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FRAMEWORKS FOR UNDERSTANDING KNOWLEDGE SHARING IN ONLINE COMMUNITIES: BOUNDARIES AND BOUNDARY CROSSING

Introduction

Earlier studies of Social Informatics aimed to understand Information and Communication Technologies (ICTs) in organizational context (Dutton 2005). In the 1970s and 1980s, ICTs were primarily developed for and used in organizations such as universities, corporations, and governments. As the price of computer devices decreased, more computers were found in private homes, and studies of personal computers were added to the corpus of SI studies (e.g., Hara and Kling 2000). Then, in the 1990s, as more and more people gained access to the Internet, SI researchers started focusing on Internet use in various settings (e.g., Kling 1996; Kling, Rosenbaum, and Sawyer 2005). In the early 21st century, there has been a surge in social media use, which has led to a wave of studies seeking insight into user relationships with social media and the consequences of these activities (e.g., Turkle 2011). In line with this trend this chapter focuses on knowledge sharing in the social media setting from an SI perspective.

Knowledge sharing in online communities

Knowledge sharing activities online have been flourishing with the advent of social media. Web 2.0 platforms, such as Facebook, Twitter, and Wikipedia, facilitate knowledge sharing in open online communities, which are not constrained by existing organizational boundaries (Qualman

2011).¹ As organizations invest more in crowdsourcing (Doan, Ramakrishnan, and Halevy 2011), it becomes easier and more frequent to share knowledge and collaborate online. As such, it is imperative to better understand how knowledge sharing occurs on Web 2.0 platforms and in these open online communities (Allen 2010; Hara, Shachaf, and Stoerger 2009; Lee and Cole 2003; Vakkayil 2012). While much attention has been given to knowledge sharing over the years, the focus of prior research has generally been limited to its practice within organizations. Wang and Noe (2010), for example, provide an excellent overview of research conducted in the area of knowledge sharing, primarily within organizations. They report that the focus of these studies ranges from motivational factors (e.g., Hew and Hara 2007; Wasko and Faraj 2005) to organizational context (e.g., Brown and Duguid 2001).

Further, Wang and Noe (2010) claim that more investigations of knowledge sharing that apply various theoretical perspectives are needed. They found that the main theories employed include the theory of reasoned action, social exchange theory, and social capital and network theories. This chapter aims to explore the usefulness of employing frameworks of boundaries and boundary crossing in the examination of knowledge sharing in open online communities, in line with Vakkayil (2012), who found the concept of boundaries to be informative for understanding knowledge sharing and creation.

Boundary Crossing

The literature on boundary crossing includes conceptual frameworks that are relevant to understanding knowledge sharing. Efforts to investigate the concepts and properties of boundaries have been published in disciplines such as Science and Technology Studies (STS), sociology, and organization science (e.g., Lamont and Molnár 2002; Star and Griesemer 1989; Watkins 2006). For example, scholars have previously investigated how to communicate across disciplines and professions by crossing boundaries, primarily via “boundary objects” (Star and Griesemer 1989) and through “brokers” (Wenger 1998).

¹ Open online communities are those that function outside the boundaries of one organization and that involve participants from many groups, organizations, countries and so on.

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Boundary objects, or shared objects that facilitate bridging across different groups and assist the intersecting of different communities of practice (Star and Ruhleder 2001), are used when crossing boundaries to communicate with people who belong to different groups and have various backgrounds (Star and Griesemer 1989). Wenger (1998), inspired by Star, elaborates on the idea of boundary crossing in the context of communities of practice. He argues that an established practice not only creates separation from others, i.e., boundaries, but also develops opportunities to interact with people in other practices. He explains that boundary objects help bridge different communities of practice, and that they can be digital documents or spaces, standardized methods or concepts.

The concept of boundary objects has been widely used in studies examining the use of ICTs (e.g., Barrett and Oborn 2010; Fox 2011). In particular, previous research has investigated how boundary objects support collaboration in various settings and between various groups, including an interdisciplinary team of designers in a museum (Lee 2007), simulation designers and users (Fleischmann 2006), and air traffic managers (Landry et al. 2010). This concept has also been used to understand the knowledge transfer processes among consultants (Miller 2005) and engineers (Carlile 2004; Hsiao, Tsai, and Lee 2012). In addition, boundary objects are frequently used to understand ICT use in communities of practice; they facilitate collaboration across these groups and allow experts to easily extract meaning from a large quantity of information (Landry et al. 2010).

Lee (2007) advances the conceptualization of boundary objects and argues that artifacts can be used to “push boundaries rather than merely sailing across them” (308). She identifies five types of boundary negotiation artifacts: 1) Self-explanation Artifacts privately used for “learning, recording, organizing, remembering, and reflecting” (319), e.g., notes, sketches, and journals; 2) Inclusion Artifacts used for developing “alliances with sympathetic communities of practice” (321); 3) Compilation Artifacts applied to cultivating shared meaning; 4) Structuring Artifacts employed to “coordinate media and understand” (330), but are frequently used when conflicts are found between two communities of practice; and 5) Borrowed Artifacts that are appropriated from one community to the other.

