



ILKKA VIRTANEN

How Tacit Is Tacit Knowledge?

Polanyi's theory of knowledge and its application
in the knowledge management theories



ACADEMIC DISSERTATION

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UNIVERSITY OF TAMPERE

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Abstract

This research discusses the concept of knowledge, particularly the concept of tacit knowledge, from two perspectives: firstly, the meaning of these concepts in Michael Polanyi's theory of knowledge from which the concept of tacit knowledge originates, and secondly, the meaning of these concepts in the knowledge management literature in which the concept of tacit knowledge has gained a significant role. Despite the important role of the concept of tacit knowledge in the knowledge management literature, it has however remained superficially studied, controversial and ambiguous concept in the research of the field. This is, on the one hand, due to the abstract nature of Polanyi's theory, and on the other hand due to the fact that the concept has been transferred in a rather straightforward way to a different kind of epistemological context. Particularly the idea of sharing of tacit knowledge that has been emphasized as an important factor from the perspective of organizations' competitive advantage in the knowledge management literature can be considered a problematic conception from the viewpoint of Polanyi's theory. In respect of the literature of knowledge management the object of analysis is particularly Ikujiro Nonaka and Hirotaka Takeuchi's conception of knowledge introduced in their theory of knowledge creation; it is not only one of the most significant theories of knowledge management, but also the most important application of Polanyi's theory in the literature of the field.

This research has two objectives, the more important of which is the enhancement of the understanding concerning Polanyi's theory of knowledge; Polanyi's theory is both clarified and expanded in this research. Polanyi's theory is approached from the perspective of cognitive science by explaining the central concepts of the theory and the examples of tacit knowing that Polanyi used in the light of recent findings in cognitive science. On the other hand, this research critically discusses the use of the concept of tacit knowledge particularly in the part of the knowledge management literature that stresses the importance of explication of tacit knowledge. This research shows that this widely adopted conception of knowledge in the mainstream knowledge management literature is internally contradictory. Moreover, it seems to imply a simplified conception of human cognition. Hence, the role of tacit

knowledge in human action seems to be different from what has been suggested in these theories of knowledge management.

Knowledge management is relatively young and developing discipline, and hence, the innermost purpose of the both objectives mentioned above is to contribute to the development of the concept of knowledge that still is not well-established in the field.

Tiivistelmä

Tässä tutkimuksessa tarkastellaan tiedon, erityisesti niin sanotun hiljaisen tiedon, käsitettä kahdesta näkökulmasta: käsitteiden merkitystä hiljaisen tiedon käsitteen luojaan, Michael Polanyin, tietoteoriassa, sekä toisaalta niiden merkitystä 1990-luvun luvun puolessavälissä yleistyneessä tietojohdamisen keskustelussa, jossa hiljaisen tiedon käsite on nostettu keskeiseen asemaan. Tärkeästä roolistaan huolimatta hiljainen tieto on kuitenkin tietojohdamisen kirjallisuudessa jäänyt pinnallisesti tutkituksi, ristiriitaiseksi ja moniselitteiseksi käsitteeksi. Tämä johtuu yhtäältä Polanyin teorian vaikeaselkoisuudesta, ja toisaalta siitä, että käsite on suhteellisen suoraviivaisesti siirretty erilaiseen tietoteoreettiseen kontekstiin. Erityisesti hiljaisen tiedon jakamista, jota tietojohdamisen kirjallisuudessa on korostettu tärkeänä tekijänä organisaatioiden kilpailukyvyyn kannalta, voidaan pitää Polanyin alkuperäisen teorian näkökulmasta ongelmallisena ajatuksena. Tietojohdamisen kirjallisuuden analyysi liittyy erityisesti tässä tutkimuksessa japanilaisten Ikujiro Nonakan ja Hirotaka Takeuchin käsitykseen tiedosta heidän esittämässään tiedon luonnin teoriassa, joka on yksi tietojohdamisen merkittävimmistä teorioista, mutta myös Polanyin teorian tärkein sovellus alueen kirjallisuudessa.

Tutkimuksella on kaksi päätavoitetta, joista keskeisempi on Polanyin tietoteoriaa koskevan ymmärryksen lisääminen. Tässä työssä sekä selitetään että laajennetaan Polanyin tietoteoriaa. Teoriaa lähestytään kognitiotieteen näkökulmasta selittämällä Polanyin teoriassaan käyttämää käsitteistöä ja esimerkkejä hiljaisesta tietämisestä viimeaikaisten kognitiotieteen tutkimustulosten valossa. Toisaalta työssä tarkastellaan kriittisesti hiljaisen tiedon käsitteen käyttöä erityisesti tietojohdamisen kirjallisuuden osassa, joka korostaa hiljaisen tiedon eksplikoinnin tärkeyttä. Tutkimus osoittaa, että tietojohdamisen kirjallisuuden valtavirrassa yleisesti omaksuttu tietokäsitys on tietoteoreettisesta näkökulmasta sisäisesti ristiriitainen ja sen taustalta paljastuu yksinkertaistettu käsitys ihmisen kognitiosta. Niinpä hiljaisen tiedon rooli ihmisen toiminnassa näyttää olevan erilainen kuin mitä edellä mainituissa tietojohdamisen teorioissa on esitetty.

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Tampere, April 2014
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1 Introduction

Although study of knowledge has almost as long roots as the known history of mankind, knowledge has gained particularly central role in the current economic reality during the past two decades; knowledge has become a differentiating competitive factor for individuals, corporations, and nations (Wiig 1997). It has been argued that knowledge is a fundamental source of power in modern society because it represents the most cost-effective means to generate productivity (e.g. Toffler 1990). The ones that possess the most adequate knowledge have also the best possibility to gain the best results. Hence, the possession of the most resources does not guarantee success, but the most effective use of available resources. This line of thinking has spread rapidly in the organizational context since the early 1990's, and as a result, knowledge¹ is considered as the key asset leading to economic progress, competitive advantage and business success in organizations.

Knowledge management (KM), a multi-disciplined approach aimed at designing and influencing processes of making efficient use of knowledge, burst into bloom in this knowledge-centric atmosphere. KM is a relatively broad term and it does not have a generally agreed definition, but it is typically related to systematically specified process for acquiring, organizing, sustaining, applying and sharing knowledge to enhance organizational performance and to provide competitive advantage by creation of new knowledge (see e.g. Alavi & Leidner 2001, Davenport & Prusak 1998). KM has been one of the most influential organizational practices since the early 1990's (e.g. Lucier & Torsilieri 2001) and it has become a major management trend in organizations (Zorn & Taylor 2003).

At the early years the focus of KM was on information and "explicit" knowledge, that is, knowledge that could be saved, stored, processed and accessed in information systems and in novel ICT-solutions (see e.g. Tuomi 2002). It was soon discovered,

¹ There is not a commonly agreed definition of knowledge, and its characterization often depends on the discipline and context it is used in. Knowledge is, however, traditionally defined as 'justified true belief' (see e.g. Pollock & Cruz 1999). This definition has been shown to be insufficient (e.g. in Gettier 1963), but it can still be considered as some kind of starting point for discussions concerning the nature of knowledge. Issues related to definition of knowledge will be discussed more in detail in the next chapter.

however, that explicit knowledge did not have much to do with individual know-how, learning and innovations that in the end were the most valuable knowledge-processes for the organizations that intended to differentiate themselves from their competitors. Hence, the information-processing view that focused on explicit forms of knowledge did not support the creation of knowledge, because it missed creative dialogue, shared experiences and collective reflection (Nonaka 1994, Nonaka & Takeuchi 1995). The idea was that organizations could create value from knowledge assets within them. As a result the focus of KM has shifted from its early years' ICT-driven knowledge acquisition, storage and sharing to social learning and knowledge creation (e.g. Koenig 2002). One of the most significant initiators of this change was Japanese theorists Ikujiro Nonaka and Hirotaka Takeuchi's theory of knowledge creation².

In the 1995 Nonaka and Takeuchi presented their theory of organizational knowledge creation, according to which creation of knowledge was vitally important to modern organizations. Drawing on Michael Polanyi's philosophy, they explained that knowledge creation was based on tacit knowledge, knowledge difficult to articulate and embodied in human action. The core of the idea of creation of knowledge was the mobilization of tacit knowledge by converting it to explicit knowledge (Nonaka & Takeuchi 1995). This externalization of tacit knowledge (also referred as explication and codification of tacit knowledge) refers to the articulation of one's tacit knowledge (ideas, beliefs, intuitions etc.) into words. Since the publication of Nonaka and Takeuchi's theory externalization has become one of the most discussed KM processes (Maasdorp 2007a). Moreover, the epistemological foundation of Nonaka and Takeuchi's theory, namely the classification of knowledge into tacit and explicit, has gained a dominant role as the basis for epistemology in the KM theory (Maasdorp 2007a, Stacey 2001).

The concept of tacit knowledge is originally adopted from Michael Polanyi's theory of knowledge. The main idea of Polanyi's theory is that an act of knowing can never be fully explicit because it cannot be reduced to the elements upon which it is based; the meaning and the acceptance of an act of knowing is dependent on elements known only tacitly by the knower (Polanyi 1966). Polanyi adverts to knowledge firming processes prior to the conscious belief. As such, knower's prior experiences affect what he knows.

² While Nonaka is the main author of the theory of knowledge creation based on his publications in 1991 and 1994, Nonaka's theory has gained its paradigmatic status via the book published with Takeuchi in 1995 (Gourlay 2006).

Polanyi's philosophy cannot be strictly subsumed under any philosophical paradigm (see e.g. Gelwick 1996, Prosch 1986). He however draws from phenomenological tradition, and has important linkages particularly to Merleau-Ponty's and Heidegger's philosophy. On the other hand, Polanyi's philosophy is essentially critique towards positivist philosophy of science and objectivist theory of knowledge. Polanyi uses the term 'objectivism' in a relative broad way referring to an epistemological view that denies (or at least ignores) the personal participation of the knower in an act of knowing. He saw the core of objectivism embodied in positivism³ (Polanyi 1958).

Since the publication of Nonaka and Takeuchi's theory of knowledge creation tacit knowledge has become one of the most fundamental concepts of KM literature. However, even a brief literature review of the subject area demonstrates that different authors interpret and understand the concept in different ways. This is problematic because, on the one hand, tacit knowledge is one of the grounding concepts of KM literature, but on the other hand, the concept is not unequivocal. For this reason the concept of tacit knowledge often seems to raise more questions than provide solutions in the KM literature. Moreover, according to Polanyi's view tacit knowledge cannot be articulated. Yet the articulation of tacit knowledge is considered as a basic premise in the KM theory. This contradiction is obvious and significant, yet many times ignored in the literature, which suggests that the subject area is not adequately studied.

Although the problems are at least partly related to the young age of the field of KM, I argue that epistemological and cognitive aspects of knowing have been treated too superficially in the KM literature. The development of successful knowledge management practices requires solid theoretical background and further development of the central concepts that are under investigation. Indeed, the term 'knowledge management' has been questioned as an umbrella term for a variety of organizational activities, none of which are actually concerned with the management of knowledge (Wilson 2002). Alvesson and Kärreman (2001) remark that KM is more likely to operate as a practice for managing people or information than a practice focused on facilitation of knowledge creation. The critics argue that particularly the conception of knowledge is too broad, or the use of the term 'knowledge' actually refers to information (e.g. Alvesson & Kärreman 2001, Wilson

³ The roots of positivism are in the 19th century, in Auguste Comte's philosophy. The positivist tradition has continued later by logical empiricism, whose core was the Vienna Circle, a group of early twentieth century philosophers. It should be noted that the dominance of positivism in philosophy of science has ended for decades ago, and it has currently mainly historical value, although of very significant kind (Caldwell 1980). The term positivism nonetheless still lives in the terminology of special sciences, and is used also in the KM literature.

2002, Donaldson 2001). A plausible theory, and a scientific discipline even less, cannot be based on fuzzy concepts.

With this research I seek to contribute to the discussion concerning the nature of knowledge in the context of KM. Hence, the focus is more on 'knowledge' than on its 'management'. The central objectives of this research are 1) to clarify epistemological, cognitive and ontological foundations of Polanyi's conception of tacit knowledge, and 2) based on the results of previous objective, to discuss and evaluate the use of the concept of tacit knowledge in the KM literature in relation to Polanyi's conception.

This research is a theoretical basic research. The primary research methods used in this research are analysis, synthesis and argumentation. My starting point is Polanyi's theory of knowledge. I seek to broaden the scope of Polanyi's theory by considering it from the perspective of cognitive science. A grounding assumption made in this research is that knowing is, before anything, a cognitive phenomenon whose understanding (and further application) is not possible if its emergence, function and cognitive basis in a deeper level are bypassed and it is only characterized superficially.

As a result of this research I argue that Polanyi's philosophy concerning human mind and knowledge is still relevant and in line with the knowledge that cognitive sciences of the 21st century have provided. Tacit knowledge is mainly related to formation of focal belief, and automated, unconscious processes. I claim that explication of tacit knowledge is not possible in the way it is presented in the KM literature (e.g. in Nonaka & Takeuchi 1995, von Krogh et al 2000, Kikoski & Kikoski 2004). The conception of knowledge on which the contemporary KM theory is based on is problematic in the sense that combining Polanyi's view on knowledge to a more objectivist theory of knowledge is shown to lead to an internally contradictory theory of knowledge. Moreover, the conception of externalization of tacit knowledge seems to imply a form of language dominance view on mind, which in turn represents a simplified conception of cognition. In conclusion, although all knowing is based on tacit knowledge, it is essentially unmanageable, and its role in knowledge creation is different from what has been presented in the mainstream KM literature. The critical approach naturally includes the responsibility to suggest justified corrections that hopefully provoke further discussion that contributes to the development of the field.

This research it belongs to the realm of information sciences, although it has strong philosophic tone. I end this chapter by briefly explaining why the subject area is important from the viewpoint of information sciences.

Data⁴, information⁵ and knowledge are fundamental concepts in information sciences. Although the study of input, storage, processing, and output of particularly data and information are in the heart of computer science, such important areas as data mining and knowledge discovery address also methodologies for the extraction of useful knowledge from data. It is often suggested in the literature that we proceed from the data to information, and further from information to knowledge. Hence, information is defined typically in terms of data, and knowledge in terms of information (Rowley 2007). This hierarchy creates impression that knowledge is a phenomenon that only appears in the higher levels of any system and is hardly involved in the processing of data and information. The impression is at least partly simplified because, in the first place, it is knowledge that must define which is the data to start with (see e.g. Tuomi 2000).

According to Floridi (2011) many information science theorists have recently adopted the general definition of information, according to which *I* is an instance of information if and only if:

1. *I* consists of one or more data;
2. the data in *I* are well-formed (i.e. the data is clustered together according to the syntax that govern the chosen system);
3. the well-formed data in *I* are meaningful (i.e. the data must comply with the semantics of the chosen system).

The second requirement of the definition suggests that in the formation of information from data the syntax of the chosen system must be initially known in order to form the data well (as well as the semantics in line with the third requirement); we have to know how the information should be structured for the purposes of the input of the data to the system. In other words, in this phase we face the problem of the representation of information because, on the one hand, the information must be transformed in the form or structure that enables its automatic processing, but on the other hand, it still must preserve the same content in this new form of representation. Finally, we have to possess knowledge of what is the most adequate way to process the data/information. In sum, all these processes necessarily

⁴ Data is typically defined as a set of discrete, objective facts about events as structured records of transactions (e.g. Davenport & Prusak 1998).

⁵ Information is typically defined as data that has been analyzed, displayed and is communicated through spoken language, graphic displays, or numeric tables (e.g. Dixon 2000), or simply data that has been given a context (e.g. von Krogh et al 2000, Amidon 1997).

require lots of cognitive work, design and especially knowledge of the subject area. Hence, knowledge is not only the basis of system design in computer science, but it can be associated with the design and development of any system. In fact, knowledge seems to be the starting point of any human goal-directed behavior, and in this sense the subject area of this research is universal.

The structure of the thesis is following: In Chapter 2 I introduce the theoretical background on which the research operates, namely Polanyi's epistemology and Nonaka and Takeuchi's conception of knowledge including the idea of externalization of tacit knowledge. In the Chapter 3 I present the research questions and the factors that have influenced them. Chapter 4 discusses the chosen methodology used in this research and explains how it is carried out. In chapter 5 I introduce briefly the original research papers, the themes they address and their contributions. Chapter 6 outlines the most important results, and chapter 7 the selected contributions of this research. In Chapter 8 I discuss the general implications of this research, its limitations and also future research directions. The conclusions are presented in Chapter 9.

2 Theoretical Background

In this chapter I introduce briefly the two most important theoretical starting points from the perspective of this research; first, Polanyi's epistemology from which the concept of tacit knowledge is originally adopted from, and second, Nonaka and Takeuchi's conception of knowledge presented in their theory of knowledge creation to which also the conception of externalization of tacit knowledge is related. Before that, I begin with a brief general discussion of knowledge and epistemology.

Discussions related to knowledge appear as early as in the philosophical works of Ancient Greek. Already Plato speculated that true belief and a rational explanation for holding such a belief were the conditions that must be satisfied in order for one to claim possessing knowledge. This account, namely knowledge defined as "justified true belief" has come down to modern times and is in general called as classical, or traditional definition of knowledge (see e.g. Niiniluoto 1996). Pollock and Cruz (1999) remark that although consensus is rare in philosophy, the classical definition of knowledge had exceptionally unquestionable role in philosophy until 1960's. Edmund Gettier (1963) was the first to show that a justified true belief can be false, suggesting that the classical definition of knowledge was inadequate. After this there have been attempts to supplement and modify the definition, but no indisputable solutions have been found (Pollock & Cruz 1999). Although there is no generally accepted consensus about the definition of knowledge, the classical definition of knowledge is generally some kind of a basis or at least an important point of reference for any epistemological considerations.

Different authors have classified knowledge to different types in order to clarify the nature of the concept. Bertrand Russell (1912) presented the distinction between 'knowledge by description' and 'knowledge by acquaintance'. Russell argued that knowledge by acquaintance meant having acquaintance with anything of which one is directly aware, without the intermediary of any process of inference or any knowledge of truths. Hence, acquaintance knowledge is the kind of knowledge we claim when we are familiar with for example a person or a thing. By comparison, knowledge by description referred to propositional knowledge, or 'knowledge that'. Hence, knowledge by description means facts that can be stated as declarative sentences or propositions.

Gilbert Ryle (1949) is also credited with stressing the distinction between ‘knowing how’ and ‘knowing that’; whereas ‘knowing that’ referred to propositional knowledge discussed above, ‘knowing how’ referred to knowledge of how to do something. This also corresponds to the classification of knowledge into declarative and procedural that is often made in the fields of artificial intelligence and psychology (see e.g. Anderson 1981). Hence, it is common in philosophy to distinguish among three kinds of knowledge:

1. propositional/declarative/’knowledge that’,
2. procedural/’knowledge how, and
3. ‘knowledge by acquaintance’ (Fantl 2014).

Epistemology refers to the study of nature and scope of knowledge, and it is one of the main areas of philosophy (Pollock & Cruz 1999). Bunge (1974) characterizes epistemology as a collection of opinions concerning human knowledge. Indeed, epistemology is divided to different directions based on, for instance, the position which is taken concerning possible sources of knowledge. The classical division is made between empiricism and rationalism; while empiricism stresses the role of experience based on perceptual observations in knowledge acquisition, according to rationalism knowledge is acquired by a priori processes. Constructivism, in turn, claims that knowledge is constructed based on human perceptions and former experiences, and has thus a significant subjective aspect.

In the tradition of philosophy epistemology is often considered as doctrine concerning particularly the justification of knowledge (Pollock & Cruz 1999). Therefore theories of knowledge are also classified basing on how they deal with the justification of beliefs; what kind of factors are necessary/sufficient to justify our beliefs.

The distinctions made above are examples to illustrate the multifacedness of epistemological considerations. Another significant aspect is the stance that different theories take on the role of the knowing subject. At one extreme knowledge is considered as objective facts separated from people (objectivism). At another extreme the primacy is given to human consciousness instead of objective reality; reality is generated in the human mind, which makes knowledge of it always subjective (subjectivism). The objective-subjective distinction is important in the context of this research, because both Polanyi, and Nonaka and Takeuchi have

sought to combine these opposite positions. Next I introduce these two theoretical entities, first Polanyi's theory of knowledge, and then Nonaka and Takeuchi's conception of knowledge presented in the theory of knowledge creation.

2.1 Polanyi's Theory of Knowledge

Despite the crucial position of the concept of tacit knowledge in the field of KM, there seems to be only scarce interest concerning Polanyi's philosophy in the literature (see e.g. Mooradian 2005, Tsoukas 2003, Grant 2007). Indeed, Polanyi is typically mentioned only as an original source of the concept of tacit knowledge with no further discussion of his philosophy. From the scientific perspective this is potentially harmful, because scientific concepts can rarely be used properly if they are taken out of their context without further understanding of the theoretical entirety, "the big picture", behind them. For this reason I see crucial to place Polanyi's theory to its historical context and look further back to the roots and the motivating factors of his thinking in order to understand the emergence of his ideas concerning knowledge.

2.1.1 The Emergence of Polanyi's Philosophical View

Polanyi (1891-1976) grew up in Hungary during the turn of the century, where he also started his professional career as a medical doctor. He immigrated to Germany in 1919 and changed there to the career of physical chemist, which had always been his primary interest (Prosch 1986). The economic dislocation caused by the First World War, the great inflation and the rising unemployment made Polanyi pay increasingly attention also to social and economic issues. Moreover, both Nazis and Communists threatened Germany at that time, and Polanyi watched close the development and workings of these two totalitarian systems. Due to his Jewish roots he was finally forced to leave Germany in the early 1930's and accordingly, he went to England where he joined the University of Manchester as a professor of physical chemistry (Prosch 1986).

Polanyi was particularly concerned of the views of communist theorists who claimed that pure science was a morbid symptom of a class society; according to communist view science pursued for its own sake would disappear (Polanyi 1966). Polanyi was concerned of these strengthening political movements that threatened

the liberty of individuals and independent scientific thought. According to Polanyi (1958) the freedom to uncover theoretically important truths was indispensable for science. Polanyi saw a clear connection between political extremist views and nihilism (Prosch 1986). Nihilism, was related to objectivist philosophy of science, Polanyi (1962) claimed. Since moral principles, justice and mercy could not be demonstrated in terms of scientific objectivism they were to become substituted by reason and philosophically less vulnerable ideals.

Polanyi believed that a terribly mistaken understanding of what science was had alienated men from their own powers of understanding the world (Scott 1985). He saw that current philosophic views of science and knowledge fuelled authoritarian and utilitarian movements that threatened social freedom. Hence, defending freedom in science meant defending freedom in general. Accordingly, Polanyi found himself increasingly involved in problems regarding the relation of science to society; he was convinced that the existence of free society and science rested upon freely held beliefs in ideals and principles that could not only be proved but could not even be made wholly explicit (Prosch 1986). According to Prosch, this is the way that philosopher Polanyi gradually emerged.

The target of Polanyi's most important work, "Personal knowledge – Towards a Post-Critical Philosophy", is what Polanyi calls 'objectivism': the assumption that genuine knowledge can result only from an impersonal operation of explicit rules and that truth depends on verifying observation (Allen 1990).

Objectivism presupposed that

1. there are objective state of affairs that are independent of human mind;
2. the method of accurate observation immediately given sense data without reference to personal participation, expectations, values or hopes is of the utmost importance;
3. the final arbiter of scientific theory is a controlled experiment (Prosch 1986).

Objectivism further presupposed that perfectly objective knowledge would gradually emerge by means of these formal criteria and exact logical structure of scientific inquiry. But Polanyi (1962, p. 254) remarked:

"For we can derive rules for observation and verification only from examples of factual statements that we have accepted as true before we knew these rules; and in the end the application of our rules will necessarily fall back once more on factual observations, the acceptance of which is an act of personal judgment, unguided by any explicit rules."

Hence, the criteria for scientific and logical knowledge claims cannot themselves be established by means of explicit rationalization (Gill 2000).

Polanyi could not accept objectivism/positivism since it rejected intuitional attempts to gain knowledge and claimed that all the unverifiable sentences were meaningless (the principle of verification in logical empiricism). He concluded that the prevailing conception of science that was based on the disjunction of subjectivity and objectivity was wrong. Instead, he argued that into every act of knowing there enters a personal contribution of the knowing subject, which is a vital component of knowledge (Polanyi 1962). Hence, science could not meet the objectivist ideal because its rules and methods could not be explicitly stated but required personal engagement of the scientist himself (Allen 1990). More specifically, he argued that the entire scientific enterprise presupposed

1. a belief that knowledge of reality was possible;
2. a personal commitment to the search for truth;
3. an affirmation of the reliability of human cognitive capacities;
4. a reliance on the imagination (e.g. for the creation of hypotheses);
5. an acknowledgement that that scientific truth was the result of social interaction and convention (Gill 2000).

Modern man's penchant for exactitude and precise statements was misleading in the sense that, according to Polanyi, human thought functioned by quite different principles (Prosch 1986). This is the idea whose development gradually became the primary interest to Polanyi, and that was the guiding principle in his epistemology.

2.1.2 Discovery

Polanyi (1962) was convinced that the most significant part of science was discovery⁶. Discovery did not, however, fit well objectivist view since the objectivist conception of science stressed the importance of verification and proof. Verification referred to a principle, according to which a sentence had empirical meaning only if

⁶ Most philosophical discussions of scientific discoveries focus on the generation of new hypotheses that explain phenomena and the observations related to them (Schickore 2014). However, the concept is not unequivocal, because it is used to refer to both the outcome and the procedure of inquiry. To Polanyi discovery seem to have meant a successful scientific inquiry in general—as Polanyi explained it, it meant to see things that no human being had seen before (Polanyi 1962).

it was capable of complete verification by observational evidence (Caldwell 1980). An acceptable proof for any scientific statement had to be either logical or empirical. Hence, Polanyi (1962) claimed that discovery had been either ignored or misinterpreted in modern theories of science (within Polanyi's time this idea was novel, nowadays this confrontation is somewhat obsolete). Polanyi believed that the better the process of discovery of new truths was understood, the better understanding of science would emerge. Polanyi had worked for years among the men who were pioneering radically new understanding of universe, such as Albert Einstein, which had apparently affected his view (Scott 1985). Einstein (1935, p. 125) wrote:

“The supreme task of the physicist is the search of those highly universal laws from which the picture of the world can be obtained by pure deduction. There is no logical path leading to these laws. They are only to be reach by intuition, based upon something like an intellectual love.”

Polanyi (1962) remarked that things are not labeled as ‘evidence’ in nature, but are accepted as such by observers. Thus, discovery was essentially about scientist's skill of seeing which matters are significant. In other words,

“Theories of scientific method which try to explain the establishment of scientific truth by any purely objective formal procedure are doomed to failure.” (Polanyi 1962, p. 135).

If all knowledge was explicit, true discoveries were not possible. Since this was not the case, Polanyi held that we had to have tacit knowledge of which we could not give an explicit account (Prosch 1986). In the pursuit of discovery we are guided by personal, tacit knowledge “by sensing the presence of a hidden reality toward which our clues are pointing” (Polanyi 1966, p. 23). Polanyi (1962) argued that the prevailing conception of science was based on the disjunction of subjectivity and objectivity that sought to eliminate from science personal human appraisals.

In sum, despite that one fundamental factor behind the achievements of humankind was the ability to preserve, pass and communicate “explicit knowledge”, such knowledge could not work on its own. Polanyi did not discuss only scientific knowledge, but the nature of knowledge in general, for humans found and used all the time knowledge that did not depend on rational reasoning.

Polanyi (1969) argued that knowing was always an act of a particular individual. Whenever we express what we know we can only do so by “sending” messages of some form. Such messages, however, carry for the most part information, which

only a knowing mind can assimilate, understand and incorporate into its own knowledge structures (Wilson 2002). Therefore Polanyi maintained that although there existed reality independent of mind, knowledge of it was dependent on the knower's mind.

When we know something, we engage in what we know and cannot be neutral or indifferent in relation to it; we have no means to abstract the knowledge from our life and experiences by the means of which we understand that knowledge. Following from that, knowledge is represented in the mind of the knower and it is thus necessarily dependent on the processes and personal properties that take part in the forming of that representation. They direct us, but we are not aware of them in a normal way.

2.1.3 Two Kinds of Awareness

The most central feature of Polanyi's theory of knowledge is a distinction between two kinds of awareness that are involved in all conscious acts. The things that we are attending to and that we are consciously aware of (e.g. propositional belief, mental image, external object, read sentence etc.) belong to focal awareness. However, all focal awareness is dependent on subsidiary awareness that consists of variety of clues, elements and processes (unconscious processes, emotional processes, past experiences, motor responses etc.) that enable focal awareness giving rise to the personal meaning of its contents. This is the structure of all acts of knowing (Polanyi 1969). Hence, the focal object is always identifiable and in this sense explicit, whereas subsidiary content is unidentifiable, tacit. Therefore, argues Polanyi, we base our knowledge of the things we are focally attending to something more fundamental.

To Polanyi the two kinds of awareness are mutually exclusive. This means that we cannot attend to focal and subsidiary elements at the same time. In fact, we cannot attend to what is functioning subsidiarily at all, because the moment we try to shift our focal attention to the subsidiary elements, it becomes focal losing the subsidiary meaning, and having its own subsidiary basis. Polanyi (1966, p. 31) describes this in a following way:

“... Anything serving as a subsidiary ceases to do so when focal attention is directed on it. It turns to a different kind of thing, deprived of the meaning it had.”

In this sense, a mind holding a focal purpose or aim is capable of recognizing relevant elements to accomplish the goal. This associative meaning cannot be turned to explicit language because it is integration of a mind trying to realize its goal; it is not a concrete thing held in the working memory independently of its purpose. Therefore, the meaning of tacit knowledge cannot be seized on by definition. Subsidiary, or tacit, knowledge is not known in itself, but in terms of something focally known; analysis may bring tacit knowledge into focus and formulate it as a maxim but such specification is not exhaustive (Polanyi 1962). For this reason, argued Polanyi, tacit knowledge is ineffable.

Also Frege (1993), among others, has introduced similar lines of thought about the unreachability of the meaning of language based on the structure of sematic meaning he presented⁷. Hence, the problem of unreachability of the contents of the mind that Polanyi discusses is familiar also in the philosophy of language.

2.1.4 Bodily Roots of Knowing

Polanyi (1969) explained that all the major skills of human mind are based on a meaningful integration performed by the body and of the sensations felt by the body. Hence, knowing subjects use their body in virtually all transactions with the world; all human behavior is expressed in and through the body (Gill 2000). As Polanyi (1969, p. 147) puts it,

“The way body participates in the act of perception can be generalized further to include the bodily roots of all knowledge and thought. Our body is the only assembly of things known almost exclusively by relying on our awareness of them for attending to something else.”

In this sense body is not a mere passive physical object in the world but serves as an interface by which one comes to know the world through interaction; man has various ways to manipulate the environment using the body, but the environment also constantly regulates man. Consequently, all knowledge has bodily roots because external objects are attended by being subsidiarily aware of things happening within the body.

Polanyi’s approach differs from the traditional analysis of knowledge notably because he sees bodily participation more fundamental than the conceptual outcome

⁷ This was pointed out to me by Haaparanta (2012).

of the process of knowing; the integration of tacit knowledge in the subsidiary awareness raises the meaning connecting it to the focal representation. Moreover, Polanyi (1969) claims that we observe external things by being subsidiarily aware of the impacts they make on our body and of the responses our body makes to them. On the basis of this one can interpret that some kind of representation of the body state is a fundamental form of tacit knowledge—as well as the ability to register changes in this basic body state and represent them.

2.1.5 The Resulting Epistemology

In general, post-modern theories of knowledge criticized modern theories of knowledge of the way that they de-emphasized the subjective aspect of human experience. Post-modern theories of knowledge suggested instead that exploration of meaning was free and a question of interpretation. The problem of these theories in general is that if any interpretation of a given statement is as valid as any other, these statements lose all their meaning and particularly, so does this claim itself (Gill 2000).

