analysis to observations outside the boundaries of specific firms. Measurements are chiefly macro-economic, and the internal characteristics and practices of different firms are unexamined. In regional studies research, technology appears in terms of the "digital economy" and the "analysis of ICT diffusion into isolated communities" (Hollifield & Donnermeyer, 2003). For instance, Malecki & Moriset (Malecki & Moriset, 2008, p. 200) define the digital economy as the pervasive use of ICTs. Moriset argues that networked connections to metropolitan areas, combined with widespread availability of ICTs make rural technology firms likely to succeed (2003).

In contrast to Moriset's optimism about the future of rural technology firms, there is evidence that pioneers in this space struggle (Malecki & Moriset, 2008, p. 200). Rural firms must overcome the social

and distance barriers described above. Some concern exists about an urban-rural "digital divide", but this is a home access gap, not a business access gap (Horrigan, 2009). Engaging the digital economy requires rural areas to overcome the intrinsic penalty that arises from their isolation, and perception of scarce human capital is the most limiting factor (Malecki & Moriset, 2008, p. 11). The rural human resource gap includes genuine labor scarcity and perceived scarcity, depending on the region in question (Henderson & Abraham, 2004).

Technology firms that thrive in rural communities have to overcome social, geographical and resource barriers, but how they do so is unexplored. A reflexive study of technology uptake and use by rural technology firms will fill important gaps in two research communities where collaborative computing plays a pivotal role. Such firms grow quickly, are dynamic, complex and highly distributed; the embodiment of virtual organization and rural economic impact. Malecki (2008) characterizes firms who locate in smaller economies and bring money in from metropolitan areas as sophisticated consumers of space.

Previous Inquiries of Distributed Work Teams

Rural work teams interact with groups in their local office, customer groups, and groups at other offices. Faced with distributed work inquiries similar to ours, past researchers have used *social worlds theory*, *communities of practice* and *ensembles*, a proposed additional analytical level in Activity theory. In this section, we briefly review the application of each of these theories in prior studies of distributed work teams.

The development of virtual workgroups within the same organization *vis a vis* ICTs is explored by Mark and Poltrock (2004), who examine instant messenger adoption across locations within a single organization. Their study focuses on firms recently merged into Boeing using the construct of social worlds (Denzin, 1978). They use Clarke's (1991) definition of social worlds: *groups with shared commitments to certain activities, sharing resources of many kinds to achieve their goals, and building shared ideologies about how to go about their business*. Each member's workgroups are framed as distinct *working spheres*, which are a special type of social world that focuses on the work of the organization.

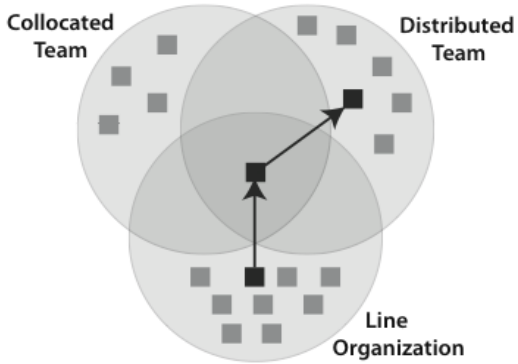

Figure 1 - Mark & Poltrock's (2004) working spheres

Explaining their construct of working spheres as an extension of social worlds, Mark and Poltrock (2004, p. 305) point out that it frames the study of distributed, highly virtual organizations without the premise of the intricate and longitudinal mutual engagement required by Communities of Practice (Wenger, 1998). Further, *working spheres* incorporate the local characteristics of each group more directly than social capital theory (Coleman, 1988) or social network analysis (Granovetter, 1985; Wasserman, 1994).