Based on two empirical case studies, Levina and Vaast (2005) have found that boundary objects-in-use have a common identity in practice and have articulated three conditions for their emergence. 1) For artifacts to

acquire a local usefulness, agents must use and make sense of them in the context of each field of practice (drawn from Bourdieu and Wacquant 1992); 2) To acquire a common identity, they have to stem from a shared symbolic capital coming from a joint field within which agents jointly recognize and value the artifact; 3) To establish the local usefulness of boundary objects-in-use and to establish their common identity, organizations rely on boundary spanners-in-practice. Similarly, Hsiao et al. (2012) emphasizes the importance of understanding boundary crossing in light of learning in situ and examines how engineers interact with boundary objects to engage in problem solving.

Although digital objects as boundary objects tend to support knowledge sharing and collaboration across diverse groups, digital objects are also problematic and can hinder knowledge sharing in this context. For example, Joyce, Butler, and Pike (2011) examine biographies of living persons in Wikipedia and argue that some shared digital objects can introduce conflicts, which they call contentious objects. Dougherty and Dune (2012) also discuss how digitalization may hinder knowledge sharing, and consequently innovation. They identify knowledge boundaries between two types of scientists, therapy and digital scientists, during drug discovery processes. Therapy scientists are traditional laboratory scientists and “work in multi-science teams centered on therapeutic or disease areas” whereas digital scientists “work on computers and other digital technologies” (Dougherty and Dune, 2102; 1469) to manipulate data and conduct experiments. Although digital scientists assist in drug discovery in innovative ways, the emergence of these scientists has also created knowledge boundaries between the two types of scientists. Dougherty and Dune (2012) propose ways to overcome these boundaries to allow for new drug innovations. For example, they suggest that it is critical to develop new common ground between the two types of scientists, who should also possess competencies for boundary-spanning and concrete boundary objects.

Similarly, Kimble, Grenier, and Goglio-Primard (2010) discuss how boundary objects and brokers are interconnected. They present two case studies, one with a software company and the other with a healthcare company, in which brokers strategically selected boundary objects to bridge two communities. They contend that these case studies reveal how “the broker acts as *tertius gaudens* (“the third who benefits”) rather than *tertius iungens* (“the third who joins”) (Kimble, Grenier, and Goglio-Primard, 2010; 443, italics original).

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Wenger further elaborates on the boundary-crossing concept by referring to a broker in addition to boundary objects. According to Wenger (1998), brokers can move from one group to another in order to bridge two communities. For example, a doctoral student who works with professors in different disciplines becomes a broker by serving as a liaison between the two disciplines (Hara, Solomon, Kim, and Sonnenwald 2003). At times brokers are also called boundary spanners (e.g., Levina and Vaast 2005; Shachaf and Hara 2005; Hsiao, Tsai, and Lee 2012). Levina and Vaast (2005) identify three compulsory conditions for a broker to become a boundary spanner-in-practice by grounding their ideas in two field studies. First, the boundary spanner becomes a legitimate, but possibly peripheral participant in the practices of both fields. Second, the boundary spanner has legitimacy as a negotiator on behalf of the field whose interest they represent. Third, the boundary spanner considers spanning boundaries an advantage.

These conceptualizations of boundary objects and brokers/boundary spanners are used widely in the frameworks of identifying types and properties of boundaries.

Types and Properties of Boundaries

Lamont and Molnár (2002) conduct an extensive literature review of a multitude of studies on boundaries in general and conclude that further work to investigate the types and properties of boundaries would be fruitful. Akkerman and Bakker (2011) concur with this need following their study of learning mechanisms that occur when crossing boundaries. During the last decade, a few frameworks to analyze knowledge sharing and transmission have been developed (e.g., Carlile 2004; Hernes 2004; Sturdy et al. 2009; Werr, Blomberg, and Löwstedt 2009; Wright 2009); these frameworks are described next and summarized in Table 1. Interestingly, the development of these frameworks has been primarily grounded in the literature of organization theories. While the authors use various terminologies, all of the boundaries fall within one of the following categories: physical, cognitive, social, and political. Physical boundaries are those that are concrete, such as boundaries created by buildings, technologies, and locations. Cognitive boundaries are those that are mentally created, such as personal beliefs, worldviews, and understanding. Social boundaries are created by cultures, social interactions, and tradition. Political boundaries are formed by contentious

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situations, such as negotiations, conflicts, and control. While this can be considered a sub category of social boundaries, researchers tend to define a distinct category for political boundaries.

Carlile (2004) has developed one of the frameworks to classify boundaries in a context of knowledge transfer that inspires innovation. He discusses three approaches to categorizing boundaries found in the literature: 1) a syntactic or information processing boundary; 2) a semantic or interpretive boundary; and 3) a pragmatic or political boundary. The first approach, the syntactic boundary approach, deals with the situation in which knowledge transfer occurs between two actors in a syntactic form (0s and 1s). This perspective is rooted in the information-processing approach whose focus is “on the storage and retrieval of knowledge” (Carlile 2004, 558). As such, this category can be considered as physical boundaries. Second, the semantic or interpretive boundary can be found when knowledge exchange happens between two actors whose backgrounds are different. This situation requires some kind of common ground, such as “shared meanings” (558) to overcome differences. Hence, this category can be interpreted as social boundaries. Third, the pragmatic or political boundary refers to when actors involved in knowledge sharing have a conflict of interest. Boundary objects are one of the useful tools for handling the political boundary.

