

Moving Beyond Tacit and Explicit: Four Dimensions of Knowledge

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Intellectual Property Research Institute of Australia

Working Paper No. 06/04

ISSN 1447-2317 © 2003

June 2004

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Abstract

Knowledge is a complex concept, yet the dominant view of knowledge in the management literature is a dichotomy between tacit and explicit. Even the knowledge management literature tends to view knowledge on a limited number of dimensions, whether this is in discussions of knowledge as a commodity or the process of knowing. A review of knowledge from first principles shows that knowledge has different degrees of validity, is highly heterogeneous and has complicated temporal and social aspects. A model of knowledge based on these aspects is presented. Comparing the four dimensions of knowledge with knowledge as a process opens up a more holistic view of knowledge management and helps articulate some of the key differences within streams of research in the field. This holistic perspective is also compatible with Polanyi's original complex conception of tacit knowledge, which drew heavily on Gestalt theory, a theory that examines the perception of "wholes". The dual perspectives of a multi-dimensional conception of knowledge as a commodity and a holistic perspective on knowledge management expands the avenues of potential research and improves our ability to put knowledge in action within organizations.

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I INTRODUCTION

Knowledge is a complex concept, and despite a strong interest in its study within organizations over the last decade or so, the dimensions of knowledge under study are still quite limited. Knowledge management has focused on a definition of knowledge that is based on a tacit/explicit categorization [1]. While useful, it has also limited our potential understanding. Recent management literature typically applies this tacit/explicit categorization, often simplifying the concept of tacit knowledge from Polanyi's [2, 3] original conception. Analyses of organizational knowledge have expanded this perspective into two predominant views: knowledge as an objective commodity and knowledge as a socially constructed process [4-7]. However, these perspectives are often seen as fundamentally at odds with each other because of differing epistemological assumptions [8]. There is also considerable theoretical debate about the definition of knowledge and organizational knowledge within both camps [9, 10].

This paper argues that this separation in perspectives and the lack of clarity in definitions stems from the complexity of knowledge and that a greater understanding of the fundamental aspects of knowledge opens up the potential for improved research on the use of knowledge in organizations. Knowledge must be precisely defined in order for it to form the basis of comparison in analyses of competitive advantage [11]. The examination of knowledge in a management context should focus on its ability to practically assist in the operation of organizations.

The unique contribution of this study is to develop, introduce and justify a new conceptual model of knowledge. An expanded model of knowledge is developed by examining other philosophical, economic and epistemological discussions of knowledge. This model consists of two perspectives. The first differentiates between key schools of thought regarding knowledge in management, particularly focusing on the differences between knowledge as a commodity versus the concept of knowing. The second focuses on building a more detailed view of knowledge as a commodity that moves beyond tacit and explicit to discuss knowledge aspects of validity, heterogeneity, temporality, and social connectedness.

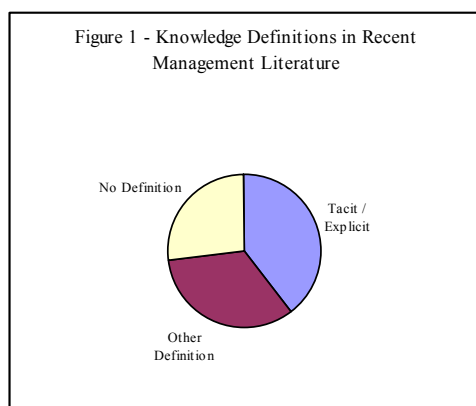
In addition to providing some new insights into aspects of knowledge, this analysis reveals some interesting implications for future research. Seeing knowledge as a more complex

phenomenon has the potential to more fully reveal its manageability. As well, more holistic views of knowledge may lead to additional insights and specificity in concepts.

II KNOWLEDGE AS A DICHOTOMY

Knowledge is an extremely complex and somewhat ambiguous term, so it is important to define the term in any discussion of knowledge management. The most typical definition is a dichotomous split between explicit knowledge (knowledge about facts and theories) and tacit knowledge (knowledge that is experientially based) [1, 12]. Explicit knowledge can be codified or documented and subsequently communicated. Tacit knowledge is less tangible, typically exists only in the mind of the individual and is not easily communicated.