In a similar way, the subjective feature of Polanyi's theory has been a point vulnerable to criticism. Some notable figures of philosophy of science, such as Imre Lakatos and Karl Popper, have claimed Polanyi's epistemology subjectivist. Lakatos denied Polanyi's conception of tacit knowing because he thought that it dragged psychological and sociological elements to epistemological considerations (Gill 2000). Similarly, Popper (1959) argued that the logical content of scientific problems, theories and arguments formed a world of objective knowledge. Thus, knowledge in this objective sense was independent of anybody's claim to know. As Popper (1972, p. 109) puts it,

“Knowledge in the objective sense is knowledge without a knower; it is knowledge without a knowing subject.”

However, the subjective dimension does not make Polanyi's theory subjectivist, but rather broadens the scope of theories of knowledge based on positivist thinking (e.g. Jha 2002, Gill 2000, Prosch 1986, Mitchell 2006). This is essentially because in an ontological sense Polanyi is a realist (see e.g. Mitchell 2006, Scott 1985, Jha 2002). Polanyi (1962, p. vii) argued that knowing was a responsible act claiming universal validity in the sense that the knower's intention was to relate himself to external reality that others could also relate themselves to. Hence, the personal participation

of the knower does not make knowing subjective because knowledge strives for objectivity having always also an objective dimension in this sense. Polanyi does not make a clear objective-subjective dichotomy but accepts both of them as different dimensions of knowledge. As regards the theory of truth, Polanyi's theory seems to manifest fallibilist thinking; according to fallibilist theory of truth empirical statements are predictive, and our developing understanding of the matter may lead us to revise or reject them (Jha 2002).

Polanyi rejected the objectivist ideal of knowledge and instead defined knowledge as a process performed by active knower. The endpoint of the act of knowing is the formed representation that the knower is focally aware of and is able to communicate. But because of the subsidiary, or tacit, roots of the formed representation, knowledge can never be wholly explicit or objective; we tacitly integrate sensations, emotions, motor responses etc. to the focal object with which we operate, which connects the meaning of tacit knowledge and the focal object. So, we know what has sunk into our minds as a result of past integrations (that is, experiences) and the general principles we have taken from them (Prosch 1986). Since we cannot articulate these factors exhaustively, knowledge cannot be justified exhaustively; explicit knowing is based on tacit knowing and thus cannot be fully justified by argumentation. Instead, knowledge becomes assessed by its functionality and acceptance. For example, according to Polanyi's view new knowledge becomes justified by the authority of scientific peers, tradition and the premises of science (Jha 2002). Hence, despite the tacit dimension present in all acts of knowing, knowledge statements can be subjected to testing and the statement may be claimed as "true" based on the evidence.

To end this sub-chapter concerning Polanyi's philosophy, I finally discuss briefly to which philosophical traditions Polanyi's theory is related, and how it can be linked to cognitive science.

2.1.6 Links to Other Traditions of Philosophy

As mentioned earlier, Polanyi's theory has a close connection to phenomenological tradition. Polanyi's conception of knowledge intersects phenomenology particularly at three points: at the emphasis on intentionality, at the concept of indwelling, and at the idea of embodiment. Intentionality refers to the feature of mind to be about, or to represent things, properties and states of affairs (Pierre 2010). Intentionality stresses the importance of the relationship between mental acts and external world

as the main characteristic of mental phenomena. The idea of intentionality derives from Brentano's philosophy of mind (see e.g. Brentano 1995) from the end of the 19th century although the idea of "aboutness" of mind as such is older (Pierre 2010). Polanyi (1968) refers to Brentano, agreeing that consciousness necessarily attends to an object, but adding that it also has roots from which it attends. Hence, Polanyi broadened the conception of intentionality by explaining that the intentional directedness is based upon tacit awareness of the subsidiaries (Zhenhua 2008).

The second point of intersection between Polanyi and phenomenology concerns the similarity of Polanyi's concept of indwelling and Heidegger's notion of being-in-the-world (see e.g. Heidegger 1962). Polanyi (1964) argues that all understanding is based on dwelling in the particulars of the object that we comprehend, and such indwelling means our participation in the existence of that object. He (Polanyi 1964, p. x) continues: "It is Heidegger's being-in-the-world." As I understand it, both of these conceptions seek to overcome the distinction between subject and object, stressing that consciousness is always consciousness of something—in this sense indwelling and intentionality illustrate almost the same idea.

In Polanyi's view, the subsidiary awareness of one's own body represents the highest form of indwelling (Zhenhua 2008). Indeed, the idea of embodiment is an important aspect of Polanyi's philosophy. On the other hand, Merleau-Ponty's phenomenology is considered the most systematic and persistent argument seeking to prove the primacy of body in human experience and meaning (Shusterman 2005). Various researchers interested in Polanyi's philosophy (e.g. Mullins 2000, Grene 1995, Zhenhua 2008) have discussed Merleau-Ponty's influence on Polanyi in this subject.

Despite these evident links to phenomenology, Polanyi cannot be considered as a phenomenologist (Gelwick, 1996, Prosch 1986). He thought that reality was not a human construction; instead, nature offered us clues on which we based our conceptions (Jha 2002). Polanyi therefore assumed the existence of external reality and argued that discovery uncovered its nature (Prosch 1986). He believed that discoveries and mistakes must be assessed in relation to reality, which was the only way to measure them. Since phenomenology in general emphasizes reality as a subjective phenomenon that is experienced in our minds, it is evident that Polanyi's view differs from phenomenological tradition in this sense. In addition, Polanyi's conception of truth is considered fallibilist (see e.g. Mitchell 2006, Jha 2002) that in an ontological sense refers rather to critical realism according to which external reality is assumed but at the same time it is acknowledged that it cannot be understood entirely (nevertheless, it can be understood to a reasonable degree).

Regarding to epistemological orientations, Polanyi's philosophy is related to social epistemology and naturalized epistemology. Social epistemology stresses that social influences considerably affect knowledge production (Goldman 2010). It identifies and evaluates social processes by which epistemic subjects interact with other agents who exert causal influence on their beliefs. On the other hand, Polanyi considers cognitive processes prior to conscious belief, which contextualizes his theory also to naturalized epistemology. According to naturalized epistemology the epistemic status of belief state is dependent on cognitive processes that generate and sustain it (Goldman 1986). As such, these processes cannot be ignored in epistemology. Particularly, the starting point of both social and naturalized epistemology is that the scope of traditional epistemology that stresses the objective justifiability of knowledge is too narrow and one-sided.

2.1.7 Links to Cognitive Science

I end this section concerning Polanyi's philosophy by relating Polanyi's theory to the research of cognitive science. At this point I only situate Polanyi's theory to the research line called 'embodied cognitive science' (or 'embodied cognition'), and the justification of this approach is discussed more in detail in chapter 4.

Embodied cognitive science is a branch inside cognitive science that stresses that the aspects of body beyond the brain of cognitive agent play significant role in the cognitive processing (Wilson & Foglia 2011). Originally dominant views in cognitive science (such as computational theories of mind) considered body as peripheral to understanding the nature of cognition, and thus conceptualized cognition in abstraction from bodily mechanisms of sensory processing and motor control (see e.g. Pecher & Zwaan 2005). Instead, embodied cognitive science aims to understand cognition in a broader sense, that is, the full range of perceptual, cognitive and motor capacities we possess as capacities that are dependent upon features of the physical body. The starting point of embodied cognition is that without the involvement of body in human action thoughts would be empty (Wilson & Foglia 2011).

An important motivation for the development of embodied cognition science has been the assumption made by computational theories of mind that the meaning of a concept consists of the links between the abstract symbol representing that concept and the abstract symbols for other concepts (and their semantic features) (see e.g. Glenberg et al 2005, Wilson & Foglia 2011). However, this view does not explain how perceptual experiences are translated to arbitrary symbols that represent

concepts, nor how the symbols are mapped back onto real world. For example, the classical sematic network memory theories assume that the meaning of a symbol is captured in its relation to other symbols. Such symbols, however, are close to meaningless without any reference to outside world (Pecher & Zwaan 2005).

The stressing of the significance of the body in cognitive processing is obviously clear point of converge between embodied cognitive science and Polanyi's philosophy, but embodied cognition offers also other significant points from the perspective of Polanyi's theory. For example, the concepts we use are shown to contain both perceptual and motor representations (for neuroimaging based evidence, see e.g. Simmons et al. 2007, Martin & Chao 2001, Simmons & Barsalou 2003; for behavioral evidence see e.g. Pecher et al 2003, Spivey et al. 2002). In other words, when we use concepts, we (unintentionally) simulate situations where those concepts apply. This means that conceptual knowledge is richer of its contents than can be expressed in words. Moreover, it gives more perspective to the relation between language and understanding by suggesting that language is grounded outside the linguistic system (see e.g. Glenberg et al. 2005). This means that language processing and understanding (for example, in communication) involves simulation of related situations, motor action, perceptions, emotions etc. To my understanding, these are the kind of subsidiary events that remain beyond the reach of articulation that Polanyi sought to capture with the term 'tacit knowing'.

2.2 Tacit Knowledge in the Knowledge Management Literature

According to Hong and Ståhle (2005) KM can be approached from four different perspectives:

1. The philosophical and psychological perspective (focus on e.g. epistemological exploration, knowledge types and their interactions, people's will and motivation).
2. The organizational and sociological perspective (focus on e.g. organizational learning, new forms of organization, networks and communities).
3. The economic and business perspective (focus on e.g. competitive advantage, measurement of knowledge and skills, KM as focus strategy).
4. The technological perspective (focus on e.g. information technology, knowledge tools and systems and enterprise portal).

As will be explained, the subject area of this research touches primarily philosophical and psychological, and the economic and business perspectives of KM.

It was already suggested in the early 1980's in the literature of strategic management that organizations should be considered in terms of their resources instead of the products they made, and that this view would set a new focus on the strategic planning (e.g. Wermerfelt 1984). The idea of this resource-based view was that organizations should identify the types of resources that could lead to high profits. Following from that, an organization should create a situation where its own resource position, either directly or indirectly, made it more difficult for others to catch up (Wermerfelt 1984). The resource-based view of the organizations in general seeks to explain how organizations can achieve sustainable competitive advantages by differentiating themselves from their competitors (Barney 1991). According to this view organizations' resources consists both tangible and intangible assets related to it, and the attention is paid particularly to the resources that can be considered unique. Therefore the resources that are uncommon, poorly imitable or nonsubstitutable are particularly valuable for organizations as they seek competitive advantages (Barney 1991).

From this perspective, knowledge as intangible, firm-specific and developed over time was seized as a strategic asset with a significant potential to be a source of sustainable competitive advantage for an organization. In the early 1990's there already was a general agreement that knowledge management will represent the most important competitive advantage factor for organizations (Toffler 1990, Quinn 1992, Drucker 1993). Indeed, knowledge was recognized as the third important factor of production alongside with labor and capital in leading economies, and become thus considered a "new" crucial resource of economy (Romer 1990). Knowledge was soon seen even as the most important factor of production and economic resource. As Drucker (1993, p. 8) remarked in 1993,

"the basic economic resource—the means of production—is no longer capital, nor natural resources, nor labor. It is and will be knowledge."

In the organizational context this meant that knowledge assets and intellectual capital became more important for companies than physical or financial assets; the implication of this shift in thinking was that to prosper in "the new economy" and to exploit the vital knowledge assets, new management techniques, new technologies, and new strategies were needed (Stewart 2001). Moreover, learning and creation of new knowledge were concluded to be of prime importance (Nonaka 1991).

2.2.1 Why Tacit Knowledge?

In the beginning of the 1990's Japanese theorist Nonaka (Nonaka 1991, Nonaka & Takeuchi 1995) presented the theory of knowledge creation. The starting point of Nonaka's theory was the idea that organizations should create new knowledge in order to innovate and recreate their environment instead of processing information in order to merely adapt to changing environment. As Nonaka and Takeuchi (1995, p. viii) put it:

“By organisational knowledge creation we mean the capability of a company as a whole to create new knowledge, disseminate it throughout the organisation, and embody it in products, services and systems...”

One crucial point that differentiated Nonaka and Takeuchi's theory from the management ideology of the time was the idea that only individuals created knowledge, and the organization should support creative individuals by providing them contexts to create knowledge (Nonaka and Takeuchi 1995). Hence, knowledge was recognized as tied to human element because humans in the organization identified, interpreted and used that knowledge. However, Nonaka and Takeuchi emphatically remarked that although knowledge creation started from the minds of the individuals, personal knowledge was generally of little value to an enterprise unless it was shared in the organization. This reflected the positivist roots upon which business and management studies were traditionally based (Hislop 2005). As Myers (1996, p. 2) put it,

“For knowledge to provide a company with sustainable competitive advantage, such knowledge must be independent of any given individual. For this reason we can identify - and then manage - organizational knowledge only to the extent it has been captured by an organization's systems, processes, products, rules, and culture.”

Hence, on this idea is based the conception that is today predominant in the KM literature: one of the most critical KM-processes of the organization is to convert subjective beliefs and conceptions of the individuals to objective organizational knowledge capital.

From the epistemological perspective this setting is interesting as the aim is to objectify subjective “knowledge”. Theoretically the objective is challenging because it presupposes bridging subjective and objective theories of knowledge. The focus was no longer on knowledge understood as objectively reliable entity but as a

resource of production despite its respectability in the scientific sense. Consequently, despite of being novel, the idea of knowledge creation signified that knowledge understood traditionally as justified true belief was not alone sufficient to explain the processes of organizational knowledge. Knowledge management theory needed a broader theory of knowledge (Maasdorp 2007a, Schreinemakers and Essers 1997). According to my understanding, it was essentially this problem that Polanyi's theory, and particularly the concept of tacit knowledge, was seen to provide the answer.

Nelson and Winter (1982) introduced the concept of tacit knowledge to organization theory in their dynamic capabilities approach to organizations (Teece 1998, Maasdorp 2007a). Dynamic capabilities refer to an organisation's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments and explain innovations in organisations (Teece et al 1997). Nelson and Winter (1982, p. 76) saw that Polanyi's theory "provides a useful perspective on other realms of knowledge". Nonaka's and his colleagues (Nonaka 1991, Nonaka & Takeuchi 1995, Nonaka & Konno 1998) work was an example of such an approach and it is generally considered to be the first KM application of Polanyi's theory (Maasdorp 2007a).

2.2.2 Nonaka and Takeuchi's Theory of Organizational Knowledge Creation

The main idea behind Nonaka and Takeuchi's theory of knowledge creation is that organisations have to constantly create new knowledge in order to be competitive. They (Nonaka & Takeuchi, 1995 p. iv) define organisational knowledge creation as

"capability of a company as a whole to create new knowledge, disseminate it throughout the organisation, and embody it in products, services and systems..."

Nonaka and Takeuchi (1995) argue that tacit knowledge has been overlooked in organizational context, but in Japan tacit knowledge is an important source of companies' competitiveness. Hence, they state the epistemological presuppositions upon which their theory is based in the following way:

"...we classify human knowledge into two kinds. One is explicit knowledge, which can be articulated in formal language including grammatical statements, mathematical expressions, specifications, manuals, and so forth. This kind of knowledge can be thus can be transmitted across individuals formally and

easily. This has been dominant mode of knowledge in the Western philosophical tradition. However, we shall argue, a more important kind of knowledge is tacit knowledge, which is hard to articulate with formal language. It is personal knowledge embedded in individual experience and involves intangible factors such as personal belief, perspective, and the value system.” (Nonaka & Takeuchi, 1995 p. viii)

Nonaka and Takeuchi (1995, p. 58) further remark:

“In our theory of organizational knowledge creation, we adopt the traditional definition of knowledge as ”justified true belief.” It should be noted, however, that while traditional Western epistemology has focused on ”truthfulness” as the essential attribute of knowledge, we highlight the nature of knowledge as ‘justified belief.’ ”

Nonaka and Takeuchi (1995) further sub-divide tacit knowledge into two types: first, the technical dimension, which encompasses the kind of informal and hard-to-pin-down skills or crafts captured in the term ‘knowhow’; second, the cognitive dimension that consists of schemata, mental models, beliefs and perceptions that reflect individuals’ vision of reality and are so ingrained that they are taken for granted.

Nonaka and Takeuchi (1995) argue that the dynamic model of knowledge creation is anchored to an assumption that human knowledge is created and expanded through social interaction between tacit knowledge and explicit knowledge that they call ‘knowledge conversion’. Knowledge conversion consists of four processes or modes that together form so called SECI-model. The four modes are socialization (conversion from tacit knowledge to tacit knowledge), externalization (conversion from tacit to explicit knowledge), combination (conversion from explicit to explicit knowledge), and internalization (conversion from explicit to tacit knowledge).

Nonaka and Takeuchi (1995) explain that socialization means social interaction that enables tacit to tacit knowledge transfer through shared experiences; since tacit knowledge is difficult to formalize, it can be acquired by spending time together. In externalization tacit knowledge is made transferable to others, for example by using figurative language, metaphors or suitable analogies. In combination mode explicit knowledge is collected from inside or outside the organization and then combined, edited or processed into new refined knowledge. Internalization is essentially about learning by doing; explicit knowledge becomes part of an individual's knowledge base and will be asset for the organization. Internalization results also as an ability to

see connections and the capacity to make sense between fields, ideas, and concepts. Nonaka and Takeuchi stress that in the process presented by SECI-model knowledge is continuously converted and created as users practice, learn and share. Thus, the process should be seen as a continuous, dynamic spiral of knowledge.

These modes are the engine of the knowledge-creating process (Nonaka & Takeuchi 1995). While all the four modes are necessary for the process of knowledge creation, Nonaka and Takeuchi argue that externalization is the most important because it creates new, explicit concepts from tacit knowledge. Hence, the key to knowledge creation lies in the mobilization and conversion of tacit knowledge to explicit knowledge. Externalization refers to the articulation of one's own tacit knowledge (ideas, beliefs, intuitions etc.) in words, and on the other hand, eliciting, deducing and translating tacit knowledge of others into an understandable form (Nonaka & Takeuchi 1995, Nonaka & Konno 1998). It should be noted that externalization is not the only way to share tacit knowledge in Nonaka and Takeuchi's theory, because also socialization means sharing of tacit knowledge through shared experiences. Externalization is however more relevant in the context of this research because it presumes conscious processing of tacit knowledge and interaction between objectivity and subjectivity, which calls for more complex epistemology.

Nonaka and Takeuchi mention metaphors, analogies and figurative dialogue as suitable methods for the process of externalization. The idea is that something previously inexpressible can be expressed by using a "non-analytical" method. Drawing on Donnellon et al (1986) they claim that metaphors create novel interpretation of experience by presenting something in terms of something else, and by that they can function to reconcile discrepancies in meaning. Analogies, in turn, reduce the unknown by highlighting the commonness of different things (Nonaka & Takeuchi 1995). Importantly, externalization is a social process among individuals within a group; Nonaka et al (2001) argue that the modes of knowledge creation cannot take place without a specific context that is a shared place for cognition and action.

2.2.3 The Establishment of the Concept of Tacit Knowledge in the KM Literature

Despite the fact that Nonaka and Takeuchi's theory has been criticized in the secondary literature (e.g. Cook & Brown 1999, Tsoukas 2003; this criticism will be

discussed below), the epistemological foundation, namely the classification of knowledge into tacit and explicit, has gained a dominant role as the basis for epistemology in the KM theory (Maasdorp 2007a, Stacey 2001). In fact, the epistemological distinction between tacit and explicit knowledge has been so influential that even the whole field of KM has been defined based on it. For example, according to different authors KM means

- "...systemic and organizationally specified process for acquiring, organizing, and communicating both tacit and explicit knowledge..." (Alavi & Leidner 1999, p. 6);
- "The identification, optimization, and active management of intellectual assets, either in the form of explicit knowledge held in artefacts or as tacit knowledge possessed by individuals or communities." (Snowden 2002, p. 63);
- "...the formalized, integrated approach of managing an enterprise's articulated and tacit knowledge assets." (Capeda-Carrión 2006, p. 34).

Nonaka and Takeuchi's theory was novel in the sense that it suggested that the creation of new knowledge was more important than processing the old one. However, SECI model did not become popular only as model of process of innovation but it has been generally adopted as a model of externalization or codification of tacit knowledge in the KM literature. Maasdorp (2007b) argues that probably since the focus in the field of KM is on management of knowledge (instead of creation), converting tacit knowledge into explicit has been over-stressed. Indeed, let us consider the following claims:

- "One of the major tasks of Information Era organizations that seek to be successful is to create conditions whereby everyone can verbalize their tacit knowledge." (Kikoski & Kikoski 2005, p. 67);
- "The primary task of managers is the conversion of tacit, human capital into explicit, structural capital." (Irick 2007, p. 1);
- "Tacit knowledge needs to become explicit; what's unspoken must be said aloud. Otherwise it cannot be examined, improved or shared." (Stewart 1997, p. 74).

Such claims are relatively exaggerated interpretations of Nonaka and Takeuchi's thinking considering that externalization is only a part, albeit important, of their theory.

In sum, from the perspective of this study Nonaka and Takeuchi's theory had two significant implications for the development of KM theory. First, the bulk of

KM authors differentiate between two types of knowledge, tacit and explicit, which is the "default" basis of theory of knowledge in contemporary KM literature. Second, in order to manage tacit knowledge, 'capturing', 'externalizing', 'codifying' and 'explicating' such knowledge is often emphasized as a central procedure of KM in organizations.

It should be taken into account that Nonaka's theory of knowledge creation has gone through a series of moderate revisions (e.g. Nonaka et al 2000, Nonaka et al 2001, Nonaka & Toyama 2003, Nonaka & Toyama 2005, Nonaka & Konno 1998, Nonaka & Peltokorpi 2007, Nonaka & von Krogh 2009) in which Nonaka and his colleagues have developed and clarified their view.

Nonaka and Konno (1998) introduced the concept of 'ba' defining it as a space for emerging relationships. The idea of ba is that it serves a context for knowledge creation; it can be physical (e.g. office), virtual (e.g. teleconference), mental (e.g. shared experience) or any kind of combination of them (Nonaka and Konno 1998). Nonaka et al (2001) argue that knowledge creation cannot take place without a specific shared context for cognition and action. Hence, ba is a place where participants create new meanings through interactions (Nonaka & Konno 1998). The innermost idea of ba is to positively influence the outcomes of the knowledge creation (Nonaka & von Krogh 2009). Nonaka et al (2006) have also discussed other enabling conditions for knowledge creation, such as trust, team atmosphere, care and courage.

Probably more significant revisions that Nonaka and his colleagues have made are related to their epistemological view. These correctives have partly derived from the critique that the theory of knowledge creation has received. Indeed, in the relatively short history of knowledge management, Nonaka and Takeuchi's theory has been extremely significant and influential—yet also controversial. As Gourlay (2006) suggests, Nonaka's attempt to provide a straightforward usable theory of knowledge creation is highly ambitious, and it is no surprise that some of its elements have been questioned by various authors. I will next discuss briefly the critique presented concerning the theory of knowledge creation, Nonaka and his colleagues' response to it, and also some clarifications they have presented concerning the theory of knowledge creation.

2.2.4 The Critique towards the Theory of Knowledge Creation

Alvesson and Kärreman (2001) have questioned the whole idea of management of knowledge and knowledge creation. They argue that the conception of knowledge in the KM literature is incoherent and vague; the concept of knowledge simply means too much, and as a result, it informs us less and less. According to them, 'knowledge' has various meanings, and when it is combined with the idea of management, the result is contradictory. The authors thus seem to present a question, how are we supposed to manage knowledge if we do not know much about knowledge itself? They claim that management part of the concept is often seen too self-evident; for example Nonaka and Takeuchi (1995) link managerial practices and knowledge creation without serious attempts to theorize what management is about. As a conclusion Alvesson and Kärreman argue that KM is more about managing people or information than practice attuned towards facilitating knowledge creation.

Gourlay (2006) argues that Nonaka and his colleagues' proposition that knowledge is created through the interaction of tacit and explicit knowledge is flawed. He particularly pays attention to the justification of created knowledge, that is, the process of determining whether the created concepts (tacit knowledge transformed to explicit) are worthwhile in the organization. He argues that this clearly involves the evaluation by managers of the new ideas against pre-defined criteria, which refers more to decision making than to knowledge creation. Nonaka's definition of knowledge as 'justified belief' thus seems to mean managers beliefs whose justification is related to prior strategic decisions and forecasts. A realistic model of knowledge creation should account for the production of scientific type of knowledge that, according to Gourlay, is the foundation of the ability to manage organizational processes. Since Nonaka and Takeuchi's theory fails to do that, it adopts a radically subjective definition of knowledge (Gourlay 2006, Essers & Schreinemakers 1997).

Nonaka and Peltokorpi (2007) suggest that the most well-articulated and quoted critique towards Nonaka and Takeuchi's theory comes from Tsoukas (1996, 2003), Cook and Brown (1999), and Brown and Duguid (2001). Tsoukas (2003) questions the nature of tacit knowledge presented in the theory of knowledge creation as set of if-then rules that are articulable after a learning process. Tsoukas argues that focusing ones attention to action, one is no longer involved in that action, but thinking that activity, which is a different thing. Also, the division of knowledge into tacit and explicit types has been criticized (e.g Tsoukas 2003, Cook & Brown 1999, Brown & Duguid 2001). The core of this critique draws from Polanyi's objection of

purely objective knowledge and the inherently inseparable nature of tacit and explicit knowledge that follows from it. Tsoukas (2003) illustrates his interpretation of Polanyi's theory metaphorically by presenting that tacit and explicit knowledge are two sides of the same coin. For these reasons these authors question the ontological and epistemological basis of the theory of knowledge creation.

2.2.5 Nonaka and His Colleagues Reply

Nonaka and his colleagues have answered the received critique in various publications (e.g. Nonaka & Peltokorpi 2006, Nonaka & Peltokorpi 2007, Nonaka & von Krogh 2009). As I understand it, Nonaka's main arguments against the received criticism are following.

First, Nonaka and Peltokorpi (2007) argue that whereas the theory of knowledge creation draws from various philosophical schools, the critique towards it is given by scholars faithful to original writings of Polanyi who base their views on interpretative philosophies (phenomenology and pragmatism). Hence, Nonaka and Peltokorpi do not see it surprising that the theory of knowledge creation becomes criticized from this kind of anti-positivistic view that reacts negatively to linear models based on "if-then" rationale. Nonaka and Peltokorpi (2006) argue instead that these contrasting philosophies should be combined to create dynamic accounts of knowledge and its creation. The core of this idea is that instead of being purely subjective or objective, both of these dimensions are included in knowledge because people validate tacit knowledge through social interaction. Tacit knowledge is this way objectified and becomes thus a socially justified true belief. In addition, they (Nonaka & Peltokorpi 2007) remark that although SECI model might create an image of linear knowledge conversion, all models in social science present real-world complexity in a crude and simplified manner.

Second, Nonaka and Peltokorpi (2007) note that Nonaka has not argued in any publication that all tacit knowledge can be converted as such to explicit knowledge. Instead, while indwelling enables people to acquire tacit knowledge, everything that is experienced cannot be internalized and all that is internalized cannot be shared. In this sense, they claim, the conversion of tacit knowledge to explicit knowledge has been misunderstood by the critics; it is rare for tacit knowledge to be completely transformed into codified form without losing some of its characteristics. However, they still maintain that some tacit knowledge can be shared even not in its original form.

Third, Nonaka and Peltokorpi (2007) remark that straightforward separation between the types of tacit and explicit knowledge has been questioned. They admit that it would have been more adequate to refer to two distinct but interrelated dimensions of knowledge. They remind that Nonaka (1994) has used the iceberg metaphor in order to illustrate that tacit and explicit knowledge exist in a continuum, and are seen complementary and mutually enabling in the theory of knowledge creation. Although they agree that purely objective knowledge does not exist, they still maintain that the different natures of tacit and explicit knowledge make knowledge conversions, and thus also knowledge creation, possible.

The knowledge continuum view is further explained by Nonaka and von Krogh (2009). They stress that Nonaka's epistemological view, and its conception of truth separates itself from correspondence doctrine prevalent in organization theory; according to correspondence doctrine truth is assessed according to its correspondence to supposedly objective reality. Instead, in the theory of knowledge creation beliefs are true to the extent that they can be justified by an individual at the certain moment (Nonaka & von Krogh 2009). Hence, drawing from pragmatism, Nonaka and von Krogh seem to argue that beliefs become true judged by their usefulness. They claim that the status of truth is important because it enables a broader definition of knowledge and justifies the knowledge as a continuum view.

I will finally discuss briefly Nonaka and his colleagues' response to the critique; this discussion may also be considered as an introduction to my research problem.

2.2.6 Discussion on Nonaka and His Colleagues' Reply

It seems somewhat contradictory that Nonaka and Peltokorpi (2006, 2007) stress the difference between paradigmatic⁸ views as a significant reason for the arisen critic, but they hardly discuss about the problems of Nonaka's own view that seeks to combine these same opposing views. Since different paradigms often represent a different worldview, their "internal conceptual worlds" may be so different that they simply cannot be combined (see e.g. Denzin & Lincoln 1994). This is why it seems that any supposedly neutral basis of combining paradigmatic views is actually necessarily paradigmatic (Burrell & Morgan 1979). As Lincoln and Guba (2000) remark, this still does not prevent one from blending elements of different

⁸ By *paradigm* I refer to different views of how research should be done based on adopted nature of reality (e.g. positivism and interpretativism here). According to Guba (1990) paradigms can be characterized through their ontology, epistemology and methodology; these characteristics create a holistic view of the nature of knowledge and how it can be gained.

paradigms. However, the blending demands that the blended elements are similar enough or at least resonate strongly (Lincoln & Guba 2000). We can now critically ask, how strong is the resonance between interpretivist and positivist views (in Nonaka and Peltokorpi's terms), the synthesis of which Nonaka and Takeuchi originally sought? The question is significant, because if there is not enough common ground to unite these views, the key concepts of the resulting theory might remain vague and loose somewhere between the different paradigms.

Nonaka and Peltokorpi (2007) correct Nonaka's view that some kinds of tacit knowledge cannot be converted to explicit while other kinds can. They further explain that tacit and explicit knowledge are seen interrelated and complementary rather than separate types of knowledge. However, neither of these points seems to change the fact that the engine of the knowledge creation still is the conversions between tacit and explicit knowledge. The conversion from one to another seems to necessitate two categories, classes or types *by definition*. Moreover, the distinction in the domain of tacit knowledge only complicates matters further (Maasdorp 2007b). Indeed, the distinction raises more questions concerning the nature of tacit knowledge than it solves, if the nature of the kinds that can be converted and the kinds that cannot be converted is not explained more profoundly. The distinction they make in fact seems to augment the need to characterize tacit knowledge more accurately, but this is left undone.

Nonaka and Peltokorpi's (2006, 2007) comment on contradictions that have arisen based on different scholarly views is understandable, yet rather trivial; it is obvious that certain phenomena appear different if observed through different "paradigmatic lenses". In fact, it seems that discussion about the nature of the tacit knowledge and its relation to concept of knowledge in general has developed relatively little during the past twenty years it has been discussed in the KM literature. Indeed, despite the figurative appeal of the competing metaphors related to different paradigms that have been presented (e.g. the iceberg metaphor by Nonaka 1994; the coin metaphor by Tsoukas 2003; the theatre stage metaphor by Brohm 2007), they are of little comfort in clarifying the concept of knowledge because unfortunately such metaphors do not have much in common with human cognition that is after all the basis of knowing.

In this research I have chosen another kind of approach. Knowledge and consciousness have been central themes in cognitive science for several decades. Hence, knowledge and knowing can be approached from a more naturalistic basis, freer from strict aprioristic assumptions (this argument will be discussed later). Although there are brief references to the interest of relevance of cognitive

psychology to the KM issues (see e.g. Nonaka and von Krogh 2009), to my knowledge this kind of research approach has not been systematically applied in the KM literature.

3 Research Problem

The application of the concept of tacit knowledge in the KM literature is foreshadowed by conceptual vagueness. Although Polanyi is widely referred as the source author of the concept, his philosophy seems to be all but well-known in the field (see e.g. Tsoukas 2003, Maasdorp 2007a, Grant 2007). In this sense the concept has been disengaged from its original epistemological context. For this reason the concept has remained loose because it is not tied to any particular theoretical background in the KM literature.