Technology can also take a more central role in adoption studies. For example, activity theory creates space for the role of technologies and artifacts in distributed work and is used to frame CSCW and HCI research. Many researchers struggle with dynamic group work and whether to classify aspects of it as either action or activity. There are limitations to how action or activity may "*account for the way individuals in practice conceptualize, delimit, and represent those practical intermediate units of work that*

allow them to instantiate their activities through sets of thematically connected actions" (2009). In an effort to apply activity theory to more dynamic group constructions where work efforts encompass actions but are not as clearly object related as activities, Gonzalez, Nardi & Mark (2009) explicate the construct of ensembles. In this conceptualization of activity theory, an ensemble is an *"intermediate unit of work between actions and activity in the hierarchical framework proposed by classical activity theory"* (Kaptelinin & Nardi, 2006).

Ensembles are sets of thematically related actions defined by a purpose (Gonzalez et al., 2009, p. 110), and in this way are more adaptable than standalone concepts like *working spheres*, projects and tasks. Ensembles help to make actions meaningful beyond their immediate scope, and serve to make workloads visible within teams -- both powerful explanatory attributes in the study of virtual teams. When groups lack intimate, longitudinal relations, as many of those examined here do, *working spheres* is more salient.

Literature Summary

Working spheres and ensembles are constructs that contribute a theoretical frame to the study of collaboration in rural technology firms. Each is applied in established, structured organizations and demonstrates the explanatory power of good theory. This study is informed by these theories, but takes a reflexive stance toward the data.

The rest of this paper is structured as follows. In the next section, we describe the field setting and research methods in greater detail. Following that, we compare and contrast the two firms from three perspectives: geography, socio-technical structure and distributed work practices. Throughout that section we describe how distinct forms of virtual organization develop in each case, and how these developments are influenced by degrees of isolation and business model. Implications for research and practice are presented at the end.

Case Descriptions and Methods

Rural Technology Firms

In this paper we examine two cases of virtual organizations that emerge around two firms in rural, Midwestern US communities. The first organization, Medium-City-Co (MCC), is in a small city, and the second organization, Small-Town-Co (STC), is in a small rural town. From 2006 to 2009, we conducted ethnographic research at STC, and extended this study to daily observation of the work at STC for 8 months in 2009. The two firms we select generate at least 70% of their revenue from outside of their immediate area, indicating significant ongoing connection with metropolitan areas (1996).

MCC and STC are smaller than the organizations Mark and Poltrock (2004) examined and have different pressures, but they do share geographic isolation as a defining trait. MCC and STC experience social and distance barriers between nodes in a virtual organization, but also as a more absolute isolation from modern, metropolitan economies.

Field Setting: Situating the Cases

The nature of each firm's location is material to each case internally, and integral to the comparisons we draw between the cases. MCC's main office is located in a small city with a population ~90,000, located 100 miles from the nearest city with over 150,000 people. STC is in a small town with a population ~4,000, located over 200 miles from the nearest city with over 150,000 people. Our data collection and analysis incorporated all locations for each firm, as summarized in table one.

Table 1 - Study location summary (December, 2008 Census)

	Rurality[1]	People
Medium-City-Co Midwest	2	20
Medium-City-Co West	2	3
Small-Town-Co HQ	9	35
Small-Town-Co Satellite 1	5	7
Small-Town-Co Satellite 2	2	9

MCC was founded in the early 1990's in a small, Midwestern college city of less than 100,000 people, more than two hours from the nearest metropolitan area. Their principle, current business is a hosted, educational software product. Between 23 & 25 people worked at MCC during the study period. STC was founded in 2004 in a small Midwestern US town of less than 5,000 people, more than three hours from the nearest metropolitan area. STC was conceived from the beginning as a company that would move technology jobs from large metropolitan areas to rural communities; its revenue is from IT outsourcing. Employment at STC has ranged from 8 to 53 employees during the period of our study. STC's main business is IT outsourcing.

Management and organizational structure at both firms is centered on the single entrepreneur who started the company. MCC's proprietor is Horace, and STC's proprietor is Alan. Each location has an employee responsible for administrative tasks, but most work at both firms is organized in small, self-directed groups of 3-5.