A detailed analysis of leading management literature pertaining to knowledge reinforces this focus on the tacit / explicit dimension. An examination of 91 articles related to knowledge in the top five management journals (based on number of citations) between 2001 and 2003 (inclusive) shows some interesting results. First, the range of theoretical perspectives examining relationships with knowledge is extremely diverse. Second, while many articles use the term knowledge, it is often left relatively undefined. Examining figure 1 shows that many papers have no definition, while the most commonly used definition is a variation of the tacit/explicit categorization. Third, regardless of definition, the empirical measurement of knowledge usually relies on proxies of knowledge such as patents or process development. There are still a limited number of concrete measures for knowledge [13]. Finally, examining both the definition and the type of measure shows that the use of tacit/explicit definitions is often a simplified view, that doesn't incorporate the full complexity of tacit knowledge as originally developed by Polanyi.



King & Zeithaml argue for empirical efforts to create a “more nuanced understanding of organizational knowledge” [13, page 769] A good example of a more complex definition of knowledge is Boland et al.’s [14] use of both figurative and objective knowledge in a study of knowledge representations.

This dichotomous definition of knowledge in turn leads to a focus on mechanisms of transferability for either tacit or explicit knowledge. Evidence from the practical applications that have arisen in the field of knowledge management reinforces this focus. Traditional implementations of knowledge management have either revolved around transferring explicit knowledge through knowledge-based systems, knowledge flows and knowledge maps, or on providing a means to link tacit knowledge via knowledge directories and communities of practice. This split is best represented by Hansen et al. [15] who argued that there were only two strategies for managing knowledge -- codification and personalization – both of which focus on improving the transfer of knowledge. This view can also be seen in Snowden’s [16] decision-based model of knowledge management where the focus is on codification of knowledge into knowledge-based systems or the explicit linking of sources of tacit knowledge. Even Earl’s [17] classification of seven schools of knowledge management shows most of the underlying processes to be focused on the issue of knowledge transferability. The basic theme is to convert tacit knowledge into explicit knowledge and benefit from modern technologies to transfer this knowledge more freely within an organization. If it can’t be codified, or it’s too time consuming to codify it, then we are advised to map it and set up some formal or informal methods of ensuring that the knowledge transfers through osmosis.

This dichotomous view even tends to simplify the original conception of the term “tacit knowledge” in Polanyi’s [3] book *The Tacit Dimension* by equating tacit knowledge with not yet codified knowledge. However, Polanyi’s concept of knowledge has much greater complexity. He describes reality as a structured hierarchy. As we come to know one layer of reality, something occurs which he calls ‘emergence’. By indwelling (or immersing oneself) in the particulars of a given layer of reality (i.e. the details), we look through these particulars to a higher level and ‘emerge’ into this level. He argues that the organizing principles involved in a higher level cannot be discerned from the laws of the lower level. The process of indwelling allows us to begin to see boundary conditions. These discontinuities lead us to a higher level of thinking. To Polanyi, knowledge is action that

moves us towards a hidden reality that is revealed as the truth. The key to this whole process is tacit knowledge. "...Tacit knowing achieves comprehension by indwelling, and all knowledge consists of or is rooted in such acts of comprehension." [3, page 55] Tacit knowledge is the basic fact that we know more than we are able to tell. Polanyi's use of the term tacit knowledge is rooted in perception and Gestalt psychology. However, rather than looking inwardly at perception in terms of its impact on our senses, he looks at it as a mechanism for shaping our experiences.

III EXPANDED VIEWS OF KNOWLEDGE

In examining a wider literature, and in particular some key analyses of organizational knowledge, it is clear that expanded views of knowledge do exist [4-7, 11]. These views tend to focus either on elements of knowledge or elements of knowing and are often seen as epistemologically incompatible [8]. However, these analyses often discuss both perspectives. For example, Blackler [4] outlines both elements of knowledge (embedded, encultured, embrained, embodied and encoded) as well as elements of knowing (mediated, situated, provisional, pragmatic and contested). Similarly, Spender [7, 11] talks about elements of knowledge (conscious, automatic, objectified and collective) in the context of a social constructivist approach. Another key point to note about these analyses is that while terminologies differ, the elements that are being studied have many similarities between authors. For example, explicit knowledge is also referred to as encoded [4] or automatic [11].

