Developing new knowledge in organisations:
Engagement with virtual social networks in problem solving

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Abstract

Organisations derive value from knowledge, but developing new knowledge is dependent on organisational members having access to the necessary resources. Traditionally the study of organisational knowledge development has focussed upon resources embedded in the material and social structures within an organisation. This was due in part to the reluctance of organisations to share knowledge externally as well as their preference to bring additional resources inside organisational boundaries. This research study, therefore, investigates how new organisational knowledge is being developed through the use of external online resources. In doing so it provides an explanation for the way in which individuals extend virtually, outside their organisational boundaries, to solve problems.

The development of tacit knowledge plays an important role strategically for organisations. This study is largely informed by the work of Ikujirō Nonaka and colleagues on knowledge creation; their research asserts that the development and sharing of tacit knowledge stems from material networks in which members engage in face-to-face communication. Management literature suggests that individuals are often tasked, however, to problem solve and develop new knowledge even when the required environmental factors and resources are not contained within the organisation. There was a gap in the literature explaining how tacit knowledge was developed in this context, specifically: Where do individuals locate problem solving resources in virtual social networks and how do individuals gain access to those resources through social connection?

This interpretivist research study used qualitative methods in order to describe and explain the behaviours of individuals engaged in problem solving. The fieldwork was split into two phases. In phase one, the material phase, 19 semi-structured interviews with software developers were conducted. In phase two, the virtual phase, 662 online discussion forum participants were observed during a three-month virtual ethnography. A thematic analysis was then employed using the lens of social capital theory, based on works by Alejandro Portes and Anita Blanchard, to explain the behaviours described and observed in the interviews and discussion forum.
The results of this research indicate that individuals involved in problem solving did use virtual social networks to share and develop new knowledge for their organisations. Individuals identified relevant networks after a process of resource assessment and searching. Social connection provided access to the embedded resources through trust in the content of the resources and through the process of developing tacit knowledge of the social network through socialisation. The networks had a mix of bridging and bonding connections, lurking and posting engagement, and normative and deviant behaviours.

Consequently, organisational concerns about individuals using external resources can be mitigated by the problem solving processes revealed in this study. Individuals demonstrated instrumental motivations for using virtual social networks and exhibited behaviours which focussed on finding solutions for organisational tasks rather than building stronger social connections outside of the organisation (and possibly compromising organisational knowledge). Online behaviours for individuals, however, could vary depending on developments in their social connections or changes in their motivations or network obligations. This study concludes that organisational members engaged in important work to develop and adapt their tacit knowledge within virtual networks as they effectively developed organisational knowledge.

The study makes contributions to the following bodies of literature: knowledge management by explaining tacit knowledge sharing in virtual networks, social media by explaining how lurking and positive deviance are used in problem solving online, social capital by explaining how access to online problem solving resources is gained through social connection, and methods by extending the use of ethnography to social media.
Acknowledgements

At every family gathering, my father would tell one of his favourite stories. Each story was a delightful mix of morality tale, insights into the character of family members (warts and all), and humour. My favourite story was of his Depression-era memories of visits to his grandmother’s house. She would make a meal, for all of the visiting family, which was never enough. As they passed the serving bowls around the table, each person would take smaller and smaller servings to stretch out the meal, until the last person was left with just a spoonful or two. As soon as everyone was served, my great-grandmother would stand up and exclaim with a satisfied look on her face, “Look, I have made just enough!” After each and every telling, my dad would laugh until tears ran down his face. This thesis is dedicated to the memory of my father, Gerald Hurley Martin, from whom I have inherited a thirst for knowledge and the love of a good yarn. My PhD story, like those old family stories, has been funny, poignant, and full of wonderful characters. I would like to thank those who made this thesis possible.

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1 Introduction

Knowledge conceived in / virtual collectives aids / organisations?
No co-location? / Virtually organise / to find what’s missing
Ethnography shows / networks not communities / in online forums
Face-to-face not sole / path to implicit knowledge. / Social media!
Social networks thrive / motivated members share / due to trust and norms
Workers use networks / embodied and virtual / for crafting knowledge

1.1 Research study background

Several years ago I began my career in software development as a bug fixer. I worked for a Silicon Valley start-up which developed voicemail software for airlines. After completing my university work for the day, I would make the hour-long commute along the congested California highway to the office park where the company was newly located. I navigated the dark halls of the sparsely populated technical services building where the electrical engineers, network technicians and software developers worked. As a new, but rapidly growing company, many of the offices were empty in anticipation of the next recruitment phase. I worked by myself in a large empty office filled with unoccupied cubicles. Once or twice a day someone anonymously slipped a stack of software bugs under my door. It was nearly my only contact with co-workers.

With only my university programming textbooks, a description of the bug, and an online help file, I made changes to the code in hopes of fixing the bugs. If successful, I had no response. If unsuccessful, the marketing team testers would re-add the same bug to the bug list and I would try another solution. It was an isolating and inefficient process for communicating, problem solving, and developing organisational knowledge.

In contrast to the example above, more recently I worked with a small economic consultancy firm on their knowledge management strategy. The first time I visited their offices I was impressed with the amount of employee engagement and communication. The office was open plan, every staff member from receptionist to chief executive

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1 This haiku is the thesis presented in six tweets. It was submitted to the first annual University of Otago Thesis Twitter Conference held in August 2011. It won third place among participating postgraduate researchers from many disciplines and was recognised for creativity (haiku use).
worked at one of the rotating hot desks\(^2\). I could see consultants leaning over their desks asking questions to co-workers about a client or an issue. I could see others emailing or talking on the phone to travelling colleagues and overseas clients.

At first glance it looked utopian, but the organisation was facing serious challenges. The company was undergoing a period of intense and rapid growth as it opened two new international offices in different countries simultaneously. It was struggling to maintain a consistent level of service between the original headquarters’ staff and the newly hired staff in remote offices. The company’s senior management believed that technology could help connect physically and temporally disconnected staff and that virtual engagement could help employees share and create new knowledge, but was unsure how to operationalise these concepts. Management was interested in leveraging emergent social media technologies, but afraid of compromising the firm’s intellectual property by engaging in external and open social network sites (SNS).

Through my contact with many different types of organisations over the years, I have observed a common dilemma illustrated in the examples above and faced by many others. The dilemma is an organisational tension between competing priorities. Specifically, there is tension between: promoting development; leveraging emergent technologies; addressing the needs of isolated staff; and encouraging knowledge sharing while controlling organisational knowledge. This observation led to the research problem at the core of this thesis: How do individuals extend outside organisational boundaries to solve problems?\(^3\)

The aim of this introductory chapter is to set the stage for the research study. The chapter is organised into four sections in addition to this background introduction: locating the study within the knowledge management and social media literatures; theorising the research questions through social capital theory; engaging with the field through an exploratory study, and study results and contributions; and the structure of the thesis.

\(^2\) Hot-desking is “the practice in an office of allocating desks to workers when they are required or on a rota system, rather than giving each worker their own desk” (Oxford University Press, 2013, Hot-desking section, para. 1).

\(^3\) The core concepts of the thesis are summarised in the Twitter haiku at the opening of the chapter.
1.2 Locating the study within literature

The external environment in which organisations do business has dramatically changed in the last 20 years (Niu, 2010). For many organisations, an increasing basis for competitive advantage is held within a knowledge-generating workforce and the ability to develop new knowledge within changing environmental contexts (Barney, 1991; Spender, 1996). The environmental changes such as globalisation, uncertainty in economic markets, or reduced access to natural resources can introduce external pressures on the organisation and its members. One of the most prominent external pressures is the need to adapt to technological changes; although frequently mentioned in management literature, it is underrepresented as the focus of research (Orlikowski & Scott, 2008).

The organisational pressure from information technology affects organisational members who must adapt to these changes and still be creative, innovate, and develop new knowledge (A. Miles, 2013). Technology changes afford both opportunities (e.g., better tools, increased communication, etc.) and challenges (e.g., increased security risks, information overload, etc.). Pressures from technological changes can also lead to tension between organisational goals, such as developing new organisational knowledge, and an individual's ability to do so. Tension can also be created by organisations wanting to control knowledge flows outside organisational boundaries. Such organisational constraints can come from a desire to limit corporate amnesia⁴ or minimize cyberslacking⁵ by bringing information technologies inside organisational boundaries where they can be monitored and controlled (Dalkir, 2005).

Organisations that attempt to use only the information technology tools without understanding the related social aspects of virtual engagement have difficulty replicating the success of the virtual spaces outside organisational borders. As Huysman and Wulf (2006, p. 40) argue, “most [IT] tools designed to support knowledge sharing, do not become institutionalized within organizations.” Consequently, even though organisational members may be tasked to develop new organisational knowledge with

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⁴ Corporate amnesia occurs when organisations are not able to retain their “organisational memory (OM), the company-specific knowledge accrued from experience” (Kransdorf, 1998).

⁵ “Cyberslacking is the overuse of the Internet in the workplace for purposes other than work” (Whitty & Carr, 2006, p. 237).
internal resources, the resources required to develop that knowledge may not be found within the organisation.

The knowledge management literature on organisational knowledge development focuses on how knowledge is developed within the organisation. Prominent models, such as the knowledge creation cycle (Nonaka & Konno, 1998; Nonaka, Toyama, & Konno, 2000; Nonaka, 1994; von Krogh, Ichijo, & Nonaka, 2000), describe how knowledge is developed by explaining the relationship between individuals and collectives within organisational boundaries. The result is an emphasis on co-located co-workers who engage in frequent face-to-face interactions in order to develop a shared context (referred to as *ba*, see page 40) which enables knowledge development. There is little mention of external resources or virtual resources in these models.

The social media literature, which includes research on virtual communities and networks, and computer-mediated communication, focuses on how individuals engage online. Influential research, such as early studies on the Internet and online social networks (Garton, Haythornthwaite, & Wellman, 1999a; Wellman et al., 1996; Wellman, Haase, Witte, & Hampton, 2001) and more recent studies on social network sites (boyd & Ellison, 2007; boyd, 2007b; Ellison, Steinfield, & Lampe, 2007, 2011), describe how individuals connect within virtual networks for primarily personal use. The result is an emphasis on personal, rather than organisational or professional use of virtual networks, with the exception of some literature on electronic networks of practice (Faraj, Wasko, & Johnson, 2008; Wasko, Faraj, & Teigland, 2004). Nevertheless, there is little overlap between the knowledge management literature and the social media literature in terms of organisational knowledge development in virtual networks.

Evident from the review of these areas of literature, is that even though knowledge management literature includes information technology; and social media literature addresses some professional networks, the social nature of knowledge development (e.g., problem solving) in virtual networks is missing. This research study is located at the intersection of knowledge management and social media by undertaking a focused exploration of problem solving in virtual networks. Therefore, in order to explore how individuals develop knowledge when the necessary resources are not fully contained

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6 Key concepts are italicised for emphasis.
within the organisation, this study investigates how knowledge resources are accessed through virtual networks. This is an area of knowledge management and social media research that is under-developed within the literature.

### 1.3  Theorising social connection

The specific aim of this research study is to investigate the practice of knowledge development through social connection in virtual networks. Using social capital as a theoretical framework, the study explores how software developers problem solve using online resources within social networks.

Social capital theory provides this research study with conceptual access to the value derived from relationships. Social capital is the social connection which provides access to embedded resources (Bourdieu, 1986; Burt, 2001; Coleman, 1988; N. Lin, 2005; Portes, 1998; Putnam, 1995b). For this study, social capital helps explain how individuals gain access to resources embedded in virtual networks when they are developing organisational knowledge. The study considers what effect strong and weak ties have and whether access differs based upon the different dimensions of social connection.

Consequently, social capital theory has been used to theorise the research problem around the following research questions:

- **RQ1:** Where do individuals locate problem solving resources in virtual social networks?
- **RQ2:** How does tacit knowledge teach individuals how to engage in the process of accessing resources; and how to interpret the context of those resources?
- **RQ3:** How do individuals gain access to problem solving resources through social connection?

### 1.4  Engaging with the field: methods, results, and contributions

This chapter begins with a story of my personal experiences in organisations and what I observed. This enables me to both introduce the topic of this research and to sensitise the reader to the ethnographic approach taken in this study. Ethnography, although
common in other social sciences, is unusual for management research studies. It was chosen because the research is inherently about social relationships and how social connection enables individuals to gain access to resources in order to solve problems. The techniques of ethnography, such as personalised storytelling and reflection, are therefore important to explain.

This research study explores social connection in virtual networks; for that reason it uses an interpretivist paradigm and qualitative methods in order to engage with the field. The study includes interviews and virtual ethnography observations of how software developers engaged in problem solving in order to investigate how virtual networks are used in organisational knowledge development. The results are presented using themes developed from both social capital literature and those which emerged from the fieldwork. Additionally, social network analysis is used to visualise the social connections within the virtual networks.

Thematic analysis of interviews and virtual ethnography observations suggest the nature of problem solving engagement in virtual social networks is determined by the value of online resources compared to their risk. This evaluation is facilitated by trust and social norms within the virtual networks. Consequently, the results of this study indicate that:

- Individuals use a combination of material and virtual networks, technology-mediated communication and face-to-face engagement, and internal and external (to the organisation) networks in problem solving;
- Individuals engage in active lurking during problem solving;
- Individuals develop the strength of their social connections (e.g., bonding or bridging) in relation to their needs and motivations (e.g., task, reputation, etc).
- There is variability and flexibility across the continuum of social connections within virtual networks.

This research study makes contributions to the following areas: knowledge management literature; social media literature; social capital theory; qualitative methods, and has implications for practice.
1.5 Thesis structure

In addition to this introduction, the thesis consists of eight chapters, organised in two sections. The first section includes chapters which focus on the theoretical foundations of the research study. The second section includes chapters which focus on the study's results and conclusions.

Section One consists of chapters two through four and provides background information necessary for the study. It includes literature reviews, theoretical framework, and the methodology.

Chapter Two discusses the knowledge management and social media literatures. The knowledge management literature focuses on organisational knowledge development and is a review of management literature related to organisations and knowledge development. This literature provides an organisational perspective on knowledge development. The social media literature focuses on online engagement in virtual spaces and is a review of social media literature related to professional online communities. This literature provides a technology-mediated perspective on knowledge development.

Chapter Three discusses social capital theory. Social capital provides this research study with conceptual access to understanding how individuals use knowledge resources through virtual social networks. It will be used as a lens for exploring how social connections work for virtual networks used in problem solving.

Chapter Four describes and explains the methodological approach used in this research study. It begins by locating this study within its research paradigm. It follows with a description of the methods used. Finally it concludes with a reflexive discussion on the research process.

Section Two consists of chapters five through nine and is a discussion of the results and conclusions of this study. There are four results-based chapters followed by the conclusions chapter. In order to present the results of both the interviews and observations in a cohesive format, the following four results chapters are integrated with analysis and discussions; and presented within themes.

The end of each results-based chapter also includes personal reflections (i.e., a reflexive summary) on the research experience. The results are presented and analysed within
each of the results-based chapters. A final conclusion chapter reflects on the research study in the context of literature, theory, and practice.

*Chapter Five* discusses locating problem solving resources embedded within virtual networks. It introduces the problem solving process described by the interview participants and observed within the forum and explains how participants locate resources within organisational, professional, and virtual networks.

*Chapter Six* discusses how individuals solve problems through lurking in virtual networks. It explains how reading and observing behaviours are used to solve problems in virtual networks.

*Chapter Seven* discusses how problem solving occurs through publically posting on online sites. It explains how participants interactively engage with virtual network members in order to solve problems.

*Chapter Eight* discusses the social dimensions of accessing resources from social norms to deviant behaviours. It explains how the continuum of behaviours described and observed facilitate and inhibit access to embedded network resources.

*Chapter Nine* reflects on this research study, both its content and the research process. It presents contributions, limitations, and concludes with suggestions for further research.
Section One

As the first of two sections, this section introduces the background literatures and theory used and presents the methodological orientation of the research study.

This research study draws upon three different fields. It is based in the knowledge management literature. The knowledge management literature is used to address the question of how individuals develop organisational knowledge. The social media literature is used to address how individuals locate resources within virtual networks. Finally, given that the focus is the social connecting within this virtual knowledge development field, the research is theorised through social capital theory. Social capital literature is used to address how individuals socially connect in order to gain access to embedded network resources. This relationship between the three fields is illustrated in Figure s1.1 below:

![Figure s1.1 Relationship between relevant literatures and theoretical framework](image)

This section concludes with a discussion on methodology. The interpretive methodological approach and qualitative methods were chosen to address the explorative orientation needs and social context of the research problem and questions.
2 Review of knowledge management and social media literatures

2.1 Introduction
The aim of this chapter is to review the literature which addresses developing organisational knowledge using online resources. This review considers literature relating to the research problem:

*How do individuals extend outside organisational boundaries to solve problems?*

The chapter is organised into two sections: knowledge management (organisational knowledge development) and online engagement in virtual spaces (social media).

The first section, on organisational knowledge development, is a review of management literature related to organisations and knowledge development. The term *knowledge management* is used in relation to the application and practice of knowledge within an organisation (as opposed to more theoretical discussions) (Easterby-Smith & Lyles, 2003). Knowledge management is the ability to apply and act on knowledge contained within an organisation’s processes, structures, and people, to add value to the organisation (Baskerville & Dulipovici, 2006; Bennet & Bennet, 2007; Dalkir, 2005). For this study, knowledge management literature provides an organisational perspective on knowledge development.

The second section, on online engagement in virtual spaces, is a review of social media literature related to professional online communities. The term *social media* is used to describe technology-mediated spaces which facilitate collaborative and participatory engagement among members (Kaplan & Haenlein, 2010). Social media allows individuals to socially connect in virtual spaces. Social media provides the space in which individuals engage as well as the artefacts of these interactions. The evidence of these social connections is the user-generated content which remains visible after engagement. For this study, social media literature provides a technology-mediated perspective on knowledge development.
2.2 Organisational knowledge development

Much has been written about knowledge and the epistemological nature of the world. This study focuses on a very specific area of knowledge, organisational knowledge development. In order to appreciate the significance of organisational knowledge development, however, it is necessary to begin with a more general discussion on the nature of knowledge and knowledge management practices.7

Knowledge

The nature of knowledge has been discussed and debated throughout history. Many philosophers have contemplated the meaning of knowledge. Contemporary Western research on knowledge, however, commonly uses the concepts Aristotle presented in *Nicomachean Ethics* as the five intellectual virtues: *technê* (craft or art), *episteme* (knowledge), *phronesis* (practical wisdom), *sophia* (theoretical wisdom), and *nous* (intuitive understanding). Even though these accepted interpretations of the Greek concepts are widely used, their precise definitions were (and continue to be) argued. In this study, the concepts of *technê*, *episteme* and *phronesis* are important because they are often associated with characteristics of tacit knowledge; know-what, know-how and know-why, respectively (Erden, von Krogh, & Nonaka, 2008; Halverson, 2004; Nonaka & Toyama, 2007; von Krogh & Roos, 1995). These three concepts are interrelated in knowledge development literature. As an illustration, Nonaka and Toyama (2007) describe their research with Japanese automakers. The manufacturers may have an objective (universal) knowledge of how to build a car well (*technê*). They may also have subjective knowledge of what makes a car good (*episteme*). Neither of these types of knowledge used in isolation, however, will make the firms successful. It is only through the integration and application of these types of knowledge (*phronesis*), that automakers can strategically use knowledge “to understand and bring to fruition that which is considered good by individual customers in specific times and situations” (Nonaka & Toyama, 2007, p. 378).

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7 Although learning is part of the greater field of organisational knowledge development, this study focuses on specific problem solving aspects of knowledge development and does not address learning except when specifically relevant to the discussion at hand.
In addition to the relationship between different types of knowledge, there are also complexities within each type. For example, Parry (2008, p. 12), suggests that technê has characteristics of both activity and product:

...Aristotle says that each technê, investigation, action (praxis), and undertaking seems to aim at some good. The ends vary, however; some ends are the activities themselves and some ends are products (erga) beyond the activities. [Emphasis added]

This distinction is relevant to organisational tacit knowledge which also has dimensions of both activity (process) and product (content). As an illustration, Parry (2008) provides examples from Aristotle’s writing. An activity is the aim in technê such as playing the flute. This is contrasted with other technê, such as shipbuilding, which has the end product of a completed ship. Both of these components of technê, however, include action (as either the aim or the means to the end). Similarly organisational knowledge has an active component which distinguishes it from data or information.

**Knowledge Management Frameworks and Models**

Within extant literature, a number of different approaches to knowledge management have been described. Some literature envisions knowledge management as a sense-making activity. Sense-making is a means of finding meaning in information and knowledge in order to organise and apply it; it “involves turning circumstances into a situation that is comprehended explicitly in words and that serves as a springboard into action” (Weick, Sutcliffe, & Obstfeld, 2005, p. 409). For example, Choo (1996) suggests that organisations are sense-making entities: by evaluating existing information and the external environment in order to generate new knowledge. Weick et al. (2005) found that organisations find meaning in information in order to organise themselves, and then act on that new knowledge. Baskerville and Dulipovici (2006) suggest that sense-making is a way of organising and structuring information which gains context and can be used for organisational benefit.
Other literature focuses on the relationship and movement between explicit and tacit knowledge. For example, in the I-Space\textsuperscript{8} framework, Boisot (1998) suggests that codifying tacit knowledge is central to distributing it and making that knowledge available for social learning within the organisation (Boisot & Cox, 1999; Boisot, 1998). Alternatively, in the SECI\textsuperscript{9} knowledge creation model, Nonaka (1994) posits that knowledge is developed in a spiral of transition between tacit and explicit knowledge among individuals and groups within the organisation (Nonaka & Toyama, 2003; Nonaka, von Krogh, & Voelpel, 2006; Nonaka, 1994). In the N-form\textsuperscript{10} Corporation model, Hedlund (1994) also considers the movement between tacit and articulated knowledge by carriers (individuals and collectives) to be the primary driver in transforming knowledge within the organisation.

There is a diversity of perspectives represented in the literature as well as commonality. The variation in research focus has generated a wide range of models used to describe knowledge characteristics, processes, and cycles. Many of the models contain elements of knowledge collection, cataloguing, organising, sharing, codifying, and transferring knowledge between individuals and groups for organisational benefit (Dalkir, 2005; Easterby-Smith & Lyles, 2003; Nonaka & Peltokorpi, 2006). Of these concepts, the focus is often on knowledge transfer, including elements such as engaging, defining, seeking, articulating, integrating and disseminating knowledge. Knowledge development is of particular interest to organisations because of the prospects of leveraging individual knowledge throughout the organisation with successful applications of sharing among individuals and collectives. Despite the large and varied field of knowledge management research, there is also consensus among researchers on central concepts: knowledge is valuable to organisations and there are environmental and organisation conditions which influence knowledge development.

\textsuperscript{8} The Information Space (I-Space) framework is a conceptual model of knowledge flows which posits that “the more you can structure information, the faster and more extensively you can share it” (Boisot & Cox, 1999, p. 528).

\textsuperscript{9} The SECI model is “the process of knowledge creation through conversion between tacit and explicit knowledge” (Nonaka, Toyama, & Konno, 2000, p. 8).

\textsuperscript{10} The N-form is a model built on the differences in knowledge development between Western and Japanese firms; it argues that multiplication and combination are preferred mechanisms for transfer and transformation, instead of M-form characteristics of hierarchical organisation and division (Hedlund, 1994).
The value of knowledge to organisations is broadly accepted by researchers. Kogut and Zander (1992) argue that organisations are better than market forces at sharing knowledge. This creates a paradox, however, in that the knowledge is so essential that there is a perpetual risk of losing this resource and thus organisations must find ways to protect knowledge as a strategic asset. Argote and Ingram (2000) find that knowledge transfer is what adds organisational value. In particular, knowledge reservoirs, which facilitate the *transactive memory* of who-knows-what, are a primary source of competitive advantage. Other economists and management researchers see the value embedded within the organisation: a *resource-based view* in which knowledge is considered a valuable, rare and non-imitable resource contained within the organisation (Barney, 1991; Conner & Prahalad, 1996); or a *knowledge-based view* in which the value of knowledge is in the processes embedded within organisational actor-networks (Grant, 1996; Nickerson & Zenger, 2004; Spender, 1996; Tsoukas, 1996).

The research largely suggests that there are environmental factors which can support (or inhibit) organisational knowledge development. Three prominent environmental considerations are: absorptive capacity, stickiness (and leakiness) of knowledge, and enabling conditions.

*Absorptive capacity* of an organisation: is a function of individual members’ abilities to absorb knowledge, and a function of the context of the organisation (Brown & Duguid, 2001); is the ability of the organisation to recognise and assimilate new knowledge and affects market competitiveness (Cohen & Levinthal, 1990) and; facilitates knowledge sharing between individuals with different areas of expertise (Reagans & McEvily, 2003).

The *stickiness* of knowledge can make intra-organisational knowledge sharing difficult (Connell, Klein, & Meyer, 2004; Szulanski, 2000, 2003). It is the sticky quality of tacit or embedded knowledge, which gives it organisational value. For example, Cranefield and Yoong (2009a, p. 259) suggest:

Embedding knowledge could be seen as the whole point of knowledge transfer – unless newly acquired knowledge is embedded, it will be unevenly dispersed and/or applied in limited ways, leading to isolated, temporary benefits.
Organisations can face both stickiness and leakiness challenges. Stickiness is managed by developing social networks so individuals develop shared perspectives in which to share sticky knowledge. Leakiness is when organisational knowledge leaks from the organisation. Leakiness is controlled by limiting knowledge flows which occur in social networks. The dilemma for organisations is in finding a balance between the two. Individuals may have memberships in multiple and at times competing social networks, such as when members of professional networks work for different (competing) organisations. When organisations attempt to stop leakiness by preventing extra-organisational network engagement they may inadvertently prevent embedding sticky knowledge (Brown & Duguid, 2001).

There are organisational characteristics, such as structure, which can aid in the development of shared context between individuals (Augier, Shariq, & Vendelø, 2001; Sabri, 2005) and enabling conditions, such as access to embedded resources, which facilitate knowledge development (von Krogh et al., 2000). The enabling conditions (also known as enabling factors, prerequisite conditions, or facilitating factors) are the environmental characteristics which facilitate knowledge development (Baskerville & Dulipovici, 2006; Nonaka & Takeuchi, 1995; von Krogh et al., 2000). Complex relationships between individuals, individuals and the organisation, and individuals and the environment, contribute to (or inhibit) the development of knowledge. These relationships are often referred to as enabling conditions (or factors) within the knowledge management literature. Enabling conditions\(^\text{11}\) for knowledge development include behaviours and traits such as:

- **Recognition** of other individuals and potential knowledge development resources. Knowledge development derives from social structures in which individuals are more intimate (Augier et al., 2001; Schutz, 1967);
- **Cooperative behaviour** rather than competitive behaviour among individuals. Knowledge sharing is based on a gift-giving economy (von Krogh et al., 2000)

\(^\text{11}\) The pilot study for this research was an investigation of the enabling conditions in blogs. Although this study extends beyond the scope of the pilot, the pilot provided more in-depth exploration of enabling conditions. A journal article, *The ba of blogs: Enabling conditions for knowledge conversion in blog communities*, was developed from the pilot (see Martin-Niemi & Greatbanks, 2010).
- Mutual trust among individuals based on a sense of mutual dependency, reliability, and reputation (Nonaka & Takeuchi, 1995);
- Active questioning when individuals question events from a unique perspective, creating a shared context through discussion and interpretation (Augier et al., 2001; Rapport, 1999);
- Storytelling to create common stories and a shared history among individuals in order to co-create knowledge (Colton, Ward, Arnold, Corney, & Russell, 2004; Connell et al., 2004).

For this study, the literature which describes the process of knowledge development, the environment in which knowledge development occurs and the embedded social relationships are relevant because each aspect explains how knowledge can be developed in online environments.

ORGANISATIONAL KNOWLEDGE DEVELOPMENT CONTEXT

Individuals learn by discovering, reflecting on, and gaining an understanding of the world around them. During the process of learning, as part of knowledge development, individuals find, share and make sense of information and may also create new knowledge. Individual knowledge development is a more familiar concept than the development of organisational knowledge. What does it mean to develop knowledge for organisational benefit? In order to understand organisational knowledge development, we must consider all three aspects of this concept.

First, what is meant by organisation? Organisation typically refers to social institutions “of people whose activities are consciously designed, coordinated and directed by their members in order to pursue explicit purposes and attain particular common objectives or goals [emphasis in original]” (McAuley, Duberley, & Johnson, 2007, pp. 12–13). Organisations consist of members engaged in activities with common purpose. This study does include individuals who are members of organisations in this sense of the term, and also engaged in organisational knowledge development. For example, this could include employees of a multinational pharmaceutical corporation, volunteer physicians working for a humanitarian organisation, or a single freelance web designer working on contract for multiple organisations.
The study, however, does not limit itself to these types of organisations when investigating collectives of individuals developing knowledge. The term organisation can be problematic because most management literature uses the concept to describe entities with formal structures and roles, such as above (Knights & Willmott, 2007). For this research study, it is more useful to also think of organisation in terms of *organising*. Due to the more fluid and flexible nature of organisation used in knowledge development, this study uses the definition provided by Jackson and Carter (2000, p. 7):

> The concept of 'the organisation' is extremely difficult to define, and, additionally, depends upon what use is to be made of the definition, in what context it is to be employed... For this reason, our focus is not on organisation as a thing but on **organisation as process**: the activity of organising and being organised... The advantage of focusing on the process of organisation is that it is a focus on those characteristics that are common to all organisations, of whatever kind, and whatever their purpose. In this, it subsumes every particular characteristic of a particular organisation, and every particular characteristic of the people and things, both abstract and physical, that constitute a particular organisation. [Emphasis in original]

Second, what is the meaning of **organisational knowledge**? In this study, the concept of organisational knowledge is created by leveraging individual and relational (social) knowledge for organisational gain. Individual and relational knowledge is based on the ability to *act* on information at an individual level. “Knowledge is the individual ability to draw distinctions with a collective domain of action, based on an appreciation of context or theory, or both” (Tsoukas & Vladimirou, 2001, p. 979). Members of organisations *interact* with the external environment, internal (organisational) resources and external resources through knowledge development activities in order to develop organisational knowledge (Nonaka & Toyama, 2007). For example, an employee may be tasked with developing a new product for a company. That individual will integrate his/her own knowledge (e.g., technical skills) with resources available within the organisation (e.g., corporate policy on product lines, technical documents or discussions with the design department) and external resources (e.g., trends in product design discussed in professional conferences) to develop the new product.

Through knowledge development activities the organisational members may engage with resources to develop individual knowledge, but within the context of the organisational tasks and existing organisational knowledge. The organisational context
of the knowledge development activities frames the new knowledge and places it within the organisation’s domain. Tsoukas and Vladimirou (2001, p. 979) describe the relationship between individual and organisational knowledge:

Knowledge becomes organizational when, as well as drawing distinctions in the course of their work by taking into account the contextuality of their actions, individuals draw and act upon a corpus of generalizations in the form of generic rules produced by the organization. [Emphasis in original]

The role of organisation is not merely a repository for information or a mechanism for knowledge transfer, however; the social structures of organisation provide a combinative capability to integrate and make use of new organisational knowledge (Kogut & Zander, 1992).

Finally, what is the significance of organisational knowledge development? Although the knowledge management literature uses several terms to describe building knowledge for organisational benefit, such as creation and conversion, this study uses the term development. Development is used because the word suggests that the new knowledge is in-progress (as opposed to complete) and is open to change and continued developments.

Knowledge development is a process. Through the actions of organisational members, existing knowledge develops into new knowledge that is available for organisational use. As Nonaka and Toyama (2007, p. 374) describe:

Knowledge starts with subjective “belief”, and it is humans who hold and justify those beliefs. Knowledge cannot exist without human subjectivities and the contexts that surround them. What is “trust” depends on who we are (values) and from where we look at it (context). And it is the differences in our values and contexts that create new knowledge. [Emphasis added]

Within the knowledge development process, there is a relationship and interaction between individuals and the organisation. For example, Edwards (2007) suggests that individuals act as agents within an organisation, acting alternatively on behalf of themselves and at other times as agents of the organisation. During self-agency, individuals self-educate, creating an environment in which they can transcend the current knowledge base and generate new combinations and forms of knowledge. After new concepts and ideas are formed, the individual is then able to act as an agent of an
organisation, interacting with internal and external resources in order to develop context and to apply the newly created knowledge for organisational benefit and advantage.

2.2.1 Tacit knowledge and knowing

At the heart of knowledge management literature is the relationship between data, information, and explicit and tacit knowledge. Much of the literature describes a hierarchical progression from data to information to knowledge through the inclusion of meaning and action (Alavi & Leidner, 2001). Explicit and tacit knowledge are typically viewed as a dichotomy (Connell, Klein, & Powell, 2003; Nonaka & Takeuchi, 1995; Spender, 1996) or as part of a dynamic progression extending to wisdom and even enlightenment (Faucher, Everett, & Lawson, 2008; Sabri, 2005).

The knowledge management literature suggests that explicit knowledge is easily articulated, codified, and shared (Alavi & Leidner, 2001; Kogut & Zander, 1992; Nonaka, 1994). This type of knowledge is knowing-about and “consists essentially of concepts, information and insights that are specifiable, and that can be formalised in rules and procedures” (Connell et al., 2003, p. 141). It is typically characterised as the physical and tangible object of knowledge creation. It is easy to codify, distribute and systematise; making it ideal to manage in structured, formal information technology systems such as databases and document repositories. Knowledge management literature often describes the codification knowledge as necessary for the dissemination of organisational knowledge (Wiig, 1997).

Alternatively, knowledge management literature suggests that tacit or implicit knowledge is an individual and personal knowledge. This personal characteristic of tacit knowledge makes it difficult to articulate or share with others. It is dependent on “action, commitment, and involvement in a specific context” (Nonaka, 1994, p. 16). Tacit knowledge is conceptual and is generally considered the experience-based knowing-how as well as expertise, know-why, and care-why (Connell et al., 2003; Nonaka & Takeuchi, 1995; Taylor, 2007). Since tacit knowledge is difficult to articulate it is often shared through collaborative and interactive activities, such as learning-by-doing and
mentoring (Seidler-de Alwis & Hartmann, 2008), which provide a shared context. The focus of this study is on tacit knowledge development.

Knowledge management literature tends to focus on both explicit and tacit knowledge as an object rather than knowing as a process (Mooradian, 2005; Oğuz & Şengün, 2011; Orlikowski, 2002). Although useful for providing access to complex concepts, focussing on the possession of knowledge can also be limiting. Cook and Brown (1999, p. 382) describe this differentiation between object and process as the epistemologies of possession and practice, respectively:

[It is called] the epistemology of possession, since these forms of “what is known” are typically treated as something people possess. To say, for example, “Robert knows auto mechanics”... [T]he epistemic work done by human action itself – that is, about what is part of practice as well as what is possessed in the head. To say, for example, “Robert is fixing cars” points not only to knowledge he possesses but also to things he is doing. [Emphasis in original]

Considering this duality in the character of knowledge, it is useful to return to the roots of tacit knowledge and tacit knowing as first introduced to knowledge management by Polanyi (1966) and examine the relationship between content and process. There are two dimensions of tacit knowledge which are often overlooked or oversimplified in knowledge management literature. The first is the concept of indwelling as a means of developing tacit knowledge. The second is the relationship between focal and background knowledge.

Indwelling is experiencing, being connected to and living within the context of the knowledge. Polanyi (1961, p. 468) describes indwelling as part of knowing (and developing mastery) and as a physical experience:

To this extent knowing is an indwelling: that is, a utilization of a framework for unfolding our understanding in accordance with the indications and standards imposed by the framework. But any particular indwelling is a particular form of mental existence. If an act of knowing affects our choice between alternative frameworks, or modifies the framework in which we dwell, it involves a change in our way of being... All thought is incarnate; it lives by the body and by the favour of society. [Emphasis added]

As illustration, Polanyi (1961) uses a rower pulling an oar through the water. The rower experiences the feel of handling the oar with the pressure of the water on each stroke;
the rower indwells in the act of rowing (pulling an oar through the water). The knowledge of how to row comes from knowing rowing. In fact, as the rower experiences rowing, it is not possible to separate any rowing-related knowledge from the act of rowing. For example, the rower’s *knowledge of the water* is indistinguishable from *knowing the oar in the water*; the rower knows the water through the oar (e.g., what the water feels like, looks like, and how it behaves in certain conditions) – the knowledge of the water is through the context of physically pulling the oar through the water. This indwelling within activity (knowing) until mastery is achieved is the transition between focal knowledge and background knowledge.

The second distinction is on the relationship between focal and background knowledge. Mooradian (2005, p. 106) distinguishes between focal and subsidiary (background) knowledge:

Focal knowledge is the knowledge that one is directly attending to when one makes a claim to knowledge of some sort… The subsidiary knowledge is knowledge that is present in the mind but not attended to directly that leads to the focal knowledge.

As an illustration, Polanyi (1961) refers to a blind man using a cane. When first becoming accustomed to the cane, the man is aware of it in his hand; he learns to hold it in a way that it reveals the nature of what he is tapping. In the beginning, the cane is the focus. As he masters the cane, he learns more of the world the cane touches. He learns the feel of the ground through the cane (indwelling). The knowledge of the cane moves to the background and focal knowledge is of the object the blind man encounters.

Sharing explicit knowledge has historically been associated with information technology (Bhatt, 2001; Lang, 2004). Tacit knowledge, being more personal and difficult to articulate, remains in the knowledge management literature, the domain of face-to-face interactions. Information technology and web technologies in particular, are predominantly seen as ineffective for tacit knowledge sharing because they lack the social cues and rich communication environment of face-to-face interaction (Lang, 2004). The extent perspective of the literature is reflected in Bhatt’s (2001, p. 68) assertion:

The conversion between data and information is efficiently handled through information technologies, but IT is a poor substitute for converting
information into knowledge. The conversion between information and knowledge is best accomplished through social actors.

This implies that social actors are only engaging in face-to-face interactions and that no social action happens through technology-mediated communication. Considering this assertion and that tacit knowledge also includes tacit knowing, it is important for this study to investigate the role of information technology in the process of knowing as well as the object of knowledge. Since the concept of knowing is embodied (and embedded) within individuals in a physical sense (Polanyi, 1961, 1966), this research study considers the role of technology-mediation in indwelling, tacit knowing and the sharing of tacit knowledge.

It is important to note that there does exist a small body of knowledge on personal knowledge management which argues that web 2.0 information technologies incorporate social aspects of knowledge management (Fang & Gong, 2012; Razmerita, Kirchner, & Sudzina, 2009). As an alternative to modelling tacit and explicit knowledge as a combination of knowledge objects and knowledge in action, knowledge can also be considered from the perspective of a personal knowledge network or personal knowledge management. In this sense, knowledge forms an ecosystem of information independently managed by only the individual (Chatti, 2012). Individuals can create and possess their own knowledge ecosystems which benefit the organisation but cannot be owned by the organisation.

Personal knowledge models reveal a tension between organisational knowledge and personal knowledge (Pauleen, 2009; Zhang, 2009) and a how information technology is used. Traditionally knowledge management literature has focussed on incorporating individual knowledge into an organisation’s body of knowledge through the use information technology to extract and retain that individual knowledge. Using a personal knowledge model changes the perspective to the individual and specifically the role that information technology may play in creating social opportunities in which individuals can develop their personal knowledge ecosystems. Although as an emergent field personal knowledge management models are helpful in understanding how the individual perceives knowledge, it does not yet specifically address how knowledge develops and is shared within and throughout a collective of individuals through the use of information technology.
From the literature, it is unclear how organisational boundaries and networks can be extended to develop new knowledge. If the environment does not exist in the material world of the organisation, how does indwelling occur? Moreover, if there are no material resources available to develop experience-based background knowledge, how is focal knowledge developed? Underlying both of these questions is the concept of knowledge as object (e.g., the blind man knows how to use a cane) and action (e.g., the blind man is using the cane) in a material space. To address these questions, more investigation of process for creating knowledge is required.

2.2.2 The social nature of knowledge development

Knowledge development is the creation of new knowledge (and knowing) for organisational use. Although there are various frameworks for knowledge development, most have a social component which describes how individuals interact to share and create new knowledge.

Knowledge management literature suggests that sharing knowledge is integral to knowledge development. Knowledge sharing is the “dual process of enquiring and contributing to knowledge through activities” (Bosua & Scheepers, 2007, p. 95). In several of the models previously discussed (see section 2.2, on page 23), knowledge sharing is a social activity and part of the process that individuals use to understand and internalise what others know. In particular, for sharing tacit knowledge, individuals must be aware of each other’s perspectives in order to interpret newly acquired knowledge. There must also be a willingness to share knowledge which stems from a connection to others or the social network as a whole (Chiu, Hsu, & Wang, 2006; M.-J. J. Lin, Hung, & Chen, 2009; Sun, Ju, Chumg, Wu, & Chao, 2009; Wasko & Faraj, 2005). There is debate, however, about whether knowledge sharing helps develop a shared context (Bennet & Bennet, 2007; Nonaka et al., 2000) or whether that context is an individual construct (Augier et al., 2001) which cannot be shared, but can be known by others.

Knowledge is shared through interactions which provide context and meaning between individuals. Knowledge management literature suggests that in order to develop context and meaning, social relationships between individuals should be encouraged. For
example, Balmisse, Meingan, and Passerini (2007) posit that frequent sessions of casual and spontaneous communication lead to social interactions which support sharing of knowledge. To communicate and share knowledge more effectively, a shared framework must be established in which individuals have a common understanding of the context. Knowledge is situation-dependent (Bennet & Bennet, 2007); in order to share knowledge individuals must interpret meaning through signals shared during communication. Often the participants in knowledge sharing will have different perspectives on the situation, which makes sharing more difficult. Knowledge management literature offers many practices for knowledge sharing, including creating flexible teams (Jarvenpaa & Leidner, 1998; Kimble, Li, & Barlow, 2000), knowledge integration (e.g., including individuals with different areas of expertise) in tasks (Tiwana, 2004), mentoring (Swap, Leonard, Shields, & Abrams, 2001; Wenger, 2000), and using descriptive language such as metaphors and stories to communicate complex ideas (Brown, Denning, Groh, & Prusak, 2005; Swap et al., 2001; Yolles, 2007).

Tsoukas (2009) suggests that knowledge is created within organisations through social interaction and dialogue. This dialogical approach emphasises face-to-face dialogues as the primary catalyst for knowledge development. This is carried out through three types of conceptual changes which occur during conversations. First, conceptual combination, involves creating new knowledge from our existing knowledge by re-forming the elements in new combinations. Second, conceptual expansion, involves extending the use of existing concepts to new meanings. Third, conceptual reframing, involves changing the view of existing concepts to conceive of them from a new perspective. As illustration, Tsoukas (2009) describes individuals discussing problems in face-to-face exchanges and using one or more of the conceptual changes to generate novel ideas from those encounters. This model relies heavily on face-to-face engagement and does not explain how conceptual changes occur during technology-mediated dialogues.

Alternatively, von Krogh (1998) suggests that knowledge is created when organisations nurture (care for) the social relationships of organisational members (von Krogh et al., 2000; von Krogh, 1998). In Figure 2.1, von Krogh (1998) illustrates the relationship between caring for the social relationships and how knowledge is developed:
The degree of care influences how individuals share and develop knowledge. In high care situations, “characterized by considerable mutual trust, active empathy, access to help, lenience in judgement, and courage”, individual motivations and behaviours are more conducive to tacit knowledge sharing (von Krogh, 1998, pp. 138–139). In contrast, in low care environments, “characterized by distrust, no empathy, little or no access to help, authoritative judgement, and cowardice”, individuals struggle to even share explicit knowledge (von Krogh, 1998, p. 139).

**Capturing** relegates an individual’s knowledge development to a solitary process in which they capture knowledge independently. Within low-care networks, individuals fear asking for help and looking for resources, so they work on tasks in isolation and learn from that experience alone. Similarly, **transacting** is also highly influenced by fear in low-care situations. Individuals transact explicit knowledge by formal, verifiable, and structural means. For example, instead of having an informal conversation or illustrating meaning through a story or metaphor, individuals would send formal documents through email. The lack of trust in low-care environments requires individuals to prove their expertise and they are unable to rely on social relationships and shared histories to provide context for knowledge which is shared. Information technology and technology-mediated communication are traditionally associated with low-care transacting behaviours.
**Bestowing** is when individuals freely and willingly bestow their knowledge in order to help others. This is done in high-care networks through informal conversations, providing hints and tricks for problem solving and sharing personal stories and anecdotes. Mutual bestowing, when there is reciprocity in knowledge sharing leads to indwelling.

Building on Polanyi’s (1966) discourse on **indwelling**, von Krogh (1998, p. 141) suggests that indwelling is the heart of creating social knowledge in high-care environments:

> [D]welling in a concept can be understood as a dramatic shift of perspectives: you change from "looking at" to "looking with" the concept. In broader terms, indwelling is about commitment to an idea, to an experience, to a concept, or to a fellow human being. In developing shared tacit knowledge, the challenge for participants in knowledge creation will be to dwell in the experiences, perspectives, and concepts of other participants, or in other words, to change from self-commitment to other-commitment.

This re-conceptualisation of indwelling, as a transformative process integral to knowledge development, relies heavily on social relationships, high-care network characteristics and the ability of the social network to facilitate tacit knowledge sharing. This is similar in concept to **self-transcendence** seen in high-performing self-organised teams (Štrach & Everett, 2006). Indwelling is a useful paradigm for this study for describing the relationship between social networks and knowledge development.

Overall, von Krogh’s (1998) model for care in knowledge development is useful in understanding individual motivations and social network characteristics which facilitate or hinder knowledge creation. As with many of the knowledge management models, it suggests that face-to-face interaction is more conducive to tacit knowledge sharing. This research study examines this relationship further in order to understand the connection between social network characteristics and knowledge development in virtual spaces.

### 2.2.3 Knowledge conversion and the knowledge creation model: socialisation and **ba**

One of the most widely used knowledge development models is the knowledge creation model (SECI); SECI is an acronym for socialisation, externalisation, combination and internalisation and represents the processes for creating new knowledge (Nonaka et al.,
This research study also uses the SECI model to provide a framework for how knowledge is developed. In particular, this study relies on the socialisation and *ba* concepts as description of the knowledge development process. *Ba* is the term used in the SECI model to describe the physical, intellectual, and emotion place/space in which knowledge is shared among individuals (Nonaka & Konno, 1998; Nonaka et al., 2000). As described in the following sections on the knowledge development, Nonaka et al. (2000) defines knowledge development as the process of (1) transitioning between explicit and tacit knowledge; (2) moving between individual and collective knowing; and (3) taking place with a shared context (Nonaka & Takeuchi, 1995; Nonaka et al., 2000; Nonaka, 1994).

**THE USE OF SOCIALISATION IN KNOWLEDGE DEVELOPMENT**

The knowledge creation cycle, Figure 2.2, represents a spiral of individual and group behaviours in material and virtual environments, which encourage the generation of new ideas. The knowledge creation cycle has four phases: socialisation, externalisation, combination, and internalisation.

![Figure 2.2 Adaptation of knowledge conversion and self-transcending process (Nonaka et al., 2000, p. 12)](#)

As an individual interacts with a collective during the socialisation phase, tacit knowledge is shared through *empathy* and common understanding between individuals. Socialisation “is the process of converting new tacit knowledge through shared experiences” (Nonaka et al., 2000, p. 9). It is the phase in the SECI knowledge creation
framework in which tacit knowledge such as know-how is shared through participation in hands-on activities. For example, an individual may learn specific techniques by performing tasks under the guidance of an experienced mentor or coach.

Socialisation not only facilitates sharing tacit knowledge between individuals, but it is also the mechanism for learning and gaining access to the process for knowledge sharing. This is accomplished through learning how to share knowledge with other individuals through “spending time together or living in the same environment” (Nonaka et al., 2000, p. 9). Socialisation implies face-to-face engagement, but not necessarily spoken. As Nonaka (1994, p. 19) describes:

One important point to note here is that an individual can acquire tacit knowledge without language. Apprentices work with their mentors and learn craftmanship not through language but by observation, imitation, and practice... The key to acquiring tacit knowledge is experience. [Emphasis added]

By emphasising experience, albeit still in a material sense, Nonaka (1994) echoes the characteristics of indwelling set out by Polanyi (1966). Socialisation is significant for this study because it makes the connection between social relationships and knowledge creation through action (experience).

In the externalisation phase, where tacit knowledge is articulated, members of a community develop a shared understanding of the issue and can communicate knowledge more easily. It is these two stages, which enable the third phase of combination where explicit knowledge is connected and codified. In this phase, the explicit knowledge can be organised and distributed to others through technology-mediated communication. Internalisation is the process of embodying the new knowledge and putting it in to practice (Nonaka et al., 2000). It is through this constant cycle that new knowledge continues to develop and the body of knowledge increases.

Although the SECI model is commonly used in knowledge management literature, there are dissenting arguments about its effectiveness as a framework. For example, Gourlay (2006) argues that the SECI model is more about information creation rather than knowledge and lacks empirical validation. For this study, however, the SECI is useful for describing the role of social relationships and interaction in the knowledge development process. Moreover, the model gives insight into how the knowledge development
process provides access to knowledge resources through socialisation and its associated space for knowledge development (ba).

**BA: THE PLACE, SPACE AND CONTEXT OF KNOWLEDGE DEVELOPMENT**

Knowledge development is also dependent on having a space in which to occur. Ba is a central concept for the SECI. It has layered meanings, but roughly translates to place in Japanese. When used in knowledge management literature, ba describes the location/space in which knowledge creation occurs. Ba is more than a physical location, but is used to capture the shared context for knowledge exchange, a space for knowledge creation activities and processes, and a way of organising based on the knowledge being created (Nonaka et al., 2000; Nonaka & Toyama, 2003; Nonaka, 1994; von Krogh et al., 2000). Nonaka et al. (2000, p. 14) describe this knowledge-creation place, which facilitates the development of relationships and experiences, as ba:

A shared context, in which knowledge is shared, created and utilised. In knowledge creation, generation and regeneration of ba is the key, as ba provides the energy, quality and place to perform the individual conversions and to move along the knowledge spiral.

Ba maps directly to the SECI model and there is a unique ba for each quadrant of the knowledge creation process as seen in Figure 2.3 below:

![Figure 2.3 Adaptation of the four characteristics of Ba (Nonaka et al., 2000, p. 16)](image)

Developing ba increases the absorptive capacity of organisations (Brännback, 2003). There is not just one type of ba, however, different types of ba are associated with the
different phases of knowledge creation. Dialoguing ba is face-to-face spaces in which individuals share. Systemising ba associated with the combination phase of SECI, connects collectives through technology-mediation. It allows geographically dispersed individuals to virtually interact (Accorsi & Costa, 2008). Exercising ba can internalise explicit knowledge.

Socialisation supports the sharing of tacit knowledge through originating ba. Due to the difficulty of articulating and sharing tacit knowledge, individuals sharing complex ideas must understand not only the ‘what’ of others’ words, but also the ‘why’. As Nonaka and Konna (1998, p. 46) describe:

*Originating ba* is the world where individuals share feelings, emotions, experiences, and mental models. An individual sympathizes or further empathizes with others, removing the barrier between the self and others... Using epistemological metaphors, Nishada’s “I love therefore I am” stands in contrast to Descartes’ “I think therefore I am.” From originating ba emerge care, love, trust, and commitment. [Emphasis in original]

As with the SECI model, the concept of ba is widely accepted in knowledge management literature, but there is also criticism of its meaning and use. For example, Chia (2003) argues that Nonaka and Konno’s (1998) interpretation of ba is too literal. Even though, in the knowledge management literature ba is described as an intellectual or emotional space, in practice it remains firmly linked to physical places and spaces. Chia (2003) suggests that ba is not physical in any sense, but inseparable from the pure experience of knowing.

Despite the criticism of how ba is used in knowledge management, the concept is useful in understanding the environmental context of knowledge development. Originating ba is significant to this study in not only how it is used within the knowledge management literature, but in how it is not used. Knowledge management literature firmly attaches originating (and dialoguing) ba to face-to-face interactions. This extant use is useful for explaining the environment in which social knowledge is created and exchanged, but limiting in the method. This study must expand on the accepted relationship between face-to-face communication and the social realm of ba to investigate whether tacit knowledge can be shared within virtual spaces which hold the same characteristics attributed to this type of ba.
This research study largely relies on the knowledge creation cycle (SECI) framework developed by Nonaka et al. (2000) due to the inclusion of the concepts of socialisation and *ba*. The SECI framework is widely used as an underlying model for knowledge development studies (Easterby-Smith & Lyles, 2003). The framework is used for two reasons. First, SECI integrates knowledge content with the process of knowledge creation. Knowledge content is both codified information, for example written instructions or documented processes (explicit) as well as personal knowledge, know-how and skills (tacit). The knowledge creation process describes how new knowledge is developed, for example the act of learning, internalising or sharing. Second, SECI locates knowledge content and process within a knowledge creation space. This space is referred to as *ba* and is the location, context or space in which knowledge development occurs.

As with other aspects of knowledge management literature, SECI and *ba* also emphasise face-to-face interaction for tacit knowledge sharing. Why is there such an emphasis on face-to-face engagement in the knowledge management literature? For example, Hislop (2002, p. 173) argues that tacit knowledge sharing requires direct face-to-face social interaction, although he does concede:

> Thus, information technology systems are arguably likely to have the greatest potential role where there is a significant amount of common knowledge between the parties involved in the knowledge-sharing process, such as within a community of practice.

Lang (2004, p. 91) echoes this position, arguing that “arm’s length relationships are suitable for the transfer of codified knowledge...[yet] technologically mediated communication is ineffective for transferring tacit knowledge”. This negative perspective on technology may be because the literature was written before the development of the rich online environments we have today. Part of the preference for face-to-face may be due to the technologies available at the time. The majority of the seminal knowledge management literature was published from the early 1990’s through the mid 2000’s. This was also the beginning of a period of great technological change. Just as the dominant knowledge management frameworks were becoming widely accepted there was a huge shift in internet paradigms. In the post dot-com bubble burst of 2001 a new collaborative model of internet engagement was born, referred to as web
2.0 (O’Reilly, 2005). By 2007 the popularity of social network sites such as Facebook surged and completely changed the way individuals communicated through technology-mediation in virtual social media spaces (Ellison et al., 2007). This research study will re-examine the extant concepts of socialisation and ba (Nonaka et al., 2000) in knowledge sharing in light of new technology-mediation paradigms.

In order to understand how individuals extend beyond organisational boundaries to develop knowledge, the SECI model provides a description of what that extended knowledge space may look like and how social interactions support the activities in that space. What is missing, however, is how the space and social relationships work in a virtual setting. The SECI model, as with most knowledge management models, heavily relies on face-to-face interaction in a material space. This research study, therefore, explores beyond the traditional association between ba and face-to-face engagement and investigates other literature. One example is the community of practice literature which focuses on social relationships in both face-to-face and virtual spaces.

### 2.2.4 Social collectives in knowledge development

The concept of community of practice was first introduced by Lave and Wenger (1991) to capture the relationship between meaning, practice, community and identity in social learning. Wenger (2000, p. 229) defines communities of practice as having three elements:

First, members are bound together by their collectively developed understanding of what their community is about and they hold each other accountable to this sense of joint enterprise... Second, members build their community through mutual engagement. They interact with one another, establishing norms and relationships of mutuality that reflect these interactions... Third, communities of practice have produced a shared repertoire of communal resources – language, routines, sensibilities, artifacts, tools, stories, styles, etc.

More recently, the concept of network of practice (Brown & Duguid, 2001) has been introduced. There are several definitions of networks of practice, which generally...

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12 The version number, 2.0, is in comparison to first generation (i.e., web 1.0) sites which were fairly static websites published to the internet with few collaborative capabilities.
describe specialised networks in which members share and develop practice knowledge. Wasko and Faraj (2005, p. 37), extend this to online networks by defining electronic network of practice as, “a special case of a broader concept of networks of practice where the sharing of practice-related knowledge occurs primarily through computer-based communication technologies”. According to Wasko and Faraj (2005) these technology-mediated social networks have three key aspects: they are self-organising; membership is voluntary; and members mutually engage in knowledge development activities.

The concepts of communities of practice and networks of practice are often used interchangeably. For example Chiu et al. (2006, p. 1873) define communities of practice as “online social networks in which people with common interests, goals, or practices interact to share information and knowledge, and engage in social interactions” which would more accurately define a network of practice. It is important, however, to distinguish between the two. Community, as seen in Wenger’s definition, have the shared (communal) resources and objectives of a tight-knit collective. Whereas, networks stress technology-mediated communication and looser network connections which have fewer obligations to the collective.

Networks of practice are compelling for this study for two reasons. First, community of practice literature has traditionally emphasised relationships in which there are knowledge imbalances in the sense that one member (junior) seeks knowledge and another member (senior) possesses that knowledge. It is a classic mentor-mentee relationship described as legitimate peripheral participation (Wenger, 1998). Knowledge development using online resources may not necessarily adhere to that model. Some studies have attempted to adapt the legitimate peripheral participation concept to online context, but not convincingly (Efimova & Hendrick, 2008).

Secondly, community has the connotation of being a bounded entity with well-defined members and structure. Network has a more flexible meaning that better captures the manner in which the forum members in this research study interacted. Wasko et al. (2004, p. 497), for example, describe networks of practice as “informal, emergent social networks that facilitate learning and knowledge sharing between individuals conducting practice-related tasks”. Networks of practice are also self-organising and have open participation (Wasko & Faraj, 2005). It requires further investigation to determine
whether these implications of communities of practice fit well with the online social collectives used in this study.

There is a third concept in the community of practice literature; the concept of knowledge networks. Knowledge networks leverage social networks to share knowledge. Knowledge networks provide members with the means to interact and share knowledge. There is disagreement, however, about what kind of networks support tacit knowledge sharing. Augier and Vendelø (1999) suggest that it is only through networks with strong ties where members have regular informal face-to-face social interactions that tacit knowledge can be shared. Augier and Vendelø (1999), draw on the definition, given by Wright (1999), that identifies networks in which members learn and share knowledge as “comprised of people who are not necessarily acquainted with each other personally, but who share a common technical language and problem solving environment” (Wright, 1999, p. 296).

An important aspect of leveraging organisational resources from a social network is in knowing who to contact. This concept of who-knows-what is referred to as transactive memory (Wegner, 1986). It is commonly used to convey knowledge embedded in a collective (the organisation or a team) of “who is proficient at which tasks (the member–task network) and who is proficient with which tools (the member–tool network)” [emphasis added] (Argote & Ingram, 2000, p. 154). Transactive memory is usually associated with close-knit knowledge networks (Wegner, Erber, & Raymond, 1991). Is it also embedded in loosely associated online social networks?

A concern of significance for this study is how social collectives support knowledge development. The community of practice literature describes environments and conditions in which knowledge development activities occur, but this research study investigates the nature of these social networks in order to explain how knowledge networks operate. Further, community of practice literature commonly uses the concept of problem solving as a discrete exercise in knowledge development. Problem solving is a useful self-contained example of knowledge creation in which activities, behaviours and outcomes are more accessible to the observer than other modes of knowledge development.
2.2.5 Summary

In this section knowledge management literature, related to knowledge development, has been reviewed. The literature review revealed the following key concepts:

- Knowledge is comprised of both content and process. Individuals acquire, share and develop new knowledge by possessing knowledge (content) and practicing knowing (process);
- Emergent research on knowledge networks (e.g., networks of practice) is beginning to focus on inter-organisational linkages and includes investigation of knowledge sharing and development in relation to online networks and technology-mediated communication.

There are, however, elements of the research problem that the knowledge management literature does not adequately cover:

- The primary focus is on sharing, developing and keeping knowledge within organisations. There is little literature on sharing and collaboratively developing knowledge using networks and resources outside of organisational boundaries;
- Research that shows the integration of virtual spaces and technology-mediation is dated and this area is not thoroughly explored;
- The concept of communication in knowledge development and sharing is described in the literature, but little explanation is provided on how communication supports the social relationships which in turn facilitate knowledge sharing and development;
- There is some description of individuals connecting through technology-mediation, but little explanation of how it works and how this virtual social connection translates into problem solving resources.

Although this literature does not fully address the research problem, it does help form the basis of a research question:

How does tacit knowledge teach individuals how to engage in the process of accessing resources; and how to interpret the context of those resources?

This study examines the role of information technology (i.e., technology-mediation in social media) in knowledge development. The extant knowledge management literature
focuses on face-to-face communication in material environments. Virtual spaces and the role of technology and social media in knowledge development are not well developed in knowledge management literature. In order to answer the research question, social media literature must be investigated.

2.3 Online engagement in virtual social collectives
The previous section on knowledge management provided insight into how knowledge is developed. After interrogating that literature, however, the question remained: where might an individual find problem solving resources online? This question requires an examination of the body of knowledge on virtual engagement, spaces and collectives. For this discussion, in order to include all potential types of problem solving spaces, such as networks and communities, the term virtual social collective will be used for these spaces. They are virtual in the sense that the majority of engagement occurs in a virtual rather than physical space. They are social as a means of connection between individuals and there are many individuals groups as some form of collective.

As discussed previously, technology has traditionally been associated with explicit knowledge. It has primarily been considered an enabling factor in knowledge sharing as a repository for codified knowledge or a means to initially connect individuals who then can meet in face-to-face exchanges. For example, Bosua and Scheepers (2007) suggest that information technologies can contain metadata about individuals: what they know and what they have done (e.g., website biographies or directories of employee CVs). These metadata repositories provide contact information to link individuals. In this model, technology is a people-to-artefact connection and not a people-to-people link. Social media, with a focus on communication and collaboration, however, now present opportunities for person-to-person relationships and interactions within the virtual sphere, which were not possible in earlier technologies. With the emergence of forums, blogs, social network sites, and other Web 2.0 environments, social interaction, communication, and relationship development have replaced an object-based view of technology-enabled knowledge sharing. With the new communication capabilities, such as web 2.0, do virtual environments now provide more opportunities for tacit knowledge sharing which were once previously modelled on only face-to-face interactions?
VIRTUAL ORGANISATION

Much of the research on online engagement in virtual social collectives centres on personal relationships and engagement among network members (see Chin & Chignell, 2006; Fu, Liu, & Wang, 2008; Morrison, 2002; S. Yang & Chen, 2008). This study, however, focuses on professional relationships and organisational problem solving. There is literature specific to the intersection between organisations, organising, and virtual networks which is commonly referred to as virtual organisation. Although this literature is mostly concerned with organisational structures and not the social relationships, it is helpful to begin with this discussion on organising structures before delving into the social structures of virtual networks.

Knowledge management literature is largely interested in traditional organisational constructs; they are derived from the physical proximity and control of resources within the organisational structure (Yakhlef, 2009). Virtual organisation examines how individuals organise within a virtual environment. As Child (2005, p. 196) suggests, it is “not bound by legal or physical structures that define a conventional organisation.” The organisational structures suggested in this literature are a departure from traditional organisational models.

Instead of being defined by hierarchical relationships, virtual organisation models are defined by virtuality: the extent to which the organisation exists in a virtual (as opposed to physical) space. Less virtual enterprises are more dependent on durable resources (e.g., buildings and material networks in co-located spaces) while more virtually organised entities find and use alternatives to these physical resources (Picot, Reichwald, & Wigand, 2008). The concept of virtuality is useful for this research study because it connects organisational structures (i.e., the where, how and what of the organisational work) with organising activities (e.g., networking and connecting) all in a virtual context. For example, Yakhlef (2009, p. 79) describes virtualisation, the act of virtualising, as an organisational strategy which leverages networked relationships:

Through virtualization, the “framework” consisting of the static components has receded to the background, whereas the process of value creation and the modes of communication, coordination, and integration have gained prominence, taking on strategic dimensions in their own rights. [Emphasis added]
According to virtual organisation literature, the boundaries of virtual organisation are ephemeral; they expand and contract past traditional boundaries to incorporate industry members, competitors, complementarities, and other value-chain members as market conditions warrant (Ahuja & Carley, 1998; Warner & Witzel, 2003). Due to the complexities of organising and the dynamic nature of technologies which facilitate virtualisation, no single definition has emerged. Even with the multitude of definitions and interpretations, most focus on the collaborative, highly networked, temporal, and flexible nature of virtual organisation, characterised by market-led, rather than hierarchical, governance and control (Burn & Ash, 2002; Holland, 1998; Kasper-Fuehrer & Ashkanasy, 2001).

As with traditional organisational structures, virtual organising also has a variety of designs. Burn and Ash (2002) describe several models for virtual enterprises based on the interdependence and strength of the organisational links of co-location, culture, synchronicity, and shared risks. Models of less virtuality depend more on traditional organisational links to conduct business. Higher virtuality models are reliant on virtual links. In the middle are virtuality models of virtual-face, co-alliance, star-alliance, and value-alliance which are largely traditional organisational structures, and have a virtual presence with strong network connections. For example, the star-alliance model is a network of formally allied organisations. This model is very similar to the networked organisation described by R. E. Miles and Snow (1995) as a spherical firm. It has a dominant core organisation at the centre with smaller satellite organisations orbiting, as illustrated in Figure 2.4 below:

![Organisational structure as interrelated network members](image-url)

Figure 2.4 Adapted comparison of hierarchical to networked/spherical structure (R. E. Miles & Snow, 1995, p. 6)
This spherical structure of a networked organisation is “delayed, highly flexible, and controlled by market mechanisms rather than administrative processes” (R. E. Miles & Snow, 1995, p. 5). These forms of organisation are characterised by finding balance between dichotomies. They are able to both collaborate and compete within a network while exhibiting both autonomous and interdependent behaviours (Burn & Ash, 2002). This tension is also seen in models of midrange virtuality, such as the star-alliance, which depend on a stable network of organisations which is also flexible in its membership.

Concerning knowledge management in virtual environments, the higher virtuality organisational models, such as the market-alliance model in which member organisations of a virtual community “exist primarily in cyberspace” (Burn & Ash, 2002, p. 5), are of particular interest. In this model, virtual organisation is dependent on a network of relationships instead of traditional organisational connections to conduct business. Instead of co-location and an organisational culture based on face-to-face interactions, market-alliance virtual organisations function like virtual or distributed teams and have a high degree of informal communication. They are reliant on members’ sense of community, commitment to reciprocity, and trust rather than structural controls for participation (Ahuja & Carley, 1998; Kasper-Fuehrer & Ashkanasy, 2001; Sarker, Ahuja, Sarker, & Kirkeby, 2011). When considering virtual organisation, perhaps the most significant contribution of virtualisation is that it de-emphasises organisation as a framework of organisational layers such as hierarchies, span of control and functional groupings and instead emphasises “the process of value creation and the modes of communication, coordination, and integration” (Yakhlef, 2009, p. 79).

The literature on virtual organisation, however, does not address other characteristics of virtual environments and collectives. In particular, virtual social networks are not always motivated and directed by a common organisational goal which is requisite in virtual organisation models. For example, Ahuja and Carley (1998, Virtual Organization section, para. 1) define a virtual organisation “as a geographically distributed organization whose members are bound by a long-term common interest or goal [emphasis added], and who communicate and coordinate their work through information technology.” Instead, virtual network members, both individual and
organisational entities, have compatible or synergistic goals which can have both competitive and collaborative influences within the network.

In summary, even though virtual organisation literature emphasises *organising over organisation*, the formality of the models and definitions may restrict the use of potential resources by excluding informal and ephemeral online resources. Virtual networks generally have informal network ties, with no formal alliances or control. Would removing the organisational constraints from this literature allow for different contexts in which problem solving could occur? These limitations of virtual organisation literature for problem solving practice in virtual spaces make it necessary to look more broadly, outside of organisational literature, at other forms of virtual collectives in the social media literature.

**Social theories used for understanding virtual collectives**

Social media is an emergent area of study, therefore much of the research focuses on describing what online engagement is and how individuals connect online. The literature is rich and descriptive, but few studies provide explanation of how virtual networks provide access to resources. Blanchard and Markus (2007) argue that the research on social media is largely disjointed and that presently there are no social media specific theories addressing both the social and psychological processes observed in virtual collectives and the range of technological aspects unique to online environments. Some studies, however, do give explanation on the meanings behind online behaviours through the use of existing social science theory. The most prominent theories used in social media literature for explaining online behaviours in the context of a social network are self-presentation, social identity, and social capital theories.

Self-presentation is concerned with how individual agents behave within a social group (Kietzmann, Silvestre, McCarthy, & Pitt, 2012; Rawls, 1987). Specifically, it is focussed on an individual’s sense of identity, how much of that identity is disclosed to others, and how the identity presentation is managed. The social media studies which provide explanation for individual social behaviours often use Goffman’s (1959) work on impression management. Goffman (1959, p. 2) suggests that there are two parts to how individuals manage their identities – the intentional and unintentional expressions of self:
The expressiveness of the individual (and therefore his capacity to give impressions) appears to involve two radically different kinds of sign activity: the expression that he gives, and the expression that he gives off. The first involves verbal symbols or their substitutes which he uses admittedly and solely to convey the information that he and the others are known to attach to these symbols. This is communication in the traditional and narrow sense. The second involves a wide range of action that others can treat as symptomatic of the actor. [Emphasis in original]

Self-presentation is used in several social media studies to explain how online identities can influence relationships in a virtual space. For example Zhao, Grasmuck, and Martin (2008) introduce the concept of nonymous (the antonym of anonymous) for social network sites which require users to disclose identifying information (e.g., name, avatar and demographic data). In their study of Facebook users, they found that in this nonymous online setting users did not present the same identities that they did offline. As explanation, the study suggests that of Goffman's (1959) two kinds of self-presentation, individuals' intentional signals were more idealised than in person; “the Facebook selves appeared to be highly socially desirable identities individuals aspire to have offline but have not yet been able to embody for one reason or another” (Zhao et al., 2008, p. 1830).