The problem originates from the classification of knowledge into tacit and explicit forms and the juxtaposition of the two forms that is a natural consequence of the classification. Tacit knowledge is widely recognized as a multidimensional phenomenon difficult to define as such. Instead, the less challenging form of knowledge, explicit knowledge, is generally defined in the literature as codified knowledge. By the definition of explicit knowledge the remaining part of knowledge, namely tacit knowledge, becomes defined non-codified-knowledge, which in the logical sense seems correct if knowledge is classified in these two forms. Consequently, the “default” definition of tacit knowledge in the KM literature seems to be ambiguous “knowledge difficult to articulate” (e.g. Hansen et al 1999, Baumard 1999, Fleck 1997).

As a result, different authors refer to different mental phenomena that all can be interpreted to be included into the realm of the definition of tacit knowledge. For example, ‘tacit knowledge’⁹ is used to refer to intuitive knowledge (e.g. Kikoski and Kikoski 2004), assumptions (e.g. McAdam et al 2007), values (e.g. Seidler-de Alwis & Hartmann 2008), unconscious knowledge (Easterby-Smith & Lyles 2003), expertise (e.g. Johannessen et al 2001), mental models (Nonaka & Konno 1998, Nonaka & Takeuchi 1995), beliefs (e.g. von Krogh et al 2000), intentionally concealed knowledge (e.g. Szulanski 1996, Leonard & Sensiper 1998), knowledge not understood (e.g. Lambertson 1997), unspoken collective knowledge (e.g.

⁹ In this research ‘tacit knowledge’ refers to tacit knowledge possessed by individuals. In the KM literature also ‘collective tacit knowledge’ has been discussed (see e.g. Collins 2010, Ambrosini 2003, Spender 1996). This theme will be briefly discussed in chapter 8.

Baumard 1999), personal internal knowledge (Irick 2007), context-specific knowledge (Nonaka & Takeuchi 1995, Gourlay 2002) etc.

Hence, 'tacit knowledge' seems to be a label for residual instances of knowing that somehow differentiate from explicit knowledge. Moreover, as Hedesstrom and Whitley (2000) have remarked KM authors have taken advantage of the nebulosity of the concept by stretching it in ways that are advantageous to them in applying the concept to their particular area of research. Yet at the time the concept of tacit knowledge is supposed to be one of the most significant foundational concepts of KM. The problem is significant for various reasons.

First, every concept has an intension and usually (but not necessarily) at least one extension (Bunge 1998). The intension of a concept is the set of properties that define the objects that represent the concept. In other words, intension is related to the contents and the meaning of that concept. The extension of a concept is the set of objects to which the concept can apply. Consequently, the more properties the intension of a concept has the more accurate the definition of the concept is and refers thus to a smaller set of objects because less objects will share wider set of properties (Bunge 1998). Inversely, adding new objects to the extension of a concept might reduce the intension of the concept in so that the intension corresponds the wider extension. As the intension of the concept refers to a wider set of objects, the intensional meaning of the concept might begin to blur. In other words, if tacit knowledge refers to virtually any cognitive or social phenomenon "difficult to articulate" it becomes meaningless, at least in the scientific context.

Second, a scientific theory or a model is fundamentally an explanation of a set of facts constructed to explain and predict phenomena of certain part of reality (Bunge 1974). Theories and models are conceptual structures explaining the phenomena under observation by defining the concepts and the relations between them. A theory or a model should have specific implications for observable events in the reality. Accordingly, theories predict some observational consequences deduced from the theory so that the correctness of the theory can be assessed. However, a theory suffering from conceptual vagueness is liable to result in various, even contradictory predictions that the theory makes because of different interpretations of the same concept (Rakover and Kaplan 1990). Moreover, given that one of most important functions of scientific theories is to make predictions, it is obvious that theories including poorly defined concepts make wider amount of predictions—up to a point in which the made predictions are anything but accurate, reliable or even very clear. Therefore, in the case of tacit knowledge it is somewhat simple to report positive results for instance concerning explication or externalization of tacit

knowledge because some assumptions, beliefs, insights or previously unspoken “knowledge” can always be “externalized” out of the subjects regardless of the used method. For example, various research papers (e.g. Jabar et al 2010, Fergus et al 2003, Mulder & Whiteley 2007) introduce a system or an application that is shown to successfully capture or codify tacit knowledge, which is not surprising if tacit knowledge is defined as “knowledge rooted within the minds of individuals” (in Fergus et al 2003).

Third, indefinite ideas cause wider problems for the research of KM by directing research to wrong lines. For example, Grant and Qureshi (2006) remark that many KM projects have stated as their aim the conversion of tacit to explicit knowledge, and storing and sharing it by developing proper ICT-systems for the purpose. These projects, however, often have very limited success (Grant & Qureshi 2006). As Grant (2007) suggests, this might have very negative effects on organizations. Importantly, when organizations take this approach, they tend to focus on the knowledge that can be captured, rather than what should be captured (Grant & Qureshi 2006). As Chimezie and Osigweh (1989, p. 580) put it,

“If any of the concepts that form a proposition are ill-defined, an ambiguous research proposition or an ill-conceived emphasis on certain aspects of an organizational phenomenon may result.”

Fourth, the use of a concept of tacit knowledge in a confusing way gives a somewhat indefinite image of the scientific study of the field of KM; KM is a multidisciplinary field, which means that it should communicate with other relevant fields of science. This naturally becomes difficult if central concepts adopted outside the field are redefined. However, theoretical statements from different disciplines should refer to the same set of phenomena (Bunge 1974). It has been also remarked that imprecise concepts make it difficult to produce cumulative knowledge (e.g. Achinstein 1968).

Fifth, if the meaning of a scientific concept begins to blur, the risk of a misuse of the original theory (from which the concept is adopted) grows. From the perspective of the scientific plausibility it is significant fault if the application of a theory does not follow the logic and the implications of the original theory. Chimezie and Osigweh (1989) note that in some cases it is possible to accept certain amount of conceptual flexibility. This means that the meaning of a concept may be applied slightly in order to give meaning to it in a different context. But still, the modified concept should not be imprecise.

In Polanyi’s theory tacit knowledge cannot be articulated because the knower is not directly aware of it (Polanyi 1966). Yet the articulation of tacit knowledge has

become an important theme in the contemporary KM literature. In sum, there is clearly a need to the better theoretical understanding and accuracy concerning the nature and forms of knowledge in the field of KM. Based on the issues described above I state the main problem of this research as follows:

How well the implications and logic of Polanyi's theory of knowledge are present in Nonaka and Takeuchi's conception of knowledge?

Whereas Nonaka and Takeuchi's theory is the most systematic and in-depth presentation of the subject, many authors have discussed the application of tacit knowledge in a more loose way referring only to Nonaka and Takeuchi, and bypassing Polanyi's philosophy (see e.g. Maasdorp 2007a). In this sense the analysis of Nonaka and his colleagues' theory logically includes theories following their thinking and adopting their conception of knowledge.

As the title of this thesis ('How tacit is tacit knowledge?') already hints, I am specifically interested in the perspective, how plausible the idea of externalization of tacit knowledge is. The question is important in the sense that if externalization was shown to be impossible, the usefulness of the concept of tacit knowledge in the KM theories emphasizing or aiming at practice would become questionable; tacit knowledge would not be the operationalizable component, and the concept's power to explain knowledge creation in a practical level would diminish significantly.

Answering this problem requires a comparison between the polanyian conception of knowledge and the conception of knowledge assumed by the theories stressing the importance of externalization of tacit knowledge. Either of the conceptions mentioned above are pre-given. Given that Polanyi's theory dates back to 1950's, it is important to analyze its credibility from the cognitive perspective; Polanyi himself drew from research of psychology of his time, and by the recent significant development of psychology/cognitive science there is a good reason to re-evaluate Polanyi's basing assumptions concerning human cognition. Moreover, it is possible to clarify Polanyi's thinking by making the founding concepts of his theory more concrete by relating them to empirically studied cognitive phenomena. This theme forms the first sub-problem, and it can be expressed specifically as follows:

Can the bodily basis and the tacit dimension of knowing stressed by Polanyi be explained in the light of contemporary understanding of cognition?

The discussion of the first sub-problem aims particularly at clarifying the concept of tacit knowledge in a polanyian sense. The second sub-problem concerns the conception of externalization of tacit knowledge present in KM literature:

What kind of theoretical assumptions, namely epistemology and theory of cognition, underlie the conception of externalization of tacit knowledge?

The analysis of the epistemological and ontological assumptions that underlie the conception of externalization of tacit knowledge is necessary in order to compare those to Polanyi's founding assumptions in an attempt to evaluate the usage of tacit knowledge in the KM literature.

In the next chapter I discuss my philosophical starting points and methodological choices in an attempt to answer the research questions stated above.

4 Methodology

In this chapter I first discuss the nature of the research in general, and then elaborate the nature of the research questions and explain my methodological choices to address them. As will be explained, I will approach the subject from a naturalistic perspective, in particular from the perspective of cognitive science. This approach and its justification are also discussed more in detail in this chapter.

This research is a theoretical basic research. The purpose of theoretical basic research is to deal with fundamentals of a certain theoretical environment in order to increase the understanding of the phenomenon under observation (Uusitalo 1991, Kallio 2006). Theoretical basic research aims at explaining and making more visible the phenomenon by asking “what is”-questions and explaining them by answering to causal “why is”-type of questions (Sutton & Staw 1995, Kallio 2006). Theoretical basic research may also problematize prevailing theories and conceptions—in this case the approach can be specified to be critical basic research (Kallio 2006). Problematization, however, necessitates that it is presented, at least implicitly, how things should be. Importantly, basic research does not mean the abandonment of empirical knowledge, but quite vice versa; existing empirical knowledge may serve as basis for theoretical basic research (Kallio 2006).

The objects of analysis of this research are scientific theories. Scientific theories can be approached from the perspective of the idea of multi-level theory building (e.g. Tsoukas & Knudsen 2005, Kallio 2006). The idea is that different types of theories can be broadly speaking classified hierarchically according to the nature of questions that they try to answer. A modification of Tsoukas and Knudsen’s idea of the subject is illustrated in the figure 1.

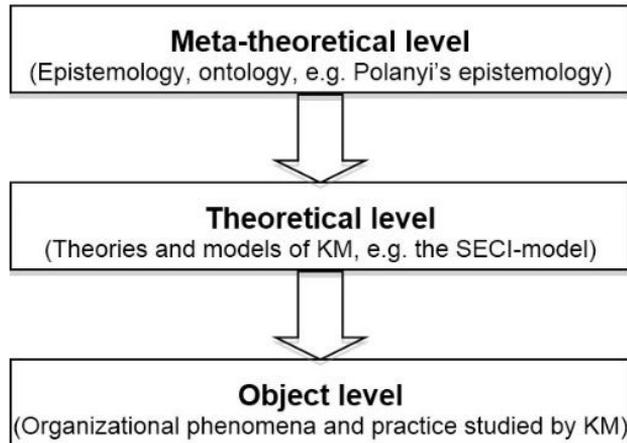


Figure 1. The idea of meta-theoretical reflection in the context of this research. The three levels are adopted from Tsoukas and Knudsen's (2005, p. 6) model.

Meta-theoretical level can be considered consisting of the theories of the nature of reality and knowledge (Tsoukas & Knudsen 2005). Meta-theoretical level thus provides the vision of the nature of reality that can be applied in the lower levels. Theoretical level refers to the basic theories of different scientific disciplines that are based on the conceptions regarding the features and problems of the subject area (see Kallio 2006). The object level is the most practical level on which scientific theories are tested, applied in practice and modified further to “everyday theories” (for example in training and consulting). As Kallio (2006) explains, the upper levels determine normatively lower levels, but also lower levels affect upper levels; for example, it is possible to show by empirical testing (e.g. on the object level) that basic theories are erroneous.

Although a theory belongs primarily to a certain level, at the same time it may be embodied in other levels. The idea is that theories themselves can be considered consisting of different levels, which aims at providing more holistic understanding of the theory. For example, Nonaka and Takeuchi's theory of knowledge creation belongs to the theoretical level as it is a disciplinary basic theory. It however carries some meta-theoretical assumptions (either explicitly stated or implicit) concerning the nature of reality that it assumes. On the other hand, it defines what kind of applications based on it can be used in the object level. Polanyi's theory, in turn, belongs to the meta-theoretical level by definition, because it discusses the nature of knowledge.

Theoretical research can be applied in all the three levels, whereas empirical research is restricted to the theoretical and to the object level. This is because the truthfulness of the theories on the meta-level is impossible to verify (see Kallio 2006). The focus in the context of this research is situated particularly to the meta-theoretical–theoretical axis, which justifies the theoretical approach.

The methodology of theoretical research is in general difficult to express because it is essentially based on researcher's intuition, thinking and insights (Neilimo & Näsi 1980). Naturally, there are no guidelines for such creative processes (Bunge 1974). On the other hand, it is difficult to differentiate the methods of theoretical research because they are mutually complementary; any theoretical research includes almost necessarily more than one theoretical method (Kallio 2006).

The primary scientific methods used in this research are analysis, synthesis and argumentation. Ritchey (1991) defines analysis as the procedure by which an intellectual or substantial whole is broken down into parts or components in order to determine its essential features and their relations. Analysis aims at better understanding of the governing principles of certain scientific system by displaying its logical structure (Beaney 2012). I use analysis particularly as I assess the meta-theoretical assumptions of the idea of externalization of tacit knowledge and the theory of knowledge creation in general. Also Polanyi's theory has to be broken down to in order to analyze it from the cognitive perspective.

Synthesis, in turn, is defined as the opposite procedure to analysis: it refers to combination of separate elements or components in order to form a coherent whole. Synthesis compile information together, for example, in order to propose alternative solutions. My attempt to clarify Polanyi's conception of tacit knowledge necessarily includes synthesis as I apply the understanding of contemporary cognitive science to Polanyi's thinking. This aims at broadening the scope of Polanyi's theory. Analysis and synthesis go methodologically hand in hand in the sense that every synthesis is built upon the results of a preceding analysis, and every analysis requires a subsequent synthesis in order to verify and correct its results (Ritchey 1991).

Argumentation in general refers to an act of presenting justifications in an attempt to show that one view is better than some other view. More formally, an argument consists of an act of concluding, one or more acts of premising (which assert propositions in favor of the conclusion), and a stated or implicit inference word that indicates that the conclusion follows from the premises (Hitchcock 2006). It should be pointed out that this account of argument allows premises and conclusions to be any speech acts which assert the truth of a proposition (including acts like suggesting, hypothesizing and deducing) (Groarke 2013). Since in theoretical

research the rationale is not based on first-hand empirical evidence, the role of argumentation becomes particularly important; the credibility of the research is deeply dependent of researcher’s ability to affect the reader by means of argumentation that is effortless to follow (see e.g. Kallio 2006)

4.1 The Nature of the Research Problems and the Structure of the Research

The structure of the research process is explained in figure 2. Polanyi’s theory of knowledge is first analyzed from the perspective of cognitive science. Next, in accordance with the research problem, Nonaka and Takeuchi’s conception of externalization has to be constructed into the meta-theoretical level in order to be able to compare it with Polanyi’s theory that itself is meta-theoretical. In particular, it is important to analyze what kind of relationship tacit and explicit knowledge have in both theoretical environments. The above mentioned procedures finally enable the comparison between the two theoretical entities. This comparative analysis is the key to answer the research problem.

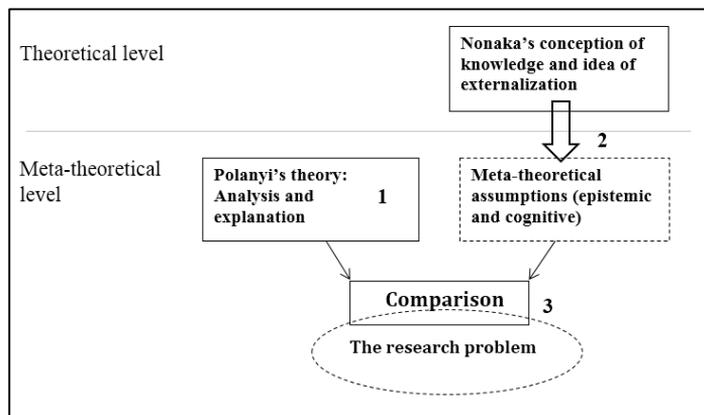


Figure 2. The structure of the research process. 1) The analysis of Polanyi’s theory, particularly from the cognitive perspective. 2) The extraction of epistemological and cognitive assumptions of the conception of externalization of tacit knowledge. 3) The comparison of the meta-theoretical assumptions of the two theories, which is the key to the research problem.

Next I discuss briefly the two sub-problems, my approach to them, and the rationale behind my approach.

4.2 The First Sub-problem – Analysis of Polanyi’s Theory

I approach Polanyi’s theory from the perspective of the findings of contemporary cognitive science. In general, psychology has come to dispute the territory of epistemology by offering persuasive arguments for absorbing the whole of epistemology (Bunge 1974). Specifically, since perceiving, representing and inferring are functions of the central nervous system, the study of knowledge falls within the realm of psychology and neuropsychology (Bunge 1974). This development refers to naturalization of epistemology, an idea inspired by Quine (e.g. in Quine 1969) and Kuhn (e.g. in Kuhn 1970). According to the main thesis of naturalized epistemology, epistemology is a multidisciplinary affair and understanding the mind-brain architecture is necessary for it (Goldman 1986). In other words,

"Questions about how we actually arrive at our beliefs are [...] relevant to questions about how we ought to arrive at our beliefs. Descriptive questions about belief acquisition have an important bearing on normative questions about belief acquisition." (Kornblith 1994, p. 2)

Moreover, whereas the starting point of the classical definition of knowledge is the belief, whose truthfulness and justifiability are then analyzed, Polanyi particularly stresses the importance of elements that form the focal belief. Such elements include neural processes. As Polanyi (1966, p. x) writes, “tacit knowing is the way in which we are aware of neural processes in terms of perceived objects”. Polanyi made it clear that knowledge of the brain (tacit knowledge) and knowledge of the mind (focal knowledge) are not identical, even though the operations and existence of the mind depend necessarily on the brain. Hence, Polanyi himself suggested that knowledge is not a matter that belongs exclusively to the realm of philosophy. Polanyi’s theory redefined innovatively epistemology by incorporating insights of psychology (Jha 2002). Hence, it is justified to continue the tradition in the light of findings of post-polanyian cognitive science.

Although the naturalization of epistemology is a significant line of research in philosophy, the suitability of naturalistic approach is not always self-evident to all contexts. For example, tacit knowing as a research subject includes certain inter-paradigmatic tensions because, on the one hand, Polanyi’s theory criticizes objectivist philosophy of science, and Polanyi’s own view takes into account personal and phenomenal elements of human cognition. In particular, Polanyi draws, among others, from phenomenological literature. Phenomenology, in turn, can be considered as opposing view to naturalism.

On the other hand, knowledge management literature that applies Polanyi's thinking recognizes itself as positivist (see e.g. Nonaka & Takeuchi 1995, Hislop 2005) discipline with often managerial perspective. The commensurability between different paradigmatic views is thus a significant theme in this research. For this reason it seems necessary to discuss briefly the suitability of my cognitive approach to Polanyi's theory. To be more precise, one might critically ask whether cognitive science is a justified approach to analyze Polanyi's epistemology.

The first question to consider is whether cognitive science is strictly related to some line of philosophy of science? As argued above, in the literature of management research positivism is often mentioned as a basing philosophic view. To be precise, although positivism plays a significant part in the history of philosophy, it had been mostly bypassed as a philosophical view before cognitive science even was born. Hence, although positivism as a term is still used in special sciences (with relatively loose and varying meanings, though), it is hardly noted as a philosophical view in cognitive science.

Given that cognitive science means an interdisciplinary study of mind applying a diversity of methods, it is difficult to label it belonging to certain philosophical paradigm. As I understand it, the richness of cognitive science is its view that combines philosophical, theoretical and experimental results in order to draw conclusions about the nature of mind. Hence, naturalistic philosophy is probably the most closely related philosophical view to cognitive science, whose basing idea is that psychological and computational results have significant implications to traditional philosophical problems in epistemology and metaphysics. The starting point of naturalism is that scientific method can, and should, be used to investigate different areas of reality (Kim 2003). In other words, naturalism in its original form stated that there was no credible position outside of science from which ontological questions could be answered. At this point the original question about the suitability of cognitive science to analyze Polanyi's theory becomes relevant, because originally phenomenology, from which Polanyi drew, has been essentially an anti-naturalistic view.

First of all, Polanyi indeed drew also from the phenomenological literature, but his own view, as I interpret it, cannot be subsumed strictly under phenomenology, nor any other modern philosophical school (see e.g. Gelwick 1996). Polanyi's ontological view, namely the assumption of existence of external reality whose nature knowledge and discovery uncovered, is relatively clear detachment from phenomenology. In this sense Polanyi's philosophy certainly can be approached from outside phenomenology.

There has recently been in general an increasing dialogue between phenomenology and cognitive science due to the acknowledgement that the interaction between the two can be mutually enlightening (Gallagher & Zahavi 2008). On the one hand, consciousness was raised as a scientific question in the late 1980s (e.g. Chalmers 1995, Searle 1992, Dennett 1991) in cognitive science, and in this context phenomenology as a philosophical approach was thought to be of possible importance (Gallagher & Zahavi 2008). On the other hand, the embodied approaches to cognition motivated the reconsideration of phenomenology in cognitive science (e.g. Varela et al. 1991, Damasio 1994, Clark 1997). This view objected strongly the body-mind dualism prevailing in cognitive science at that time, and in fact, a significant inspiration for this view were the insights of phenomenologist Merleau-Ponty (Gallagher & Zahavi 2008).

In summary, despite the early tensions between phenomenologist and naturalist approaches, they have found each other, particularly in the methodology of cognitive science. Moreover, this is not only an alternative view, but a notably strong research orientation in present cognitive science (e.g. Dreyfus 1996, Gärdenfors 1999, Wheeler 2005, Damasio 2010, Gallagher & Zahavi 2008, Schmicking & Gallagher 2010).

If we now reconsider the problem of approaching Polanyi's theory from the perspective of cognitive sciences, we can notice that the paradigmatic gap is not at all that deep that it might seem at first. However, let us still consider inter-paradigmatic commensurability in general. Lincoln and Guba (2000) remind that the boundaries between paradigms keep shifting as they are our own constructions. In addition, although researchers have their paradigmatic preferences, they seldom are, or should be, adhering strictly to one paradigm, but should be inspired by and sympathetic towards other paradigms (Tsoukas & Knudsen 2002). Quite the contrary, strict "paradigm mentality" proliferates and polarizes perspectives inhibiting discourse across paradigms (Lewis & Grimes 1999).

According to Gioia and Pitre (1990) multi-paradigmatic approach aid exploration of scientific research, particularly in the case of complex phenomena, by helping researchers employ disparate theoretical perspectives (Lewis & Grimes 1999). In the case of this research the subject area indeed deals with complex phenomena marked with debates and contradictory findings. Finally, I do not want to label this research (or myself as a researcher) strictly under a certain paradigm. As the objective of this research is to provide holistic understanding of polanyian conception of tacit knowing as a cognitive phenomenon, I feel that it cannot be analysed from one prescribed starting point.

4.3 The Second Sub-problem – Analysis of the Conception of Externalization of Tacit Knowledge

The point of this sub-problem is to extract the epistemological and cognitive assumptions that the conception of externalization of tacit knowledge seems to imply. After that it is possible to evaluate the mutual compatibility of these assumptions, but also their compatibility with Polanyi's assumptions. The evaluation of the mutual compatibility is important, because the validity of the basic theories of non-exact sciences (such as KM) must be assessed primarily by focusing on their internal consistency and their capability to solve the problems that they addresses (Heiskala 2000). This is because the validity of basic theories of non-exact sciences cannot be easily evaluated by empirical testing because the knowledge in these fields is not universal but many times dependent on the circumstances (Kallio 2006).

The internal consistency of Nonaka and Takeuchi's conception of knowledge, and particularly the idea of externalization of tacit knowledge, is assessed by deriving the meta-theoretical assumptions of their theory using the method of analysis. This makes it possible to study the coherence of its theoretical building-blocks on a deeper level. According to my understanding, particularly the method of analysis crosses the line beyond theory and opens the door for meta-theoretical considerations. Analysis, however, implies also dialogue with synthesis that refers to assembling approach in order to present a better-grounded view of the analysed system, or (as in this case) to reassess the internal coherence of the system.

5 The Original Research Papers

In this chapter I briefly present the main ideas, methodologies and contributions of the original publications in the order that they appear in this thesis.

Publication I: Representation of the Body as a Basis of Personal Knowledge.

In this publication I suggest that there are important similarities between Polanyi's conception of the subsidiary awareness of body and Damasio's (in Damasio 1999) theory of consciousness that, on the one hand, represents the most recent neuropsychological understanding of formation of human consciousness, and on the other hand, builds on the argument that conscious acts (such as knowing) are based on subject's property to represent the body state and changes in it. The main purpose of this publication is to assess the justifiability of Polanyi's concept of embodiment of knowledge. It is concluded that both Polanyi and Damasio consider representation of one's bodily states as the most fundamental form of knowledge. The publication contributes to understanding of Polanyi's theory by clarifying the idea of embodiment in a more concrete way by applying the results of recent findings in cognitive sciences. In a sense Polanyi's argument concerning the crucial role of embodiment is even strengthened because, as Damasio suggests, consciousness itself is dependent on the representation of body. Hence, the publication not only shows that Polanyi's theory is still relevant in the realm of cognitive sciences, but also suggests that from the cognitive perspective Polanyi's philosophy was rather progressive by nature at his time.

Publication II: Towards Better Understanding of the Concept of Tacit Knowledge – a Cognitive Approach.

This publication aims at clarifying and broadening the scope of Polanyi's theory, by explaining acts of tacit knowing from the perspective of cognitive sciences. In this article I pounce on the concrete examples of tacit knowing that Polanyi used most in his writings in order to analyze what they are about from the cognitive perspective. It should be noted, that the classification of the instances of tacit knowing presented

by Polanyi to relevant class of psychological phenomenon (for example, the classification of skillful use of tools to the class of motor skills) are based on my interpretation. The purpose of this publication is to trace the possible mechanisms that would explain the tacitness of tacit knowledge, and based on the results of the analysis, to assess what kind of epistemic contents, if any, tacit knowing bears. This publication contributes to clarification of Polanyi's theory by broadening it by explaining the cognitive mechanisms of the examples he presented. Polanyi's theory is also situated in the context of naturalist epistemology. In addition, it is suggested that Polanyi's epistemology includes the processes of focal belief-formation, which are not considered in the classical definition of knowledge.

Publication III: The Problem of Tacit Knowledge – Is It Possible to Externalize Tacit Knowledge?

This publication serves as an introduction to the problems related to the idea of externalization of tacit knowledge. While this problematization is not new, but discussed by various authors, this publication shows the relevance of this issue in another area, namely in the information system science. It is also suggested that mutual understanding is not only dependent on successful externalization of tacit knowledge, but requires also the understanding of the other parties. This is an aspect that has caught much less attention in the literature. Hence, this publication contributes to KM discussion by sketching the idea that while externalization of tacit knowledge seems impossible, more attention should be paid on understandable communication of, in Polanyi's terms, the contents of the focal awareness.

Publication IV: Epistemological Problems Concerning Explication of Tacit Knowledge.

This article aims at exploring the meta-theoretical assumptions of the conception of externalization of tacit knowledge by transferring it from theoretical level to meta-theoretical level by means of analysis. This allows the assessment of the internal consistency of the conception of externalization. This publication contributes to the discussion concerning the nature of knowledge in the area of KM by extracting the epistemological premises of the conception of externalization of tacit knowledge and showing, by argumentation and examples, that its epistemological basis is internally self-contradictory.

Publication V: Externalization of Tacit Knowledge Implies a Simplified Theory of Cognition.

Whereas previous publication (publication IV) discussed the epistemological basis of the conception of externalization of tacit knowledge, this publication addresses the problems of the theory of cognition that becomes assumed by it. It is shown that particularly the introspective nature of the process of externalization and the language dominance view of mind, both assumed by the conception of externalization, are problematic. These issues have not been discussed profoundly in the KM literature. Also, the unreachability of tacit knowledge leads to conclusion that the emphasis should be shifted to the pursuit of (shared) understanding instead of externalization of tacit knowledge. Finally, I argue that despite the significance of tacit dimension to human knowing, tacit knowledge might be a concept of minor importance in the KM discipline in the sense that it is impossible to manage.

Publication VI: In Search for a Theoretically Firmer Epistemological Foundation for the Relationship between Tacit and Explicit Knowledge.

In this publication I critically analyze the two prevailing epistemological views in the mainstream KM literature (that is, ‘knowledge as category’ and ‘knowledge as continuum’) addressing their weaknesses. I present a simple epistemological view that is based on Polanyi’s conception of knowledge. Polanyi’s epistemology is also compared to classical definition of knowledge, and as a result of this analysis I discuss the conception of internal justification of knowledge. Also, the idea that the emphasis should be on making focal forms of knowledge more comprehensible is elaborated along the publication.

Table 1 summarizes the theoretical and methodological approaches *primarily* applied in each of these publications. Also the sub-problem that the publication in question principally addresses is mentioned in the table.

Publication	Type of theoretical research	General purpose	Methods	Addressed sub-problem
I	Synthetic basic research	Expansion of a theory	Analysis, synthesis	1
II	Synthetic basic research	Expansion of a theory	Analysis, synthesis	1
III	Analytical basic research	Comparison between theories	Analysis	2
IV	Analytical basic research	Analysis of a theory	Analysis	2
V	Critical basic research	Problematization of a theory	Analysis	2
VI	Critical basic research	Problematization of a theory	Analysis, synthesis	1,2

Table 1. A summary of the theoretical and methodological approaches primarily used in the publications. Note that argumentation is the basic method of all the publications and hence not explicitly mentioned in the table.

6 Results

In this chapter I discuss the most important findings of the original research papers in relation to the presented research problems.

6.1 Sub-problem 1: Polanyian Tacit Knowledge – The Cognitive Perspective

Polanyi's philosophical arguments concerning the structure of knowing are in line with findings that contemporary sciences of mind (psychology, neuroscience and cognitive science) have recently provided. The assessment of Polanyi's epistemology from the perspective of cognitive science shows that tacit knowing is not only a real mental phenomenon but also the fundamental basis of all knowledge as Polanyi (1962, 1966) claimed. Hence, the claim that the basis of human knowing is beyond the knowing subject's capability to focally trace the roots of his knowledge seems justified.

According to Polanyi's epistemology the fundamental idea behind the subjective dimension of the knowing is the bodily roots of all conscious acts. Indeed, based on Damasio's (1999) view, the representation of body state is an essential condition for conscious acts. Representations of reality must be directed to organism itself (to the body state and changes in it) to be able to be conscious of them. In this sense consciousness implies subjectivity, that is, a sense of having a self that is separate from the world. Directing an external representation to self enriches the meaning of the representation by adding experience-based predictive features (such as emotional and motor information) to it. The personal perspective of knowing is constructed principally by this mechanism.

The analysis of the instances of tacit knowing presented in Polanyi's examples shows that from the perspective of knowing the processes that Polanyi calls tacit are mostly unconscious, which is the primer reason for the difficulty to describe them; these tacit processes occur in the brain regions that are not directly connected to the working memory, which means that the knowing subject cannot monitor them in any way. Tacit processes function automatically, which means that the knowing

subject becomes aware mainly of the conscious results of tacit processes (as the results become represented in the working memory), but not of the tacit processes *per se*. It seems that the acquirement of tacit knowledge is not dependent on the knower's awareness of what is being learned, and does not need to be manipulated by "higher" brain areas but is internalized automatically. It is important to note that these processes to which tacit knowing is related are not typical only to humans, but also appear in other species. From the viewpoint of evolution, the function of these processes is, before anything, adaptation to environment. Hence, the evolutionary roots of these processes go much further back in time compared to higher processes of consciousness, such as the use natural language typical only to humans. Human intelligent behavior thus should be viewed as being organized in a hierarchical way out of older neural modules, each of which had evolved programs for particular functions. From this perspective subsidiary processes represent the epistemic foundations on which emerging explicit operations are based. Although tacit knowledge is inductive by its nature, it still embodies epistemic content that gives the knowing subject better possibility to control its environment. Tacit knowledge has a personal justification based on experiences that have produced neural changes that affect behavior in a purposeful way.