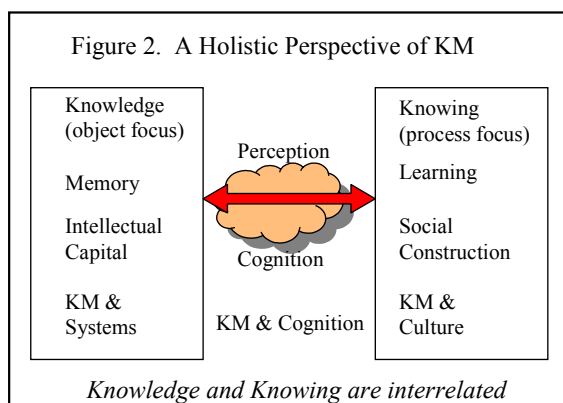
As well, a close examination of some of the more typically cited works shows that the elements of knowledge under examination are still reasonably limited. Spender's [11] frequently cited definition of knowledge expands tacit versus explicit into a new dimension of individual versus social or group-based and introduces the concept of collective knowledge. Work by Bohn (1994) hints at some expanded dimensions to knowledge, but tends to focus on technological knowledge and stages of process development rather than elements of knowledge.

A number of perspectives tend to move beyond knowledge itself to some of the implications of knowledge. Alvesson's [18] focus is on the ambiguity of knowledge work and as such focuses on the social construction of knowledge and not the particular aspects of what ambiguity in knowledge is, other than to say that "...it is extremely difficult to isolate and

point to knowledge as a particular factor that is in itself important...” [18, page 866]. Is ambiguity really a feature of knowledge or is it a feature of the situation created by knowledge? We argue that the ambiguity arises as a byproduct of the knowledge and the situation. In particular it stems from issues of the validity of the knowledge and its social interpretation. Knowledge has different degrees of validity and the result of this validity is a perception of ambiguity.

Even analyses that bridge the concepts of elements of knowledge versus knowledge as a process have tended to incorporate the tacit / explicit categorization. For example, Cook & Brown [6] use a tacit / explicit combined with individual / group categorization for knowledge. As Cook and Brown indicate [6], there is a benefit to bridging organizational knowledge and knowing. However, we argue that there is significant room to go beyond Cook & Brown’s conceptualization of knowledge to more expansive definitions of organizational knowledge that draw on epistemological arguments and help to open up greater insights into practice.

Referring back to Polanyi, we might recall that his definition of tacit knowledge is complex and examines issues of perception, particularly Gestalt psychology. Gestalt theory takes the perspective of examining “wholes”. Rather than looking at knowledge as a limited dichotomy, or taking an either/or view of knowledge versus knowing, we should examine knowledge from a more holistic perspective (See figure 2). Taking this perspective also shows a clear relationship with these two dominant views and studies in cognition and mental models. Each view of knowledge and its subsequent implications for knowledge management are part of an inseparable process. However, to get at this process, the dimensions of knowledge must be expanded and a more comprehensive perspective of knowledge presented.



IV FOUR DIMENSIONS OF KNOWLEDGE

We propose a model of knowledge that consists of four key dimensions: validity, social connectedness, temporality and heterogeneity. We do so by starting with Plato's original concept that knowledge should be considered as 'justified true belief' and incorporating other work in philosophy, epistemology and economics to help outline some of the key arguments related to knowledge.

A. Knowledge validity

Using a Platonic definition, knowledge in the form of a statement must be meaningful and true and not a guess. To determine the truth of a statement, one must analyze that it is 'justified'. It is possible to accept a statement as true with no justification or with a simple crosscheck in our minds against previous statements. But it is also possible that the initial statement will demand a further statement in order to establish this justification. Hence, the process of justification can be endless, as each justification itself requires justification. In order to halt this process, we typically rely on the credentials of a person or group of people. It is possible to see that a particular piece of knowledge may have different degrees of validity depending on the thoroughness of the justification that is demanded.

As a result of the circular nature of justification, philosophers often break justification into two parts. First, there are matters of fact which come out of perception or memory and second, principles of inference, which relate to deductive and inductive logic [19]. Perception and memory are both treated as fact, but both are subject to issues of validity. In particular, memory is often subject to decay with time. Yet it is not typical to distinguish the validity of knowledge based upon how long it has been in an individual's memory, nor by how strong the particular memory is.