Methods

The principle data collection method was ethnography. Organizational ethnography, particularly if carried out with a significant longitudinal dimension, is capable of generating richly textured data on organizational members' daily working practices, leading to insights into wider organizational culture and behaviors, such as organizational responses to changes in technological environments (Barley, 1986). From 2006 to 2009, we conducted ethnographic research at STC, and extended this study to daily observation of the work at STC for 8 months in 2009. Between 2005 and 2009, we conducted ethnographic research using participant observation, interviews, and documentary analysis to build a rich understanding of the social, working and information spheres of these two technology firms. From 2005 to 2008 we participated several days a week for 40 months in daily operations, meetings and organizational functions at MCC. In both cases we conducted and recorded interviews, observed meetings, and maintained field notes and memos. For data analysis, we followed LeCompte & Schensul's (1999) guidance for the interpretation of our ethnographic data. In the field, our data analysis focused first on description of how each organization worked and how members made sense of the socio-technically constructed relationships with distant partners, customers and locations.

At both sites our "in the field analysis" integrated a constant awareness of the "hermeneutical process" principle. The hermeneutical process foregrounds a constant consideration of the interdependent meaning developed through interaction with and interpretation of the environment. This process is central to our analysis and the experience of the organizations we studied. Out of the field, data was analyzed first from the bottom up using a grounded theory approach. The socio-technical facets we identify later in the paper emerge from this coding. The data was then analyzed from top down using a coding scheme for organizational traits, identified initially during our bottom up coding. The facets of geographical isolation emerge from these codes. Constant comparative analysis was used to surface the socio-technical facets and unique work practices that distinguish the two cases.

Interpreting and contrasting these case studies from a socio-technical practice perspective involved drawing on three methodological approaches. First, grounding our understanding of what each

[1] USDA categories, numbered 2-12 for rural areas

organization member did at work was accomplished through extended, daily participation as a member of each organization, in the ethnographic research tradition. Second, accounting for relationships with local organizations, customers and distant offices was accomplished through participation across this range of the organization. Third, through regular analysis of our data in the field we ensured that changes in socio-technical practices over time were recorded, noted and surfaced in this analysis.

Results and Analysis

This comparative case study shows how social and geographic barriers are bridged and circumvented by small, rural firms. Based on our data, we identified organizational facets of geography, socio-technical configuration and collaboration practices as instrumental in the formation of *working spheres* (2004) for members of each firm. We describe these in the sections that follow. As the facets of each firm change over time, our data show social, organizational and technical practices lead to different types of virtual organization at each firm. MCC's *working spheres* coalesce, while STC's *working spheres* split. This is woven into the three sections below, and illustrated in figure 2.

Figure 2 - Medium-City-Co (left) and Small-Town-Co (right) high level Working Spheres differences

Facets of Geography

The grounded theoretical coding and analysis of the field data (Glaser & Strass, 1967) led to the identification of the core category of 'geographical isolation' as being central (in both positive and negative ways) to the behavior of both firms. Further analysis and coding of this core category led to the identification of 3 subsidiary (or 'axial') dimensions, which were found to be important for each firm.

Physical Workspace

Both firms benefited from low cost office space, compared to large metropolitan areas. In the case of MCC, between three and five employees operated out of basement headquarters during the first four years of operation. In the fifth year the firm moved into leased commercial space where it remained through the period of our study. STC's startup operation required no physical space initially, and within six months the firm was working out of commercial office space. MCC's physical space costs were 30% of what they would have been in a large metropolitan area; STC's were 25%. These fixed costs of growth in more isolated regions were lower, and both proprietors indicated that this influenced their perception of risk, compared with comparable metropolitan operations. Lower costs were a positive feature of isolation.

Worker Mobility

Worker mobility in small cities and small towns takes on a uniquely protective flavor in the two cases. While "no competition agreements" are common in engineering and technology professions in the

USA, the specific cost damage clauses for these two firms is punitive, suggesting a perceived threat not simply of the loss of an employees utility, but the potential generation of a new and particularly dangerous local, competitive threat. For example, MCC's agreement calls for a $1,000/day penalty for each day a former employee works for a customer or competitor for two years after employment ends.