Tacit knowledge and the processes related to it in are essentially about the formation of focal belief. Whereas the traditional analysis of knowledge only starts from the belief and is primarily concerned with questions related to the truthfulness and justification of the beliefs, Polanyi's theory of knowledge stresses first and foremost how humans arrive at their conscious beliefs or representations. This idea is illustrated in the figure 3.

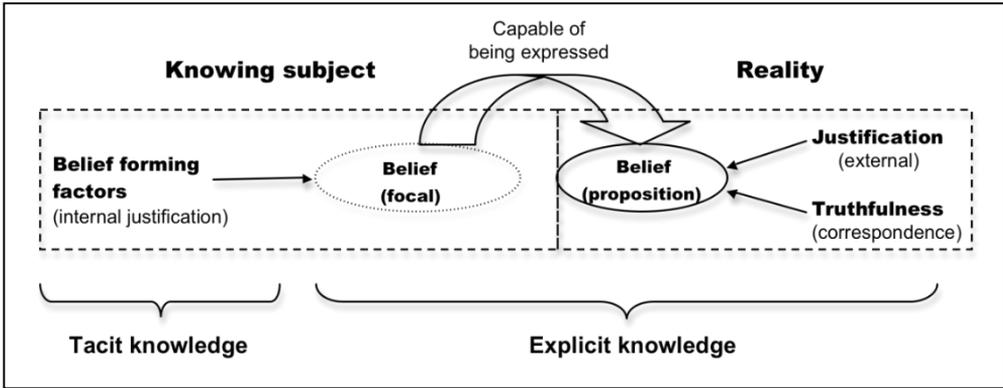


Figure 3. The relation between traditional definition of knowledge ('Reality') and Polanyi's theory of knowledge ('Knowing subject'). In Polanyi's theory both the focal belief in the knower's mind and articulate belief represent "explicit knowledge". Tacit knowledge refers to belief forming factors that cannot be fully traced. In this sense tacit knowledge can be understood as an internal justification for the focal belief. Instead, the traditional approach to knowledge studies justification and truthfulness of propositional beliefs.

6.2 Sub-problem 2: Tacit Knowledge in the Conception of Externalization of Tacit Knowledge

The externalization of tacit knowledge enabling epistemology assumes two kinds of knowledge, tacit and explicit. The conception of tacit knowledge is claimed to be adopted from Polanyi's epistemology, whereas the conception of explicit knowledge corresponds the traditional, or objectivist, definition of knowledge. The aim of externalization is to convert tacit knowledge to explicit knowledge by the means of introspective methods. Introspection refers to examination of one's own conscious thoughts or perceptual experiences. In Polanyi's terms it would mean examination of the contents of focal awareness.

These two epistemological views that are assumed are, however, mutually incompatible based principally on the stance they take on the questions concerning the justification of knowledge and the role of the knower. Hence, the theory of knowledge that the idea of externalization of tacit knowledge assumes is internally contradictory.

Furthermore, the conception of explication of tacit knowledge implies a somewhat simplified theory of cognition. According to the contemporary research of cognitive science, the presumed direct access to the contents of our mind is only

a fragment of our imagination and our mental capacity (e.g. Ledoux 2002, Damasio, 1999, Paivio 2007). We simply cannot see or describe what is going on in our brains when we are learning, remembering, solving a problem or using our expertise. Indeed, the validity of “externalized tacit knowledge” attained by introspective methods is questionable because awareness of private representations comes as a result of drawing inferences from later observations of those representations.

Moreover, the conception of externalization assumes some kind of language dominance-view of mind that in cognitive sciences has been rejected as insufficient conception. The symbolic representations do not appear from nothing before them. Our thoughts and concepts, and all other aspects of cognition, are based on the perceptual system, past interactions with our environment and our understanding of the world that is included into the body and the brain.

6.3 The Application of Polanyi’s Theory in KM Literature Based on Nonaka and Takeuchi’s Conception of Knowledge

The analysis of Polanyi’s theory shows that externalization of the content of subsidiary awareness is not theoretically possible. In other words, the idea of externalization of tacit knowledge does not follow the logic and implications of Polanyi’s theory. Actions strongly guided by tacit knowing can many times be described afterwards (e.g. intuitively made decision or skilful motor performance) but such retrospective reflection does not make tacit knowledge in the polanyian sense accessible.

The predominant epistemology basing on Nonaka and Takeuchi’s conception of knowledge that distinguishes tacit and explicit knowledge as different types of knowledge is based on misinterpretation, either intentional or unintentional, of Polanyi’s theory. To be sure, focal (explicit) and subsidiary (tacit) knowledge are central concepts in Polanyi’s epistemology. However, Polanyi does not make such a dichotomy, but describes the structure of knowledge that concerns in general all acts of knowing. The most fundamental difference between the interpretation of Polanyi’s theory presented here and the typical interpretation presented by the bulk of KM scholars is related to the question, how Polanyi’s theory is understood in general; it is widely adopted idea in the KM literature that Polanyi’s theory is a theory of the existence of two types of knowledge. However, I argue that Polanyi’s theory is rather a theory of knowledge that has two-levelled structure.

Based on Polanyi's and KM authors' ideas of tacit knowledge three different levels of content of mind can be distinguished from the perspective of accessibility.

1. Conscious linguistic representations, or representations that are easily made linguistic (e.g. declarative information, propositional thoughts, texts etc.);
2. Conscious representations that are difficult to articulate because of, for example, limitations of vocabulary (e.g. an unusual color), richness or modality of the representation (e.g. a vision or a multimodal experience) or not-yet analyzed nature of representation (an incomplete idea or assumption not yet submitted to full verification). In other words, compared to the representations of level 1, the representations of this level are more phenomenological in nature;
3. Unreachable content impossible of becoming a conscious representation.

Based on the characterizations of tacit knowledge made by KM authors applying Polanyi's theory for externalization, it is evident that they refer with 'tacit knowledge' to larger set of mental phenomena than Polanyi. This means that the extension of the concept of tacit knowledge in the KM literature is larger than in Polanyi's theory. The addition of objects (or phenomena) to the extension of the concept of tacit knowledge has reduced its intension, which in turn has caused the blurring of the concept of tacit knowledge in the KM literature. To Polanyi tacit knowledge is a phenomenon of the level 3, whereas tacit knowledge in the KM literature refers to both level 2 and 3. However, the focus seems to be on the level 2. The difference between the views is illustrated in figure 4.

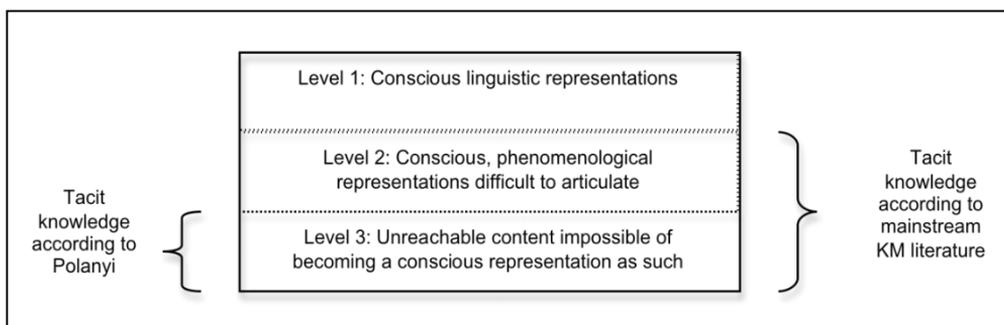


Figure 4. Tacit knowledge according to different sources.

Hence, Polanyi's theory has been extended in the idea of externalization of tacit knowledge in a way that distorts the original meaning of the concept.

Given that knowing occurs within a human knower, all knowledge has necessarily a tacit dimension that refers to subconscious or otherwise subsidiary elements that reflect the experiences of that particular knowing subject. As a result of the tacit factors the knower forms a focal conception of the matter, which represents the explicit dimension of knowledge. Hence, all instances of knowledge have tacit and explicit dimensions. When this basic structure of knowledge is taken into account, knowledge can be further divided into categories in a suitable way. Importantly, all categories in the model should manifest this structure. The basic structure and further classification of knowledge is described in figure 5.

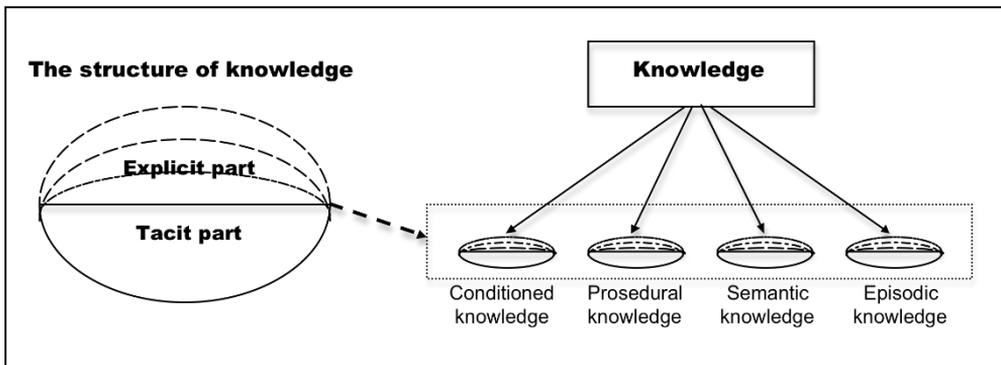


Figure 5. The structure of knowledge. Knowledge has a tacit part upon which the possible explicit part is founded. All instances of knowledge manifest this structure, even if knowledge is further categorized in a suitable way depending on the context. In this figure is presented an example of categorization adopted from the psychological memory research (e.g. Schacter et al 2000).

7 Contribution

Despite the growing number of publications in KM, theoretical (epistemological and cognitive) perspectives of knowledge have been even overtly ignored in the mainstream KM (Sthyre 2003, Jakubik 2011). KM lacks in general a solid theoretical foundation and especially a complementary understanding of the nature of knowledge (Alvesson & Kärreman 2001). Since KM itself is based on disciplines (such as philosophy, economics, information system science, psychology, social psychology and organization theory) that have well-established theories (see e.g. Jakubik 2011) it is not only possible to build such a theoretical bedrock for KM, but in fact necessary in the name of credibility of KM as an independent scholarly discipline. In a broad sense this research answers to the evident need of further research and more profound discussion of epistemological issues in the KM literature.

The main contribution of this research comes from the clarification of Polanyi's theory of knowledge, and particularly the concept of tacit knowledge in the context of KM. Although Polanyi's theory has been discussed in the KM literature, to my knowledge there has not been particularly profound attempts to clarify his thinking by broadening his theory from the perspective of cognitive science. On the other hand, in the area of philosophy Polanyi has been criticized for his failure to explain cognitive processes involved in tacit knowing despite the psychological influences of his theory (see e.g. Webb 1988, Gulick 2004). This approach provides better understanding of Polanyi's theory by relating his philosophical concepts to studied cognitive phenomena. This also expands Polanyi's theory by providing complementary elements and insights that support his philosophical claims. Also, situating Polanyi's theory in the context of current cognitive sciences shows that his ideas are still relevant, over sixty years later.

The research participates in the development of theoretical foundation of KM by pointing out problems and controversies in the existent literature, particularly in the conception of knowledge that originates from Nonaka and Takeuchi's (1995) theory, and has been widely adopted. This idea is not at all new, but discussed by various authors before, as explained above. This critique has been at least partly explained to be caused by the different philosophical position that the critical views represent

compared to Nonaka and his colleagues view (e.g. in Nonaka & Peltokorpi 2006). In this sense the perspective of cognitive science applied in this research augments this discussion by pointing out the problematic features of Nonaka and his colleagues thinking from the perspective of contemporary understanding of cognition. The idea here is to take the discussion forward without getting stuck to paradigmatic differences with which the different views have been explained. Furthermore, I have aspired to broaden the discussion by profound epistemological analysis that clarifies the theoretical controversies built in the conception of externalization of tacit knowledge.

I have suggested in this research how knowledge could be classified in a way that is supported by Polanyi's structure of knowing. In more general sense this research contributes by encouraging to adaptation of wider conception of knowledge. Conception of knowledge in different fields is typically based on the knowledge that is open to study, either direct (through perception) or indirect (through reasoning). For example, in computer science it is often assumed that there exists two types of knowledge; first, some kind of direct and observable knowledge that can be inputted and stored into information systems, and second, knowledge that the system can automatically deduce based on given rules and the inputted knowledge (Colburn 2000). Nevertheless, let us consider programming as an example: an experienced programmer is able to see the underlying commonalities, differences, strengths and weaknesses of different data structures, possible approaches and solutions of programming tasks. This is knowledge that is essential in programming, but also knowledge that goes significantly beyond the syntax and semantics that can be expressed explicitly (Soloway and Ehrlich 1984). Although this kind of knowledge is challenging to study, its existence cannot be denied and it should not be bypassed for example in the teaching of computer science.

Finally, this research shows the relevance of cognitive science to KM in general, and particularly to knowledge related issues. For instance, the starting point of knowledge creation is individuals' personal understanding, not always directly open to study. Since traditional contemporary epistemology seeks principally criteria for justification (see e.g. Bunge 1974, Colburn 2000, Polloc & Cruz 1999) its normative nature explains rather rigidly knowing in practical context. Indeed, in organizational context knowing is often closely related to decision making, problem solving and reasoning in general. Knowledge that is built in such processes might be difficult to explain with normative basis. This, in fact, is a well-known problem in the fields of computer science and artificial intelligence; many basic and effortless everyday tasks of humans are extremely difficult and computationally hard to execute by means of

rules and logic. Hence, more naturalized approach gives more perspective and conceptual tools on explaining these processes, which in turn hopefully gives more perspective also on their management.

8 Discussion

Nonaka and his colleagues were one of the first KM scholars to explicitly emphasize the role of tacit knowledge in knowledge creation and innovation. Their theory is based on an important idea that organizations should focus on individuals and subjective dimension of knowledge in order to be successful. Nevertheless, the stressing of the importance of codification of tacit knowledge seems to turn the argument upside down; tacit knowledge is seen as a reservoir of secondary knowledge that is of no use unless at least some of it is converted to explicit knowledge. In this sense explicit knowledge seems to have a privileged role in the field compared to tacit knowledge, although the original intention was to stress the importance of tacit knowledge (e.g. in Nonaka & Takeuchi 1995). To be sure, their starting point is management of knowledge, which necessarily calls for more straightforward approaches that they first assume. This controversy between the conception of knowledge and the conception of management (that e.g. Alvesson and Kärreman (2001) have pointed out) forces them to make compromises, which seem to be the foundation of the theoretical problems. The division of knowledge into tacit and explicit, is not based on the realistic theory of knowledge/cognition, but on the needs to manage knowledge.

The critique towards the KM theory presented in this research does not mean that the adoption of Polanyi's theory of the nature of knowledge would be some way a wrong choice in the KM thinking. The adoption of Polanyi's thinking by Nonaka and his colleagues is well justified in the sense that Polanyi was primarily interested in the nature of scientific discovery, which as a process also aims at creation of knowledge; both Polanyi and Nonaka with his colleagues argue that objective knowledge cannot explain innovations that are instead based on our resources of tacit knowing.

Polanyi's theory describes the structure of conscious acts, and its tacit part explains how we arrive at our conscious beliefs. The point is that because of this structure, we cannot get rid of all subjective elements of knowledge, and we cannot trace backwards the premises of our focal representations (whether they be assumptions, beliefs, intuitions, ideas etc.). According to this interpretation, externalization explained by Nonaka and his colleagues' theory occurs, and even

begins, in Polanyi's terms in focal awareness while tacit knowing is a phenomenon situated to subsidiary awareness. In conclusion, while tacit knowledge is a fundamental concept in our understanding of the nature of knowledge in any context (scientific or non-scientific), its role in the context of knowledge creation seems to be different from what has been assumed in Nonaka and Takeuchi's theory. In other words, the concept of tacit knowledge is fundamental addition to the conception of knowledge in justifying the idea of knower-dependent nature of knowledge, but the concept seems to be of limited *practical* utility in the sense that tacit knowledge cannot be operationalized in a way that Nonaka and Takeuchi, and many scholars after them assume. Moreover, if a form of classical definition of knowledge is adopted (as Nonaka and Takeuchi do), tacit knowledge is out of its realm because it hardly is based on belief or is objectively justifiable. In sum, the concept of tacit knowledge fits relatively poorly to the theories of knowledge creation.

The argument stated above suggests that focus of KM should be on the instances of focal awareness that we are able to articulate (these instances cannot always be considered as knowledge), particularly paying attention to means to comprehensive and convincing expression of such instances; the articulation of our thoughts does not mean automatic comprehension of such thoughts by the other parties involved. Indeed, the receiving of a message "externalized" by another person might range from partial recognition of linguistic expressions to considerable understanding of intended meaning, and the difference between the two is significant. On the other hand, the shifting of the focus from externalization to understanding increases the role of the person who seeks to assimilate other person's understanding. The point is that the burden of comprehension is with the learner, who can only be guided to the direction that is assumed right.

From the perspective of Polanyi's theory also the concept of 'collective tacit knowledge' present in the literature (see e.g. Collins 2010, Abrosini 2003, Spender 1996) seems rather incomprehensible. According to Taylor (2007) collective tacit knowledge refers to systemic routines and the relationship between technologies, roles and unwritten formal and informal procedures of group, organization or society. For example, Collins (2010) explains that Polanyi has missed the full complexity of bike-riding because in addition to the tacit knowledge of how to balance the bike we need collective tacit knowledge to ride it in traffic; riding safely is possible only by understanding the context dependent unspoken conventions of traffic. It seems, however, difficult to comprehend what collective focal awareness and collective subsidiary awareness might exactly be in this case. In other words, the idea of collective tacit knowledge implies some kind of collective consciousness,

which to my knowledge has not been theorized about yet, probably because the idea seems unaccountable. In fact, the author of the above mentioned example himself states that *understanding* (supposedly personal) is required to act according to the collective conventions. There certainly are commonly held beliefs and procedures (articulated and unarticulated) that are related particularly to certain groups, but again, we might critically ask: does the labeling of those beliefs 'collective tacit knowledge' clarify our understanding of the nature of knowledge, or perhaps vice versa?

As for the justification of knowledge, Polanyi argued that knowledge was justified firstly by responsible and competent personal judgment, and secondly collectively by the community that is involved in the practice in question (e.g. a scientific community) (see e.g. Gelwick 1996). Polanyi also argued that knowledge will show its value in case it is worth it, which refers to pragmatist view of some degree; knowledge is at least partly valued based on its operability. If polanyian conception of justification is applied to the context of knowledge creation in organizations, it suggests that the temporal scope of knowledge creation is longer and extends outside the organization. Knowledge does not become justified inside organization in relation to prior strategic decisions and forecasts (as Gourlay (2006) criticized Nonaka and his colleagues thinking), but at least partly in the practice, probably in the longer term, in a wider social context and possibly outside the organization; this is because it is very difficult to know beforehand what created "knowledge" turn out to be valuable. This also suggests that knowledge creation is not based on conversions between different types of knowledge but should be viewed as a development and justification of partly indefinite beliefs that represent at best some sort of preliminary form of knowledge.

Polanyi (1962, e.g. p. 277) discusses the creative power to expand beliefs into more concrete or practical form by the support of the conviction that these beliefs had the needed capacity. Therefore, according to his view it seems that knowledge creation is about creation and synthesis of ideas/beliefs and the emergence of their justification. Actually, this idea fits well to Nonaka's understanding of knowledge creation as a social process. From the polanyian perspective individuals' brains create new as they reflect external objects (such as new ideas given by other persons) onto one's existing knowledge-structures and tacit understanding. Individuals, acting by themselves, are relatively tied to their own trains of thought. In this sense illustrative dialogue and open-minded presentation of one's ideas provide new perspectives and insights. The role of tacit knowledge in polanyian sense is to intuitively foreground the ideas of others that "have something in them".

8.1 Future Research

When it comes to the continuation of the research of this particular subject area, I would like to emphasize that despite the conceptual problems of Nonaka and Takeuchi's theory, the issues that it addresses and the objectives that it aims are important. Hence, a possible research line worth of further investigation might be a reformulation of Nonaka and Takeuchi's theory towards a direction that would be conceptually simpler and epistemologically more consistent. To my understanding, this endeavor could draw more on cognitive science, particularly because, as argued above, other forms of cognitive products than knowledge have probably more dominant role at least at the early stages of knowledge creation. For example, in terms of cognitive science externalization could be explained as a process in which the intention is the conversion of internal representation(s) to external representation(s)¹⁰. In fact, this viewpoint might offer a deeper and more versatile perspective to externalization, because some important research work has been done on how we are able to improve our thinking and comprehension by creating external representations and structures (e.g. Kirsh 2010, Paivio 2007, Clark 2008). This approach could be possibly extended also to the rest of the phases of Nonaka and Takeuchi's theory. The entity under development would come closer to knowledge as it justification developed from initial commitment first to internal justification in the organization and possibly further to justification in a wider context. These ideas are however uncompleted and require further research.

In general, cognitive science could be applied more widely in the research of KM. It is methodologically rich discipline, and as showed in this research, it crosses traditional borders between different disciplines, which gives it more conceptual flexibility and explanatory power compared for example to philosophy. Alongside with philosophy it provides a rather diverse view to explain knowledge related issues, especially in the organizational context where acts of knowing are often affected by complexity, uncertainty, and economical and temporal pressures.

¹⁰ *Representation* in general refers to a likeness or simulation of an idea, a concept or an object. While external representations refer to ones that are available in the environment (e.g. writings, utterances, pictures, maps, graphs etc.), internal representations refer to ones held in the subject's mind.

8.2 Limitations of This Research

This research combines in particular three scholarly areas: philosophy, knowledge management and cognitive science. Based to my own scholarly background and to an attempt to provide a new perspective to the subject, in this research cognitive science and philosophy are emphasized at the expense of knowledge management. While I am aware of this clear limitation, the idea behind this choice has been that for the purposes of management we first have to know what we are trying to manage. In this sense, the discussion of knowledge precedes the discussion of its management. In any case, although Nonaka and his colleagues, and Polanyi are widely referred authors in the KM literature, this research is limited to the discussion that is based on their thinking and does not take a stand on what other epistemological views are present in the KM literature. In this sense this research may give deceptively one-sided image of the KM research in general. On the other hand, this leaves the door open to future research as the discussion is relatively easy to expand.

It should be kept in mind that the polanyian conception of knowledge (and of tacit knowledge) presented in this research is based on my interpretation of Polanyi's theory. I have highlighted factors that I have assessed as the most important, but the choices made by me are not the only possible. Hence, my interpretation as a researcher is in this sense one-sided and insufficient to some extent, because every interpretation is disputable and open to other alternatives (Palonen 1988). For this reason I have tried to focus on the internal consistency of this research by making the argumentation as transparent as possible.

Due to the theoretical approach of the research I have not presented any empirical evidence to support my results. The theoretical approach has been a conscious choice since the beginning of this research because the focus is on meta-theoretical questions that cannot be proven by empirical evidence (Kallio 2006). Most importantly, my aim has been to produce conceptual knowledge on which the further research could be based.

In this research I have drawn from recent findings in the area of cognitive science (and psychology). Unfortunately it is impossible to take into account all the limitations that the studies I refer have had. The empirical material I have used refers, however, for the most parts to the basic body of knowledge of cognitive science (and psychology) that is not subject to significant debates.

9 Conclusions

The main point of Polanyi's theory is that the knowledge that we are able to express (propositional knowledge) is based upon various pre-linguistic knowledge capacities that Polanyi called tacit knowledge. For the subsidiary role and the non-linguistic nature of tacit knowledge any knowledge utterances cannot be reduced to their exact origins, and consequently, Polanyi denied the existence of fully explicit knowledge. About four decades later, tacit knowledge became a basic concept of knowledge management theory.

Knowledge management is relatively recent field having only about 15-20 years of history as a distinct scholarly discipline. Nonaka and Takeuchi's theory of knowledge creation is probably the most significant theory of contemporary knowledge management. It challenged the traditional perspective that considered organizations as information processing machines and opened a far-reaching discussion on the nature of knowledge by presenting an epistemological view that highlighted the role of tacit knowledge alongside with explicit knowledge. This discussion, without doubt, has been extremely important in the evolution of the field of KM.

Whereas the attempt of contemporary KM theorists to unite subjective and objective views on knowledge has not been very successful yet, Polanyi's theory already unites subjective aspects of knowing with objective ones, and as such might function well as epistemological basis for KM theories. Polanyi's theory, however, has its practical implications. The most crucial of them from the viewpoint of KM is that tacit knowledge cannot be managed by managers or KM practices, but only by the brain. Hence, while tacit knowledge is fundamental concept in understanding the nature of knowledge, due to its unreachability it is not deployable in the theories of knowledge creation in a way that has been presented by Nonaka and Takeuchi, and the authors following their conception of knowledge. In this sense the position that has been given to tacit knowledge in the field of KM seems overestimated. Given that KM is relatively young discipline, it is not surprising that its concepts, theories and practices are only emerging. Nevertheless, I argue that the kind of meta-theoretical reflections conducted in this research should have been done more accurately before the adoption of the epistemology based on dualism of tacit and

explicit knowledge as a default epistemological view of the field. This might have changed the theoretical assumptions, the emphasis of research and even the results of the field of KM because the basis of applied research is developed in interaction with basic research.

From the epistemological perspective the most problematic feature of KM seems to be the fact that it is situated in the point of clash of scientific thinking, and economic/managerial objectives that call for practical utility. However, if KM wants to avoid alienating itself from scientific principles and hold on its status as a significant area of research, profound meta-theoretical reflections are necessary. This research has sought to contribute the patching up of this need.

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Representation of the Body as a Basis of Personal knowledge—Neuropsychological Perspective on Polanyi's Subjective Dimension of Knowing

Ilkka Virtanen

Abstract. The subjective dimension of knowing is a fundamental element in Polanyi's epistemology. Polanyi justified the idea of subjectivity by claiming that although conscious acts had an identifiable and "explicit" object as focal point, the meaning arose from subsidiary, bodily roots. We address this conception from the perspective of contemporary neuropsychology, particularly basing on Antonio Damasio's theory of consciousness. We discuss the very first stages of knowing and aim to show that the bodily roots of knowledge and the arising subjective dimension of knowing are not only relevant, but indispensable aspects of knowing. Moreover, it seems that representation of knower's own body state is the most fundamental form of tacit knowledge.

Keywords. Bodily knowing, consciousness, neuropsychology, subjective dimension of knowing.

1. INTRODUCTION

One of the most distinctive features of Polanyi's theory of knowledge is the emphasis on the subjective dimension of knowing; Polanyi situated the knower in the most fundamental position instead of what was being known. Polanyi argued that the knower actively formed the meaning of knowledge by integrating his personal appraisals and bodily feelings to the object of knowing. Hence, knowing always had a personal component. According to Sanders (1988), Polanyi was one of the first philosophers stressing the importance of the knowing person at a time when the starting point of epistemology was an objective ideal of knowledge.

Besides being a fresh epistemological insight, the subjective feature of Polanyi's theory has been a point vulnerable to criticism. Some notable figures of philosophy of science, such as Imre Lakatos and Karl Popper, have claimed Polanyi's epistemology subjectivist. Lakatos denied Polanyi's conception of tacit knowing because it dragged psychological and sociological elements to epistemological considerations (Gill 2000). Similarly, Popper (1972) argued that that the logical content of scientific problems, theories and arguments formed a world of objective knowledge. For him knowledge in this objective sense was independent of anybody's claim to know. As Popper (1972, p. 109) put it, 'Knowledge in the objective sense is knowledge without a knower; it is knowledge without a knowing subject.' Hence, Popper saw knowledge independent of the knower and the mental processes that led to it, which contradicted with Polanyi's conception of knowing.

However, as those conversant with Polanyi's thinking know, the subjective dimension does not make Polanyi's theory subjectivist, but rather broadens the scope of epistemology; Polanyi (TD) simply points out that it is impossible to get rid of *all* the subjectivity. Moreover, Polanyi (PK, p. vii) remarked that knowing was 'responsible act claiming universal validity' in the sense that the knower's intention was to relate himself to reality that others may also relate themselves to. In this

important sense knowledge strives for objectivity and has always also an objective dimension. Hence, Polanyi does not make a clear objective-subjective dichotomy but accepts both of them as different dimensions of knowledge.

Whereas the objective approach to knowledge is rather straightforward to justify by basing on empirical observation and use of language and logic, it is rather complicated to present hard evidence to justify the necessity of knower-dependent perspective that enriches the meaning of the object of knowing as Polanyi argued. It can be thus critically asked, why and by what mechanism personal meaning that puts apparently objective knowledge into personal context is created?

Polanyi (1968) justified the idea of subjectivity among others by arguing that man lives in his body using it consciously and thus attends to what he has in mind from his awareness of his body. We address this idea from the perspective of contemporary findings of neuropsychology, particularly from the perspective of Antonio Damasio's theory of consciousness. Damasio (1999) suggests that consciousness and conscious acts (such as knowing) are grounded on knower's representation of the body, that is, continuously updated representations of body states. When the representation of self is set alongside with the representation of the object of knowing, it becomes possible to represent the relationship between the knower and the object of knowing. As a result, knowing becomes personal. This claim has an interesting correspondence with Polanyi's idea of the emergence of subsidiary meaning. Polanyi's and Damasio's theories have also another significant common feature: whereas both traditional epistemology and traditional cognitive sciences normally tend to concentrate on features of knowing that normal healthy humans have in common, Polanyi and Damasio discuss aspects that makes our knowledge unique and personal. Moreover, Damasio argues that without the representation of the body knowing is not even possible. This claim is based on Damasio's studies and work with neurological patients who suffer impairments in the brain structures that map body state.

We compare Polanyi's and Damasio's theories in order to

- assess the correctness of Polanyi's idea of the structure of tacit knowing and its bodily basis from the neuropsychological perspective;
- discuss the justification of the idea of subjective dimension of knowing, and
- attempt to specify or, if possible, even develop Polanyi's central ideas of the bodily knowing.

Since the arguments that Polanyi stood for are mainly philosophic, it may seem far-fetched to relate his thinking to the findings made by contemporary neuroscience. However, whereas the starting point of the classical definition of knowledge is the belief, whose truthfulness and justifiability are then analysed, Polanyi stressed the importance elements that *formed* the focal belief. Such elements include neural processes. As Polanyi (TD, p. x) wrote, "tacit knowing is the way in which we are aware of neural processes in terms of perceived objects". Polanyi made it clear that knowledge of the brain (subsidiary knowledge) and knowledge of the mind (focal knowledge) are not identical, even though the operations and existence of the mind depends necessarily on the brain (Grene 1977). Hence, Polanyi himself seems to have suggested that knowledge is not a matter that belongs exclusively to the realm of philosophy. In this sense the comparison between Polanyi's theory and findings of the contemporary neuroscience seems justified. Moreover, it should be interesting to see how Polanyi's (among others) philosophical arguments withstand findings of more empirical branches of science that study mind.

This approach seems promising because, first, both Polanyi and Damasio stress the

importance of self and body in all conscious acts, which is a rather bypassed aspect in both modern epistemology and study of consciousness. Hence, Polanyi's and Damasio's thinking overlap in significant ways although their approaches and scientific foundations are everything but similar. Second, as well as Damasio, also Polanyi's is, among others, a philosopher of consciousness; the structure of (tacit) knowing covers all the acts of consciousness from perception to complex problem solving. Third, Polanyi has been criticized for his failure to explain cognitive processes involved in tacit knowing (e.g. Webb 1988). In this sense it seems promising to approach Polanyi's thinking from a neuropsychological perspective in order to develop or at least elucidate his central ideas concerning knowing in the light of findings of contemporary neuropsychology and cognitive science. We believe that by combining philosophical and psychological results it is possible to approach the concept of knowledge on a deeper level. In this sense we also aim at reducing the gap between philosophy and psychology by addressing the cognitive nature of knowing.

In the next section we consider briefly Polanyi's theory, particularly its central conceptions related to bodily basis of knowing. In the third section we present main points of Damasio's theory of consciousness. In the fourth section we compare the two theories presented in the previous sections by considering their correspondences and the following implications. Finally, conclusions are presented in the fifth section.