The validity of knowledge is also linked to our personal set of beliefs. "We can think of our beliefs as conjoined to form an account of the world for us, a map of reality, and to add or take away a belief is to add or subtract a feature of that map." [20, page 57] Boulding [21] refers to this as our 'image' of the world. As new information is presented to an individual, that individual may modify their beliefs, finding that a previous belief that was held as 'true' is rejected by some new piece of knowledge. In this way, one's image of the world

constantly changes. Beliefs are impacted by the truth of a statement. At any given time, someone may hold a set of beliefs that in fact consist of pieces of knowledge that are not truthful. Part of the reason for this may be the impact of faulty justification that was outlined above. Thus the requirement for justification in effect leads to belief and confidence in belief.

This interplay between truth, justification and belief leads to differing degrees of knowledge validity. Pears [22] orders knowledge in five categories of decreasing validity: knowledge (actual knowledge); knowledge of the first degree (knowledge except that the person lacks confidence in it); knowledge where reasons or credentials are deficient; knowledge where reasons or credentials are fairly good, but the statement itself is actually false; and ignorance, or, a pure guess. In each of these categories, an aspect of knowledge is removed. First, confidence or certainty is removed. Next credentials or justification is removed. Next, truth is removed. Finally, ignorance exists where all aspects of knowledge are removed.

B. Social aspects of knowledge

There is an aspect of knowledge that inherently links it to people and social groups. Continuing to build from our Platonic definition, we can see that the process of justification creates links to other individuals in society. To stop infinite justification, we rely on the credentials of a person or group of people. For example, we are more likely to believe a statement about human nature from a psychiatrist than from a homeless person. Similarly, if we have a long personal history with an individual and know that they are trustworthy and reliable, we are likely to believe their statements with little justification. So, the act of justification links knowledge into a wider social phenomenon.

Knowledge is also social in that it requires the convincing of others. Is knowledge that exists only in the mind of an individual actually knowledge, or does it demand communication to ascertain that it is justified true belief? Machlup [23] believed that knowledge which existed only in one individual's mind had no value to society and should not be considered knowledge. Sartre [24] believed that we begin in a total state of ignorance (or absence of knowledge) and it is only through others that we discover reality. "If Peter points out the table to me, I see it through Peter's consciousness" [24, page 6]. Thus knowledge is acquired through a process of intersubjectivity – a type of connection or feedback mechanism between two or more minds. Similarly, knowledge has a direct link to the confidence of the

person imparting the knowledge. “If someone makes a true statement based on adequate reasons, but does not feel confident that it is true because he does not feel confident that the reasons are adequate, does he or does he not know it?” [22, page 13]. While both these issues introduce a social aspect to knowledge, they also reinforce earlier discussions of validity. Because knowledge is linked to perceptual issues, it introduces a subjectivity that is typically not considered. Any given piece of knowledge is not clearly delineated truth, but rather a subjective and malleable object of a social nature. Knowledge achieves value only in its transmission and distribution in society. In turn, it is impacted by society through its requirement for justification and the intersubjectivity of its transmission. The social standing, the confidence, and the power of the individual or groups delivering the knowledge all come into play in its transference and make knowledge a social phenomenon, again more complex than tacit/explicit characteristics can capture.

C. Temporal aspects of knowledge

There are two ways of looking at time as it relates to knowledge. The first way is best illustrated through the use of a simple time line that breaks time into past, present and future. It is the temporal context within which the individual or organization sits in relation to their own knowledge. In this orientation of time, knowledge displays three key aspects: path dependency, historically influenced interpretation and anticipation.

Knowledge is path-dependent in that the acquisition of certain pieces of knowledge opens up an ability to acquire other pieces of knowledge. This path dependency of knowledge has been captured best in the work of Nelson and Winter [25] or Campbell [26]. Without certain fundamentals of knowledge in place, new knowledge cannot be understood. Once knowledge is acquired in a particular area, it is much easier to continue to leverage knowledge in that area, rather than to build knowledge in an entirely different area. This path dependency introduces an exponential property to knowledge [27]. The more that you have, the easier new knowledge acquisition becomes. It also means that if you are lacking in knowledge, it may take time to acquire not only the sought after knowledge, but also other prerequisites.