Unlike metropolitan firms, where the primary threat of worker mobility is employment with a rival or customer, the threat perceived by technology firm proprietors in isolated areas is more akin to the threat of property loss. For both firms, the no-compete agreements restrict employment within a 50-100 mile radius of the organizations offices. The enforceability of such agreements may be debated in other forums. The act of reading and signing the agreement does, from interviews with both firms' employees, create a clear impression of the boundaries of post-employment behavior in these isolated regions, and influences decisions about when and under what circumstances employees choose to terminate their employment.

The Vital Network

A third distinguishing characteristic in the experience of isolated technology firms, in contrast with their more metropolitan counterparts, is that MCC and STC rely on technological network connections to the world beyond their region to perform work. This shapes their *working spheres* in two distinct ways. First, at both firms operations literally cease if there is an interruption in the network connection between the firms and their geographically dispersed customers. Second, the significant relationships that develop with customers and across firm sites are fundamentally socio-technical. Teams work together at the same time, in different places, almost exclusively through ICTs.

Socio-Technical Configuration Facets

In this next section, we describe the combination of internal practices and technologies that these firms developed in response to this isolation. Each firm developed its external relationships in a way that reflected the intersection of the firm's isolation, business model and available technology. We describe these distinctions as 'socio-technical facets.' While the external socio-technical facets are distinct, the two firms share many socio-technical facets corresponding with internal, interoffice communication, coordination and information sharing. However, their communication practices vary widely, and it is the external forces that drive the key differences in these latter socio-technical facets. First, therefore, we examine and discuss the primary, common internal socio-technical facets. Second, we discuss how customer needs drive differences in the customer facing socio-technical facets for each organization.

Common Internal Socio-Technical Facets

As distinct as the socio-technical facets are outside of their locale and boundaries, these two isolated technology firms built their interoffice connections with a common arrangement of technologies. For synchronous communication, each firm uses a combination of Skype and Microsoft Instant Messenger. Instant messenger is used for interruptions between employees and Skype is used for planned interoffice communication. To coordinate tasks, both firms relied on a common set of tools as well. During project initiation, a hosted software product called Basecamp is used to develop task lists and assignments. Once a project is launched, both firms use a tool called FogBugz to manage requests, assign work and communicate with internal technology workers and customers. Not surprisingly, these common technology choices, which emerge from Internet searches for software management tools, are adopted in different ways and play different roles in each firm.

External Customer Differences Drive Faceting

One socio-technical factor that shaped the adoption of information technologies (particularly groupware) in different ways in each firm was the relationship between each firm and their customers. In this section, we start to see how the use of ICTs in work practice was both shaped and shaped by the

working spheres of each firm in different ways. These socio-technical facets are a significant influence on the way each firm constructs a virtual organization that incorporates the firm and its customers.

For MCC, the key socio-technical facets are “emotionally safe communication”, “scripting interactions with customers” and a stable set of collaboration technologies. MCC provides a service that the customers rely on, but do not understand; a subscription based, hosted software product that now serves over 30 colleges and universities. Strategic use of ICTs enabled this line of business to grow without requiring travel to client sites for sales, installation or support. For most of these 30+ software-as-a-service customers, the software configuration, management and support are handled entirely using ICTs. This requires MCC’s employees to incorporate technology in a way that provided a predictable experience for customers.

Security policies, time accountability and practices of interruption management are the principal socio-technical facets at STC. In contrast to MCC, STC’s need for information and communication technology to reach beyond their locale is core to their opening business model. STC has five major customers who are responsible for more than 90% of their gross revenue. Each of the major customers has a different set of collaboration tools required for work within those customer sites. Consequently, STC’s employees routinely adapt to different socio-technical infrastructure facets, depending on which customer they are interacting with, which influences usernames, passwords, time scheduling and how they are interrupted in the local organization, compared with the extended, virtual organization that incorporates the client.