2. POLANYI'S EPISTEMOLOGY—BODILY ROOTS OF KNOWLEDGE

A fundamental feature in Polanyi's theory of knowledge is the structure of tacit knowing that is based on the distinction between two different kinds of awareness. *Focal awareness* concerns the object of a conscious act, for example an external object that the knowing subject attends to. However, all focal awareness is dependent on *subsidiary awareness* that contains non-specifiable processes and elements of conscious acts. For example, we recognize a familiar face (focal awareness) by being subsidiarily aware of its particular features (TD). These features form the meaning of the face, but we are unable to describe them specifically. In this sense subsidiary awareness refers to the tacit processes and elements that enable conscious knowing. Therefore the formation of focal meaning is fundamentally knower-dependent, bodily action; any act of consciousness has an identifiable object as its focal point but the meaning arises from a set of subsidiary, bodily roots that function as clues to the attended object. Active integration of subsidiary, that is *tacit knowledge*, elicits the meaning of the object of knowing functioning as the basis of personal understanding. In psychological terms the formed focal representation seems to refer to the conscious representation held in the working memory, which can be described, for example, linguistically. In this sense focal knowledge is "explicit", but it has tacit roots that cannot be fully traced.

Polanyi (KB) explained that all the major skills of human mind are based on a meaningful integration performed by the body and of the sensations felt by the body. Hence, knowing subjects use the body as their instrument in all transactions with the world. To support this idea Polanyi gave examples of clear instances of bodily knowing. One of his most used examples is visual perception (e.g. in KB). Perception in general refers to the acquisition and processing of sensory information in order to see, hear, taste or feel, and finally know "what is out there". Although perception seems an effortless process that has not much to do with knowing, perceiving things does not mean that they are perceived exactly as they are in the reality. For example, in visual perception a visual representation is constructed according to the type of data the receptors in the eyes are capable of recognizing. The brain then receives and

analyses sensory signals; different features of the visual input (such as colour, shape and movement) are processed in separate brain areas specialized to certain type of processing. Consequently, the focal interpretation of the seen is dependent on the subsidiary knowledge and processes. Accordingly, perception is an active process that aspires to meaningful interpretation—it is not passive mirroring of the environment as such.

Polanyi also refers (e.g. in TD) to Lazarus and McCleary's (described in Lazarus and McCleary 1951) experiment in which subjects' bodily responses anticipated correctly a conditioned electric shock even if the exposure time of a shock-causing stimulus was too short for a conscious recognition. This kind of associative learning indeed is automatic and represents bodily knowledge in the sense that it is independent of conceptual knowledge structures and the use of language. In addition, the knowledge about the learned association is manifested by emotional response that in physiological terms can be viewed as a change in the body state. Hence, the tacit knowledge that Lazarus and McCleary's experiment expresses is literally embodied.

Probably the most understandable examples of bodily knowledge that Polanyi gave are related to motor skills, such as riding a bicycle or driving a nail. This kind of skill learning and the resulting know-how type of knowledge are usually acquired by active training and by trial and error, and the knowledge itself is stored in a form of motor maps in the motor cortex. Again, the acquirement and the use of motor skills are generally independent of conceptual knowledge structures.

However, bodily knowing does not refer only to sensory processes, emotional responses and physical engagement, but Polanyi stresses that *all* human behaviour is expressed in and through the body (Gill 2000). As Polanyi (KB, p. 147) puts it,

“The way body participates in the act of perception can be generalized further to include the bodily roots of all knowledge and thought. Our body is the only assembly of things known almost exclusively by relying on our awareness of them for attending to something else.”

In this sense body is not a mere passive physical object in the world but serves as an interface by which one comes to know the world through interaction; man has various ways to manipulate the environment using the body, but the environment also constantly regulates man. Consequently, all knowledge has bodily roots because external objects are attended by being subsidiarily aware of things happening within the body.

In sum, Polanyi's approach differs from the traditional analysis of the knowledge, notably because he sees bodily participation more fundamental than the conceptual outcome of the process of knowing; the integration of tacit knowledge in the subsidiary awareness raises the meaning connecting it to the focal representation. Moreover, Polanyi (KB) claims that we observe external things by being subsidiarily aware of the impacts they make on our body and of the responses our body makes to them. On the basis of this one can interpret that some kind of representation of the body state is a fundamental form of tacit knowledge—as well as the ability to register changes in this basic body state and represent them.

In the contemporary psychology and neuroscience the basic principles of how humans construct representations of the environment is relatively well understood (Ledoux 2002). Since the fundamental brain structures and mechanisms do not differ significantly between individuals, it is somewhat puzzling how the subjective perspective can be explained from the biological point of view. From the perspective of Polanyi's theory especially interesting questions are, how and why the personal perspective is constructed alongside with the seemingly objective representation of the world.

As a philosopher Polanyi did not commit himself particularly deeply on the questions concerning the biological basis of the formation of the subjective perspective. Moreover, neuroscience and cognitive sciences were only developing at the time when Polanyi developed his theory and his most important results. However, Polanyi (KB) writes that acts of consciousness are not only conscious of something, but also conscious from certain things that include our body; it is the *subsidiary sensing of the body* that makes the knower feel that it is his body. Indeed, as will be explained in the next section, representation of the body does not only make knowing personal, but seems to be an essential condition of knowing and more importantly, of being conscious and aware of the environment.

3. DAMASIO'S THEORY OF CONSCIOUSNESS

In this section we describe Antonio Damasio's conception of how it is possible that organisms can know about their environment. The ideas presented below are mainly taken from Damasio's theory of consciousness (in Damasio 1999).

For Damasio consciousness is the special quality of mind that makes it possible to organism to differentiate itself from the environment; it is a sense of having self that lets the organism to feel that it exists, and that things around it exist. According to him (Damasio 1999), theory of consciousness should not be just a theory of how language and reason help to construct an interpretation of what goes on in the mind, but it should account for the foundation kind of the phenomenon that supports the higher forms of cognition (such as language and reason). The sense of self that Damasio refers is based on the constant representation of the body in organism's brain. This idea is an interesting common feature with Polanyi's thinking; also Polanyi (KB) argued that the subsidiary awareness of the body is an essential part of our existence as persons. He (KB, p. 31) writes, 'To be aware of our body in terms of the things we know and do, is to feel alive.' Hence, the knowledge of the organism's own existence makes it possible to know things external to the organism.

3.1 Evolutionary and biological background

Damasio's approach to consciousness is essentially evolutionary. The basis of his theory is that consciousness evolved with an organism's ability to know itself as something separate from the environment. Before that, in earlier stages of evolution organisms could merely represent their environment. They had simple emotional responses that regulated organisms and produced advantageous actions (such as escape or attack). Thus, emotional processes evolved to enhance the survival of organisms.

Damasio (1999) suggests that these emotional states that ranged between the poles of pain and pleasure were unknown to organisms that produced them. Hence, they did not know that they were performing these actions because they did not feel their own existence. However, as the brain evolved, cognitive and emotional processes grew more and more interrelated. According to Damasio, consciousness began when brains acquired the power to represent that states of the living organism, which were continuously being altered by encounters with objects or events in its environment. In other words, consciousness requires the representation of body signals that tell that some object or event has causally changed the body state. From that moment on, claims Damasio, we begin to know.

Another important, evolutionally motivated premise of Damasio's theory is a build-in urge to survival and maintenance of life, which can be seen from the level of single cell to the level organism as a whole. *Homeostasis* is a central concept in describing this

urge. Homeostasis refers to the maintenance of chemically and physically constant internal environment of an organism. Practically homeostasis describes the largely automatic physical reactions and regulation of temperature, oxygen concentration and pH that aim to maintain a stable and constant condition of the body (Damasio 1999). From the evolutionary perspective living creatures are equipped with devices that aim to solve the basic problems of life (for example, such as the finding and the usage of sources of energy, the maintenance of the chemical balance, the maintenance of physical structure and the avoidance of external causes of injury/illness) automatically in order to support the survival (Damasio 2003). Also, in order to maintain the homeostasis organisms have some simple basic responses such as approach/retreat in relation to some object¹, or increase/repression of some action.

In addition to the adjustment mechanisms of the inner environment a representation of the body in the brain is needed in order to maintain homeostasis. According to Damasio (1999) this kind of representation of body is a collection of neural patterns that occur in many places in the brain (in several brain stem nuclei, in the hypothalamus, in the basal forebrain, in the cortex) mapping moment by moment the state of the physical structure of the organism. In normal circumstances the brain does never stop from receiving these reports concerning the body state. When a change in the representation of the body is registered, and particularly, if the change is in the circumstances is not advantageous for the organism, there are automatic responses that strive to restore the balance. Emotions are the key players in this process (Kolb and Whishaw 2009; Damasio 2003; Ledoux 2002).

Emotions are complicated collections of neural and chemical responses (Damasio 1999). All emotions have some kind of regulatory purpose aiming to the creation of advantageous circumstances to the organism. Thus, emotions are evolutionally and biologically determined processes that function automatically without conscious deliberation.

According to Damasio (1999), emotions occur in two types of circumstances. First, when the organism processes certain objects or situations with its sensory devices, and second, when the mind of the organism conjures up from memory certain objects or situations and represents them as images² in the thought process. Damasio stresses that emotions affect both the body and the brain being responsible for profound changes in both of them. These changes have the potential to become consciously felt feelings of emotions.

The biological function of emotions is twofold (Damasio 1999). The first function is to produce a specific reaction to the inducing situation. For example, in animals the reaction might be to escape or to attack. These reactions are basically the same in humans except that they are normally tempered by higher reason. The second function of emotions is to regulate of the internal state of the organism in order to prepare it for a specific reaction. As an example Damasio mentions increased blood flow to the arteries of muscles and changes in the heart and breathing rhythms. The commands necessary to generate the reactions are sent mainly via two routes, namely via bloodstream in a form of chemical molecules and via neural pathways in a form of electrochemical signals. In both cases the result of these commands is a global change in body state.

As suggested above, emotions have a fundamental role in the homeostatic regulation. It is evident that the strongest need for the internal regulation comes from

¹ Damasio does not refer by objects only to physical entities, but predominantly objects of attention. Hence, objects in this context might be entities as diverse as e.g. persons, places, memories, melodies, pains etc.

² By image Damasio means a mental pattern in any of the sensory modalities, e.g. a sound image, a tactile image, the image of an aspect of an emotional state as conveyed by visceral senses etc.

the environment in which the organism interacts. Damasio (1999) remarks that certain sorts of objects or events tend to be linked to certain kind of emotions more than to others; organisms have acquired the means to respond to potentially useful or harmful stimuli roughly the same way despite the environmental (or cultural) differences. However, as organisms develop and interact they gain factual and emotional experiences with different objects and events and thus associate many objects and events that would have been emotionally neutral with objects and events that are naturally prescribed to cause emotions.

The interesting question naturally is, how the brain “knows” what stimulus is e.g. dangerous. One part of the answer is in genes and other part is in learning (Ledoux 2002). For example, most primates show intense fear of snakes even though they had never encountered them (Kolb and Whishaw 2009). Thus, genetically evolved neural networks sensitize organisms to significant stimuli from the viewpoint of survival. However, neural networks related to emotion also learn from experience. For example, a certain stimulus present in a situation that has led to pleasant experience might be associated with positive emotions although it has not directly induced them. Damasio (1999) stresses that while the biological machinery for emotions is largely preset, its inducers are external to it. Thus, development and culture shape fundamentally the manifestation of emotions in humans. As a consequence, the range of stimuli that can induce emotions is infinite.

Fear and pleasure are naturally extreme and rather clear examples of manifestation of emotion. However, most objects and situations lead in a similar way to emotional response ranging from very weak to very strong, because the organism inevitably undergoes modifications during all the events of sensing and acting (Damasio 1999). Thus, emotional system connects virtually *every* object and event (perceived or recalled) in the everyday experience to the fundamental values of homeostatic regulation.

3.2 Central concepts

Damasio (1999) distinguishes three different kinds of selves that predominantly describe the layers of consciousness whose characteristics and neural correlates can be identified in the making and maintenance of consciousness. It should be taken into consideration that Damasio’s concept of *self* seems to be relatively wide by its meaning, and the three selves presented below refer above all to fundamental processes of consciousness.

Proto-self is an interconnected and temporarily coherent collection of neural patterns representing the state of the organism, moment by moment, at multiple levels of the brain as it aims at maintaining itself. It regulates and creates the necessary balance in exchanges with the environment, constantly making small adjustments to meet the narrow set of conditions for our existence. Hence, proto-self is mainly concerned with homeostasis, and its functions remain unconscious.

Core-self is produced whenever an object of any kind modifies proto-self, and refers thus to the changed body state. Core-self is available to consciousness; Damasio describes it as feeling of being present in a sense that whatever it is happening, it is happening to us. Core-self does not change much throughout organism’s lifetime.

Autobiographical self is linked to the idea of identity and corresponds to a non-transient collection of unique facts and ways of being which characterize a person. It occurs only in organisms endowed with a substantial memory capacity and reasoning ability, but it does not require language. It is based on memories and also on anticipations of the future. It develops gradually throughout life. Autobiographical self permits to know about progressively more complex aspects of the organism's

physical and social environment and the organism's place and potential range of action in a complicated universe.

Damasio (1999) also makes a division between two different kinds of consciousness. *Core consciousness* provides the organism with a sense of self about one moment and about one place. It is produced continuously alongside with core-self as the organism interacts in its environment. The scope of core consciousness is the here and now. Damasio suggests that core consciousness is regenerated continuously in pulses as interactions with the world modify proto-self. The pulses of core consciousness blend together to give a continuous 'stream of consciousness'. Hence, core consciousness is a simple biological phenomenon that occurs when the brain's representation devices generate a representation of the self along with the object that the organism becomes aware. Thus, organisms produce core consciousness when they construct images of a part of themselves forming images of something else. The most essential function of core consciousness is to represent moment-by-moment the physiological state of the organism mapped by a collection of neural structures. According to Damasio core consciousness is the means by which the organism indicates to itself that it is engaged by some object or event. The object or event can be directly perceived or indirectly recalled from the memory of past perceptions. In both cases core consciousness indicates that the processing of images of anything is happening within the individual organism, in its perspective. Moreover, this means that the internal state of the organism is the basic constituent of the images of the external world, and it is made in a non-verbal language, a language of somatosensory information.

Extended consciousness is dependent on long-term memory and working memory that give awareness of the lived past and expectable future (Damasio 1999). It is a multi-levelled phenomenon that on the one hand gives organism an identity, and on the other is the basis of human creativity enabling planning, problem solving and manipulation of mental pictures in the working memory. Hence, in Damasio's terms extended consciousness refers to the form of consciousness that is typical only to humans; the form of consciousness that makes it possible to put separate experiences into a broader context and over a longer period of time. Autobiographical self is the basis of extended consciousness.

Based on neurological evidence, Damasio (1999) claims that these two forms of consciousness have neural correlates. Moreover, neurological evidence suggests that extended consciousness is not an independent form of consciousness, but it is based on core consciousness; impairments of brain structures necessary to extended consciousness allow core consciousness to remain unscathed. However, impairments at the level of core consciousness impair extended consciousness as well.

3.3 First stages of knowing

The first stages of knowing can now be considered through the processes of proto-self and core-self. The object of knowing becomes mapped within the brain in the sensory and motor structures activated by that object. The sensimotor maps pertaining to the object cause changes in the maps pertaining to the knower's body state (that is, in proto-self). These changes are re-represented in yet another maps that Damasio (1999) calls *second-order maps*. Second order maps, then, essentially represent core-self: changed body state caused by the object of knowing. This process is described in figure 1.

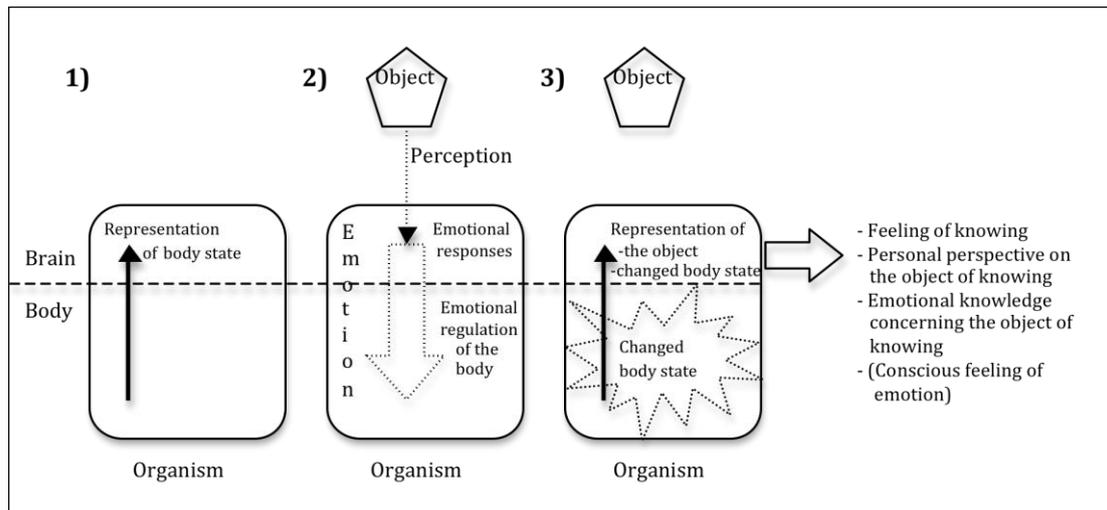


Figure 1. The formation of the relationship between the organism and the object. 1) Mapped representation of body state that precedes new act of knowing. 2) Perceived object provokes emotional responses that cause changes in body state. 3) Changed body state becomes represented alongside with the representation of the object of knowing. As a result, knowledge concerning the object arises from a personal perspective. Moreover, (tacit) knowledge based on previous experiences is manifested in the form of emotion. The emotion may become focally felt feeling (e.g. fear).

The main idea of Damasio's theory is that organisms construct neural patterns related to their environment, and these representations of objects and events cause changes in the organism. In this sense the process of becoming aware of the environment has two stages: first, the construction of a representation of certain object/event, and second, the change in the body state caused by the representation. Studies concerning consciousness have traditionally considered only the first stage, and in fact, the neural bases of the process related to it (e.g. perception, memory and learning) are relatively well understood. From the epistemological perspective this traditional view seems to explain what humans have in common in their knowledge representations. In this sense the traditional view participates in explaining the objective side of human knowing.

However, Polanyi claimed that subjective dimension of knowledge is fundamental aspect in the study of knowing. According to Damasio's central argument, knowing becomes possible as the brain's representation devices generate a nonverbal account of how the organism's own state is affected by the organism's processing of an object and this process enhances the image of the causative object. This way the organism can connect knowledge concerning previous experiences to the "selected" object (that is, conceptual, autobiographical and motor knowledge). Hence, in this sense Damasio sees the basis of an act of knowing as a nonverbal object-organism relationship, in which the change in the organism caused by the object does not only manifest important information about that relationship but actually is the key mechanism how the organism can become aware of the object and can know it.

Damasio (1999) stresses that these first stages of knowing are not verbal, but based on images and emotions; the process is so natural that it can hardly be recognized. This process occurs also in the simpler brains than human brains are, which suggests that its foundation is independent of linguistic capacities. It is difficult to think that Polanyi would have any problem to call this process *tacit* and the knowledge manifested by it *tacit knowledge*. Hence, we suggest that "the impacts that external things make to our bodies" (that we are only subsidiarily aware of) that Polanyi talked

about include also internal impacts (changes in emotional states).

3.4 Neuropsychological evidence

The justification of Damasio's theory is based on neuropsychological evidence; the theory predicts that alterations in the brain structures that are crucial in representing or regulating physiological changes in body should lead to compromised consciousness. In short, interruptions in basic emotion processes should interrupt consciousness. These crucial brain structures include

- several brain-stem nuclei that regulate body states and map body signals;
- the hypothalamus that maintains a current register of the state of the internal milieu by, e.g. registering the level of circulating nutrients and regulating it;
- the insular cortex and the medial parietal cortices that, especially in the right hemisphere, hold the representation of the current internal state of the organism at the level of cerebral hemispheres;
- cingulate cortices, superior colliculus and the thalamus that receive converging signals from various sources and are thus capable of presenting second-order mapping (that is, a representation concerning how the organism is causally affected by the processing an object) (Damasio 1999).

Indeed, even relatively small damage in the brain-stem nuclei, in the hypothalamus, in the thalamus or at the cingulate cortex cause coma or persistent vegetative state (Posner et al. 2007; Churchland 2002). In neither case are there any signs of emotion.

However, in Damasio's theory being conscious goes beyond being awake and attentive because, according to Damasio (1999), consciousness requires an inner sense of self in the act of knowing. Hence, damage in the structures that take part in the construction of the second-order representations (organism-object relationship) should disrupt core consciousness partially or completely. As distinct from coma, a person with impaired core consciousness can be awake and e.g. be able to move. Moreover, in this context we are eminently interested in the state in which a subject loses the capacity to know although being able, at least in theory, to perceive or to act in his environment. Indeed, Damasio describes an interesting class of neurological states characterized by wakefulness but a minimal degree of attention and purposeful behaviour. Epileptic automatism and akinetic mutism are examples of such states.

Epileptic automatism causes an absent seizure, during which a patient simply stares off into space; the patient may walk and act in his environment (drink water from a glass if there is one, open a door, sit on a chair etc.), but is clearly not self-conscious (Damasio 1999). The loss of consciousness is often accompanied by amnesia so that after the seizure the victim does not know anything about the seizure being however fully aware of the moments just before it (Kolb and Wishaw 2009). Thus, during a seizure a patient does not have any plans, beliefs, past or future—no sense of self.

Similarly, patients suffering from akinetic mutism may notice their surroundings, but stare in the void motionless and speechless for months. Damasio (1999) describes that a patient may lie in bed with eyes open and occasionally grab an object (or otherwise move the body normally) but non-focused staring resumes rapidly; a patient does not react to the presence of relatives or friends, but might utter meaningless words occasionally. After the seizure there are no experiences or clear memories related to the time of absence.

These neurological states described above (coma, persistent vegetative state, epileptic automatism and akinetic mutism) have something essential in common. In

none of these cases are there any signs of emotion; patients' bodies, faces or physiological measurements do not express emotions of any kind to external or internal inducers (Damasio 1999). Patients do not have any sense of self nor of their surroundings; they do not manifest any form of knowing. They can move perfectly, but they do not have a conscious mind to formulate a plan and command the movement.

Accordingly, it seems that emotion and core consciousness go together based on the fact that they are present together or absent together (Damasio 1999). Also other researchers have suggested that there exists a close relation between emotion and consciousness (see e.g. Tsuchiya and Adolphs 2007). Damasio (1999) classifies the neurological examples and the related brain structures in a following way:

- Disruption of core consciousness with preserved wakefulness and preserved minimal attention/behaviour (e.g. epileptic automatism, akinetic mutism): dysfunction in the cingulate cortex, in the basal forebrain, in the thalamus and in the medial cingulate cortex;
- Disruption of core consciousness with preserved wakefulness but defective minimal attention/behaviour (absence seizures, persistent vegetative state): dysfunction in the upper brainstem, thalamus, hypothalamus or cingulate cortex;
- Disruption of core consciousness accompanied by disruption of wakefulness (coma, anaesthesia): dysfunction in the structures of the upper brain stem, hypothalamus, or thalamus.

The loss of core consciousness entails loss of extended consciousness, but the converse is not true; compromised extended consciousness retain core consciousness (Damasio 1999). For example, a patient suffering from severe amnesia (impairment related to extended consciousness) might not know things that have happened just minutes or hours before. Moreover, since human memory also includes memories of events that we anticipate, an amnesiac may not have any memories regarding the intended plans for the minutes, hours or days that lie ahead. Although the patient is deprived both the personal history and the planned future, he retains the core consciousness for the events/objects in the here and now. Thus, patients have basic sense of their persons and they are responsive to external stimuli although the situation fails to make sense to them due to the lack of memories. Still, they are able to organize their behaviour and even report their own state; they are conscious because their emotional system supporting core consciousness is intact.

4. OVERLAPPING ASPECTS OF POLANYI'S AND DAMASIO'S THEORIES—REPRESENTATION OF BODY AS A FORM OF TACIT KNOWLEDGE

The foundation of both Polanyi's and Damasio's thinking is that the objects of conscious acts are directed to the knower itself, and accordingly, knowledge of the reality is based on the body. Thus, Polanyi and Damasio seem to suggest that knowledge is based on some kind of inner sense of self *from* which the reality is attended *to*. This conception emphasizes the idea of *intentionality*, that is, the idea that acts of consciousness are about or directed upon objects outside the mind.

Both Polanyi and Damasio claim that the relationship between the knowing subject and the object to be known is the basis of knowing; no knowledge is possible without the embodied activity of the knower. Hence, intentionality is the link that connects the internal and external (or subjective and objective) dimensions of knowing. Moreover, *from-to* structure underlines the knower-dependency of knowledge, because due to the bodily roots of knowing, knowledge is inevitably constructed and viewed from a personal perspective. Logically this means that the knowing subject has a perspective that is not entirely compatible with perspectives of other knowing subjects. The sensation of self in the act of knowing not only places the knowledge in a personal context, but the personal context also creates new knowledge that brains produce continuously in an interaction with the reality.

Both Polanyi and Damasio make a conceptual distinction between two different kinds of awareness/consciousness. Certain important theoretical aspects of Polanyi's distinction between subsidiary awareness and focal awareness seem to be analogous to Damasio's distinction between core consciousness and extended consciousness, respectively. The main idea of both of them is the fact that the higher form of awareness/consciousness that humans experience and are able to describe linguistically must be based on a more fundamental form of awareness/consciousness. In other words, neither consciousness nor knowledge is a product of use of language or other "higher forms of reason", but they are based on deeper and evolutionally older mechanisms.

Interestingly, for example the traditional analysis of knowledge (knowledge seen as a justified true belief) even highlights the role of language because, in order to be justifiable the belief is supposed to be presentable in a propositional form. In addition, the justification is gained by means of proper argumentation, which also refers to linguistic procedure. Moreover, language has also been claimed to be a prerequisite or even basis of human consciousness (see e.g. Bickerton 1990).

However, from the evolutionary viewpoint it is evident that consciousness and knowing could not have been started from the use of language, but vice versa. Language has evolved to a conscious creature that has possessed knowledge of its environment. Moreover, the representation of the body is based on the ancient subcortical brain structures compared to neocortical (that is, later in evolution) structures, in which the linguistic abilities have been located (Colb and Whishaw 2009). Consequently, consciousness and knowledge must have deeper basis, which both Polanyi and Damasio have been interested in from their own perspectives—and against their contemporary mainstream conceptions.

In Polanyi's thinking humans are subsidiarily aware of their bodies while attending to focal targets. If Polanyi's concept of subsidiary awareness is compared to Damasio's concept core consciousness, it can be confidently argued that core consciousness (a second-order map representing body state changed by an object) is a phenomenon that belongs to subsidiary awareness. As Polanyi (KB, p. 147) puts it, 'every time we make sense of the world, we rely on our tacit knowledge of the impacts made by the world on our body and the complex responses of our body to these impacts.' Hence, in Damasio's terms "impacts made by the world" and "complex responses of our body" are expressed in second-order maps. In consequence, body state, manifested by emotions, is a form of tacit knowledge.

However, the "impacts made by the world" cannot be assessed or even noted without some kind of knowledge of the organisms homeostatic basic state that it aims to maintain. Damasio (1999) calls this process of constant representation of the body state *proto-self*. On the grounds of Damasio's theory we argue that *proto-self represents the most fundamental form of tacit knowledge*: by means of *proto-self* the representation of bodily changes caused by the object becomes possible.

Basing on Damasio's description of the consequences of the impairments of the representation of body state, it is arguable that subsidiary awareness is impaired without the representation of the body; the patients suffering from akinetic mutism or epileptic automatism are able to form focal representations but they cannot connect these formed representations to anything. There might be an identifiable object in the focal awareness, but it remains meaningless without the emotional responses related to it. In other words, if the knowing subject is not aware of the bodily changes (that is, emotions) that focal objects cause, his sense of existence is weakened and the representations of the environment are at least close to meaningless. Damasio (1999) calls this state *being without knowing*. In this important sense, *representation of body seems to be also the basis of subsidiary awareness*. Figure 2 describes the relation between Polanyi's paradigm of two kinds of awareness and Damasio's ideas of proto-self and core-self.

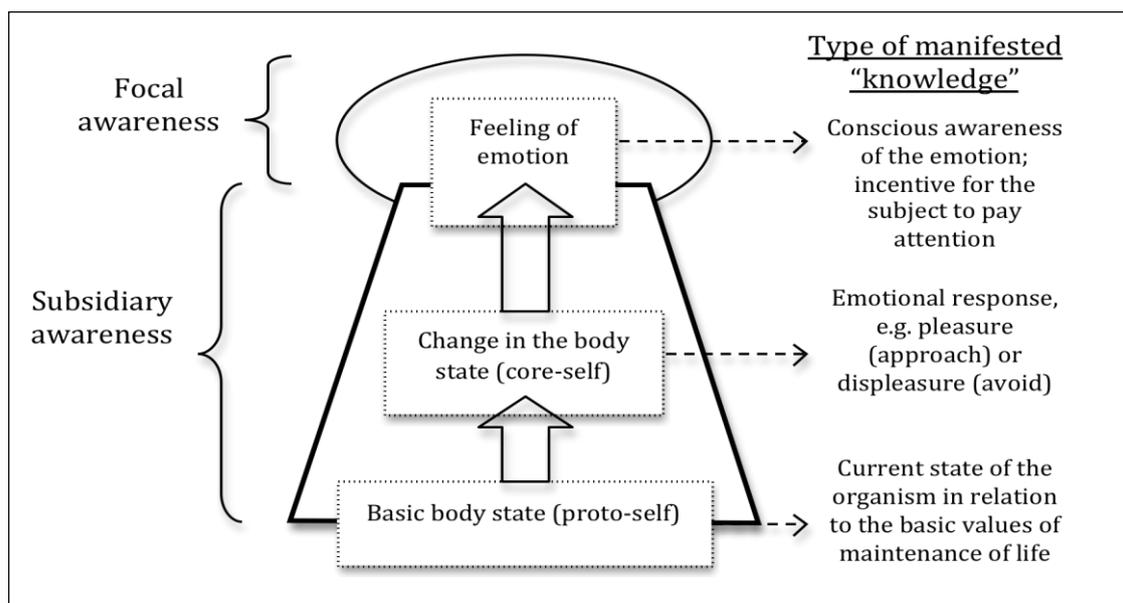


Figure 2. Polanyi's paradigm of two kinds of awareness and Damasio's concepts of selves. Proto-self is created and updated constantly independently of acts of knowing (e.g. during sleep) and is thus in this sense a processes partially external to subsidiary awareness. However, as it is impossible to register *changes* in the body state without the knowledge of the basic state, proto-self is a necessary component in subsidiary awareness. The changes caused by the object of knowing, manifested in a form of emotional regulation and represented in the brain, are also subsidiary. However, the subject may feel the emotion, and this feeling may become a target of focal awareness. On the other hand, feeling might be recognizable without ever becoming the object of attention but simply staying in the background. In that sense feeling might be also subsidiary.

5. CONCLUSIONS

The fundamental idea behind the subjective dimension of the knowing, argued by Polanyi, is the bodily roots of all conscious acts. Recent findings in the field of neuropsychology provide evidence that the representation of the body state is an essential condition for conscious acts, and hence, also to acts of knowing as Polanyi claimed. In fact, the overlapping neural systems and intimately relation between emotion and cognition is a theme that runs through all modern neuropsychological

theories of emotion (Kolb and Whishaw 2009). Hence, knowing is not only a post-language phenomenon and Damasio's theory (among others) presents in a more concrete way the idea of bodily roots of knowledge that Polanyi sketched.

Representations of reality must be directed to organism itself (to the body state and changes in it) to be able to be conscious of them. In this sense consciousness implies subjectivity, that is, a sense of having a self that is separate from the world. This subjective feature cannot be avoided in acts of knowing. In consequence, it seems that the subjective dimension of knowledge is not only relevant but indispensable aspect of knowing as Polanyi claimed. When the same event is represented both externally (e.g. visual perception) and internally (emotional response), the relationship between the knower and the to-be-known becomes represented. This seems to be the principal mechanism how the feeling of knowing and the personal perspective is constructed.