Our interpretation of events in the present is also influenced by the historical events of the past. Both individuals and organizations develop cognitive frameworks and schemas that limit the ability to perceive events in ways that differ substantially from the past [28, 29].

This differing historical perspective means that any two different entities may interpret the same piece of knowledge quite differently.

To Sartre [24] knowledge is about revealing the truth. We begin in ignorance and we must take action to reveal the truth by pursuing knowledge in a particular direction. We need vision to know which direction to pursue that knowledge and we take risks in its pursuit. That is, we risk that the future truth will not be revealed in the manner in which we had anticipated. Both Boulding [30] and Polanyi [3], in a similar view to Sartre, saw our actions and revisions as moving us closer and closer to the truth. It is this process of action coupled with anticipation of the future in which knowledge demonstrates its true value.

This first way of looking at time as it relates to knowledge becomes evident when we look at an application of knowledge – the use of knowledge in decision-making. “...Decision is always a choice among alternative perceived images of the future” [30, page 7]. As a result, decisions are based on accumulated information and knowledge from the past that is projected into the future. Von Krogh et al. [31] goes further than this in what he calls a self-referential process of knowledge development, that is, a person looks at both past knowledge and their expectation of future knowledge in order to create new knowledge. This temporal aspect of knowledge is fundamental to economics and decision-making. Boulding argues that different economic methods of organization can end up producing ‘false images’ in the minds of decision makers. As well, this path-dependency means that knowledge is very contextual in nature – it will mean quite different things to different people depending on their past history and future expectations.

The second way of looking at time as it relates to knowledge is to view time as something that is occurring in the environment that surrounds an individual or organization. That is, it is not how time is affecting our knowledge, but rather how time is affecting the knowledge of others around us. It is the temporal context related to knowledge external to the individual or organization. The key aspect of knowledge revealed in this view is the natural decay of knowledge. As knowledge in the external world grows, any given piece of knowledge tends to hold less validity. This aspect of knowledge is temporal, but has significant relationships with both validity and with the social nature of knowledge. For example, at one point in time, it would have been accepted that the world was flat or that the sun revolved around the earth. With time and greater understanding, what is accepted as justified true belief may

change. Knowledge in the external environment has a tendency to build causing a static piece of knowledge to lose value. Knowledge is subject to natural decay.

The temporal and path-dependant nature of knowledge also introduces risk. In fact, we could introduce the term ‘knowledge risk’ to mean that portion of future uncertainty that arises due to a lack of present knowledge. That is, the uncertainty of the future is some combination of events that are completely random and events that can be anticipated if the correct knowledge is possessed.

D. Knowledge heterogeneity

Knowledge is by nature extremely heterogeneous. No two pieces of knowledge are the same, it takes on many different forms, and even seemingly identical pieces of knowledge have different implications depending on the context in which they are applied. “There are so many varieties of knowledge, and each of them has so many aspects that it is easy to neglect some of the phenomena and to produce a theory that only covers part of the field.” [22, page 4]. Machlup [32] provided an analysis of this heterogeneity by looking at classification systems for knowledge in library science and within universities, but this type of content oriented analysis yields little insight into generalizable characteristics of knowledge and its transferability. More interesting insights come from looking at knowledge in more abstract ways. Aspects of knowledge related to heterogeneity are best viewed through a number of closely related analytical perspectives: definitional, physical representation, and ownership.

1. DEFINITIONAL ANALYSIS: DATA, INFORMATION, KNOWLEDGE AND WISDOM

There is considerable differentiation in the literature over the definitions of data, information, knowledge and wisdom [33], but an analysis of these terms provides greater insight into the characteristics of knowledge. There is generally a view that as you move up this hierarchy of terms, there is an increasing depth of meaning and a general increase in ambiguity [34]. However, many authors use the terms in different ways, particularly in differentiating between information and knowledge and in differentiating between knowledge and wisdom. Data is typically described as raw facts or dispersed elements [34-36]. Information is described as patterned data or data with some meaning to it [5, 34, 36]. It has also been described as the content of communication [37]. Knowledge is described as clear understanding of information [36]. Knowledge has also been described as information that has a clear action component to it – it allows predictions to be made [5]. “As information is

converted into a valid basis for action, it becomes knowledge.” [34, page 225]. However, a great deal of confusion arises when knowledge is differentiated between codified knowledge and tacit knowledge. When does codified knowledge become information? If knowledge is integrally linked to a person [22, 38], how can it still be considered knowledge when it is codified? Wisdom has been described as an ability to use knowledge to achieve goals, to implicitly know how to use knowledge, or to make judgments [34, 36]. Green and Cooper [39] have described wisdom as the act of knowing, a process oriented task that requires judgment, understanding, compassion and the ability to take action in the right direction. Other authors have described this same concept in relation to knowledge – that is, that knowledge is information combined with experience and judgment [35].