Similarly, in the study of avatar use in Internet Relay Chat (IRC) and Instant Messenger (IM), Kang and Yang (2006) explain the meaning behind participants' use of more realistic avatars using theories on self-presentation (Goffman, 1959) and online identity management (Suler, 2002). Self-presentation does not just explain positive online behaviours, but has also been used to explain deviance online. For example, Donath (1999) suggests in her study of deception in Usenet discussion groups that members deliberately manipulate both the intentional and unintentional expressions. It was easier, however to manipulate the intentional (e.g., a man claiming to be a woman) and more difficult to deceive with the unintentional (e.g., a man writing as a woman may give clues unintentionally that he is actually a man). If self-presentation explains how different online identities could influence online relationships, how does it affect how those relationships support (or inhibit) problem solving? Perhaps it is not how the individual manages his/her identity online that is important for problem solving, but more so the role that the individual has within the virtual network, that is significant.
If self-presentation theories focus on individual relationships or individuals within a single group, then *social identity theory* examines the concept of identity from a social (as opposed to individual) perspective (Tajfel, Fraser, & Jaspars, 1984; Tajfel, 1982). As Tajfel (1981, p. 255) defines, social identity is “that part of the individuals’ self-concept which derives from their knowledge of their membership of a social group (or groups) together with the value and emotional significance of that membership” [Emphasis in original]. The definition is important for this research study because it makes a connection between value and social collective membership. Kietzmann et al. (2012) suggest that for social media, the value of the network increases as the size of the network increases. This value, however, is related to identity development of network members and it is unclear whether it extends to other network resources.

In social media research, social identity has been used to explain how online social networks influence individuals’ perceptions of their own identity. For example, Pluempavarn and Panteli (2008, p. 209) suggest in their study on a social network of photography blogs:

> Social identity exists not only in the real world but also in the virtual world. In addition, social identity is shaped by the members within the community, as well as exercising an influence on the group members’ identities.

Individuals form and present identities which are dependent on the social context of the network. That social context shapes which roles and behaviours an individual exhibits within the network. Social context is formed by an individual’s opinion of the network and in turn influences how those individuals identify and represent themselves within the network. Individuals view themselves as part of the central membership (*in-group*) of these social networks (Tajfel, 1982). If individuals see themselves as outside of these core in-groups and instead as outsiders (*out-group*), how does social identity explain how their identities are informed by weak affiliation with the network?

Social identity is useful for explaining the influence online social collectives have on individuals. In virtual social collectives, if individuals can be characterised by certain communal behaviours, then social identity theory allows for that *collective* categorisation to be considered part of their *individual* identities (e.g., *in-group*out-group or roles within the online group). Social identity does not provide explanation, however, of the value of membership outside of individual identity. This research study
requires a social perspective which can help provide an understanding of the resource value of network membership.

In social media literature, social capital is predominantly used to explain how individuals derive value from online relationships. As Ellison et al. (2011, p. 875) describe, “social capital can be understood as a form of capital, like financial or human capital, that is embedded in the relationships between individuals, and can be measured at the individual or group level.” Much of the social media research centres on the concepts of trust, social norms, and bonding and bridging social capital in online social networks. Bonding is seen in close-knit ties between family and friends which provides support for common goals through network affiliation (Bourdieu, 1986; Coleman, 1988). Bridging is found in loosely connected networks which provide access to external networks and resources through weak ties (Granovetter, 1973; Portes, 1998; Putnam, 1995b; Woolcock & Narayan, 2000).

In early studies on the Internet and social capital, researchers focussed on the relationship between virtual communities and the development of offline and online social capital. For example, in Blanchard’s (2004b, p. 70) study of a sporting newsgroup, she finds that two aspects of social capital, social norms and trust were demonstrated in both virtual and material networks:

Norms of appropriate behaviour (e.g., how to behave at races) and information about the trustworthiness of members do flow between the virtual community and FtF [face-to-face] communities in ways that positively affect both communities.

There have been several recent studies using social capital to explain social connection in Facebook (see Burke, Kraut, & Marlow, 2011; Ellison et al., 2007, 2011; Steinfield, Ellison, & Lampe, 2008; Valenzuela, Park, & Kee, 2009; Vitak, Ellison, & Steinfield, 2011). These studies also include relationships between offline and Facebook social networks, as well as the influence of bridging and bonding social capital on the networks. For example, in the study conducted by Burke et al. (2011), they suggest that there is a relationship between how members communicate through Facebook and bridging and bonding social capital. In the study, Burke et al. (2011, p. 577) demonstrate that directed communication such as DM (direct messages) or chat increases bridging social capital and provides access to resources embedded with the social network:
For a tie to provide value, such as a job recommendation, a person must be aware that the tie has a resource (such as an “in” with the Human Resources department), and be able to ask the tie about it (“Hey, are you guys hiring?”). Through directed communication, friends keep a channel of interaction open, periodically maintaining the relationship.

There is still debate on whether online engagement has a positive or negative effect on sociability. Although most current studies demonstrate positive relationships between social media use and social networks, some studies suggest that Internet use has a negative impact and erodes social capital (Nie, 2001; Putnam, 1995b). For example, Pénard and Poussing (2010, p. 569) in their study of Internet use in Luxembourg, raised the concern that “the Internet may isolate individuals and redirect the time spent participating in social activities, especially if Internet users are mainly engaged in solitary usage (web-surfing, news, reading, etc.).” Concerns about social capital have implications for this research study. First, since the concerns suggest that online engagement may reduce the time spent in face-to-face social engagement, what are the effects of online engagement on the social capital in predominantly virtual social networks? Secondly, the activities described as solitary usage may be used in problem solving, does this imply that online problem solving is only a social activity when interactively engaging in the virtual social networks?

Social capital theory is especially useful for this study because of the focus on network resources. In particular, social capital provides conceptual access to the meaning behind online behaviours and explanation for how those behaviours affect member access to resources within virtual social networks. In order to use social capital as a theoretical lens, a more thorough investigation of the literature must be undertaken. This discussion can be found in chapter 3.

In summary, this research study is interested in examining the virtual spaces in which individuals engage in problem solving. The social media literature, however, mainly describes these spaces and does not explain how they function as knowledge development resources. Social capital theory is useful in understanding how value is derived from social connections, but first we need to examine literature on virtual communities and networks in order to better understand how virtual collectives work.
2.3.1 Virtual social collectives: communities and networks

In an effort to understand how knowledge is developed online, the process and the place have been considered. The process is knowledge development and the place is social media. It is difficult to understand either the process or place in isolation without exploring the people involved and how they interact. The people and their relationships are captured in the literature on social collectives. The two most commonly used literatures for virtual social collection study are virtual communities and online social networks. The virtual community literature compares and contrasts the characteristics of material and virtual communities with many studies investigating how sense of community translates between the material and virtual. The online social network literature tends to focus on the characteristics of ties in virtual networks and the impact tie strength has on members. Both of these areas of social media research focus on the social relationships and connections which exist between individuals online. Investigating these two areas will provide a better understanding of the place in which online knowledge development occurs.

The concepts of community and networks have evolved over time and have been redefined and adapted by environmental, technological and social changes in the collectives. There are many characteristics of both community groups and networks, however, it is helpful to explore themes common to both which help distinguish one from the other.

Virtual communities are an important part of the development of social and communal norms online (Gurak & Antonijevic, 2008). As Rheingold (2000, p. 7) describes, virtual communities, like their material counterparts, are social collectives where members can engage and connect with others:

Virtual communities are social aggregations that emerge from the net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace.

The difference between material and virtual is that the virtual engagement is mediated through technology and the relationships occur online instead of face-to-face. Virtual communities share many characteristics with material collectives. The social media
literature focuses on the similarities and differences between the sense of community felt in material communities and the virtual sense of community felt online.

A defining feature of communities is the sense of community felt by members. In social media literature, and in particular virtual community studies, McMillan and Chavis’ (1986) framework, *Elements of Sense of Community and Their Hypothesised Relationships*, is commonly used and adapted to explore community online. It was derived from several studies of neighbourhoods and other material communities. Much of the literature on virtual communities emphasises the importance of a virtual sense of community among members (Blanchard & Markus, 2004; Blanchard, 2004a; Q. Jones, 1997). Sense of community is a sense of belonging to a social collective. It is a sense that “members matter to one another and to the group, and a shared faith that members’ needs will be met through their commitment to be together” (McMillan & Chavis, 1986, p. 4).

The elements of sense of community represent the different dimensions of how individuals connect within a community. There are four elements: membership, influence, integration and fulfilment (reinforcement) of needs, and shared emotional connection.

**Membership**

Membership is feeling a part of a group, but it extends beyond just the sense of belonging to the community. Membership is a commitment to the community through an individual’s investment which in turn gives them the right to belong. Q. Jones (1997) suggests that a minimum level of sustained membership is required for virtual communities; variability in membership is disruptive and may detrimentally affect the survival of the community. McMillan and Chavis (1986) propose that membership has five characteristics: boundaries, emotional safety, a sense of belonging and identification, personal investment, and a common symbol system. This is illustrated in Figure 2.5:
Boundaries create feelings of membership because they delineate which individuals belong to a community (in-group/members) and equally importantly, who does not belong (out-group/outsiders). The boundaries of material communities are typically easy to see because the membership defines the boundaries of the community. For example, they may be employees of a firm, people living in a neighbourhood, or members of a civic club.

The boundaries of virtual communities, however, are difficult to determine. The varied nature of online engagement means that some people only engage for short interactions in a single encounter and others may have prolonged engagement on multiple dimensions. This makes it difficult to identify the boundaries of a distinct community because the levels of engagement do not always indicate membership in virtual communities (Agarwal, 2008). Adding to the difficulty of community identification is the fact that virtual communities are very fluid and a single site may represent multiple communities at the same time or change communities over periods of time (Prieto, Tricas, Merelo, Mora, & Prieto, 2008). There are examples, however, of defined boundaries in virtual communities. For example, Lai and Turban (2008) suggest that developing new friendships and encouraging community participation with existing friends, signal social boundaries within online communities through the friendships.

The boundaries provide a sense of protection from outsiders as well as an intimacy with the in-group which develops in emotionally safe environments. When individuals feel accepted and connected to the community, they are willing to contribute and invest in the community (personal investment). As suggested in social identity theory (see page 53), with participation develops a social perspective on an individual’s identity. As
McMillan and Chavis (1986) explain, personally investing in the community through interaction, engagement with other members, meeting obligations, and making sacrifices, leads to a sense of belonging and identification.

The final membership characteristic is the ability to communicate and relate with other community members through shared language, communal stories, and ceremonies which provides a common symbol system for community membership. For example, Wei (2004) suggests that feelings of membership are developed in blog communities which use a common language, such as English, even when that is not the primary language for some members.

Membership is not unique to the concept of community. In the social network literature, membership shares common characteristics with concepts of common ties and shared identity (Blanchard & Markus, 2007; Driskell & Lyon, 2002). The common ties are characterised by the frequency of links between network members. Common ties are an indication of identification with a social network (feeling a part of a community) because they demonstrate knowledge of the social connections and a willingness to be affiliated with those connections. For example, some studies suggest that reciprocal linking between blogs demonstrates that the bloggers are members of a shared community (Chin & Chignell, 2007; Efimova & Hendrick, 2008). These studies, however, are limiting because they do not account for other (non-blogger) members, such as readers and those who post comments.

The difference between network and communities is that in networks, a sense of belonging may not be attached to one particular network. Instead, there can be an egocentric perspective. From that perspective, all of the networks in which an individual is a member are seen as his/her own network (Haythornthwaite, 1996). In this sense membership is not defined by the network, but by each individual member. This makes a sense of belonging more ambiguous and perhaps a more personal concept. In whatever way an individual chooses to participate, that is what constitutes membership in their networks. Sometimes individuals will figure prominently within their networks,
sometimes they exist on the fringes as a lurker\textsuperscript{13}, and in other cases they may act as a broker between networks.

**INFLUENCE**

Influence is bi-directional; it is the community’s influence over members (*openness to influence*) as well as each member’s ability to *influence the community*. McMillan and Chavis (1986) suggest that influence is dependent on a member’s attraction to a community (*consensual validation*), a community’s ability to ensure *conformity* among members, and normative behaviours for individual members as well as for the community as a whole (*community norms*). Through these mutual needs between individuals and the community, influence provides cohesiveness and strong ties among members. For example, Blanchard and Markus (2007) suggest that successful virtual community development is dependent on members’ sense of inclusion within the community, the influence of shared norms, and intimacy between members.

In networks, influence is represented by network ties. It is typically investigated using social network analysis (SNA). For example, Agarwal and Liu (2008), using SNA, assert that the most influential members of the network (*influentials*) have the highest centrality and betweenness. Centrality is a count of an individual’s connections. The more connections, the more central the person is within the network. Centrality is an indicator of a member’s prominence in the network (Garton, Haythornthwaite, & Wellman, 1999b; Haythornthwaite, 1996). Betweenness is a count of the connections in which an individual acts as an intermediary between two others (*brokerages*) (Haythornthwaite, 1996). The more brokerages, the more influential that individual is because others must go through them to gain access to others (and other resources).

Individuals who possess many of these network characteristics, such as a high degree of centrality and a high degree of *betweenness in multiple networks*, are considered influential brokers *between networks* and become conduits connecting networks together. This is illustrated by “B” in Figure 2.6 below:

\textsuperscript{13}“The term “lurker” has been used for some time as the descriptive term for these non-active participants: it is not taken or meant as a derogatory term, despite its historic meaning of someone lying in wait or hiding from view for nefarious purposes” (Merry & Simon, 2012, p. 244).
The direction of network ties also helps characterise the relationships between network members and the influence they have over each other. Direction is dependent on which behaviours are being captured by the network tie. For example, an undirected tie would be two people who both consider each other friends. In-bound and out-bound directional ties represent the flow of information or communication. For example, in-bound ties could be work given to you by an employer, help given to you by a colleague, or comments posted on your blog. Out-bound ties could be emailing job announcements to colleagues (with less reciprocation) or posting on a friend’s Facebook wall (more than they post on yours). Undirected ties are balanced; directed ties have an imbalance in flow between network members.

Network members with many in-bound ties are important for the continued existence of the network. Members with many out-bound ties are particularly influential because they can share their views and possibly affect others’ views within the network (Hanneman & Riddle, 2005).

**Integration and Fulfilment (Reinforcement) of Needs**

Integration is the benefit an individual receives by participating in a community. It serves as the purpose and motivation for community participation. An individual’s sense of integration and fulfilment of needs (reinforcement of needs) is the feeling of togetherness and association with a community (McMillan & Chavis, 1986).

McMillan and Chavis (1986) find that there are many reinforcing characteristics which may provide reinforcing conditions for community members. The researchers, however, suggest that three are particularly significant: status, competence, and shared values. As McMillan and Chavis (1986, p. 13) explain:
When people who share values come together, they find that they have similar needs, priorities, and goals, thus fostering the belief that in joining together they might be better able to satisfy these needs and obtain the reinforcement they seek.

Individuals who have a high status or a recognised position within the community feel closer and more connected to the community. Additionally, the feelings of connectedness are reinforced when members recognise another’s competence (e.g., knowledge, skills or social connections) as a community resource which may potentially benefit them. Individuals are attracted to communities which offer the greatest benefits to them as recognised members. Finally, the connection between an individual member and the community is reinforced through a shared set of values.

It is more difficult, however, to identify these characteristics in virtual social collectives, either communities or networks (Chin & Chignell, 2007). Perhaps this difficulty is due to the descriptive nature of SNA. When a collective’s purpose and reward comes from a member’s association and how that collective addresses the member’s needs, the potential benefit is from being connected to other members. In order to understand the motivations and purpose for this connection, this research study will look to social capital (see Chapter 3)

**Shared Emotional Connection**

The final characteristic contributing to a sense of community is a shared emotional connection between members. Depending on the type of community, whether geographic, organisational, or virtual, the attributes of the emotional connection will vary.

McMillan and Chavis (1986, pp. 13–14) present seven significant features of shared emotional connection: contact hypothesis, quality of interaction, closure to events (i.e., resolution), shared valent event hypothesis (i.e., shared experiences), investment, effect of honor and humiliation on community members (i.e., vulnerability), and spiritual bond (i.e., esprit de corps). Contact and high quality interaction are features of shared emotional connection in Figure 2.7:
Interaction features prominently in shared emotional connection because it is both the quantity of interactions (contact hypothesis) and the quality of interaction which are important. Frequent positive interactions between members help develop close-knit communities. Social interaction provides an intimacy between community members (Blanchard & Markus, 2007; Driskell & Lyon, 2002). Social interaction indicates a requisite level of familiarity and intimacy between members which is developed through repeated community engagement.

Investment in emotional connection is different from investment in membership. In this sense investment is more like the concepts of intimacy, vulnerability or emotional risk. There is a trust among community members that they can be open to one another without risking harm. In networks, tie strength indicates that there are varying strengths of connection between members of a social network. Tie strength, in contrast to emotional connection in communities, suggests that there is a range to the intensity in network relationships. It is not that an individual has a certain level of intimacy or familiarity with other members, but instead may have strong, weak or latent ties to the network (Haythornthwaite, 2002).

Sense of community can be useful in exploring behaviours in online collectives, but there are some difficulties with using virtual sense of community as a litmus test. One of the difficulties in interpreting whether online collectives are communities or networks is the connection between sense of community and engagement within the collective. Typically, sense of community is associated with interactive participation. In social media literature, most research on community membership investigates linking, posting, and commenting which represent interactive and public engagement within the community. Preece, Nonnecke, and Andrews (2004), for example, suggest that individuals who interactively engage by posting to forum threads feel a stronger sense of membership than those who do not. Reader/observer (lurker) engagement, however,
is less studied because it is not as easily identifiable as public engagement online. In fact, even though the number of individuals lurking online continues to increase, very little research has been done on lurkers’ sense of community.

In the studies which have been done regarding lurking, researchers indicate that they do feel some sense of community. For example, Baumer, Sueyoshi, and Tomlinson (2008) suggest that blog readers feel a part of a community even if they have never commented or made their presence known. Their feelings of a sense of community come from a connectedness derived from consistently reading the other members’ posts and comments. Marett and Joshi (2009) argue that individuals who lurk have feelings of membership within communities where they solely lurk. Similarly, Blanchard and Markus (2004) suggest, in their study of newsgroups, that those who lurk have a well-defined sense of community but this is weaker than those who participate publically through posting. Not all research, however, supports a strong sense of community in virtual communities. In another study, Blanchard (2004a) argues that the blog readers in the Julie/Julia project felt little sense of community. Even though there are differences among studies in level and degree of virtual sense of community, most suggest that sense of community is an important factor for community development and sustainability.

In summary, the concepts of virtual community and online social networks are often used interchangeably (Chiu et al., 2006; Wellman et al., 2001), but each in fact do have distinct characteristics. The risk of treating all online collectives as community groups is illustrated by Garton, Haythornthwaite, and Wellman (1997, Social Network Approach section, para. 5):

> Although a good deal of CMC [computer-mediated communication] research has investigated group interaction online, a group is only one kind of social network, one that is tightly-bound and densely-knit. Not all relations fit neatly into tightly-bounded solidarities. Indeed, limiting descriptions to group and hierarchies oversimplifies the complex social networks that computer networks support.

In virtual collectives, networks are considered more dependent on communication media (e.g. technology) because of the looser structure and the lack of explicit boundaries and rules (e.g. hierarchy) that are generally attributed to communities. Virtual community literature emphasises a civic nature of virtual collectives, in which
tight-knit well-defined groups engage online (see Wellman et al., 2001), yet does not fully explain how behaviours and motivations in virtual community engagement lead to individual gain and benefit. Both networks and communities, material and virtual, however, are ultimately based on how members engage and the nature of their relationships.

In considering the social media literature on virtual communities and networks, communities and networks share similar characteristics with knowledge development environments. There is some research which suggests that web 2.0 technologies facilitate the SECI socialisation phase (see section 2.2.3, page 37) by providing environmental and social support for knowledge sharing (Chatti, Klamma, Jarke, & Naeve, 2007). The concept of ba (see page 40), and particularly the originating ba of socialisation, is quite similar to aspects of sense of community. For example, as Nonaka and Konna (1998, p. 46) suggest, “From originating ba emerge care, love, trust, and commitment”. Other similarities emerge when considering social media in relation to knowledge development. For example, the enabling conditions (see page 26) such as storytelling mirror the common symbol system of rituals and ceremonies in the sense of community membership.

These similarities are promising in that they help describe the structure of collectives, but what is still missing is the nature of the relationships between individuals and the collectives. This research study investigates literature on online engagement, both normative and deviant, in order to understand how individuals engage within social media and virtual collectives during problem solving.

### 2.3.2 Social Media

What is social media? When you check your Facebook newsfeed, check-in to foursquare, watch videos of cats jumping into bags on YouTube, or tweet what you ate for breakfast on Twitter, you are describing how we use social media.

Social media are spaces which allow participants to engage through technology; in some cases multi-media, not just text, but also through links, images, video, and in the case of technical social media, formatted code snippets. Social media participation transcends the limitations of language, time and space, making it a mechanism for communication
in which participants can fully participate using their individual language styles, time
zones, and geographical locations. Gurak and Antonijevic (2008, p. 67) argue that social
media:

Illustrate the fusion of key elements of human desire—to express one’s
identity, to create community, to structure one’s past and present experiences
temporally—with the main technological features of 21st century digital
communication (speed, reach, anonymity, interactivity, broadband, wide user
base).

Social media allow people to engage in a virtual space. Exploring how people interact
when they are not physically sharing the same space can be challenging. There are many
concepts to consider when comparing social media to material engagement: technology-
mediated vs. face-to-face, virtual vs. real life, and online vs. offline. Some literature refers
to being on the Internet, on the web or online. Others describe being connected, such
as sharing photos or uploading video from a mobile phone. Due to the emergent nature
of this field of study, there are many terms currently in use. Among the most common
terms for the place (or sites) where this technology-mediated/virtual/online
engagement occurs are social media (Hansen et al., 2009; Kaplan & Haenlein, 2010;
Kietzmann et al., 2012), new media (Haythornthwaite, 2002; Siapera, 2012), social
software (boyd, 2007a; Chatti, Jarke, & Frosch-Wilke, 2007) and web 2.0 sites
(Cammaerts, 2008; Fu et al., 2008).

This research study uses the term social media to capture the technology-mediated
environments (e.g. social spaces such as Facebook, YouTube, or Instagram). Web 2.0
technologies provide the underlying environment for social media. These technologies
“allow contributors to collaborate and share information easily. The emerging result
could not have been achieved by each individual contributor” (Ankolekar, Krötzsch,
Tran, & Vrandecic, 2008, p. 71), but as a collective more can be achieved. Kaplan and
Haenlein (2010, p. 61) define social media in terms of these underlying web 2.0
technologies:

Social Media is a group of Internet-based applications that build on the
ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content. [Emphasis added]
The ability for individuals to connect, and through that connection co-create content via their interactions with each other, is at the heart of social media. The artefacts of social media connections are user generated content which is important for social connection because it is: (1) accessible – publically available to the network and not in private spaces such as email, texts or IM; (2) novel – intended to add to the discussion/body of knowledge and is more than re-posts of existing content from other sites; and (3) open – not commercially-owned information that is unavailable for communal user (Kaplan & Haenlein, 2010). Although all three characteristics are important for further investigation, the third item, non-commercial content, is of particular interest to this research study. As previously discussed, many organisations refuse to bring web 2.0 technologies within organisational boundaries from fear of leaking organisational knowledge through social media. A question this research study examines is; if organisational members are going online to problem solve, how does it occur and what are the implications for the organisation?

SOCIAL NETWORK SITES (SNS)

There are many types of social media. Social Network Sites (SNS) are currently the most common form of social media and the centre of much social media research because of their popularity and their expanding influence on offline society (Valenzuela et al., 2009). Currently, the five most popular SNS are Facebook, Twitter, LinkedIn, MySpace, and Google Plus+ (eBizMBA, 2012). SNS feature prominently in the emerging social media field of study. There is some confusion between the terms social networking and social network sites. The concept of social networking focuses on increasing one’s social network through networking. Social network sites, however, do not place emphasis on networking online (boyd & Ellison, 2007). Instead SNS networks tend to reflect members’ material networks (Ellison et al., 2011).

In their definition, boyd and Ellison (2007, p. 211) describe social network sites as:

Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site [e.g., friends, connections or contacts].
SNS are sites used to connect, communicate and share personal information between members of social networks. Members of a social network are required to register on the site and provide some information which will help them explicitly connect to other members (e.g., friends or connections). SNS typically have a profile in which members provide identifying information about themselves (e.g., name/username, photo/avatar, brief biography, interests or affiliations). The sites usually also provide a means for semi-private (restricted based on settings, usually to the member’s immediate network or friends-of-friends) broadcast communication (e.g., post, comment, like/favourite or share) as well as private direct communication with other members (e.g., chat or direct message). Members can also communicate through site functionality such as tagging a photo; or liking or sharing a post, as illustrated in Figure 2.8

Many SNS research studies focussed on descriptive studies of network structure (see boyd & Ellison, 2007; boyd, Golder, & Lotan, 2010; Brooks & Churchill, 2010; Garton et al., 1997; Haythornthwaite, 2005). This literature describes how and with whom people connect in social networks. Since a primary characteristic of SNS is the explicit social ties between individuals such as Facebook *friends*, LinkedIn *connections* and Twitter *followers/followed by*, the focus of those studies is on the interpretation of those tangible networks.

There is an emergent area of research which explores *social network emergence*, “where a community of users adopts a social media platform that is freely available on the Internet and incorporates it into their work practices” (Riemer, Overfeld, Scifleet, & Richter, 2012, p. 2). The current SNS studies are predominantly on personal social networks of students and young adults (see boyd, 2007b; Ellison et al., 2007; Vitak et al., 2011) and there remains little literature about professional SNS use. SNS, however, are not the only type of social media.

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14 Permission was granted by all Facebook friends whose images are shown in this figure. All of the names have been obscured and when requested the images were also blurred in order to protect their identities.
BLOGS

Blogs, the commonly used term derived from weblog (web + log), are another form of social media which are quite different from SNS (see Anjewierden & Efimova, 2006; Gurak, Antonijevic, Johnson, Ratliff, & Reyman, 2008; Herring, Scheidt, Wright, & Bonus, 2005). Herring et al. (2005, p. 1) define blogs as “web-based journals in which entries are displayed in reverse chronological sequence...through which people can socialize online.” Although blogs started as online journals, they are now more commonly used for topic-based articles and discussions (Anjewierden, de Hoog, Brussee, & Efimova, 2005). Due to the variety of blog subjects, many are on topics of interest to organisations. These type of blogs and their readership are commonly referred to as professional virtual/online communities in social media literature (M.-J. J. Lin et al., 2009).
Blogs are usually maintained by a single author ("blogger") or a small group who regularly publish articles ("posts"). Other members can register to post comments or can read without registering. Individuals can regularly follow blogs or view only a single post during the course of searching, surfing or following links. They interact with the blog through a combination of reading or commenting on blog posts, or linking to the blog from other sites. Although less structured than SNS networks, the blogging environment contributes to the development of social and communal norms within the blog (Gurak & Antonijevic, 2008). These blog features are illustrated in Figure 2.9 below:

If the core of SNS is connection, then conversation is the heart of blogs. For example, Efimova and de Moor (2005, Introduction section, para. 2) describe the process of conversation in weblogs (blogs):

A weblog conversation emerges when a weblog post triggers feedback from others, either using comments to the original post or replies in other weblogs linking to it. While using comments is not much different from any forum discussion [see page 71], the practice of replying in another weblog creates complexity as the conversation spreads over multiple weblogs. Given that every weblog has its own audience, the conversation becomes exposed to new readers.
Blogs are more than just published articles; they come into their own in social media as spaces for discussion and dialogue. They become social networks when linked within conversation.

Blogs became a frequent subject of Internet research at the same time as increases in blog usage during the 2004 US presidential elections. Therefore, much of the research on blogs is in relation to politics and civic engagement. Since that time their popularity has been eclipsed by SNS. Even though SNS have much larger memberships and more activity than blogs, for this research study, blogs play a role because of their professional online communities.

**Online discussion forums**

Online discussion forums are topic-based sites which, due to their wide ranging topics, are of interest to organisational members (Fayard & DeSanctis, 2005). Similar to SNS and blogs, forums facilitate online engagement between members. Some studies indicate that professionals use online discussion forums for acquiring information, finding resources, and participating in discussions which help in problem solving (Antaki, Ardévol, Núñez, & Vayreda, 2005; Fayard & DeSanctis, 2005; Yun & Park, 2011).

Forums differ from SNS and blogs in functionality. Forums allow any registered member to post a question which starts a public thread of discussion on a specific topic. This first post is referred to as the original post (OP). Other members can register to post comments on the thread. They can also provide feedback on threads through site functionality such as marking as helpful, as a solution, or as inappropriate (e.g., abusive, spam or offensive), as illustrated in Figure 2.10.

Although precursors to online discussion forums, such as bulletin boards and chat rooms were the subject of many early studies, contemporary forums have not been the subject of as many research studies as other types of current social media. Forum use and popularity has been quite different from SNS and blogs, and did not have the huge spikes in growth and media attention that the other social media domains have. They are largely the domain of hobbyists and professionals since they are topic-based.

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15 According to the Pew Research Center’s Internet & American Life Project: 62% of internet users surveyed used Facebook, but only 30% had their own blog (Rainie, Purcell, & Smith, 2011).
The social elements of SNS have not been the primary attraction for forum participants. Since they are topic-based, they become online resources for many problem solvers and often the networks surrounding popular forums have been intact and active for decades. The research on forums, however, tends to treat online discussion forums as tools instead of virtual spaces. Much of the research uses experiments in an educational institution setting (see Marra, 2006; Mazzolini & Maddison, 2003; X. Yang, Li, Tan, & Teo, 2007). Their focus is predominantly on how forums are used as a communication tool for improvement of student learning. Studies like these have demonstrated that forums can be used as communication tools (see M. K. O. Lee, Cheung, Lim, & Sia, 2006; Yun & Park, 2011), but have not provided much insight into the social environment of forums or how forum members gain access to network resources.

Although much of the literature on online discussion forums is about its use as a tool for technology-mediated communication in education, there is a small amount of literature on knowledge sharing in the social networks within forums and preceding technologies (e.g., bulletin boards and discussion groups). For example, in a study of Usenet support groups (predecessors to online discussion forums), Joinson (2003) describes how members establish themselves as legitimate members of the social network through knowledge of group norms. This was demonstrated in the study by participants posting messages which were appropriate to the group and followed accepted social rules, and by identifying themselves as members.
The research on problem solving in forums, however, is very limited, which poses an opportunity for this research study to explore knowledge development in virtual spaces which are used by organisational members, but not reflected in the social media or knowledge management literature. There remain many unanswered questions about how problem solving might occur in forums and how social connection could work in networks which are ephemeral and loosely connected.

**COMMUNICATION MEDIATED THROUGH TECHNOLOGY**

There is a large body of knowledge on how people communicate. One subset of this literature explores how mediated communication affects people’s ability to express themselves, understand and be understood. Although mediated communication could be any form of communication (e.g., letters or documents) other than face-to-face engagement, for this research study technology mediation is the focus. The communication literature has been grouped into three eras of mediated communication: *tele*-mediation, *computer*-mediation (CMC), and *technology*-mediation.

The first era, from the 1970s through the 1980s, which can be considered *tele-mediated communication*, focused on comparing telephone and video conversations with face-to-face communication. Several theories were developed based on the comparison of mediated to non-mediated communication. They focussed on the ability to give and read cues. Although, no longer relevant in current communication literature, social presence theory (Short, Williams, & Christie, 1976) is useful in providing an historical perspective on mediated communication.

Social presence compares mediated communication to face-to-face and evaluates how much the communicating individuals feel *in the presence* of the others. As Short et al. (1976, p. 65) posit:

> The degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships is an important hypothetical construct that can usefully be applied more generally. We shall term this quality ‘Social Presence’... We hypothesis that communications media vary in their degree of Social Presence and that these variations are important in determining the way individuals interact... Thus, the capacity to transmit information about facial expression, direction of looking, posture, dress and non-verbal vocal cues, all contribute to the Social Presence of a communications medium. [Emphasis added]
As Short et al. (1976) describe, a key element of successful communication is the “salience of the other person”, in other words, the ability for the other person to command your attention during communication. They find that face-to-face has a higher social presence than single channel communication, such as the telephone. This is similar to other reduced-cues/cues-filtered-out theories (Sproull & Kiesler, 1986; J. B. Walther, 1996) and ambiguity-reduction/media-richness theories (Daft & Lengel, 1986) which suggest that face-to-face is usually better than mediated communication because it provides more information which clarifies the context of the communication. There are some exceptions, however, such as needs for depersonalisation or anonymity in some instances (Short et al., 1976; Spears & Lea, 1994).

The second era, from the 1990s through mid-2000s, commonly referred to as computer-mediated communication (CMC), focused on the email, and the emergence of the Internet and first generation web technologies. It is the use of technology instead of face-to-face interactions for communication and in particular, communication facilitating community membership and the development of relationships. CMC is commonly defined by the absence of the face-to-face ability to use non-verbal cues to give context to dialog as well as provide the rhythm of conversational timing (Tidwell & Walther, 2002).

The CMC era literature is not fully relevant to current social media environments and behaviours within social networks. CMC literature, of which there is an abundance, focuses mostly on email, newsgroups, bulletin boards, MUDs, and other early online technologies (Hine, 2000). These predecessors to social media were the subject of many early studies and focussed on asynchronous communication, online behaviours, and the digital divide between different levels of technical access (Herring, 2002; Joinson, 2003). There are, however, many similarities between older CMC participant interaction and participation in current social media. Most forms of communication in social media are asynchronous. In that respect, they are similar to the temporal and spatial freedoms of more researched CMC such as email and newsgroups (Rasmussen, 2000). The use of these older technologies has in large part been replaced in the last decade by other genres including social and mobile media. The one exception to this trend is email which

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16 MUDs, multi-user dungeons, are multi-player role-playing text-based games similar to Dungeons and Dragons (Herring, 2002; Rheingold, 2000).
continues to be heavily used in organisational settings. Significantly, even though current social media have replaced the initial CMC environments, much of the extant research is reliant on these early CMC studies (see Kang & Yang, 2006; Riva, 2002; Tidwell & Walther, 2002).

The current era, from the mid-2000s, which this research study calls *technology-mediated communication*, includes social media and emergent technologies such as mobile media (e.g., mobile phones, smart phones, and tablets). This era gives us media which is less technically challenging to navigate and has fewer technical barriers to engagement among members.

Much of the current research on technology mediation continues to focus on how it compares to face-to-face communication. Some studies suggest that the major shortcoming with technology mediation is a lack of cues (Spears, Lea, & Lee, 1990; Spears & Lea, 1994). Other studies, however, present ways in which technology-mediated communication overcomes this short-coming by developing new social cues. Individuals who participate in social media find ways to use site functionality in order to express themselves. Some common methods of embedding meaning and cues into text-based communication are: emoticons\(^\text{17}\), use of punctuation and capitalisation\(^\text{18}\), and idiomatic expressions or paralanguage\(^\text{19}\) (Faraj et al., 2008; Joinson, 2003; Mann & Stewart, 2003; Preece, 2000; Riva, 2002).

Language usage is just one of the affordances of social media which address how and what is communicated. Site functionality extends Daft and Lengel’s (1986) concept of media richness, which originally focussed on the single channel text-based communication. Much social media, even when the primary communication is through text, offer a richness in other channels which helps communicate identity and experience through additional social media specific cues.

Another method of personalisation is signatures in emails and posts which are brief statements typically containing professional information (e.g., title, email, links to

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\(^{17}\) For example, :-) [happy], :-( [sad], or :-p [teasing, sticking tongue out]

\(^{18}\) For example, I AM SHOUTING! in upper case

\(^{19}\) For example, lol [laugh out loud], fwiw [for what it’s worth], btw [by the way], or imho [in my humble opinion]
websites, or a Twitter handle) providing others with identifying information about the individual (Rains & Young, 2006; Winter & Huff, 1996). Signatures can also contain information which reveals more about an individual’s beliefs, personal experiences, or preferences, such as famous quotes. Profiles are common in social media (e.g., SNS and forums). They provide more detailed identifying information on network members including a wide range of personal information, provided in order to establish familiarity and trust among connected members (boyd & Heer, 2006). Avatars are often included as part of a profile. In predominantly text-based environments, avatars are visual representations of individuals (e.g., cartoons or photos of members) which are used to present an online identity (Kang & Yang, 2006).

Increasingly, social media sites provide ways in which members can quickly evaluate other members. In addition to the identifying features of signatures, profiles and avatars, experience and reputation systems provide cues for individuals engaged in technology-mediated conversations. Badges are icons, or easily identifiable digital artefacts, which indicate how much and what kind of experience the individual has on the site (Antin & Churchill, 2011; Halavais, 2011). For example, members of TripAdvisor are awarded badges for the number of reviews they post and how many times those reviews have been marked as helpful (Halavais, 2011).

Badges signal identity to others. A badge is a strategic signal, which is considered a reliable demonstration of quality, when it is expensive to create the signal (Donath, 2008). These signals are so named because they indicate an excess of the resource they are signalling (e.g. a moose with large antlers to demonstrate strength or a person with several expensive sports cars to signal wealth – is more than what is actually needed for the signal). In the example above, if the member reviewed 1,000 locations it would be a strategic signal because it would take a lot of effort to be awarded a 1,000-reviews badge without actually reviewing the locations (i.e., it would be too difficult and time-consuming to deceitfully create the reviews). Similarly, a badge could be an index signal (i.e., a catalogue or indicator of traits), which is also considered a reliable signal, when it directly relates to the advertised behaviour (Donath, 2008). In the example above, the marked as helpful count would be an index signal of how many people find their reviews to be of good quality. Badges which demonstrate both handicap and index signals are commonly used in social media. Used together, handicap and index signals are
considered *assessment* signals, which “relate to the quality represented and one can assess the quality simply by observing the signal” (Shami, Ehrlich, Gay, & Hancock, 2009, p. 71). The mechanism behind awarding badges is commonly referred to as Karma systems. Karma systems are sets of rules sites use to encourage participation and enforce norms of behaviour by rewarding (through badges) those who actively participate (Lampe & Resnick, 2004).

Technology-mediated communication has several characteristics, such as public/private domain, one-to-one/one-to-many communication, directed/broadcast audience, or synchronous/asynchronous temporal interaction, as illustrated in Table 2.1.

Table 2.1 Technology-mediated communication comparison

<table>
<thead>
<tr>
<th>Message Type</th>
<th>Social media</th>
<th>Example</th>
<th>Domain</th>
<th>Communication</th>
<th>Audience</th>
<th>Temporal interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>Blog/Forum</td>
<td>Blog post/article, forum question (OP)</td>
<td>Public</td>
<td>One-to-many</td>
<td>Broadcast</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Response to post</td>
<td>Blog/Forum</td>
<td>Comment or link to post</td>
<td>Public</td>
<td>One-to-many</td>
<td>Broadcast or directed</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Post</td>
<td>SNS</td>
<td>Facebook status update or Twitter tweet ²⁰</td>
<td>Semi-public</td>
<td>One-to-network</td>
<td>Broadcast</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Response to post</td>
<td>SNS</td>
<td>Facebook comment</td>
<td>Semi-public</td>
<td>One-to-network</td>
<td>Broadcast or directed</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Direct message</td>
<td>SNS</td>
<td>LinkedIn, Twitter or Facebook message</td>
<td>Private</td>
<td>One-to-one</td>
<td>Directed</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Chat</td>
<td>SNS</td>
<td>Facebook or Google+ chat</td>
<td>Private</td>
<td>One-to-one</td>
<td>Directed</td>
<td>Synchronous</td>
</tr>
</tbody>
</table>

In addition to what is communicated and how it is said, there are other characteristics of how different types of technology-mediation function. The domain of the communication can be public (e.g., visible to everyone), semi-public (e.g., only to a

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²⁰ Twitter is asymmetric; posts are read by those who follow the poster and not by the poster’s network (followed by the poster) (Gruzd, Wellman, & Takhteyev, 2011). As an analogy consider one person walking ahead of others. The lead person (the person being followed) speaks over his/her shoulder to the ones behind (followers). The lead person does not necessarily know who is behind and listening.
specific group or network), or private. The audience can also be targeted to a specific person or broadcast generally to a group. For example, when posting a comment on a blog, the poster may explicitly or implicitly address the blogger (or another person who commented). Explicitly they might use the convention of an at sign (“@”) in front the username (e.g., “@Fa that is a good point…”). Implicitly their comment can suggest the audience (e.g., “I agree with the points raised above…”). Comments may also be broadcast to a general audience (e.g., “I find the following points important…”).

One of the primary characteristics of technology-mediated communication is synchronicity. Synchronous is the real-time interaction between individuals. Asynchronous is when communications are time-shifted (Sutton, 2001). Asynchronous communication can mimic real-time communication when all participants immediately react to each other’s’ contributions, but is not truly synchronous (like face-to-face conversations). The amount of synchronisation is moderated by the behaviours of the participants. Conventionally, synchronous communication, however, is rarely used asynchronously. For example, imagine if during face-to-face conversation, one person waited in silence for long periods of time before responding to the other. Joinson (2003, p. 21) describes:

*Synchronicity refers to whether or not a discussion or conversation takes place in ‘real time’ or is spread over time. Media are usually divided into synchronous communication (e.g. the telephone) and asynchronous (e.g. the letter). However, this neat division is being blurred by newer communication technologies like e-mail and SMS [texts], that are typically seen as asynchronous, but in some cases take on the characteristics of synchronous communication because of the speed of reply and networks. However, even in these cases, the psychological imperative to reply immediately (as you would need to in a conversation) is not there.*

As noted by Joinson (2003), the timing of conversations, is not completely dependent on the technology. There are also social norms and behavioural expectations which dictate how technologies are used for communication. Table 2.1 above lists the temporal interaction (i.e., timings) for different types of social media messages. For example, a *tweet* is technically asynchronous, but two users could quickly respond to mutual
mentions\textsuperscript{21} with a nearly synchronous pace. Alternatively, Facebook chat is intended to be synchronous\textsuperscript{22} (it is only available when both parties are logged on to the site), but one user could post a message through chat with no expectation of a quick response (e.g., “saw your new photo - lol”).

Using asynchronous communication, member conversations are very different from the give and take of synchronous dialog having both longer pauses and an increased potential for divergent conversational threads. Not all technology-mediation is asynchronous. Mobile phones and internet video calls (e.g., Skype) are commonly used synchronous technologies. Most social media (e.g., Twitter tweets, Facebook messages, forum posts, etc.), however, is asynchronous.

From the social presence discussion (see page 73), it would seem that synchronous communication, having richer media\textsuperscript{23} and higher social presence, would be better for the complexities of knowledge sharing. While studies suggest that synchronous CMC “appears to be better suited for social interaction”, there is evidence that asynchronous communication is better for “more complex discussion and problem solving” (Herring, 2002, p. 135). This is due to the customary interaction in each of the sets of technology-mediated environments. Studies suggest that synchronous messages tend to be shorter, less formal, more playful, and have more social content, while asynchronous messages tend to be longer, more formal, more carefully composed, and communicate more complexity (Herring, 2002). This research study further investigates this issue.

The literature, although still heavily influenced by early CMC studies and mediated communication theories, such as social presence, is starting to turn its attention to social and mobile media. Many of the most recent studies on technology-mediated communication are on Facebook and Twitter. They are more concerned with social implications of technology-mediation and therein how it is integrated into everyday life

\textsuperscript{21} For example, Twitter users can mention each other by using their Twitter handles (e.g., @FaNiemi or @kiaorasisu) in tweets (e.g., @FaNiemi coffee in staff lounge?). The mentioned user is notified of the tweet and can respond (e.g., @kiaorasisu yep, meet in 10).

\textsuperscript{22} The functionality of Facebook is continuously changing. During this study, messages and chat were separate functions, but have since been merged.

\textsuperscript{23} “Richer media were those with a greater language variety (the ability to convey natural language rather than just numeric information), a greater multiplicity of cues (the number of ways in which information could be communicated such as the tone of voice), a greater personalization (ability to personalize the message), and more rapid feedback” (Kaplan & Haenlein, 2010, p. 1).
and, specifically, social connection online. This is an important feature of emergent research, because it is a significant departure from the focus on media as only a means of communication. Due to this change in focus, this research study will use the term technology-mediated communication to capture the emergent technologies and uses available for knowledge development.

2.3.3 Online engagement

How does participation within social media differ from face-to-face engagement? It is tempting to focus on the obvious difference that social media is mediated by technology. It is not technology, however, which provides the biggest difference to the social aspects of social media. In social collectives, technology mediates social connection rather than replaces it. It provides the possibility of different and additional forms of social connecting. As described by Castells (cited in Bell, 2001, p. 59):

This information age has never been a technological matter. It has always been a matter of social transformation, a process of social changes in which technology is an element that is inseparable from social, economic, cultural and political trends. [Emphasis added]

Castells' (2001) assertion is a useful reminder that virtual collectives are social collectives in which the engagement is technology-mediated. Therefore, with the possibility of using technology to mediate different social connections it is tempting to consider only the technical aspects of technology-mediation (e.g. text-based, asynchronous, permanent, searchable, and distributable). The focus of this research, however, is not on the technical characteristics of technology-mediated communication, but the social structures, processes and norms which saturate technology-mediated engagement.

Technology mediates the social connectivity of virtual collectives by providing a mechanism for dislocated individuals to organise and interact. Individuals participating in virtual collectives engage through technology, such as social media. Social media connects individuals through personal connections and topics of interests. Social media, such as social network sites (e.g., LinkedIn or Facebook), provide connection through member relationships; the connection is through people. Other forums of social media, such as forums, provide connection through mutual interests in topics (e.g., threads).
What socially separates face-to-face engagement from technology-mediated engagement in social media is that social media lowers the threshold of participation between individuals and it reduces the barriers to engagement (Ellison et al., 2007, 2011; Rheingold, 2003). Studies suggest that individuals potentially have more access to socially-related resources because it is easier to socially engage with others online (Bargh, McKenna, & Fitzsimons, 2002). What does lowered threshold mean for knowledge development in virtual spaces? Consider what is required to problem solve in a material setting: knowing who knows what (from material networks), having a relationship which allows you to ask them for help, and the ability to meet in the same place at the same time. The requirements for participation in many social media can be easier to meet. For some information seeking, it only requires the knowledge that resources exist. This is typically facilitated through search, wiki-walks24 or leveraging knowledge from other networks. If social media do not have the same pre-requisites for engagement then is there more (or different) access to socially embedded resources than in face-to-face networks?

PRIVATE ENGAGEMENT THROUGH LURKING

Online engagement is described as lurking when an individual’s entire social engagement in a specific online setting is through non-interactive behaviours (e.g., reading, following, or observing) – as an audience member, and does not include any posting or public social connections with other members of the network (Burnett, 2000). Early studies characterised lurking in a negative light (Kollock & Smith, 1996a). Recently, lurking has been reconceptualised in a more positive light. For example, Crawford (2009, p. 526) describes the current dilemma:

‘Lurking’ is a common pejorative term for those who are present in public online spaces but do not prominently speak up. I would argue that this term has hampered our understanding of online spaces, and that the concept of listening offers more open and critically productive ground. [Emphasis added]

24 A wiki-walk is the term for navigating a random walk through links to different sites (Yeh, Ramage, Manning, Agirre, & Soroa, 2009). Colloquially, it is “named for the ability of anybody to start out on a page and, two or three links later, find himself reading a totally unrelated trope” (TV Tropes Foundation, LLC, 2010, para. 11).
Crawford (2009, p. 528) argues that there is actually an “overemphasis on posting, commenting and ‘speaking up’ as the only significant forms of participation”. Emerging studies like this see lurking as a more active and contributing behaviour in social networks. For example, Chen and Chang (2011) suggest that not only is lurking an active behaviour (as observation), but lurking actually helps posters in co-creating knowledge (as the felt presence by those posting). This is similar to how an audience influences a live performance or a readership influences an author.

Lurking is a context-specific behaviour both spatially and temporally. In certain situations, some people lurk in some sites, but post in others. Research studies on online behaviours make two key points on lurking: (1) everybody who participates in social media lurks at some point; no one only posts without reading and (2) the majority only lurk; they have never posted publicly (Mason, 1999; Nonnecke & Preece, 2001; Yeow, Johnson, & Faraj, 2006). Moreover, some lurk in one context, but post in another. When considering lurking, it is within a given place at a given time.

As an activity, lurking is difficult to witness through observations apart from viewing counts and references to individuals who view posts. There have been few studies focussed on lurking in social media even though the majority of online engagement is through lurking (Katz, 1998). This is due, in part, to the difficulty of observing lurking (Merry & Simon, 2012). Most lurking leaves no traces in the way that the artefacts of online conversations remain as posts, threads and comments. Instead, studies on lurking rely predominantly on participant surveys (Dennen, 2008; Marett & Joshi, 2009; Merry & Simon, 2012; Preece et al., 2004; Rau, Gao, & Ding, 2008; Ridings, Gefen, & Arinze, 2006), but also use interviews (Cranefield, Yoong, & Huff, 2011; Nonnecke & Preece, 2001; Panteli, 2008), structured experiments (Chen & Chang, 2011; Y.-W. Lee, Chen, & Jiang, 2006), and network analysis (Rafaeli, Ravid, & Soroka, 2004; Yeow et al., 2006) in order to understand lurking behaviours.

What motivates individuals to lurk?

Some studies suggest that individuals lurk simply because they are unwilling or unable to publically engage or because they are “less confident learners” (Y.-W. Lee et al., 2006, p. 409). Other studies suggest that while willingness or ability account for some lurkers, some of the time, there are actually a wide variety of reasons individuals lurk (Nonnecke,
Andrews, & Preece, 2006). For example, Jon Katz (1998) suggests from his experiences as a Slashdot contributor and frequent poster, that those who lurk, the largest contingent of the virtual network, are “invisible, sometimes counted but almost never seen or heard”. Instead of publically posting, individuals who lurk frequently send him private email messages. From those emails, Katz (1998, para. 18) reflects:

Newcomers to the Net often e-mail, just to see if anybody’s really on the other end, but they wouldn't dream of posting because they feel they don't understand the language or rituals here. Foreigners are reluctant to post publicly, because they don't feel confident enough about their command of English to argue issues. Many women and elderly people often browse sites like this but frequently write that they find much of the content interesting, but have never posted publicly because they don't go online to argue. [Emphasis added]

There are different motivations for participation for posters and those who choose to lurk. In a study of an online discussion forum on intercollegiate sports, Marett and Joshi (2009) suggest that posters have a combination of intrinsic, extrinsic and normative motivations, but individuals who lurk are primarily influenced by extrinsic and normative factors. Other reasons for lurking include: uncomfortableness in public, learning about the group, building an identity, fear of persistence of messages, communication overload, and no necessity to post (Nonnecke & Preece, 2001).

How is lurking related to knowledge development?

When an individual is learning online they typically interact with content (e.g., documents or example code) and other people (e.g., mentors, fellow developers, or team members). For example, Sutton (2001) refers to these interactions as ‘learner-content’ or ‘learner-learner’. Additionally, Sutton (2001, p. 227) suggests that there is another form of interaction that is somewhat unique to an online environment:

Vicarious interaction takes place when a student actively observes and processes both sides of a direct interaction between two other students or between another student and the instructor. Interaction in this sense is not first hand, but one level removed, hence the term vicarious... Vicarious interaction occurs when a learner absorbs and processes an observed interaction between others.
This concept of interaction, during which learning can be through observation of things (content) or of processes (vicarious), is useful in its similarity to lurking behaviours. When lurking, individuals can also observe site content or conversations between others by reading threads and comments.

Online learning can entail both (i) reading content and (2) vicarious interaction with the social network during which “an otherwise passive student actively observes, absorbs, and processes the ongoing interactions between other students” (Sutton, 2001, p. 232). Is this also a valid description of how individuals who lurk develop knowledge online? There are both similarities and differences between lurking and vicarious interactions. Vicarious interaction leads to overt expression and interactions with others. Although some of the lurking literature also suggests de-lurking is the outcome of lurking, this study explores whether lurking is an activity in its own right without leading to posting.

Is lurking bad for the social network?

As an alternative to studying lurking from the perspective of individuals engaged in lurking, studies also consider the affects lurking has on the network. For example, as Wasko and Faraj (2005, p. 37) suggest, “knowledge contributors have no assurances that those they are helping will ever return the favour, and lurkers may draw upon the knowledge of others without contributing anything in return” [emphasis added].

Does this mean that even if lurking is not a harmful behaviour, it has no value to the social network? If a majority of network participants lurk as their dominant method of participation and if lurking has no value to a network, then is it better if they all either interactively engaged or left the social network? There is very little research on the contribution of lurking to social networks. What is the impact of lurking on social networks? Does lurking only have benefits to the lurkers themselves?

Many studies suggest that lurking benefits those who lurk, but is lurking harmful to online social networks? Early studies on lurking cast the behaviour in a negative light (see Riva, 2002). In this early research, lurkers are described as free-riders and social

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25 De-lurking is a “transfer from passive participation (only visiting the forum to read) to active participation (actively posting opinions and thoughts on the forum)” (Rafaeli, Ravid, & Soroka, 2004, p. 4).
loafers, eavesdroppers on private conversation, or individuals too intimidated by the technology or virtual network to post (Kollock & Smith, 1996a).

Let us consider whether lurking is akin to social loafing. First, it is important to put the behaviour in context. Karau and Williams (1993, p. 681) suggest:

Formally, social loafing is the reduction in motivation and effort when individuals work collectively compared with when they work individually or coactively. When working collectively, individuals work in the real or imagined presence of others with whom they combine their inputs to form a single group product. When working coactively, individuals work in the real or imagined presence of others, but their inputs are not combined with the inputs of others. [Emphasis added]

If lurking is social loafing, then this definition implies that when working online in virtual networks, individuals are working collectively. When individuals are engaged in problem solving using online resources, are they working collectively or coactively? It follows that if the behaviour is coactive, then the concept of social loafing does not apply.

Secondly, more recent literature challenges this idea by describing lurking as a valid and positive form of involvement in online networks (Nonnecke et al., 2006). This emergent research, however, still represents individuals engaged in lurking as potential posters with the ideal that there would be no lurking and everyone would post and publically engage (Marett & Joshi, 2009). More recently, there have been studies which suggest that lurking is an integral part of online social networks as the imagined audience (Litt, 2012). Even this emergent research, however, tends to describe lurking as a pre-posting transitional behaviour which ideally leads to de-lurking and posting (Rafaeli et al., 2004).

Lurking is a common behaviour which remains poorly understood. Several questions remain unanswered. Are individuals' needs met by lurking or would they (and the social network) benefit from more public engagement? What is the role of lurking in problem solving? Does lurking fulfil part of the problem solving process or does lurking behaviour present an obstacle to problem solving online?

**Public engagement and visible online behaviours**

The majority of social media studies are on posting and public behaviours online. Posting is defined by the act of publically interacting with a site or others. This is seen
through posts, comments, tweets, or the other ways in which people engage online. Posting is also a durable means of engagement, in which posts or other artefacts of engagement remain after the original engagement is complete. It is important to note, however, that as the ability to fine-tune social media settings, the concept of visible versus invisible becomes more blurred and less of a binary opposition.

Public engagement has a variety of behaviours. Burnett (2000) describes a typology of these behaviours and characterises them as either social behaviours or information seeking/sharing behaviours. The social behaviours fall into three categories: (1) neutral – pleasantries and gossip, (2) humorous – games and playful interaction, and (3) empathic – emotional support. These social behaviours help develop community and social relationships. The same could be said for information sharing as well. Information seeking, however, has a more instrumental motivation, to serve the needs of the seeker and not necessarily for community or relationship building.

This does not mean, however, that information seeking does not contain a social element. Information seekers find, in addition to the explicit information they seek, referent information on what the community’s expectations are of them as well as normative information on the community’s social norms (Morrison, 1993). For example, in their study on online communities of practice, Cranefield and Yoong (2009b, p. 55), present a typology of public online behaviours which support reinforcement and contextualising within the community, which include behaviours such as “stirring things up” by citing, but disagreeing with a referenced source in a post.

Although posting is described as public engagement that does not necessarily mean that posting reveals identifying information about the poster to the public. Posting may be made under a true, albeit online, identity where the avatar is a photo of the poster and the username is their real name. Posting may also be made under an alternate (or false) identity. Additionally, some social media allow posting to be made anonymously. Even though posting is public, there can still be an aspect of privacy which is similar to the privacy preserved by lurking.

A subset of the literature on online behaviours focuses on deviance in online social networks. It is primarily on extreme deviance, such as trolling, in which new and vulnerable network members are baited in an attempt to draw them into embarrassing
or potentially dangerous situations (Donath, 1999). Typically trolls engage in *hijacking* threads by starting off-topic discussions (“Internet slang - Definition,” 2010). There are also studies on flaming and spamming; flaming involves sending hostile messages to other users and spamming is sending messages multiple times (Burnett, 2000; Herring, 2002). This literature on trolls, spammers, and flamers emphasises the destructive nature of these antisocial behaviours in online environments (Donath, 1999; Herring, Job-Sluder, Scheckler, & Barab, 2002).

The consequences of deviance affect the social network. These influences can be either positive or negative. Extreme deviance often leads to negative outcomes (Donath, 1999; Herring et al., 2002). Felps, Mitchell and Byington (2006), however, suggest that outcomes can also be constructive. Responses with constructive outcomes provide benefits to the social network. Rejection ostracises or ignores deviance. Finally, forgiveness is another way in which social networks address antisocial behaviours. As Vasalou and Pitt (2005) argue, after a transgression, forgiveness is when network members refrain from acting on original negative impulses, such as revenge or avoidance, and instead react with positive behaviours, such as empathy and relationship repairing. These can all be constructive attempts to bring the member back into the group and reinforce normative behaviour.

Alternatively, defensiveness occurs when members with less power and control within the group protect their own identity and self-esteem by lashing out at deviant members. Defensiveness, in the form of *exploding* or withdrawal, in response to interpersonal deviants and can also undermine trust within the social network and damage social ties (Felps et al., 2006).

In summary, there are public and private methods of engaging with virtual networks. There are different motivations and outcomes depending on methods used. There are behaviours, both public and private, which can help or damage online relationships.

### 2.4 Conclusion

In this chapter the knowledge management and social media literature on knowledge development in online spaces has been reviewed. Revealed were the key concepts:
- Organisational knowledge development occurs in social networks;
- There are virtual spaces inhabited by social networks. There are similarities and differences between virtual and material networks;
- Problem solving occurs in virtual spaces in professional online communities by engaging with the virtual social networks;
- There are resources for knowledge development embedded within networks. They are: (1) the content contained within the social media (objects and artefacts of the problem solving process) and (2) the networks themselves.

There are, however, elements of the initial research question that the social media literature does not cover:

- There is not clarity in differentiating between virtual communities and online social networks;
- There is little description or understanding of the problem solving process using online resources;
- There is no explanation of how virtual social networks provide knowledge resources.

Although this literature does not fully address the research problem, it does help revise the research agenda question:

*How does tacit knowledge teach individuals how to engage in the process of accessing resources; and how to interpret the context of those resources?*  
*Specifically, where do individuals find those resources in virtual social networks?*

This research study explores the role of online social connection in knowledge development. Specifically, it investigates how resources embedded in networks are released to members. Neither the extant knowledge management nor social media literature provides conceptual access to this aspect of social connection. In order to answer the research question, this study must investigate the social capital literature.
3 Social capital as a theoretical framework

“Social capital [is] the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit.”

(Nahapiet & Ghoshal, 1998, p. 243)

3.1 Introduction

The aim of this chapter is to engage with a conceptual framework in order to understand how online resources are accessed through social connection during knowledge development. Social capital theory provides this research study with conceptual access to understand how individuals use knowledge resources through virtual social networks. As Nahapiet and Ghoshal (1998) describe above, social capital explains how resources are derived from social connection.

In both the knowledge management and social media literatures, the links between knowledge development and virtual networks are described through social interactions, but there is little evidence explaining how social connection provides knowledge resources. This chapter endeavours to theorise network behaviours and social connections through social capital literature. The chapter is organised into five sections: social connection, trust, network obligations, social norms, and network resources.

The first section, on social connection, is a review of literature related to bonding and bridging connections. Bonding, associated with networks of strong, close-knit ties, is used for social support; bridging, associated with networks of weak, loose ties, is used for social leverage (Briggs, 1997, 1998; R. Leonard & Onyx, 2003). Social connection provides explanation for why people come together to form networks.

The second section, on trust, is an investigation of the role of trust in social networks. Trust is explored as a structural characteristic of social networks (Fukuyama, 2001) and for the role trust plays in providing access to network resources (Nahapiet & Ghoshal,

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26 The term network is used in this chapter to describe social collectives in a nonspecific sense and not as a structural description (e.g., online networks vs. virtual communities).
Understanding how trust facilitates, or inhibits, resource access is important in order to explain the role of trust in virtual networks.

The third section, considers the impact social obligations and commitments have on network members. Obligations, commitments, and reciprocity are central to understanding why individuals participate in social networks and the effects of their contributions to those networks. The amount of obligation depends on the network characteristics (Coleman, 1988) and determines how individuals and the network in general reciprocate (Bourdieu, 1986).

The fourth section, on social norms, is an exploration of social rules, behaviours and motivations to participate in social networks. Individuals' adherences to social norms are dependent on their motivations for participating in social networks. Social norms influence behaviours as well as how resources are made available to network members (Portes, 1998).

The final section, on network resources, is a review of literature related to the positive benefits and negative outcomes of acquiring embedded network resources. The ability to mobilise resources found within networks is the reward for network participation (N. Lin, 2005). Not all network participation, however, results in a positive outcome. The negative consequences of social networks, such as free-rider problems (Adler & Kwon, 2002), are also explored.

For this research study, social capital will be used as a lens for exploring how social connections work for virtual networks used in problem solving.

### 3.2 Social connection within networks

Social capital is the value derived from relationships. Its origins stem from sociology but extend to a wide range of disciplines. In this study, social capital is used to theorise how resources used for knowledge development are accessible to individuals problem solving online.

The diversity of meaning given to social capital can make it challenging to use as a theoretical lens. Amidst the multitude of definitions, however, two aspects of social capital are generally accepted: (1) there are *social relationships* which connect
individuals (social connections/structures) and (2) the social relationships provide *access to embedded resources* (capital) through the actions of individuals within those relationships (Bourdieu, 1986; Burt, 2001; Coleman, 1988; N. Lin, 2005; Portes, 1998; Putnam, 1995b).

This section addresses the first aspect of social capital: the social relationships which connect network members. The manner in which individuals socially connect has many dimensions. Most prominent among connection characteristics are the concepts of bonding and bridging connections, and of strong and weak ties respectively.

### 3.2.1 Distinguishing between bonding and bridging social connections

Bonding and bridging were originally introduced by Putnam (1995a, 2000) to differentiate between types of social relationships. He describes the bonds of a gardening club and how they are different from Sierra Club members due to differences in how they interact, the frequency of their contact and their shared interests (Putnam, 1995a).

The gardening club members know each other and frequently interact, whereas Sierra Club member ties “are to common symbols, common leaders, and perhaps common ideals, but not to one another” (Putnam, 1995a, p. 71). Many researchers have since taken those concepts and extended their meanings. For example, in the context of online networks, Norris (2004, p. 31) suggests that bridging “bring[s] together people of different sorts”, alternatively bonding joins those of “a similar sort” [Emphasis added]. In this context, bonding represents ideological and social homogeneity, and bridging is found in heterogeneous networks having “diverse social backgrounds and beliefs” (Norris, 2004, p. 34).

Bonding and bridging are part of a continuum of social connection. They are not exclusive concepts and many networks contain elements of both. In some networks, there are members who are strongly connected (e.g., a core contingent) and others who are loosely connected (e.g., loosely affiliated). Moreover, relationships can change over

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27 The Sierra Club, founded by noted conservationist John Muir, is one of the most influential environmental organisations in the United States (Sierra Club, 2012).
time: people can become closer (move from a loose to a closer connection) and alternatively people drift apart (move from close to looser connection).

The social capital literature identifies several characteristics of social connection. Although bonding and bridging are considered a continuum of connections, Table 3.1 highlights characteristic traits of each end of the continuum.

Table 3.1 Characteristics of social connection (bonding and bridging)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Bonding</th>
<th>Bridging</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded resources</td>
<td>Getting by, resources help participants in everyday situations</td>
<td>Getting ahead, resources help improve the participants situation</td>
<td>(Briggs, 1997; Putnam, 2000; Woolcock &amp; Narayan, 2000)</td>
</tr>
<tr>
<td>Trust</td>
<td>Localised, trust is thick and maintained locally between strongly connected members</td>
<td>Impersonal, trust is thin and generalised for all</td>
<td>(R. Leonard &amp; Onyx, 2003)</td>
</tr>
<tr>
<td>Obligation</td>
<td>Specific reciprocity, mutual expectations of give and take</td>
<td>Generalised reciprocity, giving without expectation of immediate gains</td>
<td>(Putnam, 1995a; Williams, 2006)</td>
</tr>
<tr>
<td>Social norms and motivation</td>
<td>Normative, participation is dependent on consummatory motivations such as shared norms</td>
<td>Instrumental, participation is dependent on motivation to complete tasks or extract embedded resources</td>
<td>(Portes, 1998; Wiener, 1982)</td>
</tr>
<tr>
<td>Negative social norm externalities</td>
<td>Anomie, weak social norms and increased risk of norm violation</td>
<td>Anomie, weak social norms and increased risk of norm violation</td>
<td>(Portes, 1998; Woolcock, 1998)</td>
</tr>
<tr>
<td>Weight of social connection (tie strength)</td>
<td>Strong, with a density of ties between network members</td>
<td>Weak, where network members are loosely connected to a few other members</td>
<td>(Granovetter, 1973; Vitak et al., 2011)</td>
</tr>
</tbody>
</table>

Embedded resources associated with bonding and bridging are valued differently by social network members. As Briggs (1997, p. 112) explains, bonding social connections tend to provide resources for getting by and bridging for getting ahead:

[Social capital] is used by individuals for at least two purposes. The first is to get by (for social support), that is, to cope with the everyday challenges that life presents, from flat tires to divorces. When we confide distress to a friend or listen as a confidante, social capital is at work, directly serving the person in distress but also renewing the relationship in ways that will, over time, be used by the speaker and the listener...
The second use for social capital is to get ahead. Social capital is used for social leverage, that is, to change or improve our life circumstances or "opportunity set." When we ask a friend who is "connected" to put in a good word as part of a hiring or grantmaking decision, or when an inner-city kid, through a personal tie, gets a shot at a life-changing scholarship, this too is social capital.

In addition to differentiating bonding and bridging by social support and social leverage, they also differ in terms of trust, social obligations, social norms, motivation, and the negative consequences (see Table 3.1 above).

The final characteristic of social connections is the relationships, also known as ties, between members of a social network. This concept is used heavily in both social capital and social media literature to characterise how individuals are related. There is a strong connection between bonding social capital and strong ties and bridging social capital and weak ties (Vitak et al., 2011). Haythornthwaite (2005, p. 127) defines ties in the context of the social network:

A type of exchange or interaction is known as a social network relation, and pairs who maintain one or more types of relations are said to maintain a tie. Across a set of individuals, person-to-person connectivity builds into social networks. Such networks reveal how resources flow and circulate among these individuals, and what subsets or cliques of individuals are more connected than others. The ties maintained by pairs can range from weak to strong according to the types of exchanges, frequency of contact, intimacy, duration of relationship, etc. [Emphasis in original]

As Haythornthwaite (2005) describes above, the characteristics of social connection are defined by several dimensions, such as intensity, frequency, and individuals’ behaviours, and perceptions. Perhaps the most distinguishing characteristics, however, is tie strength ranging from weak to strong.

### 3.2.2 Strong ties

Much of the social capital literature is based on strong social connections consisting of permanent relationships. The strong ties of bonding social connections are often characterised by members with the following traits:
– Members who are similar (e.g., close friends, co-workers, or team-mates) and from the same social circles (Haythornthwaite, 2005; Putnam, 1995a, 2000);
– Members who engage in both emotional and instrumental participation; and members who have high levels of intimacy, self-disclosure, and reciprocity (Ellison et al., 2011; Haythornthwaite, 2005; R. Leonard & Onyx, 2003; Vitak et al., 2011);
– Members who have multiplexity in their connections and communications (Ellison et al., 2011; Haythornthwaite, 2005; R. Leonard & Onyx, 2003);
– Members who are proactive in seeking out other network members (Haythornthwaite, 2005, p. 135);
– Members who have high social influence over other network members (Haythornthwaite, 2005; Yates, Orlikowski, & Okamura, 1999).

Many social capital theorists identify durability of the social connections in tightly-knit networks as a requirement for gaining access to network resources. For example, Bourdieu (1986, p. 51) suggests that social capital is only developed within a durable network:

> Social capital is the aggregate of the actual or potential resources which are linked to the possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership in a group – which provides each of its members with the backing of the collectivity-owned capital, a ‘credential’ which entitles them to credit, in the various senses of the word.

As Bourdieu (1986) describes, the ability to gain access to network resources is through a member’s ‘credential’ which grants entitlement and access. For example, being part of a permanent institution, such as membership in an elite family, entitles members to the associated prestige and future benefits which may be derived from the prestige.