Hernes (2004) develops another framework for analyzing boundaries. Unlike other frameworks that tend to be one-dimensional, this framework is composed of two dimensions: the first addresses the “types of process that a boundary represents” (Hernes 2004, 13) and the second addresses “the effects that boundaries have on the organization” (Hernes 2004, 15). The first dimension includes three types of boundaries— physical, social and mental boundaries. Physical boundaries are explicit boundaries, such as physical structures including buildings or formal rules, whereas social boundaries consist of identity and norms that would divide one group from another. Mental boundaries refer to beliefs and core ideas that are central to organizations. The second dimension includes three effects of boundaries on organizations: boundaries as ordering agents, distinctions, or thresholds. According to Hernes (2004), boundaries can be used as forces to affect certain behaviors, play a role in distinguishing one group from another, and determine how easy it is to cross boundaries by setting standards for thresholds. When the threshold for a certain boundary is low, the boundaries become more permeable. The concept of thresholds is highly relevant to the idea of “permeable” boundaries that was articulated by March and Simon in 1958.

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Sturdy et al. (2009) provide another framework for analyzing boundaries. They argue that sociological approaches to boundaries tend to focus on the multiplicity of boundaries (i.e., individuals move from one boundary to another) and that previous organizational research has identified physical, cultural, and political boundaries. They argue that physical boundaries refer to “physical and technological arrangements” created by “architecture, and various boundary objects including human agents” (Sturdy et al. 2009; 633). Cultural boundaries consist of cognitive and emotional dimensions. Cognitive boundaries are similar to the “semantic boundaries” proposed by Carlile (2004) above, and crossing cognitive boundaries involves socio-cultural learning (Vygotsky 1978). Emotional boundaries refer to the idea that people have emotional attachments to knowledge, which may make the flow of knowledge difficult. Finally, there are political boundaries, which are created by power relations through structural differences within organizations. In addition, Sturdy et al. affirm the dynamic nature of these boundary dimensions by studying the organizational boundaries of knowledge flow among management consultancies.

Werr et al.'s (2009) framework includes five dimensions of boundaries for knowledge exchange: interests, interpretive frameworks, trust, private/organizational, and priority: 1) Individuals' interests construct and constrain boundaries; 2) Interpretive frameworks develop mental boundaries based on the understanding of the world; 3) Trust helps or hinders relationships, which in turn builds boundaries; 4) The boundaries to distinguish the private/personal and the organizational/public are determined by relationships between “the self” and “the other;” 5) The priority dimension influences the way boundaries are constructed to determine the knowledge/resource flow and personal relationships. If one perceives a lack of time, knowledge exchange may be reduced, which then creates a boundary for relationships that constrain knowledge sharing.

The final framework for analyzing boundaries is proposed by Wright (2009) who claims that individuals construct their organizational membership around four key boundary dimensions: their role and position in the organizational hierarchy (structural boundaries), their expertise and functional activities (knowledge boundaries), their organizational legitimacy and power (political boundaries) and their personal relationships with clients and other stakeholders (interpersonal boundaries).

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Authors	Terminology of Boundary Types			
	<i>Physical</i>	<i>Cognitive</i>	<i>Social</i>	<i>Political</i>
Carlile (2004)	Syntactic		Semantic	Pragmatic
Hernes (2004)	Physical	Mental	Social	
Wright (2009)	Structural	Knowledge	Interpersonal	Political
Sturdy et al. (2009)	Physical	Cultural (emotional)	Cultural (cognitive)	Political
Werr et al. (2009)		Mental (interest, interpretive framework, priority)	Social (trust, private-organizational)	

Table 1: Summary of types of boundaries described in the literature

These frameworks are useful for understanding knowledge sharing; yet, they are somewhat limited in that they were developed based on and for the use in organizational contexts. As knowledge production outside of organizations in open online communities is increasing (Allen 2010; Hara et al. 2009; Rau, Neyer, and Möslein 2012), it is imperative to examine whether any of these frameworks are useful when traditional organizational structures are challenged.

Conclusion

As we move forward in the 21st century, the foci of SI studies are expanding from analyzing computing use in organizations to studies that include social media that are external to organizations. Along the same line, the frameworks for analyzing boundary types and properties, as well as the process of boundary spanning, have been predominantly developed in an organizational context, but much knowledge sharing today happens outside of these organizational boundaries. It is possible that the utility of

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these theories is inadequate in the context of knowledge sharing in mass open collaborative projects and the social web. As such, boundary crossing processes and frameworks for analyzing boundary types and properties may need to be modified and extended to explain knowledge-sharing processes in this complex environment. Rau et al. (2012) indicated that previous research has not paid enough attention to crossing semantic and pragmatic boundaries in Web 2.0 environments. Table 1 in the previous section is a synthesis of the previous literature. Our own future research aims to investigate further development of boundary types in online communities.

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