Moreover, the second-order representation of body also contains embodied tacit knowledge, expressed in a form of emotion, about the external event, which makes it possible to assess, predict and plan one's actions from a richer perspective. Thus, directing an external representation to self enriches its meaning. Interestingly, this is a perspective that has been largely bypassed in modern epistemology and study of consciousness, perhaps due to the exaggerated emphasis on human rationality.

We argue that the representation of body state can be considered to be in Polanyi's terms *subsidiary knowledge* of body state, and thus, the most fundamental form of tacit knowledge and the basis of cognition. Interestingly, Polanyi seem to have outlined this kind of idea although at that time there were not enough psychological evidence available to formulate the argument more accurately. Most importantly, Polanyi's philosophical arguments seem to withstand well the new knowledge that rapidly developing cognitive sciences and neuroscience keep producing, which suggests that Polanyi's theory is highly relevant also in these areas of science.

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Towards Better Understanding of the Concept of Tacit Knowledge – A Cognitive Approach

Ilkka J. Virtanen

Abstract—Tacit knowledge has been one of the most discussed and contradictory concepts in the field of knowledge management since the mid 1990s. The concept is used relatively vaguely to refer to any type of information that is difficult to articulate, which has led to discussions about the original meaning of the concept (adopted from Polanyi's philosophy) and the nature of tacit knowing. It is proposed that the subject should be approached from the perspective of cognitive science in order to connect tacit knowledge to empirically studied cognitive phenomena. Some of the most important examples of tacit knowing presented by Polanyi are analyzed in order to trace the cognitive mechanisms of tacit knowing and to promote better understanding of the nature of tacit knowledge. The cognitive approach to Polanyi's theory reveals that the tacit/explicit typology of knowledge often presented in the knowledge management literature is not only artificial but totally opposite approach compared to Polanyi's thinking.

Keywords—Cognitive science, explicit knowledge, knowledge management, tacit knowledge.

I. INTRODUCTION

MICHAEL Polanyi's epistemology has been a subject to considerable amount of interest in the field of contemporary management research. Particularly, the concept of tacit knowledge has become a common buzzword that is almost impossible to avoid seeing in the contemporary knowledge management (KM) literature. In the 1990's Polanyi's tacit knowledge became related to the widely supported claim that organizations can achieve competitive advantages by using effectively their unique knowledge (see e.g. [1]). Since then possible procedures for making tacit knowledge representable has been a widely discussed issue in the KM literature.

Polanyi made in his theory a distinction between two different kinds of awareness that involved different kinds of knowing; the content of *focal awareness* was conscious and thus subject to verbal description. However, according to Polanyi [2] focal (or 'explicit') knowledge was always based on tacit knowing in *subsidiary awareness*. Drawing from Polanyi, various authors have chosen an ontological position according to which there generally exist two types of

knowledge, tacit knowledge and explicit knowledge (e.g. [3]-[5]). This interpretation has been claimed to be misleading, even opposite to Polanyi's thinking (see e.g. [6], [7]). According to the view that distinguishes tacit and explicit knowledge, explicit knowledge is usually defined straightforwardly as codified knowledge, easy to share in words and numbers [8]. However, defining the concept of *tacit* knowledge has proven to be extremely difficult task. That is probably why the attempts to define it are often bypassed in the KM literature by remarking that tacit knowledge is "knowledge difficult to articulate" (e.g. [9], [10]); the definition seems logical once the tacit-explicit distinction has been made and tacit knowledge becomes juxtaposed with articulate explicit knowledge.

However, according to the definition of tacit knowledge presented above *anything* difficult to represent instantly using language can be generalized to be 'tacit knowledge'. Thus, it seems that tacit knowledge has become a "warehouse" for any ambiguous or difficultly approachable mental or social phenomena in various scientific fields. The term 'tacit knowledge' nowadays has a large variety of meanings also in the KM literature [11], [12]. Very rare, if any, other scientific concept leaves the reader as puzzled about the innermost meaning of the concept as the concept of tacit knowledge.

Despite that the concept of knowledge has a heavy philosophical charge it is proposed that in order to understand human knowing and its tacit capacities the subject area should be approached from the perspective of cognitive sciences; the varied proposals of the exploitation of tacit knowledge lack firm grounding to real cognitive phenomena. Also, the traditional analysis of knowledge (i.e. knowledge seen as a justified true belief) is a rather stiff characterization to explain the knowledge on which human acting is based in the ever-changing environment that requires fast decisions and problem solving. Instead, knowledge is property of individual minds and the understanding of mind-brain architecture is becoming an increasingly important issue also for epistemology.

The problem of lack of cognitive perspective described above is considered to be problematic feature also in Polanyi's theory. In fact, one important reason for the abstruseness of Polanyi's theory is the lack of efforts to elucidate cognitive processes behind tacit knowing [13], [14]. It is, however, quite natural because cognitive sciences were only developing at the time when Polanyi developed his most important results. The fact that Polanyi's philosophical concepts have not been

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connected with studied cognitive mechanisms is one important reason why tacit knowing has been interpreted so many varying and inconsistent ways.

Instead of offering a clear explanation of the cognitive processes on which tacit knowing is dependent, Polanyi illustrated his theoretical principles of knowing with various examples. Thus, some of the most important examples that Polanyi used are analyzed in order to explore the core of tacit knowing from the perspective of cognitive science. The downside of this approach is that a few examples are not necessarily enough to describe extensively the whole phenomenon. However, even a few examples can offer valuable insights to the phenomenon promoting its understanding. Moreover, while the correct use of the concept of tacit knowledge can be (and has been) questioned in many scientific writings, it can be confidently claimed that tacit knowledge is being discussed here *in its original sense* since the focus is on the examples that Polanyi himself used.

The aim is to provide answers to three questions:

1. What is tacit knowledge like in a cognitive sense; on what kind of cognitive mechanisms tacit knowing is based?
2. How can Polanyi's claim that explicit knowledge is based on tacit knowledge be justified; what is the relation between tacit and explicit knowledge from the perspective of cognition?
3. What kind of epistemic contents (if any) tacit knowledge bears?

By setting Polanyi's theory into a wider cognitive and epistemic framework it is possible to gain better understanding of his theory generally and the concept of tacit knowledge specifically. It seems that this kind of cognitive extension of his theory has not been done before. However, it is necessary to answer the questions presented above before realistic models of management or explication of tacit knowledge can be developed.

In the next section Polanyi's philosophy is discussed briefly in order to introduce the core of his idea of tacit knowing. Three groups of examples of tacit knowing are then discussed in the sections III-V. Based on the analysis of these examples, the epistemic status of tacit knowledge is considered in the section VI. The conclusions are presented in the section VII.

II. POLANYI'S THEORY

The starting point of Polanyi's epistemology was his dissatisfaction with positivist philosophy of science and the epistemological account following from it. According to positivism genuine knowledge had to be verified by experience and scientific method. Sense data was considered to be the foundation of human knowledge, but logic was also seen as a valid tool for producing knowledge by deducing conclusions from the known facts. In this sense, not only knowledge itself had to be fully explicit but also the logical steps that led to it.

Polanyi [15] argued that positivism itself could not lead to genuine knowledge because scientific discoveries could not be credited to any purely analytical operation. He explained that the first step of any discovery or creative act was to see a problem. Knowing a problem was thus knowing something hidden; "it is an engrossing possession of incipient knowledge that passionately strives to validate itself." [16, pp. 131-132]. According to Polanyi [2], modern science was based on disjunction of objective and subjective and thus aimed to eliminate passionate and personal human appraisals from theories of science. Instead, Polanyi claimed that personal participation was included in every act of knowing. As he [2, p. viii] put it, "Into every act of knowing there enters a passionate contribution of the person knowing what is being known, and ... this coefficient is no mere imperfection but a vital component of his knowledge."

Thus, in Polanyi's philosophy the knower is situated in the most fundamental position instead of what is being known; the knower does not simply pick up or see the meaning of knowledge but actively forms it by integrating his personal appraisals to the thing that is being known. Polanyi believed that the positivist demand that all subjectivity had to be eliminated from knowledge was impossible to fulfill, because there could not be knowing without the active involvement of a knower [13].

Unlike traditional epistemology, Polanyi's theory of knowledge stresses the process of knowing instead of its justification. Thus, the mental skills that cannot be formalized by language or the ones that escape the knower's focal attention are in the center of his analysis of knowing. He stresses that the embodied participation of the knowing subject is the most fundamental element of knowing. By placing the embodied activity at the center of human cognition Polanyi connects the knowing subject and that which is to be known instead of separating them as in modern philosophy traditionally has been done [17].

Polanyi [16, p. 147] argues that making sense of the world was about "relying on our tacit knowledge of impacts made by the world on our body and the complex responses of our body to these impacts". Thus, all knowledge has bodily roots because external objects are attended by being subsidiarily aware of things happening within the body. In this sense the body is not a mere passive physical object in the world but serves as an interface by which one comes to know the world through interaction. Therefore the formation of focal meaning is fundamentally bodily action.

Polanyi [2] presents a distinction between two kinds of awareness that is parallel to the distinction between tacit and explicit dimensions of knowing. *Focal awareness* concerns the object of conscious act, for example an external object or a propositional belief. *Subsidiary awareness* refers to the bodily basis on which the focal awareness operates; processes of subsidiary awareness provide the elements that the focal object consists of. Thus, tacit knowledge and tacit mental skills belong to subsidiary awareness whereas the articulate, or conscious, knowledge emerges to focal awareness.

Consequently, knowing agents can describe and construct rules for explicating what is in focal awareness.

However, as focal awareness is supported by subsidiary awareness, the explication of the contents of focal awareness remains always incomplete [18]. The thing the knower is focally aware of as a result of an act of knowing is formed subsidiarily of *tacit clues*, which enriches focal knowledge with personal coefficient [2]. Therefore the knowledge of the focally attended things is based on something more fundamental; explicit knowledge is based on tacit clues, or tacit knowledge. Moreover, in Polanyi's thinking this structure is present in every conscious act. Knowing agents end up having conscious (explicit) representations that are enabled by tacit processes and tacit particulars that the knower cannot define.

Since the main interest in the present context is in explaining why tacit knowledge is "tacit", the most important question is why the content of subsidiary awareness remains unspecified. Polanyi [19] presents two reasons for the tacitness of subsidiary particulars. First, *the difficulty of tracing the subsidiaries*, which means that the subject is "focally ignorant" of the subsidiaries; the subject knows only the joint meaning of the tacit clues but does not reach the clues themselves [20]. This explanation seems to refer directly to unconscious cognitive processes. Second, *logical sense deprivation*, which means that the subsidiary clues can be traced but if traced they become focal losing their subsidiary meaning and function. For example, a pianist playing his instrument focuses his attention on the piece of music that he is playing being only subsidiarily aware of the movements of his fingers. If he suddenly shifts his attention to the movements of his fingers, he gets confused and probably has to stop the playing [21].

As the example of a pianist already suggested, the two types of awareness are in Polanyi's theory mutually exclusive in the sense the subject cannot attend to both of the awareness at the same time. Thus, logical unспецифиability means that the tacit particulars of the performance might be focally known as such, but even in this case their *functional* meaning in the performance itself remains tacit.

Polanyi also distinguishes between two different types of tacit knowledge, particularly in the case of perception (e.g. in [22], [23]). First, *subliminal clues* that refer to the somatic events that cannot be observed directly. Second, *marginal clues* that can be observed directly, but do not become attended to because attention is directed to some other target. Polanyi further divided also marginal cues into two kinds [24]; besides what can be seen marginally externally (for example, in perception at the corner of the eye) knowing agents are influenced by internal marginal clues (for example memories). Thus, knowing agents tend to see things as they are used to see them, or supposed to see them. The types on unспецифиability and tacit clues are summarized in figure 1.

Although Polanyi analyzed the reasons of unспецифиability and the different types of tacit clues he did not offer a clear explanation of the cognitive processes on which tacit knowing

is dependent. Instead, Polanyi illustrated his theoretical principles of knowing with various examples. There are three particularly important groups of examples in the sense that these examples repeat in his literature.

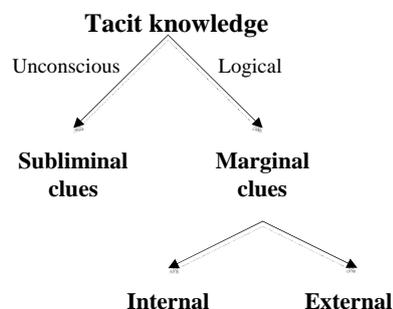


Fig. 1 Theoretical types of tacit knowledge as presented by Polanyi.

1. Tacit knowing related to perception.

Polanyi found in perception a most useful example to elucidate the structure of tacit knowing and the idea of mental integration. For example, visual perception that happens seemingly very effortlessly is an act of integration of many clues to a focal perception of attended object. As Polanyi [19, p. 28] puts it, "I look at my right hand as I move it about in front of me, and I see a thousand rapidly changing clues as one single, unchanging object moving about at changing distances, presenting different sides at variable angles and in variable light. The integration is innumerable, rapidly changing particulars makes us see a real object in front of us."

2. Tacit knowing related to emotional responses.

In *The Tacit Dimension* Polanyi [21] discusses a psychological experiment (conducted by Lazarus and McCleary [26]) in which the authors presented nonsense syllables to the subjects. Half of the syllables had been associated with a painful electric shock whereas the other half consisted of neutral control syllables. The authors found that the subjects were unable to recognize or identify the shock-causing syllables, but showed symptoms of anticipating the shock (measured with galvanic skin response) when a shock-syllable was presented—even when the exposure time of a presented syllable was too short for a conscious recognition. The authors concluded that "some kind of discrimination is made when the subject is unable to make a correct conscious discrimination." Polanyi claims that this experiment shows *most clearly* what is meant by saying that one can know more than one can tell. The main point in this group of examples is that one can acquire knowledge that affects or guides one's action but what cannot be specified; the knowing subject is

not fully aware of the nature of the knowledge he has nor necessarily even the fact that it affects his judgment. Instead, what the subject is aware of is some kind of feeling that there might be something special in a certain stimulus.

3. *Tacit knowing in skilful performances.*

There is nothing new in the claim that *knowing how* to do something is generally difficult to describe. Polanyi discussed about hidden rules that are not explicitly known to the actor himself for example in such performances as riding a bicycle [2], playing a piano [21] and using tools [23]. Thus, the third group of Polanyi's examples is essentially about motor skill learning.

Each of these groups of examples will now be discussed in its own section.

III. TACIT KNOWLEDGE IN PERCEPTUAL PROCESSES

Many of Polanyi's examples in group one discuss the problem of having at the center of the attention a constant, unambiguous perception of an object (focal awareness) that is dependent on clues to which one is not attending (subsidiary awareness). For example, "When looking at the stereo-image, we do see the separate pictures too; for we see the stereo-image only because we have a precise impression of the two pictures which contribute to it. But we must distinguish between the two kinds of seeing: we are focusing our attention on the stereo-image, while we see the two pictures only as they bear on the stereo-image. We don't look at these two in themselves, but see them as clues to their joint appearance in the stereo-image. It is their function to serve as clues. We may describe the situation by saying that we are focally aware of the stereo-image, by being subsidiarily aware of the two separate pictures ... The seeing of two stereo-pictures as one spatial image is, indeed, irreversible in two senses. Firstly, it is difficult to find our way back to the clues in the two pictures, because they are hardly visible. And there are many other clues to seeing something, like memories and the feeling inside our eye muscles, which we either cannot trace or cannot experience in themselves at all; they are largely submerged, unrecognizable." [25, p. 800]

Perception in general refers to the acquisition and processing of sensory information in order to see, hear, taste or feel objects [27]. The main purpose of perception is to organize the continuously changing sensory input into stable, meaningful objects and recognize them.

It can be obviously questioned if the process of perception counts as a form of knowing at all since it seems in a sense a self-evident and passive process. However, perceiving things does not mean that they are perceived exactly as they are in the reality. For example, in visual perception a visual representation is constructed according to the type of data the receptors in our eyes are capable of recognizing. The brain then receives and analyses sensory signals, not the environment as such. Thus, perceiving does not mean

mirroring reality in an objective way. Perception understood this way puts forward Polanyi's structure of knowing. Moreover, it is easy to agree that perception normally leads to justified beliefs about the external world. Thus, Polanyi considered perception as knowing even though he remarked that it was the simplest and impoverished form of it [21].

Despite that the heading of this section refers to perception in general, the main focus is on visual system because many of Polanyi's examples of perception concern visual system. However, the same general principles (related to tacit knowing) of perceptual processes concern also other sense modalities because each sensory system is organized on a rather similar plan [28].

All the sense modalities respond to a certain form of physical stimulus. In the case of visual system the form of physical energy is electromagnetic energy (light) [29]. Light passes through the eye and stimulates the color and brightness sensitive receptors in the retina. Electromagnetic energy is then converted to neural impulses and transmitted along optic nerves to the visual cortex specialized to the processing of visual information [28].

In the primary visual cortex the input information is segregated, among others, into color, form and movement, each of them represented by neurons sensitive to these attributes [30]. From the primary visual cortex the information goes to secondary areas that are specialized for processing these different features of the input. The processing of visual information continues from the secondary areas that have even more specific functions, such as object, face and body analysis [28]. Neural pathways of vision are finally connected to prefrontal cortex, the area generally related to working memory [31]. A conscious, coherent visual experience that tells what there is and where is supposedly formed in working memory—the things that the subject is conscious of are the things that he is processing in the working memory [31].

In sum, visual system consists of different modules that analyze parallel different attributes of visual stimuli separately. The visual scene that a knowing agent is focally aware of is thus constructed of various components (such as shape, color, movement etc.) as Polanyi claimed. Refined visual information then gradually converges on its way towards working memory.

This crude and somewhat simplified description of the brain architecture related to visual perception reveals that the convergence of different type of information processed in the specialized modules is one of the key processes of comprehensive perception. This neuropsychological fact is well in unison with Polanyi's idea of "integrating clues into a comprehensive whole". At this stage of the process the clues are subliminal, because the processes are unconscious.

However, the most interesting question is, does this kind of anatomical architecture embody knowledge of any kind? It consists of interrelated, yet functionally independent, modules that receive data flows, process them and then send information forward to following modules.

Since the processes of the specialized areas are not random, it seems indispensable that these modules embody knowledge in order to determinate how a certain data flow is processed, even if the processing was mainly spontaneous sorting at the first stages. Let us briefly consider the function of some of the modules of the visual system in order to illustrate this idea.

Separation of objects: eye responds to stimulus pattern with a mosaic of millions of independent neural responses that code the amount of light falling on that particular area on the retina, and the first task is to determine which of these areas belong together [28]. The most important information for this process comes from color and texture; an abrupt change in color or texture is interpreted as a boundary between two regions [32]. This is why humans are able to see figures and their backgrounds; a stimulus that contains more than one region distinguished by a change in light or texture is normally seen as a figure and its background [33]. Thus, a change in color or texture *predicts* a border of two separate objects and is likely to be interpreted as such. Object's boundaries that are perceived in focal awareness are tacitly inferred based on changes in light and texture. These changes serve as cues of the boundaries of the object and the knowing subject is focally ignorant of them.

Tacit knowing in the case of separation of objects can thus be related to internal unconscious processes. However, Polanyi suggested that tacit knowing might also be based on environmental cues in which case the unspecified information is external to the knower. For example, the case of binocular vision that Polanyi discusses means that having two eyes (instead of one) makes it possible to see reality in three dimensions. Both eyes receive a slightly different view of the world and essentially these two views combined enable the perception of depth. The tacit process of combination of the two pictures into one richer version is also unconscious and internal. However, in addition to these binocular cues humans use also many external sources of information in order to assess depth. Some of this information is called monocular because its interpretation is possible using only one eye. For example, *interposition* is a depth clue occurring when an object blocks off the view of part of another object giving information that the occluded object is farther away [33]. *Linear perspective* is another clue of depth; it is present when two parallel lines pointing directly away seem progressively closer together as they recede into the distance (e.g. railway tracks). Also *shading* (see e.g. [34], [35]) and *familiar size* (knowledge of the actual size of a distant object, see e.g. [36]) have been shown to be powerful monocular depth clues. Thus, monocular clues are external from the knower's perspective but provide rich information that is tacitly assessed in a process of perception.

Consequently, the world is perceived unaware of the calculations and tacit inferences that construct the perception. The cognitive perspective is thus in tune with Polanyi's claim that we observe external facts without an exhaustive formal argument and without a capability of explicitly stating how it gets done.

Recognition of perceived object amounts to assigning an object to a category or to a particular instance (for example in a case of recognizing a face). For that the constructed representation has to be compared to object representations stored in long-term memory [33]. However, perception is not a process driven solely by input information from the senses (bottom-up processes). Individual knowledge, expectations and contextual factors (top-down processes) have been shown to affect considerable to human perception. For example, confronting objects in places we expect to see them makes it easier and faster to recognize them [37]. Therefore it is easier to recognize that an object is a piece of soap based on the fact that it is on the sink. Thus, interpretation of perceptual input depends on pre-existing, organized knowledge structures that provide *predictions* of "what should be there" based on the previous experiences (internal marginal clues in Polanyi's terms).

From the viewpoint of knowing recognition is particularly important stage because it enables the access to semantic knowledge and individual episodic memories concerning perceived object. In this sense recognition assigns meaning to percept and enables to retrieve conceptual information concerning the recognized object. Thus, object recognition is a point of confluence of in which personal aspects blend with information predominantly dependent on physiological structures and functions.

What then is tacit knowledge involved in the perceptual processes? According to Kolb and Whishaw [28] single neurons are coded to detect certain features from the visual input. Consequently, in the lowest level tacit knowing can be viewed as scanning for special features of stimuli and passing sorted information on to the more specialized areas. Perception is also affected by both internal marginal clues (prior beliefs and expectations) and external marginal clues (e.g. monocular clues) that support the formation of unambiguous interpretation. Also, tacit knowing includes the convergence of different type of visual information, which culminates in the focal representation in the working memory. Only at this stage it is possible to explicate what has been perceived.

IV. TACIT KNOWLEDGE RELATED TO EMOTIONAL RESPONSES

Polanyi [38] discusses various psychological experiments (e.g. [39], [40]) that are practically analogous to the Lazarus and McCleary's [25] experiment described earlier. The majority of these examples can be summed up in the following findings made by the authors of the experiments:

- The actual experiments were preceded by a conditioning phase during which some of the stimuli were systematically paired with an electric shock.
- In the actual experiments the subjects were unable to identify the shock-causing stimuli, but they showed physiological symptoms of anticipating the

shock whenever such a shock-causing stimulus was presented—even when the exposure time of a presented stimulus was too short for conscious recognition (see e.g. [25]).

- The subjects clearly avoided actions that caused the shock, but on questioning it appeared that they were not aware of doing it (e.g. [39]).

This group of examples can be considered particularly important, because Polanyi remarks that these experiments show “the principal mechanism by which knowledge is tacitly acquired” [21, p. 7].

Unconscious perception and implicit perception are other important mental phenomena related to subliminal perception. In fact, they are sometimes treated as synonyms for subliminal perception (e.g. [41]). Yet implicit or unconscious perception refers rather to a situation where a stimulus does not enter to conscious awareness because attention is directed to somewhere else (for example, attention may be directed to reading a text while certain events in the environment are processed unconsciously). Polanyi would probably call this kind of environmental information marginal tacit knowledge. Subliminal perception, however, refers to a situation in which the stimulus is presented too briefly for conscious perception, even if subject attends to it. In this sense subliminal perception is a narrower phenomenon than unconscious or implicit perception. Yet the fundamental principle concerning also unconscious and implicit perception is the same: the brain is capable of detecting and assessing stimuli below the level of conscious detection. Support for this claim has come from various authors (e.g. [42], [43]).

To be precise, subliminal perception as such does not seem to differ much from the basic perceptual process discussed in the previous section. Subliminal perception includes the early stages of perception but lacks proper recognition of the processed stimuli. However, this is not the most important aspect of the phenomenon that Polanyi describes. Instead, he addresses the fact that even without a correct, conscious recognition the stimulus gets registered and assessed by the nervous system. Polanyi [21] explains that even though the subjects did not recognize, for example, the distinction between shock-causing syllables and neutral syllables, they became aware of facing a shock syllable *based on the apprehension it evoked in them*. The unrecognized sight of a shock-causing stimulus made the subjects somehow aware of its presence.

The experiments that Polanyi refers seem to be essentially about classical conditioning; a neutral stimulus is presented along with a stimulus of some significance. The neutral stimulus is neutral in a sense that it does not produce a clear behavioral response in the subjects. Instead, the significant stimulus elicits automatically a reflexive response (such as mild sweating or changes in heart rate). After sufficient amount of repetitions of pairing the stimuli the neutral stimulus (even when presented alone) begins to elicit physiological responses equivalent with the responses caused

by the significant stimulus. This passive learning process thus culminates in the formation of association between the neutral and the significant stimulus.

In these experiments the case was to associate an *unpleasant* stimulus with a neutral one; the subjects confronted unpleasant consequences of certain stimuli. From the evolutionary perspective something unpleasant refers to something potentially dangerous. This kind of conditioning is also known as *fear-conditioning*. According to Phelps [44], a typical fear-conditioning paradigm in humans involves presenting a neutral stimulus and pairing it with an aversive stimulus. An aversive stimulus automatically elicits physiological responses related to stress or fear, for example arousal in autonomic nervous system [45].

Although Polanyi's examples of subliminal perception are mostly related to the fear-conditioning paradigm it can be assumed that tacit knowing can be generalized to refer nervous system's ability to form associations to significant objects/events and manifest this knowledge via emotional system. In these particular examples bodily responses are emphasized as warning signals (predictions of *negative* consequences of certain stimuli), but Polanyi [21] wrote also about signals and cues that guide humans into right direction or “towards success” (predictions of *positive* consequences).

The emotional system provides predictive information what is advantageous and what is disadvantageous to the organism based on its previous experiences. As Damasio [45, p. 55] puts it, “Emotions are inseparable from the idea of reward or punishment, of pleasure or pain, of approach or withdrawal, of personal advantage or disadvantage.” It is important to take into consideration that subliminal perception is only a peculiar instance of the functioning of the emotional system; emotional responses occur also during conscious perceptions. Subliminal perception, however, shows that no conscious representation of the association is needed in order to execute adequate emotional responses.

Following Damasio's [45] definition, emotions are complicated collections of chemical and neural responses that have some regulatory function that aims to creation of advantageous circumstances from the organism's perspective (e.g. fear prepares to retreat or escape). The most important function of emotions is therefore to produce a specific response in certain situations. Therefore emotional responses cause profound changes in the body and in the brain. The collection of these changes is a basis for neural patterns that eventually may become conscious feelings of emotions [45].

As organisms develop and interact they gain factual and emotional experiences with different objects and situations associating originally emotionally neutral things with naturally defined emotions [45]. However, Damasio stresses that virtually every perceived or recalled representation is accompanied by emotional response.

According to Ledoux [31], a neural association between two stimuli is possible only if there is a neural structure that receives information about both of the stimuli. In addition, there has to be a mechanism by which the association is

possible in the point of convergence. Findings of cognitive neuroscience have shown that certain brain areas are particularly important for emotional responses. Moreover, brain-imaging studies indicate activation of the amygdala (subcortical brain structure in both temporal lobes) during fear conditioning and later in response to the conditioned stimulus (e.g. [44], [46]) suggesting that amygdala has an important role in emotional processing. It monitors sensory inputs and triggers emotional responses related to fear and defense in the case of an aversive input.

Patients suffering from damage in amygdala fail to show normal physiological responses that healthy subjects show in fear conditioning experiments [44]. These subjects, however, may have a good cognitive understanding of the situation. Therefore they understand (in a rational sense) the relation between the neutral stimulus and the aversive event. However, the amygdala responds to significant stimulus automatically prior to cognitive awareness [47], [48]. Pure rational calculations without emotional information about the past experiences would most certainly make humans very ineffective. Moreover, Anderson and Phelps' [49] study suggests the amygdala can modulate sensory input and attention by increasing its activation in the presence of significant information, which ensures that emotional, thus important, stimuli get requisite amount of attention.

The significance of emotions does not restrict only to extreme behaviors such as escape or attack. Damasio [50] has addressed the significance of emotional information to human decision-making; our everyday decisions require predictions what will be advantageous or disadvantageous to us in different time spans. According to Damasio's *somatic marker hypothesis* experienced life events are marked in the brain by emotional system; the somatic consequences (changes in the body state) of every event are stored in order to be able to reproduce a copy of a corresponding somatic state next time when the organism is approaching the same (or same kind of) event. Thus, a reproduction of a somatic state can be seen as an emotional information based on previous learned experiences that has a potential to affect cognitive processing by favoring or suppressing somatically marked alternatives in cognitive processing without time-consuming, rational calculations (for example in complex decision-making). Support for Damasio's theory has come from various authors (e.g. [51], [52]).

Still, it is obvious that emotions cannot substitute reason. Damasio [50] stresses that emotions assist reasoning by pointing it where it should operate based on previous experiences; a relatively dynamic, overlapping use of these systems is probably the reason what makes humans cognitively very capable compared to other animals.

To be precise, emotion per se cannot be considered as tacit knowledge but rather as a manifestation of tacit knowledge. The source of the emotion in Polanyi's examples is related to the fact that two events have occurred sufficiently in parallel in the past. Tacit knowledge itself seems to be related to associations between objects/situations and

advantageous/disadvantageous outcomes formed in interactions with them.

In sum, associative learning is an important mechanism to acquire knowledge about the world. It is a mechanism that predicts good/bad consequences or events that are likely to happen. Although Polanyi did not present extensive considerations about emotions in his theory, it seems that he was aware of the importance of automatic bodily mechanisms for human cognition. The most essential feature of associative learning mechanism in this context is that one does not have to be aware of important associations in order to be able to form them [53]. That is probably why such knowledge remains tacit.

V. TACIT KNOWLEDGE IN SKILL LEARNING

The third group of Polanyi's examples concerns motor skill learning. Polanyi used, among others, examples of riding a bicycle [2], playing a piano [21] and using tools [23] in order to describe how skillful actions are performed by relying on the coordination of muscular acts; one is aware of them only in terms of the performance but not aware of them in themselves. As Polanyi [26, p. 3] explains, "when we perform a skill, we attend focally to its outcome, while being aware subsidiarily of the several moves we co-ordinate to this effect."

Skill learning means a gradual improvement of performance with practice that generalizes to a range of stimuli within a domain of processing [54]. In the field of psychology motor skills are related to implicit memory that is often contrasted with explicit memory. Graf and Schacter [55, p. 501] define the distinction between these two memory systems in a following way: "Explicit memory is revealed when performance on a task requires conscious recollection of previous experiences ... Implicit memory is revealed when performance on a task is facilitated in the absence of conscious recollection."

The strongest evidence to justify this distinction is the consistent finding that most amnesic patients have no difficulty is motor skill learning and performance although they generally perform poorly in explicit memory tasks. Explicit memory is generally considered to contain fact-based semantic memories and episodic memories whereas implicit memory is defined to be nonintentional and unconscious type of memory [28].

One important difference between implicit and explicit memories-based knowledge is the way the received data is encoded and stored. Explicit memories depend on conceptually driven processing, in which the subject reorganizes the data in order to store it. Instead, encoding implicit information depends simply on receiving the sensory information without a need to manipulate it by "higher" (conscious) cognitive processes [28]. Thus, implicit learning refers to the process of acquisition of complex information typically in a non-conscious way, which leads to learning of this information without complete articulate knowledge of

what has been learned [56].

From the perspective of neuroscience motor skill learning seems to be an integrative product of various neural mechanisms, each contributing to a different aspect of learning [57]. Several lines of evidence, such as functional imaging studies, suggest that the motor cortex, the basal ganglia and the cerebellum are particularly important brain regions for motor skill learning. According to the contemporary view on motor skills, motor cortex is organized for the control of movements that require the coordinated action of many muscles in different combinations [28]. This view suggests that humans have a repertoire of movement categories in the motor cortex [59].

One important idea emerging in the field of motor skill learning research is that basal ganglia teaches the cortex through a certain type of trial-and-error learning [58], [60]. This means that messages from the motor cortex are optimized in terms of their reward value and accuracy, and repetition of the successful behavior leads to the reinforcement of corresponding motor patterns [58].