Similarly, Nahapiet and Ghoshal (1998) suggest that durability and stability are essential for the development of trust and norms. In virtual networks, participants may not invest in developing stable relations with other network members (Norris, 2004; Vitak et al., 2011). In this situation, how do participants establish network trust? Are there other network features that can substitute for durability when it is absent from network relations?
This approach, rooted in the durability of ties, is not as useful for this study because the nature of most virtual network ties is weak (Ellison et al., 2007, 2011; Haythornthwaite, 2005; Vitak et al., 2011). It is likely that most virtual networks used in online problem solving will not be durable. Participants may transit many networks in the course of knowledge development without repeated engagement in any one network in particular. In this situation, how is access to network resources granted (or gained) when the social connections are transient?

In addition to durability, strong ties also create networks in which members are connected repeatedly and in multiple ways. The frequent contact among network members creates a network density which can lead to network closure (Burt, 2001; Coleman, 1988). Network closure is when all members of the high density network are connected to all other members. Network members have multiple paths of connections between each other. When there is no closure there may be only one path of connections between network members. In dense networks, like in an extended family, family members may have contact every day in multiple ways (e.g., informal face-to-face conversations, by email, or having dinner together). In high density networks, every member of the network has strong ties. Those ties are developed and maintained through multiple bases of engagement.

When network members have multiple bases of social connection they have multi-dimensional connections, also referred to as multiplexity (Garton et al., 1997; Haythornthwaite, 2005). Networks of strong ties have more frequent interactions and higher multiplexity. For example, co-workers with strong ties not only work together, but may also have children at the same school or belong to the same church. This concept extends to communication (media multiplexity) among network members who use multiple forms of communication, usually face-to-face and technology-mediated (Haythornthwaite, 2005).

In networks with strong ties, which have dense multi-dimensional connections among members, there are reduced transaction costs for gaining access to resources and less risk in transactions due to high trust (Burt, 2001). For example, Coleman (1988, p. 310) suggests that when the resource is information, transaction costs can be high:
An important form of social capital is the potential for information that adheres in social relations. Information is important in providing a basis for actions. But acquisition of information is costly. At a minimum, it requires attention, which is always in scarce supply. One means by which information can be acquired is by use of social relations that are maintained for other purposes.

As Coleman (1988) describes, having multi-dimensional social connections provides access to information which is privy to other members. This is true even when the information is not related to the nature of the social connection. Coleman (1988, p. S104), for example, describes using friends as information sources:

A person who is not greatly interested in current events but who is interested in being informed about important developments can save the time of reading a newspaper by depending on spouse or friends who pay attention to such matters.

Coleman’s (1988) description of gaining access to friends’ information through social connection raises an important dichotomy in networks: what is the role of heterogeneity versus homogeneity? This example is based on strong social ties in dense multi-dimensional networks which tend to have homogeneous membership (Norris, 2004). Homogeneity allows for the members to understand each other (common language) and indicates shared interests. However, this example also indicates that shared interest does not mean the same interests or same information. Members have knowledge of diverse information in these networks which can introduce heterogeneity in some dimensions of their social connections.

When considering social connections in virtual networks, what is the role of homogeneity versus heterogeneity? Do virtual networks provide access to embedded network information in the same way? Twitter users, for example, may follow friends, colleagues, members of their professions or celebrities. Some of these social connections are dense and multi-dimensional, such as friends and colleagues. Relating back to Coleman’s (1988) current events example above, being socially connected in one dimension (through work) can lead to another dimension (through Twitter). The information revealed in tweets may be markedly different from work-related information.
This raises the question, does this access through network members hold true for the individuals one does not know (e.g., only connected through ‘following’ on Twitter)? How do individuals gain access to embedded network information when there is only a weak, loose connection through a single (and perhaps one-directional) connection?

3.2.3 Weak ties

In contrast to the literature on strong ties, weak ties have emerged as another form of social connection which is looser and less durable than strong ties. The weak ties of bridging social connections are often characterised by members with the following traits:

- Members who are dissimilar (e.g., different backgrounds or experiences) and from disparate networks (e.g., different social circles or unrelated) (Ellison et al., 2007; Granovetter, 1973; Haythornthwaite, 2005; Wellman et al., 2001);
- Members who engage with instrumental participation, have a low motivation to share resources, and feel a generalised reciprocity with the network (Haythornthwaite, 2005; Vitak et al., 2011; Williams, 2006);
- Members who use a single medium for communication (Haythornthwaite, 2005);
- Members who are opportunistic in their use of “passive opportunities to interaction e.g. hallway encounters, class sessions” (Haythornthwaite, 2005, p. 135);
- Members who have little social influence over other network members (Haythornthwaite, 2005).

Weak ties within a social network can also lead to bridging connections between social networks when the weak ties are the only connection between the networks (Granovetter, 1973). Network bridges occur when there is a weak tie between two individuals in different social networks. Bridges are an important aspect of weak ties because they do not tend to occur with strong ties.

When there are strong ties between a member and two others, there cannot be a weak tie between the others. For example, if Xavier has strong ties with two others (e.g., Xavier—Yolanda and Xavier—Zephyr), there cannot be a weak tie between the others,
(e.g., Yolanda—Zephyr). This is referred to as a forbidden triad (Granovetter, 1973) because the strength of, for example, Xavier’s ties implies a strong tie closing the triad. When there are dense networks containing many strong ties, it is unlikely that two strongly connected members will form a bridge between two networks since they are likely to have many connections in common. Instead it would be more likely that the strong ties would represent a connection within the same (extended) network.

As an illustration, consider members of a functional area, such as an accounting department in a firm, which may have strong ties between each other. It is unlikely that any of these ties will bridge to external social networks such as other departments in the firm or accountants in other firms. This is because strong ties tend to be redundant (many members have the same ties) and any external connection would be shared by many of the other accountants. Those external connections would simply be an extension of the accounting departments’ social network and not a bridge (to new non-redundant resources). Instead, it is more likely that if one of the accountants has a weak connection to an external accountant, then that will be the only connection to the other accountants’ network. In that case, the weak tie would be a bridge between the two accounting social networks because there would only be one path.

This concept of a bridge between social networks is useful because weak ties present opportunities for different social networks to share resources through the weak connection. For example, Burt (2001, p. 5) suggests that weak ties bridge structural holes which create brokerage opportunities:

Structural holes – create a competitive advantage for an individual whose relationships span the holes. The structural hole between two groups does not mean that people in the groups are unaware of one another. It only means that the people are focused on their own activities such that they do not attend to the activities of people in the other group... Structural holes are thus an opportunity to broker the flow of information between people, and control the projects that bring together people from opposite sides of the hole. [Emphasis added]

As Burt (2001) posits, access to network resources can be brokered by individuals who span the structural holes between networks. These holes provide opportunities for non-network members to connect to new resources unavailable in their own networks. This concept suggests that individuals have greater access to network resources when
connected to more networks with weak ties rather than connect to fewer networks with strong ties.

This concept may be useful in explaining how weak connections to virtual social networks can make resources available to other social networks. Does this concept of bridges hold true for members of material and virtual networks? For example, do individuals bridging structural holes in virtual networks bring back those resources (knowledge) to their organisational networks?

This description of the value of structural holes seems contradictory to the position Coleman (1988) presents on network closure (see page 95), however, the two concepts can actually be integrated as Burt (2001, p. 25) suggests:

> Closure describes how dense or hierarchical networks lower the risks associated with transaction and trust, which can be associated with performance. The hole argument describes how structural holes are opportunities to add value with brokerage across the holes, which is associated with performance.

As Burt (2001) describes, network closure and structural holes explain how bonding and bridging social capital provide access to network resources respectively. This suggests that individuals may need, depending on the situation, both types of social capital at different times and in different contexts to effectively capture resources through social connection.

In addition to network bridges and structural holes, there is also a state of having no ties when an individual is not connected to a network. In between no ties and weak ties, there are latent ties. Latent ties are potential ties; they have the ability to become weak ties, but have not been socially activated (Haythornthwaite, 2002). This concept of latent ties is of particular interest to this research study because social media have technical affordances which improve the ability to convert latent ties (Ellison et al., 2011). For example, Ellison et al. (2011) suggest that even though technologies such as the telephone provide the technical ability for one person to call another, it would be uncommon and not socially appropriate for someone to call a stranger in order to create a weak tie. In social media, however, there is a richer set of social cues, even among unconnected members (e.g., in Facebook, friends of friends can see shared information,
photos, and conversations), which enable latent ties to engage in socially relevant interactions in order to convert from latent to weak ties (Ellison et al., 2011).

All of the concepts discussed in association with weak ties are in the context of networks in which there are also strong ties since this is true of most material network structures. In virtual networks, however, there may be no strong ties. Do the characteristics of weak ties afford the same benefits when all of the virtual connections are weak?

### 3.3 Trust among network members

Trust is a complex concept which spans many disciplines and bodies of knowledge. Social capital literature frequently integrates trust into social connection through discussions on social norms, motivations, and network obligations (Fukuyama, 2001; Nahapiet & Ghoshal, 1998); and even includes trust in the definition of social capital (Portes, 1998). Therefore, in order to focus the discussion of trust, this research study concentrates on the role trust plays in gaining access to network resources. Similarly, there are several definitions of trust.

Of many theories on trust, this research study will focus on three which are particularly relevant. The first is the Integrative model on organizational trust (Mayer, Davis, & Schoorman, 1995) which frames trust as a dynamic of organisational relationships. This is followed by Trust as a sociological concept (Lewis & Weigert, 1985) which envisions trust as a dimension of social connection. The final discussion is on an integrating model of Trust and distrust as alternative social realities (Lewicki, McAllister, & Bies, 1998) which differentiates between high and low trust, in addition to high and low distrust, as separate concepts.

**Organisational trust**

First, trust can be examined from an organisational context as a construct of social interaction. Mayer et al. (1995, p. 712) define trust as:

The willingness of a party [trustor] to be vulnerable to the actions of another party [trustee] based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party... Making oneself vulnerable is taking risk. Trust
[however] is not taking risk per se, but rather it is a willingness to take risk. [Emphasis changed from the original]

In the definition above, Mayer et al. (1995) introduce several characteristics of trust which make it different from other concepts and significant to understanding resource access through social connection. First, since trust is defined as involving two parties, it encompasses both the trustor’s trust of the trustee and the trustee’s trustworthiness as perceived by the trustor. This study examines each of these concepts individually.

The trustor’s trust of the trustee is referred to as generalised trust or a propensity for trust. This should not be confused with systemic trust. Systemic trust, also described as cognitive and sometimes generalised trust, is used to describe situations in which individuals have trust in a specific system as opposed to an interpersonal trust between individuals. Mayer et al. (1995, p. 715), however, define generalised trust as a characteristic of the trustor in which the trustor has a propensity or “general willingness to trust others” in most situations. This definition suggests that generalised trust is not an individual-to-system and context-specific trust, but instead is an individual-to-all (e.g., system, group, or individual) trust in which the individual has an inherent trust in others.

On the contrary, trustworthiness is a characteristic of the trustee. The trustee’s trustworthiness has three dimensions: ability, benevolence, and integrity. Ability is a domain specific trait, which suggests that the trustee has access to the specific knowledge required. For example, if a problem solver (trustor) visits a site (trustee) then ability is the belief that the site has expertise on the subject on which the problem solver needs help. Benevolence is from the trustee’s perspective. It is the trustee’s positive perception of the trustor, such that the trustee is motivated to give resources to the trustor. This motivation is not selfish or extrinsic, such as enforced by personal gain, explicit rules, or sanctions. Instead, the motivation is intrinsic, stemming from the trustee’s desire to help the trustor. A common illustration of benevolence is the motivation for a mentor to provide guidance to a mentee. Finally, integrity is from the trustor’s perspective. It is the trustor’s belief that the trustee will follow rules which are amenable to the trustor. For example, if a problem solver (trustor) believes a site (trustee) has integrity, the problem solver believes that the site and its members adhere to a code of conduct which is consistent and equitable.
The second point raised in the definition proposed by Mayer et al. (1995), is that trust has a strong relationship to risk and vulnerability. Vulnerability is accepting the possibility of risk. In online environments trust includes behaviours such as disclosing personal information. Trust is an assessment of the cost of potential risks within the social context (Inkpen & Tsang, 2005). Risk-taking in social networks is also seen as an avenue for resource sharing and information flows (Misztal, 2011; Resnick, 2001).

Risk and vulnerability are important concepts because they help to distinguish trust from other concepts in the literature often used synonymously, such as cooperation, confidence, and predictability. Some literature equates trust to cooperation (Nahapiet & Ghoshal, 1998). Mayer et al. (1995) argue that since cooperation does not require risk, it is important to distinguish between the two concepts because it is possible to have cooperation without trust. Likewise, some literature does not distinguish between the concepts of confidence and trust. The difference, however, is illustrated by Luhmann (2000, p. 102):

> The distinction between confidence and trust thus depends on perception and attribution. If you do not consider alternatives (every morning you leave the house without a weapon!), you are in a situation of confidence. If you choose one action in preference to others in spite of the possibility of being disappointed by the action of others, you define the situation as one of trust. [Emphasis added]

In the example above, Luhmann (2000) argues that trust requires a conscious decision to take a risk (e.g., choosing an action despite the possibility of disappointment) whereas confidence does not. Similarly, even though some literature defines trust as predictability, Mayer et al. (1995, p. 714) argue that predictability does not require “a willingness to take a risk” nor “to be vulnerable” so “predictability might best be thought of as influencing cooperation” and not as trust itself.

The final point raised from the definition by Mayer et al. (1995) above, is that trust leads to the expectation of an action important to the trustor (e.g., being helpful, giving advice, or providing instruction). For example, if a problem solver is looking for help, he/she must expect that the site will be helpful. If there is not that expectation, then the problem solver would simply go elsewhere. Furthermore, in order to be helpful, the site must take action by releasing (helpful) resources to the problem solver (e.g., discussion
threads). Nahapiet and Ghoshal (1998, pp. 254–255) suggest that “trust may both open up access to people for the exchange of intellectual capital... and increase anticipation of value through such exchanges.” In this sense, trust is a means of gaining access to network resources. This is a particularly useful conceptualisation of trust when considering how trust enables (or inhibits) access to network resources for problem solvers. As Tsai and Ghoshal (1998) explain, different levels of trust and trustworthiness lead to different levels of resources exchanged and released.

**SOCIAL TRUST**

Trust can be seen as an individual or relational construct. In the organisational sense presented above, trust is a quality of *individuals* (e.g., trustors have a propensity to trust and trustees have trustworthiness). Lewis and Weigert (1985) argue, however, that trust is not an individual construct. Instead, trust is embedded in the social relations between members of a collective. Trust is a social system in which “members of that system act according to and are secure in the expected futures constituted by the presence of each other or their symbolic representations” (Lewis & Weigert, 1985, p. 968). A caveat, however, is that although trust is part of all social relationships, the primary function of trust (and distrust) is to reduce complexity in social relations (Lewis & Weigert, 1985; Luhmann, 2000).

How does trust help with complexity? Social relations are very complex. It is difficult to know how to behave in an interaction because there are many variables. What will the other person say? How do I respond? What is the meaning behind their words? What impression do I want to give? For instance, if one person knows another, they can make assumptions about what the other knows, how the other will behave and how each will respond to each other. That allows for each individual to plan and engage in the encounter without the burden of trying to make predictions for a multitude of scenarios. Essentially being familiar with someone allows you to ignore (potentially infinite) possibilities and focus on probabilities. As an illustration, consider co-workers Jan, Fran, and Stan. Jan thinks Fran will probably give her some valuable information if she asks her when she is not busy. Jan believes that Stan, however, will spend his lunch hours finding information for her if they talk over a coffee break. Although there may be an infinite number of reactions that Fran and Stan could have to Jan’s request for help, she
uses trust to focus her courses of action. Jan’s probable scenarios are formed from past experiences and used to predict future interactions.

Lewis and Weigert (1985) posit that there are three dimensions to trust which allow it to reduce complexity in social interaction: cognitive, emotional, and behavioural. Cognitive familiarity and emotional bonds are associated with bridging and bonding social connection respectively. Behavioural enactment, the actions which demonstrate trust, can be “conceptualized as situationally activated cognitive and/or emotional trust” (Lewis & Weigert, 1985, p. 977). Therefore, since behavioural trust is essentially a situation-dependent version of the other dimensions, this research study will focus on emotional and cognitive trust.

Emotional trust is also referred to as interpersonal or localised trust and is associated with bonding social connections. As Lewis and Weigert (1985, p. 973) explain, “the emotional content of trust relationships is typically quite high in primary group relations, and the cognitive-rational base of trust is more extensive and continuing in the formation of trust relationships in secondary groups.” For virtual collectives, emotional trust would be more common in tight-knit communities and cognitive trust in loosely-connected networks. When a member has a strong identification with the network and “perceives similarity with the group members, the more likely he or she may be to trust others in that group” (Blanchard & Horan, 1998, p. 11). Similarly, in tight-knit online networks members exhibit high-trust and are more inclined to cooperate and engage in social exchanges (Nahapiet & Ghoshal, 1998). What does this mean in terms of social networks where engagement is limited? Is trust in that context low (or fleeting)?

If you consider the extremes of these two concepts, all emotional with no cognitive trust would be blind faith; all cognitive with no emotional trust would be considered rational prediction (Lewis & Weigert, 1985). Are these dimensions of trust a dichotomy or do individuals fall along a continuum in trust in their social connections? Zand (1972) suggests, in his study on trust in problem solving, that high-trust groups which have both common problem solving goals and mutual interests in the subject area exhibited interpersonal trust which facilitates greater success during problem solving. This raises an important issue for online problem solving because individuals may have a common interest with the online social networks they use, but be instrumental in their use and
not share a common purpose with other members. Does this suggest that there is no emotional component of trust among members of virtual networks? Or perhaps individuals can blend different dimensions of trust?

Alternatively, cognitive trust, which is also referred to as systemic, impersonal, or generalised (Holland, 1998; Kankanhalli, Tan, & Wei, 2005) trust, is closely associated with bridging social connections because it allows individuals to interact with others who are not well known and with whom there is no emotional connection (Lewis & Weigert, 1985). For example, you may (cognitively) trust a salesperson because they represent a company, industry or economic system in which you generally have trust. Cognitive trust is a generalised trust in systems (as opposed to individuals). It is a trust that those systems are a trustworthy and reputable information sources. In an online context, trust can be measured by the trustworthiness of the entire network instead of assessing individual members, but the individual members are granted trust through their associated membership (Law & Chang, 2008). It is illustrated in situations in which “social actors no longer need or want any further evidence or rational reasons for their confidence in the objects of trust” (Lewis & Weigert, 1985, p. 970), they simply “trust in trust” (Luhmann, 1979, p. 66).

Cognitive familiarity is a pre-condition to trust because it allows individuals to generalise and make predictions about course of action during engagement with others based on being familiar with associated systems (Lewis & Weigert, 1985). This is an important concept, because in virtual environments, individuals may not be familiar with other individuals or even other networks, but instead have a familiarity with the sites in general (e.g., discussion forums or technical support sites). In this sense, cognitive trust is an essential precursor to sharing tacit knowledge (Aurum, Daneshgar, & Ward, 2008; Law & Chang, 2008). It is the trust which allows a member to believe “that fair rules, procedures, and outcomes will be enforced competently, reliably, and with integrity in the online community” (Law & Chang, 2008, p. 6).

It is difficult to separate cognitive trust from the concept of social norms and reciprocity within social networks. Blanchard and Horan (1998) suggest that trust is highly integrated with the generalised reciprocity found in social networks. Trust is built on the expectations that there will be adherence to social norms and that investing in the network through contributions and help will be reciprocated.
HIGH TRUST, LOW TRUST AND DISTRUST

The final discussion is on an integrating model of trust and distrust, as alternative social realities (Lewicki et al., 1998), which differentiates between high and low trust in addition to high and low distrust as separate concepts. Lewicki et al. (1998, pp. 439–440) define trust and distrust, not as “opposite ends of a single continuum”, but as “separate but linked dimensions”, explaining:

We define trust in terms of confident positive expectations regarding another’s conduct, and distrust in terms of confident negative expectations regarding another’s conduct... We assert that both trust and distrust involve movements toward certainty: trust concerning expectations of things hoped for and distrust concerning expectations of things feared. [Emphasis in original]

This definition is useful for understanding how trust (and distrust) functions within online environments. The literature on trust (as seen in the previous sections) focuses on trust without actually mentioning distrust. It is easy to infer from this literature that lack of trust and distrust are the same concept. This is particularly challenging when investigating virtual networks because if the characteristics of high emotional trust, for example, are absent, then the assumption is that there is no emotional trust or even that there is distrust in emotional bonds. If instead we consider trust and distrust as separate concepts, it is possible to envision different combinations of each which are more similar to virtual social connection.

Lewicki et al. (1998) suggest that there can be any combination of high or low trust and high or low distrust. Low trust/low distrust is characterised by casual interactions among individuals. The low distrust suggests no fear or scepticism about the engagement, but low trust includes no hope or confidence, so it remains the realm of simple interactions. High trust/low distrust is similar to high emotion and high cognitive trust in bonded social connections. Low trust/high distrust is a tense situation characterised by paranoia among individuals. It is similar to the damage inflicted by negative experiences such as the deceptive practices of trolls and spammers. In this combination, virtual communities may lose members and experience reduced active participation (Wagner, Ip, Cheung, & Lee, 2005).

Finally, for high trust/high distrust Lewicki et al. (1998, p. 447) explain:
[It is when] one party has reason to be highly confident in another in certain respects, but also has reason to be strongly wary and suspicious in other respects. The relationship likely is characterized by multifaceted reciprocal interdependence, where relationship partners have separate as well as shared objectives. [Emphasis added]

This combination of high trust and high distrust allows for a multiplexity of connections between individuals and networks in which some of the connections may be high in trust and others high in distrust (Granovetter, 1985; Lewicki et al., 1998). Additionally, the individual connections may change from one to the other over time depending on specific experiences. The dynamic nature of virtual social networks may be better represented by this concept of high trust/high distrust rather than more simplistic dichotomies based on bridging and bonding connections alone.

In summary, there are different ways to think about trust in social connections. Organisational trust theories posit how access to resources may be gained through trust. Social trust theories integrate bonding and bridging social connection to trust in relationships. Finally, models of trust and distrust allow for multiplexity in the variety and dimensions of social connections.

### 3.4 Social obligations on network members

From a social connection perspective, an obligation is “a commitment or duty to undertake some activity in the future” (Nahapiet & Ghoshal, 1998, p. 255). There are, however, two distinct dimensions of obligation in social networks. The first dimension is reciprocity and the second is social investment.

The social media literature on social network sites (SNS) describes sites, such as Facebook or Twitter, which have explicit and visible ties between connections (e.g., friends or followers) (see page 68). This literature cites the benefit of SNS in social investment obligations because “these sites lower the coordination costs associated with maintaining a larger network and facilitate information discovery about others via the profile” (Vitak et al., 2011, p. 1). Alternatively, there are online environments which do not have explicit ties between connections, such as blogs and forums. Does the lack of explicit connection change the way obligations behave within these sites?
Public social connection in networks is also emphasised in social capital theory. The term *capital*, although used more metaphorically than literally in current literature (Field, 2003), still has the connotation of accumulation through investment similar to other forms of capital such as economic or physical (Bourdieu, 1986). The implication is that one must actively and openly invest in the social networks in order to develop and accumulate the social capital. Moreover, the social capital is seen as only available to active and public connections in the network (Bhandari & Yasunobu, 2009); private (unseen) participants may be excluded from its benefits.

### 3.4.1 Reciprocity

The obligation of reciprocity is the first dimension of obligation. If one considers a dyadic social exchange, there are two sides of an obligation. As Coleman (1988) suggests, when there is an exchange of social capital, the source of the exchange holds a 'credit note' which carries an *expectation* of reciprocity and the recipient of the exchange carries an *obligation* of reciprocity. For example, Coleman (1988) describes Cairo merchants referring a customer to a friend’s store to exchange money (instead of the bank or turning them away) which creates an obligation for the friend to send customers to their store at some point in the future.

This specific reciprocity between individuals can also be extended to an exchange between an individual and a network, often referred to as *generalised* or *diffused* reciprocity (Putnam, 1995a; Williams, 2006). In this situation, if the individual releases resources to the network then there is only an expectation that in the future that individual may gain access to network resources. The obligation of reciprocity between network participants provides access to future resources. If a network member claims network resources, then that creates an obligation to reciprocate by allowing other network participants in the future to claim their resources. Similarly, if an individual provides resources, then there is an expectation of the network to reciprocate in the future.

In this form of generalised reciprocity, there is a danger, however, that obligations of reciprocity will not be met. Bourdieu (1986, p. 55) explains:
Social capital in the form of a capital of obligations that are usable in the more or less long term (exchanges of gifts, services, visits, etc.) necessarily entails the risk of ingratitude, the refusal of that recognition of nonguaranteed debts which such exchanges aim to produce.

As Bourdieu (1986) describes, while reciprocity is an expected obligation, there is the risk that the obligation will not be met. In this situation, other members will not be able to access those withheld resources. Coleman (1988, pp. S107–S108) suggests the way this risk is mitigated is through network closure:

Closure of the social structure is important not only for the existence of effective norms but also for another form of social capital: the trustworthiness of social structures that allows the proliferation of obligations and expectations. Defection from an obligation is a form of imposing a negative externality on another. Yet, in a structure without closure, it can be effectively sanctioned, if at all, only by the person to whom the obligation is owed.

In Coleman's (1988) description, obligations are enforced by the network more effectively when there is network closure. Network closure, in dense networks of strong ties, enforces obligations through norms of behaviour. The result (reward) of this enforcement is that members can trust that obligations will be met. For example, Coleman (1988, p. S107) describes school children whose friends’ parents are also friends. In this situation, parents (who are connected to each other as friends and through their children as parents) “can discuss their children’s activities and come to some consensus about standards and sanctions”. These norms obligate parents to sanction their own children and children of friends on school-related and non-school-related behaviour violations. The reward from norm-enforced obligations is that parents can trust that their children will be parented by other network members in a consistent manner as their own parenting.

If a large number of members, who do not reciprocate by interactively engaging and sharing knowledge resources, are compared to those who do, how is social capital formed? How do the unmet obligations of reciprocity affect the ability of members to gain access to network resources? When there is an imbalance in reciprocity obligations, does it follow that reciprocity is not a social norm of the network or that the network does not have effective sanctions for violations?
Reciprocity is not a simple exchange of obligations. M. Leonard (2004, p. 934) argues that it is “the mutual recognition of the obligation to give and receive and draws economic actors into dense webs of expectations, which modify their ability to selfishly pursue their individual economic interests.” Reciprocity is more than a general trust of network members, but is actually dependent on the specific trustworthiness of network members to satisfy obligations (Putnam, 2000). According to Coleman (1988, p. S102), there are mitigations for this risk:

This form of social capital depends on two elements: trustworthiness of the social environment, which means that obligations will be repaid, and the actual extent of the obligations held. [Emphasis added]

As Coleman (1988) describes, there is a relationship between the trust members have in the social network and the extent to which they will tolerate an imbalance in obligations. If there is no network closure, however, as is the case in many virtual networks, does the relationship between norms, obligations and trust hold true?

It may be helpful to consider obligations as a microcosm of the network; extending beyond the idea of mutual exchange and instead treating obligations as their own internal network of relationships, reciprocal behaviours, and mutual social investments within the greater social network.

Reciprocity is not the only social obligation which motivates network members to engage. In fact, Constant, Sproull, and Kiesler (1996, p. 122) argue:

Offering help is unrelated to direct reciprocity and more related to maintaining the social institution of the network as an organizational resource. [Emphasis added]

Therefore, it is useful to consider not only reciprocal obligations, but also situations when individuals are committed to investing in the social network.

3.4.2 Social investment
The obligation of social investment is the second dimension of social obligations. Social capital, like other forms of capital, relies on investment in the capital to realise continued benefit. It is through investment that network members continue their network
association and maintain access to network resources. For example, Bourdieu (1986, p. 52) suggests that with social capital it is the network of relationships which require investment in order to continue to provide resources to members:

The network of relationships is the product of investment strategies, individual or collective, consciously aimed at establishing or reproducing social relationships that are directly usable in the short or long term.

As Bourdieu (1986) describes, investment is an obligation of network participation. Obligations to maintain social relations can be considered social membership dues or social tithing in that payment is required for continued membership. For example, members of a prestigious group may feel obligations to recognise and respond to “feelings of gratitude, respect, friendship” (Bourdieu, 1986, p. 52). The investment required to maintain the relationships (and access to future benefits) may come in the form of an exchange of gifts or an acknowledgement of the benefits received.

If most individuals do not invest in the social relationships of the virtual networks, how are the relationships maintained? In virtual networks, who feels the obligation to invest and what are the consequences to those who do not fulfil their obligations? If virtual network participants have social connections (at least during the period of knowledge development), how are social connections formed when there is little or no investment in the relationships?

The concept of investment is also seen in virtual networks. In a recent study by Sun et al. (2009), the relationship between a willingness to share information and individuals' social networks is examined under the lens of social capital. The study solicited questionnaires from publically contributing members (posters) of various virtual communities. The study reveals that there is a positive relationship between engagement (knowledge sharing) and one’s position in the network (centrality). It seems intuitive that those with more social connections would also be more willing to invest in the network by contributing to community discussions.

Surprisingly in the study, there was not a positive relationship between one’s expertise and willingness to share knowledge. This is contrary to much of the extant knowledge management literature such as communities of practice studies which model
participation on expert mentors helping other members and suggests that there are other social influences governing social network participation.

The obligation of social investment is not reciprocal and can indicate a different level of investment burden for different members of (or roles within) the social network. For example, Rankin (2002, p. 14) suggests that women in the Himalayan Newar merchant community (*guthis*) experience an obligation not equally shared with the men in the community:

> Within guthis members [women] often describe the norms of association entailed in the mandatory membership as exacting onerous, if not unbearable, costs in terms of time, labor, and money. These costs accrue most notably through the feasting obligations that punctuate all life cycle rituals, ancestor worship, festivals, and other occasions for propitiating the deities. Members endure these obligations, often at the expense of basic material comforts, only to escape the even more burdensome social sanctions against nonconformity – tantamount, in some cases to excommunication from Newar social life.

Rankin's (2002) description of this type of social obligation is reminiscent, albeit in a milder situation, of the members of virtual network who spend immense amounts of time contributing to the site without any expectation of reciprocity. Is it possible that these highly involved members feel an obligation to invest in the social relationships of the network and under that obligation willingly give their knowledge and time to other network participants? Rankin (2002, p. 14) describes this concept as “profits transformed into social investment”.

The concept of converting economic or another non-social form of capital into social capital is useful because it demonstrates the cost of investing in a social network. Typically, social capital literature discusses the benefits of social connection such as the *conversion* (Bourdieu, 1986) or *appropriation* (Coleman, 1988) of the social capital embedded in networks into economic capital. Rankin’s (2002) description of the *guthis* is an illustration of the cost of socially connecting. This and other negative aspects of social capital are discussed in more detail later in this chapter (see section 3.6.2, page 127).
In the *guthis* example, the repercussions of failing to meet the obligation are severe. In virtual networks, what are the consequences of failing to invest? In Twitter only 40% of active users post tweets, with the majority lurking instead by following others’ tweets and not tweeting themselves (Bosker, 2011). In fact, only a small percentage of internet users in general contribute the majority of material. Nielsen (2006, Summary section, para. 1) indicates that “in most online communities, 90% of users are lurkers who never contribute, 9% of users contribute a little, and 1% of users account for almost all the action.” In this online situation, how is the social network maintained with such a small number of participants fulfilling the network obligations? Moreover, why do the highly-active 1% of members continue to contribute within such an imbalanced state of network obligations?

Is the reason for this disparity that there are different expectations of obligation for different types of virtual network participation? For example, if you want to identify as a highly involved member you are under this investment obligation, but more weakly associated members are not. Alternatively, is the reason for this disparity that the sanctions for failing to invest are low? In this example, there is an expectation that all network members will participate, but there is no punishment for remaining a lurker. This reason would indicate that there may be little threat of the *tragedy of the commons* (and related free rider problem of overusing shared resources – see discussion on page 129) in these social networks, so extreme consequences are not warranted. Resources are not used up, as they are in the tragedy of the commons, so the implications of an imbalance in contribution are different between material and virtual networks.

Blanchard and Horan (1998) argue that in virtual networks the cost of investment (e.g., posting a reply or comment) is low, so in large social networks, it is relatively easy to find someone willing to help. In these situations, there is no expectation of specific reciprocity and instead there is commitment to the well-being of the network. This is reinforced by the norms of the network. Since the acts of helping are public and visible to the entire network, even a few small contributions can demonstrate to the network as a whole that being helpful is a social norm.

Significantly, Blanchard and Horan (1998) suggest that virtual communities afford members a norm of reciprocity whether or not they actively and publically engage (e.g., lurk instead of post). They observe that help and support are commonly observable in
virtual communities, but argue that members need not “directly participate in the exchange of help for social capital to be affected... simply observing a helpful act may be sufficient” (Blanchard & Horan, 1998, p. 11). Even though contribution may be low by most virtual network members, the imbalance in obligation may not negatively impact the network.

3.5 Engagement in social networks: social norms and motivation

This research study investigates how individuals use online resources in problem solving. In this context, engagement has two primary components: how individuals engage within social networks (norms) and why they engage (motivation).

3.5.1 Norms of behaviour in social networks

There is a large body of literature dedicated to exploring the rules and governance of social connections. For this research study, however, understanding how social norms influence behaviour in order to create and gain access to resources is of particular interest.

Social norms are the rules of conduct within a social network. Cialdini and Trost (1998, p. 152), for example, define social norms as:

[The] rules and standards that are understood by members of a group, and that guide and/or constrain social behaviour... These norms emerge out of interaction with others; they may or may not be stated explicitly, and any sanctions for deviating from them come from social networks.

There are both externally and internally developed social norms used within networks. External norms develop and are shared across networks. Internal social norms are rules of social behaviour which form from within the network. They are a co-created codebook for understanding and governing the words and actions of others. This codebook allows individuals to interpret others’ behaviours as well as providing guidance for how they in turn should behave. The norms provide context to individuals during engagement with the network. They do this by assigning a social meaning to others' behaviours (Sunstein,
Social norms help members of the network interact with one another in a manner which maintains the social network.

The concept of social norms assigning meaning to network behaviours is central in providing access to network resources. Individuals must understand what is said by other members in order to benefit from the knowledge. Fayard and DeSanctis (2005, Challenges of Online Forums section, para. 2), for example, argue that in loosely connected networks, such as forums, it can be difficult for members to learn the social norms needed:

Visitors to a forum must be able to interpret text comfortably, find meaningful content, and know how to formulate messages that will interest others. Understanding who is saying what and how the group conversation is unfolding within a vast array of messages can be difficult, especially for newcomers; and with many people coming and going, a forum can lack a sense of continuity and coherence. [Emphasis added]

Different social networks have different norms, although many include norms such as reciprocity, collaboration, cooperation, knowledge sharing and other collectivist norms (Kankanhalli et al., 2005; Law & Chang, 2008; van den Hooff, de Ridder, & Aukema, 2004). Morrison (2002) suggests that social norms, such as communication norms (e.g., how/when can you ask questions or how often can you ask a co-worker for assistance), help socialise new network members. The socialisation operates at three levels: organisational (how the network functions), task (how to perform the task at hand), and role (what role does the member fulfil within the network). Bock, Kankanhalli, and Sharma (2006), however, argue that strong social norms, such as inter-network collaboration, may inhibit collaboration across networks.

At the heart of social norms is the connection between individual and network. Social norms can encourage members to collaborate, work cooperatively, or openly participate within the network. Members of the network define and follow these social norms even when the benefit is for common gain rather than individual benefit. In this way, social norms transform individual interests into collective interests by making network interests a priority of members (Coleman, 1988).
How are social norms able to influence individual behaviours? One of the prominent characteristics of norm development and adherence is through public engagement within the network.

**NORMS ENCOURAGING PUBLIC PARTICIPATION**

The norm of participation is prominent in social networks. Participation emphasises public interaction and investment in the network. Public participation: (1) adds resources to the network (Nahapiet & Ghoshal, 1998), (2) facilitates socialisation (Lyon, 2000), (3) defines the boundaries of the network and its membership (Bourdieu, 1986), and (4) ensures that the network remains active (Woolcock, 1998).

First, when members publically engage it embeds resources within the network (Nahapiet & Ghoshal, 1998). For example, consider employees gathered in a meeting. There are norms specific to the group which specify who should speak, how often, how the conversation flows, the topics of conversation and so forth. Public engagement is a requisite social norm in meetings, although specific behaviours will be dependent on the context (e.g., a presentation may have just one speaker, but a staff meeting may have more). The public (visible) nature of the engagement is important in this setting because it communicates information (the content of the meeting) and also the rules of engagement. Without some form of public engagement, there would be no benefit gained from meeting.

Similarly, in online networks, there are often norms around public engagement. Like with the meeting example above, at least some people need to publically contribute in order for benefits to be gained from the virtual network. In fact, the norms for participation at some level can be even more important because the information resources (content) are actually the artefacts of public engagement (e.g., posts, comments, or threads) which are visible to the network after the engagement has concluded.

Second, social norms can help socialise individuals to the network. They socialise members by modelling social behaviours and highlighting anti-social behaviours (Lyon, 2000). Socialisation grants access to embedded network resources (i.e., the value/benefit of social connection). For example, consider making an introduction for a friend seeking employment to an influential employer. Social norms influence the behaviour of both
the friend seeking the employment contact (e.g., I know how to ask my friend for help, we are close friends and feel comfortable helping each other, etc.) and the friend with the connection (e.g., I know how to approach the contact, my contact will appreciate that I personally know who I am recommending, etc.).

Socialisation also indicates how different members participate and have different network roles. Some members of social networks fulfil certain roles within the collective. One of the most common roles is a small cluster of individuals within the group who are mandated to speak for and represent the group. For example, Bourdieu (1986, p. 53) suggests that a small group of agents play an important role as representatives for the network:

[They] defend the collective honor when the honor of the weakest members is threatened, the institutionalized delegation, which ensures the concentration of social capital, also has the effect of limiting the consequences of individual lapses by explicitly delimiting responsibilities and authorizing the recognized spokesmen to shield the group as a whole from discredit by expelling or excommunicating the embarrassing individuals.

As Bourdieu (1986) describes, this role of network representative has the dual responsibilities of defending the weakest members as well as ‘shielding the group as a whole from discredit’. Bourdieu uses the example of the pater familias representing the family’s interests and providing protection. In virtual networks, this concept may be useful for explaining why some participants may act as agents for the network. This also provides an illustration as to how social norms vary depending on member roles. It might be acceptable for the pater familias to speak for the entire network, but it would be a violation of norms for a weaker member to do so.

Third, public participation defines network boundaries by illustrating who is a member. The active interaction among network members is a central theme in social capital. Not only does interactive engagement constitute the entirety of network participation in much of the literature, but it also determines the boundaries of who is in (and out) of the network. Bourdieu (1986, p. 52) argues that interactive and public engagement via the exchange of network resources is a visible symbol of network membership:

Exchange transforms the things exchanged into signs of recognition and, through the mutual recognition and the recognition of group membership
which it implies, reproduces the group. By the same token, it reaffirms the limits of the group... Each member of the group is thus instituted as a custodian of the limits of the group.

As Bourdieu (1986) describes, the visible exchange of network resources serves to define the network. For example, participation in a club’s social events may be expected. Event participation demonstrates membership (e.g., individuals in attendance) and those excluded (e.g., individuals not extended an invitation). Individuals reinforce network boundaries by interactively (visibly) participating in the club’s social events. This does not account for, however, how invisible participation affects network boundaries. If most of the interactions are private in virtual networks, what is the role (if any) of lurking in defining network boundaries?

Lastly, public engagement is an investment in social relationships. This behaviour maintains the on-going structure of the social network. For example, this is seen when members of an organisation attend a social event after work to get to know co-workers better.

Social norms are an important facet of maintaining social networks. Norms encourage trust between members. In networks where there are high linkages (i.e., extra-network ties) but low integration (i.e., intra-network ties), anomie can occur. This breakdown of social norms is an extreme state where the social network has only weak bridging ties and no bonds from stronger ties. Woolcock (1998), for example, characterises this state as providing members with a wide range of opportunities to pursue social connections, but lacking a stable social network base and social norms for guidance. The trust developed through positive interactions fades as network members pursue their own self-interests.

What does this signal for those who lurk online? Are they exhibiting anti-normative behaviours or is lurking a valid and recognised role for some members? How do social norms enforce behaviours?

**NORMS AS SOCIAL CONTROLS**

Norms are social controls which reward normative behaviours through rewards and by imposing sanctions on anti-normative behaviours. Rewards for adhering to social norms can be either intrinsic or extrinsic (Best & Krueger, 2006). Intrinsic rewards, such as
reputation or status, can be a strong motivation for some members because increased reputation can lead to a more powerful position within the network and has a positive effect on individual identity (Best & Krueger, 2006; Constant et al., 1996; Oreg & Nov, 2008; Wasko et al., 2004). Extrinsic rewards, such as information and social support, provide access to network resources.

Sanctions are the punishments for deviating from social norms. As Sunstein (1996, p. 915) suggests:

Reputational incentives impose high costs on deviant behaviour. The relevant sanctions create a range of unpleasant (but sometimes pleasant) emotional states in people who have violated norms. If someone behaves in a way inconsistent with social norms, public disapproval may produce embarrassment or perhaps shame and a desire to hide.

Both rewards and sanctions are helpful in motivating individuals. Sunstein (1996) also argues, however, that some individuals find the imposed sanctions pleasant (e.g., they like the attention) and in those cases sanctions may not have the desired effect. Nonetheless, in typical cases, social controls encourage individuals to put the needs of the network above their own self-interest which can encourage participation and reduce problems such as free-riding (Markus & Agres, 2000).

Social norms also address antisocial behaviour in online social networks through controls such as shunning or expelling violators (Wasko et al., 2004). Davis (2002), for example, describes how some sites use moderators to intervene on behalf of members and address undesirable behaviour such as inappropriate sexual advances or swearing. Network members of any status or position can also influence network behaviours. C. B. Smith, McLaughlin, and Osborne (1997) find that in Usenet discussion groups, members reproach transgressions by posting messages which identify the violation, condemn the behaviour or offered advice for future network participation.

In summary, social norms are helpful for maintaining a functional network as well as a means to gaining access to network resources. Most of the literature on social norms, however, assumes that the norms are developed in tight-knit groups in which members develop an understanding of the social rules over time. The question remains, how do loosely-connected networks develop and share norms?
3.5.2 Motivation for network participation

If social norms influence how individuals behave within social networks, then motivation explains why they engage in the way they do. There are a variety of reasons why someone would be motivated to participate in a social network. In organisational behaviour literature, a distinction is made between instrumental and normative motivations. Wiener (1982, pp. 419–420) identifies two factors of motivation using the Fishbein model of behavioural intentions:

The first component, or the person’s attitude toward performing a particular act, is a function of his beliefs concerning the consequences of the act and their value to him. These can be referred to as instrumental-cognitive beliefs. The second component, the subjective norm, is a function of a person’s beliefs about what important referents think he should do, weighted by his motivation to comply with the referents. Referents may include relevant others, a reference group, or the society at large. Such beliefs may be termed social-normative beliefs. [Emphasis added]

In social capital literature, these two factors, also referred to as instrumental and consummatory, are opposite ends of a continuum of motivations to participate in social networks.

While the motivation to seek out network resources and lay claim to them may be obvious when individuals are developing knowledge and problem solving, motivations to make those resources available are more complex. When providing access to embedded resources, Portes (1998) distinguishes between instrumental and consummatory motivations.

Instrumental motivation

Instrumental motivations are the expectations of reciprocity between an individual and the network. Instrumental motivations, also referred to as extrinsic or external, focus on individual interests, such as information-seeking, getting help, self-development, or developing a reputation (Oreg & Nov, 2008). If the network identification is low, investment in the network is minimal and the motivation for members to engage is typically extrinsic (Bock et al., 2006). Individuals within the social network gain access to resources because the network itself can enforce trust within the network by ensuring that obligations will be serviced by network members. For example, Portes (1998)
describes how bankers in tight-knit religious communities can lend money to members without collateral because the community can enforce repayment (through sanctions and ostracism). Instrumental motivations are heavily dependent on obligation and generalised reciprocity (Portes, 1998).

In addition to motivators, such as social obligations and reciprocity, building a reputation is strong motivation for some individuals (Donath, 1999). What is the relationship between identity and reputation? If a shared identity can motivate network participants to grant access to resources, does the development of an individual’s reputation play a part in that? Coleman (1988, pp. S107–S108) suggests that reputation is related to network norms and is a trait of tightly bound networks:

> Reputation cannot arise in an open structure, and collective sanctions that would ensure trustworthiness cannot be applied. Thus, we may say that closure creates trustworthiness in a social structure.

As Coleman (1988) describes, reputation stems from how well (or poorly) an individual adheres to network norms and meets network obligations. An individual’s identity within the network is therefore related to that individual’s reputation in the network. Moreover, if individual members demonstrate reputable behaviour then the network’s reputation for trustworthiness increases.

In virtual networks, how does individual behaviour of loosely connected members translate into their own network identities and reputations? How do the reputations of the members whose participation is ephemeral and dynamic determine the reputation of the network?

Does Coleman’s (1988, p. S108) assertion that “closure creates trustworthiness in a social structure” imply that open networks do not create trust in the same way? If that is true, how is trust determined in virtual networks with weak ties? In virtual networks where reciprocity and obligations cannot be enforced in the same way as bonded material communities, how would instrumental motivations facilitate resource exchanges?

**Consummatory motivation**

Consummatory motivations are the internalised norms of network members (Portes, 1998). Consummatory motivations, also referred to as intrinsic or internal, are based on
satisfaction gained from a focus on collective interests, such as altruism (Oreg & Nov, 2008). Members adhering to the social norms of the network, such as recognising obligations or adhering to norms of reciprocity, make network resources available to others. For example, Coleman (1988) describes how neighbourhoods which exhibit anti-crime norms allow residents to walk the streets at night without fear.

A compelling feature of consummatory motivation is the concept of bounded solidarity. Portes (1998, pp. 7–8) suggests the concept is an extension of Marx’s analysis of class struggles:

By being thrown together in a common situation, workers learn to identify with each other and support each other’s initiatives… For this reason, the altruistic dispositions of actors in these situations are not universal but are bounded by the limits of their community. Other members of the same community can then appropriate such dispositions and the actions that follow as their source of social capital.

Bounded solidarity has three important features for explaining resource access in virtual networks: (1) norms of social networks can stem from a common identity and shared destiny, (2) granting access to resources without expectation of reciprocity can be a norm (altruism), and (3) individuals can socially connect and gain access to network resources through this form of internalised norm.

For example, Portes (1998) describes bounded solidarity as the motivation for church members to anonymously donate. First, church members share a common religious identity and shared destiny in the success of the church. Second, donating members do not expect that the church will reciprocate the donation. Lastly, other members gain access to funded church activities by common religious identity and engaging in church activities without necessarily knowing or engaging directly with donors.

In virtual networks, such as those that form around professional topic-based sites, bounded solidarity could explain why some participants contribute and provide access to network resources (knowledge embedded within the network). There are, however, other possible explanations. Wasko and Faraj (2005, p. 40), for example, suggest that individuals engage in virtual networks because “engaging in intellectual pursuits and solving problems is challenging or fun, and because they enjoy helping others.”
Could it be that there is a distinct change in motivation between members who infrequently post and those who more frequently engage with the network? That is, a shift in motivation from self-interest to network-interest. As Blanchard and Horan (1998, p. 10) describe, it does not take many in-crowd members to support a large social network because “the costs in helping are so low, people can easily obtain assistance from others when the group is large” and additionally, “a few group members’ helpful actions will reinforce the group’s concept of itself as being helpful to its members”.

What motivates members of online social networks to participate either privately as lurkers seeking information or publically as contributors? Huysman and Wulf (2006) suggest that motivations for participation in online social networks range from individually motivated to a collective orientation. The range suggests that members pursuing different goals may be motivated by different factors. The decision for an individual to use online resources is dependent on the benefits of those resources and the cost of using them. The perceived value is dependent on both the quality of the information and credibility of the resource (Bock et al., 2006).

In addition to the motivations for seeking information online, there are also de-motivations. As Bock et al. (2006) suggest, information-seeking is moderated by expectations based on trust and obligation as well as the risks from the cost of using those resources. In online social networks there is a close relationship between cognitive trust in the norms of the network, the norm of generalised reciprocity and the obligation to adhere to social norms.

There is some literature on online participation which suggests members may be reluctant to share knowledge because of knowledge-hoarding (Kankanhalli et al., 2005). Ardichvili, Page, and Wentling (2003, p. 70), however, argue that the most prominent demotivation for participation in online communities of practices is that “people are afraid that what they post may not be important (may not deserve to be posted), or may not be completely accurate, or may not be relevant to a specific discussion”. Similarly, Bock et al. (2006, p. 11) suggest that another strong demotivation can be the lack of self-efficacy; self-efficacy is a “belief in one’s capabilities” and is “essential in overcoming the fear many novice users experience”.
As discussed previously, both strong and weak ties are beneficial to social network members, however, they may serve different purposes. Motivations to participate are also different depending on the strength of ties in online social networks. Motivations to participate in social networks with strong ties are similar to motivations to participate in virtual communities in which sense of community influences participation and behaviour (Koh, Kim, Butler, & Bock, 2007; H.-F. Lin, 2006).

Motivations in networks with weak ties, however, prove more difficult to understand because they lack many of the motivators of communities such as personal relationships (see discussion pages 82 and 85). Constant et al. (1996, p. 121), suggest that the challenge in understanding online sharing motivations is that they deviate crucially from personal relationships in which “benefactors themselves benefit from providing help, either through increasing the beneficiary’s obligation to reciprocate or through receiving the beneficiary’s esteem or both”. They do, however, present two alternative motivations for weak ties in online social networks. First, network members are motivated by self-interest; “if technical expertise is important in self-identity, experts can gain personal benefits from helping strangers on a computer network with technical problems” (Constant et al., 1996, p. 121). Secondly, they are motivated by “organizational citizenship” and “norms of generalized reciprocity” to provide help to other members of social networks with weak ties (Constant et al., 1996, p. 121).

In summary, motivations for engaging in social networks vary depending on the type of network and the purpose for participation. Social norms influence how members participate in a network as well as provide context for interpreting other members’ behaviours. Social norms also serve as social controls over networks through the use of rewards and sanctions. Depending on individuals’ goals (e.g. information seeking), their engagement with the network is driven by instrumental or consummatory motivations.

3.6 Embedded network resources
The value of social connection is in the resources, not held individually by members, but embedded in the relationship between members. This section discusses the value of resources embedded with social networks and the negative social externalities which may prevent access to those resources.
3.6.1 The value of resources embedded in social connections

Social capital theory distinguishes between the *social relationships* which allows claim to other member resources and the amount and quality of *network resources* (Bourdieu, 1986). Therefore, the social network is conceptually separate from its embedded resources. As N. Lin (2005, p. 4) differentiates:

Networks provide the necessary condition for access to and use of embedded resources. Without networks, it would be impossible to capture the embedded resources. Yet networks and the network features by themselves are not identical with resources.

As N. Lin (2005) describes, social networks are not equivalent to resources, but instead they perform two functions related to their resources: access and use. For example, consider a social network such as a professional association like the American Bar Association (ABA). The resources (e.g., the benefits of membership described on the website), may be credibility gained from affiliation, such as contacts that can lead to job referrals or knowledge on legal matters (ABA, 2012).

The first function of social networks creates access to embedded resources. By participating in social networks individuals gain access to embedded resources. Access begins by *knowing of* or being able to identify the resource and then appreciating its potential. Using the ABA example above, the ABA is not the resource, but gaining membership in the ABA (through passing the bar and being accepted into the association) grants access to the embedded resources such as new professional contacts. Having access suggests that a member has identified resources that may be of potential benefit. It does not indicate, however, that a member has used or acted on the resources.

The second function of social networks allows mobilisation of embedded resources. By participating in social networks participants use embedded resources. Continuing with the ABA example, a member would reference his/her ABA membership to gain credibility with a potential client, use a fellow ABA member as a referee to gain employment, or discuss a legal matter with other ABA members to further his/her own knowledge. Mobilising the embedded resources is made possible through social connection.
The access and mobilisation of embedded resources through social connection can vary depending on the characteristics of the network and an individual’s association with the network and other network members. N. Lin (2005, p. 4), for example, suggests:

Variations in network features may increase or decrease the likelihood of having a certain quantity or quality of resources embedded. Thus, network features should be seen as important and necessary antecedents exogenous to social capital.

As N. Lin (2005) describes above, there are network traits which determine the kind of resources available to participants. Dense networks provide a greater quantity of shared resources whereas loosely connected networks may provide a greater diversity of resources.

Dense networks have multiple re-occurring interactions between participants. The repeated interactions among individuals in the same network provide access to potentially redundant resources. For example, in a study of bio-medical research scientists, McFadyen and Cannella (2004, p. 744) suggest that researchers with strong relations develop “homogeneous knowledge stocks” from embedded network resources:

It is through shared experiences that individuals develop and exchange tacit knowledge, a resource that is key to the [knowledge] creation process; however, interacting with the same others increases the probability of developing similar resources, thus constraining the creation process.

As McFadyen and Cannella (2004) describe, the research scientists who frequently interact with the same group of individuals within the social network, gain access to shared knowledge resources, but not novel or new knowledge resources.

Alternatively, loosely connected social networks of weak connections may have a greater diversity of embedded resources. Granovetter (1973, pp. 1370–1371) explains this with the concept of weak ties which provide bridges to other networks and their embedded resources:

In the “weak” sector [of an ego-centric social network], however, not only will ego’s contacts not be tied to one another, but they will be tied to individuals not tied to the ego. Indirect contacts are thus typically reached through ties in this sector; such ties are then of importance not only in ego’s manipulation of networks, but also in that they are the channels through which ideas,
influences, or information socially distant from ego may reach him. The fewer indirect contacts one has the more encapsulated he will be in terms of knowledge of the world beyond his own friendship circle; thus, bridging weak ties (and the consequent indirect contacts) are important in both ways.

In Granovetter's (1973) description above, it is through indirect connections to individuals outside your immediate social circle that you gain access to different individuals and potentially to non-redundant resources through their social networks. For example, job seekers predominantly used weak connections (such as “an old college friend or a former workmate”) as contacts to find new jobs (Granovetter, 1973, p. 1371). For these job seekers, access to their new employer was through an indirect contact. The job seeker was directly (but weakly) connected to a contact (such as an old friend) and that contact was directly connected to the new employer. Although the emphasis in social capital literature is often on the positive consequences of socially connecting, there are also negative repercussions, referred to in the literature as the negative externalities of social capital.

3.6.2 Negative social externalities

The term externality is typically used from an economic perspective, but is used here to convey the unintended consequences that can also affect individuals outside of the social network or outside of the social capital exchange. In this meaning, the negative social externalities result in exclusion from network resources. Exclusion derives from either the social network preventing access or individuals leaving the social network and loosing access.

In the social capital literature, for example, Portes (1998) suggests that there are negative social externalities stemming from norms of behaviour in strongly bound social networks. Portes (1998, p. 15) describes these externalities as ‘negative social capital’ consisting of at least the following four negative consequences: (1) “exclusions of outsiders”, (2) “restrictions on individual freedoms”, (3) “downward leveling norms” and (4) “excess claims on group members”. The first three of the negative consequences, (1) exclusions of outsiders, (2) restrictions on individual freedoms and (3) downward levelling norms are related to specific tightly-connected dense material communities.
First, having strong ties may prevent outsiders from the same access. For example, Portes (1998) cites Waldinger’s (1995) studies of Korean immigrants to the US who restrict access to non-Koreans in the East Coast produce markets by limiting recruitment of skilled labour to their ethnic communities.

Second, participation in the community requires a strict adherence to community norms. For example, Portes (1998) describes rural communities with specific expectations for behaviour (e.g., how to dress or showing deference to elders) where young adults leave for urban centres to experience more personal freedoms.

Third, communities bound by shared adversity require members to maintain their current situations and those who seek better circumstances are either held back or forced to leave the community. Woolcock (1998), building on Banfield’s (1958) concept of *amoral familism*, identifies this consequence as an excess of community (integration) without the balance of linkages to extra-community social connections. Amoral familism is characterised by “such fierce ethnic loyalties and familial attachments that members are discouraged from advancing economically, moving geographically, and engaging in amicable dispute resolution with outsiders” (Woolcock, 1998, p. 171). This can be seen in inter-city communities bound by extreme poverty, substance abuse and criminal activity. Those who find employment or continue their education can be seen as disloyal. This is perhaps an extreme example of “tall poppy syndrome” (Kirkwood, 2007), where high-achievers are rebuked for bringing attention to themselves and standing out from (or above) the rest. It is also known as the “crab mentality” (Mendoza & Perkinson, 2003), where achievement for one member of the community (the top crab in the bucket) is seen as being at the expense of the other members (the crabs below that have been used to climb on so the one crab can escape). In virtual networks where ties are weaker, would these negative social externalities prevent access to network resources in the same way as material networks?

The fourth negative consequence, excess claims on members, is also discussed in terms of strongly-connected social networks, but may have implications for loosely-connected networks as well. Excess claims stem from social networks where there is a strong norm of mutual assistance. In these networks, members with access to more resources can be drained by claims made by members with fewer resources. For example, Portes (1998) cites studies by Geertz (1963) of family members in Bali making excessive claims of jobs.
and loans from their more successful relations. Portes (1998, p. 16) suggests that there are negative implications for this type of behaviour:

Thus, cozy intergroup relations of the kind found in highly solidary communities can give rise to a gigantic free-rider problem, as less diligent members enforce on the more successful all kinds of demands backed by a shared normative structure.

The free-rider problem is often associated with the tragedy of the commons (Hardin, 1968) where cows overgrazed common land because the herders all took advantage of the public resource. The herders are an example of free-riding described by Kollock and Smith (1996b, The problem of cooperation section, para. 7):

Whenever one person cannot be excluded from the benefits that others provide, each person is motivated not to contribute to the joint effort, but to free-ride on the efforts of others. If all participants choose to free-ride, the collective benefit will not be produced.

Is the free-rider problem only a negative social externality for tight-knit networks or could this type of behavioural norm also extend to loosely connected networks? In virtual social networks, if there are strong norms of mutual assistance particularly among highly active members of the network, could excessive claims to their knowledge limit their participation and ultimately deny access to non-free-riding members?

Similarly, Adler and Kwon (2002, p. 22) suggest that since social capital resources are “nonrivalrous”, they are “vulnerable to free-rider problems and the resulting ‘tragedy of the commons’ risks”. The resources are nonrivalrous in the sense that their value is not diminished by use. For example, in virtual networks a blog post can be read by many and still remain useful for others. The concept of nonrivalrous resources is typically associated with public goods, but because embedded network resources are only available to those socially connected, others can be excluded from access to resources. Alder and Kwon (2002) use the term ‘collective goods’ instead to emphasise the distinction that embedded resources are only available to the network.

This still leaves the potential free-rider problem. Are virtual networks in danger of disappearing due to lack of resources? How can there be a tragedy of the commons if
resources are not diminished by use? In the case of social networks, it is not that the embedded resources disappear. Instead, the risk of failure is twofold.

First, there is a danger of unfulfilled obligations leading to diminishing access to future embedded resources. For example, consider in a professional social network if only a small minority of members provide new job prospect contact information to the rest of the network. If that small minority does not receive any benefit from continued network participation, they may stop providing job contacts in the future. The obligation imbalance could lead to too many claims against too few resources.

Second, there is a danger of stagnant embedded resources. Continuing with the professional network example from above, if new job contacts are not replenished by the network, their value diminishes. In virtual networks dependent on the most current information, this could potentially be a bigger threat than the traditional scenario in the tragedy of the commons.

Nonetheless, Blanchard and Horan (1998) argue that since it takes a relatively small segment of a network’s population to publically contribute enough to satisfy the majority, a relatively small percentage of contributors do actually replenish the embedded resources in virtual social networks.

In summary, there are benefits as well as negative consequences from social connection. The benefit of social connection is derived from gaining access to the resources embedded within the network. Members, however, do not always benefit from engagement. Network participation can also restrict access to opportunities and limit members in individual achievement.

3.7 Conclusion
In this chapter social capital theory was used to provide conceptual access to understanding how individuals use knowledge resources through virtual social networks. This chapter revealed the following key concepts:

- Bonding social connections contain redundant resources and facilitate sharing existing knowledge (e.g., getting by). Bridging connections contain new knowledge (e.g., getting ahead);
- Virtual networks are more likely to have weak ties and proportionately few publically engaging members;
- Trust is required in order to gain access to network resources;
- Social obligation and social norms motivate network members to publically engage with the network and contribute in the development of network resources;
- Social connection provides access to embedded resources.

There are, however, elements of the initial research question that the social capital literature does not cover:

- How do lurkers gain access to network resources in the absence of public engagement, limited trust, or very weak ties?
- How is trust developed in weak connections in which network members have no prior knowledge of each other or the network in general?
- Are social networks able to develop and release embedded resources when members do not follow social rules?
- How do virtual social connections provide access to embedded knowledge resources during problem solving?

Although this literature does not fully address the research problem, it does help theorise the research questions:

**RQ1:** Where do individuals locate problem solving resources in virtual social networks?

**RQ2:** How does tacit knowledge teach individuals how to engage in the process of accessing resources; and how to interpret the context of those resources?

**RQ3:** How do individuals gain access to problem solving resources through social connection?

After investigating the knowledge management, social media, and social capital literature, it can be seen that knowledge development in online environments is not well understood. In order to address this gap, this study seeks to answer the research questions above by exploring how individuals problem solve using virtual networks.
4 Methodology

4.1 Introduction
The aim of this chapter is to provide a description and rationale for this study’s research approach, design, and data analysis. It explains how, as the researcher, I accessed and engaged with the field in order to address the research questions. The chapter is organised into five sections: research paradigm, research methods, pilot study, participants, and reflexivity.

The first section on locating the research paradigm is a discussion of the approach this research study used to engage with the field. The second is a discussion of the two methods used in this research study: (1) interviews and (2) virtual ethnographic observation. The third reflects on the issues highlighted from the pilot study. The fourth, explores the social networks of software developers engaged in problem solving online. The final section is a reflexive discussion of my research perspective, influence, and biases as an integral part of the research experience. In particular, I reflect on my participation with the field and participants as a former software developer.

4.2 Locating the research paradigm
In order to investigate online social connection, I needed an overall approach to the research which matched my aims. I wanted to develop an understanding of online behaviours and find meaning from those behaviours, so I chose an approach that focussed on those concepts, as opposed to approaches which predict behaviours or causal effects between behaviours and outcomes. These research approaches, referred to as research paradigms, are the frameworks under which we view reality (i.e., ontology) and the nature of knowledge (i.e., epistemology) while engaging in research (Denzin & Lincoln, 2011; Guba, 1990; Silverman, 2010).

Ontology in research examines assumptions about the nature of reality. Different research paradigms employ different ontological approaches in order to position the research study and address research objectives. Willig (2008, p. 13) suggests the spectrum ranges from realist to relativist:
A realist ontology maintains that the world is made up of structures and objects that have cause-effect relationships with one another... A relativist ontology, by contrast, rejects such a view of the world and maintains instead that the world is not the orderly, law-bound place that realists believe it to be. A relativist ontology questions the ‘out-there-ness’ of the world and it emphasizes the diversity of interpretations that can be applied to it. [Emphasis added]

From a relativist position, there are multiple realities, instead of one reality, each created from the personal and social experiences of those involved (Creswell, 2007; Denzin & Lincoln, 2011; Guba, 1990). For this research study, which focuses on how individuals socially connect in virtual networks, the concept of individuals constructing multiple realities from their own personal experiences is essential for understanding online social connection from an individual’s point of view. Therefore, this study adopted a relativist ontology.

The relativist ontology suggests the use of certain methods for engaging with the field. Denzin and Lincoln (2011, p. 103) propose that when assuming a relativist approach:

[It] means that we construct knowledge through our lived experiences and though our interactions with other members of society. As such, as researchers, we must participate in the research process with our subjects to ensure we are producing knowledge that is reflective of their reality.

This positions the researcher relative to the individuals under investigation. In order to maintain this perspective, a “researcher uses quotes and themes in [the] words of the participants and provides evidence of different perspectives” (Creswell, 2007, p. 17). There is further discussion on the research methods used in this study later in the chapter (see section 4.6, page 170).

As with ontology, epistemology is a defining aspect of the research paradigm. Epistemology in research is concerned with the nature of knowledge. It addresses questions such as: what can be known; what is truth; and what is the relationship between knowledge, the researcher, and the researched (Creswell, 2007; Denzin & Lincoln, 2011; Willig, 2008). Epistemological positions range from objectivism, in which the researcher is positioned outside of the subject in order to objectively investigate the phenomena; to subjectivism, in which “inquirer and [the] inquired are fused into a single entity” (Denzin & Lincoln, 2011, p. 103) and knowledge is co-created within the
interaction between researcher and subject (Guba, 1990). Similar to the multiple realities of relativism, Cunliffe (2011, p. 656) argues that in subjectivism, “there are ‘truths’ rather than one truth...[and] meanings, sensemaking, and knowledge are relative to time, place and manner in which they are constructed – in the everyday interactions of people.”

For this research study, which explored social behaviours from within social networks, a subjectivist stance was more appropriate for the research aims. By choosing this approach, as researcher I was placed within the research context, in order to engage with the field. Denzin and Lincoln (2011, p. 104) suggest that by positioning oneself in this paradigm, “this means we are shaped by our lived experiences, and these will always come out in the knowledge we generate as researchers and in the data generated by our subjects”. Therefore, this study adopted a relativist ontology and subjectivist epistemology, which is characteristic of an interpretivist research paradigm (Denzin & Lincoln, 2011).

4.2.1 Interpretivist paradigm

In the interpretivist paradigm, also referred to as anti-positivist, naturalistic, constructivist or social constructivist, the social world is constructed through meaning (Creswell, 2007; Denzin & Lincoln, 2011; Guba, 1990). That meaning is assigned by those who participate in the social world, such that all of the meanings derived from the social experience are specific to a particular context and setting. Burrell and Morgan (1979, p. 28) describe the interpretivist paradigm:

[It] is informed by a concern to understand the world as it is, to understand the fundamental nature of the social world at the level of subjective experience. It seeks explanation within the realm of individual consciousness and subjectivity, within the frame of reference of the participant as opposed to the observer of action.

According to Lindlof and Taylor (2002, pp. 11–12), an interpretivist study may be characterised by the following traits:

- The study “should illuminate how cultural symbol systems are used to attribute meaning to existence and activity”;
Within the study, “the researcher is the instrument” and cannot be separated from the study as in other studies which use pre-existing or external instruments such as hypotheses from theory or pre-defined survey instruments;

The study gains knowledge “through prolonged immersion and extensive dialogue practiced in actual social settings” such as with ethnographies;

Within the study, “knowledge claims should preserve the subjective experience” of the participants;

As part of the study, “researchers should continuously reflect” on the research experience.

As opposed to a positivist paradigm in which “the goal of research is to produce objective knowledge, that is, understanding that is impartial and unbiased, based on a view from ‘the outside’, without personal involvement or vested interests on the part of the researcher” (Willig, 2008, p. 3), interpretivism aims to interpret behaviours from within in order to create meaning. As Burrell and Morgan (1979, p. 5) argue:

The social world is essentially relativistic and can only be understood from the point of view of the individuals who are directly involved in the activities which are to be studied... One can only ‘understand’ by occupying the frame of reference of the participant in action.

As described by Burrell and Morgan (1979) above, the methods used within the interpretivist paradigm are designed to describe and explain phenomena from the participant’s point of view.

Knowledge management research engages with the field from both a positivist and interpretivist position. In the literature reviewed for this study, however, positivist research using case studies with surveys, interviews, and observations in order to categorise behaviours was more prevalent (see Ferguson, Huysman, & Soekijad, 2010; Orlikowski, 2002; Webb, 2008). Case studies were considered for this study, but were not considered ideal because (1) the explorative nature of the study meant that I did not know which cases would be appropriate for study and (2) I needed more extensive engagement with the field in order to understand the meanings behind behaviours.

Due to the disparate nature of social media research studies, it is difficult to categorise a general positivist or interpretivist perspective in the literature. It is possible, however,
to generalise that studies focused on producing an objective view of social media use (e.g., descriptions of social networks, typologies of online behaviours, etc. tended to take a positivist position). Positivist studies, which use statistical analysis of data to define causal relationships in online behaviours, most commonly use online message analysis gained from observation and data mining (see Beaudouin & Velkovska, 1999; Faraj & Johnson, 2011) and surveys (see Burke et al., 2011; Vitak et al., 2011), but experiments and case studies were also used (see Antaki et al., 2005; Sarker et al., 2011). For example, in their study examining the social structure of online networks of practice, Wasko, Teigland, and Faraj (2009) assume a positivist approach. They tested hypotheses on the nature of the social structures by downloading threads from an online bulletin board site, conducting surveys of selected participants, coding threads, statistically analysing the surveys, and conducting social network analysis of thread posts between individuals.

Alternately, studies exploring virtual social networks from the point of view of participants (e.g., social norms, group roles, and communication patterns among social network participants) tended toward an interpretivist position. These interpretivist studies used virtual ethnographies to observe and explain online behaviours (see Blanchard, 2004b; da Cunha Recuero, 2008; Maloney-Krichmar & Preece, 2005; Ridings & Gefen, 2004). For example, in their study exploring how profiles were used in online conversation, boyd and Heer (2006) interpret the meanings of observed behaviours through ethnographic fieldwork and visual analysis of social network graphs. This integration of observation and visualisation is an emergent method in virtual ethnographic studies. Adding visualisation to observation is important because, as boyd and Heer (2006, 1.2 Methodology section, para. 3) explain, “it gave us a visual means to confirm ethnographic observations, particularly concerning the presence and composition of dense network clusters.”