These two firms have significant differences in their socio-technical faceting, though they use similar technologies. MCC is the collaborative technology leader who is able to define practices within itself and for its customers. STC is a collaborative technology consumer that adapts to unique socio-technical configurations on a customer-by-customer basis. Though each firm leverages the opportunity of lower cost structures and a less mobile workforce combined with high speed networking access into metropolitan areas, the way these factors impact the experience of the firms is influenced by how they structure their social interactions, and how ICTs are used to mitigate distance.

The different socio-technical facets that distinguish these two firms arises from and reinforces differences in communication flow between the firms and their customers, depicted in figure 3. A MCC employee uses a consistent and stable set of information and communication technologies, and those technologies are core to the collaboration and communication that occurs between MCC customers and MCC. STC employees reference a shifting and varied range of ICTs both internally and externally, depending on the context of the work.

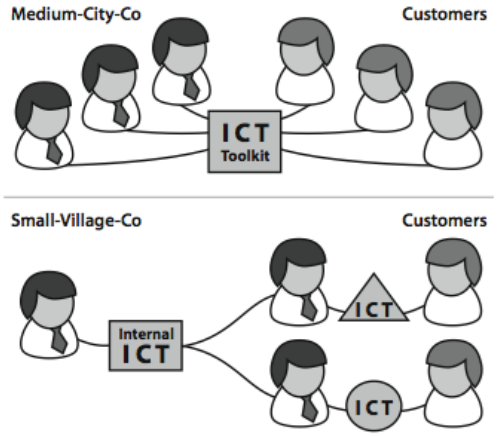

Figure 3 - Communication Technology Use at Medium-City-Co and Small-Town-Co

Collaboration Practice Organizational Facets

In each firm, small work groups interact with each other and with customer groups outside the firm. The practices developed through these interactions create dynamic and sustained *working spheres*. The socio-technical facets for each firm emerge from the structuring influence of their technology configuration, and from the collaboration practices that emerge.

Medium-City-Co

MCC's collaboration emerges around two major functions of their business: Software design and sales. The owner, Horace, is involved in both, as is Bryan, who manages a good deal of customer contact. In the next sections we describe the facets of collaboration in these two groups, and through this description MCC's socio-technical facets of emotionally safe communication, scripted interactions and stable technologies become clearer.

Software Design Groups at Medium-City-Co

MCC regularly engages customers in design discussions and decisions to improve their product. Bryan, who is the primary customer liaison, operates as a proxy for customer software change requests to the Schoolsoft (not the real name) hosted application that is now MCC's dominant source of revenue. Horace, the owner of the company, works closely with Bryan during early design processes, usually following Bryan's conversations with customers. Quinton, the chief architect for the product, is an accomplished technologist, and usually participates in design sessions. Design sessions are planned, as Quinton and Bryan are at the opposite ends of 6,000 square foot office in the Midwest, and Horace does his work from another state.

In this next section, we describe an example of the design process at MCC. This micro-case begins with Bryan and a customer with 400 active users trying to build an organization level report. Bryan and the customer do this using WebEx, a telephone and a digital sketchpad. Schoolsoft is designed to support individual user needs, but not the assembly of data pulled together from multiple users. Bryan and the customer each expect this limitation can be overcome. In this case, Bryan sketches a basic system design (user interface) that, in concept, enables the customer organization to manage member data and produce reports at the organizational level.

Bryan's sketch could be viewed as a boundary object between MCC and the customer, except that Bryan's use of the sketch reflects simple articulation of a shared understanding. Bryan and the customer already share much common ground, the Schoolsoft system, and the sketch is within that common ground. The boundary for Schoolsoft customers is the emotional tension of dealing with a technology product, and a technology company. Sketching is a recognized interaction design technique, but it is also viewed by customers engaged in the design process as non-threatening, or in terms of socio-technical faceting, emotionally safe. This is one way MCC bridges the social barriers between themselves and their customers.

With the ideas of the customer clear, Bryan, Horace and Quinton begin a design session. One notable characteristic of these design sessions is the fluid role switching that occurs. Throughout each design interaction, there is "sketcher", a "problem space owner" and an "implementation analyst". Bryan is most frequently the sketcher, Horace most frequently takes on the role of the problem space owner, and Quinton is most often the implementation analyst.