Both Earl [40] and Bierly et al. [36] provide frameworks that identify key substantive differences between data, information and knowledge. The Bierly et al. analysis differentiates the terms based on the Bloom et al. [41] taxonomy of learning objectives. As such it is focused on the cognitive requirements of each level of analysis. Moving up the chain of data, information, knowledge and wisdom involves successively higher levels of understanding.

In summary, there are two key ways that a definitional view of knowledge helps outline key aspects of knowledge heterogeneity. First, as we move from data to wisdom, there is a greater depth of meaning. In other words, each level has more precise value in use. Information is patterned data; knowledge is actionable information; wisdom is directionally accurate knowledge. At each level, the additional meaning provides some additional benefit. From a user’s perspective, this is equivalent to saying that higher levels of understanding are required. The definitions are hierarchical in nature. Some form of indwelling at each level of the hierarchy is required to reach the higher level. So one aspect of the heterogeneous nature of knowledge is that it can display varying depths of meaning. The second aspect of knowledge heterogeneity that arises from a definitional view of knowledge is that higher levels represent increasing ambiguity. In other words, there is greater difficulty in describing and isolating the higher levels of the scale. The boundaries of a piece of knowledge would be more difficult to describe than the boundaries of a piece of information.

2. PHYSICAL REPRESENTATION: FORMS OF KNOWLEDGE

The natural state of knowledge is in the mind of an individual [38], but it can also be represented in a number of different forms. Knowledge in its natural state is typically referred to as tacit knowledge – it is tied up in the mind of an individual and difficult to remove or ‘non-articulable’ [42]. Codification of knowledge typically means codification in the form of a document or information in a computer system. However, knowledge can also be ‘codified’ in physical forms such as software or tangible products. Boulding [30] referred to the codification of knowledge into products as “three dimensional printing” (Page 5). Economists have also attempted to look at knowledge as a commodity. However, because the nature of knowledge is that it is almost completely heterogeneous, no basic unit of knowledge has emerged [30]. Holsapple et al. [43] has referred to a ‘knowledge management episode’ as the time between when the need for knowledge is recognized and the time that need is satisfied. However, this is not a basic unit of knowledge, but a way of describing knowledge requirements in a firm. A number of authors have viewed knowledge as a stock, similar to capital stocks, and information as a flow, similar to income flows [23, 30, 44].

Different physical representations of knowledge provide insight into the heterogeneous nature of knowledge. The various forms of knowledge represent different methods of codification. Codification of knowledge has a number of benefits including ease of replication and standardization. Knowledge that has been codified into a document, some portion of a computer system, or a product, can be easily replicated and this aids in the underlying transfer of the knowledge that is being represented. Codification often involves standardization, allowing like objects to be held together, indexed and referenced in some common methodology, thus increasing the accessibility of the knowledge and potentially its subsequent transfer.

Codification of knowledge typically has some limitations. The act of codification also involves some form of documentation into a particular language and as such, it may lose some of the depth of the knowledge. More fundamentally, codified knowledge may be difficult to separate from its original human component. The transfer of codified knowledge often requires additional human explanation to make it meaningful. The value of codified knowledge is only determined by its subsequent use.

As knowledge moves from its natural state to codification to physically embedded forms, it becomes more difficult to change. Thus knowledge that is frozen within a physical product is static and this in turn means that it is subject to natural decay. Printing freezes knowledge and allows it to avoid being forgotten, but the temporal nature of knowledge pushes knowledge forward, and the frozen knowledge holds increasingly less economic value.