Even though, there are many positivist studies in both knowledge management and social media genres, in order to address social connection in online environments, an interpretivist approach was selected for this research study.
4.2.2 Qualitative research methodology

Another dimension of the research paradigm is methodology. Methodology is the approach to investigating a phenomenon. It is not methods, which are the techniques used in the investigation (Silverman, 2010). Methodologies are typically categorised as quantitative or qualitative. Quantitative methodology is concerned with quantifying and measuring data whereas qualitative methodology is concerned with thick descriptive characteristics such as stories, meanings, and reflections (S. Jones, 1999). Qualitative research examines phenomena in their natural settings (Denzin & Lincoln, 2011). In other words, if quantitative research places the researcher outside of the participants’ world to objectively investigate the phenomena, then qualitative research invites the researcher into the participants’ world to interpret the phenomena.

Qualitative research uses a process of analytical induction, unlike quantitative deduction, to explain phenomena (Creswell, 2007; Mann & Stewart, 2003). Qualitative research is appropriate when there is a research problem which requires exploration as opposed to hypothesis testing or cause and effect. It is particularly useful when the problem has the following characteristics (Creswell, 2007; Flick, 2002; Lindlof & Taylor, 2002; Mann & Stewart, 2000):

- It is complex (e.g., involves social relations) and requires a detailed or in-depth understanding of the situation;
- It involves individuals who cannot be separated from the environment and context of the situation;
- It is not adequately addressed by existing theories or instruments (e.g., surveys, frameworks, or models).

In order to engage with the field, qualitative studies may use a variety of methods and typically use multiple methods (i.e., triangulation) in order to provide multiple perspectives on the phenomena (Denzin & Lincoln, 2011; Lindlof & Taylor, 2002). Semi-structured interviews and ethnographies are commonly used. Unstructured and semi-structured interviews “are used to explore different meanings, perceptions, and interpretations” (Cunliffe, 2011, p. 659). Similarly, ethnography and observation is used so that the “researcher collaborates, spends time in [the] field with participants, and becomes and ‘insider’… [The] researcher works with particulars (details) before
generalizations, describes in detail the context of the study, and continually revises questions from experiences in the field” (Creswell, 2007, p. 17).

A quantitative or statistical methodology was not an appropriate fit for the research agenda in this study because social interactions and relationships are difficult to explore and explain separate from their setting and context. Therefore, this research study followed a qualitative research methodology using interviews, observation, and social network analysis in order to explore, describe and find meaning in social connection.

4.3 Research methods

In order to investigate the characteristics and behaviours of social connection in virtual spaces, research methods must be selected based on their suitability for this type of exploration in an online environment. Using only interviews would not have provided a complete picture of problem solving online. Interviews are useful for providing “perceived attitudes and motivations” [emphasis added] (Marett & Joshi, 2009, p. 61), but not actual behaviours. To investigate actual behaviours, observation needed to be included. I determined that the study would benefit from both interviews and observation, but the role of the interviews would be to contextualise the virtual phenomena under investigation. Additionally, while the observations would be able to provide descriptions of individual connections, social graphs were also needed to illustrate the networks and clusters of social connection within virtual space. In this study, social graphs were used as an analysis tool within an interpretivist paradigm to explore relationships of participants rather than the method within a positivist study used to definitively describe those relationships.

<table>
<thead>
<tr>
<th>Table 4.1 Research study dimensions</th>
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<tr>
<td><strong>Dimension</strong></td>
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<td><strong>Material</strong></td>
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<td><strong>Virtual</strong></td>
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Consequently, the study consisted of two methods to address the challenges of studying behaviours within a virtual environment: material interviews (e.g., face-to-face semi-structured interviews) and a virtual ethnographic study. These are illustrated in Table 4.1.

The characteristics of the research methods (adapted from Creswell, 2007, pp. 78–80; Denzin & Lincoln, 2011; Garton et al., 1999b) are illustrated in Table 4.2.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Method 1 - Interviews</th>
<th>Method 2 - Observation</th>
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<tr>
<td>Approach</td>
<td>Narrative</td>
<td>Ethnography</td>
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<tr>
<td>Focus</td>
<td>Explore individuals’ experiences</td>
<td>- Describe and interpret a culture-sharing group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Describe network structures and patterns of connections</td>
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<tr>
<td>Unit of analysis</td>
<td>An individual</td>
<td>- Individuals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- A culture-sharing group</td>
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<td></td>
<td></td>
<td>- The connections (e.g., relationships or ties) between members of a network</td>
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<tr>
<td>Data gathering</td>
<td>Interviews and secondary sources such as participants’ profiles and communications</td>
<td>- Observation and secondary sources such as participants’ external sites (e.g., blogs,</td>
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<tr>
<td></td>
<td>in online social networks (e.g., Twitter, Facebook, and LinkedIn accounts)</td>
<td>websites, and Twitter accounts)</td>
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<td></td>
<td></td>
<td>- Documenting interactions between network members (e.g., thread posts, comments, links</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to external sites, etc.)</td>
</tr>
<tr>
<td>Fieldwork materials</td>
<td>Oral narratives (e.g., reflections and stories)</td>
<td>- Written narratives, participant profiles (e.g., biographies, avatars, usernames, etc.),</td>
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<td></td>
<td></td>
<td>and the researcher’s fieldnotes</td>
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<td>- Connection data between network members (e.g., bases for connection, frequency, and</td>
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<td></td>
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<td>intensity)</td>
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<tr>
<td>Data analysis</td>
<td>Thematic analysis on individual narratives</td>
<td>- Description of behaviours and thematic analysis of individual behaviours and group</td>
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<tr>
<td></td>
<td></td>
<td>interactions</td>
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<td></td>
<td></td>
<td>- Social network analysis (SNA) of patterns illustrated in social graphs</td>
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</table>
The first dimension, knowledge development, explored whether or not knowledge development occurred in virtual networks. The focus was to address the first two research questions:

\textit{RQ1: Where do individuals locate problem solving resources in virtual social networks?}

\textit{RQ2: How does tacit knowledge teach individuals how to engage in the process of accessing resources; and how to interpret the context of those resources?}

The second dimension, social connection, investigated the role of social connection in problem solving. The focus was to address the third research question:

\textit{RQ3: How do individuals gain access to problem solving resources through social connection?}

The research methods selected for this study were chosen for their individual relevance to phenomena under investigation and their ability, when used together, to provide multiple perspectives on the same phenomena.

\textbf{4.3.1 Ethics}

This study fully complied with the University of Otago research and ethics requirements (see Appendix A: Research study ethics application).

Due to the specific challenges of researching online social connection (see page 149) which significantly influenced the study, I treated this study as \textit{internet research}. Internet research is “the study of online behaviour (what people do in virtual and mediated environments)” (Mann & Stewart, 2000, p. 5) as well as “human behaviour in general” (J. Walther, 1999, p. 1). As an internet study, the issue of ethics was more complicated than in material studies because (1) there are very few extant internet studies compared to material research and (2) the concept of privacy is very different online than it is in material spaces. In order to address the second issue, I structured the study by privacy domains and addressed the ethical considerations within each context.
This research study engaged with participants within the private, semi-public, and public domains. I ensured that participants were protected from harm or discomfort within each of the domains through the following means.

In the **private domain**, the study used semi-structured interviews with participants. In order to protect participants within this domain, I:

- Refrained from asking intrusive or personal interview questions;
- Allowed participants to withdraw from the interview process at any time without consequence;
- Maintained participant confidentiality and anonymity, where possible, throughout the interview, transcription, thematic analysis, and publication of the interview-related materials;
- Provided an explanation of the research study and an information sheet to each participant to read and sign.

In the **semi-public domain**, the study used participant observation as part of a virtual ethnography (method 2). Semi-public is defined as a site which is available to most people via some form of registration or membership application, in particular, community-oriented or social network sites (Sveningsson Elm, 2009). In this study, the semi-public domain included sites such as Twitter, Facebook, and LinkedIn. When participating within this domain, I observed software development related knowledge sharing behaviours. In order to protect participants within this domain, I:

- Posted a link to the Information Sheet for Participants on my profiles for all sites contained within the study;
- Maintained participant confidentiality and anonymity, where possible, throughout the thematic analysis and publication of the ethnographic artefacts and materials.

Finally, in the **public domain**, the study accessed and observed an online discussion forum using virtual ethnography methods. Since these forums are freely accessible public spaces, participation was based on the norms for public venues and the code of conduct for the site. According to the Association of Internet Researchers (AoIR), “the greater the acknowledged publicity of the venue, the less obligation there may be to protect individual privacy, confidentiality, right to informed consent, etc.” (Ess, 2002, p.
5). As such, participants were not considered subjects or informants in the traditional meaning of social science investigation, but “as authors whose text/artifacts are intended as public” (Ess, 2002, p. 7). In order to protect participants within this domain, I:

- Posted the Information Sheet for Participants on my research blog and included a link to the page in my profile;
- Maintained participant confidentiality and anonymity, where possible, throughout the thematic analysis and publication of the ethnographic artefacts and materials.

The next two sections detail the two methods employed, interviews and virtual ethnography.

4.3.2 Method 1 - Interview procedures

Interviews are a useful method for developing an understanding of an individual’s personal experiences and perspectives (Lindlof & Taylor, 2002). This study followed Kvale’s (1996, p. 88) *Seven Stages of Interview Investigation*: thematising – developing research themes (e.g., social capital themes), designing – planning the interview process (e.g., developing questions), interviewing, transcribing, analysing, verifying – ensuring quality in the process, and reporting – communicating findings (e.g., the results chapters of this study).

I conducted semi-structured interviews in order to: explore the meanings behind behaviours in virtual environments (see Kvale, 1996), gather descriptions of behaviour which would not be possible to observe (see Lindlof & Taylor, 2002) (e.g., lurking), and identify potential online social networks and sites to study in more depth.

**Phase 1 – Interview preparation**

In the first phase of the interview process, interview preparation was done by thematising and designing the interview method (see Kvale, 1996). The initial themes were developed from knowledge management, social media, and social capital literature reviews. The designing included steps one and two below: identifying participants and developing interview questions with preliminary themes.
Step 1 – Identifying interview participants

There are several methods for selecting interview participants (e.g., random or theoretical sampling). Qualitative studies conventionally use “purposive rather than representative samples of participants” (Mann & Stewart, 2003, p. 84) which look for participants with certain qualities. Therefore, this study used a snowball technique for selecting participants. In snowballing, “finding one participant through another” (Mann & Stewart, 2000, p. 79), I was able to identify participants who were experienced with the concepts under investigation. The participants were located quickly, I had more immediate access to them than individuals with whom I had no connection, and I was able to more easily establish the trust necessary to engage in interviews. A summary of the individuals who participated in the interviews for this research study (collected between 30/11/09 – 8/9/10), is in Table 4.3.

Table 4.3 Interview participants’ demographic information

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Years Experience</th>
<th>Location</th>
<th>Gender</th>
<th>Org Type</th>
<th>Org Size</th>
<th>LinkedIn User</th>
<th>Facebook User</th>
<th>Twitter User</th>
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<td>✓</td>
<td>✓</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Gov’t</td>
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<td></td>
<td></td>
<td>✓</td>
</tr>
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<td>✓</td>
<td>✓</td>
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</tr>
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<td>Gov’t</td>
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<td>✓</td>
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</tr>
<tr>
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<tr>
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<td>NZ</td>
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<td>1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Count=19 Avg.=12 US=14 NZ=5 M=17 F=2 Gov’t=10 Private=9 Avg.=634 Count=10 Count=16 Count=9
Potential interview participants were identified from my personal and professional networks of software developers in both the United States (US) and New Zealand (NZ). The participants were contacted online through email and social media messaging (e.g., Facebook chat). They were all software developers who created applications either as an employee of a traditional organisation or contractor virtually connected to other developers. All participants had experience in software development and were familiar with social media. They were all of working age, between 18 and 65 years. No payment was offered to participate in the study.

*Step 2 – Developing interview questions with preliminary themes*

The semi-structured interview questions were informed by the literature on knowledge management and social media as well as the social capital theoretical lens. Semi-structured interviews were used so the questions could be extended to elicit clarification from participants and to further investigate topics arising from interview responses. The questions included demographic information and questions related to the following themes:

- Community structure and membership;
- Opportunity and potential resources;
- Motivation, trust and relationships;
- Cognitive ability of resources;
- Knowledge development.

The complete set of questions is listed in the appendices (see Appendix B: Interview questions).

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28 A test interview was conducted before the others to refine the interviewing process and interview questions. The responses and demographics are not included in this study’s results.
PHASE 2 – DATA GATHERING

In the second phase of the interview process, data gathering was done by interviewing participants (see Kvale, 1996) and investigating secondary sources in steps three and four below.

Step 3 – Conducting interviews

Initially, I conducted one test interview. This test interview was used to refine the interview questions and my interview style. After refining the interview process, I conducted the remaining 19 interviews in both the United States and New Zealand. All interviews were conducted in person except for two. All interviews were audio recorded. The interview locations were chosen by participants. All locations were in participants’ offices, in local cafés, or via Skype. All interviews were done within a ten-month period.

Step 4 – Investigating secondary sources

During the interviews, I solicited information on social media use. For the three sites most commonly used by participants: Facebook, Twitter, and LinkedIn, I asked permission to connect and follow the interview participants throughout the study. I was looking for demonstrations of behaviours described during the interviews. I took fieldnotes about their use of these social media and I retained email and social media messaging conversations (e.g., Facebook chat or Twitter direct messages) with participants for coding and analysis.

PHASE 3 – DATA ANALYSIS

In the third phase of the interview process, data analysis was conducted by transcribing and analysing interview materials (see Kvale, 1996) in steps five and six below.

29 The two technology-mediated interviews were conducted via Skype with video and audio connectivity and treated similarly to the face-to-face ones. The only difference was an acknowledgement that even video calls are still mediated and lose some of the visual communication of face-to-face encounters (Fontana, 2003).
Step 5 – Transcribing interviews, coding, and thematic analysis of materials in NVivo

All interview audio recordings were transcribed. I carried out the transcription for most of the interviews. As Lindlof and Taylor (2002, p. 205) suggest, transcription is an important part of the research process:

> One clear advantage of doing it [transcribing interviews] yourself is that the participants are already known to the researcher, and thus it is easier to recognize their speech patterns, references to people and places, and so forth. Transcribing also allows the researcher to listen to the interview in a more studied way. One can attend more closely to the conversation and pick up certain themes, issues, or contradictions that may not have been noticed in real time [during the actual interview]. Thus transcribing can serve as a portal to the process of data analysis. [Emphasis added]

After transcription, the interview audio recordings, transcripts, and secondary materials were imported into NVivo for coding and analysis. NVivo was selected because it was able to hierarchically code themes, manage the large set of material generating from observations, and export matrices of data for analysis in other software tools. There were, however, some issues using NVivo which are discussed later in this chapter (see page 160).

Both deductive and inductive approaches were used during coding. The preliminary themes from the literature were used deductively to guide the initial coding sessions. As additional codes emerged inductively, through time spent within the fieldwork materials, the new codes were applied to the materials. All of the interviews were completed before coding commenced, therefore, new codes were applied uniformly to all interview materials, and did not influence individual interviews within the interviewing process. As Lindlof and Taylor (2002, pp. 214–215) argue, the research process evolves as time is spent in a “rich data set”:

> Researchers sometimes look to existing theory and research for categories and apply them to the data in deductive or etic fashion... Most often in qualitative

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30 “NVivo is software that supports qualitative and mixed methods research. It lets you collect, organize and analyze content from interviews, focus group discussions, surveys, audio” (QSR International, 2012, para. 1). This study used NVivo versions 8, 9, and 10.

31 “An etic approach (sometimes referred to as ‘outsider,’ ‘deductive,’ or ‘top-down’) uses as its starting point theories, hypothesis, perspectives, and concepts from outside of the setting being studied” as
research, a strong current of inductive thinking stimulates the development of categories, that is, a category begins to form only after the analyst has figured out a meaningful way to configure data. [Emphasis in original]

During the process of transcription, coding, and analysis I read the written materials and listened to the audio of the interviews. I frequently re-listened in order to familiarise myself with the responses and to listen for meanings, patterns, and descriptions that were not as clearly identifiable in the transcribed text (e.g., nervous laughter was commonly an indication of reflections on uncomfortable experiences which was more easily detected in audio).

As an interpretivist study, it was important to accurately reflect and interpret the participants’ behaviours through transcription and coding. The analysis of participant behaviours, however, solely reflects my interpretation, as researcher, of how the literature and theory applied to participant behaviours. Therefore, this study did not employ social constructivist techniques, such as participant checking (Morrow, 2005), because the aim was to explore participants’ points of view but not to co-create the analysis of these behaviours with participants.

Instead, I used thematic analysis following Saldaña’s (2009) guidelines for qualitative coding and the process of *themeing the data* which looks for thematic patterns which emerge from the data set. After the process of coding and (re)developing themes, through interpretation I found meaning in the coded materials. Interpretation is to first “decontextualize the incidents (i.e., coding them out of their places in fieldnotes, transcriptions, and other materials) and then recontextualize them into category systems...[which translates] an object of analysis from one frame of meaning to another” [emphasis in original] (Lindlof & Taylor, 2002, p. 232).

The complete set of codes is listed in the appendices (see Appendix C: NVivo themes and codes).

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opposed to an *emic* approach, used in Grounded Theory, in which theory is developed from the research materials (President & Fellows Harvard University, 2008 Emic and Etic Approaches Section, para. 3).
Step 6 – Identifying sites for observation

There were some commonalities in sites used among interview participants, but instead of providing a shared site to use for the observations, the interviews informed the ethnography by providing characteristics which would be useful in selecting a site. The following characteristics were found to make a site more appropriate for observation in this study:

- Online discussion forums were commonly used in problem solving;
- Forums which focused on a specific development platform, tool, or language potentially offered more opportunities to observe software development problem solving activities;
- Forums maintained by software companies (e.g., Microsoft or Oracle) were used more frequently than others;
- Social network sites, which had a mix of professional and personal connections, such as LinkedIn and Twitter, were possible sources of some problem solving activities;
- Social network sites, such as Facebook, which were used primarily for personal social network engagement, would be less helpful for observing problem solving.

Reflexive summary of method 1

Once I decided software developers were an ideal sample for my research, my connections here in New Zealand and back in the United States enabled me to select a suitable pool of interview participants. My developer contacts had an interesting combination of being technically savvy, but perhaps less social in their online behaviours than other users I had encountered. Their online social interactions tended to centre on software development and technology, so they were potentially a very good fit for this study. Moreover, since I was a developer for most of my professional life, I felt equipped to deal with interviewing these participants who tended to be shy, uncomfortable with the interview process, or introverted.

I had no reservations about conducting research in both New Zealand and the United States. As an American residing in New Zealand, I am comfortable with both cultures, having lived and worked as a developer in both countries. All of the developers I interviewed were native English speakers, as I am, and I was able to easily engage with
them by reflecting on my own development experiences as well as demonstrating that I identified with their stories. The topics explored in the interviews were common to development practices in both countries, therefore, I found no cultural nor language barriers during the interviews.

I also discovered that the interviews provided an effective introduction for me into research methods. The interviews eased me into fieldwork by gradually helping me to feel more comfortable with the process and the subject matter. After conducting the interviews, I felt more prepared to conduct the ethnography and enter the virtual world of software development problem solving.

In summary, the interviews contributed to the study by informing the ethnography on potential site characteristics and by sensitizing me to the research topic in preparation for observations. From the interviews, I surmised that the observations needed to:

- Provide a different perspective from the individual reflections gathered in the interviews. I should be able to observe group dynamics and collective behaviours;
- Demonstrate the actual problem solving process of developers within the site;
- Demonstrate social interactions between site members.
- Aid in visualising the relationships and communication patterns in the social network;
- Aid in visualising the different levels of participation in the virtual space.

4.3.3 Method 2 - Virtual ethnography fieldwork

“Nobody lives only in cyberspace.”
(S. Jones, 1999, p. 70)

As S. Jones (1999) states above, people do not live in virtual spaces, so ethnographic techniques which depend upon locating researcher and subject in the same place must be adapted for virtual study. Similar to traditional ethnographies, virtual ethnographies typically focus on direct observation, but may also use interviews, analysis of secondary sources, and reflexive exercises (Mann & Stewart, 2000). At the centre of ethnographic
fieldwork, “participant observation allows researchers to gain a better understanding of participants’ ranges of identity performances and the meaning those performances have for them” (S. Jones, 1999, p. 57).

Ethnographic study allows researchers to embed within social groups to explore their behaviours and language, “addressing the richness and complexity of social life” (Hine, 2000, pp. 41–42). Creswell (2007, p. 68) for example, describes the process as “extended observations of the group, most often through participant observation, in which the researcher is immersed in the day-to-day lives of the people and observes and interviews the group participants” [emphasis in original text]. Similarly, virtual ethnography permits researchers to explore online groups, although the researcher embeds within a virtual experience rather than physical place. In addition to experiential immersion, adopting reflexivity as an integral part of the ethnographic practice allows for “social location” (Mauthner & Doucet, 2003) and exploration of the social meanings and contexts of ethnographic materials.

In this research study, the term participant observation describes how I engaged in the field. There are degrees of participant observation from complete participation to complete observation in ethnographic studies (Garsten, 2007). My level of participation was observer as participant. As Garsten (2007) explains, observer as participant emphasises observation over participation. It is used in cases where full participation in the group is not possible, such as observing new factory workers. It may be possible for the researcher to attend employee induction, but not to actually perform job duties. I decided this was the appropriate level of participation for this research study. I would register for the site and create a profile, but not ask nor answer technical questions during the observation period.

An important aspect of ethnography is the length and intensity of engagement with the field. Ethnography requires “prolonged engagement and persistent observation” (Lincoln, Lynham, & Guba, 2011, p. 120). In virtual participant observation, S. Jones (1999, p. 70) argues that time spent in the field is important for interpreting behaviours:

For studying interactive forums, especially synchronous forums such as chat and muds [multi-user dungeons], participant observation (whether or not used with other methods) may provide the most accurate observations. Spending time with other participants and getting to know the particular
norms and understanding of the group allows researchers to build trust and to learn to interpret participants’ identity performances in the same way that the participants themselves do.

Therefore, for this research study, I concluded that three months was a meaningful period of engagement because it accommodated a large volume of completed interactions (e.g., threads marked as solved). For example, many threads were initiated and resolved within a day or two. Others were resolved over weeks or months. There were a few threads which lasted years. During that three-month period I was able to observe a snapshot of forum activities. It also allowed me, as researcher, sufficient time to acclimatise to the environment, understand normative (and deviant) behaviours, and become familiar with many of the regular participants in the social network. At the end of the three-month period, I was prepared to continue observations, if necessary. I discovered at the end of the period, as with the interview responses, that new themes were not emerging, but instead existing patterns of behaviours were being repeated. This suggested that data saturation was occurring.

This ethnography adhered to Hine’s (2000, pp. 63–65) Ten principles of virtual ethnography: (1) sustained presence in the field, (2) cyberspace is not detached from real life social connections, (3) ethnographic location does not require a specific site, (4) a culture sharing group can be conceptual rather than located in a specific site, (5) defining ethnographic study boundaries is a pragmatic decision, (6) virtual ethnographies have spatial and temporal dislocation, (7) is not a holistic description of the group, (8) intensive and reflexive engagement in the field, (9) all forms of interaction are valid, and (10) virtual ethnography is an adaptive method.

It also followed the three conventional stages of ethnographic fieldwork: (1) initiation (i.e., preparation), (2) participant observation (i.e., data gathering), and (3) interpretation (i.e., analysis) (Angrosino, 2007).

**Phase 1 – Initiation (Preparation)**

*Step 1 – Site selection*

The interviews did not reveal a common site location; therefore, I created a list of characteristics useful in site selection (see page 148). The issue of accessibility was foremost in my site selection criteria. Some sites I considered were at such a specialised
technical level, that it was difficult to understand the technical discussions, let alone interpret underlying behaviours and motivations. I needed to find a site where I could understand the content of the threads and could follow the technical discussions. I found a forum with access, both intellectually and socially, to members. I chose the Microsoft Transact SQL (TSQL\textsuperscript{32} ) database development forum, located within Microsoft’s developer support websites (MSDN\textsuperscript{33}).

This forum was chosen because it was a popular and active site for database administrators and developers. It provided a network of developers, and an environment in which to share knowledge and problem solve. The forum was open and had a large membership which provided a quantity and variety of opinions, knowledge and perspectives. The forum was not formally bounded nor was it an exclusive group, as there were few barriers to participation. Anyone with internet access could read the forum threads. The only formal requirement for membership was that an individual was required to register and create a profile in order to post a question, reply to a thread or set alerts to follow threads.

**Phase 2 – Participant observation (Data gathering)**

*Step 2 – Daily observation and fieldnotes entry*

I became a forum member by creating a profile with a photo, a username containing my full name, and a brief biography with links to my research blog. An important aspect of virtual ethnography is managing the researcher’s “identity and presentation of self [online]” (Garcia, Standlee, Bechkoff, & Cui, 2009, p. 53). Even though ethnographic research often involves informant interviews and conversations, I refrained from posting questions to threads during the study. Research-related questions I would have posted to participants would have been in violation of forum’s code of conduct (see “Code of

\textsuperscript{32} TSQL is a programming language for querying and manipulating data in a SQL Server database. TSQL can be used either to directly query or administer databases or embedded within software applications. This dual purpose meant that the forum members were both database administrators (DBA) interested in the former and software developers doing the latter. Typically DBAs tended to be concerned with preserving good programming practices and proper database structure (purists, conservative and traditional) and software developers with favouring the application behaviour over strict SQL rules (pragmatic). This caused some tensions within the forum.

\textsuperscript{33} [Company Name 'X']DN is a commonly used acronym for sites supporting a specific product, such as Microsoft Developers’ Network (MSDN). Frequently they are a collection of themed forums, such as the TSQL forum, which allow developers to engage with the larger community. Many of the ‘XDN’ sites are moderated or followed by technical staff from the company.
Conduct,” 2010) and were not permitted. The intent of the forum was to foster technical discussions, so I remained an observer and observational participant (i.e., lurker). In lieu of interactive involvement with forum members, I immersed myself within the extended social network through extensive observation and fieldnotes.

When links to external sites such as blogs were provided in forum members’ signatures and within the content of threads, the linked materials were read and considered in the fieldnotes. My reflections and interpretation of events and texts were recorded as fieldnotes as both a documentation of the study and a reflexive exercise on the research experience. I used Zotero to manage links to the individual forums threads as well as meta-data on each thread (e.g., posters and dates). Zotero was selected because it has the ability to manage web-based resources.

During the study I actively followed over 400 threads and 662 forum members’ posts by reading new posts, taking field notes and entering, and coding answered threads four to five mornings per week. My threshold for whether or not I followed a thread was when it reached 10 or more replies to the original post (OP) because I wanted more in-depth discussions, not just quick replies. I set alerts for active threads which notified me via email, when new posts occurred. Even though I was on the site most days and had an open profile with a brief description and link to my research blog, I did not expect that other members would be aware of my presence. The one exception may have been the forum moderators who could have noticed the high number of alerts I had set, but no one contacted me about my participation or research during the study. I did not directly contact the forum moderators in accordance with internet research studies in public forums (see page 141). After the three months I continued taking field notes and coding the remaining answered and unanswered threads from the study period.

**Step 3 – Investigating secondary sources**

In addition to direct observation, I included the following secondary sources within the ethnography:

34 “Zotero is an easy-to-use yet powerful research tool that helps you gather, organize, and analyze sources (citations, full texts, web pages, images, and other objects)” (Zotero, 2012 para. 1).
– I followed all forum members on Twitter who referenced their accounts in threads, their profiles, or in their signatures;
– I followed and read links to external blog posts when they were important for understanding the meaning of a forum post.

I was looking for context to the behaviours and social connections observed within the forum. I took fieldnotes on the secondary sources for coding and analysis.

**PHASE 3 – INTERPRETATION (DATA ANALYSIS)**

During the interpretation stage, I conducted a thematic analysis of all texts and artefacts as well as reflected on the observation experience through fieldnotes. Additionally, I visualised network structure and relationship through social network analysis (SNA).

The fieldnotes reflected my experience of conducting an ethnographic study and located me within the forum (i.e., located on the forum site and located as a member of the virtual network). A typical entry in my fieldnotes journal included links to the TSQL forum threads, coding themes, observations, and my analysis of why the behaviours were occurring. For example, one thread conversation between Donny44 and Booter45 contains a joke related to file naming conventions:

![Joke about TSQL file naming conventions](image)

**Forum Thread 4.1 Technical Joke (Donny44)**

Which another forum member finds amusing:

![Response to joke](image)

**Forum Thread 4.2 Response to humour (Booter45)**

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35 All forum participant names have been replaced with pseudonyms. Other identifying features have been changed or omitted. Forum participant pseudonyms end with a number to differentiate them from interview participants.

36 Forum threads are distinguished from interview responses by the caption text, “Forum Thread [optional descriptive title] (participant username/s)”. Additionally, screen images may be cropped to hide extraneous detail (e.g. long code snippets).
My fieldnotes entry remarked that humour appears to be an acceptable thread comment (e.g., adheres to social norms and no one posted a complaint about the joke) and allows members to engage on a social (as opposed to purely technical) level. This joke required inside knowledge of TSQL by both the one telling the joke (Donny44) and the other members who read the joke (e.g., Booter45 and lurkers). Booter45’s response on the thread demonstrated that he understood the technical nature of the joke (e.g., what NDF really stands for, plus the humorous version ‘Nuther Data File’). This thread suggested that those involved in the joke had a connection because they shared common TSQL expertise and a similar sense of humour.

I also noted in my fieldnotes that Booter45 used the common idiomatic expression, *rofl* (*rolling on the floor laughing*), instead of others which might not be as appropriate, such as *lmao* (*laughing my ass off*), which may have violated site rules or social norms. Additionally, I noted when a username reflected an association with a technical group (e.g., SQL developers) or revealed the individual’s gender. Participants’ genders were also potentially identifiable from their avatars, except when they did not upload a photo, but instead used the default gender-neutral image provided by the TSQL forum site. I was unsure of the meaning behind Donny44 and Booter45, except that neither used their real names. I also made notes on the relationship between achievement points, and avatar and handle (i.e., types of usernames chosen) use. All of my analysis was informed by my participation in the forum as researcher during the study and as a former TSQL developer.

*Step 4 – Thematic analysis and coding of fieldwork materials*

During the observation period, in the TSQL forum, I identified several types of participation. There were original posters (OPs) who posted questions and initiate threads, members who posted responses to threads, and others who lurked. The term OP is a common internet expression for the beginning of a thread. It is used for both the person (i.e., *Original Poster* of the question on the thread) or for the first post in a thread (i.e., the question from the *Original Post*). The forum also had more formal roles. Members could be designated as *answerers* or *moderators* (“TSQL Forum Help,” 2011). Answerers were able to mark any thread as *answered* even if they were not the OP. Moderators had administrative privileges to perform a wide range of tasks such as moving, deleting and censoring threads. Some moderators were also MVPs (Most
Valuable Professional) and could bring threads to the attention of Microsoft for immediate action (e.g., serious software bugs or security issues).

The social media literature typically groups levels of participation in online social networks. Extant groupings include: lurkers, infrequent posters, frequent posters (Ridings et al., 2006); outsiders, seekers, professionals, and critical mass (Wasko et al., 2009); core group, highly/less active, visitors, and newcomers (Fayard & DeSanctis, 2005); and leaders, posters, and lurkers (Blanchard & Markus, 2004). This study uses the grouping of leaders, posters, and lurkers with slightly altered names. The term leader was changed to frequent poster. Leader implies that those members are directing the activities of the social network. The term frequent poster does not carry that connotation and allows for those members to influence network behaviours without controlling them. The term poster was changed to infrequent poster to distinguish those behaviours from the more active members of the forum.

Whether to retain the term lurker was a more difficult decision. In early research studies on computer-mediated communication, lurkers were spies who eavesdropped on semi-private conversations in chat rooms (Riva, 2002). I considered using the term audience member instead of lurker because of the historical negative connotations. I also considered using the term readers, but thought that it did not capture the real-time aspect of following an evolving conversational thread. Nor did the term adequately describe the active observations, sense-making, and interpretation lurkers employed when problem solving online. There were many lurkers who do not see a thread until after the conversation had concluded (i.e., been answered), so the term reader would have worked for those cases. Some of the interview participants had their own terms for lurkers such as voyeur. Lurker, however, is generally accepted as the term for members who do not post and is no longer considered pejorative (“lurker,” 2010). Consequently, the term lurker was used in this study.

After the observation period, the remaining answered and unanswered threads from the study were coded. The fieldnotes and unformatted thread narrative were imported and coded in NVivo software. The process of thematic analysis and coding is discussed in more detail in Method 1 above (see page 146). During the analysis, additional themes and codes were also identified. This updated coding structure was applied to both the observation material from Method 2 and the interview data from Method 1. Even though
the methods were conducted sequentially, the analysis was iteratively conducted on the entire set of materials. A complete list of codes used in this research study are in the appendices (see Appendix C: NVivo themes and codes).

**Step 5 – Social network analysis**

Due to the large dataset I gathered from the forum observations, I decided to use social network analysis and to graph the communication patterns between network members to help visualise (1) who was communicating with whom and (2) different levels of forum participation, as identified by clusters of “highly connected actors” (Haythornthwaite, 1996, p. 332). I chose a whole network approach, which is a snapshot of all relations within a network for a given period of time (Garton et al., 1999b) to visualise the entire network structure of the forum. I also used ego-centered networks, which is a representation of an individual’s connections from their perspective, in order to visualise how certain representative members interacted within the network.

Creating social graphs to visualise large datasets has become a useful method for internet research (Hine, 2008). The process of creating and analysing the social graphs is historically based on the sociology technique of sociometry (Hogan, 2008). The current practice of this type of visualisation is referred to as social network analysis (SNA); it “focuses on patterns of relations between and among people” (Garton et al., 1999b, p. 76).

Social graphs illustrate social connections and consist of two dimensions: nodes and edges. The nodes are the social actors. The edges are how the actors are connected (e.g., ties). The edges represent ties (see Table 4.4 below). Edges can be directed (i.e., specific the direction of communication) or undirected. The greater number of edges increases the multiplexity of the connection (i.e. translates to a stronger connection). The total number of edges connected to the node is the node’s degree (Freeman, 1978). Total edges directed towards the node are called the in-degree and directed away from the node are called the out-degree.

In extant social media studies, nodes are conventionally defined as the members of the social network (e.g., Facebook friends or Twitter followers). There is much more variation, however, in how edges are defined (i.e., the nodes’ composition). Studies use a range of connection criteria such as: stated friendships from surveys, Twitter followers
and followed, Facebook friends, and messages between forum members (see Faraj & Johnson, 2011; Gruzd, Wellman, & Takhteyev, 2011; Hangal, MacLean, Lam, & Heer, 2010).

I followed the Social Network Approach to social network analysis described by Garton et al. (1999b, pp. 78–81) using the definitions in Table 4.4 (see also Garton et al., 1997; Haythornthwaite, 1996) below:

Table 4.4 Social network analysis terms

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
<th>Use in this study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors</td>
<td>The individuals participating in the social network</td>
<td>Forum members who posted on a thread which was active during the observation period</td>
</tr>
<tr>
<td>Relations</td>
<td>“Characterised by content, direction, and strength...of the resource exchanged”</td>
<td>A thread post</td>
</tr>
<tr>
<td>Ties</td>
<td>“Connects a pair of actors by one of more relations”</td>
<td>– Original posts (OP) on a thread (a self-referencing tie)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– A post to the OP on a thread (a tie from poster to OP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– A response to a comment on a thread from the OP (a tie from OP to poster)</td>
</tr>
<tr>
<td>Multiplexity</td>
<td>“The more relations...in a tie, the more multiplex”</td>
<td>Relations in addition to thread posts (e.g., Twitter following, comments on external blog posts, etc.)</td>
</tr>
<tr>
<td>Composition</td>
<td>The characteristics of a relation or tie</td>
<td>The weight/strength (e.g., number of posts) and the direction (e.g., to whom the poster is addressing)</td>
</tr>
</tbody>
</table>

In this study, I defined the nodes as forum members and the edges as the posts. Specifically, I used the following criteria:

- Every OP who initiated a thread had a directed connection to themselves (i.e., a circular reference to themselves);
- Every forum member who posted on a thread had a directed connection to the OP;
- I did not make a directed connection from the OP back to the posters because there was too much variation in interpreting when the OP was talking to a
specific poster. In some threads it was obvious that the OP was talking to a poster because they addressed them by name or it was clear in the text of the response. In others it was not clear. I decided that because of the variation, it was better not to include this sort of directed connection.

From the study, the analysis of empirical material supported the characterisation of several levels of forum participation (collected between 31/08/10 – 02/12/10), as illustrated in Table 4.5 below:

<table>
<thead>
<tr>
<th>Level of participation</th>
<th>Frequency of posts</th>
<th>Description</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent poster</td>
<td>Very active</td>
<td>Frequent contributors who regularly monitored and post to threads</td>
<td>25</td>
</tr>
<tr>
<td>Frequent poster</td>
<td>Moderately active</td>
<td>Active contributors who post questions or respond to posts on multiple threads</td>
<td>97</td>
</tr>
<tr>
<td>Infrequent poster</td>
<td>Single response</td>
<td><em>Newbies</em> (new members to the forum) and infrequent contributors who only respond to posts on one thread</td>
<td>250</td>
</tr>
<tr>
<td>Infrequent poster</td>
<td>Original Poster</td>
<td><em>Newbies</em> (new members to the forum) and infrequent contributors who only post questions on one thread</td>
<td>290</td>
</tr>
<tr>
<td>Lurker</td>
<td>Never</td>
<td>Participants who read or follow threads, but do not post</td>
<td>N/A37</td>
</tr>
</tbody>
</table>

Social graphs, which were previously hand-drawn, are now created with the use of tools such as NodeXL.38 I selected NodeXL because it is widely used in social media research (see Bonsignore et al., 2009; Hansen et al., 2009; M. A. Smith et al., 2009), is a free add-

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37 Lurkers are identified as a degree of participation as seen by thread the count of ‘views’ which are significantly higher than the count of ‘replies’. This indicates that there are individuals viewing the thread without posting – lurking on the thread. It is difficult, however, to determine exact numbers of individuals viewing each thread from this data so the number of members has been omitted ("N/A").

38 “NodeXL is a free, open-source template for Microsoft® Excel® 2007 and 2010 that makes it easy to explore network graphs. With NodeXL, you can enter a network edge list in a worksheet...and see your graph” (Microsoft, 2012c, para. 1).
on to software I already used (e.g., Excel), and easily imported paired nodes matrices. I used NodeXL in conjunction with NVivo using the following process:

- In NVivo, I created a source for each forum member who posted to a thread (either as OP or posting a response);
- In NVivo, I coded each post with the authoring forum member. OPs were attributed to the thread in its entirety. Other posters were attributed to their individual posts on a thread;
- In NVivo, I created a matrix query of forum members and associated threads. This created an OP-to-poster matrix because each thread was associated with the OP.
- In NVivo, I exported the matrix to Excel;
- In Excel, I cleansed the data, so it adhered to the proper format for NodeXL;
- Using the NodeXL add-on in Excel, I generated whole network graphs, and isolated single threads and ego-centric graphics for in-depth analysis of the visualisations.

After generating the graphs, I looked for visual patterns of communication among members and patterns of problem solving interactions in specific threads (see Figure 7.2 TSQL social network graph (all nodes) on page 249).

Reflexive summary of method 2

Due to the emergent nature of virtual ethnographic fieldwork, I experienced the following unanticipated challenges conducting the fieldwork and analysing the materials:

First, although my observations focussed on the TSQL forum, virtual networks are not well-bounded. I was constantly faced with decisions about how far I would explore the connections extending outside of the forum. In the end I found it helpful to think of my unit of analysis. I was investigating the ties between members of a virtual social network, not the individuals themselves. I consciously limited the external observations. I was tempted to do more analysis, on the forum members’ Twitter connections and those who commented on their external blogs, to see if there was an overlap with the forum membership, but I left that activity for a future study.
Second, one of the most challenging aspects of observation was deciding how to *stand on the street corner* in a virtual space. In many of the early virtual ethnographies, the researchers interviewed participants using the communication tools within the virtual environments (see Markham, 1998). They would chat or email participants with questions. I did not want another set of interviews, however, even if they were computer-mediated; I wanted to observe behaviours as if I were a fly on a (virtual) wall. I decided that I would not post comments on the threads that I followed. Any posts to threads would have been artificial because I did not have technical questions. I would have been posting for clarification of behaviours and other research-related purposes. This was not the intent of the forum and I did not feel that it would have been well received, so I chose to remain a silent observer. It would be interesting, however, to return to the forum and conduct interviews in order to get participants’ perspectives on forum. This could be fieldwork for a future study.

Third, I did not anticipate how large the volume of easily accessible data would be in virtual ethnography. Material ethnographies also produce large volumes of materials (e.g., detailed and extensive fieldnotes and audio recordings), but the process for collecting those materials is time consuming. I would assume that the burden of the quantity of materials would be more evident over a long period of time. In comparison, the materials collected during a virtual ethnography were easy to collect (e.g., web pages and avatar images). Therefore, I discovered that I was collecting materials more quickly than I could code and analyse them. I was treating the forum threads like conversations, but because they can occur simultaneously and around-the-clock, I was accruing these conversations faster than a traditional ethnographer who would be limited to listening to a single conversation at a time. In order to process the large volume, I decided to ignore code snippets, except when they provided new or exemplary insight into the problem solving process. I also decided that social network analysis would be increasingly important in illustrating larger patterns of communication and participation than I could present through individual thread analysis.

Lastly, I found some difficulties in using NVivo for web-based artefacts. The version of the software that I used during the study did not support web pages and I was forced to strip out the formatting from forum pages before importing them. This meant that I lost some of the meanings of thread conversation that were evident though presentation of
the web pages and not from the text (e.g., profile images, images in signatures, or symbols in the posts). I chose to return to the forum when I needed to see the formatting. I discovered, however, that the forum was continually evolving after the study was complete and so instead of having a snapshot of the site in NVivo, I had to reference continually changing web pages. The changes that I had to accommodate included:

- Additional posts to threads;
- Changes and edits to posts;
- Changing usernames, profiles and avatars;
- Changes to the entire look and feel of the forum;
- Changes to how badges were calculated and displayed.

In order to accommodate these site changes, I re-collected all images from the website, but did not include responses that were posted after the end of the observation period. When there were significant changes that impacted the findings, I made note of those in the results chapter.

In summary, the ethnography contributed to the study by providing observable problem solving activities and interactions between members of a virtual social network. I found using social network analysis a very effective technique for engaging with the ethnographic materials. Even though the emphasis in qualitative research tends to be on words, I found the visualisations extremely expressive and provided an insight that I would not have gained from text alone.

4.3.4 Research trustworthiness and quality standards

As a qualitative internet research study, this study adhered to standards of quality according to the guidelines for Naturalistic Evaluation, prescribed by Lincoln and Guba (1986), which argues that trustworthiness in naturalist (i.e., qualitative) studies differs, but has parallels with conventional (i.e., quantitative) research rigor. This study also used Quality Standards in Internet Research specified by Baym (2009), which suggests that internet research quality must remain flexible and integrate with other criteria.

The two standards are combined (Adapted from Baym, 2009; Lincoln & Guba, 1986) in Table 4.6:
Table 4.6 Quality Criteria for this research study

<table>
<thead>
<tr>
<th>Dimensions of trustworthiness in qualitative (vs. quantitative rigor)</th>
<th>Criteria in naturalistic inquiry</th>
<th>Internet Research quality standards</th>
<th>Use in this study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credibility (vs. internal validity)</td>
<td>Prolonged engagement</td>
<td>Grounded in theory and data</td>
<td>Conducted intensive engagement with the field during the ethnography</td>
</tr>
<tr>
<td></td>
<td>Persistent observation</td>
<td>Multiple strategies to obtain data</td>
<td>Used three methods of data collection and analysis</td>
</tr>
<tr>
<td></td>
<td>Triangulation</td>
<td>Takes full account of participant perspectives</td>
<td>Conducted interviews to give material context to virtual observations</td>
</tr>
<tr>
<td></td>
<td>Negative case analysis (exposes contradictions in data)</td>
<td>Considers internet research within material context</td>
<td>Coded contradictory interview responses and observed behaviours</td>
</tr>
<tr>
<td>Transferability (vs. external validity)</td>
<td>Thick descriptive data</td>
<td>Included materials from a wide variety of sources during fieldwork</td>
<td></td>
</tr>
<tr>
<td>Dependability (vs. reliability)</td>
<td>Audit trail of research processes</td>
<td>Demonstrate rigor in data collection and analysis</td>
<td>Documented research processes in fieldnotes</td>
</tr>
<tr>
<td>Confirmability (vs. objectivity)</td>
<td>Audit trail of research results</td>
<td>Self-reflexivity</td>
<td>Documented reflexive discussions in fieldnotes</td>
</tr>
</tbody>
</table>

4.4 Pilot study - researching online knowledge sharing

Prior to this research study, a pilot study was conducted (see Appendix D: Pilot study ethics application). The research aim of the pilot was to explore the factors which contributed to the development of a blog-based community which supported knowledge sharing. There were, however, other aims from the pilot study which informed this research study:

- To identify enabling conditions for knowledge sharing in virtual environments (see Martin-Niemi & Greatbanks, 2010);
- To explore techniques for conducting a virtual ethnography;
- To develop strategies for gathering materials from a virtual ethnography;
- To explore access to online social networks for researchers.
First, when identifying a site and population for an ethnographic study, it is essential to find participants engaged in behaviours that are specific to the research study. In the pilot I chose a topic-based blog. It was a small and specialised community. While it did offer insight into environmental factors which may contribute to knowledge sharing, it was difficult to identify knowledge sharing behaviours because that was not the focus of the blog. In this research study, I needed to find participants who were purposely engaged in knowledge development activities in a virtual network which focuses on supporting those activities. This led to the decision to study participants engaged in problem solving as a clear and purposeful illustration of knowledge development activities.

Second, when locating a virtual ethnography, it is important to have cultural and technical access to the site and related social networks in addition to field access in the traditional sense of ethnography. In the pilot, the topic was public relations, which is not an area of expertise for me. Although I could understand the communication between members, I did not feel that I could fully appreciate the nuances of the observed behaviours. In the main research study, I needed to ensure that I had both cultural and technical access to the research site. This led to the decision to study software developers for two reasons: (1) as a former developer I was familiar with software development behaviours and attitudes, terms, work, etc. and (2) I could more fully appreciate the technical and cultural aspects of online interactions and conversations.

Third, when identifying participants for internet research, it is important to consider their comfort with technology. In the pilot, I recognised that some members of the community were not as comfortable using the technical functions of the blog environment as others. Although technical accessibility is an interesting subject, for this research study I wanted to focus on problem solving behaviours and not technical proficiency. Therefore, I needed to choose participants who were comfortable with technology and virtual environments so I could focus on problem solving and social access rather than technical access to online social networks.

Fourth, when choosing methods for investigating social interaction in virtual environments, observation proved very informative during the pilot study. Through participant observation, in the pilot I was able to observe a wide range of behaviours and interactions between individuals and their virtual environment. I found technical access
to be easily gained. Therefore, for this research study, I chose virtual ethnography to be the cornerstone of my research methods because it was useful and appropriate for exploring online behaviours.

Fifth, I found during the pilot study that site selection must be connected to the research objectives in order to address the research questions through observation. In the pilot study the site was chosen by popularity and locale (i.e. it was an active blog located in Australia, near my research base of New Zealand). While being active proved helpful because it provided more interactions to observe, the location was unimportant for my research, and not having extensive familiarity with the topic (public relations) presented barriers to analysis. For this research study, the site was selected based on information gathered in interviews, having a population (software developers) which was relevant to the research problem, and a topic that was culturally and intellectually accessible (technical problem solving) to me as a researcher.

Finally, the blog site used in the pilot study was too small and restrictive to capture the social connection behaviours I wanted to explore. In the pilot, several of the members were connected in material networks and had face-to-face interactions that were briefly mentioned within the blog threads. For this research study, I needed to use additional methods for better capturing social connections which extended past a single virtual site.

In summary, after reflection on the pilot study and investigation of research paradigms, I concluded that a virtual ethnography would be useful as the cornerstone method for this research study. In addition, I decided that having multiple methodological perspectives would reveal different aspects on the phenomena under investigation. Therefore, using different methods before and after the ethnography was important.

4.5 Software developers as study participants
To answer the question of how knowledge is shared in a virtual environment, it was vital to choose a participant group for the research study who exhibited observable knowledge sharing activities in a manner that was recognisable to me as researcher. This study uses software developers as the participant group. This section discusses why developers were a relevant group to study in terms of knowledge sharing and in
particular within virtual environments such as social network sites or technical forum and blogs.

As a group for ethnographic study, developers present a unique situation because of their technical proficiency and task-oriented needs. In general, when developers are engaged in knowledge sharing activities, these activities are part of problem solving a particular task. So when seeking and sharing knowledge, the activities are quite focussed and narrow in scope as opposed to someone who might be developing a broader set of knowledge or participating in professional networking. This makes it more apparent from a research perspective to recognise the knowledge sharing activities. Moreover, since the intent of many of these activities is to solve a particular problem or contribute to the development of a particular piece of software, it is easier to see how the knowledge sharing activities contribute to the output. If the output is a success, then it is reasonable to infer that the knowledge sharing methods were also successful. In this research study, the term *solver* is used to refer to these software developers who use online resources during problem solving.

### 4.5.1 Software development in practice

The practice of software development, also referred to as software engineering, computer programming, or colloquially as *coding*, is generally defined as the creation of software systems, applications, components or websites. The work entails use of a programming language such as C or Java to write code that compiles or is translated into a format that is understood by computers and other devices. Development traditionally takes place within a project framework of an allotted time, scope and cost. Most software development life cycles contain phases for analysis, design, code development, testing, and implementation with traditional frameworks using formal phases and agile methods compressing activities into iterative sprints.

Developers must possess technical skills in the development language and environment they use, but also must work with non-programmers such as clients, designers and content/process experts to capture processes and functionality within a usable interface. Development is a balance between technical problem solving and interpersonal communication (Ye, Yamamoto, & Nakakoji, 2007). Moreover, the technical knowledge
required for development is not only explicit rules for programming, but also involves application of techniques into unique contexts. In the study of Australian software development firms, for example, it is suggested that “most of SE [software engineering] knowledge was tacit and contextual in nature which was difficult to capture and store” (Aurum et al., 2008, p. 524). Codified information is rarely used by developers without adaptation for the specific situation. Even with the leverage of reusable code and standardised environments, most software development is new and unique, creating the immense need for techniques which support tacit knowledge sharing.

Moreover, it has traditionally been difficult to codify software development knowledge. Popular attempts to manage software development knowledge through tools such as specifications, change logs, diagrams, models, and code documentation have been difficult for organisations to keep current and incomplete sources have provided little benefit for developers. For instance, in the Australian study “most participants consider updating a knowledge base to be an onerous activity, and one that was not assigned high priority in the projects they were involved with” (Aurum et al., 2008, p. 525). Fortunately with the advent of the internet and many virtual technical resources, including development-related forums and blogs, there is a mechanism to find current information on technical issues. However, the value of these resources is not just as a repository for technical information, but more importantly as a mechanism to share complex, context-specific, tacit knowledge.

Software development presents an interesting participant context for exploring how knowledge is shared within virtual environments because developers are for the most part very technically proficient, but not necessarily avid users of popular social media. Software development is a relatively new practice, only becoming part of organisational functions with the increased use of mainframe computers in the late 1960’s (Basili et al., 1992). By formal standards such as the ISO 900039, it is not a mature discipline which is reflected in quality and consistency of outputs (software) as well as ability to effectively manage knowledge (Aurum et al., 2008). As an emergent profession, practices are still undergoing great changes which are exacerbated by ever changing technologies.

39 ISO 9000 are internationally recognised standards in quality (ISO - International Organization for Standardization, 2011). This certification programme is widely adopted by large organisations developing complex, enterprise-wide and high-risk software.
Fortunately, from a profession that originated as a solitary endeavour, new collaborative practices and virtual environments have provided access to large bodies of knowledge and expertise, previously unavailable.

Software development is also unique in that commonly the software outputs embody the development knowledge. Essentially software development is a series of problem solving activities in which the final product is the solution to the problems. This characterisation of development illustrates its dependence on context-specific knowledge and specifically a strong dependence on effective knowledge creation and sharing activities. It is possible to develop software without managing knowledge; however, quality and efficiency may be compromised leading to lost opportunities to develop and maintain competitive advantage for organisations engaged in software development activities.

In the Australian study of software development firms, development activities were characterised as 'knowledge-intensive' involving both explicit and implicit knowledge (Aurum et al., 2008). Even though their results show that knowledge sharing in the organisations could be inconsistent and ad-hoc, they did find the most effective knowledge-related activities centred on personalisation strategies which leveraged personal networks. Along with finding expertise in networks, they also found that access to external resources, such as information found on the Internet improved the 'quality of software development process' and ultimately the software.

Most extant research studies conclude that software development is a knowledge-intensive activity which requires high levels of technical skills as well as the ability to find and apply relevant information from a variety of sources to produce a successful output (LaToza, Venolia, & DeLine, 2006). Moreover, others studies present similar findings which suggest that software development requires a balance of solitary and collaborative activities (Ye et al., 2007).

### 4.5.2 Software development practitioners

There have been studies debating whether or not software developers are homogeneous as a group as well as distinct from other groups of practitioners. For example, Capretz (2003) posits in his study of personality types in software development, that even though
the stereotype of a *nerd* may be overstated, there is evidence that developers tend to identify as introverted more than the general population. In fact, from administering his own Meyers-Briggs surveys and analysing the results of extant MBTI studies, he concluded that “from the data it can be deducted that the majority of software engineers (ISTJ) are technically oriented and prefer working with facts and reason rather than people” (Capretz, 2003, p. 213). Therefore, even though software developers are individuals with unique personalities and behaviours, as a group they tend to prefer solitary and logical activities.

In addition to personalities influencing behaviours and activity choices, the characteristics of software developers as a group also influence their motivations for knowledge sharing activities. For example, Beecham, Baddoo, Hall, Robinson, and Sharp (2007) found in their comprehensive literature review of 20 years of research on motivation in software development that the answer is mixed. They recognised that there are some characteristics that may be evident within developers, but that individual personalities have a strong influence on perceptions and behaviours so it is difficult to generalise. However, in their findings, some themes did emerge. Some common characteristics of software developers arose in several studies, among them a growth orientation such as task-related challenges and learning new skills. The findings also suggested that introversion (i.e., a low need for social interaction) and a desire to remain autonomous and independent in their work were common characteristics. These three characteristics are particularly interesting when considering knowledge sharing behaviours of developers in a virtual environment. For instance, if developers tend to be more introverted and independent they may choose to interact with resources in a way that minimises contact and dependence on others. Additionally, they may choose venues such as online resources where their interactions not only allow solving a particular problem, but also lead to a deeper understanding of technical issues.

There have been studies on software development practitioners’ motivators and de-motivators. For example, one suggests that the primary motivator for developers is a “need to identify with the task” (Beecham et al., 2007, p. 868). As with the common characteristics, however, motivators are influenced by individual factors, such as personality or culture, so what motivates developers generally will not necessarily motivate each individual. They did recognise as another theme throughout the studies,
though, that there was a link between motivation and productivity. They found motivation to be strongly tied to quality of software outputs as well as other organisational concerns such as retention. Besides task identification, several studies found that a participatory environment and a sense of belonging were common motivators while poor working conditions such as being physically separated from co-workers was a frequently cited de-motivator. These factors may provide insight into how developers perceive and utilise virtual environments and online communities.

I concluded that software developers would make an appropriate participant population for this research study due to their technical proficiency and task-oriented approach to problem solving. To understand how knowledge is shared within virtual spaces, it was important to observe behaviours that demonstrated intent to share and acquire knowledge as well as provide observable outcomes of knowledge sharing activities. Software developers seeking information online provided such an environment to observe how knowledge is shared within the blogs, forums, and other virtual places where they search for insight into their technical problems.

4.6 Reflexivity

Reflexivity in qualitative research is more than documenting research biases (Baym, 2009). Reflexivity is a deliberate and self-aware conversation in which the researcher intertwines the research experience with the research study (Denzin & Lincoln, 2011; Finlay, 2002; Mauthner & Doucet, 2003). Alternatively, reflexivity is also considered an opportunity to question, unsettle, and challenge conventions of truth (Cunliffe, 2003). Burrell and Morgan (1979, p. 244) argue that reflexivity is essential to developing meaning in qualitative research; “meaning is dependent upon reflexivity – the process of turning back on oneself and looking at what has been going on”. In virtual ethnography, reflexivity is also used to locate the researcher within the ethnographic site, as Hine (2000, p. 10) describes:

Ethnography could instead be construed as needing to have similar experiences to those of informants, however those experiences are mediated. Conducting an ethnographic enquiry through the use of CMC opens up the possibility of gaining a reflexive understanding of what it is to be part of the
Internet. This provides a symmetry to the ethnography, as the ethnographer learns through using the same media as informants. [Emphasis added]

Consequently, in this research study I included reflexive discussions in my fieldnotes throughout the study. This is seen in the reflexive summaries at the end of each method discussion. Two main themes emerged from this reflexive activity: (1) I was strongly influenced by my software development past and (2) I felt completely immersed in the virtual experience by participating in virtual social networks, both as a researcher conducting a study and as a researcher connected to the research community.

First, I approached this research study heavily influenced by my former profession of software developer. Prior to my academic life, I was a software developer on and off for 15 years. During that time I worked with and came in contact with many others in the field. My impressions of my fellow programmers are described below.

- Many developers strongly identified with being a coder as part of their personal identity, not just as a job. It was more than a profession and closer to a calling or vocation.
- Many of them were attracted to software development because they like solving puzzles, they never wanted to wear a suit to work, and they wanted control and flexibility in their work environment.

Second, I was equally influenced by my experience as a researcher investigating virtual spaces within a virtual research community. In the beginning it was quite difficult for me to separate my research roles during this study. On one hand I was a researcher observing a social network as had been done in many ethnographic studies. On the other hand I was also a researcher who was immersed in virtual communities and who had my own (overlapping) virtual networks. It seemed useful to embrace my dual roles and treat them an important influence on my research, particularly in terms of the reflexive discussions.

While I lurked in the forum, quietly observing, I was very visible and interactive on Twitter, Facebook, LinkedIn, and to some extent my research blog. I continued to publish my thoughts and experiences while actively reading and thoughtfully considering the contributions of others. What it meant was that instead of just having the influence of articles, books, co-located colleagues, and supervisors at my university,
I was also surrounded by influences of the very active and wide-spread virtual networks in which I participated. For instance, when people I followed on Twitter attended the same conference, or had similar research experiences, or wrote a related paper, I was immediately engaged and influenced (perhaps distracted) with those experiences. One could argue that we are all influenced by external events when we are engaged in fieldwork, but I think it is worth noting the immediacy and extent to which my virtual networks influenced my perspective on the events I observed during this study. Since a large part of my networks were engaged in internet research or in some form of technology-related fields, I was constantly introduced to alternate perspectives and views on subjects near to my own. In this way I believe that my virtual network participation broadened what could have been quite an insular research experience by reminding me and connecting me to ideas outside my own world view.

4.7 Conclusion

In this chapter the methodological approach and my engagement with the field for this study was presented. This chapter described the following key elements of the study:

- An interpretive approach was used, placing me as the researcher within the study;
- This was a qualitative study which explored behaviours of participants in their natural settings and from their points-of-view;
- Software developers engaged in problem solving activities were chosen as the participant group;
- The study was conducted in an ethical manner, ensuring trustworthiness and authenticity were achieved;
- Two research methods were used for this study: interviews and observations.

Significantly, this research study contributes to the methodological body of knowledge in two key areas: first, by conducting a virtual ethnography under the theoretical lens of social capital and second, by using virtual ethnography to study social media networks. Typically, virtual ethnographies are sited in communities which have material and virtual dimensions. This is one of the first virtual ethnographies to examine the social networks of online discussion forums. Consequently, this study was able to identify characteristics of social connection in social media, presented in the following results.
Section Two

The second section presents the results, discussion and conclusion and is separated into four chapters. Each chapter integrates the (i) interview responses; with (2) the ethnographic findings from the TSQL forum\textsuperscript{40} observations (presented as direct quotes and as reflections from my fieldnotes), the forum thread conversations, and social network graphs. Analysis, discussion, and engagement with the literature are integrated within these chapters; and each chapter concludes with a reflexive discussion of the research process. The structure of the results-based chapters is illustrated in Figure s2.1:

\textsuperscript{40} The TSQL forum is the site location for the virtual ethnographic study (see page 155). It is an online discussion forum for database programmers using the \textit{Transact Structured Query Language} (TSQL).
The interview responses provide reflections, descriptions, and insights into the problem solving process and the use of virtual networks. In other words, these help to explain the motivations for the participants’ problem solving behaviours. The themes which emerged are based upon both the literature and the thematic analysis.

In comparison, the forum threads are used to illustrate behaviours and patterns of online engagement. The analysis of ethnographic materials was also iterative. The initial analysis occurred during the three-month observation period through reflections recorded in fieldnotes. Subsequent analysis was conducted during entry and coding within NVivo and during the writing process.

Presenting the materials and analysis of ethnographies can be challenging because they contain so much detail and so many varied stories and vignettes; they can rarely be summarised as a single table or ordered in a sequential diagram (Ritchie & Lewis, 2003). Instead, I use direct quotes and screen images as an illustration within the discussion of overarching themes derived from my experience as a participant-observer in the forum.

The interviews were equally challenging (Ritchie & Lewis, 2003). As is typical of an explorative qualitative study such as this, the interview questions are open-ended in order to allow interview participants more freedom in their responses. This results in many individual stories which can be difficult to organise because the presentation (e.g., the sequential ordering of results) is not self-evident. Additionally, this study’s challenge, for presenting problem solving results involving diverse material and virtual networks and resources, reflects the complexity inherent in the problem solving process. The different steps, decisions, and factors involved in problem solving are not easily isolated from each other, but instead are intertwined and integrated as the solvers encounter different scenarios. In order to present the study’s results in a clear and coherent way, however, I present problem solving behaviours and themes as linear and discrete elements of a problem solving process.

Even though the virtual networks discussed in these chapters are more accurately envisioned as a dynamic, complex, many-connected social entity, for clarity, these connections are dissected and effectively freeze-framed so that the nature of the content

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4 The term solver is used in this research study to indicate individuals who use online resources during problem solving activities.
and social processes that shape virtual networks can be examined. As the solver is at the heart of this research study, the results reported and discussed in these results-based chapters are organised around a hypothetical solver. Initially, the solver will be considered as (1) a searcher (chapter five), then (2) a lurker (chapter six), and finally as (3) a poster (chapters seven and eight).

The results are organised into four chapters representing stages in the problem solving process: locating problem solving resources in virtual networks, problem solving through lurking, public posting in problem solving, and the social dimensions of accessing resources. Section two concludes with the significance and implications of this research study.
5 Locating problem solving resources in virtual networks

5.1 Introduction
The aim of this chapter is to present and discuss study results which describe and explain how solvers find resources in virtual networks. In order to conceptualise problem solving using resources embedded in virtual networks, it is important to begin with a discussion of how solvers first assess resources available from existing organisational and professional networks. Having introduced this prior activity, the chapter proceeds to specifically address Research Question 1: Where do individuals locate problem solving resources in virtual social networks?

The study results discussed in this chapter are dependent on the concepts of networks and resources. The term network, as discussed within knowledge management (see section 2.2.4, page 43), social media (see section 2.3.1, page 56), and social capital (see section 3.1, page 89), has different meanings depending on the context. In this chapter, network is used broadly to represent a group of individuals connected through an organising structure. For example, networks discussed in this chapter include formal organisations, professional organisations, and the individuals who engage with the same social media (e.g., people who read and/or post on the same blog, discussion forum, etc.).

If networks (as used within this chapter) are groups of connected individuals, then what are resources? In relation to the study results discussed in this chapter, resources are the process knowledge (e.g., how to engage in the forum) and the objects of knowledge (e.g., code snippets) which are embedded within networks. These study results are consistent with elements of the social capital literature (see section 3.6.1, page 125), which argue that those individuals must connect to networks in order to gain access to the resources embedded within the network.

In order to locate resources to solve problems, solvers must determine which resources are needed and where to find them. As expressed by interview participant Raheem42,

42 All interview participant names have been replaced with pseudonyms. Other identifying features have been changed or omitted.
“Solving problems isn’t so much remembering how I did it; it is remembering where I did it (laughs).” Problem solving, therefore, not only involves the process of answering questions (how), but also requires a location (where), where the problem solving occurs and resources are found. The locations are the networks where resources are embedded.

As the first of four results-based chapters, this chapter introduces the problem solving process described by the interview participants and observed within the forum. While participants describe (and are observed participating in) a process that is iterative and variable, for the purposes of clarity, it will be presented in a more linear and chronological form in this chapter. Therefore, this chapter is organised into four sections on how the solver locates resources, as represented in Figure 5.1:

![Figure 5.1 Flow of how solvers locate resources in different networks (structure of chapter five)](image)

The sections are: formal organisational networks, existing connections (professional networks), and searching for new virtual networks and virtually organising to access embedded resources. The chapter concludes with an analytical summary of the themes associated with this chapter and a reflexive summary.
The first section on formal organisational networks is a discussion of how study participants locate resources internally within the formal organisation in which they work. Organisational networks consist of the other members of the organisation, such as co-workers or project team members. In organisational networks, participants may be co-located or geographically separated. In this study, organisational networks are considered existing (as opposed to new) networks because they are known to the solver through membership in the organisation (e.g., an employee, who is a member of a department, knows of and is already connected to the departmental network).

Having exhausted internal organisational resources, solvers then look to external resources located outside of their formal organisations. The second section provides a discussion of how study participants use known professional networks in problem solving. Professional networks consist of other individuals in the same profession, such as user group members or colleagues from other organisations. In professional networks, networks may be material or virtual geographic-based groups. In this study, professional networks, like organisational networks, are considered existing networks because they are already known to the solver through membership.

In the third section, we trace those solvers now connecting to new virtual networks through searching online. Searching, in this study, is when solvers use online search engines (e.g., Google, Bing, etc.) in order to find virtual networks and locate their embedded resources in order to problem solve. It then explores how solvers virtually organise to connect to those new virtual networks. Virtual networks, in this study, consist of connections to others through social media and/or technology-mediated communication (e.g., email, texts, etc.), with similar professional-related interests, such as discussion forums and social network sites. In virtual networks, technology is used to mediate engagement among participants. Significantly, this engagement, although mediated by technology, is social in nature.

The fourth section then discusses the themes which emerged from the analysis of the results: problem clarification, network and resources assessment, efficient use of networks, the dual nature of knowledge (i.e., process and object), expanding and reducing potential networks, and trust in networks.
The final section is a reflexive discussion of my experience, as a researcher, engaged in analysing, organising, and presenting ethnographic observations and supporting interview responses from this exploratory study.

5.2 Formal organisational networks

The research problem prompting this study is the dilemma individuals encounter when they do not have the resources required for knowledge development within their formal organisational networks. Consequently, the focus of this study is on how those individuals solve problems using external virtual networks. In order to understand how virtual networks provide problem solving resources, however, we must understand when organisational networks are used and how solvers decide when to extend past organisational boundaries to include external networks.

The results presented in this section are primarily from interview responses. The interview questions are framed in an organisational setting, therefore, even when respondents are discussing online behaviours, it is from an organisational reference frame (e.g., a participant describes how he/she problem solves from within an organisation first and then from outside that network). Subsequently, there is a clearer connection in the interview responses between problem solving behaviours and the decisions about which networks to engage in. Interview participants reflect, in their responses, about how and why they make choices. On the other hand, it is more difficult to understand the decision-making process of network choice from forum observations. The observations start from the point when the forum members have already chosen an external network (e.g., the TSQL forum) and it is difficult to observe how organisational networks are (or are not) included in that process.

This section examines how the participants in this study problem solve within their formal organisational networks, using organisational connections and resources, through face-to-face and technology-mediated communication. Additionally, it explores what considerations solvers make when deciding between engaging in organisational networks and external virtual networks.
5.2.1 Characteristics of formal organisational networks

The study results suggest that there are characteristics of formal organisational networks which make them conducive to problem solving. Within the organisation, an individual may have opportunities to have frequent, impromptu, or informal interactions with co-workers. Through these interactions, individuals discover the quality and availability of network resources (e.g., co-workers’ suggestions/advice, code written by co-workers, co-workers’ explanations of technical concepts, etc.).

Having multiple opportunities to ask co-workers for help allows solvers to develop an understanding of co-workers’ technical expertise (e.g., what information they have, how well they explain it, the depth and breadth of that information, how well it matches the questions asked, etc.). For example, Jack, a software developer in a small government agency, describes:

“\textquote{It is Pavlov’s dog (laughs). You get the reward when you go to the right person. Or you go to a person and you don’t get the answers that you are looking for and you repeatedly go and never get anything particularly useful and you can stack them up. You realise that there are certain people that you always go to and they always have something productive to say.}” (Jack - interview) 43

As Jack explains above, there is a benefit in finding the “\textquote{right person}” (within the network) who can help solve a problem. Finding the right person is dependent on multiple encounters in which a solver can assess over time the quality of his/her help. In Jack’s experience, when he repeatedly asks different co-workers for help, from some “you never get anything particularly useful”, but others “always have something productive to say”. Through these encounters, Jack discovers who to approach when he needs help during problem solving.