During 17 of the 23 design sessions we observed, there are periods where the members jump into different roles, and when this happens another member fills the missing role. The members rotate, in a sense. This occurs most fluidly during distributed design sessions, when Horace is at his office in a different state; 19 of the design sessions take place with Horace at a remote office. During one session, Quinton prepared a sketch of an idea he developed to implement an improved "customer dashboard". Horace immediately jumped into the space of implementation analyst and Bryan rejoined the role of problem space owner. They proceeded in these roles for 80 minutes, leading to a design that was eventually implemented in the Schoolsoft system. While these transitions also occurred during sessions when the team was physically co-located, the dynamic shift of roles was frequent and clear only during

the distributed collaboration work. In this way, socio-technically executed design practices at MCC appear to enable this group to work more effectively in a distributed manner than a face-to-face manner.

Customer Groups at Medium-City-Co

As noted in our discussion of the software design team, the transitions between roles and production of designs flowed more smoothly when the team worked in a distributed manner. In the case of customer development (sales), a physically co-located team in the Midwest handled this repetitive work, which consisted mainly of methodically contacting, following up and providing demonstrations of the software product for prospective customers. When Horace and others at his remote office became involved in these established sales processes a new type of coordination challenge emerged. Despite numerous attempts at resolution, challenges and ongoing communication failures persisted whenever the sales process became distributed across locations.

At first blush, this confirms well-established findings in CSCW: distance matters. What is novel here is where it matters. Software design is an unstructured activity. At MCC the sales process is highly structured and repetitive. Horace & Bryan are active in both processes. The same tools are used for both processes. The barriers of distance are constant. Distributed design works well, distributed sales work does not. How is this possible? The principle difference is how the *working spheres* are constructed in the sales process. With sales there are more *working spheres*, and they change more frequently. In order to overcome distance and social barriers between the firm and customers, MCC builds an effective distributed design enterprise; they do this because they have to. With the sales process, they simply keep it in the main office because there is no penalty. The lesson is that barriers fall when survival depends on them falling, and MCC's distributed design success exemplifies that.

Small-Town-Co Collaboration

STC work groups emerge around the two key practice domains of sales and customer projects. Each of these functional teams is constructed around a stable core of STC management personnel: Alan, Bob, Carl, David, Ellen, Fred, Gerritt & Helen. Each functionality oriented group experiences the socio-technical nature of distributed collaboration differently. Unlike MCC, each STC employee must adapt and make use of different technologies for each customer interaction, including in some cases customer specific email infrastructure. In the next section we describe the practices and trajectories of socio-technical group emergence at STC in the two key practice domains where we observed extensive group work. Through these descriptions, the dominant socio-technical facets of customer security policies, time accountability and interruption practices emerge.

Sales Process Groups at Small-Town-Co

STC services are sold across a wide array of industries and geographic locations. While MCC leverages information and communication technology to facilitate sales across the US, STC's markets expect face to face visits, which in turn requires an average of 2-3 days of sales travel each week for Alan, the owner. Unlike MCC, sales practices are not reified in a sustainable way.

Isolation and being in a rural area is not handled with ICTs at STC; people travel. This condition reverberates through each of the *working spheres* at STC. Practices for assessing and sharing information or coordinating sales activities are spread across the organization and not handled consistently. For example, practices for assessing information quality in the prospecting cycle, selecting new cities to target and managing the process of moving a sales lead to close are all highly variable. Three factors contribute to these performance gaps. First, heavy travel to meet customers and potential customers limits the amount of time used for planning. Second, like many technology firms, STC's internal IT is not well developed. Third, operations management and senior technologists are often pulled into the sales process with limited preparation. This third point has repercussions in the broader organization. Operations staff members (people on teams doing customer work) are frequently interrupted, which interferes with performance on customer contracts and creates a tension between

customer requirements for time logging and internal billing – 40 hours per week – and non-billable, unplanned sales work.