Feedback is thus a necessary element for any motor skill learning to occur through reinforcement of a motor pattern. In this context so called intrinsic feedback has an essential role; it refers to sensory information received by the actor as a direct result of producing a movement [61]. Intrinsic information can come from the sources outside the body (e.g. visual feedback) or sources inside the body (from muscles, joints or the sense of balance). Intrinsic feedback is important for attempts at replicating successful responses because when a desired result is achieved the actor attempts to repeat it [61]. The resulting motor pattern is then constantly updated in the following performances [53]. Due to the skill learning mechanism outlined above it seems that humans do not have conscious rules of how to do something, but rather what they are trying to do.

Behavioral, brain imaging and cognitive neuropsychological studies provide evidence that motor skill learning is a complex and staged process. However, in the present context it is essential to understand that there cannot be any type of learning without some kind of structure where experiences can be stored and recollected. Practice results in a gradually evolving and specific representation of the trained sequence of movements in human motor system. More specifically, practice results in functional and structural neural plasticity that leads to the construction of new motor maps in the brain [62]. Behaviorally this can be seen as an elimination of extraneous movements and effective coordination of muscles to act as a single functional unit [62]. As opposed to declarative forms of memory, these changes are known to evolve slowly, requiring many repetitions over several training sessions.

Generally speaking, and specifically from the evolutionary perspective, motor skill learning leads to automatic behaviors. Wheatley and Wegner [63] define automaticity as actions that occur efficiently and without the need of conscious guidance. A certain skill becomes more automatic through repetition,

and finally it requires hardly any conscious monitoring; if all actions required conscious thought, there would not be time to anything else than planning the next step [63].

The epistemic value of this kind of know-how has not been questioned in the KM literature. It seems to be a very common way generally in the literature concerning knowledge to divide knowing to two categories, *knowing that* and *knowing how*, following Ryle's [64] distinction. Also, in the field of psychology procedural knowledge is presented alongside with declarative knowledge. Indeed, the fact that someone can act skillfully seems to necessitate some kind of knowledge despite the subject's inability to explain or even articulate that skill.

But how can it be justified that skills have real epistemic content? A skill means that there is a plan how to handle a certain situation, and when the decision to use the skill is made behavior is automatically channeled into that plan [65]. Repetition of certain act develops the behavior because actions that lead to good or at least satisfactory results get reinforced. In a biological level the reinforcement can be understood as neural changes that lead to development of new motor maps.

The resulting skill embodies knowledge because its components are stored to neural structures based on the observation of their positive outcome. It is knowledge about the adequacy of a certain motor response to a certain stimulus or a situation. Thus, the knowledge that is embodied in certain skill seems to be a link between a certain situation (or stimulus), a motor response (or a sequence of motor responses) and a satisfactory outcome. Again, in the present context the most important question is, why that knowledge remains tacit.

Psychological evidence suggests that implicit learning is not dependent on higher cognitive processes. There is no need to process the procedure being learned consciously. Moreover, motor skill learning does not presuppose any use of language, which differentiates it from learning of many forms of declarative knowledge. As the evolutionary motivation of motor skills is to know how to act in a certain situation when confronting it, that knowledge need not be represented in a propositional form. From the perspective of performing a skill it is absolutely irrelevant whether the actor is able to verbalize that skill.

VI. THE EPISTEMIC STATUS OF TACIT KNOWLEDGE

According to the analysis of the first two groups of examples the focus of Polanyi's epistemology is essentially on the process of formation of the contents of focal awareness. They explain the basic principles of the creation of perceptual knowledge of the environment (Group one) and the following possible intuitive knowledge that leads to approach and retreat behaviors (Group two). Following from this, it seems that tacit knowledge and the processes related to it in the first two groups of examples are essentially about the *formation of focal belief*. Interestingly, the traditional analysis of knowledge only starts from the belief and is primarily

concerned with questions related to the truthfulness and justification of the beliefs. Polanyi's theory of knowledge precedes the traditional approach in this sense; the most fundamental part of Polanyi's epistemology concerns tacit knowing situated in subsidiary awareness, which describes first and foremost *how* humans arrive at their conscious beliefs or representations.

Obviously the evolutionary function of these processes is not to create focal beliefs but has been motivated purely by adaptation and survival. Moreover, perceptual, emotional and automated motor processes are functions that are not typical only to humans, but also appear widely in other species. All mammalian sensory systems follow the same basic principles on their anatomy, function and chemistry [66]. Also, different forms of associative learning appear and have been studied in many animals. Thus, the evolutionary roots of these processes go much further back in time compared to higher processes of consciousness, such as the use natural language typical only to humans.

Human intelligent behavior should be thus viewed as being organized in a hierarchical way out of older neural modules, each of which had evolved programs for particular functions [67]. Therefore also from this perspective unconscious mental processes can be considered as the epistemic foundations on which emerging explicit operations are based. However, probably due to the introspective obviousness of conscious knowledge it has been traditionally given the epistemic priority compared to the tacit processes [68].

From these perspectives it is rather uncomplicated to accept one of the strongest of Polanyi's claims: explicit knowing is based on tacit knowing and thus cannot be fully justified by analytical argumentation. In this sense Polanyi's theory of knowledge refers to a form of naturalized epistemology, according to which epistemic status of a belief state depends on psychological processes that generate and sustain it [70]. According to this view natural cognitive and physiological processes involved in the process of knowing cannot be bypassed in an analysis of knowledge. However, Polanyi's epistemology represents a quite light form of naturalism because, as most of the philosophical theories of knowledge, naturalist theories tend to deal with the question of justification by describing processes that are generally reliable in generating epistemically virtuous mental states (see e.g. [71]). However, Polanyi was not particularly interested in the norms that justify human knowledge. Instead, he stressed in general the importance of confidence in human cognitive capacities in understanding reality.

Polanyi's argument of the fundamental position of tacit knowledge in all knowing is supported from the cognitive perspective. This means that the tacit/explicit typology of knowledge presented in many writings of KM literature is not only artificial, but also totally opposite approach compared to Polanyi's thinking. Polanyi's main point was that no cognitive judgment can ever be made wholly explicit—he did not say that there generally exist two types of knowledge.

Moreover, in the KM literature it has been suggested that it

is important to identify the subtypes of tacit knowledge in order to be able to better articulate or explicate tacit knowledge (see e.g. [72], [73]). Some of these subtypes are claimed to be for example intuitions, beliefs and mental models. However, in Polanyi's terms, what humans are able to describe verbally is the contents of focal awareness. From this perspective it seems problematic to claim that for example intuition is a subtype of tacit knowledge. Intuition is usually defined to be some kind of direct knowing without a formal argument (e.g. [72]). Indeed, tacit knowledge would be the argument, but it cannot be reached. What can be reached instead is the focal impression (that is, the intuitive feeling) that is only the conscious product or a reflection of tacit knowledge and tacit processes. Thus, although intuition is a manifestation of tacit cognitive powers, tacit knowledge itself remains unarticulated. In this sense intuitions, beliefs or mental models are not subtypes of tacit knowledge. If they were, even more fundamental form of knowledge than tacit knowledge would be logically necessary to explain how these "subtypes" are formed.

VII. CONCLUSIONS

Cognitive mechanisms that make tacit knowledge tacit are based on a learning that is not dependent on subject's cognitive awareness of what is being learned, but essentially about automatic reinforcement/weakening of certain behaviors based on the received feedback. Thus, these processes are inductive and predictive by their nature.

From the cognitive perspective the structure of knowing that Polanyi presented seems justified; if explicit knowledge is considered to be justified belief, and tacit knowing refers to the process of forming that belief, in this sense tacit knowledge indeed precedes explicit knowledge as Polanyi claimed. The priority of tacit knowledge can be justified also in the sense that cognitive processes related to tacit knowing are evolutionally more fundamental than processes of 'explicit knowing' that are related to the use of language.

According to the traditional analysis of knowledge, tacit knowledge does not fulfill the requirements of knowledge; tacit knowledge is not necessarily justifiable (because the knowing subject might be focally ignorant of it) or true (because it is inductive by its nature). Tacit knowledge does not even include anything comparable to a conscious belief but is rather related to the unconscious belief-forming processes and to learned automatic responses to certain type of stimuli.

However, although tacit knowledge is inductive and predictive by its nature, it still embodies epistemic content. Tacit knowledge has its personal justification based on experiences that have produced neural changes that affect behavior in a purposeful way. It is essentially bodily knowledge as Polanyi proposed.

Although the vast majority of authors in the field of KM refer to Polanyi agreeing that the concept of tacit knowledge comes originally from his epistemology, very few of them

seem to base their understanding of the concept on Polanyi's philosophy. In the KM literature tacit knowledge is often related to context specific knowhow or expertise. It is important to bear in mind that Polanyi's analysis concerns *all the levels of cognition*. Therefore the structure of two kinds of awareness enters into all conscious acts from perception to complex problem solving.

Although the "lower level" tacit processes discussed here are probably not the primary interest in the KM field, the aim has been to promote better understanding of the concept of tacit knowledge. If we want to understand what tacit knowing is about it is essential to begin the endeavor from the very roots of the phenomenon.

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The Problem of Tacit Knowledge – Is It Possible to Externalize Tacit Knowledge?

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Abstract. Various authors in the field of knowledge management have adopted the view that individuals' tacit knowledge should be externalized and shared in organizations. According to Polanyi's original theory of tacit knowing, an explicit expression of tacit knowledge is, however, considered very difficult, even impossible. We studied this contradiction by analyzing Polanyi's theory of tacit knowing in order to consider the correctness of the idea of externalization of tacit knowledge. Despite the fact that tacit knowing is an essential basis for all knowledge, we claim that tacit knowledge cannot be externalized in a way it is presented in the knowledge management literature.

Keywords: tacit knowledge, explicit knowledge, focal awareness, subsidiary awareness

Introduction

Tacit knowledge has been a popular concept since early 90's in the area of knowledge management. The origin of the concept is traced back to Polanyi's philosophy of knowing [19]. The basis of Polanyi's theory is the observation that "we can know more than we can tell." [21, p. 4] Thus, tacit knowledge refers to an individual knowledge that is highly personal and hard, even impossible to express or share with others.

The main motivation for the popularity of the concept in knowledge management discussion is the widely supported claim that organizations can achieve competitive advantages by using effectively their unique knowledge [e.g. 6, 23]. According to many authors, tacit knowledge is an important source of unique knowledge [e.g. 1, 2, 9]. These theories suggest in many cases that individuals' tacit knowledge should be externalized and shared with other members of the organization. According to Nonaka and Takeuchi [14, p. 64], externalization is a process of articulating tacit knowledge into explicit concepts. This kind of process aims to creation of new knowledge that may lead to innovations and more efficient internal functions of the organization.

Polanyi's theory illustrates that knowledge possessed by humans is more complex phenomenon than often considered. This is a fundamental, yet sometimes ignored, basis also in information system science; as Kangassalo [8] remarks, although the idea that

shared knowledge in information systems forms a globally understood phenomenon sounds good, it contains various difficulties in practice. One of those problems discussed here is that information systems do not guarantee objective understanding of knowledge, because language cannot fully translate persons' inner representations of it. This question is naturally even more challenging in multilingual environments. Moreover, according to Hori and Ohsuga [7], we cannot do anything with computers unless some structures of the real world are mapped onto a representation in the computer. They suggest that it cannot be assumed that some structure of the real world can be captured rationally and unambiguously. They call this problem of knowledge representation *an articulation problem*. They see it as a "core-problem" of information modelling. According to Tuomi [25, p. 113], there has been generally too little emphasis on the sense-making aspects of information systems. Sense-making refers to creation of situational awareness and understanding of complex phenomena. Klein *et al.* [10, p. 71] characterize sense-making as "a motivated, continuous effort to understand connections (which can be among people, places, and events) in order to anticipate their trajectories and act effectively." For example, in conceptual modelling it is important to understand how tacit knowledge affects the way humans explain and structure concepts and relations between them – no modeller can rely only on the formal knowledge of the target. These questions should be faced before planning of a system. This is why tacit knowledge and personal understanding can be considered as an increasingly important question also in information system science.

According to Polanyi's original definition of tacit knowledge it cannot be expressed explicitly. This contradiction becomes obvious despite the fact that knowledge management theories are claimed to be built on Polanyi's thinking. The question is important in current knowledge management discussion; if externalization of tacit knowledge is considered impossible, the application of the concept in certain contemporary theories can be seen very questionable, even wrong. On the other hand, it may also be possible that the mentioned theories are practical extensions of Polanyi's theory, meaning that they do not contradict with Polanyi's thinking. The difference between these options is significant.

We argue that an essential problem is that the concept lacks a commonly agreed definition; too little attention has been addressed to the question, *what tacit knowledge really is?* The question is often bypassed by remarking that tacit knowledge is the kind of knowledge that is hard to articulate – this obviously can mean many things. Based on Polanyi's original theory of tacit knowing, we claim that the idea of externalization of tacit knowledge indeed seems too simplified in certain respects. It should be, however, taken into consideration that we do not question the idea of knowledge creation and its methods, but restrict our analysis to the use of the concept of tacit knowledge.

We first introduce Polanyi's theory by presenting its epistemological motivation and then concentrating on the part concerning tacit knowing. Based on Polanyi's theory we then reconsider how accurately Polanyi's thinking is taken into consideration in the contemporary knowledge management literature.

1. Related Work

The question about the exploitation of tacit knowledge arose in the mid 90's. The most important impulse to contribute to the generalization of such a view was given by the theory of organizational knowledge creation by Nonaka and Takeuchi in 1995 [14]. They presented a so-called SECI-model that explains a creation of new knowledge by means of conversions between tacit and explicit knowledge. The most essential part of the theory is an operation where tacit knowledge is converted to explicit knowledge. Nonaka and Takeuchi call this operation *externalization*. They point out that tacit knowledge is hard to articulate and must therefore be externalized indirectly by an illustrative use of language: for example by using metaphors, analogies and stories person's tacit knowledge can be shared and taken advantage of by other persons. According to Tsoukas [24], ever since the publication of Nonaka and Takeuchi's theory it has been nearly impossible to find a publication on knowledge management that does not make a reference to or use the term "tacit knowledge". Many authors have adopted Nonaka and Takeuchi's view supporting the idea of exploitation of tacit knowledge [e.g. 1, 2, 9]. It seems reasonable to state that their theory has influenced significantly ways of thinking in knowledge management.

Some authors, however, criticize Nonaka and Takeuchi's view. Cook and Brown [4] claim that explicit and tacit knowledge are different forms of knowledge, and conversion from one form to another is impossible; neither of the forms can substitute the other nor be its variant.

According to Orlikowski [15], tacit knowing is an inseparable part of action because it has developed in action. Consequently, tacit knowledge is bound to practice and maintains that form. Thus, it cannot be shared.

Tsoukas [24] argues that Nonaka and Takeuchi's view is erroneous because they have ignored the ineffability of tacit knowledge. He claims that tacit knowing cannot be captured or translated but is only manifested in what humans do. People can learn from others through social interaction, but it does not mean that something tacit becomes explicit.

Tsoukas and Orlikowski seem to stress knowing in practice instead of knowledge itself. According to that view, tacit knowledge cannot be transferred due to the inseparability between knowledge and action. Nonaka and Takeuchi seem to treat knowledge as something more objective, because they see externalization and transfer of tacit knowledge possible. The difference between these views is important. It raises a need to clarify what Polanyi's epistemological basis is for the concept of tacit knowledge.

2. Polanyi's Theory of Knowing

Polanyi's cognitive theory developed during over three decades in various writings. He believed that modern epistemological theories had described human knowledge far too narrowly since the birth of western philosophy, because an absolute objectivity was emphasized as an attainable ideal for knowledge; knowledge was seen as something detachable and independent of knower. According to Mitchell [13], for Polanyi 'objectivism' was shorthand for a collection of epistemological theories rooted in

Descartes' and Locke's thinking. In Descartes' [5] thinking human was able to produce wholly objective knowledge of surrounding world. Descartes further assumed that anything not recognized by human reason could not be acknowledged as knowledge; knowledge had to be something distinctive and verified. Also, in the tradition of empirism a pursuit of common and objective laws that described phenomena of the reality was seen ideal (for example Locke [12]). This view refers to positivist philosophy in a sense that knowledge is seen as an entity that can exist independent on the knower, for example in a written form.

Polanyi saw theories basing on objectivistic traditions wrong, even destructive, for personal participation was included in every act of knowing in his thinking; even scientific discoveries were often made based on unexplained informed guesses, intuitions and imaginative ideas that reflected some kind of *hidden knowledge*.

Polanyi [21] claims that objectivistic theories had ignored this *tacit dimension* of knowledge. The tacit dimension means briefly that every piece of knowledge has knower-dependent, tacit elements, on which the explicit dimension of the knowledge is built. Personal meaning and understanding of knowledge are based on this process; mind does not reflect reality in a passive way, but actively tries to build up the understanding of it.

In Polanyi's thinking there has to be a knowing subject for the existence of any knowledge. The idea refers to constructivistic idea that human cognitive processes are dependent on the knower's existing impressions and experiences of the world. This makes also the result of the process (the definitive understanding for the individual) subjective. As Polanyi explains, words and concepts themselves do not mean anything, for their meaning is in the personal understanding of every human being [19]. If we read a short message written on a paper, we probably remember the meaning of the message after a while but we might not remember the exact words that were written. We are generally not interested in the words themselves, but the meaning the words bear.

According to Polanyi's theory described so far, the nature of knowledge seems very subjectivist. However, Polanyi does not deny the existence of objective reality. Instead, he stresses that knowledge always has an objective side as well [19]. First, the linguistic character of thinking means that all human thinking comes into existence by mastering the use of language of certain society. According to Polanyi [20], this means that all thinking is rooted in society. Second, people are born in a certain culture. They grow up in some cultural environment and education typical to that community. This inevitably affects the way people see the world. Third, knowing something can be seen as a responsible act that seeks universal validity. Our knowledge often concerns the world around us, which means that we do not accept something to be knowledge unless we think that the knowledge corresponds to the state of matters in reality that is accessible to all. However, in Polanyi's thinking definite truth about reality is improbable because reality manifests an infinite amount of different possibilities to humans.

It may be possible that Polanyi overestimates the importance of language in human thinking. According to contemporary psychology, linguistic statements, and prepositional thinking in general, represent only one form of thinking. For example Paivio [16] has proposed that there is a nonverbal imagery system of thought alongside of linguistic processes. That does not, however, contradict with Polanyi's idea that human thinking is influenced by culture and tradition.

2.1 Two stages of awareness

The major feature of Polanyi's theory is a distinction between two stages of awareness in an act of knowing. *Focal awareness* concerns the conscious object of the directed attention. *Subsidiary awareness* provides the background within which the focal awareness operates. An essential idea of the theory is that while attending to focal awareness a person *dwells in* subsidiary awareness that contains subsidiary components of the meaning of the focal target. Subsidiary knowledge is closely related to how the object of the focal awareness should be acted with.

Polanyi [19] describes the interaction between the two stages by an example of a pianist. While playing piano the pianist's focal awareness is attended to playing piano taken as a whole. The pianist knows subsidiarily, for example, how to move the fingers or how to read the notes while playing. The content of subsidiary awareness makes meaningful action with the target of focal awareness possible.

In an act of knowing the stages of awareness are interacting: the target of knowing is attended focally, which "activates" subsidiary knowledge related to the target. The target is then known based on tacit particulars, which enriches the meaning with personal understanding. Polanyi argues [19] that this kind of integration of focal and subsidiary awareness occurs in every act of knowing for it is necessary to the understanding of focal target. It is essential to recognize that the focal target gives rise to subsidiary knowledge in a sense that only the target may characterize subsidiary knowledge applied to it. Thus, the content of subsidiary awareness can only be tacitly applied by attending to the focal target. Practically this means that *subsidiary knowledge is not available for the knowing subject without a focal target*. This argument means that to be able to benefit from tacit knowledge a person has to have a context where tacit knowing is applied. The structure of tacit knowing is described in figure 1.

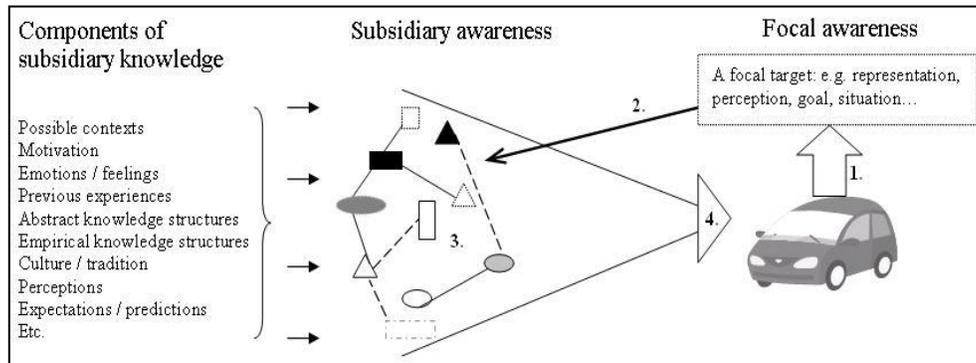


Figure 1. The process of tacit knowing: the target of knowing is attended focally (1), which enables the use of tacit particulars related to the target – the knower dwells in subsidiary awareness (2). Tacit particulars are integrated into a meaningful whole (3). A new meaning emerges as the target is attended from the subsidiary knowledge (4).

The two states of awareness are *mutually exclusive* [19]. This means that attention can be directed to only one of them at a time. If we try to direct our attention from focal awareness to subsidiary awareness, we interrupt the act of knowing; if the pianist shifts his attention from the playing to the movements of his fingers, he gets confused and he may have to stop. In addition, there should not be anything to attend to in subsidiary awareness anyway, because the meaning of subsidiary particulars is lost as a result of attending away from the focal target.

What then exactly is subsidiary knowledge? People gradually gain understanding of the reality as a result of personal experiences, conceptions and feelings. These kinds of components clearly constitute an essential part of subsidiary knowledge. Basically any kind of possessed knowledge may function as subsidiary, even knowledge that is focal in some other context. According to Polanyi [19], a mental effort has a heuristic effect in a sense that it tends to incorporate any available elements of the situation that are helpful for its purpose. This structure of knowing explains in a clear way the human ability to pack various features in an act of knowing and experience them simultaneously, which finally builds up the meaning.

We now present two examples (originally given by Polanyi) in order to illustrate how tacit knowing functions in practice according Polanyi's thinking.

Example 1: In a psychological experiment [11] subjects were presented tachistoscopically nonsense syllables. Half of the syllables had been associated with an electric shock. Subjects were unable to recognize the shock-causing syllables, but they showed symptoms of anticipating the shock (measured with galvanic skin response) at the sight of the shock-causing syllable. When subjects were asked to explain what made them expect the shock, they could not answer. Subjects learned to connect two terms, the shock and shock-causing syllables. They relied on their awareness of the shock syllables for attending to the shock, for the electric shock represented the meaning of the shock syllables. Thus, identification of shock syllables was impossible. The knowledge of them remained tacit. [21, pp. 7-8]

Example 2: All research must start from a problem that must be good and original. But how is it possible to see such a problem that no one else has seen before? If the problem is not seen before by anyone else, it seems to be either impossible to solve or meaningless, and cannot be good. However, as experience shows, scientific problems are found and solved. Thus, to be able to see a good problem, one has to see something hidden. One must have an inkling of a coherence of particulars of the problem. Indeed, the knower is guided by a deepening sense of coherence. This proves that we can know things that we cannot tell. [21, pp. 21-22]

2.2 Epistemological Significance of Tacit Knowing

The second example reveals the most striking argument of Polanyi's theory: if all the knowledge were totally explicit, there would not be a way to know problems or find their solutions. Thus, Polanyi denies the existence of totally explicit knowledge; all knowing is personal knowing requiring active and continued participation of the knower. He claims

that all the spoken words, all the formulae and all the maps are strictly meaningless if they are deprived of their tacit coefficients [17, p. 195]. The denial of strictly explicit knowledge leads to the culmination of Polanyi's epistemology: all knowledge is either tacit or based on tacit knowledge. This means that *completely* articulated knowledge cannot exist.

Although in Polanyi's thinking knowing can never be completely objective, he recognizes the objective nature of things to be known, for there is an external reality and it is knowable to all. Consequently, Polanyi's view does not represent subjectivism or radical constructivism, but refers to realism. Polanyi's realism challenges the traditional definition of knowledge, according to which knowledge is seen as *a justified, true belief*. The traditional view clearly emphasizes the objective ideal of knowledge.

In the next section we estimate to what extent Polanyi's ideas are present in the contemporary knowledge management literature concerning the externalization of tacit knowledge.

3. The Presence of the Original Meaning of Tacit Knowledge in Knowledge Management Theories

Nonaka and Takeuchi [14, pp. 11-12] describe a typical process of externalization with a following example (truncated):

In the late 70's top management of Honda (Japanese car manufacturer) realized that their car models were becoming too familiar. They started a project whose goal was to come up with a product concept fundamentally different from anything done before. The project team leader coined a slogan "automobile evolution" to express his sense of the project. The slogan posed a question: if automobile were an organism, how should it evolve? Based on this question, the team eventually developed an idea of a sphere: a car simultaneously short and tall. Such a car would be lighter, cheaper and more comfortable than traditional cars, they reasoned. The team called the product concept "tall-boy". The new concept provided the most room for the passenger and took up the least amount of space on the road. This process led to Honda City that was a revolutionary, urban car and a success product for Honda.

Nonaka and Takeuchi explain that this is a typical way that Japanese managers approach the process of making tacit knowledge explicit [14]. The use of figurative language and symbolism are important elements for the expression of inexpressible; the use of figurative language enables articulation of intuitions and insights, and further the distribution of tacit knowledge.

3.1 Relationship between Tacit and Explicit Knowledge

The idea of externalization of tacit knowledge is based on a classification of knowledge into tacit and explicit. This view seems problematic from the viewpoint of Polanyi's theory;

Polanyi does not present different types of knowledge, but knowledge that always either has tacit elements or is wholly tacit. Knower constructs his understanding, and it does not happen automatically. Thus, knowledge has *both* explicit *and* tacit elements. In any case, explicit knowledge does not exist independently; tacit knowledge is an indispensable precondition that enables “explicit knowing”.

As Nonaka and Takeuchi [14] recognize, tacit and explicit knowledge are not totally separate forms of knowledge. The classification is, however, present also in their theory up to a certain point, because it describes the conversion from one type to another. According to Polanyi’s theory, tacit knowledge converted to explicit knowledge would still have a tacit side. Yet for example Kikoski and Kikoski [9, p. 65] declare that “we need to recognize that there are two kinds of knowledge: the first kind is explicit and the second is tacit.” Similarly, for example Sivula’s *et al.* [22, p. 123] claim that “a common way of describing the characteristics of knowledge is to divide it into explicit and tacit knowledge as classified by Polanyi”, seems rather confusing. These kinds of arguments suggest that the concept of tacit knowledge has been quoted from Polanyi without knowing accurately the epistemological context it is brought from.

3.2 Unattainability of Subsidiary Knowledge

According to Polanyi’s thinking, the tacit dimension of knowledge is essentially related to subsidiary particulars and the way they are connected and then linked to the focal target. From this basis externalization of tacit knowledge does not seem possible: subsidiary particulars, of which the focally known part consists, cannot be known consciously as such because they only exist with the focus to which they are related. As Polanyi [19, p. xiii] states, “when we switch our attention to something of which we have hitherto been only subsidiarily aware, it loses its previous meaning.” This seems to mean that *tacit knowledge cannot be consciously known in itself*. Polanyi admits that an analysis may bring subsidiary knowledge into focus, but such specification would not be exhaustive. He [18, pp. 31] explains: “anything serving as a subsidiary ceases to do so when focal attention is directed on it. It turns into a different kind of thing, deprived of the meaning it had ... Thus subsidiaries are – in this important sense – essentially unspecifiable.”

3.3 Metaphors, Intuitions and Insights

An illustrative use of language is suggested an adequate method for externalization of tacit knowledge [e.g. 1, 14]. According to Nonaka and Takeuchi [14, p. 71], “appropriate metaphor or analogy helps team members to articulate hidden tacit knowledge that is otherwise hard to communicate.” But what kind of relationship exactly is there between a metaphor/analogy and the phenomenon it describes? It seems that a metaphor/analogy does not necessarily give an intensional definition, or even an intensional characterisation, of the phenomenon, but is predominately an example that merely represents the phenomenon in a certain way. Consequently, we might ask if externalization actually means giving *ostensive characterisation* based on that (tacit) knowledge. This would mean that no tacit knowledge is externalized but only some kind of a manifestation of it. According to Polanyi’s thinking,

if we express a metaphor or give an ostensive definition, we still leave a gap to be bridged by the person who we are communicating to; we can only hope that the other person *himself* discovers the part we have not been able to communicate [21, pp. 5-6]. Polanyi seems to refer to the fact that a metaphor given by someone must still be decoded by the others. Consequently, tacit knowledge that is pursued to be passed from a person to another by the use of analogies/metaphors is unavoidably left behind in Polanyi's thinking.

If we consider this idea by means of figure 1 presented earlier, we notice that an externalized concept appears and is placed in focal awareness. It is the result of the mental process that is enabled by and based on subsidiary knowledge. But why is the result exactly that? What kind of processes and personal understanding led to it? It seems that these questions are almost impossible to answer despite the fact that the result is a reflection of knower's subsidiary knowledge. Similarly, an intuition may reflect tacit knowing of the knower, but the source of the intuition remains unarticulated. The knower cannot explain the processes an insight was based on.

However, metaphors and analogies certainly facilitate communication of things that are hard to describe as proposed; they indeed seem to provide an advantageous method for building a common ground for sufficiently similar understanding, discussion about experiences and knowledge creation. Instead of doubting that, we question the idea of *conversion* of tacit knowledge into explicit through such a procedure.

4. Conclusions

Tacit knowledge is often defined as knowledge that is *difficult, but not impossible to articulate*. Many authors, applying Polanyi's theory, claim that individuals' tacit knowledge should be externalized and shared in organizations. We argue that this view of tacit knowledge is too simplified. However, our point is not to criticize the theory organizational knowledge creation [14] that represents significantly different way of thinking and has already proven to be a useful tool in practice. Instead, we see it important to address varying use of the concept of tacit knowledge that often is claimed to be based on Polanyi's theory without actually being that so much. Based on Polanyi's thinking presented in this paper, we claim that tacit knowledge cannot be externalized in a way presented in the knowledge management literature. We claim that one important reason for the questionable use of the concept is that it has been separated from its theoretical background and then applied in a different kind of epistemological context.

Whereas Nonaka and Takeuchi never claimed that *all* tacit knowledge could be externalized, many authors seem to have interpreted them quite broadly. As Kikoski and Kikoski [9, p. 67] put it, "One of the major tasks of Information Era organizations that seek to be successful is to create the conditions whereby everyone can verbalize their tacit knowledge." In contrast, Polanyi seem to stress that human thinking, learning or generally any cognitive function cannot be resolved into logical or systematic collection of rules or assumptions - there probably is not any recognizable logic how tacit knowledge builds up.

Our understanding of the functions of human mind has increased enormously since Polanyi's days, thanks to the recent advancement in the area of neuroscience and cognitive

science. We suggest that tacit knowing needs to be approached from the perspective of cognitive science in order to understand its role in human behaviour better.

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¹ Erratum (sixth page, fourth paragraph): Reference to Nonaka and Konno (1996) should be Nonaka and Konno (1998).

Epistemological Problems Concerning Explication of Tacit Knowledge

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Abstract. Many authors in the contemporary knowledge management literature have highlighted *explication of tacit knowledge* as one of the most important functions of modern organizations. However, the theories stressing the importance of explication of tacit knowledge have to adopt assumptions from both Polanyi's theory of knowledge and objectivist theory of knowledge, in which case the resulting epistemological view often remains puzzling. We analyzed the epistemological foundations of the idea of explication of tacit knowledge. We argue that the idea of explication of tacit knowledge is based on a combination of two different epistemological views that are shown to be mutually incompatible in certain significant aspects.

Keywords: Epistemology, explication, explicit knowledge, objectivism, Polanyi, tacit knowledge

Introduction

Tacit knowledge has been one of the most discussed concepts in area of knowledge management (KM) during the recent years. Tacit knowledge is usually defined as "knowledge difficult to articulate" (Nonaka and Takeuchi 1995; Baumard 1999), and is therefore often used to refer to practical knowledge, such as expertise, know-how and professional intuition that are rooted to personal experiences. It has been also contrasted with codified, objective knowledge that is easy to share in words and numbers (Busch 2008).