Brian is a software developer in a small consulting firm with only two developers on staff. Like Jack, Brian finds it beneficial to know what his co-worker (the other developer in

43 Interview response excerpts are distinguished from other types of study results by the text following the block quote, “(participant username - interview)”. In the excerpts, emphasis has been added by the author and only selected portions of the response are presented. Additionally, transcribed text has been left intact as much as possible with exceptions made to improve legibility. Changes made by the author to original quotes are indicated by square brackets for additional text (i.e. “I use it [Facebook]”) and for replaced text (i.e. “I live in [place name]”).
his office) knows, in order to decide whether to use organisational resources (e.g., ask his fellow developer for help) or external resources (e.g., search online). Brian describes:

“I think we’ve got a fairly good idea of what each other knows. So [co-worker name] will sometimes ask me about database or mySQL questions. Stuff like that. And I mean I am always asking him about [software name] because he has developed most of [software name] himself. Stuff like that...about how [software name] might be working or if I can call this function here or whatever.

If I don’t know, I think we think we know what each other will be able to answer or not... We are always asking each other stuff anyway. Usually it is fine to just to [ask] a quick question. But I mean I know I didn’t ask him this morning before I looked into the session stuff. Just because, well I think we had been talking about it actually and he wasn’t sure either.” (Brian - interview)

As Brian explains above, since he and his co-worker have “a fairly good idea of what each other knows,” he can choose when to ask his co-worker for help (i.e., use his formal organisational network) and when not to (“we had been talking about it actually and he wasn’t sure either” because his co-worker does not have expertise in that area). Brian develops this knowledge of his co-worker’s expertise by “always asking each other stuff” and building a personal catalogue of his co-worker’s technical expertise (e.g., technical languages, development platforms, etc.). With frequent contact between the two sole developers, they are able to informally discuss many technical issues. Through frequent contact, they can also build on earlier conversations. In Brian’s experience, knowing his fellow developer’s expertise in different technical areas allows him to more efficiently and effectively use his co-worker’s knowledge when he is problem solving. He does this by asking quick questions when he is confident his co-worker knows the answer.

Software developer Ang, like Brian and Jack, finds having frequent contact with co-workers also allows him to decide who to go to for help. Ang describes:

“It is just experience from knowing what projects they have been on in the past or things that I have worked with them on in the past. Or maybe I have overheard some problem that they are working on with that sounds similar to the problem that I have encountered now.” (Ang - interview)
As Ang explains above, it is useful knowing co-workers’ past technical experiences because it identifies potential resources for current problem solving tasks. According to Ang, he informally maintains an inventory of his co-workers technical experiences by “knowing what projects they have been on”, having “worked with them on in the past”, or having “overheard some [similar] problem that they are working on”. His familiarity with co-workers’ technical experience develops over time as they work together and interact. Ang continues:

“I don’t want to bother someone with an obvious solution. But pretty quickly if it becomes obvious that it is going to be one of those tricky problems that are going to have some obscure solution that will take me forever to find then I may sometimes ask co-workers.” (Ang - interview)

As Ang explains above, there are some problems that you can solve without help from organisational resources (“I don’t want to bother someone with an obvious problem”). In his experience, however, there are others which are “one of those tricky problems” that require organisational resources for help. The question is: why do tricky problems need formal organisational resources?

An important concept is revealed in Ang’s comments on the nature of organisational resources and how they may differ from external resources. He considers working together with a co-worker different from working on a problem with someone in a virtual network. He says that for “some obscure solution” it will take him “forever to find [a solution]” without a co-worker’s help. Although he does not explicitly explain why this is the case, it can be interpreted that he needs another member of the organisation because this type of problem requires a similar perspective (e.g., shared context from within the organisation), or a shared responsibility for finding a solution. Additionally, he could be suggesting that if he uses virtual resources, he will not interact with virtual network members in the same ways he does with co-workers. For the “tricky problems,” he requires engagement that he has access to within his formal organisational network.

The knowledge management literature (see section 2.2.2, page 34) suggests social interactions among organisational members supports knowledge sharing (Tsoukas, 2009). The literature (see page 34) also argues that through frequent and informal contact individuals are better equipped to share knowledge because they understand
each other’s perspectives and can more easily develop a shared understanding (Balmisse et al., 2007). The results of this study confirm the literature and reveal two specific characteristics of formal organisational networks which help solvers locate problem solving resources through frequent and informal social interactions. The two characteristics of formal organisational networks observed in this study are: the ability of these networks to develop transactive memory within network members and the ability of these networks to facilitate socialisation.

The knowledge management literature (see page 45) describes transactive memory as knowing who-knows-what (Argote & Ingram, 2000; Wegner, 1986). The literature suggests that transactive memory is a feature of close-knit networks, such as formal organisational networks (Wegner et al., 1991). As seen in the interview responses above, the three participants develop transactive memory by frequently interacting with co-workers. Jack (see page 180) learns what his co-workers know by repeatedly going for help. Moreover, he finds he is rewarded by finding the “right person”. He learns who these helpful resources are by assessing their previous answers.

Likewise, Brian (see page 181) and Ang (see page 181) learn what their co-workers know by becoming familiar with the projects they work on and the tools in which they are proficient. The three participants note that it is the frequent social contact that they have with formal organisational network members which allows them to develop and maintain their knowledge of co-workers’ expertise. In this study, interview descriptions of co-worker contact, such as “…we had been talking…”, “…I’ll walk over…”, “…I’ll see him sign in…”, “…they are so close…”, “…I might talk with some…”, and “…I would just come and ask…”, suggest that participants have this frequent social interaction within their formal organisations because co-workers know each other (i.e., they have access to co-workers and know how to engage with them) and are often co-located so there are more opportunities to informally interact (e.g., passing in the hallway, sitting next to each other, etc.).

Similarly, the knowledge management literature (see section 2.2.3, page 37) also suggests that, like transactive memory, socialisation is a feature of formal organisational networks in which co-workers have frequent social contact (Nonaka et al., 2000). During socialisation, which is the process of learning how to engage with the network, members develop a common understanding (e.g., how to ask questions, when to ask someone for
help, what language to use, etc.) in order to share knowledge (Nonaka et al., 2000). As seen in the interview responses above, Brian and Ang both describe having developed this process knowledge (e.g., how to engage with co-workers) in order to find problem solving resources. Brian describes asking “quick questions” and “always asking” as successful means for locating formal organisational resources. Due to the frequent social contact he has with co-workers, he has learned (through socialisation) that he can find help to simple problems by frequently asking short questions. Likewise, Ang has learned that he can locate resources by overhearing conversations between other network members.

The idea of overhearing other network member conversations raises another interesting point. Socialisation is typically associated with interactive social engagement, however, Ang’s behaviour (e.g., overhearing others’ conversations) could be considered passive and even opportunistic (i.e., Ang is taking advantage of the opportunity).

The social capital literature associates opportunistic behaviours, such as passive opportunities for social connection, with weak ties (see section 3.2.3, page 97) in loosely-connected networks (Haythornthwaite, 2005). The literature explains that because individuals with weak ties do not have the ability to engage in the same ways as those with strong ties (see section 3.2.2, page 93), they must be opportunistic in forming any kind of social connection (e.g., they do not have the ability to talk to someone they do not know, so they listen into hallway conversations instead). Ang does not characterise his behaviour in this way. Instead, he suggests that his opportunistic contact with co-workers is just one way of many in which to engage with his organisational network. In the terminology of the social capital literature (see page 94), Ang, Jack, and Brian all have a multiplexity of connections (e.g., multiple ways in which to engage with co-workers, such as team meetings, hallway conversations, email, after work gatherings, etc.), which is characteristic of strong ties such as those found in formal organisational networks. What is contradictory, however, between this study’s results and the social capital literature is the use of opportunistic social connection, as described by Ang, as one of many bases for connection within a formal organisational network.

The study results suggest that there are characteristics of formal organisational networks which make them suitable for problem solving, such as when the known embedded resources (e.g., transactive memory of a co-worker’s experience) may answer a solver’s
problem. Knowing of potential resources, however, is only part of locating them. Solvers also must engage with the network in order to assess the applicability of potential resources for their specific problems. Solvers have the option of face-to-face or technology-mediated communication. Why do they choose one or the other (or both)?

5.2.2 Organisational engagement through face-to-face and technology-mediated communication

The study results indicate that interview participants and forum members use either (or both) face-to-face and technology-mediated communication to locate formal organisational resources depending on specific problem solving circumstances. Participants with remote co-workers only have the option of technology-mediated communication. Having co-workers co-located, however, means that solvers can choose to communicate with them in person (i.e., face-to-face) or through technology (e.g., email, instant message, etc.). How they choose the method of engagement depends on what their needs are.

The method of engagement may be dependent on the needs of the solver before problem solving begins. The initial purpose of network engagement may not be to solve the immediate problem. Solvers may first need help identifying the specific nature of the problem (i.e., articulating the problem) or more general help in developing techniques for solving those type of problems (e.g., learning coding syntax, code development procedures, how to test code, etc.). For example, Eddie, a new software developer, relies heavily on senior developers within the office. He describes a typical situation in which he has a problem and needs help:

“When I am stuck then I’ll walk over to [senior developer] and just say, ‘I am really stuck right here’. I think my goal is to take as little time from them as possible. I don’t necessarily want them to solve it for me. I’d like them to walk me through and observe what I am doing so they know that I can actually get it right the next time. ... I’ll try to solve it myself first and go to Google, go to MSDN [forum] and if it is just not working, then that is when I’ll ask for help from senior developers.” (Eddie - interview)
As Eddie explains above, as a new developer he is still learning how to write code. He can approach more experienced developers in person, not for the solution, but for expert-mentoring. By engaging with co-workers in person, they are able to observe Eddie trying to solve the problem and give him advice about the process (e.g., the problem solving process or specific coding techniques). This mentoring also helps him to define the problem when he is “really stuck” and does not know how to begin the problem solving process.

It is important to note that, like other participants (see section 5.4, page 202), Eddie does not use a single method of engagement, but integrates online searching into the face-to-face problem solving process. In this case, however, he uses searching not to add new resources when existing ones have been exhausted, but as the first step in preparation for approaching material network members. According to Eddie, before he approaches co-workers he tries to “solve it myself” by searching for resources in virtual networks. He does this because of his concern for efficient use of his organisational network resources (“my goal is to take as little time from them as possible”). This behaviour is interpreted as a choice between efficiency (e.g., it costs less to use virtual resources) and effectiveness (e.g., the result will be better if I use organisational resources).

Also of interest is Eddie’s reference to using virtual network resources as solving the problem by himself. He does not consider, at least in this example, that when using virtual resources (e.g., code snippets, hints, or instructions) that he is also receiving help. It is not clear from the interview context, but this could be interpreted as another dimension to the cost of virtual resources. Not only are they less costly than organisational resources monetarily (e.g., a developer’s time spent helping another), but there is also less cost in terms of reputation (e.g., if I use virtual resources, no one will think that I am a less skilled developer because I needed help from a co-worker). Therefore, using virtual resources (or perhaps not using organisational resources) can be seen within the organisation as equivalent to solving it by oneself (i.e., without the aid of additional organisational resources).

Eddie continues his explanation by describing when he uses technology to interact with formal organisational network members (as opposed to the external virtual resources described above):
“Not usually [do I contact senior developers online], because they are so close. But I guess there have been times when, because [senior developer] never seems to quit working, he’ll be [online] and I’ll see him sign in. I try not to take up his personal time, but if he asks me something about work [first] then I figure that it is open season (laughs).” (Eddie - interview)

As Eddie explains above, he tends to engage with co-workers face-to-face because they are co-located. There are times however, when he will take the opportunity to communicate through technology when one of the developers is working at home. Eddie recognises that just because he can see that the senior developer is online does not mean that he is free to engage him with work-related questions. The online status provides a social cue for engaging. Instead, Eddie waits for an indication that it is acceptable to proceed (“if he asks me about work first”). Eddie has learned (through socialisation) how to engage with formal organisational members through technology-mediated communication. Like Eddie, Kenneth also chooses the method of communication based on the circumstances of the problem solving. In Kenneth’s experience:

“If I have a simple question then I would just ask them. If it is a question that helps by pasting code in then I would email it or something. [What about for remote staff?] Probably, since I can’t go over and talk to him, then Instant Messaging. Instant Messaging is best because it’s convenient.” (Kenneth - interview)

In Kenneth experience, simple questions are best suited to face-to-face engagement. If the communication includes code, however, technology-mediated communication is used because code can be more easily integrated into the conversation (e.g., pasted in email). Alternatively, if co-workers are not co-located, then technology must be used.

Ease of access is not the only criteria solvers use for deciding between face-to-face and technology-mediated communication. There are certain types of problems which lend themselves to one method of communication over the other. The study results suggest that internal business problems require engagement within the formal organisational

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44 This interpretation is based on the commonly held understanding among developers that it is easier to read rather than hear code. Although, this was not explicitly stated during interviews, I inferred this meaning from our shared background as developers.
network and preferably face-to-face. Like Eddie, Al tends to go online as a first course of action, unless it is a business problem. Al explains the difference:

“I would say that I go online first, unless it is something that is more conceptually related to the business. If it is more in the business direction of stuff or we want to architect certain things. Or our internal stuff. Then I might talk with some of our other people. A lot of our projects you may be the only one working on them, except for a few that are more teamwork things. The ones that are in a teamwork setting and more related to the business rules. You aren’t going to be able to Google [a business problem]. That’s the stuff that I would be more likely to interact more directly with a co-worker.” (Al - interview)

As Al explains above, problems that are business-related and internal (and unique) to the organisation (“...conceptually related to the business...more in the business direction...our internal stuff...”) require engagement with the formal organisational network. In his experience, Al argues that “you aren’t going to be able to Google” that type of problem. Instead, for internal business problems, it is more appropriate to “interact more directly with a co-worker”. By engaging in person, solvers can access different people within the organisation in order to find specific expertise or perspective on an issue, and can include interactive participation (e.g., working through a problem together on a whiteboard). The formal organisational network will be able to specifically address organisational issues (e.g., organisation-specific processes and structures), in ways that more general external resources cannot.

In other situations, the decision to interact through face-to-face or technology-mediated communication is dependent on efficiency. Unlike Al, Margaret describes how she decides based on convenience and urgency:

“There are definitely times when I would run across something and think, ‘I bet so-and-so knows this,’ so I would just come and ask them real quick, unless they are not at their desk. If they weren’t at their desk I’d probably go search it, I probably wouldn’t wait for them to come back.” (Margaret - interview)

Margaret knows who-knows-what (“I bet so-and-so knows this”) (i.e., has transactive memory), then she will try to engage in person. This type of engagement is for quick
questions. If they are not available, however, she turns to virtual networks (“I’d probably go search it”), because they are immediately available when co-workers are not. Margaret continues the explanation by describing when she uses technology to engage with co-workers (as opposed to external virtual networks described above):

“I like instant messenger for quick stuff or if I don’t really need the answer right away I’ll just do that. If [co-workers] aren’t at their desks and I’m still looking for an answer, I tend to do email more so than messenger-ing.” (Margaret - interview)

Margaret uses technology-mediated communication (e.g., instant messenger or email) with co-workers for quick questions. She distinguishes between using technology within the formal organisational network and external virtual networks (e.g., searching) by indicating that she engages with co-workers when there is no urgency (“I don’t really need the answer right away”), but with external virtual networks when an immediate help is needed as seen in her previous example.

Finally, the study results suggest that different methods of engagement are not used in isolation. Solvers benefit from integrating face-to-face and technology-mediated communication within formal organisational networks with engagement with virtual networks.

For example, in the TSQL forum, co-workers Gretch14 and Moebe29 communicate through forum posts:
In the forum thread\textsuperscript{45} above, one co-worker starts the thread as OP (Gretch14), but another (Moebe29) continues with the problem solving. Even though Moebe29 indicates that both he and Gretch14 work at the same company and could presumably communicate in person, they are using the forum to include additional (virtual) resources into the problem solving process.

Like Moebe29 and Gretch14, Margaret also incorporates virtual network resources into formal organisational problem solving. Margaret describes how a typical problem solving exercise can include different networks and methods of communication:

\begin{quote}
“Just this morning we got a common message, someone needed troubleshooting help and she sent it to a couple people, it said, ‘call me.’ We used IM, but since neither of us really knew about the issue we talked to each other to work on that. Then we went searching for other people, ‘Do you know anything about [problem description]? Do you know why this is happening?’ [They responded] ‘Not really, I just heard it was happening’. So then we start searching [online]... We both knew the problem existed and neither of us had a good answer, so we both went searching, with a ‘Check back in if you find anything that’s useful.’” (Margaret - interview)
\end{quote}

As Margaret explains above, she engages with co-workers face-to-face in order to discuss the nature of the problem.

Margaret also includes virtual networks (“we start searching”). Additionally, she stays in contact with co-workers during the problem solving process through technology (e.g., IM) and in person. Through the combination of networks and methods of communication, Margaret expands her pool of potential resources and has the flexibility to incorporate them when appropriate for her situation.

This use of organisational resources to identify the nature of the problem is particularly significant. Margaret describes talking with co-workers in order to understand the problem. This is similar to Eddie’s use of organisational resources (see page 185). This is a useful example of how solvers integrate formal organisational and virtual resources. Solvers need a conceptual understanding of the problem in order to solve it (i.e., they need to be able to articulate it). Organisational networks are useful in helping solvers

\textsuperscript{45} Forum threads are distinguished from other types of study results by the text following the screen image, “Forum Thread <optional descriptive title> (<participant username(s)>)”. Additionally, screen images may be cropped to hide extraneous detail (e.g. long code snippets).
identify the problem. Once solvers can articulate the problem, they can expand the potential resources (through online searching). The new external resources they find can be brought back to the organisational network for use in face-to-face or technology-mediated problem solving.

5.2.3 Summary of resource location factors

The results of this study indicate that the use of formal organisational networks in locating resources involves both face-to-face and technology-mediated communication. The study identifies several factors of problem solving which influence study participants when choosing the method (or methods) of communication, as summarised in Table 5.1.

Table 5.1 Factors of resource location influencing method of communication

<table>
<thead>
<tr>
<th>Factor</th>
<th>Problem context</th>
<th>Method of communication</th>
<th>Study examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epistemology of practice</td>
<td>The problem requires the solver to practice the knowledge through active engagement such as mentoring</td>
<td>Face-to-face</td>
<td>Eddie asks co-workers to watch him solve a problem and provide advice (i.e., expert-mentoring) p. 185</td>
</tr>
<tr>
<td>Problem identification</td>
<td>The nature of the problem is unclear to the solver</td>
<td>Face-to-face</td>
<td>Eddie is &quot;really stuck&quot; and does not know how to begin the process of problem solving p. 185 Margaret is unfamiliar with the issue (e.g., problem context) and seeks help from others p. 190</td>
</tr>
<tr>
<td>Indwelling and bestowing</td>
<td>The problem requires the solver, other network members and the associated network resources to be immersed within the context of the problem and willing to dedicate time to solving the problem</td>
<td>Face-to-face</td>
<td>AI discusses organisational business problems with co-workers p. 188</td>
</tr>
<tr>
<td>Efficient use of (organisational) resources</td>
<td>The problem must use organisational resources efficiently</td>
<td>Both</td>
<td>Kenneth walks over to co-workers and uses IM for simple questions p. 187 Eddie searches online in order to prepare for FtF engagement and not waste co-workers’ time p. 185</td>
</tr>
<tr>
<td>Factor</td>
<td>Problem context</td>
<td>Method of communication</td>
<td>Study examples</td>
</tr>
<tr>
<td>-------------------------------</td>
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</tr>
</tbody>
</table>
| Multiplexity of connections  | The problem solving process benefits from increased access to other network members (and resources) | Technology-mediated communication              | Eddie communicates with co-workers online after work hours p. 187  
Kenneth uses IM to communicate with remote staff p. 187  
Margaret uses IM and email when co-workers are not available FtF p. 189 |
| Characteristics of technology-mediated communication | The problem solving process benefits from specific characteristics of technology, such as text-based communication and asynchronous communication | Technology-mediated communication              | Kenneth integrates code snippets into email conversations p. 187  
Margaret cannot wait for co-workers to return and uses online search instead p. 189 |
| Urgency                       | The problem requires immediate attention                                        | Technology-mediated communication              | Co-workers Gretch4 and Moebe29 communicate within a TSQL forum thread to include external network members in their organisational problem solving process p. 189  
Further examples of external networks are provided in the following section (see section 5.3, page 195) |
| External resources            | The problem requires resource not available internally in the formal organisational network | Both                                           |                                                                                                                                               |

In Table 5.1 above, the factors of *epistemology of practice*, and *bestowing and indwelling* are described within the knowledge management literature. The knowledge management literature (see section 2.2.1, page 30) suggests that tacit knowledge is developed through interactive engagement such as learning-by-doing and mentoring exercises (Seidler-de Alwis & Hartmann, 2008). This is also referred to as an *epistemology of practice* (Cook & Brown, 1999) in which individuals develop knowing through action (e.g., *Joe writes code* indicates that he possesses and can act on the knowledge – knowledge as object and process). Furthermore, the literature (see page 40) argues that the development of tacit knowledge requires face-to-face interaction.
among individuals (Nonaka & Konno, 1998). The results of this study both confirm and illustrate the emphasis on face-to-face engagement in formal organisational networks in order to practice knowledge development.

As part of the process for developing tacit knowledge, the knowledge management literature (see page 31 and 36) describes indwelling as living within the context of the knowledge (Polanyi, 1961). Indwelling is the consequence of bestowing (i.e., giving knowledge freely to others) (von Krogh, 1998). Of significance from this study’s results is the specific example of business problems and how they relate to indwelling. As Al describes (see page 188), business problems are different from technical problems. The solutions cannot be found outside the organisation because they require knowledge sharing and development among network members who are familiar with (i.e., dwell/live within) the specific circumstances of the formal organisation. This is an important distinction because it provides a specific type of problem which is best suited to solving within the formal organisational network and using face-to-face engagement.

In Table 5.1 above, the factors of multiplexity of connections and characteristics of technology-mediated communication are described within the social media literature. The social media CMC literature (see page 73) argues that technology-mediated communication is not as effective as face-to-face communication because it suffers from a lack of cues necessary to communicate social information (Spears et al., 1990). Other social media literature (see page 77), however, recognises that technology-mediated communication, which is typically more asynchronous in nature, can be effective depending on the communication needs of those engaged (Herring, 2002; Joinson, 2003; Sutton, 2001). Specifically, synchronous communication is well suited for social engagement because the messages tend to be short and informal while asynchronous is better for more complex discussions because participants spend more time and thought in preparing the messages (Herring, 2002). The study results confirm that participants choose to engage face-to-face or through IM (using the tool synchronously – see description of chat in Table 2.1, page 77) when they have quick questions which can be discussed in short messages. Furthermore, the study results also confirm that participants choose asynchronous communication (e.g., email) when they have more complex problems. Of significance from this study is the specific characteristic of
complex problems which require communication of code, which has not been previously described in the social media literature.

The social capital literature (see section 3.2.2, page 93) associates the factors described in Table 5.1 above with the strong ties of bonding social connections. The literature describes strong ties as the connections within a durable network (Bourdieu, 1986), such as the formal organisational networks seen in this study. The results of this study confirm that participants exhibit the characteristics of bonding social connections (e.g., strong ties) within their formal organisations. In networks with strong ties, members are proactive in seeking out other members in order to locate and gain access to resources (Haythornthwaite, 2005). This is seen in multiple examples where participants seek out other co-workers in order to locate problem solving resources, such as Jack (see page 180) approaching several co-workers for help. Moreover, the multiplexity of connections also signals the strong ties within these formal organisational networks.

There is one characteristic of bonding social connection, however, in which the study results conflict with the social capital literature. The social capital literature (see section 3.2.2, page 93) argues that strong ties have reduced transaction costs due to low risk and high trust (Burt, 2001; Coleman, 1988). That suggests that solvers would choose formal organisation resources that they know and trust over virtual resources. The study results, however, indicate that when participants are considering the cost and efficient use of resources, they choose the weak ties of virtual networks over formal organisational network, as seen in several examples, such as Eddie (see page 185) not wanting to waste co-workers’ time.

In summary, this section considered how study participants locate resources within their formal organisational networks. Participants gain access to organisational resources through: (1) knowing about network resources (i.e., transactive memory), (2) knowing how to engage with network members and resources (i.e., socialisation), and (3) being a member of the formal organisation (i.e., bonding social connections). Once access is gained, study participants choose the method of communication based on the specific circumstances of the problem. Formal organisational networks, however, do not always contain the necessary resources. The next section discusses how solvers locate resources in external professional networks.
5.3 External professional networks

This section investigates how study participants locate resources in external professional networks through face-to-face and technology-mediated communication. Since the TSQL forum is not considered an external professional network (see descriptions below), all of the results presented in this section are from interview responses. The external networks are outside of the formal organisation, however, they are still familiar and known to solvers. In this study, the external networks used in problem solving are defined as: externally organised networks, user group networks, and technology-based virtual networks.

*Externally organised networks* consist of former contracted project team *co-workers*. These are networks of developers who have worked together in the past on contracted work. During their project period, they are similar to the formal organisational networks of the previous section and may be material or virtual in nature. After the contracted work is completed, they remain virtually connected through social network sites (SNS).

*User group networks* consist of developers using the same programming tools and are located in the same region. User groups typically have both material (e.g., conferences) and virtual (e.g., website, email directory, etc.) network aspects. In this study, interview participants more commonly connected with user group members for general technology trends or socialising, and not for specific problem solving help.

*Technology-based virtual networks* consist of developers using the same programming tools and are similar to the *user group networks* above, but are entirely virtual and are explicitly formed to be problem solving resources. In the study, for specialised development tools, sites such as discussion forums are available for developers to ask questions and stay connected to other developers using the same tools. Unlike a large discussion forum, such as the TSQL forum in this study, these virtual networks consist of a close-knit community of highly specialised developers who are mostly known to each other through reputation or membership in the *externally organised networks* above. These networks are typically initiated by the company which makes the programming tool, but can also be formed by well-connected and well-known developers within the network who use the tool.
5.3.1 Externally organised networks

In externally organised networks, solvers are connected to former and current co-workers. In many ways this connection is similar to the formal organisational networks discussed in the previous section. The network members are familiar with each other’s technical experience through frequent face-to-face contact during periods when they work together. The difference, however, is how they remain socially connected and continue to engage after they no longer work on the same projects. In these externally organised networks, solvers use social media to stay connected to, to engage with, and to keep informed about the expertise of other network members.

As with material networks, within online social networks impressions of network members’ skill sets and expertise can also be formed. For example, experienced software consultant Alfonso is the sole employee of his private consulting firm. When he works on bigger projects, he is often co-located with other developers from his clients’ organisations. He also, however, does project work from his own office where he is physically separated from other developers (or the sole developer on a project). Alfonso describes:

“I have a good idea up front who knows what and who is better at it than I am. Or simply who might have come across the problem because of the types of projects they have been involved with in the past. That knowledge is key. Experience, longevity and that [pauses trying to find the right words] adds a hell of a lot...
Because I have been in this game for so long and know so many people and I know what they have been involved with. That is why the social network continues to be quite important. Because a lot of the people who work in my field update LinkedIn on a project by project basis so that helps quite a bit. It is kind of like a living CV if you like.” (Alfonso - interview)

As Alfonso explains above, he uses his knowledge of what other network members know in order to approach the appropriate developers for future problem solving help. Like Jack (see page 180), Brian (see page 181), and Ang (see page 181) in the formal organisational networks, Alfonso develops this transactive memory through his continued interaction with network members through face-to-face and social media engagement, such as LinkedIn. In this way, social media facilitates transactive memory in networks which do not have frequent face-to-face engagement. In these externally
organised networks, solvers use social media and interact through technology-mediated communication in order to stay connected and to assess potential resources for future problem solving.

Besides problem solving, Alfonso also uses these networks to stay connected for potential future co-working (e.g., he finds other developers to work with on future contracts). He explains in the background segment of his interview that his contracted work requires him to frequently virtually organise with different network members. The newly formed social networks do not start anew each time; instead, they maintain the history (and connections) from previous contracting project networks. They bring their social connections with them to the new networks.

It is important to note that Alfonso is self-employed and is the sole employee of his consulting firm. Alfonso’s interview responses indicate that he uses externally organised networks more frequently than other interview participants who belong to larger formal organisational networks. The reason for his use of these networks is interpreted to be two-fold: (1) he does not have access to traditional co-workers to engage with in formal organisational networks and (2) he develops social connections with project members during contracted work which are similar to formal organisational co-workers. After the contracted work ends, the social network remains. It is informal, but strongly-connected from years of working together on short-term contracts. Even though they may no longer have formal organisational network ties, they are still connected through shared interest in their specific programming tools and their common clients and project teams.

Software consulting firm manager and experienced software developer, Conan, like Alfonso, uses social media to connect with externally organised network members. Conan describes:

“The first thing I do is I actually visit people’s blogs. That drives me out of my shell. I just go out and start gathering information like I was researching something for an essay or a thesis (laughs)... I will do whatever it takes to get to an actual person that knows it with something critical like that... I will do the research, so I don’t waste our time interacting with somebody who I am trying to get to answer questions for me.

I guess the key factor is to not to waste other people’s time. To make the questions as concise and precise as I can. Even when I do that, I still
typically end up wasting some of their time. That scenario is when I use blogs. Then I move away from blogs when I get to an actual person. After working with that person and we get into some more really really specific technical issues on the project, and then I might actually go back to the blogs again. That is the pattern.” (Conan - interview)

As Conan explains above, he uses blogs to prepare himself for face-to-face engagement and to find potential resources. Like Alfonso, he has externally organised networks comprised of subcontracted developers and contracted project team members. During the contracts, he and his firm’s developers work with external developers on projects in person and virtually. After the projects are complete, he does not actively maintain social connections as Alfonso does, but he uses social media, such as blogs, to re-familiarise himself with network members who he may need in the future.

Conan’s explanation also re-iterates a theme introduced in the last section on efficient use of resources. He argues that he uses social media so he does not waste other people’s time, but it is also evident from his response that he does not want to waste his own time interacting with network members who cannot provide the resources he needs. He sees social media as an inexpensive method of locating resources before he engages in the more expensive (in terms of time) face-to-face engagement. He concedes that both methods are important. Conan continues:

“I feel like I can build up a trust with a person that I meet face-to-face on a regular basis. As opposed to somebody that I would query and ask questions of online.” (Conan - interview)

As Conan explains above, not only is face-to-face important for discussing really specific technical issues, but in his experience he finds it difficult to build up a trust unless he meets others in person. As the social capital literature argues (see section 3.3, page 100), trust is required for gaining access to embedded network resources (Fukuyama, 2001; Nahapiet & Ghoshal, 1998; Portes, 1998). Trust leads to the expectation of action; action which follows the social rules and is potentially beneficial (Mayer et al., 1995). In the example above, Conan differentiates between face-to-face and technology-mediated communication by suggesting that face-to-face is better for more complexity in communication and developing stronger social ties (e.g., specific technical issues or
developing trust), but technology-mediated communication is well suited for efficient use of resources such as those that can be found in the information stored in social media (e.g., posts, comments, profiles, etc.) or quick queries with simple answers. These study results suggest that in virtual networks, the need for trust in accessing resources may be mitigated by the nature of the resources, such as low risk technical knowledge.

5.3.2 User group networks

Not all external professional networks are made up of former co-workers like the externally organised networks discussed above. Some external networks are user groups consisting of developers who share a common set of tools or technical interest, but who may not have worked together in the past. In this study, the members are also geographically co-located (e.g., live in the same region). The networks are a mix of material and virtual networks and members use both face-to-face and technology-mediated communication. In these integrated material and virtual networks, topic-based connections (e.g., Microsoft .NET software development) are integrated with place-orientation social connections (e.g., the Microsoft .NET developers' user group of New Zealand).

In this study, some interview participants are members of local software development user groups or in organisations which have an embedded virtual collective (e.g. an organisational discussion forum, blog or wiki). These individuals participate in the social collectives by attending meetings, or by posting to online forums or sending emails. Pete, a very experienced software consultant, describes the difficulty in using user groups for problem solving:

“One of the places ... is the [place name] .NET user group. Although as the environment has changed throughout the years, that is becoming less and less important because of so many other [online sites] ... it takes critical mass. There is not a lot of critical mass in [place name]. If one developer gets online and posts a question and then they don’t get a response for 2 weeks, by the time they get a response the need for the information has probably passed.” (Pete - interview)
As Pete explains above, the virtual place-oriented user groups offer less efficiency than their location-independent counterparts. By limiting the participants to a specific geographic area there may be fewer members who can help and even fewer available to provide help when needed. As an alternative, unrestricted topic-based virtual networks can lead to a larger possible pool of resources. In turn, that can lead to an increased possibility of getting a question answered successfully.

What the user group networks do offer is a sense of community that is not always found in larger virtual networks. Having face-to-face engagement, such as attending regular meetings, gathering at professional events (conferences and trade shows), or meeting occasionally with individual members informally, can help provide a sense of connection to members. Raheem describes:

“I feel some membership] with the .NET user group. That makes it less virtual. It gets more face-to-face when you wander around with people in the same area.” (Raheem - interview)

As Raheem describes above, he chooses to “wander around with people” to feel a sense of belonging in the user group. This sense of belonging described in the social media literature (see section 2.3.1, page 56) as a characteristic of sense of community (McMillan & Chavis, 1986). Feeling closely-connected to other network members can provide an environment for problem solving, such as with the communities of practice and networks of practice (Faraj et al., 2008; Wenger, 1998) described in the knowledge management literature (see section 2.2.4, page 43). The difficulty, however, is that even if these user group networks of practice provide the support and context for knowledge development, referred to as ba (Nonaka & Konno, 1998; Nonaka et al., 2000; von Krogh et al., 2000) in the knowledge management literature (see page 40), they may not be able to provide the breadth, depth, and access to resources needed for specific problem solving needs.

5.3.3 Technology-based networks

The third type of external professional network identified in the study results are technology-based networks. In many ways these networks are similar to the TSQL online discussion forum observed as part of this research study, except they are smaller, focus
on specific technology tools, and members have stronger ties because they have many bases for connection (e.g., they have worked together in the past, met at technical conferences, attended training sessions together, etc.).

As discussed in the section above, user group networks may not be helpful in problem solving because they are not responsive enough for problem solving needs. This can also be the case with externally organised networks of technology tool companies and their clients. Selecting the most appropriate network is important. Buzz describes:

“We had a technical support contract. It was never useful and I told them so. It is expensive and it is useless. Because you would call them and more often than not they would come back and say, ‘Wow, I’ve never run into that.’ Or even if they did come back with something it would be days later. I would have solved my problem by then. And I always did it with discussion forums - always.” (Buzz - interview)

As Buzz describes above, he has tried to find resources by using a technology-based network (i.e., the company’s technical support). He explains that it a more efficient, however, to look for resources in large online discussion forums. Buzz finds, like Pete (see page 199), that the major problem with these smaller networks is the lack of responsiveness. Both Buzz and Pete have experienced long waits when contacting members of these networks. In Pete’s experience, the long delay is the most compelling reason to bypass user group network in problem solving, as network members are capable of providing help if they could respond more quickly.

In Buzz’s case, however, when network members do respond, it does not provide problem solving resources. This could be due to differences between the smaller technology-based networks and larger online forums. The members of the company’s network are not developers, but technical support staff. Their experience is derived from helping developers who call them and not from actually using the tool. In contrast, forum membership is more diverse. A forum’s network may consist of the technology tool employees and developers who use the tool. Forum networks are typically much larger because they are not limited to technical support staff and developers with support contracts. Therefore, there is a greater diversity of experience (e.g., potential effective problem solving help) and more likelihood that more members will see the
request for help and respond more quickly (e.g., potential efficient problem solving help) in larger virtual networks.

In summary, this section presents a discussion of how study participants locate resources in external professional networks. Participants assess network potential based on their knowledge of network members. Unlike formal organisational networks, however, the transactive memory is maintained through technology-mediated communication in virtual networks (e.g., Alfonso’s use of LinkedIn, page 196). Participants describe locating resources within externally organised networks of former co-workers. User group networks and technology-based virtual networks are not used, however, due to inefficient and/or ineffective embedded resources (e.g., Buzz’s technical support experience, page 201). The results suggest that solvers typically exhaust formal organisational networks and then look for resources in new virtual networks, skipping external professional networks except when former co-workers are known to have specific knowledge. The next section discusses this process, by describing how solvers search for and virtually organise in order to locate resources in new networks.

### 5.4 New social connections in virtual networks

The following section examines how solvers locate new networks and their embedded resources. It begins with a discussion regarding online searching and follows by describing how solvers virtually organise in order to locate problem solving resources.

#### 5.4.1 Searching for new resources

The study results suggest that participants search online for new networks while engaged in problem solving. Most of the results presented in this section are from interview responses, as the motivations for searching are more evident in interviews than from forum observations. There was, however, evidence of searching in the forums.

In this study, forum thread comments, such as “...Thanks. That kind of reading was what I was looking for. I don’t know why it didn’t come up on my google search...”, “…didn’t find anything useful there either. Google search was fruitless also…”, “…try google for ‘openquery linked server hangs’, the first link that comes up…”, “…I prefer to google my
question...”, and “…I have searched over the internet and find some solutions...”, suggest that solvers did engage in searching to find the TSQL forum or locate other resources mentioned within threads, but it is difficult to determine why searching is used from these observations. What is clear from both interviews and forum observations, however, is that online searching is very prevalent in problem solving.

In both interviews and forum observations, the term Googling is used synonymously with online searching. For example, interview participant Avery succinctly explains, “What do I do? I just Google everything.” Therefore, this study also uses both of the terms, online searching and Googling, to describing these behaviours. Moreover, most interview participants, like Avery, describe searching (e.g., using Google or Googling) as ubiquitous in problem solving and their primary means of locating new resources.

What is online searching? The study results suggest that searching virtual networks for new resources typically involves three steps: articulating the problem (i.e., capture as a succinct query); interpreting the search results; and making decisions about how to proceed in the problem solving process based on the search results. This is graphically represented in Figure 5.2 below:

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46 Googling specifically refers to using the Google online search engine to search the web (“Google,” 2006).
As illustrated in Figure 5.2 above, solvers must be able to articulate their problem in order to use online searching. This is necessary because they must enter search terms as a query in order to retrieve results. Using, as illustration, a query suggested in a TSQL forum thread post (“...try google for ‘openquery linked server hangs’, the first link that comes up…”):

![Google search query](image)

**Figure 5.3 Example Google query**

The study results suggest that problem articulation is helpful in problem solving because it clarifies the nature of the problem as well as helps locate new resources (through search). For example, interview participant Ang explains, “I almost always Google first, not necessarily a thorough search, but I will almost always just take a first pass at it on the web and see if anything comes up as an obvious solution”. In Ang’s experience, by starting the problem solving process with a Google search, he can efficiently check for quick solutions to the problem.

Once the search query has been articulated and searched for, search results are available for the solver to interpret. The search results provide feedback to solvers on how they should proceed with the new information. The interview responses suggest three scenarios commonly used by study participants: expanding new networks, filtering or finding specific networks, or clarifying the nature of the problem.

Expanding the variety or quantity of networks is useful to solvers when they need more resources than are currently available in formal organisational networks. Kenneth describes:
“If it is purely just a technical question then I always go to Google first. But if it is something specific to our specific [situation] like making a change to a system or making sure our standards are followed then Google is not really going to help. But if it is just purely technical then I would probably go to Google first. If I just ask somebody they may know one answer, but if I Google it I get multiple answers. You can evaluate which one seems the best.” (Kenneth - interview)

Kenneth, like Al’s description of internal business problems (see page 188), distinguishes between internal (e.g., business) problems and general technical questions. Kenneth explains that for business problems searching will not help so he uses his formal organisational network. For technical questions, however, he is able to search first. Kenneth finds the biggest benefit to searching is that he receives a greater quantity of potential solutions and from a greater variety of perspectives than are available within his formal organisation.

Solvers do not always need more variety in potential resources. The study results suggest that sometimes solvers need resources which are more focused on their specific problem. Jack describes:

“I think sometimes even if they [co-workers] don’t have the answer they help you better articulate your question through the dialog with them; refine what questions you want to ask. If you are bouncing it off and working back and forth you’ll realise that maybe that wasn’t exactly what I was looking for. What I need to look for might be something entirely different. More honed and refined than [searching] some broad questions. [Do you have different Google terms after talking?] Uh huh (nods head).” (Jack - interview)

As Jack explains above, he uses his formal organisational networks to help him adapt his query enabling him to receive “more honed and refined” search results. In his experience, he finds more effective resources when he uses search to filter his potential resources to better match his specific problem.

Interpreting and reacting to the search results can lead to a virtual network which contains the exact solution a solver is seeking. For example, Jonathan describes:
As Jonathan explains above, he works through the search result sites and uses trial and error to test suggested solutions. He continues this behaviour until a suggestion works for his specific problem. This example is useful because it introduces the concept of experiential knowledge development. Jonathan experiences the development process (e.g., he tries out and modifies different code snippets). Even though he is not interacting with the networks he locates from his search results, he is connecting to them by reading posts and experimenting with the code snippets provided. This behaviour is referred to as active observation in lurking and is discussed in more detail in the next chapter (see section 6.2, page 220).

The study results suggest that solvers also use feedback from search results to change their original query. Refining the query terms is required when the results do not help advance the problem solving process. It reflects a mismatch between a solver’s description of the problem and the virtual networks which contribute to the search results. Software developer Kenneth describes how he is getting too many search results until he refines the query:

“The problem could have been solved much quicker. It actually took a good few days to figure out. The problem would have been quicker if we had searched Google with better search terms. Because there was a posting very specific to [our problem]. You would have had to have searched for the attribute that was the problem. So you would have to know ahead of time. Because otherwise you are searching for things like “form does not submit” with the name of the form. I wasn’t getting anything; well actually I was getting too much. Even if you added the [product name] part of it. It was still getting too much. So there was a posting that was available on the internet which you could have found through Google if you had the proper search terms.” (Kenneth - interview)

As Kenneth explains above, he did not get the search results he expected because he was not using the correct terms in his query. Reformulating the initial problem is necessary when the search results provide additional information to the character of the problem.
It reflects a mismatch between a solver’s understanding of the problem and the virtual networks which contribute to the search results.

Like Kenneth, Margaret also finds that if the search results do not match what she expected to see, then she has the wrong criteria and needs to revise her interpretation of the problem. Margaret describes:

“I usually give the first couple a try, unless it’s just obvious that I’ve hit the wrong search criteria. And then I usually try to just kind of see what’s highlighted.

Sometimes I see the terms that I’ve used, but they are not in the right order, so I’ll kind of notice that it looks like it’s probably talking about the topic but not the exact piece that I’m looking for and I’ll skip over it. Then if I have no luck, I’ll usually go back and look over the ones I missed or revise my search and hope that it’s better off.” (Margaret - interview)

As Margaret explains above, she uses the same trial and error technique as Jonathan (see page 206). The difference in Margaret’s experience, however, is that she determines after a few unsuccessful attempts that she might be using the wrong search terms for her problem. She revises her search in order to find results that better fit her problem.

Not only do search results provide feedback on how well the problem has been articulated, but the search results can also provide hints to other terms. The hints can provide the solver with insight into other problem solving strategies (e.g., process knowledge) that would work better than the current one. This is significant because having access to different problem solving strategies is vital to cooperative problem solving. It means that even though hints may not be helpful to some solvers they are potentially useful to others. There is a synergy gained from working with others on a problem that extends beyond the additive benefits of totalling the subtasks solved by separate solvers. It is the availability of alternate strategy hints which enables creative and innovative approaches to problem solving.

Even though the study results suggest that there is a clear connection between problem solving in virtual networks and online searching, there is little in the knowledge management literature on the role of online searching in knowledge development. The few studies which do approach the subject (see Aurum et al., 2008; Choo, Detlor, &
Turnbull, 2000; Hertzum & Pejtersen, 2000), focus on describing searching and information seeking behaviours, but do not make the connection to knowledge development. It is significant that the results of this study describe how solvers locate problem solving resources through online search.

In summary, searching is a means of connecting solvers with resources by presenting possible virtual networks (e.g., websites, forums, blogs, etc.) which contain those embedded resources (e.g., code snippets, thread discussions, etc.). The search results can help expand the problem solving options (e.g., provide new sites and information not previously considered). The results can also help reduce and filter the options (e.g., focus results around a single, site, topic, or error message). The search results provide important feedback to solvers and can help clarify the problem in order to locate new resources. Searching, therefore, becomes a useful dimension of problem solving, which introduces solvers to potential virtual networks and resources.

**5.4.2 Virtually organising in new networks**

The final aspect of locating embedded resources is how solvers connect with the virtual networks. The study results indicate that there are two aspects of connection, *virtual organising* and *social connecting*. The literature describes the concept of virtual organisation (see page 48) as how individuals engaged in organisation-related tasks (e.g., developing organisational knowledge, problem solving in order to complete organisational work, etc.) connect to virtual networks. Virtual organisation relies on trust in lieu of formal organisation structures (Ahuja & Carley, 1998; Kasper-Fuehrer & Ashkanasy, 2001; Sarker et al., 2011). The focus of virtual organisation is on communication, coordination, and integration in order to meet goals and complete tasks (Yakhlef, 2009, p. 79). The study results confirm and extend the literature, by indicating that in addition to virtually organising for general organisational coordination, individuals specifically engaged in problem solving virtually organise in order to locate problem solving networks and resources.

The study results suggest that when virtually organising to problem solve, solvers assess network members and embedded resources in order to develop trust and socially
connect. For example, Elvis, an experienced programmer and lead developer, describes his experience of using online resources to find high-quality information:

“I don’t know if I would go [to a well-known site] first, but I might treat the information with a little more/level of certainty that it was correct. There are plenty of places you can go where you see people giving completely incorrect advice... [I would be more likely to take the advice] especially from the higher end/cream of the crop ones that have books out and things like that. When you see that kind of information available online it is pretty much ‘golden’. You are not going to have any issues with accepting that stuff.” (Elvis - interview)

As Elvis explains above, he can assess resources because of the information contained within the social network. As he describes, the network provides information of the quality and reputation of network members and embedded resources. They are artefacts of the knowledge which are digital representations/manifestations of human resources.

Solvers can also assess the cues given by other members in order to decide whether or not to connect to the virtual networks. Forum observations reveal that posters signal their membership and affiliation through their signatures, titles and badges. In the following forum example, Eliz11 presents some identifying information by displaying his roles within the forum (e.g., Moderator and MCC47), through his badges, through his avatar, and with his signature which includes a link to his personal website and a quote. He does not include, however, other identifying information such as his full name, an avatar image of himself, nor his current employer, as seen in the forum thread below:

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47 “The Microsoft Community Contributor [MCC] badge is given to those who make notable contributions to Microsoft online communities such as TechNet, MSDN and Microsoft Community. The value of these resources is greatly enhanced by participants who voluntarily contribute their time and energy to improve the online community experience for others” (Microsoft, 2012a, MCC section, para. 1).
Forum Thread 5.2 Identity signals in the forum (Eliz11)

These assessments of social network resources are commonly formed when individuals engage with others within the network to form impressions of others’ skill sets (i.e., individuals learn from feedback which resources are more helpful than others). How do solvers know which resources to use during the problem solving process? Can the solvers reach their end goals by using contacts from their organisational and material social networks? If they can, then their problems are resolved and the problem solving process is complete. If not, then they can choose to use virtual resources. This is a fundamental part of virtually organising. The ability to call upon social connections outside of formal organisational networks reveals new avenues of problem solving and knowledge development.

When selecting which resources to draw upon, it seems natural to assume that the individual solver would always choose resources with strong ties and with whom face-to-face communication is possible. The solver (presumably) has easy access to material resources. Moreover, it seems as if it would be easier to communicate with others in material networks. They would be familiar with the solver’s experience and perhaps even their current projects (and problems). The study results, however, challenge the concept that organisational material resources will always be preferred. Instead, it suggests that solvers assess resources based on four criteria: first, the types of resources available; second, the potential of the resources to solve their unique problem; third, the access solvers have to the resources; and last, the communication methods required when accessing those resources.

In order to assess networks, solvers piece together the evidence of experience and task proficiency in the artefacts they find online. For example, Rhett describes:
“They can recognise my name and I guess they can see my post count being quite high, the number of posts. It is not really a ranking thing because you can have 10,000 posts on a forum and they are all stupid posts. People are going to know that you are an idiot.” (Rhett - interview)

As Rhett explains above, the social aspects of virtual networks indicate that there is familiarity between some network members (“they can recognise my name”), although the assessment of the quality of the network member and potential resources is also determined from virtual cues, such as post counts. As Rhett argues, however, the artefacts of the posts are available for individual assessment. If the posts “are all stupid”, then the credibility of the individual network members are called into question (“people are going to know that you are an idiot”). The permanency of virtual artefacts is an important part of virtually organising because solvers have access to artefacts whenever they need to assess them.

Senior developer Josh frequently spends time online problem solving or keeping current on technology trends. In Josh’s experience, the timing and availability of resources is part of his assessment of resources. Josh describes searching for help online:

“What actually happened was I went looking and I did not find a good solution, which is uncommon. I didn’t find much and just tabled it [and used a] different approach to that problem. I did find the code for that searching online as well.

But three months later I come back and do the same search again (thinking that it’s a loose end and maybe I can tie it up) when right there on Stack Overflow there is a very explicit solution to the problem... It just shows how quickly the information moves. And I did a search, shortly after this version of the software came out. So it was just new enough that nobody had posted about it yet. A couple months later, it was really easy to find that information.” (Josh - interview)

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48 To table an issue is a colloquialism used by developers in this research study, meaning to skip or only partially complete a prioritised task and return to it in the future. It implies that their development team has a backlog or list of software development tasks, bugs, or issues and developers work through the tasks in order.

49 “Stack Overflow is a question and answer site for professional and enthusiast programmers.” (Stack Exchange Inc., 2013, para. 1). It is widely used by the interview participants in this study and was considered as a possible location for the ethnographic study.
As Josh explains above, Googling aids in problem solving when the problem space changes quickly. He connected to the network of Stack Overflow through his previously unsuccessful Google search only after the problem had been discussed within that software development site.

There is much more to virtually organising than the ability to communicate through technology. Participants in virtual collectives are socially connected. They discuss, argue, share information, express emotions, develop relationships and exhibit other behaviours evident in material collectives. They may not be identical behaviours and exhibited in the same way, but both virtual and material collectives are social. People are connected within those collectives. Jack, a software developer working for a small government agency, offers this observation:

“A virtual community is a group of people who are tied together technologically rather than physically. A group through social networking, through blogs and those types of electronic communication tools that brings groups of people together. As opposed to having to all be physically located.” (Jack - interview)

Jack’s observation above, that in virtual networks people are “tied together”, is significant because it illustrates the connection between technology-mediation and the ability to virtually organise.

Technology mediates the social nature of connectivity. Technology is not a replacement for social connections; instead it creates different opportunities for social connection. In the knowledge management literature (see Fayard & DeSanctis, 2005; Sharratt & Usoro, 2003; Wang & Lai, 2006), the social aspects of virtual networks are often less emphasised than the technological aspects. What makes a virtual network social? In this study, participants recognise the social nature of their networks. Buzz, a seasoned software developer working for a private consulting firm, and an avid music fan, describes how important the social (rather than the technical) is in his music network:

“More than anything [I use] a site called LastFM. It is a music site. You can listen to almost anything you want. To me this is the only real personal value I have seen from SNS [social network sites]
You know Pandora\textsuperscript{50}? \textbf{Pandora works by an algorithm}. If this song has these qualities and if you like that, well here is another song with those qualities. It is purely these algorithms. \textbf{LastFM is social}. If you like these things, here is a person who likes those things. They also like this so maybe you want to try that. They have been much more successful than Pandora at predicting things I might like.” (Buzz - interview)

The sentiment Buzz captures when describing the social nature of his virtual network illustrates an important aspect of technology in those networks. Technology-mediated does not imply that technical aspects dominate the social connection. In Buzz’s comparison, the patterns of behaviour in the two social network sites, Pandora and LastFM, are quite different. Pandora represents a virtual network in which members are connected through technology. In essence their relationships in the collective are with technology, not other people (“\textit{Pandora works by an algorithm}”). Pandora does not connect members through music, it analyses member characteristics (such as artists, genres, beats per minute, and dates/eras of the songs in a member’s playlist). The engagement in the collective is between person and algorithm. On the contrary, LastFM connects people (“\textit{LastFM is social}”). Technology is merely a tool to support social engagement.

Even though his example is from a music social network site; the point holds true for professional virtual networks as well. There are social aspects to how and why members of professional collectives engage. Pete finds that problem solving online is like a game he plays with other developers.

“How in the world would I know about the idiosyncrasies of Windows Communication Foundation and how to write a channel factory? \textbf{It is fun for us techie-geek kinds}. It is very much like the old Dungeons and Dragons game. Where we have got to go find the secret Amulet of Yendor which will open up the cave and allow us in to find the sacred scroll that tells you how to... build a channel factory for Windows Communication Foundation! (laughs)” (Pete - interview)

\textsuperscript{50} Pandora is a social media site in which members connect through a shared preference in music. analyses the characteristics of songs and algorithmically recommends music from other members based on the attributes of songs that a member likes (Pandora Media, Inc., 2012).
Pete is a very experienced programmer who has been developing software professionally (and playing games) for over 30 years, since his early teens. He compares participation in online collectives to playing Dungeons and Dragons:\textsuperscript{51} Pete explains, discovering and sharing the technical details in very complicated subjects (e.g., “idiosyncrasies of Windows Communication Foundation and how to write a channel factory”) is similar to playing a game or solving a puzzle with friends. He finds the engagement in his professional networks “fun for us techie-geek kinds” when they are both professionally collaborating (sharing information) and socially competing (trying to win the game).

When considering what makes a network virtual, what is prevalent in the interview responses and forum observations is that virtual networks are social. They are social in the sense that members voluntarily engage and are not mandated to do so. They are social in that they are based on human-interaction and not algorithms. They are also virtual social connections, which are spatially and temporally independent, relying on technology to open up the possibilities of different and additional forms of socially connecting.

Unlike much of the knowledge management literature which argues that information technology is for explicit knowledge exchange (Bhatt, 2001; Lang, 2004), the results of this study challenge the separation of virtual and material domains as well as the separation of face-to-face and technology-mediated communication into distinct roles. The contribution this study makes to the field is in presenting an integrated view of the relationship between virtual and material social spaces. This study results suggest that individuals are able to develop knowledge and problem solve by leveraging virtual collectives as a replacement, supplement or complement to material and organisational resources.

In summary, in this section we traced how solvers connected to new virtual networks through searching online. After searching and finding potential networks, the section then explored how solvers virtually organise to locate new resources for problem solving.

In this and the previous section, many themes were introduced including the six key themes discussed below.

\textsuperscript{51} Dungeons and Dragons is a fantasy role-playing game (Wizards of the Coast, 2002) popular with computer programmers and science fiction enthusiasts.
5.5 Thematic summary of locating problem solving resources

Six themes emerge which specifically connect to locating resources in virtual networks.

*Problem clarification*: The study results indicate that solvers must understand the nature of their problems conceptually in order to articulate the problem to others. Articulation is necessary for finding potential networks, assessing potential resources, searching for new resources, and engaging within networks. Interview responses suggest that participants not only use problem solving networks to find solutions, but also to help clarify their problems.

*Network and resource assessment*: The study results indicate that solvers must understand how potential networks and resources may help them in pursuit of finding a solution. The assessment is specific to the nature of the problem. For example, if a problem is complex and requires intense engagement with other network members, solvers will look for resources in networks which support that type of engagement.

*Efficient use of networks*: The study results indicate that solvers will choose networks which allow for the most efficient and effective access to embedded resources. Efficiency is determined by whether the resources can be accessed in a timely manner (i.e., meets the solvers’ time requirements), with the least amount of effort (from both the solvers and other network members), and effectively addresses the problems (i.e., provides an acceptable solution).

*Two dimensions of knowledge*: The study results confirm knowledge management literature (see section 2.2.1, page 30), which argues that knowledge has two dimensions, the process of knowing (e.g., the act of problem solving, explaining, trial and error, etc.) and the object of knowledge (e.g., artefacts of problem solving conversations, documents, instructions, code snippets, etc.).

*Expanding and reducing potential networks*: The study results indicate that solvers use searching to both expand and reduce the set of possible virtual networks for problem solving. Expanding helps bring in additional resources that are not available in existing networks. Reducing filters the possible networks to a small set which is focussed only on the specific context of the problem.
Trust in networks: The study results confirm social capital literature (see section 3.3, page 100), which argues that trust is required in social networks. The study results indicate that study participants consider (to varying degrees) generalised trust, reputation, and quality in their choice of virtual networks when assessing embedded resources.

5.6 Reflexive summary on presenting research materials
During this research study, I found the analysis and then later the presentation of this chapter’s results to be particularly challenging. Due to the exploratory nature of the study, I found many results that were not anticipated from the literature review. As a researcher, this can be exciting, but also daunting. In a different type of study, I may have presented the results systematically as a set (e.g., Research Question leads to Interview Question leads to Result). When I encountered results which suggested that participants use a variety of networks and decision-making criteria, not conceived of in a logical sequence (e.g., first I try this, then that, etc.), it was both difficult to make sense of these results and then to present them in a way which would make sense to others. It is fair to say that exploratory results can be messy. They do not necessarily fit together in ways which complete a puzzle, but instead provide clues and interesting pieces of a puzzle which ultimately begs more research and analysis in future studies.

5.7 Conclusion
In this chapter the results addressing locating problem solving resources were presented. This chapter described the following key results:

- Solvers use a combination of material and virtual networks, technology-mediated communication and face-to-face engagement, and internal and external (to the organisation) networks in problem solving;
- Solvers assess where (i.e., in which networks) to find and engage with resources;
- Solvers engage in searching to connect with problem solving networks;
- Solvers socially connect with virtual networks in order to both filter and expand problem solving resources (and potential solutions);
Solvers consider efficiency and effectiveness when assessing networks and resources during problem solving;

The results of this study suggest that knowledge is developed within formal organisational, professional, and virtual networks through face-to-face engagement and technology-mediated communication. In this sense, the results challenge the premise that face-to-face communication is required. The results indicate that problem solving is not solely an individual process. It does involve individual thought and reflection, but it has a very important social component. Moreover, it is through assessment of resources that a problem's context can be defined (and re-defined) ultimately enabling the solver to make decisions about how to proceed towards a solution.

The results presented in this chapter suggest that in relation to Research Question 1, where individuals find problem solving resources in virtual social networks, solvers locate resources in virtual networks after exhausting or determining that existing networks will not yield help in an effective and efficient manner. They assess the suitability of existing networks (formal organisational and external professional) through transactive memory which is developed from frequent contact with members. The level of engagement solvers have with other members is chosen depending on the specific problem context. Yet with either method (or both), the interaction is social in nature.

The social aspect of virtual networks is not emphasised in the knowledge management literature. Therefore, it is significant that this study’s results suggest that when solvers are using information technology, it is not to use technology tools – it is to communicate. Using technology-mediated communication enables solvers to talk to, learn about, make connections with, share, collaborate, and problem solve with other network members. Information technology and social media are used as means of communicating and connecting with other people – it is a social connection in a virtual space.

Now that solvers have located the appropriate networks for finding embedded resources, they need to use those resources for problem solving. This chapter discussed locating resources, but did not address how solvers engage with virtual networks in order to find and use embedded resources. The following chapter discusses virtual network engagement and specifically private engagement through reading and observing, referred to as lurking.
6  Lurking in problem solving

6.1  Introduction

In the previous chapter, results were presented on how solvers locate resources within virtual networks. The results described how solvers choose networks based on the effectiveness, efficiency, and the access they have to network members. Now, once resources are located, the solver must engage with the network in order to release and use those resources. In order to investigate solver engagement in networks, the aim of this second results-based chapter is to present and discuss study results which describe and explain the primary type of engagement found in the study – lurking.

The social media literature (see discussion on lurking, page 81) distinguishes between the two online activities of public interactive engagement (i.e., posting) and private non-interactive engagement (i.e., lurking) (Chen & Chang, 2011; Crawford, 2009). The primary characteristic of lurking is that participation is not visible to other network members, instead lurkers participate by reading, listening, and watching others interact (Burnett, 2000; Crawford, 2009; Dennen, 2008). The chapter structure is illustrated in Figure 6.1:

![Figure 6.1 Lurker engagement in problem solving (structure of chapter six)](image-url)
The first section of this chapter describes how solvers lurk while engaged in problem solving. It focuses on the behaviour of lurking, referred to as *active observation* in this study. The emphasis is on the active nature of lurking, which challenges social media literature in which lurking is characterised as a passive activity.

As an integral part of the discussion on lurking, this section explores the use of *embedded network resources* in problem solving. In the context of the virtual networks explored within this research study, the embedded resources are *knowledge objects* such as code snippets, instructions, written explanations, or programming language rules and syntax. The resources can also be *process knowledge*, which is captured and retained as the artefacts of technology-mediated communication, such as the thread conversations which convey technical process knowledge or tacit knowledge of the social rules of engagement within the network. This section addresses Research Question 2, *how does tacit knowledge teach individuals how to engage in the process of accessing resources; and how to interpret the context of those resources?*

The second section discusses how interview participants describe trust (or lack of trust) when lurking. It examines the concepts of trust through the lens of social capital to investigate the role of trust in problem solving. This section on trust also serves as an introduction to the role of trust in social connection and resource access which is discussed in greater detail in Chapter 8.

The third section is a discussion of why solvers lurk and what happens when solvers de-lurk and decide to publically engage in virtual networks by posting. It examines the reasons for de-lurking, such as exhausting resources available through lurking without problem resolution, wanting to make a suggestion to a thread conversation, or needing to register on a site in order to mark a thread post as helpful.

The fourth section discusses the themes which emerged from the analysis of the results: efficient use of networks, the dual nature of knowledge (i.e., process and object), instrumental motivation, generalised trust in networks, and bridging social connection.

The final section is a reflexive discussion of my experience, as a researcher and virtual network member, engaging in lurking behaviour.
6.2 Active observation

After locating resources, solvers must decide how to engage with them. This section explores the behaviours participants engage in during lurking. Although lurking is often characterised as passive engagement in the social media literature (Burnett, 2000), the results of this study suggest that lurking in problem solving can involve very active behaviours, even if they are not interactive. For example, Elvis describes:

“I know that there are a lot of people who just consume and read. That is a member of a community. You are engaging and taking that information that someone else has provided. That is a kind of virtual discourse.” (Elvis - interview)

As Elvis explains above, the seemly passive engagement of reading a thread is only part of the lurking activity. As lurkers are reading and observing the virtual network content and interactions, they are also “engaging and taking that information that someone else has provided” by re-contextualising the resources (e.g., adapting it, applying it, trying to understand it, etc.), so they can use them in their own problem solving tasks.

The lurking behaviours include reading network content in order to try suggestions, watching network engagement (e.g., technical conversations in threads) in order to practice development processes (e.g., trial and error use of code snippets), or following network members in order to assess the trustworthiness of network resources. In this study, these behaviours are referred to as active observation.

6.2.1 Lurking for technical content

The results of this study suggest that lurking in order to find and use technical information is a common problem solving behaviour. Lurkers engage with online content (e.g., threads, documents, code snippets, etc.), but do not publically post questions about their specific problems. Since they do not ask other network members about their individual problems, lurkers must take the technical content they find and adapt it to their own needs and situation.

For example, Margaret describes:
“In certain cases where I can’t figure anything out, I try something that I imagined it couldn’t work, but someone had some luck so let’s try it out. And I’ll try anything else that seems reasonable.” (Margaret - interview)

As Margaret explains above, she actively tries out code when she is lurking. It is more than just reading, but taking the code, modifying it so it works in her situation, and evaluating whether or not it solved her problem. Active observation of technical content includes actively practicing software development. It is also important to note that she also assesses the effectiveness of the technical resources (“I imagined it couldn’t work”) by observing the interactions in the thread (“someone had some luck”) in conjunction with reading the code.

Lurking for technical content often spans multiple sites in order to bring additional information to the problem solving process. In this study, reading information on various sites is a common way solvers find technical resources to help in their problem solving. The reading process is not linear, but integrated within the problem solving process. Solvers may follow one thread, but jump to other sites to find additional information. Even when a solver is interactively posting on one site, they may lurk on other sites as part of problem solving. Even frequent posters describe lurking on other sites as part of their problem solving process when helping others. Nancy30 commonly uses wikis to help her with complex concepts:

Forum Thread 6.1 Wiki lurking (Eliz11)

Eliz11 describes in the post above, re-reading (she is not the wiki contributor) the wiki page on this concept. She has used that information to support her response on the forum thread.

Lurking can be integrated with posting; problem solving by posting on one thread may also include lurking on other sites. In this thread conversation, the OP, Hank15, is having difficulty understanding how to progress on his problem. After several attempts from various responses, one poster recommends Googling and using information from another site in the problem solving.
Forum Thread 6.2 Original post seeking help (Hank15)

Several suggestions are provided. None of the suggestions appear to help Hank15 as seen in the following exchange:

Forum Thread 6.3 Difficulty problem solving within thread (Hank15 & Shawn34)

Finally, Nancy30 suggests using a blog that she recently read as additional information in the problem solving process:

Forum Thread 6.4 Suggestion to read external sources (Nancy30)

In the example above, reading the material on the external site helped the OP find a solution. Both Nancy30 and Hank15 lurked on this blog (neither posted any comments – there were no comments left on this blog post), but found the information helpful in other contexts (e.g., this thread).
Members of the forum actively encourage reading other sites as part of the problem solving process. For example, in the thread below, the OP, Terry39, is looking for help on string manipulating:

Forum Thread 6.5 Suggestion to read article (Haze16)

Terry39 agrees, but continues trying other thread solutions first.

Forum Thread 6.6 OP agrees to read suggested article (Terry39)

The other forum members, present suggestions which require visiting other sites and reading materials on the subject that have already been published. The OP is reluctant, and instead hopes that a solution for his specific problem will be posted on the forum thread.

Forum Thread 6.7 Encouraging lurking (Howard17)

The OP's unwillingness to incorporate the other sites' material is disappointing to Howard17 and he admonishes the OP for hoping for a tailored solution instead of actively problem solving by incorporating other materials as was suggested by Haze16. Many virtual networks have expectations about solvers reading available materials before posting (Bernstein et al., 2011). It is important to note that, in this study, Howard17's response indicates that there are problem solving engagement norms and Terry39 has not adhered to them (i.e., failed to meet his obligations dictated by the social norms) by not taking Haze16's advice. There is more discussion of social norms in Chapter 8.

The results of this study suggest that for lurking, the act of active observation and the obligation of observation are both significant for social connection. Lurkers actively
observe forum threads by following them in real-time or after they are resolved. They use the forum information in their problem solving activities (e.g., modifying code snippets, translating generic errors codes for specific situations, etc.).

Subsequently, lurkers have a single obligation to the social network, to observe. Even though the connections are unseen, observation is an active endeavour. Knowing that individuals are reading and using the content of the threads influences what posters write and do. For example, in the study, forum posters remark that they have added or corrected information in a post for other readers (see example on page 254). Observation by lurkers facilitates the development of trust in the explicit artefacts of the network and provides a means for deciphering social norms. This confirms the social media studies (Arnold & Paulus, 2010) which suggest that observation is a method of socially connecting. As described in the literature, members need not “directly participate in the exchange of help for social capital to be affected... simply observing a helpful act may be sufficient” (Blanchard & Horan, 1998, p. 11).

6.2.2 Observing technical and social interaction

As seen in Margaret’s example above on trying out code based on the context of the thread conversation (see page 221), technical content is not presented or interpreted in isolation. Lurkers can watch and learn from network engagement captured as artefacts in the site content.

While lurking, solvers may read through many different sites until they find a piece of information that helps them solve their problem. Margaret explains below how she lurks in conjunction with more interactive engagement with her co-workers:

“We did a lot of different searching, definitely some in-person collaboration. It was really hard to find the answer. One of the most helpful [pieces of information] was that person’s reply to the post saying what he discovered; (pause) it was kind of magic.” (Margaret - interview)

The behaviour Margaret describes above is an integrated process of reading many different online resources and discussing them with members of her material network.
This demonstrates that lurking alone cannot always answer the question and therefore underpins the importance of the material social network.

Solvers lurk on a few forums or blogs, watching for a development in the conversation which might help them solve their problem. Observation of technical and social interactions often involve interpreting and combining sources from a variety of sites or iterations of dialogue to understand the context of the information being provided. Ang describes searching, reading and following other people’s conversations online:

“Usually in most cases when I find a solution it is someone else saying [in high frantic voice with arms waving] ‘Oh my God I have got this problem - help me out!’ Then it is a third party helping them out. I am able to take that same solution and apply it to my situation. So usually it is not someone out there going ‘Hey, I had this problem, here is how I solved it.’ Usually it is someone going ‘I got this problem’ and someone else going ‘Here is how you solve it.’ Then I can use that same solution to my needs.” (Ang - interview)

The study results suggest that part of the process of interpreting a variety of information from different sources (either individuals or sites) is to understand the context of that information. Solvers describe considering each information source and how it relates to information that has already been collected. Alfonso describes an experience of going straight to a forum and lurking instead of looking for help through a search result link:

“My first thought was to go to the SDN to the specific SAP developers’ network site... The information was good in the sense that the person asking the questions was quite specific. Because you do get a lot of questions that are very vague and you go through many iterations to actually figure out if that is what you are looking for or if it is the same sort of issue.” (Alfonso - interview)

This aggregate helps solvers understand if the resources they have found in the virtual networks are able to help with their specific problem (e.g., if they share a similar context).