Customer Project Teams at Small-Town-Co

Following a successful sale, work moves into project execution. The main type of deal is their preferred "outsourcing" deal that includes the services of a minimum of four personnel for at least three months, but usually for two years or more. Project types include ongoing software maintenance, software testing or data analysis services for the customer. The transition between sales and operations follows a set of established practices. Bob, Carl, Gerritt and Fred are all experienced at successfully establishing customer specific socio-technical infrastructure, which typically involves the configuration of new software and the establishment of new coordination practices with a customer. Unlike MCC, STC does not dictate communication and information sharing technologies; each team adapts to its customer.

This adaptation to customer technology includes STC employees becoming primarily accountable for time directly through the customer system, use of customer security infrastructure and participation in social technologies like email and instant messenger exclusively through customer remote desktops. The consequence for STC employees is that their identity shifts quickly to that of the customer; their connection to STC diminishes. This results in coordination challenges within STC, and across teams serving different customers. Here we see an inversion of the usual consultant experience, where a nomad loses touch with his employer because he is never there. In this case, people sitting side by side in the same room lose touch with their employer because they are connecting to an outside world through an ICT. The person seated next to an STC worker is less connected than the person on IM, in a large city.

Outsourcing customer teams at STC do not experience challenges with awareness and interruption management resulting from remote work; at STC such challenges are local. The STC workers and their customers develop a repertoire of coordination and information sharing practices that serve the customer work well. The challenge with interruption comes from the co-located management and other work teams, who rely on STC workers for sales support and internal operation support regularly. The close identity workers develop with the customer they are working for is placed in regular conflict with local demands. STC workers often work extended shifts to manage these demands because their personal, geographic isolation means that STC is their only choice for a technology job.

Discussion

The question of how groupware technologies diffuse through and support work groups in organizations is an important one that has received a lot of attention. As the socio-technical landscapes within which such diffusion takes place are constantly changing and evolving, there is always a need for new studies of these processes. The ready availability of cheap collaboration tools enabled MCC and STC to create unique forms of virtual organization in isolated regions. Each followed a unique trajectory of adoption and use.

Mark and Poltrock provide one useful analytical lens for analysis of the diffusion of groupware in organizations. They correctly point out that many existing theoretical approaches to the study of organizational groups reify the concept of the group itself, to the point where the fluid nature of such groups is ignored. They propose the concept of the *working sphere*, a fluid, emergent, *ad hoc* and shifting model of the temporary alliances that form and dissolve in response to ongoing organizational tasks. It is the circulation of organizational members across *working spheres* that provides a path for individuals (and the groupware that they adopt) to travel and diffuse through an organization.

This model is useful but it also has a number of limitations, and these provide opportunities for new research. The original analysis focused on Boeing (2009 revenues, $68 billion) and bracketed off a large number of socio-technical factors at this site as something of a given, such as the large scale of the firm, its metropolitan locations, etc. What therefore is to be learned from the application of *working spheres* in other contexts, such as the small-scale, geographically isolated firms? Our contrast begins with the geographical isolation of these two firms, and extends to the work practices that develop in the distinct *working spheres* that emerge within and around these firms.

In these two, geographically isolated firms, technology is not simply adopted, it transforms what is possible. For instance, MCC's decision to supply turnkey software services led them to deal with a standard product, which led to the routinization of a lot of their business and organizational processes, and thus also to the routinization of their groupware tools and use. This was reflected, for instance, in the ways in which team members fluidly switch roles during creative work. In contrast, STC's business model of providing outsourced IT support constantly placed their staff in new organizational and technological environments, in which their clients controlled a number of important environmental factors. This meant that STC had to adapt constantly to new situations. While this 'agility' might be seen as advantageous (and perhaps emblematic of new types of firm in knowledge and service economies), it was also problematic, in that this ongoing external shaping effectively prevented the routinization of many of their core organizational practices.