Knowledge that is codified also has a requirement for some form of organization prior to its codification. Organization of knowledge allows it to be built up into something of greater utility. But this process also tends to increase the level of representation, reducing the depth of meaning that is presented. This organization may be as extensive as all the actors involved in the production of a complex semiconductor, or as simple as a categorization of knowledge prior to formulating a document. Kogut and Zander [45] provide a good example of this requirement for organization in their discussion of software development and the concepts of know-how and know-why. An individual may have the skill to use software to accomplish some task, but this is different than knowing how the software was designed. The design of software requires a higher level of knowledge because it demands an understanding of the complex relationships in the subject matter of the software. The higher level of 'know-why' may be critical to be able to effectively codify that knowledge. As well, the process of codifying this know-why into the form of software limits the scope of the original knowledge. The software in essence becomes a language of communication and if the language is simple, the communication is not as rich.

3. OWNERSHIP: KNOWLEDGE AND UNIT OF ANALYSIS

One aspect of the heterogeneity of knowledge is the ownership or unit of analysis which knowledge is represented. This may be at the individual, group, organization, inter-organizational, industry or nation level.

In a group or organization there are a number of additional aspects that come to bear on knowledge. First, there is a collective aspect to knowledge within a firm. Spender [11] referred to this type of knowledge as either objectified (when explicit) or collective (when tacit). Collective knowledge is seen as enacted within a group of individuals [46], dependent on their particular context [47] and influenced by their shared understanding [9]. The existence of collective knowledge is particularly important to an organization's competitive advantage because its tacit knowledge is in a form that would be very difficult to imitate. As

well, it implies a form of organizational ignorance, in that organizations would not necessarily be able to identify the nature of this collective knowledge.

The nature of knowledge is such that knowledge which is meaningful and relevant for one organization may not have similar significance to another, even if those organizations are competitors in the same industry [47]. There is an internal social context and an external industry context related to the particular circumstances of a company. These contextual issues mean that two similar companies will make different productive use of similar knowledge.

Knowledge at the level of an industry or country introduces other issues. Knowledge can be used by multiple individuals simultaneously without diminishing its value [47, 48]. As a result of this property, the market for knowledge becomes quite difficult. If you sell knowledge, it is in essence replicated, rather than transferred. An additional unit of knowledge is produced and its rarity is diminished, however, not necessarily its value. As well, once it is sold, the buyer now has the ability to resell this knowledge without diminishing his own use of it. This has led to the development of intellectual property rights that allow the originator of knowledge to maintain control over its distribution for some period of time.

V KNOWLEDGE AND GESTALT THEORY

This look at first principles gives us an expanded view of the dimensions of knowledge that goes beyond tacit and explicit. This creates a more comprehensive view of the components of knowledge and the corresponding implications regarding its manageability (See table 1). While these expanded dimensions have value in themselves, they are more valuable when linked to the holistic perspective of knowledge management presented earlier in the paper and to concepts in Gestalt theory.

But how does Gestalt theory help link dimensions of knowledge with a holistic perspective of knowledge management? Let's first look back to Polanyi's earlier work to see what issues of Gestalt formed an important part of his thinking regarding tacit knowledge. First, Polanyi discusses Gestalt as "...the active shaping of experience performed in the pursuit of knowledge." [3, page 6]. That is, we possess knowledge and are able to make judgments by integrating details without being able to identify what these details are – hence the concept of

tacit knowing. Second, Polanyi discusses the Gestalt focus on perception and argues that this acts as a bridge between higher creative powers and bodily processes. Perception, and particularly the idea of field and ground, creates a relationship between the two terms of tacit knowledge. "...We know the first term only by relying on our awareness of it for attending to the second" [3, page 10]. Our focus is on the second term, so we only perceive this, and tacitly know of the particulars related to the first term.

Gestalt theory opens up a number of important possibilities. First, building on Polanyi's discussions, an understanding of the specific elements of knowledge as a commodity and focusing on the perception of these may lead to a bridge to a higher level of thinking.

Second, we can think of the study of knowledge in the same way in which Gestalt theory examines wholes and parts. Looking at part of the concept of knowledge, such as knowledge as a process, may lead us to discern certain laws or principles. However, the true meaning of knowledge can only be appreciated by examining the whole. That is, knowledge as a process, or knowledge as a commodity "...participates in sustaining the whole..." [2, page 58] – they are both key components in an overall understanding of the impact of knowledge on organizations. Each way of viewing knowledge, the dimensions of knowledge and its key components are clues in an overall understanding of its meaning.