Observation of social interaction is also referred to as vicarious interaction. The social media literature (see page 83) describes vicarious interaction as solvers watching social interactions in order to understand social norms and rules of engagement (Sutton, 2001).
Vicarious interaction allows lurkers to interpret thread conversations in context of social network behaviours. For example, Alfonso describes:

“In addition, you sometimes get a lot of responses where it is evident that the responder hasn’t read the question properly. This is also quite frustrating (laughs). Then the original requestor reiterates. You get this backwards and forwards of iterations. It must be bloody frustrating to the person who asks the question in the first place.” (Alfonso - interview)

It is evident from Alfonso’s description that there can be difficulties in interpreting conversations online. This is true for Alfonso as he tries to understand how well the forum thread he is lurking on relates to his specific problem. He describes the “backwards and forwards of iterations” in thread posts. This is when participants are trying to articulate and understand complex concepts which help him as a lurker gain context to their problems as well as his own.

When more visible members are posting on threads they are cognisant that they are being observed by a peripheral audience and there are unseen members reading their posts. Posters know of lurking as seen in the following example:

**Editorial note to future readers:**

This entry is not a good example of how to handle things in a trigger. Cat20’s response of COLUMNS UPDATED is probably a better approach to solving at least part of the original problem than [user]'s previous post which was marked as “the answer.”

Readers should consider the responses on the thread and the comments of others.

**Forum Thread 6.8 Note to lurkers (Kat20)**

Posters occasionally directly address lurkers to ensure that after the original discussion, context remains with the thread. In the example above, Kat20 explains that the response the OP marked as the solution was not necessarily the best. He suggested that Nancy30’s response should have been marked as the solution in his opinion. Kat20’s note indicates awareness that the responses on the thread are not just for participants in the discussion, but for those lurking in the future.

There is some level of obligation/commitment to reciprocity for lurkers. As discussed in the previous section, lurkers must have some level of trust in the accuracy of the information to use the network resources in problem solving. The reciprocal obligation to the accuracy of information is that lurkers are following, reading and using that information; they are actively engaging with the content of the site. This expectation of
lurkers using the site is demonstrated in posters’ comments about future readers. For example:

**Forum Thread 6.9 Helping other members (Howard17)**

In the forum post above, Howard17 reminds the OP about the social rules (e.g., use descriptive titles in your questions) in order to help lurkers who may observe the thread in the future.

This raises an interesting issue on the nature of free-riding in virtual networks. In addition to failing to adhere to norms of obligation, the social capital literature (see section 3.6.2, page 127) also argues free-riding may restrict access to network resources (Adler & Kwon, 2002). The results of this study indicate that lurkers are an accepted part of online networks and that they are not considered social loafers or free-riders. In fact, there is an obligation among posters to help lurkers, as is seen in Howard17’s post above.

Lurkers are often treated as free-riders in the social media literature because they do not visibly *invest* in the social network through posting. They benefit from the forum, but do not seem to contribute to the social network in obvious ways. The fear commonly expressed in the literature is that if everyone lurks then the tragedy of the commons would destroy the network because there would be no resources to share (Hardin, 1968; Portes, 1998). The tragedy of the commons risk in virtual networks, however, is different from the overgrazing of the town commons. It is not overuse of resources, but under production of resources which is at risk in virtual spaces. In this study’s forum observations, however, under production of resources is not a problem. Posters continue to answer questions even though lurking is recognised as the way most members participate. It may be the posters are in fact motivated to answer individual posts because they recognise that answering a single question benefits more than one member. The benefits of posting extend to the wider network of lurkers.

Awareness of those lurking is seen in several threads. For example, George12, describes concern for the thread losing value for those reading it:
In the example above, George12 expresses concern for the unrealistic examples the OP uses. It is a complex discussion on different data types. He wants to ensure that the discussion not only helps the OP, but is of value to those who are reading it.

There are conflicting responses in the interview results. It is not always clear that lurkers are an influential presence in virtual networks. For example, Rhett describes when he posts:

“I liken [posting online] to standing on a pedestal in front of a bunch of people. I am talking while they are watching. Some of them will respond back. Some of them won’t. What I am saying - I am going to say regardless of who is watching.” (Rhett - interview)

Even though, Rhett does not alter his public posts because of lurkers, he does acknowledge that he is aware of their presence.

These results confirm the social media literature (see page 81) which suggests that lurking is the most common online behaviour (Mason, 1999; Nonnecke & Preece, 2001; Yeow et al., 2006). Significantly, this study also extends social media research by specifying the lurking behaviour of solvers engaged in problem solving. The results of this study suggest that solvers commonly lurk as the first or only method of engagement within virtual networks while problem solving.

Lurking allows for acclimatisation to the social network. It is a mechanism for learning and becoming comfortable with the social norms (i.e., the tacit knowledge of the network rules) through observation. The study results further suggest that lurking is a fundamental part of how solvers acquire knowledge in virtual social networks. Lurking not only provides access to explicit resources, but is also a mechanism for learning. In the interviews and forum observations, participants describe developing knowledge through two dimensions of learning: learning the tacit rules of engagement through observation of social interaction and learning tacit (e.g., complex, difficult to share, etc.,
When observing social interactions, lurkers are acclimatised to the social norms of the network. The literature on knowledge development and learning suggests that observation of processes and interactions is an important component of learning (Bandura & McClelland, 1977). The concept of vicarious interaction builds on this, by suggesting that when actively observing interactions, the lurker absorbs and processes observed interactions between others (Sutton, 2001). In this research study, lurkers watch interactions between posters. This concept of interaction, during which learning can be through observation of things (content) or of processes (vicarious), is useful in its similarity to lurking behaviours. When lurking, individuals can also observe site content or conversations between others by reading threads and comments. The interactions socialise lurkers in forum norms (e.g., how members communicate, what is appropriate to discussion, how to ask a question, etc.). This socialisation is significant because it provides a context for understanding the written text of the threads. For example, the study shows cases in the thread where forum members use external links in their responses to OPs. The expected behaviour of OPs is to follow the links and read the information provided before asking for additional help from the forum (see example on page 302). When lurkers observe these interactions, they learn from the interaction how to interpret the thread conversation (e.g., the lurker also needs to read the links before reading the remaining thread responses).

When observing technical interactions, lurkers are also acclimatised to the technical conventions of the social network. For example, in the forum, members communicate through code snippets and frequently ask (in technical terms) for additional contextual information about the OP questions (e.g., what version of SQL are you running). In addition to observing the written interactions in the forum, lurkers also use the information within the threads to actively solve problems outside of the forum. In the knowledge management literature (see section 2.2.2, page 34), socialisation is dependent on both face-to-face interaction and actively experiencing knowledge development (e.g., practicing, apprenticeships, etc.) (Nonaka et al., 2000; Polanyi, 1966; von Krogh & Roos, 1995). The literature argues that knowledge development can even occur without
language, but instead through experience (i.e., the process of knowledge/knowing) (Nonaka, 1994).

The interview participants describe taking information found online and actively working with it (e.g., changing code snippets, adapting advice for their specific situation, etc.). For example, Alfonso describes a scenario typical of interview responses, “...I found more information about that particular way of solving the problem. I coded it up. I made it work and was really happy...” In this case, coding it up, describes writing code, based on this found information, specific to his situation.

Consequently, this active use of the online resources indicates that lurkers are acquiring tacit knowledge because they are developing experience through the problem solving process. Although this section describes problem solving behaviour, it does not address how resources are accessed during problem solving activities. Therefore, the next section explores the role of trust in gaining access to resources and Chapter 8 extends the discussion to include the role of social norms (i.e., the tacit knowledge of the virtual network) in resource access and exclusion.

6.3 Trust in lurking

Interview participants in this study, even those who feel trust is important, all describe quickly and efficiently navigating interactions with other online resources (human and sites) without delaying in order to react to (and assess) each individual action. The study results do reveal, however, that there are situations when trust has been violated. For example, Alfonso is an experienced developer and has been developing software for more than 30 years. He is the sole employee of his private consulting firm, but he works with many of the developers in his specialised field. Even though much of his professional communication is technology-mediated through the phone, email or social media, he values knowing the other members of his development community and regularly engages with the community through conferences and other events. He discusses the role trust plays in his use of online resources:

[Trust does actually matter]; it’s quite interesting. I mean I am an old bugger and I’ve got really old-fashioned values. Trust is important. I mean it is key. It is a key factor. If I find if I visited a particular site to obtain information
and I have had a bad experience there more than once... When you add it up the percentage of bad information or misleading information - it may just be worthless information. If the percentage of that is high then I won’t go there again. (Alfonso - interview)

As with Alfonso’s example above, experienced developer and consulting firm manager Conan finds it difficult to establish trust online. Conan explains that trust is important for certain kinds of problem solving activities. He can assume a sufficient level of trust for technical problem solving, but cannot for business process:

“I think trust is an issue and that is why I don’t get online and use the online community in the same way for business process decision-making as I do for technical decision-making. I can’t trust somebody that doesn’t know me to take to heart how important it is to me to get the right response or the right solution to a problem. Actually that is why I have hired a business consultant that I typically work with on a regular basis.” (Conan - interview)

The reason for different criteria for trust (depending on the type of problem) is because Conan cannot assume trust when it is difficult to judge the trustworthiness of the resource (“I can’t trust somebody that doesn't know me to take to heart how important it is to me to get the right response”). In this way, lack of ability to assess trust becomes a barrier to possible network resources.

Accessing network resources through lurking involves both trust and vulnerability. In other words, if solvers feel they can minimise exposure to vulnerability, they can assume trust to use online resources. In this way, Josh appears to equate trust to vulnerability. He not only uses online resources in problem solving by searching for and reading posts, but he also actively participates by contributing to forums. He expresses not needing trust to participate in virtual environments:

“I don’t feel trust in the sense of allowing myself to be vulnerable. I don’t feel there’s a lot of vulnerability exposed over the web. In that sense I don’t think it really plays in. And for a lot of answers, like if it’s a solution to a coding problem, it’s either going to work or it’s not, generally. Because you’re looking for a small snippet of code, you’re not looking for a whole module of code. Usually when you’re looking for source code, we’re looking for a two-line algorithm or a ten-line algorithm that solves a problem. It’s generally going
to work or not, and we can write tests to verify that. I’d say that’s mitigated in a lot of ways.

**Reputation plays a lot more than trust.** I think of trust as more of allowing yourself to be vulnerable around someone, and in that case, I would say [trust is] not involved. Reputation matters a lot, in terms of ‘am I going to give you just a quick glance?’ or ‘even if I don’t see something on the surface, am I going to dig through and expect that the information I’m looking for is in there?’” (Josh - interview)

In the reflection above, Josh differentiates between trust and reputation. Reputation, he feels, is a reflection of the potential (quality) of the information embedded within the network (e.g., network members’ expertise, the site’s ability to attract useful exchanges between members, etc.). Whereas trust is a reflection of the solver’s willingness to accept risk and be vulnerable. In problem solving, Josh believes that risk can be managed through the quality of the source, so a solver does not need to accept the risk of poor network resources (e.g., time wasted with poorly conceived code, inexperienced advice, etc.). The concept of **reputation**, which Josh uses, can be equated to a trust in the technical knowledge embedded within the network. Similarly, Jonathan re-iterates:

“*I am not usually [concerned with trust] because most of my problems are syntactical. If it compiles and I see it behaving like I think it should behave. I don’t paste huge amounts of code. Just small little problems.*” (Jonathan - interview)

As does Avery:

“Well, I mean, obviously if you know some programming, you’re going to go, ‘No way is that going to work’. But if I’m not sure, yeah, check it in, see if it works.” (Avery - interview)

There are low risk/low vulnerability situations, however, when even though the risk of trusting bad/poor quality information is low, the potential to ‘waste time’ is high. In these cases, participants describe using trust to help filter good information from bad. In contrast to Avery, Raheem reflects on the importance of trust:
“I think [trust is important] to an extent, because I am not just going to try out every Joe’s chunk of code.” (Raheem - interview)

Some social networks do require more trust than others. Interview participants describe needing more trust in socially motivated (as opposed to instrumental/task motivated) personal connections developed in social network sites (SNS), however, during problem solving the nature of the connection does not require that level of trust. When lurking, the motivations are instrumental and based on the ability of the network to solve the lurker’s problem. Bucky describes:

“I guess I require a certain amount of trust in something like LinkedIn or Facebook. They are doing pretty well on that. It is not like they are scamming anyone. If they are giving some sort of solution, if some site shows something then I’ll try it out. If it doesn’t work I’ll throw it away. So you don’t really need the trust on that kind of stuff. Although in saying that, they do earn a certain amount of trust. Like Stack Overflow. I trust that they are going to have good results. If I Google something and I see that on the first page then that will be the first one I click on. So you earn a certain amount of trust in the quality of the content.” (Bucky - interview)

There is also trust that develops due to the shared background developers have in common. Many of the interview responses indicate that because other developers have posted information, that is a strong enough reason to trust the posts. Gavin describes:

“I find especially in programming -- most people that are programmers are mostly helpful people. Especially with PHP, they are mostly helpful people. You sort of trust people that are doing the same thing as you almost. Because you know that they are not out to be malicious. Because most programmers aren’t -- at least the good ones. (laughs)

...most of the programming people out there if they are putting the effort to put it online then, they are obviously pretty passionate about it. They are doing it out of their own good, so the fact that it is there you can usually trust that it is alright. I mean there are always sites where somebody has answered a question and it might help you in some way. But, it may be poorly written, but you still get the gist of it. But the trust factor, I trust most of the stuff that is out there. People put it out there for a reason. So it is usually pretty good.
Although you do come across a site and straight away where Firefox is blocking pop-ups -- you are pretty much turned off and you want to leave right away.” (Gavin - interview)

Although trust was discussed as having some relevance by some interview participants, most have a generalised trust of the virtual networks they use in problem solving. Ang’s reflections below are representative of the participants:

“As far as programming goes, trust tends not to factor in too much. It tends to be more of how well or what they are saying lines up with what I know about the problem. So if what they are talking about sounds like it could be good and potentially solve my problem then I’ll take their word and go and try it. Because that is the nice thing about programming. You can try it and if it blows up then you can try something else. So that is kind of my approach. I tend to take things at face value and give them the benefit of the doubt and assume that they are not spewing garbage out the side of their mouth. You don’t need trust in order to try it.” (Ang - interview)

Ang describes above, because “you don’t need trust in order to try it”. This can be interpreted to mean that, in practice, solvers can trust everything (or distrust nothing) because the risk is very low. Therefore low levels of risk may mitigate the need for high levels of trust.

Alfonso explains how he develops trust and understanding the context of the conversation:

“Then I saw that one of the responses was from a guy who I recognised as a world expert in this field. He gave a short and concise response. He didn’t elaborate, just short and sweet and he provided a solution... The reader would have had to have had a certain level of skill to understand the response... Unfortunately the reader must have been fairly green. He didn’t understand it so he found another way of solving the problem in the end. However, I picked up on it. I was fairly green in this area also, but I knew that if it was from this guy, it must have been the 'dog's bollocks' so to say. It must have been the answer. He didn't spell it out, so I continued to investigate.” (Alfonso - interview)
Alfonso’s description of his ability to work towards solving his specific problem by lurking on this site is useful to illustrate the effectiveness of this lurking in problem solving. Alfonso continues:

“It all boils down to the reason I took that path is because that SAP mentor responded to that thread (original question) after it had gone to and fro a bit. I knew that that was definitely the way to do it because he had said it. I have absolute faith in that guy. I didn’t quite understand it so I had to do more research to figure it out. But at least it steered me in the right direction.” (Alfonso - interview)

Further, it suggests that Alfonso’s problem solving engagement is intellectually active, even if socially passive. He is trying to apply the information contained in the thread to his specific problem. He is actively thinking and reflecting on the conversation observed in the thread as well as the technical information provided in order to solve his own problems, which required even more active engagement through additional research. It is also important to note that Alfonso has individual trust (“I have absolute faith in that guy”) which extends to the network as a whole when assessing the quality of embedded resources.

Social capital explains how resources are available through social connections. Having social connections, however, does not guarantee access to network resources (Portes, 1998). There are other factors which also determine who gains access and who is excluded. This study indicates that access to virtual network resources comes from trust and a tacit knowledge of network norms. Trust provides access to explicit resources. For example, when Margaret (see page 221) and Ang (see page 225) lurk for technical information (i.e., explicit resources), they must have a generalised trust in the virtual network in order to try using the resources. Margaret describes reading the observations to see if the resources (e.g., code) were helpful for other network members. Additionally, tacit knowledge provides access to tacit resources, by providing context and understanding of the meanings behind the explicit knowledge. For example, when Alfonso (see page 226) observes the social interaction on the thread, he does not just use the suggested solution (i.e., explicit content), because he knows that the suggestion will not work. He has developed an understanding of the context of the thread because he sees that the poster has not interpreted the original post correctly.
In short, trust allows network participants to gain access to network resources. The concept of trust, observed and described in this study, is predominantly a trust in the network itself and not a trust among individuals. In opposition to the way that trust provides the foundation of social connection, lack of trust prohibits network participants from gaining access to resources. The lack of trust in this case is manifest as resistance to social norms, where from the solver’s perspective, the network appears in violation of its own rules; calling network resources into suspect as being not what they appear and untrustworthy. There is further discussion of adherence and resistance to social norms in Chapter 8.

Exclusion from network resources, therefore, appears to be a self-exclusion prompted by a lack of trust in the resources. The network resources available through trust alone include digital artefacts, descriptive network information (about digital and human resources) and explicit rules of engagement, such as the ‘FAQ’, ‘Terms of Use/Service’ or ‘Rules of conduct’ published on sites.

The social capital literature is dominated by the importance of trust as an underlying element of social networks. The forum observations and interview responses, however, present a more ambiguous concept of the role of trust in virtual social networks.

Interview responses reveal that there is not a consistent view of the importance of trust. Some respondents find it important; others do not consider trust at all when using online resources. Perhaps the only uniform concept to emerge from the interviews is that trust online has different definitions and implications to trust in material relationships.

From the forum observations, the patterns suggest that there is not necessarily trust between individuals (for most did not know each other well enough to make an assessment of trust), but there is systematic trust of the forum itself (or perhaps the social network underlying the forum? Or even of the internet as a whole?). This trust that can be developed through experience and reputation; and lack of trust (or the lack of means of the assessment of trust) is mitigated by low risk engagement. It is not possible, however, for network participants to assess every resource they encounter for trustworthiness.
In this study, trust is a gateway to access network resources. If there is no trust of the technical knowledge, then solvers will ignore the possibility of using the network resources. They are self-excluded from access due to their own lack of willingness to use the resources. If there is no trust of the social connections (through the solver’s exposure to network deviance), then solvers will stop connecting with the network and lose the possibility of gaining access through lack of continued connection.

The social capital concept of bridging social connection is particularly helpful in explaining how solvers gain access to resources through lurking. As seen in the study, when lurking, solvers have loose connections in their problem solving networks. These loose connections have similar characteristics to the weak ties of bridging connections. As discussed in the social capital literature (see section 3.2.3, page 97), weak ties are less durable connections to other members of a social network. Weak ties tend to be characterised by instrumental motivations, a single basis of connection, and generalised trust.

The lurkers in this study typically engage with networks through a single basis of connection, through observation. The basis for connection has two aspects: frequency and dimension. The frequency is the density (or looseness) of the connection. It is how often the connection is made. For lurkers, the social connections tend to be infrequent (e.g., a single visit to a site) or frequent for only a short duration (e.g., intensely following a discussion, but never returning to the site after the thread discussion is complete). The dimensions are the bases for the social connections. This supports the findings of previous studies which describe weak social ties as having a single medium for communication (Haythornthwaite, 2005).

The results of this study indicate that when lurking, solvers have mixed feelings about trust in virtual networks. Some study participants describe alternative concepts to trust, such as reputation, quality, risk, or vulnerability. As suggested in the social capital literature (see 3.3, page 100), trust in bridging connections tend to be generalised. Although the interview responses indicate that the sense of trust is dependent on the context of the problem solving (e.g., more trust required for higher risk problems), most describe what can be considered as trustworthiness in the sites they use.
Consequently, having study results which indicate an association between lurking, and generalised trust and trustworthiness is significant, because it is trust that ultimately releases embedded network resources. This is done by setting an *expectation of action* (Mayer et al., 1995). That action from network members (e.g., being helpful, giving advice, etc.), is how lurkers gain access to embedded knowledge. In short, trust is not developed between individuals who come to know each other but it is instead a generalised trust in the virtual network which relies on reputation and low risk or low vulnerability.

### 6.4 Motives for lurking and de-lurking

The social media literature (see page 82) argues that individuals lurk for several reasons, such as they lack confidence to interact or do not feel comfortable with the rules of engagement (Katz, 1998). The aim of this section is to discuss motivations for lurking during problem solving and why lurkers would be motivated to de-lurk and transition to posting.

The study results discussed in the previous chapter suggest that solvers locate resources which are effective in solving their problems and can be efficiently used. The results also suggest that the desire to be efficient can motivate solvers to lurk when lurking leads to the effective resources. Solvers do not over-engage by posting if lurking meets their instrumental needs to solve a specific problem.

As opposed to posters who may be connected in multiple ways (e.g., posting on multiple threads, commenting on each other’s blogs, etc.), lurkers typically have a single basis for social connection in networks, that is through observation (e.g., reading, following, etc.). They do not connect with members in other ways, such as through other personal or professional connections. Lurkers may or may not know the identities of the other network members, but the focus of their connection is through the quality and applicability of the network content (e.g., artefacts, threads, posts, articles, etc.). Brian describes his lack of interest in the posting:
“I am sure you can [identify individuals] but I don’t really. Usually, sites rank answers as well. So if someone has asked a question and there are several different answers or accepted solutions for that problem. It will say if it is just a comment or a verified solution or whatever. So yeah, you just look for the accepted solutions.” (Brian - interview)

Lurkers observe anonymously by reading or following threads, but do not post. They are often hidden or unseen by the other members. They may not register as a site member unless they are required to or want to use site tools, such as marking as helpful. If they remain anonymous they will still have a presence on the site through view counts on individual threads. Brian describes:

“I wouldn’t want to register unless, I mean, of course if you can’t find the answer and you have to register to ask a question. That’s fair enough. But usually I’d be reading.” (Brian - interview)

During problem solving, interview participants’ responses indicate that most of the online activity is searching, following, reading and observing sites. There are times, however, when lurking does not provide the necessary resources for finding a solution. In those situations, lurkers transition to posters. Interview participant Bucky describes:

“I was working for a customer who was using Oracle as a backend and classic ASP as a frontend. (sighs) Oracle is a pain in the ass... I was struggling with that for quite a while. I was Googling quite a lot. I knew that no one in the office had... in fact I had asked around and no one in the office had any great experience (any experience) in that. So I posted it to the company mailing lists. I got a couple responses from that... But still couldn't quite get it going. And some of them had mentioned "I don't think you can do that"...
I then sent the same request to the .NET user group in New Zealand. I got a couple responses from that. I think some people referred to blogs. A bit more information came. And I still couldn't get it going.
I posted it to Stack Overflow. I get the best answers I think from that. And some solid evidence that I couldn't do it (laughs).” (Bucky - interview)
As Bucky describes above, he exhausted formal organisation networks as well as searching and lurking and had no success in finding resources for his problem. He finally posted a question to an online discussion forum for developers (Stack Overflow) and received answers to his question. It is significant that Bucky did not immediately post his question on the forum, because it suggests that he was not motivated to do so until he had exhausted material networks and lurking. It is interesting to consider why this is the case. One interpretation is that Bucky, like Eddie (see page 185), prefers finding the answer on his own. Alternatively, Bucky may consider it more efficient to read and observe technical information (about Oracle), rather than investing the effort required to articulate the problem (e.g., Oracle is a pain in the ass... I was struggling) in order to post.

Like Bucky, other interview participants, describe similar behaviours of searching for and lurking to engage with resources in social networks in order to address specific problems. Brian frequently uses online resources, but only as a lurker and never posts. Brian states: “I am not answering questions. I am looking for the answers.”

According to the social capital literature, this suggests that lurkers have instrumental motivations for socially connecting in virtual networks. Interview participants describe lurking for a single purpose (e.g., problem solving) and not to engage more broadly (e.g., making friends, helping others, etc.). Moreover, when lurking, solvers are motivated by efficient and effective use of resources and will opportunistically use network resources (e.g., follow threads in order to glean information that is helpful to them). This confirms results from other studies which suggest that instrumentally-motivated members have a low motivation to share resources (Haythornthwaite, 2005; Vitak et al., 2011; Williams, 2006) and are opportunistic in their use of passive opportunities to acquire knowledge, such as listening in to hallway conversations (Haythornthwaite, 2005).

Josh describes posting solutions as an important part of participating in his online social networks, but it is outside of his work duties:

“I am not spending a lot of my time, especially during the work day, posting anything new.” (Josh - interview)

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52 During his interview, Bucky was not directly asked a follow-up question on why he was motivated to exhaust other resources before posting.
Kenneth re-iterates this conflict between obligations to his formal organisational networks and the virtual networks:

“I have probably only posted on Microsoft MSDN forums. I don’t think that I have ever posted a technical question anywhere else. **I don’t think it is really part of my job duties.** Maybe if I was at home and I did it as a hobby I might [post more].” (Kenneth - interview)

As Kenneth explains above, part of his motivation to lurk instead of post is that posting “is [not] really part of my job duties.” He describes an obligation to refrain from non-work related activities while engaged in problem solving tasks at work. In Kenneth’s view, posting is not part of his social obligation to his employer. Kenneth’s sentiment is re-iterated by Al:

“[I rarely post]. Very Rare. Occasionally. It depends on the topic. If I have something that I think is worth saying”(Al - interview)

In summary, searching and lurking often begin the problem solving process. When lurking, solvers are an audience to the posters. Some posts reflect the authors’ awareness of the unseen (silent) audience. They are an indicator that the network is active and current because if they were not getting their problems addressed, they would post questions. If a question has not been addressed, then someone will post it. After that, there is no need for additional posts and the others with similar problems lurk. When something is helpful, they may mark it as helpful. That they have been to the post/thread is evidenced by the view count.

There can be a transition from lurking to interactive participation. Lurkers become posters when they need more feedback than they can get through lurking. If the question is not there, a lurker may post a question. In the course of problem solving they may come across a question to which they have some suggestions or possible solutions. They may post a response on those threads. Lurking, however, does not necessarily lead to interactive engagement. Moving from lurking to posting is a big transition in problem
solving because lurkers have a looser connection with the network than do posters. As seen in Bucky’s response (see page 239), he exhausts all of his alternative resources (e.g., formal organisation, external professional networks, etc.) before posting on a forum. If lurkers start posting they may incur unintended or unwanted consequences of a closer association with the virtual networks. Potential consequences could include the risk of exposure or visibility, such as losing the anonymity of lurking. There may also be increased vulnerability in having their personal identity and reputation linked to the virtual network. There could also be increased organisational tension from more time spent in the virtual network or the possibility of knowledge leaks or cyberslacking.

6.5 Thematic summary of lurking

Five themes emerge which specifically connect to lurking in virtual networks.

**Efficient use of networks:** The study results indicate that solvers engage in problem solving by lurking because it is the most efficient method of accessing network resources.

**Two dimensions of knowledge:** The study results confirm knowledge management literature (see section 2.2.1, page 30) description of process and object knowledge. In the context of lurking, solvers actively observe technical content (i.e., object knowledge), and technical and social interactions (i.e., process knowledge).

**Instrumental motivations:** The study results suggest that lurkers have instrumental motivation when engaged in problem solving tasks. The purpose of their lurking is to solve their individual tasks.

**Trust in networks:** The study results suggest that lurkers have a generalised trust in the virtual networks they lurk in, but do not necessarily know or have trust in individual network members.

**Bridging social connection:** The study results suggest that when solvers engage in lurking, they are forming bridging social connections to virtual networks. In the social capital literature (see section 3.2.1, page 91) bridging is described as having generalised trust and weak ties. Network members typically only have a single basis of connection and participate within the network in order to achieve individual goals (i.e.,
The results of this study confirm that solvers who lurk demonstrate characteristics of bridging social connection.

### 6.6 Reflexive summary on lurking in research

During this research study, I found the concept of lurking to be an enigma. I was initially sensitised by the social media literature to consider lurking as a common, but somewhat inconsequential activity. Particularly since much of the literature describes it as a passive activity, I was not prepared for the role of lurking in the very active endeavour of problem solving. When I began the fieldwork, I discovered that even though the activity of lurking seems to exist at the fringes of the virtual networks, in some ways lurking is both the heart of problem solving and glue of the social networks.

As discussed earlier in the chapter, lurking is a prevalent behaviour in problem solving, but I think is also has a more significant role in virtual networks. I felt, when I was lurking, that even though posters may not consciously think about their unseen audience, their behaviours were more like people behave when physically in a public spaces (as opposed to when they are in private spaces). When lurking, it seemed as if I was influencing the behaviours of the posting members (e.g., they followed social norms, interacted with more earnestness, were on their ‘best behaviour’, etc.) because I was there. As a consequence, we lurkers may have helped posters have a stronger connection to the network because their behaviours reinforced network ties. In fact, it would be interesting to explore further if lurkers, and the awareness of an audience, also influences the quality of the content. If not the sole reason, it is perhaps one of the reasons that social networks remain active and continue to attract people – in that sense, lurkers are part of the social glue of the network.

The second point relates to lurking as a role (a lurker) compared to an activity (lurking). Admittedly, as witnessed throughout this chapter, it is tempting to think of individuals online as either lurkers or posters. I found as a researcher, however, that I was not always a lurker. During the fieldwork I did spend much of my time lurking on sites and I did identify as a lurker while engaged in observation online. When I was offline, however, I was no longer engaged in online observation, but instead discussing or writing about what I had experienced and that changed my perceptions. I found, as I reflected on my
online experiences while offline, I felt more like a social network member who lurks and not a lurker. This subtle change in my identity occurred when I changed environments (e.g., went online or offline) or when I changed tasks (e.g., switched from observation to conversation). Consequently, it may be more accurate to describe my virtual ethnographic study as a time engaged in lurking rather than as a lurker.

This identity fluctuation that I felt makes me question whether it is correct (or fair) to classify my study participants as lurker or poster. My sense of identity and feelings of social connection changed as my activities and location changed. I suspect that some of the forum members may have had similar experiences. In particular, I think the experiences of the more active forum members might have mirrored mine and perhaps not the solvers who were instrumentally lurking to solve an immediate problem.

The final point about lurking is how I felt I was perceived while lurking. As suggested in this chapter, lurking is common and an important part of problem solving. Yet, for all of its significance, lurking is largely ignored. Both in the social media literature and in practice within the forums, lurking as an activity is mentioned or noted by those interested in more public engagement and then (almost) forgotten. As a researcher, I felt a little like a ghost when engaged in lurking during the fieldwork. I had an ephemeral presence which may have been occasionally noticed by others (e.g., a quick thought about the larger audience or perhaps a glance at my profile), but as if I had given them a shiver of ghost flesh, it quickly vanished. I do not think this is necessarily a negative aspect of lurking, as most of us engaged in it prefer to remain silent and anonymous, but it is worth noting that even though lurking is no longer considered a negative or deviant activity, it does not receive the attention proportional to the large numbers who engage in the activity.

6.7 Conclusion

In this chapter the results addressing problem solving through lurking were presented. This chapter described the following key results:

- Solvers engage in lurking during problem solving. Lurking is not passive, but an active engagement with the virtual network through observation;
In order to gain access to embedded resources, solvers engaged in lurking require a generalised trust of the virtual network;

- Lurking creates bridging social connections between solvers and networks;
- Lurkers gain access to embedded network resources by learning the social norms of the virtual network;
- Solvers efficiently use resources by only engaging on a level necessary to complete the task. In other words, if the problem can be solved by searching or lurking then they will do that first and most often. They will only engage more actively if that does not solve their problem.

The results presented in this chapter indicate that in relation to Research Question 2, how tacit knowledge development instructs individuals on the process as well as content of resources external to the organisation, solvers engage with virtual networks by lurking when formal organisational resources are exhausted. Within the virtual networks, there are embedded resources which enable solvers to develop new knowledge. The resources are in the form of knowledge objects (e.g., code snippets, instructions, written explanations, etc.) and artefacts of knowledge processes (e.g., threads of problem solving conversations, social norms of interaction, etc.). Resources are not automatically available to all. It is through trust that solvers gain access to network resources. In the case of lurkers, network resources are made available through bridging social connection (see section 3.2.1, page 91), but may also be restricted by failure to meet social obligations and the negative social externality of free-riding (see section 3.6.2, page 127).

Solvers who have exhausted problem solving resources available through lurking without finding a resolution to their problems need to find other ways of engaging. The following chapter discusses virtual network engagement through public and interactive behaviours, referred to as posting.
7 Posting in problem solving

7.1 Introduction

In the previous chapter, results were presented on how solvers lurk within virtual networks. The results described how solvers actively, albeit vicariously, observed network content and interactions in order to apply those resources to their specific problem solving situations. When lurking does not lead to useful resources and problem resolution, however, solvers may publically engage within the network by posting in order to find additional resources.

The aim of this third results-based chapter is to present and discuss study results which describe and explain how solvers use posting in problem solving. The chapter begins with a description of the characteristics of different types of posters, and an analysis of how solvers problem solve through posting. This is followed by thematic and reflexive summaries. The chapter structure is illustrated in Figure 7.1 below:

![Figure 7.1 Poster engagement in problem solving (structure of chapter seven)](image)
The first section of this chapter describes the characteristics of TSQL forum members who post to threads. Forum members differ in how they engage and how frequently they post. The section differentiates between posters who frequently engage in the forum from those who only post a question or response once. Social network graphs are used to visually illustrate how different types of posters engage within the forum.

The second section describes how solvers post while engaged in problem solving. It presents analysis of TSQL forum thread conversations to illustrate how solvers use thread posts as technology-mediated communication in order to ask for help, share information, and develop solutions. This section addresses Research Question 2, how does tacit knowledge teach individuals how to engage in the process of accessing resources; and how to interpret the context of those resources?

The section concludes with a discussion on how posters socially connect within virtual networks and how social connection leads to resource access. It examines the posting behaviours through the lens of social capital to investigate how bridging and bonding social connection help solvers gain access to embedded resources.

The third section then discusses the themes which emerged from the analysis of the results: the dual nature of knowledge (i.e., process and object), and bridging and bonding social connection.

The final section is a reflexive discussion of the challenges of researching trust in virtual networks.

### 7.2 Characteristics of posters

Posting is the term used in this study for publically engaging in virtual networks. Solvers are referred to as posters when they interact with other network members in ways that are visible to the rest of the network. In addition to posting a question, reply, or comment on a thread, the term posting is also used, in this study, to refer to other public behaviours such as creating a public profile, marking a thread as helpful, and any behaviour which can be seen by other network members. In order to fully discuss posting in problem solving we must first investigate the characteristics of posters as revealed in the study results.
The characteristics of posters described in this section are the results of social network analysis of the TSQL forum participants’ communication (see Step 5 – Social network analysis, page 157). The resulting social network graphs of the posting patterns among the forum members capture a three-month snapshot of participant activity. During the three-month study, forum members communicated by posting questions and comments, as well as marking other members’ posts. In each individual thread post, the communication may vary, consisting of any number of types of communication, such as original post questions, comments, suggested solutions, clarifying questions, directed responses, and social interactions (e.g., greetings, humour, etc.).

Revisiting the forum member participation table in the Methodology chapter (see page 159), the definition of each level has been updated using degree counts from the social network graph (Figure 7.2) below. Each edge connected to a node (see connection criteria on page 158), was tallied and grouped by the social network graph degree threshold listed in Table 7.1 below. The more ties individuals have to others within the network (i.e., the higher the degree), the stronger the connection. After analysing forum connections, there were natural clusters correlating to degrees. These clusters are summarised by levels of participation, illustrated in Table 7.1 below:

**Table 7.1 Forum member participation**

<table>
<thead>
<tr>
<th>Level of participation</th>
<th>Frequency</th>
<th>Description</th>
<th>Grouping thresholds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent poster</td>
<td>Very active</td>
<td>Frequent contributors who regularly monitored and post to threads</td>
<td>Degree &gt; 25</td>
</tr>
<tr>
<td></td>
<td>Moderately active</td>
<td>Active contributors who post questions or respond to posts on multiple threads</td>
<td>Degree &gt; 2</td>
</tr>
<tr>
<td>Infrequent poster</td>
<td>Single response</td>
<td><em>Newbies</em> (new members to the forum) and infrequent contributors who only respond to posts on one thread</td>
<td>Out-degree = 1 In-degree = 0</td>
</tr>
<tr>
<td></td>
<td>Single original poster (OP)</td>
<td><em>Newbies</em> (new members to the forum) and infrequent contributors who only post questions on one thread</td>
<td>Out-degree = 1 In-degree &gt;1</td>
</tr>
</tbody>
</table>
To illustrate the different levels of participation, Figure 7.2 below is the social network graph of all forum member activity during the study. The social network graph represents patterns of communication among members. The most densely populated region of the graph, in the centre, represents the communication patterns of the cluster of very active, frequent posters. The less dense middle ring is the moderately active members. Finally, the outer sparsely populated area of the graph designates infrequent posters, original posters (OPs) and newbies who only occasionally post to threads. Not shown in the graph are the lurkers, who can be thought to occupy the white space around the contributing nodes.

Figure 7.2 TSQL social network graph (all nodes)
Each node represents a forum member. Members engage in a variety of forum activities (e.g., reading threads, providing external links, offering advice, looking for help, testing suggested code, providing code snippets). Each edge represents one of those activities between participants. The total number of edges connected to a node is referred to as the node’s degree (see discussion on page 157).

Figure 7.2 above aids in visualising the structure of the forum’s social network, by illustrating two central forum characteristics:

1. Forum participation is open and fluid. There are no well-defined boundaries of membership. There are no restrictions on how individuals participate. Anyone with internet access can read posts (i.e., lurk). Any registered user can post to any open thread;

2. The levels of participation are flexible and varied. Infrequent posters can temporarily activate latent ties in order to problem-solve and then leave as soon as their problems are resolved. Other more active members can reinforce and strengthen existing ties through continued engagement.

In this research study, social network analysis, represented in the social network graph (Figure 7.2) above, suggests that there are different levels of participation for forum members. They range from very active frequent posters to infrequent posting of a single question or response. Now that the overarching patterns of communication are established, it is important to investigate the behaviour characteristic of each end of the continuum.

7.2.1 Frequent posters

In the forum there is a small cluster of members (n=25) who have been categorised in this study as very active frequent posters. They engage as a micro-community within the larger social network of the forum. Among these frequent posters there is praise, direct communication, pleasantries, citing and cross-referencing to personal blogs or other

53 The edges are typically a straight line between two different nodes. There are also circular edges, however, which are self-referencing edges representing the OP (connected back to himself/herself) initiating the thread.
threads within the forum. Typical behaviours and forum engagement for frequent poster include:

- Demonstrating active participation by gaining forum achievements;
- Including forum title/roles in username, profile or signature;
- Including forum name/topic in username, profile or signature;
- Using photo for avatar;
- Using real name for username.

As illustration of a frequent poster, Nancy30’s profile is presented in Figure 7.3 below:\(^{54}\):

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![Nancy30's forum profile](https://example.com/nancy30)

**Figure 7.3** Very active frequent poster forum profile (Nancy30)

Nancy30’s profile provides detail about her activities and achievements. Her biography and accrued achievements provide signals to other members of her experience. Her profile provides details about her titles, links to her blog and her workplace; clues indicating the role she fulfils in the social network of the forum. Both Nancy30’s

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\(^{54}\) TSQL forum profiles, including photo avatars, are included in the ethnographic materials of this research study. For the ethical implications, see section 4.3.1, page 141.
achievements and titles of Microsoft Partner and Microsoft Community Contributor identify her as an established forum member.

When comparing patterns of participation in the social network graphs, the frequent posters occupy the centre of the graph and tend to reinforce communications with other frequent posters. In the following graph, the very active frequent posters observed during the study are seen (dark grey) in comparison to the entire group of participants (light grey). The lines represent posts to a thread and the dots represent individual members of the group, as seen in the social network graph of very active frequent posters in Figure 7.4 below:

![Very active, frequent poster thread posts (dark grey)](image)
![Other forum thread posts (light grey)](image)

Figure 7.4 TSQL social network graph (very active frequent posters)
As a group, frequent posters are in the centre of the network space. They have a high number of posts, with a density of communication between both frequent and infrequent posters. In comparison to very active frequent posters, those who posted less (i.e., moderately active) tend to act as a bridge between frequent and infrequently posting members, contributing to a wide variety of threads. In the following graph, the number of moderately active members (n=97) observed during the study are seen (dark grey) in comparison to the entire group of participants (light grey). The lines represent posts to a thread and the dots represent individual members of the group. The social network graph of moderately active members is illustrated in Figure 7.5 below:

![Figure 7.5 TSQL social network graph (moderately active posters)](image)

As a group, moderately active members are in the centre of the network space, but unlike the very active cluster their connections tend to extend more to the outer regions of the network (i.e., bridging between the very active cluster and the loosely connected...
members). They have a higher number of posts than most forum participants, with a density of communication between frequent and infrequent posters. This is an interesting finding because social media studies which investigate this group (see Blanchard & Markus, 2004; Huffaker, 2010; Ridings et al., 2006), commonly referred to as leaders (see discussion on page 156), do not distinguish between very active and moderately active network members. Therefore, this research study extends the typology of network participation by clarifying the bridging role played by moderately active posters in communicating between frequent and infrequent posters.

As an illustration of a moderately active poster, Arolz’s profile is presented in Figure 7.6 below:

![Figure 7.6 Moderately active frequent poster forum profile (Arolz)](image)

He has a high level of achievement points on the forum as well as titles indicating his role in the forum. Arolz, unlike Nancy30, has not provided a biography. Both Arolz’s achievements and title of MVP identify him as an active forum participant.

It is important to note that the study results suggest that the behaviours of very active frequent posters who regularly monitor and post to threads are similar in character to clusters of tight-knit virtual communities. For example, frequent posters share similarities with social media literature descriptions of virtual community members. As
seen in this forum thread below, frequent posters, Katzo and Kaylie21, indicate that they know each other and have a friendly relationship:

Forum Thread 7.1 Calling friend the wrong name (Katzo)

In the post above, Katzo accidentally types the wrong name when addressing Kaylie21. Kaylie21 quickly notes the error. In the post below, Katzo is embarrassed by his error and corrects the post:

Forum Thread 7.2 Using humour (Katzo)

There is a final follow up from Kaylie21:

Forum Thread 7.3 Future lurkers will not understand context (Kaylie21)

In this sequence of posts with the thread, Katzo is clarifying Kaylie21's earlier post. When he cites her, he accidentally refers to her as the wrong name although he clearly knows her real name. He is embarrassed by the faux pas, “(as you are observing, I am well capable of blundering big time)” and quickly edits the post to correct her name. Both Kaylie21 and Katzo inject emoticons (smiley face and frown-y face) to express the related emotions. Additionally, Katzo uses descriptive language so readers can visualise his embarrassment, “(as he looks for the ‘bang head here’ sign)”. Kaylie21 muses that the audience will not understand the joke because Katzo edited the post and corrected the error. This raises an interesting issue on the difference between witnessing the conversation unfold in real-time (as did the other thread contributors, some of the lurkers, and the researcher) and seeing the thread afterwards as most of the lurkers do (see discussion on lurkers’ obligation to observe on page 223). The thread
conversation reveals thoughts and behaviours which will have meaning only during the conversation as posts are created and edited. Everyone involved, posters and lurkers, experiences the conversation (i.e., knowledge as process). In contrast, those who see the thread afterwards will be missing part of the context and will need to rely on the written content of the thread (e.g., knowledge as an object) in order to develop the context as discussed in the previous chapter on lurking.

This example confirms the two dimensions of knowledge (e.g., process and object), which are described in the knowledge management literature (see discussion on page 30). It also illustrates the difference between experiencing the technology-mediated communication in real-time and after-the-fact. It is interesting to note that frequent posters who know both Kat20 and Kaylie21, may appreciate the interaction even if they did not witness the original encounter (e.g., misspelling Kaylie21’s name). Infrequent posters, however, may not understand the social interaction within the thread.

Process (i.e., experiential or tacit) knowledge is not only social information, but can be technical as well. Frequent posters also provide technical process knowledge (e.g., how to problem solve, how to practice software development, etc.) to other network members within their thread posts. Frequent poster Nancy30 gives the following advice to the OP, an infrequent poster:

Forum Thread 7.4 Googling the question (Nancy30)

In the example above, the suggestion Nancy30 reveals, “I prefer to google my question – just add T-SQL at the end”. She is not using the post to present knowledge content (e.g., code snippets, technical explanations, etc.). Instead she is giving insight into her own problem solving process by describing how she uses search in problem solving.

In another example of the familiarity between members of the very active cluster, in thread below Shawn34 starts a thread on a high-level question on CTE use in SQL Server:

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55 Common Table Expressions (CTEs) allow SQL developers to build complex expressions from smaller discrete elements (Microsoft, 2012e). They are generally used by users with more expertise in the language.
Forum Thread 7.5 Frequent poster as OP (Shawn34)

Like the exchange between Kat20 and Kaylie21 (see page 255), in this example, the post is followed by several responses from frequent posters, which are familiar and jovial. Additionally, they illustrate a respect for both the topic and the OP.

Forum Thread 7.6 Frequent poster discussion (Kat20 & Ave1)

In the thread posts above, it is evident that Kat20, Ave1, and Shawn34: frequently engage in the forum and are very familiar with each other’s' experience and skill level (”...there is always a good reason behind Shawn34’s questions...”) and enjoy interacting with each other in the forum (“Right now, I’m THIRSTY FOR MORE! YEAH!”).

As seen in the discussion above, frequent posters present identifying information about themselves which helps associate them with the profession and social network, and engage in more social interactions within the TSQL forum social network to form stronger ties. They represent one end of the continuum of network participation. At the other end, there are infrequent posters with very different behaviours and characteristics.
7.2.2 Infrequent posters

Typically, infrequent posters (n=540) provided less identifying information in his/her posts and profile than frequent posters (n=122). Infrequent posters demonstrate minimal identification with the forum compared to frequent posters.

Common behaviours of infrequent posters include:

- No avatar (default image used);
- Username is not related to true identity (e.g. random characters/words, non-identifying words);
- No profile;
- No signature.

As illustration of an infrequent poster (who responded on a thread and was not an OP), SpotCom49’s profile is presented in Figure 7.7.

![Figure 7.7 Infrequent poster (responder) forum profile (SpotCom49)](image)

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56 The number of infrequent posters is the sum of single responders (n=250) and original posters (n=290)
57 There is no identifying gender information for SpotCom49 (e.g. avatar, username, signature, and links to blogs/websites). When gender information is not available the convention of his/her and he/she is used.
58 The number of frequent posters is the sum of very active (n=25) and moderately active (n=97) posters.
SpotCom49 has few achievements, little recent activity, uses the stock avatar image and has no profile details. All of these details on his/her profile reveal that he/she is not very active on the forum and characterises a single response poster. During the study, his/her sole activity was a single response on one thread.

The communication for single response infrequent posters is represented in the ties connecting their nodes to the far reaches of the graph below. In the following graph, the single response participants observed during the study are seen (dark grey) in comparison to the entire group of participants (light grey). The lines represent posts to a thread and the dots represent individual members of the group. They have an out-degree of 1 and an in-degree of 0. An out-degree of 1 indicates that they have posted a comment on a thread. An in-degree of 0 indicates that they have not initiated any threads (as OP), so no other members have posted a comment to them. The social network graph of infrequent posters who only responded to threads once during the study is illustrated in Figure 7.8.

![Social network graph of infrequent poster responders](image.png)

Figure 7.8 TSQL social graph (infrequent posters - responders)
In contrast to the single response infrequent posters, the infrequently posting OPs present self-referencing bubbles of activity below. In the following graph, the OP participants observed during the study are seen (dark grey) in comparison to the entire group of participants (light grey). The circular lines represent original posts for a thread and the dots represent individual members of the group. They have an out-degree of 1 and an in-degree of greater than 1. An out-degree of 1 indicates that they have initiated a thread (as OP) once. An in-degree greater than 1 indicates that at least one other forum member has posted on their thread. The social network graph of infrequent posters who only posted a question (i.e., OPs) to threads once during the study is illustrated in Figure 7.9:
As illustration of an infrequent poster (OP), AllGrizz50’s profile is presented in Figure 7.10 below. AllGrizz50 has few achievement points on the forum, no official forum roles/titles. He/she has not included an image for his/her avatar and provides no profile information. He/she has little recent activity and uses the stock avatar image. All of these details on this profile suggest that he/she is not very active on the forum and has the characteristics of a typical OP (e.g., only posting one question during the study).

![Figure 7.10 Infrequent poster (OP) forum profile (AllGrizz50)](image)

From the study results presented in this section, it is clear that frequent posters communicate more identifying information (e.g., broadcast information to the entire network) and more frequently post on forum threads (e.g., interact with individual network members) than infrequent posters. The social capital literature (see discussion on page 94) suggests that a multiplexity of communication and connection (Garton et al., 1997; Haythornthwaite, 2005), as demonstrated by frequent posters, helps strengthen ties and develops bonding social connections among network members. This research study’s results confirm that network members who engage more frequently (i.e., have more bases of connection), demonstrate characteristics of bonding social connection, such as more communication of information to the network. While network members who only developed a single basis for connection (e.g., infrequent posters) demonstrated characteristics associated with the bridging end of the social connection continuum.
The social capital literature (see discussion on page 121) also argues that bonding social connection is formed by consummatory motivations of network members, whereas bridging connections are developed and maintained through instrumental motivations (Oreg & Nov, 2008; Portes, 1998). The results of this study confirm that frequent posters demonstrate behaviours which have been interpreted as having consummatory motivation, such as affirming social norms and providing help. In contrast, infrequent posters demonstrate behaviours which are interpreted as being more instrumental in nature, such as finding answers to problems. The following section examines these concepts in more details, with more complete discussion and examples of how solvers engage in problem solving and how other network members provide access to problem solving resources.

7.3 How solvers engage in problem solving by posting

This section investigates how TSQL forum members solve problems by posting questions on forum threads. It explores the communication patterns of solvers as they engage with other network members. The thread communication is illustrated through social graphs of posts.

7.3.1 Thread posts as problem solving dialogue

For problem solving which requires an exchange of ideas, solvers not only post a question and sit back waiting for responses, but must participate in the thread conversation to explore and challenge the concepts introduced. For example, the following thread illustrates the problem solving process of Kleo22. Kleo22 is a one-time poster to the forum (although this single question was actually spread over two related threads).

He is having a problem creating randomised data for a quiz. Over the course of the thread discussion there are several branches in the conversation patterns which lead not only to a solution for him (or at least a transition to a new problem state), but also lead to an alternate solution for another participant in the thread discussion.
Over the course of 17 days, 5 members of the forum post 25 responses to Kleo22’s problem (OP). The pattern of these two threads is a good example of how the conversation evolves (and changes direction) with each additional post. The thread can be separated into eight segments of patterns of behaviour, as illustrated in Figure 7.11 below (in chronological order of posts from bottom to top\textsuperscript{59}):

![Social network graph of Kleo22's thread](image)

**Figure 7.11 Social network graph of Kleo22’s thread**

The discussion has six highlighted event segments:

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\textsuperscript{59} The direction of the arrow goes from poster to intended recipient of the post (e.g., in segment (b) post “2”, CC8 posts a response directed at Kleo22.}
(a) **OP**: Kleo22 posts the question about randomising database results. In online discussion forums, the term *OP* refers to both the *original poster*, Kleo22, and the *original post* question;

(b) **Dead end**: CC8 clarifies the question, but the post does not directly lead to an answer. This study refers to the thread paths which do not lead to solutions as *dead ends*;

(c) **Answer**: Nancy30 answers the original question to Kleo22’s satisfaction. In this study, posts which are marked as answered are designated as the *answer*;

(d) **Alternate answer path**: Howard17 presents an alternate solution which provides a hint for the solution. This study refers to posts marked as answered after the first answer as *alternate answers*. The related threads are referred to as the *alternate answer path*;

(e) **Dead end**: Howard17 presents a third solution which Nancy30 suggests as an answer for Kleo22, but Kleo22 does not mark it as answered;

(f) **Status check**: Shawn34 asks Kleo22 if there has been any resolution, but there is no response. This study refers to the final post in a thread as a *status check* because it is directed at the OP and seeks verification on whether a solution has been found.

We will now look at each in turn.

**SEGMENT (a) OP**

In segment (a), the OP, Kleo22, posts the original question. Kleo22 starts the thread with an open-ended question about retrieving a random set of data from a database. He communicates in *code*, by providing an example of some of his data and a small code snippet as a means of explaining what his problem and the desired goals are. Kleo22 describes his representation of the goal state by presenting a sample of what the output should look like when the code is functioning properly:
Forum Thread 7.7 Segment (a) original post (Kleo22)

Kleo22 provides the expected output in the goal state above in order to show other members what a solution should do when properly functioning. In software development, output data is helpful for testing code. By providing output data, Kleo22 is communicating that any suggested solutions provided by other network members must have the same outputs.

**SEGMENT (B) DEAD END**

In segment (b), a dead end provides a hint to the OP. The original post generates five alternative suggestions. Two immediately terminate and two others lead to solutions. This dead end, however, provides a hint. The hint gives context to the other members of the discussion by revealing the purpose behind the question. The conversation pattern is illustrated in Figure 7.12 below:

![Figure 7.12 Segment (b) Dead end provides hint](image)
CC8 is a frequent poster and frequent contributor on the forum. In post “2” (see Figure 7.12 above), CC8 has the following conversation with Kleo22:

**Forum Thread 7.8 Segment (b) Trying to understand OP problem (CC8)**

Checking if the problem is a quiz

Confirming the problem context

**Forum Thread 7.9 Segment (b) OP confirming problem (Kleo22)**

This exchange between CC8 and Kleo22 is important because it shows the importance of understanding the context of the problem for both the solver and other network members offering help. Now that CC8 and the others understand why Kleo22 needs the output to be randomised, they may be able to offer suggestions from their previous experiences developing quizzes.

**SEGMENT (C) ANSWER**

In segment (c), Nancy30 answers Kleo22’s original question. Nancy30 is a frequent poster and frequent contributor to the forum. During this study, she has the highest number of contributions with responses to over half of the 400 threads included in the study. She is even an OP for one thread which is unusual for frequent posters who mainly respond on threads and normally do not initiate questions. Many of her responses are marked as answered indicating that OPs find her responses helpful in their problem solving. In this thread, CC8’s insight and feedback from Kleo22 prompts Nancy30 to respond with the following answer in the forum thread:
Forum Thread 7.10 Segment (c) Marked as answered by Kleo22 (Nancy30)

Kleo22 responds to Nancy30’s post by marking the post as “answered” and responding, “Flawless. Can you explain how that works and how you came to this conclusion? I’d rather learn to understand what was done instead of just copy/pasting.” This clearly demonstrates that not only does Nancy30 understand Kleo22’s problem from the thread conversation, but has also aided in his problem solving process.

Even though Kleo22 responds positively to Nancy30’s answered post, Nancy30 actually finds Howard17’s post “7” more helpful in her own problem solving endeavours. The thread changes focus at this point and does not just address Kleo22’s original problem, but also serves as discussion for Nancy30’s problem and branches out past the answered post.

Howard17 is also a frequent poster and frequent contributor on the forum. He is a Microsoft MVP and a forum moderator. The communication between Kleo22 and the other participants displays a common pattern, code snippet-directed response, seen within the forum as illustrated in the forum thread. Forum members (e.g., Nancy30, CC8, and Howard17) provide code snippets with little or no narrative. These are often taken from other problem scenarios or generic solutions. The typical response from the OP (e.g., Kleo22) is a narrative response to the suggested code snippet which provides feedback on his specific implementation (e.g., the context of the unique problem). This pattern is typical and is displayed throughout this thread and in many of the other threads in the study.
The code snippet-directed response problem solving pattern above, is important because it demonstrates types of post communication that are helpful for problem solving, such as clarifying questions, code snippets, and directed responses. In response to these posts, it also illustrates expected behaviours for those engaged in problem solving. For example, when Nancy30 posts a code snippet, it is expected that Kle022 will try using the code, test it (against the output data), and post a directed response to Nancy30 on whether or not it was successful (e.g., did it work, did if fail, did it produce the correct output data, etc.).

**SEGMENT (D) ALTERNATE ANSWER**

In segment (d), Howard17 provides an alternate answer path for Nancy30. Even though Nancy30 provides a solution to Kle022’s original post, she is intrigued by post “7” from Howard17. They have a discussion in which she acknowledges that her organisation has a similar need to the OP and Howard17’s code snippet might be of help to her, illustrated in Figure 7.13 below:

![Figure 7.13 Segment (d) Alternate answer path](image)

Nancy30 expresses some concern for implementing the code snippet that Howard17 posts and responds in post “9”, “*I thought your solution is the winner, but on this small set it doesn’t look like it*”. However, she does see some hints which would be beneficial for her own situation and concludes in post “11”, “*BTW, this problem may help us (our company) as well, as we recently added ability to generate surveys*”.

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* BTW means “by the way” and is a common internet abbreviation to indicate that the author is adding additional information and possibly changing the topic.
This exchange is interesting because it illustrates that threads are not just for OP problem solving, but can be useful to other network members. Nancy30 uses the post as inspiration for alternative ways of addressing a problem that she has (un-related to the OP problem). As the social capital literature suggests (see section 3.2.3, page 97), with the weak ties of bridging social connection, members use passive opportunities to connect with network members (Haythornthwaite, 2005). In this case, Nancy30 is directly engaging with Kleo22 on his problem, but she is also opportunistically engaging with Howard17 to meet her own problem solving needs.

**SEGMENT (e) DEAD END**

In segment (e), the dead end provides references to other resources. Howard17 posts another approach to the problem. Nancy30 indicates that it may be helpful to the OP and signals as much by proposing it as (another) answer to the thread. Kleo22, however, does not agree and does not complete the process by marking it as answered.

This behaviour of proposing multiple solutions to a thread is common. Although it is difficult to determine whether this alternate solution has benefit to the larger network of lurkers, it is clear that often alternative answers create branches in the thread and leads to solutions for either the OP or other active participants in the thread discussion. Another important facet of these posts is when they credit other members of the community. In this case Howard17 refers to ldrew47, a frequent poster and MVP, and Ecriss46, a forum frequent poster. By explicitly citing other members provides a link to other problem solving resources and potentially develops both familiarity and trust within the network. This confirms the social capital literature on the need for social connection in order to access embedded resources (Bourdieu, 1986; N. Lin, 2005).

In this thread example, it is difficult to interpret how helpful the links are as it only appears to lead to a dead end with the conversation continuing down an alternate branch.
Forum Thread 7.11 Segment (e) Proposed as answer by Nancy30 (Howard17)

The post above, in which Howard17 cites Idrew47, is an illustration of how bridging social connection is developed among network members. The social capital literature (see section 3.2.3, page 97) argues that bridging social connection can be formed between unconnected individuals through bridges who have weak connections to both (Burt, 2001; Granovetter, 1985). This post illustrates that by citing Idrew47, Howard17 is introducing other forum members to him (and his work). Other forum members, including lurkers, can form latent ties from Howard17 citing Idrew47. The social capital literature also suggests that social media is better than other forms of technology-mediated communication at creating socially relevant latent ties because there is more social information provided in the artefacts of engagement (Ellison et al., 2011). For instance, a network member could refer to this post when posting to Idrew47 on a thread in the future.

SEGMENT (F) STATUS CHECK

In segment (f), Shawn34 checks-in with the OP to see if the thread has a solution. The conversation is spread over two connected threads because the original question generates a second related question. Unlike the first thread, the second thread does not get answered by the OP, but instead is marked as answered by a forum moderator after the OP stops responding to the thread posts. Typical for threads ending in this way, the
final post is a status check to see if the OP question was answered. In this case, forum frequent poster Shawn34 asks:

Forum Thread 7.12 Segment (f) Status check (Shawn34)

There is no response from Kleo22. It is unclear why Kleo22 does not respond to Shawn34’s question. Possible interpretations include that he no longer needs forum help (e.g., it remains unsolved or it was solved through other networks) or he simply did not see this final post. It is interesting to consider the social implications of this non-response if Kleo22 intentionally ignored Shawn34’s question. Again there are many possible interpretations of the behaviour. It could signify that the social rules of the forum to not require a response to a status check. There are other examples of threads where the status check was also ignored. It could also be interpreted that Kleo22 has in fact violated a social norm and a response is expected. In this situation it would reflect that Kleo22 is unconcerned with the impact of the violation on his social connection with Shawn34 or the other network members who posted on the thread. This would reflect the instrumental motivations of weak ties (see section 3.2.3, page 97). The social media literature suggests that instrumental motivations, which focus on tasks as opposed to consummatory motivations which are more concerned with developing and maintaining social norms, are more prevalent in weak ties.

This thread confirms the social capital literature by illustrating examples of weak ties and bridging social connection in the forum, such as instrumental motivation, passive opportunities for connection, and a single basis of connection between the infrequent poster (the OP solver) and the other network members.

7.3.2  Mentoring through thread posts

The knowledge management literature (see section 2.2.1, page 30) describes mentoring as an important part of experienced-based knowledge sharing (Seidler-de Alwis & Hartmann, 2008). The study results suggest that mentoring occurs within the TSQL forum. This section explores two types of mentoring in evidence, expert-mentoring and peer-mentoring.
**EXPERT-MENTORING**

When solvers seek help in virtual networks, there is a variety of expertise available from members. When solvers receive help from members with high levels of expertise, this study refers to that behaviour as *expert-mentoring*. In the TSQL forum, expertise is indicated by the forum’s Recognition System\(^6\). It is common for discussion forums, like the TSQL forum, to have some mechanism for identifying participation within the site. The TSQL forum distinguishes between recognition and achievement with separate formulas to calculate each. For simplicity, this study refers to forum recognition as *achievement badges*. In this study, the forum members have achievement badge points ranging from 0 to over 100,000 points. An analysis of points indicates that members observed participating infrequently (e.g., one or two posts during the observation period) typically have badges of 1,000 points or less. At the other end of the range, very active frequent posters typically have badges over 10,000.

The following thread, for example, is a conversation between infrequent poster Bev6 and frequent poster Arol2. Bev6 is seeking access to expert advice:

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**Forum Thread 7.13 Looking for help by posting questions (Bev6)**

Bev6 is not the original OP on the thread, but discovers the thread three years after it has been started. He is having a similar problem to the OP so he decides to append his

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\(^6\) The MSDN Recognition System has two dimensions: (1) Recognition Points (i.e., the points displayed on a member’s post) are an indicator of quality of contribution (e.g., downloaded code snippets, marked as helpful, etc.) and (2) Achievements Earned (i.e., the gold, silver, and bronze badges on member’s profile) are an indicator of a member’s level of forum participation (e.g., posting) (Microsoft, 2012b).
question to this thread (and leave it unanswered) instead of starting a new thread in hopes that “another guru would barge in” and help him solve his problem:

Forum Thread 7.14 Looking for a guru (Bev6)

This strategy appears to work as he does receive some help from frequent poster and MVP Arol2 who escalates the problem to a more experienced (and exclusive) group of “MVPs/Answers/Moderators” to which he has access. This forum expert-mentoring behaviour is consistent with the knowledge management literature (see section 2.2.2, page 34) which argues that in communities of practice, less experienced members receive help from experts (Lave & Wenger, 1991; Wenger, 1998).

Forum Thread 7.15 Integrating external expertise into the problem solving (Arol2)

The forum observations on the use of network expertise in the example above confirm that there is evidence of expert-mentoring in virtual networks used for knowledge

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62 “The MVP Award recognizes exceptional technical community leaders from around the world who voluntarily share their deep, real-world knowledge about Microsoft technologies with others” (Microsoft, 2012a, MVP section, para. 2).

63 “An Answerer is a role where the person focuses on marking and unmarking answers. This is the most important part of all the roles. If no answers are being marked, then far fewer people will want to try to answer questions” (Microsoft, 2012d, Answerer section, para. 1).

64 “A Moderator is someone who helps do the following activities: Marking/Unmarking answers, Merging threads, Deleting threads, Splitting threads, Editing threads, Moving threads, Deleting individual replies, Editing individual replies, and Clearing abuse flags” (Microsoft, 2012d, Moderator section, para. 1).

65 As discussed in the knowledge management literature (see section 2.2.4, page 43), communities of practice or also referred to as networks of practice, electronic networks of practice, or knowledge networks. This research study refers to all collectives used for professional knowledge sharing as communities of practice.
development. These observations reveal that there are experts who monitor the forum (from Microsoft as well as industry experts) who fill the role of mentor. Inexperienced OPs (e.g., newbies) post questions in hopes of receiving mentoring guidance from the experts.

Expert-mentoring is sought out in some of the threads. When individuals recognise experienced members posting, some will give weight to their suggestions. For example, in a thread started by the OP Toofer40 below, he and two very active posters are the only contributors to the thread. He recognises one frequent poster in particular since she has responded to his other threads as well. When they have a debate about one of her suggestions, Toofer40 replies:

Forum Thread 7.16 Deferring to experts (Toofer40)

As the thread concludes, it ends with him deferring to their expertise ("More than likely I misspoke, you usually tend to be right on the money about things") and taking the advice of both experts. The pattern of behaviour in this example, which is repeated help from the same individual who is more experienced and active within the virtual collective, could be considered an expert-mentoring relationship.

Even though forum observations reveal that it is common for this type of interaction to happen once for an individual, it was not observed to be a typical pattern of behaviours to have a more-experienced member repeatedly helping the same less-experienced member. This forum behaviour is different from traditional communities of practice, where close bonds are formed so individuals can repeatedly seek help from the same members (Wenger, 2000) and have multiple bases of connection. In the forum, solvers have weak ties and may not even know the members who provide help. Each time solvers use the forum for problem solving, they seek resources from any member who can provide help. Since there is no evidence of the development of long-term mentoring relationships from the observations, the results challenge the idea that expert-mentoring relationships in virtual collectives are the dominant form of knowledge sharing, as described in communities of practice literature (Lave & Wenger, 1991; Wenger, 1998).
The mentoring described in community of practice literature, however, is not only defined by the expert-mentoring relationship (i.e., an expert giving advice to a novice), but also by the sharing of complex knowledge (Wasko et al., 2004; Whelan, 2006). Sharing more complex concepts was observed in the forum and was notable in the threads regarding best practices. In these threads, members debate fundamental concepts in programming, which form the basis for how development tasks should be undertaken. Many of these concepts stem from mathematics and programming theory. Demonstrating familiarity with theory is another way members can identify expertise within the community.

**Peer-mentoring**

When individuals seek expertise, observations of the forum reveal that not only experts, but members with all levels of achievement badges and familiarity with programming theory respond on threads. For example, in the following thread several forum members offer suggestions which are marked as solutions to the original OP post by Mike25:

![Forum Thread 7.17 Best practice question (Mike25)](image)

In the post above, the OP, Mike25 asks a question regarding best practice on creating database keys. Questions of best practice were observed to remain active (e.g., continued posting of responses) for a longer period and receive a variety of responses other than pure technical questions. This thread exhibited the traits of a best practice thread because it remains active for a long period of time (it started two years before observations began), it has a relatively large number of responses (n=18), has a high number marked as answers (n=9), and has several marked as helpful (n=3).

The following posts are all responses marked as answers to Mike25’s question:
Forum Thread 7.18 Very active participants' responses to Mike25 (Shawn34 and Nancy30)

In addition to the very frequent posters with high levels of expertise, other members also contribute to the thread:

Forum Thread 7.19 Best practice responses to Mike25

In the posts above, members with different levels of achievement badge points post their perspectives on creating keys. They support the suggestions of others and add additional information. In the posts below, however, there is some debate on the process of creating keys:

Forum Thread 7.20 Best practice responses to Mike25 (CC8 and Milton26)

In the posts above, CC8 and Milton26 disagree about the definition of database keys in their thread responses to OP Mike25. Both members have similar achievement badge points in the forum (i.e., active, but not the highest point scores), although as seen below in Maul27's response, CC8 is very well known to other members.
Very novice participants also respond with posts that are marked as the answer. In the post below, Maul27 summarises her assessment of the previous responses and provides her own perspective:

**Forum Thread 7.21 Novice participant response to Mike25 (Maul27)**

There are several illustrative behaviours evident in Maul27’s post above. First, she qualifies her response by indicating that she has less experience than other contributors (“I’ll qualify my response by saying that I am taking a grad-level course (professional, not academic), so I am not yet a DB professional with the typical 2+ years experience”). This is also indicated by her achievement badge. She does this so others can compare her response to those with more experience (“Take what I have to say with extra scepticism”). In qualifying her post with this comment, Maul27 is signalling the quality of her post and can therefore trust using it. This supports the social media literature on gaining access to embedded resources through the generalised trust weak ties (R. Leonard & Onyx, 2003).
Finally in the third behaviour, Maul27 evaluates the other responses and argues her own views on the subject based on her personal experiences with the issue. When a member has a similar experience as the OP, it is shared as a peer within the forum, not dependent on the expertise status. It is through discussion that members learn and gain insight from the thread and not from just asking an expert for an answer. Ultimately, all of these responses are marked as answered and together present a well-rounded and lively debate on a best practice topic.