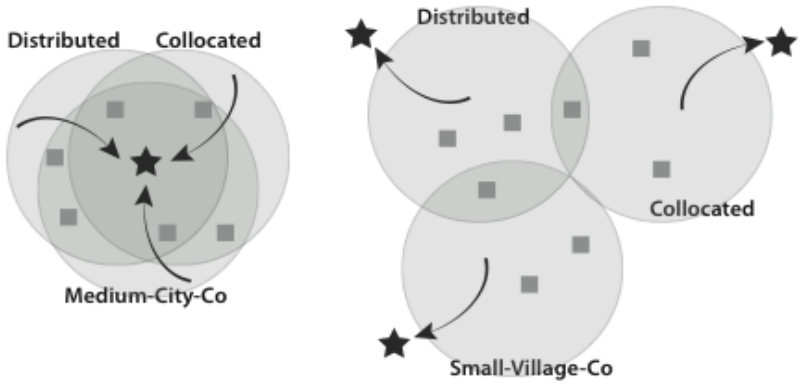

Figure 4 - Mark & Poltrock's Model Applied to Medium-City-CO and Small-Town-Co

In the case of MCC, therefore, situational factors led to organizational consolidation, routine, and stability; in effect, they approached the same problem time and time again. In the case of STC, on the other hand, situational factors led to change, churn, and a lack of stability and routine; there was always something new to deal with. We can view this contrast between the two firms in terms of an adaption of Mark and Poltrock's original figure (Figure 1, above). In this adaptation, we can see that in the case of MCC, there were centripetal organizational forces – such as the ongoing routinization of organizational process in relation to a standard product – that acted to pull the work groups and their associated groupware back towards the core business, and thus also back together. In the case of STC, there were centrifugal external organizational forces – such as the constantly changing technological practices of their clients – that acted to pull them apart.

We represent this conceptually in figure 4. As in Mark and Poltrock, the circles are *working spheres*, populated with group members. We have added two new elements: stars, representing environmental factors that either pull groups together, or pull them apart, and arrows, representing the pulling forces. The degree of overlap in the spheres defines the structure of the virtual organizations that form around each firm. MCC is represented as having developed a set of socio-technical facets and work practices that draws remote customers into their way of working, leading to the routinization of organizational practices across the firm, represented by the star. It can be seen that the work spheres overlap considerably. At STC, in contrast, members are pulled toward external customer concerns (represented by multiple stars), and as a result they participate in working spheres that often barely overlap, or which may even be in conflict.

The varying degree of overlap in *working spheres* has a number of consequences. First, the greater geographic isolation experienced by STC workers creates greater contention and accountability for their time with customers, but also leads to more local interruption. MCC bridges the social divide by creating routine. STC bridges the social divide by frequent face-to-face visits with distant customers. Geographical and social barriers are overcome in each firm by establishing *working spheres* that incorporate local and distant members. These firms do not adopt ICTs and *working spheres* do not resist; instead, two different classes of rural technology firm emerge through their use. ICTs in these firms, and

we suspect other isolated technology firms, are adopted quickly and transform what is possible at a speed that few studies of large corporations have noted. We think it is possible that these kinds of firms could become important organizational laboratories for CSCW research in the next decade.

Structural Fluidity in Rural Technology Firms

Working spheres are a theoretical construct that enable reflection about how new forms of structurally fluid organization are enacted through technology and across geographic boundaries. Organizational studies have examined dynamic work groups, organizations and distributed work. Distance between work groups and the efficacy of technologies for bridging that distance are the subject of ongoing inquiry. In the case of these rural technology firms, we show two cases where structural fluidity – the capacity of an organization to shape itself, through technology, into a context that includes customer organizations – supports new organizational shapes in new types of regions; or, at least regions that are under examined in the organization science literature. Developing theory to better understand how structural fluidity is connected to performance in a range of organizational contexts in the future.

Conclusion

The distributed work in the two small, geographically isolated firms described in this paper takes a notably different form than that which has been described in prior studies. The differences in their socio-technical practices, and the rapid rate at which they adopt new technologies to structure their businesses, suggest that other small geographically isolated firms that operate as virtual organizations may also take multiple complex forms. The contrast between these two firms and previously reported examples suggests that the uptake and use of information and communication technologies now enables a new class of virtual organization that warrants further study.

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