Third, we may be able to apply the Gestalt concepts of: the organization of perception; and, the view of individuals as open systems in interaction with their environment; to knowledge concepts. If "...thinking and problem solving are characterized by appropriate substantive organization, restructuring and centering of the given insight in the direction of the desired solution" [49], does the same apply to knowledge? That is, knowledge is naturally centred and organized towards a desired solution. Further, the memory systems of an individual naturally organize incoming perceptions and thus knowledge is automatically structured based on existing knowledge structures that reduce an individual's cognitive dissonance [49]. Does this imply that frameworks and structures outside of an individual's mind may also contribute to the natural organization of knowledge towards desired solutions? If so, then a holistic view of knowledge, in interaction with individuals would contribute to the ability to lead the development of knowledge in the direction of organizational goals.

Finally, we may be able to use the Gestalt concept of wholes to examine the connections between different schools of thought in organizational knowledge. "...The same general

type of dynamical process which leads to the formation and segregation of extended wholes will also explain their specific properties.” [50, page 148] Taking a holistic approach, we can examine the various divisions within the study of knowledge to discern particular properties of knowledge itself.

VI CONCLUSIONS AND FURTHER RESEARCH

Knowledge is an imprecise term with many complex attributes that have been debated, literally over centuries, and to which no definitive conclusions have been reached. This complexity of knowledge means that any discussion of knowledge based on tacit vs. explicit knowledge should, at the very least, be framed with the underlying aspects of knowledge in mind. Knowledge is not a dichotomy despite the fact that it may be convenient to discuss it in these terms.

We have presented a model of knowledge that moves beyond tacit and explicit to include four dimensions: validity, social connectedness, temporality and heterogeneity. While knowledge heterogeneity and social connectedness have been widely examined, the dimensions of validity and temporality warrant further exploration. Can we measure knowledge validity? Is knowledge validity directly linked to managerial issues of image and crisis management? Do employees alter knowledge validity to affect their input into key managerial decisions? Is there a link between knowledge validity and perception of effective leadership? As well, the dimensions of knowledge suggest some more fundamental investigation of more detailed elements of knowledge and their specific relationships to manageability. For example, what are the specific factors involved in the natural decay of knowledge. Ideally, this would lead to a more detailed field of the “mechanics of knowledge” that examines specific manageable aspects of knowledge in particular managerial settings.

This paper has also discussed a more holistic view of knowledge, which incorporates elements of knowledge and the process of knowing with research in perception and cognition. Examining the interaction of knowledge as an object with the process of knowing has the potential of opening up new insight into the use of knowledge in organizations. As well, a further exploration of Gestalt theory and knowledge may open up key issues. For example, does knowledge naturally self-organize, and if so does this suggest the importance of frameworks and structures upon which knowledge builds?

There remain many interesting paths of investigation for knowledge and its use in management. As our understanding progresses, it is hoped that the combination of more detailed and more holistic perspectives on knowledge will lead to a greater ability to put knowledge in action within organizations.

Table 1: Four dimensions of knowledge – components & implications		
Knowledge Dimension	Key Components	Manageability Implications
Validity	<ul style="list-style-type: none"> • Actual Knowledge • Confidence of Knowledge • Poorly justified knowledge • Falsely justified knowledge • Perception • Memory • Belief 	<ul style="list-style-type: none"> • Ambiguity • Image Management • Crisis Management • Symbolism • Organizational Memory Systems • Impact on Decisions
Social Connectedness	<ul style="list-style-type: none"> • Social Standing • Power • Personal Knowledge (within a mind) • Intersubjectivity • Credentials for Justification 	<ul style="list-style-type: none"> • Collective mind • Politics • Image Management • Language systems • Organizational Culture • Motivation & Performance Mgmt.
Temporality	<ul style="list-style-type: none"> • Path Dependence • Historically influenced interpretation • Anticipation • Natural Decay 	<ul style="list-style-type: none"> • Capabilities development • Cognitive Frameworks • Decision Making • Innovation • Knowledge risk
Heterogeneity	<ul style="list-style-type: none"> • Depth of Meaning • Ambiguity • Levels of codification • Tacit knowledge 	<ul style="list-style-type: none"> • Transfer • Segregation & Replication • Standardization • Appropriability • Cost of Modification • Organization & Filtering • Intellectual Property Rights

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