As the final indication that knowledge sharing occurs within the forum among members with all levels of expertise, and not just between experts and novices, OP acknowledge the help received with a final thread post. For example, the OP Simon35 on his first post to the forum receives several suggestions in responses from other forum members. Although some of the posts are from highly active frequent posters with a high-level of expertise (as indicated by their achievement badges), there are also posts from less active members who just happen to have experienced similar problems. Simon35 responds to all of the thread participants:

```
Thank You all! I really appreciate the help! This was my first post. I am so much excited about the help! I can't just believe myself that without any relation I got help. Wish one day I also able to help others.

Thanking all respondents
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**Forum Thread 7.22 Thanks for the help (Simon35)**

The sentiment the OP expresses regarding the help he receives (“Thank You all...”), illustrates the benefit virtual collective participants gain from exposure to a diversity of responses and discussions.

The knowledge management literature (see section 2.2.4, page 43), suggests that communities of practice are social collectives used to share and distribute knowledge (Ardichvili, 2008; Cranefield, 2010; Faraj et al., 2008; Wenger, 2000). Extant literature emphasises relationships within these communities in which there are knowledge imbalances. Typically there is a hierarchy, with a junior member who seeks knowledge and a senior member who possesses that knowledge. This study refers to this type of problem solving partnership as an expert-mentoring relationship because the less experienced solver is seeking help from a more experienced (i.e., expert) network
member. The results in this study suggest that there is another mentoring relationship found in communities of practice (e.g., TSQL forum) – peer mentoring.

While there is evidence of the mentoring described in community of practice literature, the predominant behaviour in virtual collectives is actually the offers of help from a diverse group of individuals and not only from experts. Moreover, from the forum observations, there is little evidence of less-experienced members returning to the forum to get more help from a specific individual (e.g., Toofer40) and developing the stronger, longer-lasting bounds that are traditionally seen in a mentoring relationship. When problem solving in the forum, participants generally post questions and react to whatever responses are received. Except for one observed case, they do not ask (via posting on a forum thread) for a specific forum member to help them with their problem. The mentoring and knowledge sharing observed in the forum more closely resembles a form of peer-mentoring (i.e., individuals of any level of expertise offering advice to others) than the traditional hierarchical expert-mentoring conventionally described in communities of practice. These results extend the knowledge management literature on communities of practice (Lave & Wenger, 1991; Wenger, 1998), by specifying peer-mentoring as a method of engagement for solvers engaged in problem solving in virtual networks.

7.3.3 Developing a shared context through posts

There is evidence that in virtual networks a shared context in problem solving can be established. For example, in the TSQL forum, Heffreyi8 is a one-time poster to the forum. In the following excerpt, he originally thinks that he is having a problem storing both English and Arabic text into his database as seen in the forum thread below. Through the course of the conversation, however, other members realise that the actual problem is with the design of his application and not database storage. This becomes apparent as the thread participants gain insight into Heffreyi8’s experience and specific situation – the context of his problem. Heffreyi8 posts:
After some discussion among participants and more code snippets from Heffrey18, Ecriss46 changes the course of problem solving in the thread as seen in the following forum thread. Ecriss46 is an MVP, a frequent poster and frequent contributor. Ecriss46 realises that Heffrey18’s code is in fact correct and the error is actually in how his application is using it:

**Forum Thread 7.24 Response (Ecriss46)**

Ecriss46’s response changes the problem solving discussion from storing Arabic characters to properly using *stored procedures* (i.e., database programs written in TSQL) within a software application. As he states in his post, this realisation occurred to Ecriss46 after seeing that other participants in the discussion were able to successfully run the Heffrey18’s code snippets. Ecriss46, because of his high level of TSQL experience, recognises that the error is in Heffrey18’s use of the stored procedure. Heffrey18 follows by admitting, “Yes, I am running it from a stored procedure”.

Ecriss46 concludes the thread with a final piece of advice based on his interpretation of Heffrey18’s predicament. Ecriss46 explains that in order for hiba84 to understand the problem, Ecriss46 is not going to provide the solution:
Ecriss46 finishes the thread by offering advice on best programming practices and a hint on how hiba84 can solve the original problem. He does not give the solution (“I am not going to tell you...”), but does offer hints so the OP can learn a better approach to writing stored procedures.

In the space of 8 days and 13 posts, Ecriss46 is able to accurately assess the context of Heffrey18’s problem and offer a direction for a solution. They have no other interaction on the forum during this time. They do not work together and do not appear to know each other outside of this isolated interaction. Yet they can adequately understand each other’s point of view and discuss complex database concepts through small dialogs in English and TSQL code snippets. This example illustrates sharing tacit knowledge through technology-mediated communication. Therefore, the results of this study challenge the knowledge management literature (see section 2.2.1, page 30) which argues that face-to-face communication is required for tacit knowledge sharing (Bhatt, 2001; Lang, 2004).

The knowledge management literature stresses the importance of having shared context among individuals engaged in problem solving (see 2.2.3, page 37). When a solver is working through a complex problem, to interpret and understand what other developers are saying, the solver needs to know why others are presenting their ideas in a certain way. Understanding the point of view or perhaps world view of other members of a problem solving discussion provides a concrete model or place for the more abstract concepts to be shared. The ambiguity which makes tacit knowledge difficult to share does not disappear with a shared context, but if there is enough shared understanding, it at least does not hinder communication and continued discussion. If discussing why
a query fails, knowing that the other discussion participants have seen similar situations and are familiar with the terminology, greatly narrows what must be explicitly articulated and explained (Augier et al., 2001; von Krogh et al., 2000).

7.3.4 Social connection through posting

Interview participant Josh has more public social connections within virtual networks than many of the other developers in the study. He describes how he publically connects to the virtual social network in the course of his own problem solving. When beginning to investigate problems, Josh, like the other interview participants, searches or goes directly to known sites (e.g., blogs or forums). As one of the few developers in the interviews study, however, who not only lurks, but posts (“I've responded to quite a few blogs with source code changes, patches and things like that, for problems.”), Josh describes what happens at the point of social connection:

“I don’t generally go out looking for questions to answer but [the site’s] format is such that if you're on one question, you're seeing ten other related questions down the side bar. So if one looks juicy or has the little icon that there has been no answer or not voted ‘good answer’, I'll jump on those if it looks like something I can help with.” (Josh - interview)

For Josh, there are not clear demarcations between giving and taking. While problem solving he makes a social connection to a network to lurk for solutions and ends up posting a solution to someone else’s problem:

“Most recently, there’s a new version of the software invalidator plug-in and it looked like the developer had blog postings about it, but hadn't posted anything about updating it, so I responded in his forum with ‘OK, here are the changes you need to make this compile into the 2008 version’. And then he subsequently posted a new blog post and gave me a shout-out and posted the code and everything...” (Josh - interview)

A shout out is a colloquialism, common in the United States, for acknowledging someone else’s contribution to your work. It can be a subtle nod or homage to another's influence in your work, which is typically done in film and video games (“Shout Out - Television Tropes & Idioms,” 2012) or a more visible “public expression of thanks or gratitude” (“shout-out,” 2012, para. 1).
In the following example, the discussion between Láenna48’s post and Shawn34 illustrates that a social connection with other network members can lead to access to network resources, as posited in the social capital literature (N. Lin, 2005). Over the course of 5 days, 5 members of the forum post 20 posts related to Láenna48’s problem.

The pattern of this thread is a good example of how the conversation evolves as members become motivated to engage more deeply in the problem solving process, as illustrated in Figure 7.14 below (in chronological order of posts from bottom to top).

This thread discussion is organised into segments, labelled (a) through (f):

(a) **OP**: Láenna48 posts a question about forced parallel plans

(b) **Conceptual discussion**: Several forum members respond with different approaches to the theoretical problem. The conversation remains abstract. This study refers to high level discussion and theoretical explanations (as opposed to just code snippets) as conceptual discussion.

(c) **Change in conversation**: Shawn34 directly asks Láenna48 to provide more detailed information about his problem. The conversation becomes more specific. When the nature or style of the thread posts changes, this study refers to this behaviour as a change in conversation.

(d) **Intense problem solving**: Shawn34 and Láenna48 engage in intense problem solving with increased familiarity. This study refers to threads which involve nearly synchronous communication, and specific and directed questions and responses as exhibiting intense problem solving behaviours.

(e) **Increased engagement**: Shawn34 discovers that he shares common interests and background with Láenna48 and becomes more engaged in the thread. When a thread transitions from containing mostly single suggestions from a number of different members to a back-and-forth series of exchanges between a few members, the study refers to this change as increased engagement.

(f) **Stronger social connection**: Láenna48 thanks Shawn34 for the problem solving help and recognises their common background. The social media literature characterises increases in bases of connection as an indication of strong ties
(Ellison et al., 2011; Haythornthwaite, 2005; R. Leonard & Onyx, 2003), which lead to a *stronger social connection* between members.

Figure 7.14 Social network graph of Láenna48’s thread

We will now look at each in turn.

**SEGMENT (A) OP**

The OP, Láenna48, posts a question. He opens the thread with an abstracted question about how to improve the speed of his complex database query. He provides pseudo code and a brief description of his problem. The discussion remains at a theoretical level with the focus on general SQL practices related to the issue and not on his specific problem:
Forum Thread 7.26 Segment (a) original post (Láenna48)

Posing the question as a conceptual discussion (as opposed to specific problem with a piece of code), invites more high-level responses. One interpretation of why Láenna48 begins the thread this way, is that he is looking for different approaches to problem solving instead of an answer to his specific problem. This would indicate that he believes that the most effective and efficient use of forum resources is as problem solving guidance.

**SEGMENT (B) CONCEPTUAL DISCUSSION**

The original post generates four streams (see Figure 7.14, page 284). Three terminate quickly and one leads to a more in-depth discussion. Since the OP does not provide the actual code snippets, the conversation remains abstract and no specific solutions are offered, only general hints. The language use in this part of the thread is impersonal and brief. There are no salutations or pleasantries. The posts in this section have concise narrative suggestions, small snippets of pseudo code with a brief narrative, or have links to other forums and blogs which connect forum members to external networks (i.e., bridges between social networks). This is illustrated in the thread conversation in Figure 7.15:
In the segment above, Arol2 offers a quick suggestion of TVF instead of UDF functions. Láenna48 has an equally brief directed reply explaining why he cannot use the suggested TVF functions. These exchanges form a pattern of communication norms used within the forum network. These social norms are discussed further in section 8.2 (see page 296).

SEGMENT (C) CHANGE IN CONVERSATION

There is a pivotal moment in the thread conversation when the engagement between the two of the members changes. In post “11” frequent poster Shawn34 directly asks Láenna48 to provide more detailed information about his problem and the conversation becomes more specific, “Laszlo, [technical discussion deleted] For quicker assistance, can you post your script?”

There are two characteristics of change in this post (i) familiarity and (2) level of engagement. The first is that Shawn34 uses Láenna48’s name as a salutation. This indicates that he is speaking directly to him and with more familiarity than seen earlier in the thread. The second is that Shawn34 asked for more involvement in the problem solving process by asking him to “post your script” and provide more information. This was a turning point in the thread and the problem solving which became more intense for the remainder of the thread conversation. This initiates a change in the trust they share. It has developed from a technical trust of the information (i.e., trust of knowledge
as object) to a trust in each other as forum members who can share important information (i.e., social trust of knowledge as process/relationship). As discussed in relation to lurkers (see section 6.3, page 230), solvers use different aspects of trust to gain access to embedded resources. For example, Josh (see page 231), explains that trust was not necessary; network reputation was a reflection of the quality of the knowledge objects (e.g., code snippets) he used in problem solving. At the other end of the trust continuum, Alfonso (see page 234), describes having trust in an expert member of the network. The trust in the individual is from a stronger relationship between the two (e.g., Alfonso is familiar with the expert). Similarly, in Segment (c) above, with changes in intensity of the social connection between Shawn34 and Láenna48, the virtual trust begins to resemble trust found in close-knit material networks.

**SEGMENT (D) INTENSE PROBLEM SOLVING**

Láenna48 responds to Shawn34’s request in post “12” with a code snippet and a more detailed description of his problem. It intensifies the problem solving because it allows the other forum members (and Shawn34 in particular) to see the actual code (and not a pseudo code abstraction) and put the problem in context. Additionally, it reveals the nature of Láenna48’s work by providing clues:

```
ALTER TABLE user_10090217400198_1_Match_0 ADD CONSTRAINT [dbo_user_10090217400198_1_Match_0] PRIMARY KEY
GO
-- 9/2/2010 5:40:21 PM
DECLARE @H Float = 0.000000000000001
-- ""BayesFactorX_MatchResources/PopulateInitialMatchTable.sql"" ...

INSERT [dbo].[user_10090217400198_1_Match_0] WITH (TABLOCKX)
```

**Forum Thread 7.27 Clues about astronomy in post “12” (Láenna48)**

Shawn34 continues to ask for more information and clarification throughout the next several threads. He is eager to provide more help, which is illustrated by requests such as “Can you provide [sample database tables] for population? Thanks.” Shawn34 later provides Láenna48 with a suggested solution (“I fixed up the sample and ran it.”) which represents a significant investment in development and testing for Shawn34. This
investment of time is an investment in the social network. As the social capital literature argues, investing resources (e.g., your time) in the social network strengthens ties (Bourdieu, 1986). In doing so, Shawn34 has embedded resources within the social network (e.g., developed and tested code) and provided access to those embedded resources by increasing the dimensions of social connection with Láenna48 (e.g., same nationality, common university experience, same language, same field of interest, etc.).

**SEGMENT (E) INCREASED ENGAGEMENT**

During the phase of intense problem solving, Shawn34 starts addressing Láenna48 by his first name only, thus strengthening the social connection through familiarity and engaging in the same social circles (Haythornthwaite, 2005; Putnam, 1995a, 2000). Additionally, once Shawn34 has the code snippet he can see that the SQL programming was for an astronomy database using statistical analysis to manipulate photographic data from the GALEX telescope. Shawn34’s posts demonstrate he is comfortable enough with this problem-space to provide a working solution to the problem:

![Figure 7.16 Láenna48’s MSDN profile](image)

However, not all of the information Shawn34 has about Láenna48 could have been gathered from the thread. It appears that Shawn34 either views Láenna48’s profile or finds the information from another source and learns more about Láenna48 sometime before post “15”. In doing so, Shawn34 discovers similarities between the two and establishes a more heterogeneous relationship. In post “15” Shawn34 makes the comment, “Can you give us something we can test with? Pretty exciting stuff... BTW: I studied physics also at Eötvös University.” This comment reveals that Shawn34 sees a connection to Láenna48 through both shared university experience and the shared interest in astrophysics. After this revelation, Shawn34 continues investment in the problem by testing and correcting the sample code provided. The motivation for engaging in the thread is now less instrumental as they have increased the bases of connection. They now have a stronger connection, potentially longer-term relationship,
which can continue to develop and release embedded network resources. Moreover, with the increase in familiarity and bases of connection, their social connection moves from bridging to a relationship more characteristic of bonding.

**SEGMENT (F) STRONGER SOCIAL CONNECTION**

At the end of the thread, acknowledging that they are both from the same university, Láenna48 replies, “Köszí!” which is Hungarian for ‘thank you’. This reply acknowledges the investment Shawn34 made in the problem solving and demonstrates a closer relationship between the two members over the course of the problem solving experience on the thread.

The results of this study challenge the knowledge management literature which argues that technology-mediated interactions are only for explicit knowledge sharing (Bhatt, 2001; Lang, 2004). In fact, when sharing tacit knowledge during the problem solving process, study participants gain access to a range of embedded network resources, through face-to-face and technology-mediated communication, and strong and weak ties.

Through the forum observations, there is evidence of bonding and bridging social capital, but it is more difficult to identify bonding. In much of the social capital literature this is equated to the strong ties of families (Bourdieu, 1986; Coleman, 1988). At first glance it seems that this would not be seen in the forum, which brings together diverse individuals. Even the active members are from different countries and have different areas of expertise. Their relationships suggest they are co-workers rather than family members. There is, however, one aspect of the forum membership which is very homogeneous; they are all interested in database development. In fact, all of the threads are discussions about problem solving or some other aspects of SQL development. The forum threads were about SQL development in the workplace. It is difficult to judge the backgrounds of the lurkers, but for the active participants it is entirely a network of database developers. So even though they do not have the close ties of family members, there is some aspect of bonding social capital in this topic-based forum that provides benefit to members just by being part of the same profession. They have access to the resources of the network by virtue of their common SQL identity. These results confirm the social capital literature on bonding social capital which argues that network
members who have a common identity (e.g., close friends, co-workers, or team-mates) benefit from the stronger ties (Haythornthwaite, 2005; Putnam, 1995a, 2000).

Bridging social capital is much easier to identify in the forum. Frequent posters display evidence of bridging loosely-connected networks. Even though most of them do not work together or appear to be close friends, many of the participants do seem to know each other and are quite familiar with each other's work. In threads participants link to other forum members’ blogs and sites or cite their solutions. Infrequent posters and lurkers from disparate networks come together in the forum to access resources unavailable in other networks. The threads are filled with participants with different backgrounds and experiences offering advice and asking questions in an attempt to communally solve SQL-related problems.

In the social capital literature (material collectives), whether you build a robust relationship or how the relationship/connection develops, it is dependent on the norms and trust (Coleman, 1988). For example, are you the right sort of person? Do you know how to behave? Do you do an adequate amount of work? Do you dress appropriately? These are the behaviours associated with a particular social context. It is not only the individual assessing the potential of the social connection, but it is also the assessment of the individual by the other social connections (are you worthy of gaining access to our network resources?).

This research study argues that the resources used in the development of knowledge are in fact the network resources made available through the social connection. Put another way, virtual networks are primarily sources of bridging social capital for these programmer knowledge workers. The social capital literature suggests that both bridging (Burt, 2001; Granovetter, 1973) and bonding (Bourdieu, 1986; Coleman, 1988; Putnam, 2000) social connection connects members to embedded resources. This research study suggests that bridging social connection in particular helps solvers gain access to important problem solving resources in virtual networks by indicating the quality of resources (e.g., trust) and providing instruction of how to access the resources (e.g., tacit knowledge of the social rules of engagement).
7.4 Thematic summary of posting

Two key themes emerge which specifically connect to posting in virtual networks.

**Two dimensions of knowledge:** The study results support the knowledge management literature (see section 2.2.1, page 30) about the description of process and object knowledge. In the context of posting, solvers interactively create technical content (i.e., object knowledge), and technical and social interactions (i.e., process knowledge) by problem solving publically on threads. Both of these types of knowledge are then available to future solvers (e.g., lurkers) as thread artefacts.

**Bridging and bonding social connection:** The study results suggest that when solvers interactively engage by posting they are forming bridging and bonding social connections to virtual networks. In the social capital literature (see section 3.2.1, page 91) bridging is described as having generalised trust and weak ties whereas bonding is characterised by individual trust and strong ties. Posters’ social connection can change during the course of problem solving, moving from bridging to bonding, as they develop multiple bases of connection. Therefore, the study results indicate that, in addition to bridging social connection, bonding social connection can also be developed through technology-mediated engagement in virtual networks.

7.5 Reflexive summary of trust in problem solving

I found trying to develop an understanding of trust in virtual networks was one of the most challenging aspects of this research study. After the mixed results from the interviews, I entered the observation phase unsure of what I would find, but confident that solvers did not assess and develop trust in each resource they encountered.

As the social capital literature suggests, trust is an important mechanism for dealing with complexity and the absence of trust can be problematic in forming ties and accessing resources. Trust allows individuals to interact with minimal analysis and interpretation of individual actions. For example, in a conversation, trust allows participants to easily and quickly speak because they can make assumptions about how the others will behave (fairly and without causing harm - according to norms). In the absence of trust, interaction would appear to be much less efficient because individuals would not be able to anticipate behaviours, but instead must wait and react to each
separately. This is not indicative of the patterns of behaviours observed online. In fact, responses in threads are often very fast even for an asynchronous environment.

In contrast, if the absence of trust is not valid, then complete trust needs to be considered. What if everything online is trusted? Trusting everything seems to be equally problematic. Not everything online is trustworthy, in fact, there are individuals and sites which are malicious and can cause harm to other. If that is true, then how can everything be trusted? Assuming trust does not imply that all information found online is correct or even helpful. It does not even really mean that we believe that all online resources are trustworthy (we know that they are not). Instead, it provides a starting point for network engagement. It suggests that solvers can anticipate how other network participants will behave (i.e., follow social norms) and they can assume that the interaction will be fair and not cause them any harm. There is an assumed presence of social trust. This interpretation is more consistent with this study’s results.

7.6 Conclusion

In this chapter the results addressing problem solving by actively engaging in online social networks were presented. This chapter described the following key results:

- Solvers connect to resources through social networks;
- Social network engagement constantly changes depending on current needs;
- Solvers convey complex concepts (tacit knowledge) through technology-mediated communication;
- Individuals perform different roles in different networks (frequent poster, infrequent poster, newbie, lurker, network-bridge, etc);
- Solvers use technology-mediated communication to serve many purposes: information exchange, complex/conceptual discussions, context-sharing, establishing role within network, impression management/identity signals, etc;
- Solvers develop the strength of their network relationships (bonded, strong/weak/latent ties) in relation to their needs and motivations (task, reputation, etc).
The results presented in this chapter indicate that in relation to Research Question 2, how tacit knowledge development instructs individuals on the process as well as content of resources external to the organisation, that when lurking does not meet problem solving needs, solvers publically post in virtual networks. Posting allows solvers to access embedded resources and also creates resources which are available to future solvers. Posting typically occurs after formal organisational resources (see Chapter 5) and lurking for new virtual resources (see Chapter 6) have been exhausted. Instrumental motivations prompt solvers to post questions. They then engage in problem solving by responding to thread suggestions and comments from other network members. Only a small cluster of very active frequent posters develop the stronger ties of bonded social connection.

The results challenge the knowledge management literature which argues that in communities of practice, such as the virtual networks observed in this study, members seek out expert-mentoring from more experienced members (Lave & Wenger, 1991; Wenger, 1998). The forum observations revealed that the help offered is more accurately described as peer-mentoring because members of all levels of expertise engage in problem solving on forum threads.

Now that solvers are lurking or publically engaging by posting in virtual networks, we must explore how solvers gain access to embedded resources through social connection. The following chapter investigates the social dimensions of accessing network resources along a continuum of adherence to resistance of social norms.
8 Social dimensions of accessing resources

8.1 Introduction
In the previous chapter, results were presented on how solvers publically engage in virtual networks by posting questions and interacting with other network members on threads. The results described how through posting on threads, solvers can use technology-mediated communication in order to explain their problems, develop a shared context with other network members, and ultimately solve their problems. This is done through the help of both very active frequent posters who offer expert-mentoring and through the general network membership which includes infrequent posters who can peer-mentor solvers. The two previous chapters, on lurking and posting, describe how solvers engage in problem solving in virtual networks. Whilst these chapters introduce the concept of social connection, they do not explain how social connection enables access to embedded network resources. In order to explain resource access in virtual networks, the aim of this final results-based chapter is to discuss study results which explain how solvers gain access to resources through the social dimensions of engagement in virtual networks. The chapter structure is illustrated in Figure 8.1.

Figure 8.1 Resource access in virtual networks (structure of chapter eight)
The chapter is organised into three sections: how resources are accessed through compliance with social norms; how resources are excluded through resistance to social norms; and the consequences of positive deviance in resource access. The chapter concludes with a summary of the themes associated with this chapter and a reflexive summary.

The first section of this chapter begins with a discussion on how members engage in virtual networks. Engagement in social networks is governed by social rules, such as how to communicate, and behavioural expectations. It is important to understand the rules of network engagement because, according to social capital literature (see section 3.5.1, page 114), it is through compliance with social norms that network members gain access to embedded resources (N. Lin, 2005). Therefore, this section explores how adherence to social norms allows solvers access to problem solving resources. It specifically addresses Research Question 3, *how do individuals gain access to problem solving resources through social connection?*

Not all network members, however, comply with expected behaviours. There is also resistance to social norms within virtual networks. The second section explores the nature of these resistance behaviours and the resultant effect resistance has on exclusion from network resources. The section examines resource access through the lens of social capital to investigate how trust and knowledge of how to engage helps solvers gain access to embedded resources.

The study results indicate that when network members deviate from expected behaviour, there can be negative consequences. There are, however, some categories of behaviours which have a more complex role within virtual networks. The third section takes a different approach to resource access by exploring the resistant behaviours which have positive consequences for the virtual network. The behaviours are referred to in this study as *positive deviance* and include: lawful stupid, self-defenders, and enforcers.

The fourth section then discusses the themes which emerged from the analysis of the results: trust in loosely-connected virtual networks; the role of tacit knowledge in resource access; and positive deviance in virtual networks.

The final section is a reflexive discussion of the challenges of researching social norms and deviance in virtual networks.
8.2 Resource access through social norm compliance

The previous chapters on lurking and posting described how solvers engage with virtual networks and the types of resources embedded within those networks. The results of this study suggest that the problem solving resources embedded within virtual networks are knowledge resources. The nature of these knowledge resources align with the knowledge management literature which describes knowledge as having two dimensions; process and object. The object knowledge in this study is the content of the online sites and consists of information posted in threads. The process knowledge in this study is characterised as either technical (e.g., software development processes) or social (e.g., how to behave within the virtual network). The process knowledge is contained as artefacts of social and technical interaction in thread posts.

This section explores the expected behaviours (i.e., social norms or rules of engagement) found in problem solving within virtual networks and how compliance to those norms of behaviour allows access to embedded knowledge resources.

8.2.1 Resource access through lurking

In Chapter 6, lurking was described as an independent activity for problem solvers. Chapter 7 then discussed how solvers use lurking as both a predecessor to and integrated with posting. For the basis of the discussion on resource access, this section treats lurking as predecessor to posting. In practice, as discussed in the previous chapters, the relationship between lurking and posting is much more complex, but in order to focus on the social dimensions of resource access, this simplified approach is used.

Resource access through social connection has also been introduced in previous chapters. Therefore, this section focuses on how resource access occurs through trust and the development of tacit knowledge when lurking. This relationship is illustrated in Figure 8.2.
Figure 8.2 Relationship between lurking and resource access

Figure 8.2 illustrates a simplified explanation of the progression from initiating a lurking problem solving experience in a virtual network through gaining access to the embedded resources. It does not represent all of the complexity of lurking or all of the permutations, instead the illustration provides an abstraction of the lurking process. In between each stage are numbered transitions, which are network behaviours seen from the lurker’s perspective:

1) **Observation of network behaviours**: In the first transition, the lurker observes how network members behave while engaged in problem solving. During this observation they can determine if network members generally follow the rules of engagement. For example, reflecting on Alfonso’s (see page 226) comments on posters who were not reading OP questions properly, it is evident that through lurking he learns if network members follow the rules of engagement (e.g., stay on topic, read carefully, etc.).

2) **Development of trust**: In the second, the lurker develops a generalised trust of the network by observing that members follow expected rules of behaviour. This trust is significant because without a generalised trust of the network, solvers would not trust the embedded resources. For example, Conan describes situations when he has not developed trust so he will not use the virtual network’s resources.

3) **Active observation**: In the third, the lurker actively observes network engagement. Through observation, the solver develops a tacit knowledge of the rules of engagement. For lurkers, developing this tacit knowledge (i.e., process knowledge) allows them to interpret the engagement and gives meaning to the embedded information (i.e., content knowledge).

4) **Application of resources**: In the final transition, the lurker, now equipped with both a trust of the resources and the tacit knowledge of how to interpret them, can apply the resources to their specific problems.
The progression above explains how resources are accessed during lurking through developing a generalised trust in the network and learning the tacit knowledge of how to interpret resources (as opposed to tacit knowledge of how to engage in the network which is discussed in the following sections on posting). Continuing with the premise that lurking precedes posting, now we need to explore how resources are accessed after lurking during posting.

8.2.2 Posting questions

The previous section explained how resources are accessed through lurking. This section continues that discussion by describing post-lurking resource access through posting. Chapter 7 presented examples of forum members engaged in problem solving (see examples in section 7.3.1, page 262 and section 7.3.4, page 282). This section highlights specific behaviours identified as communication norms. These norms are discussed in order to explore how conforming to engagement rules leads to resource access through trust and tacit knowledge development. This section examines OPs posting questions, the rules of formal and informal communication, communication-through-code (e.g., code snippets and pseudo code), and providing background and contextual information on the nature of the problem are explored. The study results suggest that when other network members post responses resulting in an active discussion with specific responses to problem solving needs, this active problem solving within the thread is an indication that norms are being followed and resources are being created and shared.

Solvers who cannot locate problem solving resources through lurking post questions on threads. There are expected behaviours for solvers when posting a question. The following example illustrates the expectations on the formality of language used. The original post has both formal and informal characteristics. For example, forum OP Subhas35’s post is similar to an email you might receive in an organisational setting. It has aspects of more formal professional correspondence while also using informal conventions.
There are several indications of more formal communication in this post. The salutation “hello” signals to forum participants (and potential thread participants) that he is welcoming them to read (and hopefully help solve) his problem. The problem statement, “I have a fairly complex ...” uses standard capitalisation, grammar, and punctuation. Providing a code snippet demonstrates his programming skills (he is using advanced concepts in his code snippet) and his programming style (he has well-formed syntax, illustrated by his capitalisation of keywords “SELECT” and using underscores to make column names more readable “new_Table”). By using a certain programming style, such as seen above, cues are giving to a forum member's programming experience. This, in turn, shows other members the technical level responses should use (e.g., simple explanations for beginners, with links to programming basics or more complex theoretical advice to members with more programming experience).

There is also an informal side to his post. The final sentence has relaxed punctuation “...” and capitalisation “but that did not work”. He also includes thoughts in parenthesis after the problem statement “(probably didn’t work because...)”. This is a way of providing context to text-based conversations so the descriptive narrative is kept separate from the analysis or point of view captured in the parenthesis. By observing and interpreting technical language use, forum members are developing tacit knowledge of how to engage in the forum.

The post is proposed and then unproposed as the answer, indicating that one member believes it to answer the OP question and another does not. Forum frequent poster, Aerie3, provides advice for the OP to slightly alter his original code.
Forum Thread 8.2 Proposed and unproposed as answered (Aerie3)

Aerie3 gives the OP advice to “Try like this” without making demands or judgement about the OP’s code. The narrative is very brief and most of the information is communicated through the code snippet. Nancy30, another frequent poster, marks the post as “Proposed as Answered”. Most participants would have to use this as an indicator that they think the OP’s original problem has been solved. Nancy30, however is a Moderator on the forum and could “Mark as Answered”, but proposes as a suggestion or question rather than a statement that the post does in fact provide an answer. The difference is subtle, but proposing is a milder action than essentially overriding the OP and marking it as answered.

One interpretation of this behaviour is that Nancy30 is encouraging the OP to decide the course of action in this thread. If this is the case, then Nancy30 is subtly conveying social rules on how the OP should engage in problem solving in the forum. It suggests that while the forum can provide help, advice, and guidance, the responsibility for directing the problem solving process lies with the OP. This is important because by learning the tacit rules of the forum, OPs can gain access to resources, such as if an OP accepts a proposed solution it signals that the problem has been solved and additional posts are not required. Alternatively, if the OP unproposes, then it indicates that more problem solving help is needed.

The most prevalent behavioural expectations within virtual networks are rules about communication, such as how to ask a question, how to respond in a discussion, and so forth. Consider a discussion on why a query fails. Knowing that the other discussion participants have seen similar situations and are familiar with the terminology greatly narrows what must be explicitly articulated and explained. In the following forum thread, Kat20 posts pseudo code which Ave1 correctly interprets (based on his familiarity with Kat20) and posts the equivalent code snippet:
Forum Thread 8.3 Pseudo code used in conversation (Kat20)

Forum Thread 8.4 Response to the pseudo code post (Ave1)

Forum Thread 8.5 Acknowledgement of sharing complex (tacit) knowledge (Kat20)

Ave1 is able to correctly translate Kat20’s pseudo code into a real code snippet because, as Kat20 states, “exactly what I was thinking”. The familiarity between the two forum members can also be seen in Kat20’s friendly statement, “Thank you for picking me up”.67

The knowledge management literature (see section 2.2.1, page 30) argues that due to the difficulty of articulating and sharing tacit knowledge, individuals sharing complex ideas must understand not only the what of others’ words, but also the why (Connell et al., 2003; Nonaka, 1994; Taylor, 2007). When a developer is working through a complex problem, to interpret and understand what other developers are saying, individuals need to know why others are presenting their ideas in a certain way. Understanding the point of view or perhaps world view of other members of a problem solving discussion provides a concrete model or place for the more abstract concepts to live. The ambiguity which makes tacit knowledge difficult to share does not disappear with context, but if there is enough shared understanding, it at least does not hinder communication and continued discussion. The results of this study support the knowledge management literature (Bennet & Bennet, 2007; Nonaka et al., 2000) that solvers use a common context to share tacit knowledge. Significantly, the study results show that shared context can be developed through technology-mediated communication. Therefore, these results also challenge the knowledge management literature (Bhatt, 2001; Lang,

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67 Picking up means to cheer a person up or make him/her happy (YourDictionary, 2012).
which argues that shared context is only developed through face-to-face engagement.

8.2.3 Responding to posts

This section, focussed on forum members responding to OP questions, explores links to external resources, narrative explanations, acknowledging help, and code-to-code communication. The study suggests that when problem solving progresses, it is an indication of norm compliance.

LINKS TO EXTERNAL RESOURCES

Links to external resources included in forum posts point to sites outside of the forum. The forum serves as a mechanism for conversations focussed on problem solving. As seen in the discussion on active observation in lurking (see section 6.2.1, page 220), external links can introduce alternative views, novel ideas, or well-documented concepts to use in problem solving, as illustrated in the thread below:

Forum Thread 8.6 External links in a thread post (Ave1)

Sometimes the entirety of the problem solving takes place within the thread. Sometimes external resources are references, such as links to blog posts or other forum threads. Usually links provide more detailed technical explanations that would be considered too long for a forum post. By providing links to external information, Ave1 is conveying norms of problem solving in the forum. This is tacit knowledge about how to interpret links included on posts. It helps the OP understand how to engage in problem solving, by indicating that external links should be followed and read as part of the problem solving process.

CODE-TO-CODE COMMUNICATION

Code-to-code communication is succinct communication (often using only code snippets). For example, in the following forum thread, all three of these behaviours are
evident. In the first example, (a) the OP, Aolqeen4, uses a code snippet to explain his problem. The conversation begins with Aolqeen4’s post:

```
update #dates_final_TEMP
set #dates_final_TEMP.division = INFORMATION.dbo.Specify.DIVISION
from #dates_final_TEMP t2
inner
join INFORMATION.dbo.Specify t1
on t2.ConsultantSpeciality = t1.SPECNAME

I can't get this to compile correctly, i get the following error message

"The multi-part identifier "INFORMATION.dbo.Specify.DIVISION" could not be bound"
```

Forum Thread 8.7 Code-to-code OP (Aolqeen4)

There are very few words of narrative in the conversation other than Aolqeen4’s request, (b) “I can’t get this to compile correctly...” and Mete28’s response, (c) “If you have declared the alias names to tables, use them”. Yet, the original code conveyed enough information and context of the problem to get a response.

```
update t2
set t2.division = t1.division
from #dates_final_TEMP t2
inner
join INFORMATION.dbo.Specify t1
on t2.ConsultantSpeciality = t1.SPECNAME
```

Forum Thread 8.8 Code-to-code response (Mete28)

The first response, (d) is also in the form of a code snippet from Mete28, who updates the original snippet with the correct syntax. The code in that response, (e) provided enough of a solution to be marked as Answered, which is an indication of the helpfulness of the post.

```
update t2
set t2.division = t1.division
from #dates_final_TEMP t2
inner
join INFORMATION.dbo.Specify t1
on t2.ConsultantSpeciality = t1.SPECNAME
```

Marked As Answer by, Friday, June 19, 2009 11:41 AM

There are instances of norm enforcement in code-to-code communication. For example, in the following thread frequent poster CC8, chastises infrequent poster Toofer40 for not providing the correct type of code:
Forum Thread 8.9 Code should be in standard SQL (CC8)

CC8 emphasises the importance of adhering to social norms of communication, which he makes explicit in his post (“Code should be in Standard SQL as much as possible and not local dialect...”). CC8 provides reasons for these communication norms (“In short this is pretty messy and I cannot figure out what you are trying to do.”). By explicitly expressing forum communication norms, CC8 signals how to engage in threads in order to locate problem solving resources. In other words, solvers must provide clearly expressed questions in order for other forum members to provide suggested solutions (i.e., create knowledge resources).

PROVIDING NARRATIVE EXPLANATION

Narrative explanations are typically given as suggestions or advice without judgement. The second example follows later in the same thread discussion. Mete28 gives advice to Aolqeen4. The narrative is terse, which is common in thread discussions, however, it is not a mandate but rather a suggestion or offering of help. Mete28, a moderator on the forum and active participant in thread discussions, posts:

Forum Thread 8.10 Providing a suggestion to the OP (Mete28)
Forum Thread 8.11 Professional demeanour (Aolqeen4)

Initially, Mete28's post to Aolqeen4 is quite blunt, responding “I must tell you, you are following a very very wrong practise…” It is clear from this post that Mete28 believes that Aolqeen4 is not adhering to programming best practices. He does not, however, rebuke this behaviour, instead Mete28 suggests, “To overcome this you can try...” This was a common pattern of communication in the forum for normal behaviours. Forum members would indicate that there were better solutions, but would suggest rather than dictate those solutions. The forum observations reveal many normative practices for communication. The OP, Aolqeen4, acknowledges and thanks Mete28 for his help on the thread:

It is common in threads with solutions to see comments similar to Aolqeen4’s post, “your solution..., this is what I need. Thanks”. He mentions Mete28 by name and recognises and thanks him for his problem solving efforts. Even though the language (grammar and spelling) is very informal, the message behind the narrative is professional and respectful. By communicating in this way, frequent poster Aolqeen4 is modelling expected behaviours to newbie forum members. Tacit knowledge is shared when more experienced network members demonstrate behavioural norms. This is an effective and efficient method of communicating norms within virtual networks.

8.2.4 Communicating through posts

In this section, focussed on communicating through posts, proposing/unproposing, marking/un-marking, voting as helpful, and marking as abuse are explored. The study suggests that by identifying the quality of resources, trust is established which in turn leads to resource access.

VOTING AS HELPFUL

Voting as helpful is used on the forum by individuals other than the OP to indicate that the post helped solve their problems. This can be used by both lurkers and posters. The
votes accumulate so the greater the number, the more individuals find it helpful. For example, the following post was voted as helpful by one member:

Forum Thread 8.12 Helpful post (CC8)

It is important to note that you must be registered on the site to vote as helpful. This means that if lurkers want to vote for a post, they must register and create a profile. This is another example of lurking as an active (as opposed to passive) activity. Lurkers are actively engaging with the virtual network, even if evidence of their presence is only seen through vote as helpful counts.

PROPOSING/UNPROPOSING

Proposing/unproposing a post as answered is used in the forum by individuals other than the OP to indicate that they think the post answers the OP’s original question. It is a communication directed at the OP and requires the OP to react to the suggestion. For example, in the following post:

Forum Thread 8.13 Proposing solution (Revon32 and Tray41)

In the post above, Revon32 (who contributed earlier in the thread) suggests that this post (by Ecriss46) is the solution to the OP’s problem. The OP agrees and marks it as answered. The OP, however, does not always agree with the suggestions:

8.14 OP Rejects unproposes solution

Just like the narrative and code snippets in posts, proposing and unproposing is another form of technology-mediated communication in the TSQL forum. Similarly, there are expectations for how to use propose/unpropose. The study results suggest that it is acceptable to disagree with a proposed solution, but when there is disagreement, members typically include a narrative comment explaining why they disagree with the
suggested “propose/unpropose” provided by another member. By following the social rules about the use of propose/unpropose, the members are providing valuable information back to the network. Proposing indicates that a specific post is a potential solution to the original problem. Lurkers and other forum members can interpret that a proposed solution on a post makes it a potential resource for them. They in turn will trust that they can use the information provided within the post. This trust is essential to gaining access to resources. These results support the social capital literature (see section 3.6.1, page 125) which indicate that social relations dependent on trust allow network members to access embedded resources (Bourdieu, 1986; N. Lin, 2005).

**MARKING/UNMARKING**

Marking/unmarking a post as answered is used in the forum by the OP (or special forum roles) to indicate that a post is an answer to the OP’s original question. When it is used by the OP, it reflects their feelings. For someone other than the OP, marking a post as answered indicates that they believe that it has contributed to solving the OP problem. There are no explicit rules regarding when to mark a post as answered except that only certain types of members can do so (the OP, Editors, Answerers, Moderators, etc.). The forum provides a FAQ (“TSQL Forum Help,” 2011) with the following statement:

*Why should I indicate a post answered my question?*  
When someone adds a post to a question you asked, you can rate this post as “the answer” to your question. By rating a post as “the answer”, you acknowledge the contribution of the person who posted the answer, help others find the answer quickly, and steer further discussions in the right direction.

**Figure 8.3 TSQL Forum FAQ**

This statement indicates that marking as answered not only provides recognition to those who contribute, but aids those searching for information and may also provide motivation for others to contribute in the future (having seen how badges are collected). Most of the signals for social norms concerning this functionality come from those who violate them. Active forum member Rick33 admonishes the OP for marking his/her own posts as the answer to the original problem:
Forum Thread 8.15 Explanation of marking rules (Rick33)

In response, the OP does not respond directly to Rick33’s post or follow his instructions. Instead, Shawn34 unmarks the posts and marks the post which (in his opinion) best answered the OP:

Forum Thread 8.16 Unmarked as answered (Shawn34)

Forum Thread 8.17 Marked as answered (Shawn34)

There can be conflict and disagreement about which post actually answered the original question. In the following exchange, there are several occurrences of marking/unmarking, proposing/un-proposing. Aleezza5 posts a suggestion which is marked as helpful by two members, but is ultimately unmarked as answered and unmarked as proposed by Shawn34:

Forum Thread 8.18 Communicating through marking posts (Aleezza5)

The example above illustrates the communication norms of using mark and un-mark in the forum. Marking communicates to the network that for this OP, the marked post answers the original question. This communicates important information to other forum members. To the other posters on the thread, it signals that the problem solving...
is complete and there is no need to continue posting. For lurkers, it helps them interpret the thread content for their own problem solving. This is a useful illustration of the importance of understanding communication norms in order to interpret knowledge resources.

8.2.5 Self-disclosure

This section explores the role of self-disclosure in gaining access to resources. It examines how forum members use profiles, signatures, and avatars to communicate information about themselves and their technical skills. For example, some posters use usernames which do not reveal their true (real life) identity:

Forum Thread 8.19 No identifying information provided (Hank15)

By not providing his/her true identity through an avatar, username, or signature, Hank15 makes it awkward for other posters to address the response by name:

Forum Thread 8.20 Referencing by username (Gretha13)

Different types of forum participants have different self-disclosure behaviours. As seen in the discussion on poster characteristics (see section 7.2, page 247), frequent posters tend to include more identifying information (e.g., real names and photos). On the other hand, infrequent posters tend to remain more anonymous. These identity cues are
important because they signal network familiarity to other members. Forum members learn from these cues how to interpret posts. For example, an OP might consider an external link presented in a frequent poster’s post more worthy of investigation because their experience in the forum (signalled from their signature, avatar, etc.), indicates that they are familiar with other forum threads and know of relevant external resources.

In summary, during posting solvers gain access to embedded network resources through trust in network engagement and the tacit knowledge of how to engage. Like the relationship between lurkers and resource access, resources are released during posting through trust and tacit knowledge development. This relationship is illustrated in Figure 8.4.

![Figure 8.4 Relationship between posting and resource access](image)

(1) Original post (OP): In the first transition, the solver posts a question, initiating a thread conversation. Through posting, the solver develops and applies a tacit knowledge of the rules of engagement. For posters, developing this tacit knowledge (i.e., process knowledge) allows them to learn how to engage with the virtual network through socialisation.

(2) Solver complies with norms: In the second step, the solver complies with network social norms. Through norm compliance the poster is able to engage with other network in expected ways. The solver reacts to other member posts in a manner that continues the problem solving process.

(3) Individual network members comply with norms: In the third step, solver is able to continue problem solving because the other network members engaging on the OP are behaving in expected ways.

(4) Applying resources to the problem: In the final step, posters now equipped with a trust of the resources and the tacit knowledge of how to interpret them (from lurking),
and the tacit knowledge of how to engage so resources are created and communicated, can apply the resources to their specific problems.

This progression above explains how resources are accessed during posting through developing a tacit knowledge of how to engage with the network. The results of this study suggest that tacit knowledge development in virtual networks enables access to embedded resources. The results support the knowledge management literature which indicate tacit knowledge is shared through socialisation (Nonaka et al., 2000; Nonaka & von Krogh, 2009; Nonaka, 1994) and the social capital literature which argues that tacit knowledge of social norms enable network members to access resources through adhering to expected behaviour (Portes, 1998; Wiener, 1982).

### 8.3 Resource exclusion through resistance to social norms

This section explores the expected behaviours found in virtual networks and how resistance to those norms of behaviour excludes solvers’ access to embedded resources.

#### 8.3.1 Exclusion through solver resistance

Interview participants describe situations in which they do not conform to the social rules of the online sites where they problem solve. There can be many reasons for not adhering to the rules, including a reluctance to publically engage. Margaret admits that she feels she should more interactively engage in social networks outside of her organisation:

"I am really **not** a good participator. It’s terrible... I’m hoping I’ll be willing to post some replies if some questions come that I can help with... I don’t tend to post questions or really reply to things. **I think that is part of the expectation of me being in the group**, so I’ll need to grow a little bit, to figure out how to do that better." (Margaret - interview)

Her response indicates that she perceives her lurking behaviour, in this situation, as anti-normative when there is an expectation in the network that members will interactively engage.
Shyness, insecurity, and lacking of confidence are also reasons for not participating when it is expected. Some solvers will not post, even when they feel they should and have a potential solution because they worry there will be a negative response from the network if their post is without value (e.g., incorrect suggestions or not enough novelty or originality in their ideas). Avery worries about the value of her contribution, she reflects:

“It probably would help me [to post more]. I’m just shy about that kind of stuff I don’t want to be wrong. I don’t want to say, ’listen to this’ and then go ‘Oh crap, way off.’” (Avery - interview)

There are social norms within the forum which dictate how members should engage. In the forum, members are encouraged to communicate with code snippets. When solvers are reluctant to provide code, it challenges the social norms and can create conflict. In the thread below, Nancy30 is discussing a problem presented by OP, TLutz42. After several attempts to work through the problem, Nancy30 finally makes a direct request for a code snippet:

Forum Thread 8.21 Direct request (Nancy30)

Nancy30 stresses that it is difficult for members to help others without seeing some code. Her explanation makes explicit the social rules of asking for help on the forum. As response, TLutz42 reluctantly provides a code snippet:

Forum Thread 8.22 Reluctant response (TLutz42)

It is clear from the posts above that TLutz42 is nervous about being judged on the quality of his code, so he uses narrative and pseudo code instead. The forum social norms, however, favour using real code that can be run and tested, so TLutz42 eventually complies.
The forum observations reveal situations when forum members resist adhering to social norms. In the forum, communication is written and frequently contains a mix of technical language and code snippets. It is common for members discussing a thread question to try out code in their own environments to ensure that it is correct. When an OP provides structure, code and sample data it is easier (and more efficient) for those responding to the question. Moreover, for developers it may be easier to recognise the purpose (and constraints) of a problem when code is provided.

Does informality indicate that there are no rules for communication? The forum threads provide the means of engagement with technical concepts either through posting or reading. The official language of the threads is English, however, members have varying degrees of proficiency with English, so the threads are written in a combination of formal English, “texting” English and code. It can be seen, however, that the communication norms within the forum dictate a certain level of formality.

For example in the following post, Rick33 is scolded by Shawn34 and Nancy30 for using too informal language:

Forum Thread 8.23 Too informal communication (Rick33)

Of particular interest, in the example above, is that all three members are very active and frequent posters in the forum. They interact on many threads and are familiar with each other’s contributions to the forum. It is common for active posters to enforce social norms with newbies and infrequent poster, but as seen in the thread above, even established forum members need clarity on the social rules.
In the thread above, Rick33 accepts that he has violated the rules and commits to try following them in the future (“Will try to do…”). In contrast, in the example below, the OP is more resistant to following the social norms. The violation occurs when the OP, Su36, is slow to provide more complete information which would be helpful to those responding to the thread. He provides very few code snippets and several of the responders ask questions in an attempt to get the kind of information that is typically provided by OPs in the forum:

Forum Thread 8.25 Too little information provided (Rick33)
Finally one of the posters gets frustrated with the OP behaviour and attempts to correct it with an admonishment:

Forum Thread 8.26 Admonishment for not providing enough information (Ecriss46)
In the response above, Ecriss46 points out several problems with the OP’s behaviour and the effect this has on the forum:
- The OP has not provided enough information which means that the other members will not be able to provide the best suggestions for the problem (“[what you have presented is really just a guessing game]”);
- The OP has not been active enough in his participation in finding a solution (“you may have to get your hand dirty...you seem to have opted for the armchair solution”);
- The other members have not been utilised efficiently and it will take them longer to help the OP find a solution (“you can wait to find the problem...it is not necessarily the most efficient solution”).

The study results indicate that there is an expectation within the forum that OPs will provide enough background information about their problem to enable other members to help them. This expected behaviour encourages a more efficient use of resources (e.g., member’s time) because those who provide help are not spending time trying to fill-in-the-blanks of the missing information. Complying with these expectations allows for more efficient creation of network resources (e.g., suggested solutions on posts).

The OP, Su36, defends his behaviour by responding that he is doing exactly what the other thread responses recommended (and has not violated the social norms):

Forum Thread 8.27 Defence of behaviour (Su36)

In the thread above, Su36 explains that he has in fact been actively engaged in the problem solving outside of the forum thread. He stresses that this work he did before posting his original question was appropriate so he can benefit from the collective experience in the forum (“Many people in here have experienced the ‘gotcha’s’ thus saving [me] tons of time”).

In the final post, Ecriss46 continues to argue that Su36’s refusal to provide complete information is indeed a violation of the social rules of the forum:
As Ecriss46 explains, the problem with Su36 holding back information and not presenting it in the thread for all to see is that it not only makes it more difficult for others to help him, but ultimately it may not even answer his problem at all (“It is a little bit devilish, because even if you don’t get the error [after applying one of the forum solutions], you cannot conclude that you have taken out the problematic data or code”).

In the following post, Rick33 chastises another forum participant for not adhering to the social norms of the forum:

There is an expectation that solvers will actively engage in their own problem solving when using forum resources (e.g., other members’ time and knowledge). In the post above, Rick33 explains that he is disappointed that the OP has posted a question without trying to actively engage and solve the problem. Instead the OP has waited for other forum members to solve it for him in order to “save time” (the OP’s time presumably). By condemning this behaviour, Rick33 is making explicit a forum norm of active engagement in problem solving. It is understood from his statements that if an OP posts a question to the forum, then there are expectations that the OP is actively trying out and providing feedback on suggestions instead of just waiting for a forum member to solve it for him/her.

It can also be difficult for solvers to learn and adhere to the social norms of different social networks. Solvers may engage in many different social networks while problem solving. Particularly, for employees of organisations with co-workers involved in the same work, there may be overlapping social networks of organisational, professional and virtual domains. This can present conflicts and tensions between social networks when individuals are motivated to participate in online networks and contribute to
discussions, but because of their obligations to their organisational networks they feel they cannot make the investment. For instance, if a solver *does* provide detailed information about a problem, it may reveal sensitive or confidential information about the organisation. Alternatively, if a solver *refuses* to provide code, then solver may not receive help because other virtual network members find it inefficient spending the time trying to understand a partially specified problem in order to provide help.

In this sense, even though solvers may be excluded from gaining access to resources through norm violation, some still resist adhering to those norms. Some of the reasons for failing to adhere to social norms include: discomfort and inability to abide by the rules, not knowing or confusion about the rules, or disagreeing with the validity of the rules. In this section, we discussed when *solvers* violate social rules and the effect it has on their ability to access network resources. In the following section, we will examine when *other network members* exhibit deviance which prevents network resources from being created or released.

### 8.3.2 Exclusion through network member resistance

There are specific behaviours that demonstrate network deviance. Encountering these behaviours can cause solvers to lose trust in the network and exclude solvers from network resources (through lack of participation). From the solver’s perspective, network deviance can prevent access to resources that are only available through interactive engagement, as seen in the previous section. Another barrier to participation is the behaviour of other network participants. Eddie explains that he may require feedback on a specific problem of his, but cannot gain access to that resource because he is afraid to encounter network deviance that he has witnessed before (as a lurker):

> “Yeah and I think [the reason I do not post] is more my level of comfort right now. I don’t feel I know the jargon as well as people I work with... I mean I see some responsive people who are kind of mean, I *don’t like it when people are mean* *(laughs).*” *(Eddie - interview)*

In order to work effectively, online social networks are dependent on members adhering to social norms. Most of the interaction between forum participants follows a common
pattern of behaviour. Typical forum behaviours include: professional interactions, succinct communication (often using only code snippets), and providing advice without judgement. Additionally, within the cluster of very active members there is: praise, direct communication, pleasantries, giving credit to each other, and cross-referencing personal blogs or other threads within the forum.

Occasionally, the social norms are violated. In one forum thread, a member tells a fellow member, CC8: “CC8 you are honestly the biggest a-hole moron on the internet”. The forum member’s language is not typical of forum engagement, where members usually refrain from name calling. Most forum members adhere to social norms, although some deviance is evident, with a few members exhibiting extreme deviance, such as trolling. Trolling is when one network member attempts to embarrass others by creating a deceptive network identity, developing a social connection with them, luring them into a vulnerable situation, and then attacking them (Donath, 1999).

Although not common, there is some evidence of trolling within the forum. Suspected troll, SQLDon37, answers the OP with an extreme perspective on the nature of databases. It can be assumed that the OP is seeking a fairly simple and straight-forward definition of the two terms, but SQLDon37 uses the opportunity to promote his very strict (although technically correct) view on databases. The OP posts a simple question about two aspects of databases:

![Simple question on the difference between constraints and triggers in databases]

**Forum Thread 8.30 Newbie asking a basic question**

This is a common question for new database developers and has been heavily discussed in the forum. As forum member posts in his response: “Please keep in mind that the ‘Constraint vs. Trigger’ discussion will likely continue forever, and can become a religious debate”. The suspected troll, SQLDon37 responds with a technically accurate answer which would be very confusing to a novice database developer:
Forum Thread 8.31 An unnecessarily complicated response (SQLDon37)

The statement that SQLDon37 makes: “there are no triggers in a TRDBMS [database]”, is akin to being asked how many vegetables are in a bowl full of tomatoes and answering that there are no vegetables in the bowl because tomatoes are technically fruit. It is correct, but not helpful. An active member, Sonal38, recognises this and responds:

Forum Thread 8.32 Request to follow social norms (Sonal38)

Most of the other responses in the thread ignore SQLDon37’s comment and present appropriate suggestions on the differences between the two concepts. Active member, Bianc7, however, feels that it is important to name SQLDon37’s behaviour and reinforce the social norms of engagement within the forum:

Forum Thread 8.33 Don’t feed the trolls (Bianc7)

Bianc7’s final comment, “Don’t feed the trolls”\(^\text{68}\), is a request to fellow forum members to ignore SQLDon37’s comments and focus on the OP. Bianc7 characterises SQLDon37’s behaviour (“He doesn’t help the OP. He just uses it as a springboard for blathering about his comments”). This type of behaviour that Bianc7 describes is called hijacking in social media literature (see page 86) and is commonly employed by trolls. Hijacking is often explicitly mentioned as a deviant behaviour, as seen in the post below:

Forum Thread 8.34 Pointing out hijacking (Kat20)

\(^{68}\) Since trolls are attention-seeking, the phrase “Don’t feed the trolls” is commonly used in social media to remind members to ignore the troll and thus stop feeding the troll attention (RationalWiki, 2012).
The behaviours illustrated above are not common in forum thread discussions. In a typical thread, the focus of the posts is on the following topics:

- Solutions/suggestions for the OP problem/request;
- Questions/clarifications on the OP;
- A technical topic related to the OP;
- Best practices related to the OP.

When there is a violation, however, the focus of the subsequent responses to the post in question changes to the following topics:

- Comments on the post author (e.g., that was rude);
- Comments on the style or nature of the post (e.g., that does not answer the OP);
- Explicit rules of engagement (e.g., that is abuse, that is not how the forum works);
- Comments directed at the post author (e.g., you are awful);
- Corrective action/sanctions responses directed at the post author (e.g., you should stop doing that).

In summary, the reasons for being excluded from resources are: prevention of resource creation, failure to communicate resource knowledge to solver, and lack of trust in resources.

### 8.4 The consequences of positive deviance

Resistance to social norms was discussed in the previous section. This section focuses on groups of resistant behaviours referred to as deviance. The study results suggest that there are some forms of deviance which do not have only negative consequences, such as exclusion from social networks, but also have positive benefits. The study refers to this type of behaviour as positive deviance. Positive deviance is mildly deviant behaviour (as opposed to extreme deviance, such as trolling). It is negative behaviour which can have positive consequences for the social network, such as making social rules explicit. While most forum participants interact in pro-normative manners, deviance is also evident. The behaviours observed on the forum threads have been grouped into three types of positive deviance: lawful stupid, self-defenders, and enforcers.
8.4.1 Lawful stupid

Lawful stupid deviants criticise and personally attack newbies who fail to adhere to strict programming practices and standards. Lawful stupid deviants lose sight of the original OP question and present long off-topic (OT) diatribes without consideration to other points of view or to the potential damage to network ties. They strongly adhere to personal principles, even though it is often at the cost of social relationships.

The term lawful stupid is a trope derived from the role playing fantasy game Dungeons & Dragons (DnD). This term has been borrowed to describe behaviours that are similar to trolls and spammers, but with more honourable motivations. The term lawful stupid is actually a play on the character trait lawful good which is often associated with Paladin holy warriors (“Paladin,” 2005). They are characterised as lawful good because whenever they encounter evil agents they must act and attempt to destroy them, but only in a completely lawful manner. Often the evil characters, however, are much more powerful and by blindly following the rules, the outcomes end up quite damaging. In particular, they can end up hurting relationships between characters within the game. Often they end up compromising trust and future interactions between characters for the sake of following their ideology.

Lawful stupid forum members also demonstrate behaviours outside of the expected norms of behaviour for the group. Their posts, for instance, will denigrate others (usually the OP). They also speak in extremes or absolutes, such as “we always/never...” They are often rude and berate OPs for posting poor questions and having lesser programming skills. To clearly differentiate between the perceived lack of knowledge the OP has and the vast amounts of knowledge the lawful stupid possess, it is not uncommon to find them telling the OP to “read a book”, “visit a website”, “Google it”, or generally increase their knowledge before posting again. Often the book or website was developed by the lawful stupid.

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69 Linguistically, the word trope is a figure of speech (Oxford University Press, 2012). In social media, the word trope is a trope itself, meaning a cliché within popular culture (TV Tropes Foundation, LLC, 2012).

70 The Lawful Stupid trope is illustrated in a DnD-related web comic, The Order of the Stick. In the comic, one character condemns another: “Sure, you fight Evil, but when was the last time you showed a ‘concern for the dignity of sentient beings’? You’re just a mean, socially inept bully who hides behind a badge and her holier-than-thou morality as excuses to treat other people like crap” (“Lawful Stupid,” 2010).
In the forum, CC8 and his alleged alter-ego, SQLDon37, exhibit the most recognisable lawful stupid behaviours. Their intentions are to introduce proper programming standards into forum threads. In doing so, they depart from the social norms, however, when they personally attack other members, call them names and question their technical abilities. They berate and condescendingly communicate with the OP and the other thread contributors in a manner that demonstrates that either they do not recognise or they do not care to uphold the social norms concerning communication. This negative behaviour is often met with swift condemnation.

Lawful stupid deviants follow their own personal rules no matter what the cost to the social network. To SQLDon37, if the OP has violated a programming rule then he cannot help him solve the problem. The programming rules are more important than the social rules of the forum. In the example below, SQLDon37's first post is a condemnation of the way the OP is trying to solve his problem. Sqlguruu has answered the OP with an extreme perspective on the nature of databases. The OP is seeking a fairly simple and straight-forward definition of the two terms, but SQLDon37 uses the opportunity to promote his views on databases. In SQLDon37's view, he cannot help the OP with his problem because the OP has violated programming rules, so all he can do is point out the rule breaking (“not a universal magic number”). This is not well-received by other forum members:

Forum Thread 8.35 Berating the OP (SQLDon37)

In the post above, SQLDon37 belittles the OP by implying that he does not understand the fundamentals of database structure and believes it to be magic. Active forum member Bianc7 posts immediately after to defend the OP, by responding to SQLDon37 (although addressed to CC8 using his real first name):
Forum Thread 8.36 Reprimanding the offender (Bianc7)

In the post above, Bianc7 counters SQLDon37’s post by:

- Revealing that Bianc7 believes SQLDon37’s true identity to be CC8;
- Telling SQLDon37 that he is “bashing the user for being an idiot”;
- Commending SQLDon37 on his extensive knowledge (“You have a lot of knowledge, and I hope one day you put it to good use”);
- Reprimanding SQLDon37 publically (“Your posts are off-topic, borderline abusive, and misleading (to new posters)”).

In SQLDon37’s response to Bianc7 (although curiously also addressed to CC8), he argues that his response is appropriate and technically correct:

Forum Thread 8.37 Defending his post (SQLDon37)

In the response above, SQLDon37 explains that it is most important to give technically correct information. He provides a woodworking analogy and argues his answer (“I am the guy who replies with ‘Your question is bad. Don’t you know about screwdrivers?’”) is better than the approach that Bianc7 recommends (“Granite! Use big hunks of granite!”).
Moreover, he concludes by continuing the woodworking analogy and describing experience levels ("six years to become a Journeyman\footnote{In carpentry, as experience is gained and skills achieved, carpenters progress from apprentices to journeymen and finally to masters (United Brotherhood Of Carpenters, 2012).} Union Carpenter in New York State. Not Master, Journeyman"). Since SQLDon37 uses this statement to support his argument and condone his behaviours on the forum thread, it is interpreted to indicate that SQLDon37 considers that he is a master carpenter and has much more experience than the OP who is not even at a Journeyman level. Finally, Bianc7 responds:

\begin{quote}
In response to “are you really helping them when you say “Granite! Use big hunks of granite!”
\end{quote}

\begin{quote}
In response to “I am the guy who replies with ‘Your question is bad. Don’t you know about screwdrivers?”'
\end{quote}

Forum Thread 8.38 Clarifying social norms of the forum (Bianc7)

In the post above, Bianc7 clarifies the social norms by explaining to SQLDon37 (and anyone else reading or lurking on the thread) that in the forum the norm is: “Answer first, then suggest”. Lawful stupid deviants, like SQLDon37, derogate other forum members (usually newbies and infrequent posters) and refuse to answer OP questions in responses. The difficulty participants face when communicating with SQLDon37 is that he is so committed to his own perspective (and his belief about what is right for the preservation of the database development standards) that he does not appear to empathise with others. The knowledge management literature (see section 2.2.2, page 35) argues that empathy is a factor contributing to the sharing of tacit knowledge and without empathy it is difficult to share tacit or explicit knowledge (von Krogh et al., 2000; von Krogh, 1998). As von Krogh (1998) suggests, lack of empathy is characteristic of low-care environments in which network members must prove their qualifications in order to engage. In the research study, SQLDon37’s behaviour is not typical and does not suggest that the forum is a low-care environment. In fact, the results indicate that there is not only general tolerance, but the expectation that less experienced members will engage and other members will behave empathetically towards them (e.g., ignore poorly written code snippets, bad programming practices, etc.) and provide help.
Consequently, as a result of lawful stupid behaviours, there is a negative effect on social ties between the lawful stupid members, the OP, and other members of the network. There are, however, some positive effects too. The introduction of variety to the posts, by posting about technical standards and best practices, means that there will be a diversity of opinions in the discussion possibly leading to a novel and better solution. This can facilitate creativity and knowledge sharing. The benefit of deviant threads can be seen in the forum when they are occasionally marked *voted as helpful* in the thread.

In addition, to the introduction of novel solutions, lawful stupid behaviours often trigger a series of responses: first by the OP in self-defence and then a response by the moderator, answerer or other frequent poster. This pattern of actions and reactions is a useful indicator to other members of the forum that social norms have been violated.

### 8.4.2 Self-defenders

Self-defenders are typically newbies or infrequent posters who have little power or prestige within the forum. When self-defenders have negative encounters with other forum members they either become self-protective and lash out defensively at other members or withdraw and leave the forum.

As discussed in the section above, there are some network behaviours which present barriers to participation for others. It can be intimidating to post a question on a forum when a lawful stupid responds. Occasionally, OPs have negative experiences which make them reconsider engaging in the future. Typically, newbies or infrequent posters will only have a few posted questions (as OP) or a few responses to others. Without the social authority of stronger ties within the network, their behaviours have little influence over others. In response to deviant behaviours, less active members simply withdraw and remove themselves entirely from the network.

In the following example, the OP, Danny9, posts a simple question to the forum. There are several responses including one from CC8:
Forum Thread 8.39 Lawful stupid berates OP (CC8)

Instead of addressing the specific OP question, CC8, in typical lawful stupid fashion, remarks that the OP’s code was “awful”, admonishes him to “Think! Why did you invent your own language?”, and suggest that the OP read CC8’s own book on programming before posting any additional questions to the forum. In response, the OP replies with the following post:

Forum Thread 8.40 Self-defender reaction (Danny9)

In the OP’s final post, he takes offense and threatens to leave the forum (“I’ll think twice before coming into this forum again”). This response from the OP demonstrates a common response from self-defenders, by exploding in response to deviance and then withdrawing from the forum. As a result, there is a negative effect on social ties between the OP and lawful stupid member.

There is also a positive side to this encounter. Self-defender behaviours can function as triggers for intervention, by more active members, on their behalf. In the post below, Ecriss46 comes to Danny9’s defence:
Forum Thread 8.4.1 Explanation of deviance (Ecriss46)

Ecriss46 explains to the OP who is attacked by CC8 that there are social norms for the forum and even though CC8 violates them, his participation also benefits the network by making explicit the rules of how to respond to posts. Birchmeier, Joinson and Dietz-Uhler (2005), argue that when an ambiguous act occurs, members must determine if it is deviant. If the behaviour does deviate from the norms of the group then members must discern a normative reaction to it. Dysfunctional or unfavourable behaviour puts positive social identity for the group at risk. Most members identify norms by inductive categorisation; they emulate or model their behaviours on a prototypical member, generally an active member, such as the very active frequent posters in the forum. Positive deviance, however, identifies social norms by departing from them.

This deviance also provides an opportunity for Danny9 to socially connect with Ecriss46 (e.g., Ecriss46 directly responds to Danny9 in the post). Ecriss46 demonstrates empathy for Danny9’s situation with CC8. It could be interpreted that Ecriss46’s empathetic response to Danny9 could actually restore the trust potentially damaged by CC8’s post.

Consequently, there is also a positive outcome from this exchange. The social rules of the forum have been identified and clarified (e.g., responses should focus on answering the OP questions while not discouraging participation in the forum).

8.4.3 Enforcers

Enforcers are commonly more active forum members who chastise and reprimand members who act in ways they find detrimental to the social network of the forum. Enforcer behaviours can be quite harsh compared to normal forum engagement. They often seek to embarrass or shame the norm violators into conforming to social norms.

What can be done about deviance in virtual collectives? Newbies and infrequent posters do not have enough influence to change behaviours, but frequent posters do. As seen in
the previous section, sometimes a frequent poster will let the social network know how they feel about social norms and behaviours by confronting the offender.

There are options for responding to deviance and remaining within the social rules. For example, marking as abuse is an indication that an individual feels that the post violates social norms and should be evaluated (and possibly removed) because it is abusive.

Forum Thread 8.42 Abusive post (SQLDon37)

Sometimes, members who typically behave as expected do deviate from the norms. In fact, even a hostile response to deviance can be considered a form of deviance. It is deviance because a hostile response does not comply with the expected communication in the forum. The study results suggest that expected behaviours in the forum are non-confrontational and directed responses to individual members, in particular, typically have a professional tone. By aggressively confronting deviance, they are not acting within the norms of expected behaviour. Not only do enforcers deal aggressively with deviance, but they may also try to shame deviants into behaving within the social norms either through direct confrontation or public criticism. In the following example, Arol2 “gets on his soap box” and confronts SQLDon37 directly:

Forum Thread 8.43 Strong admonishment of deviant behaviour (Arol2)
In his response, Arol2 violated several social norms of the forum, in order to stop SQLDon37’s behaviour:

- Personal attacks (“it feels like your head is so far up your own back side...you have lost your grip on reality”);
- Challenges his authority (“You are not the Data Architect responsible for all database projects in the world and hence should give up your futile attempts at making people feel small for not doing things your preferred way. The big stick you would like to yield is non-existent”);
- Implies that SQLDon37 is arrogant (“vain or what???”);
- Reprimands his behaviour (“This forum is designed for users who require assistance... If you don’t like it then don’t come here... Continued abuse of our users will not be tolerated and responding to your posts is often futile and a waste of our time.”).

Enforcers are motivated to protect the social network of the forum. Because they have stronger network ties, they have more influence within the forum, but they also have a greater investment in its well-being. The more involved they become in the forum, the more their identity becomes dependent and interrelated with the forum’s reputation. This is most prominently demonstrated in their signatures. For example, in the following posts, both members have signatures which identify their SQL expertise and link to their blogs.

Figure 8.5 TSQL forum example signatures
It is interesting to note that in the comment above, “vain or what???, that Arol2 is implying that SQLDon37 is arrogant in his username selection. Choosing the username SQLDon37 signals that he is (or wants to convey that he is) an expert in the development language of the forum (e.g., SQL). Arol2 points out that SQLDon37 must be vain to pick such an arrogant username. The study results suggest that it is common for forum members to use SQL or developer references in these names (e.g., AdatheDev, sqlrockss, code_warrior, etc.). It is not common, however, to boast about your SQL prowess in a username. This type of resistance of username conventions may have negative consequences on the trust others have of SQLDon37’s posts. SQLDon37 may be trying to signal that he is a SQL expert, but instead it could be interpreted by other members that he is just vain.

Forum participants who respond to deviance keep the online social network open and useful, thus ensuring that the forum survives. From their view, the deviance they attack is a threat to the continued existence of the network, which they value and support. The cluster of frequent posters has more power and control within the forum than infrequent posters or newbies. Not only do frequent posters have more influence, but they may be first to recognise the deviance. With time spent in the forum the more active members are more experienced with typical forum responses and can more quickly notice when responses deviate from the norms.

By calling attention to deviance in a very aggressive manner, active members are identifying the boundaries of forum social norms (e.g., this behaviour is not acceptable) and defining what is acceptable for different roles within the forum (e.g., it is ok for me to reprimand, but as a newbie you may not be taken seriously by other members). In this way enforcers are helping other forum members learn how to engage within the social network and how to use that engagement to gain access to resources.

Consequently, there is both a negative effect on social ties between the frequent poster enforcers and the other forum participant (usually a lawful stupid deviant) and a positive effect with the members they are defending (usually the OP). The primary benefit, however, is that social norms were identified and clarified for other network members.

Social norms can be difficult to identify in social networks, but because deviance violates norms it can also help clarify normative behaviours. It is through these deviant
interactions that the social norms are developed and given meaning. As Fernback (2007, p. 55) suggests, drawing from Blumer’s (1969) work on symbolic interactionism, "meanings arise from social interaction". Therefore an essential component in establishing meaning and clarifying social norms is that members interact. In online forums, members actively learn norms through thread posts. For example, in the thread conversation between Rick33, Shawn34, and Nancy30 (see example of Not a chat room on page 313), Rick33 tries a communication style (e.g., informal chat syntax) which is corrected. He learns the norms by trying different behaviours and being corrected by other network members when he deviates from expected behaviours. In this way, positive deviance helps establish norms because it illustrates boundaries as the members engage in discussion.

Variety in ideas and concepts can be a positive consequence of positive deviance because deviant members introduce behaviours and ideas that are a departure from the norms. In fact, positive deviance can be seen as mechanism for combating homophily. As McPherson, Smith-Lovin, and Cook (2001, p. 416) describe, "homophily is the principle that a contact between similar people occurs at a higher rate than among dissimilar people." Deviance inhibits homophily by challenging the conventions of the network. Specifically, positive deviance from lawful stupid members introduces new concepts and points of view to the forum.

Positive deviant behaviours differ from the other forum behaviours in that they are all honourable, voluntary and a departure from norms. Positive deviance, however, still includes behaviours which resist social norms and may exclude access to network resources. Figure 8.6 below graphically depicts the range of engagement behaviours and where they fall relative to each other on a continuum of social norm compliance-resistance:
Social norm compliance is illustrated by typical forum engagement behaviour. Questions are posted that are well-formulated, clear and on-topic. Advice and code-snippets are offered in a professional manner. Through conversations within the thread solutions are developed and discovered. For norm compliant posters, when there are difficulties with communication or divergent points of view, differences are directed at the tasks and not at individuals. An effort is made not to damage social ties even when instrumental motivations are governing problem solving behaviour (e.g., solvers do not respond rudely, even if their motives are to find problem solving resources and not to befriend other forum members). The private engagement of lurkers is also compliant since the only evidence of their engagement is through the influence as observers. It could be argued that they are slightly less compliant because they do not post and are therefore not following the expected posting behaviours.

In contrast, the more resistant behaviours are atypical for the forum. For the positive deviance of lawful stupid, self-defenders and enforcers, the intentions behind the behaviours are honourable even if they do not adhere to norms. The least deviant of the norms from this group are the self-defenders. They threaten to leave the forum (e.g., never revisit or simply just lurk) and sometimes leave without warning. Their posts eventually become inactive, ending in a questioning “Any progress?” with no response. These threads either remain unanswered or are marked as answered by the moderator or answerer.

Occasionally the infrequent posters have a champion in enforcers. The frequent posters challenge negative comments with direct confrontation. That confrontation is a
departure from the forum norms, but is tolerated because it protects the social ties within the forum. At the higher end of the deviance continuum are lawful stupid behaviours which tend to be quite hostile and derogatory. Those members single out newbies in order to enforce technical standards and rules or to encourage them to leave the forum until they are better informed. They often cross the boundary of criticising the task or code snippet and attack the person instead (e.g., SQLDon37’s posts have been marked as abusive for attacking the OP). The most deviance observed in the forum is from trolls who, unlike the positive deviants, attack other members for dishonourable motives such as attracting attention to themselves.

8.5 Thematic summary of the social dimensions of resource access

Three themes emerge which specifically connect to the social dimensions of resource access in virtual networks.

**Trust in loosely-connected virtual networks:** The study results confirm the social capital literature which argues that trust is required to gain access to embedded network resources. Trust allows solvers to connect with virtual networks. In loosely-connected networks, generalised trust allows solvers with instrumental motivation (e.g., need to solve a specific problem), to locate, gain access, and use embedded resources. Solvers socially connect with virtual networks to the extent required to address their motivations for network participation. For instance, the weak ties of bridging connections are used for instrumental motivations (e.g., task-focused) and bonding connections with stronger ties for consummatory motivations (e.g., maintaining network social norms).

**Tacit knowledge in resource access:** The study results confirm knowledge management literature which argues that there is an epistemology of possession (e.g., the objects of knowledge that are known) and the epistemology of practice (e.g., the process of knowing). In other words, there is knowledge that can be possessed and known. In virtual networks, that dimension of knowledge is captured within the content of sites (e.g., code snippets, explanations, and the diversity and nature of the problems themselves). There is also a process side of knowledge, which is developed and shared through the practice and the experiences of knowledge. In virtual networks, that
dimension is experienced vicariously through following and observing interaction in threads (e.g., lurking) or directly experienced through technology-mediated communication (e.g., posting on threads). What is unique to virtual networks (as opposed to material networks), is that the artefacts of process knowledge are retained so future network members can continue to experience them after the original interaction is complete.

Positive deviance in virtual networks: The study results extend the organisational literature which suggests that there are behaviours which do not adhere to social norms, but have positive consequences. There are a range of social behaviours in virtual networks. Behaviours that adhere to the social rules allow access to embedded resources and strengthen social ties. Deviant behaviours can limit access to resources and damage social ties. The results of this study argue that there are moderately deviant behaviours which can potentially help develop resources and reinforce network norms. This positive deviance does this by introducing variety in thread discussions and illustrating social rules by breaking them.

8.6 Reflexive summary of positive deviance

Just as social norms are defined by the collective, deviance is also determined by members of the forum. What may appear to an outsider (researcher) as rude, hostile or a norm violation may not always be interpreted as such by the social network. I found using an ethnographic approach was an excellent way to mitigate this risk as a researcher and acclimatise myself to both norms and norm violations in the forum. Over the three months, by observing the forum behaviours (posts and response) I was able to identify patterns of behaviour when members reacted to posts which varied from typical responses. The first signal to me as a researcher that there was a norm violation was actually through following the response to the post in question. Moreover, I discovered that I could recognise deviance more easily as I spent more time (and gained more experience?) in the forum.
8.7 Conclusion

In this chapter the results addressing how norm compliance and resistance affect access to network resources were presented. This chapter described the following key results:

- Norm compliance gives access to embedded resources through trust and knowledge of social rules of engagement;
- Norm resistance excludes resources by preventing the creation of needed resources, introducing barriers in communicating resource information, and reducing trust;
- There are a set of behaviours, referred to as positive deviance, which resist norms, but have positive influences on the social network.

The results presented in this chapter suggest that in relation to Research Question 3, how individuals gain access to problem solving resources through social connection, solvers gain access to resources embedded in virtual networks through trust and tacit knowledge of how to engage within the network. The results support the knowledge management literature which indicate tacit knowledge is shared through socialisation (Nonaka et al., 2000; Nonaka & von Krogh, 2009; Nonaka, 1994). Additionally, the results support the social capital literature which indicate tacit knowledge of social norms enable network members to access resources through adhering to expected behaviour (Portes, 1998; Wiener, 1982) and which argues that social relations dependent on trust allow network members to access embedded resources (Bourdieu, 1986; N. Lin, 2005).
9 Discussion and conclusions

9.1 Introduction

This research study explored the social nature of engagement within virtual networks. The aim of the study was to investigate how individuals extended outside organisational boundaries in order to solve problems. In order to address this aim, the research study was structured as an exploratory virtual ethnography of how software developers engaged in problem solving in virtual networks. The fieldwork was conducted in relation to knowledge management, social media, and social capital literatures.

A review of the knowledge management and social media literature revealed gaps. While knowledge management studies provided frameworks for knowledge development, the extant research on the role of information technology in tacit knowledge development was found to be minimal. The review of the social media literature provided descriptions of how individuals interact in virtual networks, but with the exception of a small set of studies on online networks of practice, few studies focussed on professional virtual networks and knowledge development. Subsequently, by including social capital as a theoretical lens for the study, virtual network engagement was interpreted through bridging and bonding social connection. This provided the study with a means to explain how resources embedded in virtual networks could be located and accessed by solvers.

The aim of this final chapter, which reviews key aspects of the study results, discusses the implications of the study for organisations, and provides conclusions, is therefore to reflect holistically upon the research study. The chapter is organised into five sections in addition to this introduction: an overview of the results; a discussion of the key results from the study; a discussion of the implications of this research from a methodological perspective; contributions made to theory; and a final reflective summary on the limitations of the study and possibilities for future research.
9.2 Overview of results

In order to explore social connection in virtual networks, the research study was organised around three research questions: locating resources, problem solving, and accessing resources.

In the process of addressing the problem, participants choose both their preferred networks and their preferred engagement to find and access problem solving resources. First, solvers considered using existing resources in known networks. Second, they turned to virtual networks. In virtual networks they searched as a means of connecting with virtual networks in order to locate embedded resources. Third, once they had located the network, solvers lurked to gain access to embedded resources. Fourth, if lurking did not provide solutions they then turned to posting and more public engagement. Finally, beyond the instrumental motivations of problem solving, network members engaged as frequent posters in order to maintain their ties in the virtual network and their role within it.

9.2.1 RQ1 - Locating resources

The aim of the first research question, where do individuals locate problem solving resources in virtual social networks, was to establish a starting point for the problem solving process. The flow of how solvers locate resources is illustrated in Figure 9.1 below:

![Figure 9.1 Flow of how solvers locate resources](image-url)
It was apparent from the study results that solvers had criteria for locating problem solving resources. First, they chose existing resources in known networks (e.g., formal organisational networks) and those existing resources were used when they had access to other network members. The embedded resources would effectively help solve their problems, and the use of existing resources was efficient (e.g., for both the solver and the network). After exhausting existing resources, the solver then searched for resources in new networks.

9.2.2 RQ2 - Knowledge development

The aim of the second research question, *how does tacit knowledge teach individuals how to engage in the process of accessing resources; and how to interpret the context of those resources*, was to describe a problem solving process and the types of knowledge resources embedded within virtual networks. The flow of how solvers problem solve using virtual resources is illustrated in Figure 9.2 below:

![Figure 9.2 Flow of how solvers problem solve using virtual resources](image)

This research study demonstrated that solvers instrumentally connected to virtual networks in order to gain access to embedded resources. As indicated by the study results, lurking was commonly used as the primary method of engaging with virtual networks. Through lurking and generalised trust, solvers gained access to the object of
knowledge (e.g., code snippets, explanations, etc.). Solvers also gained access to process knowledge (e.g., tacit knowledge, complex ideas, social rules of engagement, etc.) through vicarious interaction and active observation.

When lurking did not provide solutions, solvers turned to infrequent posts (e.g., posting a single question on a forum). By publically engaging with other network members, solvers increased their connection with other network members and received direct feedback on problem solving. It was clear in this study that solvers did not engage in frequent posting for problem solving. Instead, frequent posting was used for other motivations, such as maintaining the network and developing an identity or role within the network (e.g., becoming an MVP or forum moderator).

### 9.2.3 RQ3 - Accessing resources

The aim of the third research question, *how do individuals gain access to problem solving resources through social connection*, was to show how solvers gained access to knowledge resources embedded within virtual networks. The relationships between solvers and virtual networks are illustrated in Figure 9.3 below:

![Figure 9.3 Problem solving in virtual networks](image-url)
The figure illustrates how the individual (organisational members engaged in problem solving) use virtual networks to gain access to resources. The study results supported the social capital literature by demonstrating that solvers gained access to embedded resources through social connection. Social connection through generalised trust and social norms of engagement allowed solvers to interpret and use the artefacts of problem solving contained in social media. Solvers were then able to apply knowledge gained within virtual networks to their specific problems.

9.3 Discussion of key results from an organisational perspective

This research study examined individuals engaged in problem solving. This section, however, discusses the results from an organisational perspective and is organized by questions of potential organisational interest which emerged from reflections on the study results as a whole.

9.3.1 How does the use of virtual networks and resources affect productivity?

By understanding how employees use virtual networks in problem solving, organisations can support more productive development of tacit knowledge through leveraging external resources for organisational benefit. This study indicates that productivity gains can come from either organisational or virtual resources.

In formal organisational networks, for example, employees engage in complex and difficult problem solving which benefits from face-to-face communication, or business problems specific to the organisation. Organisational networks are able to specifically address organisational issues (e.g., organisation-specific processes and structures), in ways that more general external resources cannot (see Al’s example on page 188). This is because business problems are different from technical problems. The solutions cannot be found outside the organisation because they require knowledge sharing and development among network members who are familiar with (i.e., live within) the specific circumstances of the organisation. If organisations are concerned about these activities, the results of the study may help by clarifying which types of problems, such as business-specific issues, are better suited to organisational networks.
This study also reveals, however, that increased productivity can come from employees integrating formal organisational and virtual networks into problem solving. Virtual networks are used to efficiently and effectively provide what is missing from formal organisational networks. If employees can attain goals by using contacts and resources from their organisations, then their problems are resolved and the problem solving process is complete. If not, then they can choose to use virtual resources. This study shows that organisational networks are useful in helping employees identify the problem (see Eddie on page 185 and Margaret on page 190). Once the problem is articulated, they can expand the potential resources (through online searching). The new external resources they find, such as code snippets or technical information can be brought back to the organisation for use in face-to-face or technology-mediated problem solving.

Employees’ productivity can be increased when they have better access to the necessary resources to solve a problem. The ease of connection to virtual networks and the ease of locating virtual resources can significantly enhance their productivity. This is particularly evident in the permanency of virtual artefacts (see Rhett on page 211), which provides employees with convenient and timely access to knowledge resources.

Significantly, this study extends extant literature on knowledge development by explaining how employees make decisions about the networks and resources they use in problem solving. The study shows that there is not always a preference for organisational resources. Instead, employees assess resources based on the types of resources available, the potential of the resources to solve their problem, the access solvers have to the resources, and the communication methods required when accessing those resources (see Elvis on page 209).

It is not only the integration of organisational and virtual networks which can increase how productive employees are during problem solving. It is also the employees’ behaviours and motivations which contribute to a productive environment. The study indicates that employees are in fact motivated to use resources efficiently during problem solving. Employees determine which method of engagement will be the most efficient use of organisational resources (e.g., organisational members’ time, the solver’s time, etc.) before attempting to solve a problem (see Kenneth on page 187).
When engaged in problem solving, the study explains that employees only do what is necessary to locate knowledge resources. Importantly, this explains how and why they engage in virtual networks in certain ways. The study indicates that employees do not over-engage by posting if lurking meets their instrumental needs to solve a specific problem (see Bianc7 on page 239). Instead, they lurk for a single purpose (e.g., problem solving) and not to engage more broadly (e.g., making friends, helping others, etc.). When lurking, employees are motivated by efficient and effective use of resources and will opportunistically use network resources (e.g., follow threads in order to glean information that is helpful to them).

It is important to note that this behaviour, which can benefit the organisation with increased productivity, does not harm or disadvantage the virtual network used. This study confirms the literature on the use of network resources in social media by finding that lurkers are an accepted part of online networks, and that they are not considered social loafers or free-riders when engaging in lurking behaviours during problem solving.

In addition to lurking, productivity gains can also come from employees who post in virtual networks. The study indicates that employees engage with other network members of all levels of experience (see Bev6 on page 272 and Mike25 on page 275). The mentoring and knowledge sharing in which employees engaged, more closely resembles a form of peer-mentoring (i.e., individuals of any level of expertise offering advice to others) than the traditional hierarchical expert-mentoring conventionally described within organisations and traditional communities of practice. This practice is important because it increases the amount of potential resources available.

In order to become more productive, an organisation is dependent on employees engaging in activities which are efficient, as described above, but there is also the need for an environment which facilitates efficient knowledge development activities. This study confirms the knowledge development literature, which says that there are environmental characteristics enabling more effective knowledge development. In the study, there was evidence of network characteristics which facilitated problem solving, the ability of networks to develop transactive memory within network members, the ability of networks to facilitate socialisation, and ability of network members to practice knowledge development. These are all featured in formal organisational networks, as
described in the literature. It is significant, however, that this study also found evidence of these characteristics in virtual networks, challenging the literature which argues these characteristics require face-to-face engagement.

For both socialisation and the practice of knowledge development, tacit knowledge sharing features prominently. This makes tacit knowledge a valuable resource for organisations. The value is not just in the tacit knowledge itself as a resource, but the value can also be derived from its use to increase the productivity of knowledge development.

An important dimension of tacit knowledge is its ability to facilitate socialisation. Socialisation teaches employees how to engage within a network, such as organisational teams or departments, or in virtual networks. This study makes contributions to the knowledge management literature by explaining mechanisms of socialisation which occur in virtual networks during problem solving.

The study indicates that there are two dimensions of learning: learning the tacit rules of engagement through observation of social interaction and learning tacit (e.g., complex, difficult to share, etc.) knowledge for individual problem solving through observation of technical interaction (see Margaret on page 221 and Nancy30 on page 221). Socialisation can occur either during lurking or posting. When lurking, employees can observe site content or conversations between others by reading threads and comments. The interactions socialise lurkers in forum norms (e.g., how members communicate, what is appropriate to discussion, how to ask a question, etc.). This socialisation is significant because it provides a context for understanding the written text of the threads. When posting, employees can learn the social rules of engagement by emulating other network members, or through the rewards of behaving as expected or the corrections of violating norms.

This socialisation, described above, takes place within virtual networks. Therefore, this study reveals an important characteristic of socialisation, that tacit knowledge can be shared through technology-mediated communication. Consequently, the results of this study challenge the knowledge management literature which argues that face-to-face communication is required for tacit knowledge sharing.
Another critical dimension of tacit knowledge is its dual nature, as object and process. This study's results, on formal organisational networks, confirm the literature which describes how the practice of knowledge occurs in material networks. The study also finds, however, that the practice of knowledge also occurs in virtual networks.

Process (i.e., experiential or tacit) knowledge is not only social information (e.g., socialisation), but can be technical as well. During lurking and posting, employees can develop experiential knowledge. Frequent posters learn technical process knowledge (e.g., how to problem solve, how to practice software development, etc.) from other network members through posts. They practice knowledge through activities such as working through software development problems or trying out different code snippets. Lurkers also acquire tacit process knowledge through active observation of technical content.

In summary, there are compelling reasons why the use of virtual networks during problem solving should be encouraged to potentially increase organisational productivity. Organisations develop new knowledge to retain and increase their competitive advantage. By leveraging the virtual networks of social media, organisations can increase communication channels, capture organisational knowledge and create a social environment for knowledge development (ba). Virtual networks also provide a means for managing the consequences of growth which can leave staff isolated and temporally, socially, and physically dislocated from the formal organisational networks. This is done through adapting the role of information technology within the organisation, recognising that social media tools are interconnected with social networks and that social media can bridge formal organisational networks with external virtual networks.

9.3.2 Is there risk to the organisation in using virtual networks and resources?

By understanding how employees behave in virtual networks while problem solving, organisations can recognise the risks inherent in developing organisational knowledge with and without external resources. This study indicates that there are risks in both the use and exclusion of virtual networks in problem solving. Understanding problem
solving engagement, however, can help organisations mitigate the risks while benefiting from including these external resources.

Organisations may have concerns about using virtual networks because of the behaviours of employees or other network members, or they may have concerns about bringing other networks' resources into the organisation. Organisations have expectations about employee behaviours, or the quality of resources used, during employee participation in external networks. Are employees representing the organisation well? Are they protecting organisational assets, such as knowledge?

This study addresses concerns organisations may have about employees' behaviours, such as leaking organisational knowledge to external networks. The study observations indicate that employees are very protective about divulging sensitive corporate information. Network members typically provide test data which is modified or fabricated in order to protect corporate confidentiality. In the study, threads tended to contain just enough context of the problem to help in developing a solution. Therefore, when engaged in problem solving, this study's results show that revealing valuable organisational knowledge is not common behaviour. Indeed, tensions between forum members were observed because an inadequate amount of information was shared (see the interaction between Nancy30 and TLutz42 on page 312). Instead, when employees are searching for new networks and resources, they are forming new social connections, activating latent network ties, or expanding or filtering potential networks and resources.

In fact, the study results indicate that the challenge for employees is not in revealing technical organisational information, but in how to remain socially consistent between networks. It can be difficult for employees to learn and adhere to the social norms of different social networks. Particularly, for employees of organisations with co-workers involved in the same work, there may be overlapping social networks of organisational, professional and virtual domains. This can present conflicts and tensions between social networks when individuals are motivated to participate in online networks and contribute to discussions, but because of their obligations to their organisational networks they feel they cannot make the investment. Perhaps there is an opportunity for organisational management to address this issue by including participation in virtual networks as part of employee development.
What is important from the study results is that the time spent problem solving in virtual networks helps employees develop the skills to effectively and safely engage in those networks by developing trust and mitigating risk. One could also argue that there is a secondary benefit as well. The skills that solvers develop can also be applied to face-to-face engagement within the organisation, thereby improving the organisations’ problem solving capabilities through the tacit knowledge developed through lurking and posting in virtual networks.

The study shows that when employees lurk, they are developing trust in the explicit resources embedded within organisations. The lurking also helps them decipher social norms and interpret network behaviours. This all leads to a safer engagement by mitigating risk through the development of trust. Employee behaviour also helps mitigate risk when the networks appear untrustworthy. The lack of trust in this case is manifest as resistance to social norms, where from an employee’s perspective, the networks appear in violation of their own rules, calling network resources into doubt. The employee rejects the network and foregoes these resources in an act of self-exclusion from network resources. This study indicates that employees simply do not use networks and resources that appear in violation of their own social norms (see Alfonso on page 230). This behaviour diminishes the risk of untrustworthy resources being used in organisational knowledge development.

For organisations concerned with cyberslacking or knowledge leaks, searching outside of the organisation could be problematic. The study results, however, may alleviate some of this concern. First, the study participants were instrumental in their searching for virtual networks. They did not describe aimlessly wandering (e.g., taking a wiki walk) or visiting social network sites for personal reasons during problem solving. Instead, they described searching for and lurking on sites specifically to find problem solving resources. One could argue that interview participants could have engaged in cyberslacking, but refrained from disclosing it in their interview responses. Given the focus of the interview questions, this study suggests that interview participants, even if they did take part in cyberslacking, did not feel that it represented their typical problem solving process. Therefore, at least when engaged in problem solving, this study’s results suggest that cyberslacking is not typical behaviour.
While engaged in both lurking and posting, bridging social connection in particular helps employees gain access to important problem solving resources in virtual networks by indicating the quality of resources. As employees engage more, their social connection with other network members can change. They may find other common bases of connection and develop more familiarity with others. This initiates a change in trust. It can change from a technical trust of the information (i.e., trust of knowledge as object) to a trust in other network members who can share important information (i.e., social trust of knowledge as process/relationship). With changes in the intensity of the social connection, the virtual trust begins to resemble trust found in the bonded social connections of close-knit material networks.

Not only are organisations concerned with employee behaviour, but also with the general quality and trustworthiness of virtual network resources. Importantly, this study indicates that trust that can be developed through experience and reputation in the context of social of trust (or the lack of means of the assessment of trust) is mitigated by low risk engagement, such as using low risk technical knowledge. In the study, participants felt that they if they could minimise exposure to vulnerable situations, such as using small instead of larger amounts of code snippets, they could assume a certain level of trust within the networks. Just because there is low risk, however, there are still reasons that employees avoided some networks. There are low-risk/low-vulnerability situations, when even though the risk of trusting poor quality information is low, the potential to waste time using those poor quality resources unsuccessfully is high. In these cases, employees can mitigate the risk of poor quality and inefficient use of organisational resources (e.g., their own time) by locating other virtual networks.

The final dimension of risk that this study addresses is the risk of not using virtual resources. The study results indicate that formal organisational networks do not always contain the resources employees need in problem solving. Smaller networks, such as organisations, can be less responsive because resource access is dependent on a smaller number of members, for example when only one person can help, but is not available when help is needed, the employee must wait (see Pete on page 199). In study observations, forum networks are typically much larger because they are not limited to employees of a single organisation. Therefore, there is a greater diversity of experience (e.g., potential effective problem solving help), less homophily, and more likelihood that
more members will see the request for help and respond more quickly (e.g., potential efficient problem solving help) in larger virtual networks. Additionally, where there may be limited new resources created within organisations, under production of external virtual network resources is not a problem. A small percentage of posters continue to answer questions even though lurking is recognised as the way most members participate.

Organisations may be tempted to limit risk by limiting the amount of engagement employees have in virtual networks. Since the study indicates that most participants only instrumentally use virtual networks in problem solving, this would appear to be an appropriate risk mitigation strategy. In the study, however, observations indicate that there are benefits from posting that are not directly related to individual problem solving. Forum participants who respond recognise and respond to deviant network behaviours (see Arolz on page 328) keep the online social network open and useful, thus ensuring that the forum survives. From their view, the deviance they attack is a threat to the continued existence of the network which they value and support. Significantly, while most employees are instrumental and only lurk or post to answer their own problems, it may be advisable for organisations to encourage this type of socially motivated posting in order to increase trust in the virtual networks and resources used by employees in problem solving.

In light of these results, from an organisational perspective, there are reasons why organisations would be concerned about protecting organisational resources embedded in virtual networks. Organisations may choose to protect resources by controlling the use of social media. This is the case when organisations separate the tools from the social networks and bring the technologies within organisational boundaries. For instance, some organisations bring social media tools into the organisation instead of using external sites such as Twitter. By limiting the virtual network, organisations can control knowledge flows out of the company, but also potentially limit the social connections to external networks as well as limiting the knowledge flows into the company.
9.3.3 How does engaging in virtual networks change organisational IT paradigms?

Finally, by understanding how the virtual networks of social media are used in problem solving, organisations can develop new paradigms for organisational information technology strategies. Traditionally IT strategies have focussed on governance, control, security, standardisation, and technology management. New paradigms, based on leveraging the benefits of emerging social media, could focus on flexibility and adaptability, supporting creativity and novelty, and most applicable from this study, the facilitation of social connection and communication.

Virtual networks are social. They are social in the sense that members voluntarily engage and are not mandated to do so. They are social in that they are based on human-interaction and not algorithms. They are also virtual social connections, which are spatially and temporally independent, relying on technology to open up the possibilities of different and additional forms of socially connecting. Technology mediates the social nature of connectivity. Technology is not a replacement for social connections; instead it creates different opportunities for social connection.

When employees are engaged in problem solving, frequent social contact with formal organisational network members allows employees to develop and maintain their knowledge of co-workers’ expertise. IT policies could focus on creating opportunities for employee interaction, inside and external to the organisation. The study results indicate that having a multiplexity of connections from network interaction, such as team meetings, hallway conversations, email, after work gatherings, and participating in external social media networks, helps create stronger ties useful for tacit knowledge sharing and resource access.

Employees gain access to organisational resources through engaging in networks and communicating with network members. They develop an understanding of what resources are available through transactive memory. IT strategies could focus on improving contact between employees and their problem solving networks in order to develop transactive memory. Moreover, employees learn how to engage with network members and resources through socialisation. By being a member of the organisation, they can gain access to resources through their bridging and bonding social connections. Once access is gained, employees can choose the method of communication based on
the specific circumstances of the problem. Therefore, it is essential for organisations to provide for a variety of face-to-face and technology-mediated communication opportunities.

When employees are not co-located, then technology-mediated communication must be used. Even when employees work at the same company and could presumably communicate in person, they can include additional (virtual) resources into the problem solving process by using technology-mediated communication in social media, such as online discussion forums. Of significance from this study is the specific characteristic of complex problems that require communication of code, which has not been previously described in the knowledge management or social media literature. In this situation, even when co-located, employees use technology-mediated communication because code can be more easily integrated.

In summary, through the combination of networks and methods of communication, employees can expand their pool of potential resources and have the flexibility to incorporate them when appropriate for their specific problem solving situations. Face-to-face is better for more complexity in communication and developing stronger social ties (e.g., specific technical issues or developing trust), but technology-mediated communication is well suited for efficient use of resources such as those that can be found in the information stored in social media (e.g., posts, comments, profiles, etc.) or quick queries with simple answers. Instead of separating virtual and material domains as well as face-to-face and technology-mediated communication into distinct roles, this study indicates that it is better to consider an integrated view of the relationship between virtual and material social spaces. Employees are able to develop knowledge and solve problems by leveraging virtual collectives as a replacement, supplement or complement to material and organisational resources.

9.4 Methodological implications
This section is a discussion of the research study from a methodological perspective. Specifically, it focuses the methodological implications this study has on the field of ethnography. These are presented as three main areas of contribution: social media use
in virtual ethnography; the use of social graphs in virtual ethnography; and the use of reflexive summaries in the presentation of ethnographic materials.

The study of social media in ethnography is an emergent methodological approach in internet studies. Although, with the increased popularity of social network sites, social media networks are becoming more common locations for virtual ethnography, virtual ethnography use, on the whole, is still not very common. This is particularly true of qualitative knowledge management studies which typically use case study methods. Specifically, this study has extended virtual ethnographic approaches by developing or adapting the following:

- Expanded ethnographic sites to include social media by adapting material and traditional virtual ethnography techniques in order to locate the study in an online discussion forum. This included developing processes for handling and analysing larger data sets, defining how to establish the boundaries of the site location by social connection (e.g., forum posts, member blogs, external links to other sites, etc.) instead of by place (e.g., a single geographical location or a single virtual community);
- Expanded ethnographic conversations to include technology-mediated communication (e.g., forum threads, tweets, etc.). This included defining the characteristics of conversation within the forum, how to interpret directed communication within conversations, and the introduction of communication-through-code into the analysis of language use in forum conversations;
- Explained virtual network behaviours, in particular behaviours associated with bridging and bonding social connection, through social capital theory which is typically used for material networks. There are few studies which integrate virtual ethnography and social capital to explore social media engagement. This is one of the first virtual ethnographies to examine the social networks of online discussion forums. Consequently, this study was able to identify characteristics of social connection in social media within the study results.

This study also uses social graphing in the visualisation of ethnographic data. Social network analysis (SNA) and social graphing are typically used in quantitative internet studies. In order to adapt these techniques to ethnography, this study extended social graphing methods by developing or adapting the following:
- A whole network social graph was extended to visualise levels of participation within the forum (e.g., frequent posting, infrequent posting, etc.). In order to use this social graphing approach, this study developed a new definition for graph edges, based on thread post conversations. It also adapted definitions for other SNA concepts to include forum social connections (see Table 4.4, page 158);

- Developed a process for using qualitative materials coded in NVivo to be analysed using SNA in NodeXL. SNA typically uses quantitative data. This study developed a new process for converting thread conversations into node-pairs which could be used in social graphs (see description on page 159);

- A second type of social graph was developed to visualise virtual network communication in the forum. Individual thread conversations were graphed to illustrate communication patterns specific to problem solving. No extant examples could be found which demonstrated this type of communication, so this study developed a new use of social graphing. In order to visualise problem solving conversations as social graphs, this study extended SNA concepts such directed-communication (e.g., who is talking to whom on a post) and connected ties (e.g., chronological depiction of single ties in a continuous stream of thread posts). See examples on page 263 and on page 284;

- This study extends the typology of network participation by using SNA in the analysis of forum participation levels in order to clarify the bridging role played by moderately active posters in communicating between frequent and infrequent posters (see example on page 249).

Finally, this study adapts the use of reflexivity in the presentation of virtual ethnographic materials, by developing the concept of reflexive summaries. Typically, in ethnography an account (e.g., thesis) is written in a personal first-person style when representing the role of the researcher within the ethnographic experience. Ethnographies are not common approaches to management research, however, and I was concerned that the ethnographic style would inhibit acceptance of the research study by appearing too informal (or perhaps not rigorous or academic enough). I instead devised a concession to the ethnographic style with the reflexive summaries used within this thesis.

In this thesis, reflexive summaries were used to discuss how I approached the research process as a former software developer, how I was influenced by my own virtual
networks during the research experience, the difficulties of exploratory studies, the nature of lurking, the challenges of researching trust, interpreting social norms and deviance, and finally, the limitations and opportunities for future research (see section 9.6, page 353).

9.5 Contributions to theory
In addition to the discussion of key results and implications of this study described in the previous sections, this research study also makes contributions to the following areas: knowledge management literature, social media literature, and social capital theory.

The study contributes to knowledge management research by extending:

- Tacit knowledge sharing frameworks to include virtual networks;
- Knowledge development theory to include problem solving;
- Characteristics of socialisation to include technology-mediated communication.

The study contributes to social media literature on virtual network engagement by explaining how lurking in virtual networks is used in problem solving and how network engagement changes depending on motivation and problem solving context.

The study also contributes to social capital theory by incorporating virtual networks, problem solving resources, and positive deviance in social norms into the theory on social connection.

9.6 Reflexive summary of limitations and future research
In light of the key results and contributions this study makes, there are several things I would do differently next time. For example, the primary limitation of this study is also the very element which makes the research experience so rewarding and the field material so rich – structuring the research as an exploratory study. While engaging with the field, I frequently observed different and interesting behaviours. For each, I was tempted to follow the topic down a rabbit hole, but was forced to show restraint to remain within the scope of a PhD thesis. An interesting focus could be achieved in future
studies by conducting interviews before and after the on-line discussion forum observations. This would allow for a more targeted set of interview questions based on observations. Having a second set of interviews of forum members would also provide the opportunity to gain their perspectives on specific observed behaviours, to drill down into the specific thinking and decision-making beneath the observed behaviour. By conducting interviews with a different group of participants than the observations, I was sensitised to subject area, but not to individuals. It would also allow further exploration of how demographics such as gender, age or experience (e.g., see discussion of Alfonso on page 234 and Brian on page 239) influence relationships and behaviours during problem solving.

The other major limitation for this study stems from the nature of ethnographic studies. Ethnographies require focussed engagement with a specific culture-sharing group. For this study, only one group (software developers using the TSQL forum) was used. Because of the very specific engagement with one group in one location, there is a limit to the extent the results can be generalised to other populations and other environments. For future studies, it would be helpful to include a more diverse group of virtual network members engaged in different types of knowledge development.

For future research, this study introduces several concepts which could benefit from further investigation. Three in particular, would be most useful to organisations considering social media use and policies.

The first topic is integrating problem solving in virtual networks with existing knowledge management frameworks. This study has contributed an understanding of how solvers use virtual networks in problem solving. Continued study could focus on the procedural steps and specific decision-making process solvers undergo during problem solving and how it contributes to organisational knowledge development. It would be particularly valuable for organisations to understand and be able to assess when their own formal organisational networks should be able to provide resources, but currently do not.

The second topic is creating a typology of participation roles virtual networks. This study has revealed how solvers participate and contribute to virtual networks. Moreover, this study argues that when organisations separate the technology tools from the social
networks, there are limitations to the value of participation. It would be useful for organisations, when decisions are made about social media use, to be able to assess what the role of roles (i.e., levels of participation and contribution) are in virtual networks and the impact of roles in the development and maintenance of sustainable virtual networks used in problem solving.

The third topic is on the role specific behaviours (e.g., normative and deviant) in gaining access to embedded resources. I must admit that the concept of positive deviance was one of the most exciting discoveries and contributions for me as a researcher. Although the deviant behaviours will be familiar to anyone who has spent time online, it was particularly exciting to make the connection between these moderately deviant behaviours and the health and wellbeing of networks used in problem solving. There is a wealth of opportunities in this topic to explore the behaviours and reactions of network members and how those interactions affect specific problem solving tasks.
References


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Ess, C. (2002). Ethical decision-making and Internet research: Recommendations from the AoIR ethics working committee.


Razmerita, L., Kirchner, K., & Sudzina, F. (2009). Personal knowledge management: The role of Web 2.0 tools for managing knowledge at individual and organisational levels. *Online Information Review, 33*(6), 1021–1039. doi:10.1108/14684520911010981


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Vitak, J., Ellison, N. B., & Steinfield, C. (2011). The ties that bond: Re-examining the relationship between Facebook use and bonding social capital (pp. 1–10). Presented at the System Sciences (HICSS), 2011 44th Hawaii International Conference on, IEEE.


Appendices

Appendix A: Research study ethics application

Application Form for ethical consideration of research and teaching proposals involving human participants

APPLICATION TO THE UNIVERSITY OF OTAGO HUMAN ETHICS COMMITTEE FOR ETHICAL APPROVAL OF A RESEARCH OR TEACHING PROPOSAL INVOLVING HUMAN PARTICIPANTS

1. University of Otago staff member responsible for project:
   Greatbanks, Richard Dr. (primary supervisor)

2. Department: Management

3. Contact details of staff member responsible:
   Dr. Greatbanks 8658 richard.greatbanks@otago.ac.nz
   Dr. Boon 8654 bronwyn.boon@otago.ac.nz

4. Title of project:
   Knowledge sharing in virtual environments: How knowledge is shared through virtual organisation of software developers participating in online communities

5. Brief description in lay terms of the purpose of the project:
   The environment in which organisations do business has dramatically changed in the last 20 years. Pressures from technological innovations such as the internet and new collaborative technologies have meant that even the concept of organisation is being revised from a physical geographic-based to a more virtual context. For many organisations, a major asset and basis for competitive advantage is held within a knowledge-generating workforce. As such, knowledge management continues to play an important role strategically for organisations.

   Virtual communities, such as blogs, provide an environment for knowledge sharing. Knowledge sharing takes place when personal knowledge is validated, connected to and synthesized with others' knowledge (Nonaka & Takeuchi, 1995). The relationship between knowledge sharing within blogs and organisational knowledge management however has not been well studied. Indeed, a literature review of both knowledge management and computer-mediated communication reveals a significant gap in how tacit knowledge is shared within virtual
environments. Tacit knowledge is an individual and personal knowledge which is difficult to articulate to others and is dependent on "action, commitment, and involvement in a specific context" (Nonaka, 1994, p. 16). Even though knowledge management theory provides useful frameworks for knowledge sharing, it relies heavily on face-to-face interactions for tacit knowledge sharing models. There are few studies on how tacit knowledge is shared in a virtual setting. In part, this is due to the rapidly changing technologies behind the virtual environments. Research conducted less than a decade ago uses models for technology that are outdated and it does not address innovations in current collaborative and networked environments. This research study builds on the knowledge creation framework (Nonaka & Takeuchi, 1995; Nonaka, Takayama, & Konno, 2000) and extends the tacit knowledge sharing models from material to virtual environments.

Associated with knowledge management in virtual environments is the issue of organisational structure in knowledge sharing. Firms, now part of complex systems and networks, must reflect the influences of virtual organisation. Since organisational structure functions as a system for organising people, new models must go beyond current conventions of organising people into different geographically located departments, functions, and layers. In order to recognise how knowledge is shared within a virtual setting, therefore a new understanding of organisation for knowledge management must be established. This research study examines organisation from the perspective of social networks and virtual community.

The overall purpose of this research study therefore is to investigate the practice of knowledge sharing within virtual organisation.

6. **Indicate type of project and names of other investigators and students:**

A PhD research study conducted by PhD candidate, Ms. Fa Martin-Niemi, and supervised by Dr. Richard Greatbanks (primary) and Dr. Bronwyn Boon (secondary)

| Student Research | X | Names | Fa Martin-Niemi |

7. **Is this a repeated class teaching activity?**  No  X

8. **Intended start date of project:**  1 November 2009 (start of empirical research)

**Projected end date of project:**  30 June 2011 (planned PhD submission date)
9. Funding of project. Is the project to be funded: (a) Internally

10. Aim and description of project:

NOTE: This PhD research study originated as a MCom study of a blogging community. The MCom study was given ethics approval in January 2009 (reference number D08/257). It was conducted from January to May 2009 and analysis was completed at the end of June 2009. After the student researcher’s application to upgrade to PhD was accepted in June 2009, the MCom study effectively became a pilot for the PhD research study. The PhD study builds on the pilot study by extending both the environmental boundaries of the study to include multiple virtual settings and behavioural boundaries to include not only the enabling conditions of knowledge sharing but also how knowledge sharing occurs within virtual environments.

This research study is an investigation of two themes: (1) knowledge sharing and (2) organisational structure. It endeavours to explore how knowledge is shared within virtual environments including blogs and online social network sites. Specifically it will address the question, “How is knowledge shared through virtual organisation?” It is organised into two phases: (1) the material and (2) the virtual. The material phase is based on face-to-face interactions and uses semi-structured interviews to gather data. The virtual phase is based on interactions within virtual environments and uses virtual ethnographic techniques of participant observation to gather data.

The following table illustrates the research agenda of this study.
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Table 1. Research Agenda

<table>
<thead>
<tr>
<th>Phase</th>
<th>Phase 1 - Material</th>
<th>Phase 2 - Virtual</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theoretical background</td>
<td>Theoretical background</td>
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<td>Private domain</td>
<td>Semi-public domain</td>
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<tbody>
<tr>
<td>Theme 1 - Knowledge sharing</td>
<td>How does problem solving occur?</td>
<td>What is the value of problem solving in virtual environments?</td>
<td>What are the meanings behind behaviours?</td>
<td>Enabling conditions for knowledge sharing in virtual environments (Martin-Niemi &amp; Greif, forthcoming)</td>
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<tr>
<td></td>
<td>Knowledge sharing in blogs (Anjewierden, de Hoog, Brussee, &amp; Elinova; Coyther, 2004; Kaiser, Müller-Seitz, Pereira Lopes, &amp; Pris E Cunha, 2007)</td>
<td>Virtual ethnography:</td>
<td></td>
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<tr>
<td></td>
<td>1. Identification of social network sites (e.g. Facebook, LinkedIn, Twitter)</td>
<td>2. Observation of knowledge sharing behaviours</td>
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<td></td>
<td>3. Thematic analysis</td>
<td>Virtual ethnography:</td>
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<tr>
<td></td>
<td>1. Identification of public sites (e.g. blogs, forums)</td>
<td>2. Observation of knowledge sharing behaviours</td>
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<td></td>
<td>3. Maintenance of research blog as public fieldnotes</td>
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<tr>
<th>Theme 2 - Organisational structure</th>
<th>Social capital (Nahapiet &amp; Ghoshal, 1998; Portes, 1998)</th>
<th>Social networking (boyd &amp; Ellison, 2008)</th>
<th>Face-to-face interviews:</th>
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<td>Sense of community (McMillan &amp; Chavis, 1986)</td>
<td>Virtual ethnography:</td>
<td></td>
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<tr>
<td></td>
<td>1. Identification of social network sites (e.g. Facebook, LinkedIn, Twitter)</td>
<td>2. Participation via follow-up questions</td>
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<td></td>
<td>3. Thematic analysis</td>
<td>Virtual ethnography:</td>
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<tr>
<td></td>
<td>1. Identification of public sites (e.g. blogs, forums)</td>
<td>2. Observation of blog artefacts</td>
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<td>3. Maintenance of research blog as public fieldnotes</td>
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**THEME 1: KNOWLEDGE SHARING**

This theme will analyse whether or not tacit knowledge sharing actually happens in a virtual environment. The focus will be on three aspects of knowledge shared: how knowledge is shared from person-to-person (tacit-to-tacit socialisation); how knowledge is articulated from individual-to-collective (tacit-to-explicit externalisation); and how new knowledge is created. The aim is:

- To explore whether knowledge can happen as well as how does it happen

**THEME 2: ORGANISATIONAL STRUCTURE**

This theme extends the observation of a single blog community to a network of social media. Depending on the social media used by participants of the study, this may include online social network sites such as Twitter, Facebook, or LinkedIn. This theme seeks to investigate the relevance of the ten enabling conditions beyond blog communities. It is founded on studies on computer-mediated communication including research on a sense of community (McMillan & Chavis, 1986) within blogs (Blanchard & Markus, 2004). The aim is:

- To explore the concept of virtual community beyond blogs to include a more complete set of virtual environments such as online social network sites which make up an individual’s sense of community

11. **Researcher or instructor experience and qualifications in this research area:**

**RICHARD GRETABANKS**

Dr. Greatbanks is the primary supervisor for this PhD, and has interests in the development of operations management with a particular focus on process improvement, quality and knowledge management practices adopted within organisations. Much of his research is qualitative and focuses on providing solutions to real business problems.

**BRONWYN BOON**

Dr. Boon is the secondary supervisor for this PhD. She has experience with the qualitative data collection methods and techniques of analysis that will be used within this current study. In addition, like this project, her current research programme includes engagement with the dynamics of social capital and social networking.

**FA MARTIN-NIEMI**

Ms. Martin-Niemi is a PhD candidate in the University of Otago Management department and the researcher for this study. She has a background in software development and IT project management. Her research area of interest is knowledge management via online social media. She has conducted two previous research studies. The first was a case study on knowledge management conducted in 2008. Interviews were used to explore how individuals used technology to find information and problem solve. The second was a virtual ethnography of a blog community
conducted in 2009. It was the pilot study for this research and refined virtual ethnographic
methods which will be used within this study.

12. Participants

12(a) Population from which participants are drawn:

The population for this study is software developers who create applications as (1) an employee of
a traditional organisation, (2) contracted as part of a virtual organisation, or (3) who develop
software as part of a virtual community as a hobby. The software developers reside in New
Zealand as well as overseas. This study will select participants from the following population
groups:

2. Direct network: software developers from the researcher's personal online social network site
   contacts on LinkedIn, Facebook, and Twitter as well as contacts from other local interest-based
   communities. Participants from this group reside in New Zealand and the United States.

2. Extended network: software developers who are part of the researcher's extended social
   network, identified from interviews with group 1 (Direct). Participants from this group reside in
   New Zealand and the United States.

3. Community members: Members of public blog communities identified from interviews with
   groups 1 (Direct) and 2 (Extended). Participants from this group may reside anywhere.

12(b) Specify inclusion and exclusion criteria:

This study will not use minors, prisoners, hospital patients, or anyone whose capacity to give
informed consent is compromised in anyway.

12(c) Number of participants:

Forty software developers from group 1 (Direct) will be contacted initially. Interviews will be
conducted with 25 to 50 participants from groups 1 (Direct) and group 2 (Extended). The
ethnographic participant observation will be conducted on 1 to 5 virtual communities with varying
membership group 3 (Community).

12(d) Age range of participants:

All participants must have some experience in software development and be familiar with online
social network sites, although they may not be currently participating in virtual environments.
They will also be of working age, between 18 and 65 years.
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12(c) Method of recruitment:

The study will use a snowball technique for selecting participants. Contacting potential participants from personal social networks is an effective way of identifying informants in an ethnographic study and particularly for studies of ‘hidden’ or ‘hard to research’ populations (Browne, 2005). Many software developers tend to work in isolation or remotely, only interacting through virtual networks on software development related issues. Therefore, using a snowball strategy originating from personal online social networks allows access to this community as well as establishes the trust necessary to engage in interviews and ethnographic participant observation fieldwork. For this study, participants will be contacted initially online through email and virtual environment messaging tools.

12(f) Please specify any payment or reward to be offered: None

13. Methods and Procedures:

In order to investigate the characteristics and behaviours of virtual communities, a research method suited to the study to online social media must be used. This kind of exploratory study of behaviours and motivations requires a method, which facilitates the examination of common practices within a community. Established research methods for investigating the feelings, experiences, and perspectives of community members rely heavily on traditional organisational structures and modes of communication. When researching communities in a virtual environment, which have neither formal boundaries nor face-to-face interactions, it is necessary to adapt extant research methods such as participant observation. Therefore, the study will consist of two phases to address the challenges of studying behaviours within a virtual environment, a material domain using semi-structured interviews and a virtual domain using an ethnographic study.

**Phase 2: Material**

This phase of the research study will use semi-structured interviews to explore the meanings behind behaviours in virtual environments as well as identify potential virtual communities to study in more depth. The face-to-face interviews will be conducted in New Zealand and in the United States.

*NOTE: Even though this is an international study with participants in New Zealand and the United States, the researcher has no reservations about conducting research within these two countries. The researcher is American, but has lived in New Zealand for the past three years. She is very familiar with both cultures as well as the culture of software developers since she has also worked as a software developer in both countries. The interview questions and structure are common to literature and practices in both countries. No cultural or language difficulties are anticipated during this international study.*
Phase 2: Virtual

After the interviews, an adaptation of place-based and virtual ethnographic approaches will be used. The virtual communities studied in the ethnographic phase will be identified through the semi-structured interviews. Adopting an anthropological perspective, virtual ethnography has emerged as a means of exploring web communities using the same traditional techniques, which have been long established for social science research in communities and organisations. Rasmussen (2000, p. 355) posited that since online communities demonstrate extended interactions and established mechanisms of communication, they exhibit the characteristics of an organisation, not as a geographically defined entity, but as an environment possessing 'extended interactions'.

The virtual ethnography will follow three stages of fieldwork: (1) initiation, (2) participant observation, and (3) interpretation. During initiation, the virtual communities will be chosen and initial contact will be made. As a participant observer, there is the opportunity to both observe behaviours within the virtual environments as well as participate by asking follow-up questions and joining social network sites. The virtual communities will be international, with members residing in New Zealand, the United States and potentially other countries as well. Finally, the interpretation stage is a period for conducting thematic analysis of all texts and artefacts as well as reflecting on the experience through fieldnotes.

Precautionary Measures

The research study engages with participants with the private, semi-public, and public domains. The researcher will ensure that participants protected from harm or discomfort within each of the domains through the following means.

In the private domain, the study will use semi-structured interviews with participants. In order to protect participants within this domain, the researcher will:

- Refrain from asking intrusive or personal interview questions
- Allow participants to withdraw from the interview process at any time without consequence
- Maintain participant confidentiality and anonymity, where possible, throughout the interview, transcription, thematic analysis, and publication of the interview-related materials

In the semi-public domain, the study will use participant observation as part of a virtual ethnography. Semi-public is defined as a site which is available to most people via some form of registration or membership application, in particular, community-oriented or social network sites (Sveringsson Elm, 2009, p. 75). In this study, semi-public includes sites such as Twitter, Facebook, and LinkedIn. When participating within this domain, the researcher will observe software development related knowledge sharing behaviours as well as participate by asking clarifying
questions when necessary to interpret behaviours. In order to protect participants within this domain, the researcher will:

- Post the Information Sheet for Participants on the researcher’s profiles for all sites contained within the study.
- Maintain participant confidentiality and anonymity, where possible, throughout the thematic analysis and publication of the ethnographic artefacts and materials.

Finally, in the public domain, the study will access and observe public websites such as blogs using virtual ethnography methods. Since blogs, are public forums, participation is based on the norms for public venues. According to the Association of Internet Researchers, “the greater the acknowledged publicity of the venue, the less obligation there may be to protect individual privacy, confidentiality, right to informed consent, etc” (Ess & the AoIR ethics working committee, 2002, p. 5). As such, participants are not considered subjects or informants in the traditional meaning of social science investigation, but “as authors whose text/artifacts are intended as public” (Ess & the AoIR ethics working committee, 2002, p. 7). In order to protect participants within this domain, the researcher will:

- Post the Information Sheet for Participants on the researcher’s blog and include a link to the page in all correspondence with blog participants including email messages and blog comments.
- Maintain participant confidentiality and anonymity, where possible, throughout the thematic analysis and publication of the ethnographic artefacts and materials.

**Semi-structured interview Questions**
The interviews in this research study are semi-structured and the questions may be extended to elicit clarification from participants or to investigate further a topic arising from an interview response. Initial questions are listed in the appendix.

14. **Compliance with the Privacy Act 1993 and the Health Information Privacy Code 1994 imposes strict requirements concerning the collection, use and disclosure of personal information. These questions allow the Committee to assess compliance.**

14(a) **Are you collecting personal information directly from the individual concerned?**

Personal information such as names, addresses, telephone numbers, or other contact details will be collected for a limited time for practical purposes but will be unlinked from research data and destroyed once the details are no longer needed. Additionally, identifying personal information collected as part of the interviews and ethnographic study will be solely related to the research study.

If you are collecting the information indirectly, please explain why: N/A
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14(b) If you are collecting personal information directly from the individual concerned, specify the steps taken to make participants aware of the following points:

The Information Sheet for Participants (see attached) will be permanently posted on the researcher's blog site. It will be provided electronically via a link in an introductory email to all participants. At the beginning of each interview, the information sheet will be reviewed.

14(c) If you are not making participants aware of any of the points in (b), please explain: N/A

14(d) Does the research or teaching project involve any form of deception? NO

14(e) Please outline your storage and security procedures to guard against unauthorised access, use or disclosure and how long you propose to keep personal information:

The interviews will have audio recordings and typed transcripts kept in both paper and electronic form. The ethnographic artefacts and fieldnotes will also be kept in both paper and electronic form. At the end of the project, any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in secure storage for five years, after which it will be destroyed. The secure storage for personal information, stored electronically on an external drive or in paper files, will be a locked filing cabinet in the department. The method for destruction will be erasure using reformatting software for electronic files and shredding for paper documents. Dr. Greatbanks as primary supervisor will have ultimate responsibility for this.

14(f) Please explain how you will ensure that the personal information you collect is accurate, up to date, complete, relevant and not misleading:

Participants will have the opportunity to review interview transcripts to ensure that the personal information collected is accurate, up to date, complete, relevant and not misleading.

14(g) Who will have access to personal information, under what conditions, and subject to what safeguards against unauthorised disclosure?

The PhD student researcher and the student's supervisors will have access to all research material including personal information on participants. Individual participants will have access to their own interview transcripts.

14(h) Do you intend to publish any personal information and in what form do you intend to do this?

No, every effort will be made to anonymise the identifying personal information in the PhD dissertation and other publications using the research material by using pseudonyms for individuals and organisations.
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14(i) Do you propose to collect information on ethnicity? NO

15. Potential problems:
No harm or discomfort to participants in anticipated. However, if the interview or ethnographic process does cause concerns, participants may withdraw from the process and have any evidence of their participation destroyed at any time with no adverse consequences.

16. Informed consent: Both the Information Sheet for Participants and Consent Form are attached to this application.

17. Fast-Track procedure Do you request fast-track consideration? NO

18. Other committees
If any other ethics committee has considered or will consider the proposal which is the subject of this application, please give details: N/A

19. Applicant’s Signature: .................................................. Date: .........................

Please ensure that the person signing the application is the applicant (the staff member responsible for the research) rather than the student researcher.

20. Departmental approval: I have read this application and believe it to be scientifically and ethically sound. I approve the research design. The research proposed in this application is compatible with the University of Otago policies and I give my consent for the application to be forwarded to the University of Otago Human Ethics Committee with my recommendation that it be approved.

Signature of Head of Department: ........................................ Date: ..........................
Application Form for ethical consideration of research and teaching proposals involving human participants

APPENDIX – INTERVIEW QUESTIONS

- Which online resources such as blogs, forums, social network sites or other virtual environments do you use the most when problem solving software development related issues?
- How do you choose which sites to use?
- What are important features of the sites?
- How do you determine the reliability, quality, and reputation of the sites?
- What does virtual community mean to you?
- Describe how you have solved a software development related problem within a virtual environment
- Describe how you have helped someone else solve a software development related problem within a virtual environment
- Describe how you and others have worked together to solve a software development related problem in a new way
- How does membership in a virtual community benefit your activities as a software developer?
- How would you characterise your involvement in virtual communities?

REFERENCES


Ess, C., & the AoIR ethics working committee (2002, Approved by the AoIR, 27 November 2002). Ethical decision-making and Internet research: Recommendations from the aoir ethics working committee, from http://www.aoir.org/reports/ethics.pdf
Application Form for ethical consideration of research and teaching proposals involving human participants


Markham, A. N. (1998). Life online: Researching real experience in virtual space. Walnut Creek, CA: AltaMira Press.


## Appendix B: Interview questions

<table>
<thead>
<tr>
<th>Research theme and questions</th>
<th>Interview Questions</th>
<th>Rationale</th>
</tr>
</thead>
</table>
| **Demographic**              | - What is your name, organisation, and job title?  
                               | - How long have you been developing software/websites?  
                               | - Would you describe what you do?  
                               | - Where are you located?  
                               | - Do you work with developers in other locations?  
                               | - Do you consider yourself more introverted/extroverted in face-to-face situations? | - Locating participants in relation to the research problem |
| **Community structure and membership** | - Which online resources such as blogs, forums, social network sites or other virtual environments do you use the most when problem solving software development related issues?  
                               | - How do you choose which sites to use?  
                               | - What are important features of the sites?  
                               | - How do you determine the reliability, quality, and reputation of the sites?  
                               | - What does virtual community mean to you?  
                               | - How would you characterise your involvement in virtual communities? | - Structure (Network ties, network configuration, and appropriable organisation)  
                               - Structure (market, social, and hierarchical)  
                               - Characteristics of virtual environments and social networks |
| **Opportunity and potential resources** | - Is there a difference between how you get help from close friends online as opposed to people you do not know very well or at all?  
                               | - How does membership in a virtual community benefit your activities as a software developer? | - Gaining access to parties for combining/exchanging intellectual capital  
                               - Anticipating the value through combining/exchanging intellectual capital |
<p>| <strong>Motivation, trust and relationships</strong> | - How do you determine the trustworthiness of | - Relational (Trust, norms of reciprocity, obligations, and identification) |</p>
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<thead>
<tr>
<th>Research theme and questions</th>
<th>Interview Questions</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sites/people/information you find online?</td>
<td>– Motivating the combination/exchange of intellectual capital</td>
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<td>How do you determine how you participate in online environments? Specifically, do you have personal guidelines for when and how you communicate within an online environment? For instance, when do you use email, a public post, a private message or a tweet?</td>
<td>– Motivation (Shared destiny, enforced trust, generalised reciprocity, and shared norms)</td>
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<td>How do you decide when to post information without solicitation? Respond to a posted question privately?</td>
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<td>Cognitive ability of resources</td>
<td>If you have found information/members useful in the past, does that influence how often you return to the online environment? Does it influence whether or not you contribute to discussions vs. just follow/watch/read them?</td>
<td>– Cognitive (Shared codes/language and shared narratives)</td>
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<td>Describe how you have solved a software development related problem within a virtual environment</td>
<td>– Develop combination capability</td>
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<td>– Ability (Shared beliefs)</td>
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<td>Describe how you and others have worked together to solve a software development related problem in a new way</td>
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<td>– Effects (Benefits and risks)</td>
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<td>– Context (Task; symbolic: norms, beliefs; and complementary capabilities: networks’ abilities)</td>
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<td></td>
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<td>– Behaviours within virtual environments</td>
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Appendix C: NVivo themes and codes

The following is a list of codes used within NVivo. Additional codes were applied to quotes, observations, and other fieldwork materials outside of NVivo in the fieldnotes and other external notes.

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Appendix D: Pilot study ethics application

ETHICAL APPROVAL AT DEPARTMENTAL LEVEL OF A
PROPOSAL INVOLVING HUMAN PARTICIPANTS (CATEGORY B)

NAME OF DEPARTMENT:
Management

TITLE OF PROJECT:
Identification of factors which contribute to the development of a blog-based community

PROJECTED START DATE OF PROJECT:
December 2008

STAFF MEMBER RESPONSIBLE FOR PROJECT:
Richard Greatbanks

NAMES OF OTHER INVESTIGATORS OR INSTRUCTORS:
Fai Martin-Niem, MCorn student

BRIEF DESCRIPTION OF THE AIMS:
The research study, which is the basis of a Master of Commerce thesis, is to identify the factors which contribute to the development of a blog-based community. Blogs are websites which display regular commentaries ("posts") in reverse-chronological order. They provide a community of readers with periodic new posts as well as an archive of posts which can be searched and easily retrieved. Blogs are written and maintained by one or more authors who write the posts, respond to comments and determine other blog characteristics such as design, linked websites (biogrolf), general blog themes, and individual post topics. The blogs in this study are public and open for reading and commenting by anyone with internet access.

In order to investigate the characteristics and behaviours of blogging communities a research methodology suited to the study to blogging must be used. This kind of exploratory study of blogging behaviours and motivations requires a methodology, which facilitates the examination of common practices within a blogging community. Established research methods for investigating the feelings, experiences, and perspectives of community members rely heavily on traditional organisational structures and modes of communication. When researching communities in a web
environment, which have neither formal boundaries nor face-to-face (FTF) interactions, it is necessary to adapt extant research methods such as interviewing and observation.

Research on blogs and blogging communities is a relatively new field of study and only within the last few years have articles on blogs appeared in management journals. The earliest studies describe blogs as an "emerging form" of computer-mediated communication (CMC), date from the beginning of the decade (Riva, 2002, p. 582). Whilst early blog studies have been generally considered either an extension of CMC research (Blanchard, 2004; Gurak, Antonijevic, Johnson, Ratliff, & Reyma, 2004; Wei, 2004), or focussed on the mechanics of blogging (Riva, 2002; Rodzvilla, 2002), more recent literature has included a greater variety of topics and methods.

This research study uses applied ethnographic methods to study blog community members within a blog environment. The primary technique for interacting with participants is using blog-based interviewing or blogviewing which is a one-to-many dialogue between the bloggers and readers. It uses not only the technical infrastructure and techniques of blogging, but also relies on the blogging community norms and behaviours. Blogviews blend the traditional interviewing techniques with ethnographic principles, which are sympathetic with the sensibilities of a blogging community. Thus, blogviews present a research method, which minimises the limitations of extant research practices, and yet leverages the benefits of the blogosphere environment. Participating in a blog-based dialogue provides not only the narrative of the discussion, but also facilitates observation of related blog communities, narrative and artefacts. Because of the separation of the researcher's physical and virtual presence, the researcher is able to participate as both an internal member of the blog community and an external observer. Although, as with ethnography and all forms of qualitative research, the researcher's perspective shapes and influences the interpretation of data generated.

**BRIEF DESCRIPTION OF THE METHOD:**

To generate data on blogging behaviours and motivations, this study will develop a blogging community by creating a research blog in which to engage and interact with participants. The blog, [http://famartinniemi.wordpress.com/](http://famartinniemi.wordpress.com/), will be authored by the primary researcher for this study. The topic of the blog and the theme of the posts are motivations and behaviours of members of blogging communities. The posts include the author's personal thoughts and reflections on blogging as well as elicit comment and feedback of readers. Using the infrastructure, methods and social norms of the blogging community, the primary mechanisms for gathering data will be through blog-based interviewing and discussions as well as the analysis of linked websites, such as hyperlinks within the blog text, commenter blogs, and the blogroll. The blog will be updated regularly with commentary and questions in order to attract participation. The data collection will last for three months.

The study is open to anyone with internet access who wishes to participate within the research blog community. Participants will therefore self-select by visiting the blog website. The level of participation can vary greatly from reading a single post to regularly reading and commenting on posts. Participants are "recruited" in the same manner as other blogs attract a readership via links to the blog, search engine queries, and discussions in other social media such as Facebook and Twitter. Participants are encouraged through the behavioural norms and accepted practices of
blogging to read posts, comment, and link to the blog. There will be no targeted recruitment using email or other personal appeals. Participation is completely voluntary and participants may withdraw at any time without notification by simply discontinuing visits to the website.

DETAILS OF ETHICAL ISSUES INVOLVED:
The blog will not contain a research disclaimer at the top of postings as it contravenes blogging etiquette and could compromise this research study by making the site function less as an interactive blogging environment and more as a static website. However, the research blog will display a permanent page containing the text of the Information Sheet for Participants (see INFORMATION SHEET FOR PARTICIPANTS) as per blog conventions using a separate page for static information with the page tab displayed on every page.

The research blog posts which include topics for discussion as well as questions for readers, will not solicit personal information from participants. The only identifiable information available on participants comes from the following areas:

- Commenter information – name, email address, and website (see Figure 2: Interface for submitting a comment). For owners of other WordPress.com blogs, the comment information will link to their blog information, for others they may enter any information they choose ranging from a true complete name to a fictional alias.

- Linked blog "About" pages – by convention, blog authors usually post a public page about themselves, although the nature of personal information varies widely and is controlled by the individual blog authors.
The research blog will follow all of the privacy and security policies established by the hosting environment, Wordpress.com. Details of these policies are available via the following links:

- Privacy, http://automattic.com/privacy/
- Participant responsibilities, http://wordpress.com/tos/

Since blogs, such as the research blog in this study, are public forums, participation is based on the norms for public venues. According to the Association of Internet Researchers, “the greater the acknowledged publicity of the venue, the less obligation there may be to protect individual privacy, confidentiality, right to informed consent, etc.” (Ess & the AoIR ethics working committee, 2002, p. 5). As such, participants are not considered subjects or informants in the traditional meaning of social science investigation, but “as authors whose text/artifacts are intended as public” (Ess & the AoIR ethics working committee, 2002, p. 7).

REFERENCES


Ess, C., & the AoIR ethics working committee. (2002, Approved by the AoIR, 27 November 2002). Ethical decision-making and Internet research: Recommendations from the aoir ethics working committee. from http://www.aoir.org/reports/ethics.pdf


Reporting Sheet for use ONLY for proposals considered at departmental level


**ACTION TAKEN**

- [ ] Approved by Head of Department
- [ ] Approved by Departmental Committee
- [ ] Referred to University of Otago Human Ethics Committee
- [ ] Referred to another Ethics Committee
  
  Please specify:

**DATE OF CONSIDERATION:**

________________________________________

**Signed (Head of Department):**

________________________________________
Student Research project: Identification of factors which contribute to the development of a blog-based community

INFORMATION SHEET FOR PARTICIPANTS

This blog has been developed and is used for research purposes. By visiting this website, reading, and/or commenting on the blog content, you are participating in an academic research project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you of any kind and we thank you for your consideration.

What is the aim of the project?
This research study is part of the requirements for a Master of Commerce for the University of Otago. It aims to understand blogging behaviours and norms which contribute to the development of a sustainable blogging community. In particular, it will investigate the motivation of blog authors, readers, and those leaving comments to understand how a blogging community is established and sustained over time. Finally, it seeks to establish metrics and measures of blogging characteristics in a community formation.

What type of participants are being sought?
Anyone with access to the blog website may participate, under the terms of service of the host environment, Wordpress.com (http://wordpress.com/tos/).

What will participants be asked to do?
There are no rules to participation other than the terms of service listed above. Participation may range from a single visit to this blog to regular reading or RSS subscription and frequent commenting. You may visit this blog as little or as much as you prefer and there is no participation expectations for anything outside of your desired level of participation. Please be aware that you may decide not to take part in the project without any disadvantage to yourself of any kind.

Can participants change their mind and withdraw from the project?
You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind. To withdraw, simply discontinue visiting this blog.

What data or information will be collected and what use will be made of it?
All of the statistical data and narrative text from this blog and hyperlinks to other publically available websites and blogs will be included in the data collection for this project. The statistical data will be used to establish metrics for blog community development. The narrative will be used to identify themes and a typology for blogging behaviours, norms, and motivations.
This project involves an open-questioning technique where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the blog discussions develop. Consequently, although the University of Otago Human Ethics Committee is aware of the general areas to be explored in the interview, the Committee has not been able to review the precise questions to be used.

In the event that the line of questioning does develop in such a way that you feel hesitant or uncomfortable you are reminded of your right to decline to answer any particular question(s) and also that you may withdraw from the project at any stage without any disadvantage to yourself of any kind.

The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand) but every attempt will be made to preserve your anonymity. You are most welcome to request a copy of the results of the project should you wish. The data collected will be securely stored in such a way that only those mentioned below will be able to gain access to it. At the end of the project, any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in secure storage for five years, after which it will be destroyed. Reasonable precautions will be taken to protect and destroy data gathered by email. However, the security of electronically transmitted information cannot be guaranteed. Caution is advised in the electronic transmission of sensitive material.

What if participants have any questions?
If you have any questions about our project, either now or in the future, please feel free to contact either:

Farin Martin-Niemi
Student Researcher
Department of Management
fnemi@business.otago.ac.nz

Dr. Richard Greatbanks
Research project supervisor
Department of Management
rgreatbanks@business.ac.nz

Please Note: by reading this information sheet and visiting this website you are giving consent to participate in this project. You are free to request further information at any stage. By consenting to participate, please read and understand the following:

1. Your participation in the project is entirely voluntary;

2. You are free to withdraw from the project at any time without any disadvantage;
3. The *personal* data gathered (if any) will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for five years, after which it will be destroyed;

4. This project involves an open-questioning technique where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the discussions develop and that in the event that the line of questioning develops in such a way that I feel hesitant or uncomfortable I may decline to answer any particular question(s) and/or may withdraw from the project without any disadvantage of any kind.

5. The results of the project may be published and available in the University of Otago Library (Dunedin, New Zealand) but every attempt will be made to preserve my anonymity.