The main motivation for the popularity of the concept in the area of management studies is the widely supported claim that organizations can achieve competitive advantages by using effectively their unique knowledge (Spender 1996). According to many authors, individuals' tacit knowledge is particularly important source of unique and sustainable knowledge in the organizational context (e.g. Argote and Ingram 2000; Kikoski and Kikoski 2004). Various authors have remarked that individual's tacit knowledge might be of little advantage for the organization if it is not shared among other members of the organization (e.g. Nonaka and Takeuchi 1995; Kikoski and Kikoski 2004). That is why *explication of tacit knowledge* has been particularly discussed topic in the contemporary KM literature.

The concept of tacit knowledge is adopted from Polanyi's theory of knowledge. Polanyi, however, did not present a condensed definition of the concept, which partly has led to varying interpretations of his theory. Accordingly, while some authors (e.g. Kikoski and Kikoski 2006; Sternberg 1999) stress the importance of making tacit knowledge explicit to be further shared, others (e.g. Tsoukas 2003; Hislop 2005) argue that explication of tacit knowledge is not possible. These two different views are said to represent two different epistemological schools, *objectivist epistemology* and *practice-based epistemology* respectively (Hislop 2005). Thus, the possibility of explication of tacit knowledge is a significant and widely discussed issue in the contemporary KM literature.

The core of this problem goes back to the question concerning the nature of tacit knowledge; what is tacit knowledge, and what kind of epistemology the concept presupposes in its *original* sense? These questions are the key to better assess the possibility of explication of tacit knowledge independently of scholarly emphases. Although epistemic problems are not the most central matter of management studies, these questions cannot be completely bypassed if theories concern knowledge conversions or creation of new knowledge. However, this seems to be often the case in KM literature dealing with the concept.

We claim that the explanation of the nature of tacit knowledge must be based on Polanyi's epistemology for three reasons.

1. There is generally no disagreement over the origin of the concept. This is a widely recognized fact that most of the KM theorists also mention.

2. Polanyi spent a great deal of his career studying this phenomenon and developing his epistemology. Therefore, as far as is known, he is the scientist who has studied the phenomenon most thoroughly.
3. According to our understanding, not only the expression providing the definition of the concept but the entire theoretical context signifies the concept to be defined (Bunge 1967). Hence, the meaning of a concept in a certain theory is dependent on the theory itself (Tuomela 1973). Therefore, separating the concept of tacit knowledge from the rest of Polanyi's theoretical framework includes the risk of unintentional conceptual change if the original theory is not taken into account.

The theories that stress the importance of making tacit knowledge explicit differ in an epistemological sense from Polanyi's theory because Polanyi did not make ontological distinction between tacit and explicit knowledge equivalent to the distinction often presented in KM literature (usually claimed to be adopted from Polanyi). Thus, we address the question, *what kind of epistemological theory is required for a procedure of explication of tacit knowledge*. The theories stressing the importance of making tacit knowledge explicit generally seem to lack this kind of theoretical considerations.

We claim that the epistemology that enables the explication of tacit knowledge presumes a combination of two different kinds of epistemologies that are, however, shown in this work to be mutually incompatible. In this sense the idea of explication of tacit knowledge seems to lack theoretical plausibility. Also, the introduction of the concept of tacit knowledge to a different kind of epistemological environment seem to have led to distortion of the original meaning of the concept.

Related work

According to Cook and Brown (1999), the traditional understanding of the nature of knowledge is widely adopted in the literature concerning organizational knowledge. They call this view an *epistemology of possession* due to its way to treat knowledge as an entity that people can possess; it highlights objectivity of knowledge and therefore privileges explicit knowledge over tacit knowledge. However, Cook and Brown remark that there is more epistemic work being done in something that humans can do than can be accounted in terms of knowledge that humans possess; knowing is doing. Cook and Brown call this view an *epistemology of practice*. It stresses that knowledge is essentially about human activity, and furthermore, knowledge is embodied in people. Cook and Brown's thinking seems to refer also to subjective aspects of knowing. Therefore, this view raises new issues from the perspective of knowledge sharing compared to the epistemology of possession.

Hislop (2005) makes practically the same distinction between two schools based on different kinds of epistemological assumptions; *objectivist* perspective of knowledge assumes that knowledge is an objective entity possible to be codified into explicit facts by cognitive processes in the human brain. On the contrary, *practice-based* perspective stresses that knowledge is embedded in practice. This means that knowledge is not seen as an objective entity that can be separated from people. Instead, development of knowledge is seen as an ongoing process that involves the whole body; it is impossible to disembodify that kind of knowledge from people into objective form. In table 1 are presented the epistemological core assumptions of these schools according to Hislop (2005).

Table 1 Differences between objectivist and practice-based epistemologies according to Hislop (2005). The features of both epistemologies correspond also to Cook and Brown's (1999) division of epistemologies.

Objectivist epistemology	Practice-based epistemology
Knowledge derived from an intellectual process	Knowledge is embodied in practice Knowing/doing inseparable
Knowledge is disembodied entity/object	Knowledge is embodied in people Knowledge is socially constructed
Knowledge is objective facts	Knowledge is culturally embedded Knowledge is contestable Knowledge is socially constructed
Explicit knowledge (objective) privileged over tacit knowledge	Tacit and explicit are inseparable and mutually constituted
Distinct knowledge categories	Knowledge is multidimensional

From the objectivist perspective sharing of explicit knowledge is a trivial procedure because explicit knowledge is considered to be objective. Also sharing of tacit knowledge is seen possible when enriched with the presupposition that tacit knowledge can be converted to explicit. Instead, practice-based epistemologies do not generally support the conception of explication of tacit knowledge. Given that our interest is focused in the idea of explication of tacit knowledge, in Hislop's terms our analysis concentrates particularly on the so-called objectivist view.

Despite that the KM field is closely related to the philosophical questions concerning the nature of knowledge, it is obvious that its main interests are not in analysis of the definition of knowledge but in more practical questions such as utility and value of knowledge, and knowledge sharing. Thus, theory of knowledge in this context seems to stress the *form* in which knowledge may appear. This perspective is understandable as the main concern is *management* of knowledge.

On the other hand, in the area of philosophical epistemology, *validity and origins* of knowledge have been the most fundamental problems since the times of philosophy of Ancient Greek (Vehkavaara 2000). Therefore, the meaning of the term *epistemology* in the context of KM is somewhat looser compared to epistemology as a branch of philosophy that addresses issues concerning *what knowledge is* and *what justifies it*. Despite the more pragmatic aims of theories of KM, the traditional epistemological problems, should not be left uncovered—at least if the resulting KM models are expected to be theoretically coherent and credible.

Different characterizations of knowledge—traditional, objectivist and Polanyian views

Traditionally knowledge has been defined as justified true belief, which is the *classical definition of knowledge* (Niiniluoto 1996). However, the traditional view on knowledge is not totally unproblematic. Gettier (1963) was the first to show that a justified true belief can be false, suggesting that the classical definition of knowledge is inadequate. Thus, there is no generally accepted consensus about the definition of knowledge. Nevertheless, the classical definition of knowledge is often some kind of basis or at least an important point of reference for any epistemological considerations. Therefore we briefly discuss what the traditional view consists of, and what kind of properties it requires of knowledge.

According to the classical definition, knowing something posits that the thing being known must be believed. In this sense belief is the basic component of knowledge to which the truth and the justification conditions are set (Scheffler 1965). To believe something is mentally to represent it as true (Graham 1998). Hence, belief is a mental state in which a subject holds a proposition to be true. To represent something mentally as true naturally includes an idea that the knowing subject is *conscious of that belief* (Vehkavaara 2000).

The content of the belief must correspond the prevailing state of things in reality in order to be regarded as knowledge; it is intuitively clear that a false proposition cannot be *known* (Steup 2008). However, the truthfulness does not make the belief knowledge according to the classical view. For example, in the case of a lucky guess it does not seem reasonable to claim that the subject *knew* how the things were because the subject had no rational explanation for the belief. In this sense it have to be assessed, what *the grounds* are for holding the belief. Therefore, a theory of knowledge is most basically a theory about epistemic justification because justification makes a belief “epistemically permissible” (Pollock and Cruz 1999).

According to Vehkavaara (2000) the condition of justification presupposes that knowledge can be expressed in a form of propositional sentence(s), because an essential idea behind the condition of justification is that the “verification” of knowledge should be repeatable, or at least examinable, by anyone. Indeed, justifiability of knowledge is specifically related to the ability to publicly present evidence supporting a claim (Niiniluoto 1996). Thus, knowledge is supposed to be *presentable linguistically*. Also, the propositional form of knowledge suggests that no knowing subject is actually required, because a justified, true proposition exists as an ideal object independent of the knower and time (Vehkavaara 2000). In this sense the condition of justification seems to have a close connection with *objectivity*.

Objective knowledge and objectivism

As explained earlier, the theories that highlight the importance of explication of tacit knowledge are related to objectivist-based epistemological tradition (Hislop 2005; Cook and Brown 1999). *Objectivism* can be understood as an ontology or an epistemology. Objectivist ontology (metaphysical objectivism) refers to the idea that there is one objective reality that exists independently of human mind (Niiniluoto 1999). We can perceive the existing reality with our senses, but the understanding we form about the world might not be entirely correct. Thus, objectivist ontology concerns the world and its form of existence. Instead, objectivist epistemology holds that our knowledge concerning the world is objective.

Objectivism as a branch of epistemology has a history starting from late 1950's. It refers to Ayn Rand's philosophical view that a knowing subject can acquire objective knowledge of reality only through reason. Objective knowledge can be formed from a perception in a process of concept formation and reasoning (Darity 2007). Rand (1962 p. 35) wrote: "Reality exists as an objective absolute—facts are facts, independent of man's feelings wishes, hopes and fears." Rand (1962 p. 35) further describes human relation to reality in a following way: "Reason ... is man's only means of perceiving reality, his only source of knowledge, his only guide to action, and his basic means of survival." Hence, knowledge is based on rational reasoning that can be executed by anyone

Consequently, epistemological objectivism essentially concentrates on the objective nature of reality and on the justification of knowledge. It seems even useless to deal with the question of the relationship between tacit and explicit knowledge from the perspective objectivist thinking because, strictly speaking, the notion of inarticulate and vague (tacit) knowledge is senseless within the objectivist theory of knowledge; the theoretical framework of objectivism simply does not support such a conception.

In the next subsection we present the core of Polanyi's theory of knowledge. It is precisely the requirement of justification that differentiates Polanyi's thinking from the traditional view.

The Core of Polanyi's Epistemology

According to Polanyi (1958) epistemological theories of the time had described human knowledge too narrowly because an absolute objectivity was traditionally emphasized as an attainable ideal for knowledge. He claimed that modern science that was based on disjunction of objective and subjective aimed to eliminate passionate and personal human appraisals of theories from science. Polanyi claimed that if all the knowledge were objective, it would be impossible to make scientific discoveries. Instead, scientific discoveries were often made on the basis of unexplained informed guesses, intuitions and imaginative ideas that reflected some kind of *tacit knowledge*. From this critique of modern epistemology and philosophy of science raised the concept of *personal knowledge*. According to Polanyi, all the acts of conscious mind included *a personal coefficient*; "Into every act of knowing there enters a passionate contribution of the person knowing what is being known, and ... this coefficient is no mere imperfection but a vital component of his knowledge." (Polanyi 1958 p. viii)

Consequently, Polanyi adds subjective elements of knowing to the traditional conception of knowledge; the knower is situated in the most fundamental position instead of what is being known. The knower does not simply pick up the meaning of knowledge but actively forms it by integrating his personal appraisals to the thing that is being known. This is exactly opposite approach to epistemological objectivism, which claims that knowledge should be independent of the knower. However, Polanyi's theory is not subjectivist. Polanyi's concept of personal knowledge has strongly objective element because it affirms the possibility to establish contact with knower-independent reality (Mitchell 2006). Thus, in the ontological sense Polanyi's theory refers to realism.

The structure of knowing: subsidiary and focal awareness

The major feature of Polanyi's theory is a distinction between two kinds of awareness that are involved *in all conscious acts*. *Focal awareness* concerns the object of conscious act represented in the mind, for example a perception of an external object or a propositional belief. *Subsidiary awareness* refers to the basis on which the focal awareness operates. Processes of subsidiary awareness provide the elements that the focal object consists of. For example, when we perform a skill, we attend focally to its outcome, while being only subsidiarily aware of the several moves we coordinate to this effect (Polanyi 1969). The most essential idea

of the theory is that while attending to focal awareness a person *dwells in* subsidiary awareness that contains subsidiary elements, or clues, of the focal target. Polanyi (1964 p. xiii) explains:

When we are relying in our awareness of something (A) for attending to something else (B), we are but subsidiarily aware of A. The thing B, which we are thus focally attending, is the meaning of A. The focal object B is always identifiable, while things like A, of which we are subsidiarily aware may be unidentifiable. The two kinds of awareness are mutually exclusive: when we switch our attention to something of which we have hitherto been subsidiarily aware, it loses its previous meaning.

This is the structure of knowing that Polanyi sees valid for *all acts of knowing*. The idea is that the thing we are focally aware of as a result of a conscious act is formed subsidiarily of tacit elements, which enriches focal knowledge with personal coefficient. Therefore we base our knowledge of the things we are focally attending to something more fundamental.

For example, if we observe a moving object, we see thousands of rapidly changing clues as one, unchanging object; we are not aware of calculations of changing distances, variations of light or movements of our eye muscles, but simply the focally attended object (Polanyi 1968). The resulting visual perception is a matter of focal awareness. We cannot reach clues, calculations and physiological functions that take place in the subsidiary awareness enabling our knowledge of the focal object. The process has only one direction terminating in the focal awareness.

According to Polanyi the two kinds of awareness are mutually exclusive; we cannot attend to both of the awareness at the same time. In fact, we cannot attend to what is functioning subsidiarily at all, because the moment we shift our attention to the subsidiary elements, it becomes focal losing its subsidiary meaning, and having its own subsidiary basis. Polanyi describes (1968 p. 31) this in a following way:

... Anything serving as a subsidiary ceases to do so when focal attention is directed on it. It turns to a different kind of thing, deprived of the meaning it had in the triad.

Therefore, the meaning of tacit knowledge cannot be seized on *by definition*. For example, we can shift our focal attention to movements of our eyes (a subsidiary element) while observing a moving object, but it changes radically our perception; the thing we are now attending to (the movements of our eyes) is focal and we can understand hardly anything of how it functioned subsidiarily as a part of attending to the moving object.

Justification of knowledge according to Polanyi

The focal part of knowing corresponds relatively well to the belief in the traditional definition of knowledge; the focal representation is the conscious understanding that the knowing subject forms of the object of knowing, and that the subject might be able to articulate. However, this focal “belief” is a result of something more fundamental, not the starting point of the knowledge, as it is in the traditional definition of knowledge.

As all knowing is based on tacit elements in Polanyi’s theory, objective knowing is not possible by definition. However, logical deduction is a process that comes near explicit knowing in the sense that it is based on connecting focal items, namely the premises and the consequent (Polanyi 1975). The deductive conclusion is attained using operations with fixed mental structures, which minimizes the need of indwelling to subsidiary awareness because the premises are already given (Polanyi 1965). The most important difference between deduction and knowing based on tacit subsidiaries is that deduction is a reversible process; it is possible to go back mechanically from the consequence to the premises. However, knowing based on tacit subsidiaries is not similarly reversible. It is not possible to go back from the integrated focus to its subsidiaries (Gill 2000).

Thus, in addition to being capable of stated clearly, explicitness seems to refer also to the possibility to trace the origins of the focal knowledge—the justification *would* make knowledge more explicit. However, *knowledge cannot be exhaustively justified because it is always based on unspecified particulars* (Polanyi 1968). This logic leads to the culmination of Polanyi’s theory: the rejection of the idea of fully explicit knowledge.

This claim might seem problematic because it questions our ability to e.g. to verify scientific knowledge claims, meaning that knowledge would always be only subjective. Polanyi (1958) answered this problem by stressing that knowing is a responsible act that claims for universal validity. As he (Polanyi 1958 p. 65) puts it:

It is the act of commitment in its full structure that saves personal knowledge from being merely subjective. Intellectual commitment is a responsible decision, in submission to the compelling claims of what in good conscience I conceive to be true.

Therefore even scientific knowledge claims cannot be verified by means of explicit articulation. The confirmation of scientific knowledge claims would require the use of skills and insights, which themselves lie outside of empirical demonstration (Gill 2000). Instead, knowledge will be tested in reality that all knowing agents can access; knowledge will justify itself in case it is worth it. On the other hand, reasons that justify our beliefs can be repealed as our understanding of the subject area accumulates. This, indeed, seems to be often the case in science.

Epistemological framework for the idea of explication of tacit knowledge

The idea of explication and sharing of tacit knowledge was originally made famous by Nonaka and Takeuchi (1995) in their theory of organizational knowledge creation. Their SECI-model describes conversions between tacit and explicit knowledge types. The most essential part of the model is the conversion of tacit knowledge to explicit (Nonaka and Takeuchi 1995). Since the publication of Nonaka and Takeuchi's theory tens of authors have embraced the idea of explication of tacit knowledge.

The idea of explication of tacit knowledge is rooted on the distinction between explicit knowledge and tacit knowledge (Hislop 2005). E.g. Nonaka and Konno (1996 p. 42) make the point clear by stating: "There are two kinds of knowledge: explicit knowledge and tacit knowledge." Despite this classification, many authors still recognize some kind of inseparability between these two types (e.g. Nonaka and Takeuchi 1995; Ambrosini and Bowman 2001). However, explication of tacit knowledge seems to logically presume such a classification; the aim, after all, is to convert knowledge existing in a tacit form to more exploitable explicit form. Generally speaking, there hardly is any conversion of one form to another form if two or more different forms are not presupposed.

According to KM theories embracing the idea of explication of tacit knowledge, explicit knowledge is seen codified, impersonal and objective (Hislop 2005). As Nonaka and Konno (1996) put it, "Explicit knowledge can be expressed in words and numbers and shared in the form of data, scientific formulae, specifications, manuals and the like." Thus, explicitness seems to refer to the form in which knowledge is presented. Also, explicit knowledge is assumed to include the correct meaning unchangeable and ready to be received by anyone. This characterization of explicit knowledge clearly sets a strong objective nature to that kind of knowledge and corresponds well the traditional definition of knowledge.

Tacit knowledge is usually defined as subjective knowledge that is *not yet explicated*, considering tacit knowledge as a latent resource that needs to be shared (e.g. Sternberg 1999; Nonaka and Takeuchi 1995; Kikoski and Kikoski 2004). The use of the concept of tacit knowledge in general is very inconsistent depending on author, but according to the usual characterization it refers to expertise or know-how that is difficult to articulate.

Hislop (2005) considered the theories concerning explication of tacit knowledge objectivist opposing them to practice-based epistemologies. However, this classification of epistemologies seems somewhat crude in a sense that the idea of vague and non-justified knowledge cannot be accepted easily into the realm of objectivist thinking, in which the strict justification is a fundamental requirement for knowledge. For example, expert's intuitive hunch simply is not knowledge according to objectivist definition because it is not based on rational, objective reasoning. In order to be useful or even understandable a concept must be supported by other concepts within a conceptual system. This is not the case of the concept of tacit knowledge within the objectivist framework. However, the theories concerning explication of tacit knowledge would consider intuition as an instance of tacit *knowledge*. Therefore, the theories stressing the explication of tacit knowledge are not objectivist. Rather, they seem to be some kind of extensions of

traditional view on knowledge, because according to these theories objective and “real” (explicit) knowledge can be created basing on non-specific forms of “knowledge” (tacit knowledge).

In sum, the theories of explication of tacit knowledge seem to be based on a relatively straightforward distinction between tacit and explicit knowledge. The notion of explicit knowledge comes from traditional view on knowledge, whereas the notion of tacit knowledge is based on Polanyi’s theory of knowledge. Since there is no explicit knowledge according to Polanyi’s theory, and unjustified tacit knowledge seems rather questionable idea from the perspective of traditional theories of knowledge, explication of tacit knowledge requires an epistemological environment that combines Polanyian elements with traditional idea of knowledge.

Explication of tacit knowledge enabling epistemology

The idea of explication of tacit knowledge presupposes that the inarticulate tacit knowledge is first made articulate. An articulated, explicit form of tacit knowledge can then be shared with other individuals. This idea clearly has a strong objectivist presupposition; as long as tacit knowledge is explicated, it is supposed to be understandable and usable by others as such.

Nonaka and Takeuchi (1995) have considered the definition of knowledge that their theory presupposes. They (p. 58) explain:

In our theory of organizational knowledge creation, we adopt the traditional definition of knowledge as “justified true belief.” It should be noted, however, that while traditional Western epistemology has focused on “truthfulness” as the essential attribute of knowledge, we highlight the nature of knowledge as “justified belief.”

Nonaka and Takeuchi do not make clear whether this definition concerns both explicit and tacit type of knowledge. If this is considered to be a general definition of knowledge, and knowledge is then supposed to have various types, this implies that the definition concerns both types of knowledge; both tacit and explicit knowledge are justified beliefs.

However, according to Polanyi’s theory indefinable tacit elements cannot be rationally justified, which makes knowledge partly unjustifiable in general. Also, as Vehkavaara (2000) remarks, a requirement of justification presupposes that the representation of knowledge in question can be made *linguistic*. However, the most common feature of definitions of tacit knowledge in the KM literature is the problem of articulation. Also, intuitive knowing is often equated with tacit knowledge in KM literature. It is self-explanatory that an intuition is just an intuition exactly because of the lack of justification; it is a feeling of knowing something without a well-defined explanation. Therefore the requirement of justification supposedly cannot concern tacit knowledge in these theories.

Consequently, ‘justified belief’ may only concern ‘explicit knowledge’ in the theories that make the distinction between different types of knowledge. This seems to place tacit and explicit knowledge in an unequal position in a way that is contrary to Polanyi’s thinking; instead of being a fundamental basis of all knowing, tacit knowledge is seen rather as some kind of possible resource for new, “real” knowledge. Now, in the case of explication of tacit knowledge it is logically presumed that tacit knowledge functions as a justification of explicit knowledge as it is the only source of this attained knowledge. However, if tacit knowledge itself is at most very weakly justified, can it function as a justification of something else?

In sum, the idea of explication of tacit knowledge seems to provide that the attained objective knowledge is based on a weak justification, that is, for example on characterizations of beliefs, hunches and implicit know-how. In other words, the requirement of objectivity of knowledge is seen to true, but the application of Polanyi’s thinking leads necessarily to rejection of requirement of rational justification. Hence, the resulting epistemology seems to be a combination of Polanyian epistemology and the traditional view on knowledge; it both assumes and rejects some features from both views. This idea is presented in figure 1.

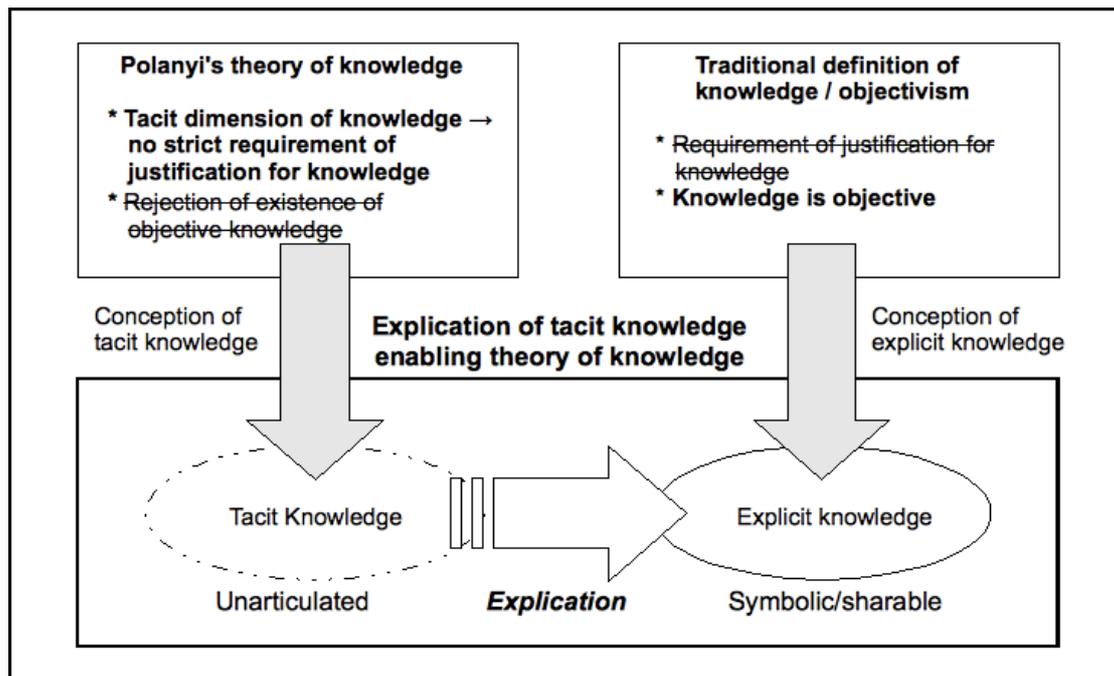


Figure 1 A model of explication of tacit knowledge enabling theory of knowledge. The concept of tacit knowledge comes from Polanyi's theory of knowledge, but the idea of explicit knowledge corresponds to the traditional, or even objectivist view, on knowledge. The resulting theory of knowledge has to reject some features both from Polanyi's theory of knowledge and from the traditional view on knowledge (struck through in the upper boxes). The features that the resulting theory of knowledge adopts from these theories are highlighted in the upper boxes.

The problems concerning the combination of these two different types of epistemologies are discussed in the next section.

Problems of the explication of tacit knowledge enabling epistemology

Given that the basis of Polanyi's theory of knowledge was a critique against the objective ideal of knowledge, it is not surprising that these two views conflict in some crucial points. This is also why an epistemology that combines features from both of these theories seems to head for some theoretical problems.

Non-justified Objective Knowledge?

The idea of accepting non-strict criteria for the basis of objective, explicit knowledge that can be exchanged between individuals seems to be controversial in itself. In a theoretical level, to attain reliable objective knowledge it should be derived and justified by anyone based on the same criteria—this is the basic idea behind the requirement of justification; people should end up having the same conclusion, which cannot be generally expected if there are no recognizable premises or if the premises vary a lot from individual to individual.

As objectivist epistemology (and also Polanyi) states, logic and reason are the most straightforward means to attain fully objective knowledge. Objectivist epistemology considers this possible, whereas Polanyi rejects the idea of fully explicit knowledge. However, neither of these epistemologies, nor the traditional view on knowledge, accepts that *objective* knowledge can be based on vague justification.

Let us consider a concrete example of a theoretical problem that follows from this view. Kikoski and Kikoski (2004 p. 72), among others, illustrate the difference between tacit and explicit knowledge by giving characteristics that distinguish tacit knowledge from explicit knowledge:

- Explicit (known): Public, conscious/aware, logical, certain, strong, hard, structured, goal oriented, stable, direct perception, rules/methods/facts/proof.
- Tacit (not yet known): Private, unconscious/unaware, allogical, uncertain, fragile, soft, unstructured, indeterminate, unstable, indirect, subception, intuition/sensing.

Drawing from Polanyi, Kikoski and Kikoski (2004 p. 73) state, "all knowledge either is tacit, or is rooted to tacit knowledge; that is, explicit knowledge depends on and is encompassed by tacit knowledge." However, following their characterization of different knowledge types it seems logically controversial, that strong, certain and stable knowledge is based on fragile, uncertain and unstable knowledge.

Therefore, tacit knowledge understood as a foundation of all knowledge (the Polanyian conception) simply is not compatible with the idea of objective, explicit knowledge. If the idea of fully objective knowledge is, however, still adhered, it leads to distortion of the concept of tacit knowledge; its original intension must be modified in order to make it fit the new theoretical environment.

Simplified image of tacit knowledge

Polanyi's notion of tacit knowing goes far beyond the idea of tacit knowing defined merely as intuition or context-specific know-how that accumulates as a result of experience. Instead, tacit knowing belongs inextricably in all conscious acts. The predominant conception of tacit knowledge in the KM literature that supports the idea of explication of tacit knowledge seems therefore to be based on simplification of the concept of tacit knowledge.

Let us consider an example given by Sternberg (1999 p. 232) as he explains the way explication of tacit knowledge reduces individual differences:

For example, if, in the past, knowledge about the importance of buying the boss a gift for his or her birthday was tacit, those who possessed this knowledge were at distinct advantage. But if now everyone knows and uses this piece of knowledge, it will no longer serve to differentiate employees, in the boss' eyes, and most likely some other as—yet tacit knowledge will take its place. As this example points out, tacit knowledge can become explicit.

The awareness of certain way of action (as in this case) is hardly unspecified or subsidiary. "Tacit knowledge" in this example, namely the awareness of the importance of buying the boss a gift, seems to be a focal belief (justified or not) that can be shared if wanted; someone simply *knows* or *believes* that buying a gift is important in certain culture. This kind of conception of tacit knowledge has very little to do with Polanyian contents of subsidiary awareness. In fact, we might critically ask, what additional value or explanatory power the introducing of concept of tacit knowledge brings to this example?

The way intuition and its relation to tacit knowledge are discussed in the literature of management studies serves as another example of the simplified conception of tacit knowledge. Nonaka and Konno (1998 p. 42), among others, argue that intuitions and hunches fall into the category of tacit knowledge. Also Nonaka and Takeuchi (1995) describe externalization (the conversion of tacit knowledge to explicit knowledge) by saying that the use of figurative language is a way to articulate intuitions and insights. From this seems to follow that articulation of intuition is considered to be articulation of tacit knowledge, which pretty much equates tacit knowledge with intuition. However, it is important to make a distinction between the conscious representation of unexplained feeling of knowing something (simplified view on tacit knowledge) from the meaningful elements that *precede and enable the feeling of knowing* (Polanyian view on tacit knowledge).

The sensation of knowing a solution (not to speak of its verbal description) belongs in Polanyi's terms to the focal, not the tacit, part of that act. Indeed, a relevant question seems to be, where the sensation of knowing does come from. Why is the intuition just that and not something else? An intuition must be based on something because otherwise it would be just a random guess. In Polanyi's terms integrated subsidiary knowledge that finally forms the focal sensation remains unexplained in the process. Thus, intuition is an innate sensibility to coherence that cannot be explained with rules or algorithms (Polanyi 1966). The knowledge on which intuition is based remains tacit. As Polanyi (1968 p. 42) puts it:

It is intuition that senses the presence of hidden resources for solving a problem and which launches the imagination in its pursuit. And it is intuition that forms there our surmises and which eventually

selects from the material mobilized by the imagination the relevant pieces of evidence and integrates them into the solution of problem.

Therefore, if intuition itself is equated with tacit knowledge, we logically need a third level of knowledge that is even more quintessential than tacit knowledge, namely the instances of meaning that form the intuition. Although intuition indeed is an outstanding manifestation of tacit knowing, tacit knowledge does not seem to become articulated in the process of articulation of the intuition. Instead, intuition seems to only reflect knower's tacit resources more or less the same way that a skilful performance reflects performers' skills that also cannot be described in words.

Conclusions

Explication of tacit knowledge has been proclaimed as the most important function of modern organisations in the contemporary KM literature. However, it seems that the theoretical grounds of this idea has not been profoundly studied, which cuts down the plausibility of the theories stressing the importance of making tacit knowledge explicit. On the other hand, the development of efficient practises is based on coherent theories. This suggests that the conception of knowledge still calls for more theoretical development and research also in the organizational context.

We have described two significant theoretical problems of the idea of explication of tacit knowledge. First, the division of knowledge into tacit and explicit. Interestingly, many authors claim that the classification of knowledge to tacit and explicit comes from Polanyi's theory of knowledge (e.g. Baumard 1996; Spender 1996). To be sure, focal ("explicit") and subsidiary (tacit) knowledge are central concepts in Polanyi's epistemology. However, the distinction is not ontological, but functional. Polanyi did not say that certain things are known tacitly, while others are known explicitly. Instead, the distinction describes the structure of knowledge that concerns *all acts of knowing* being the basis of Polanyi's *theory of knowledge*—it is not a theory of the existence of two types of knowledge.

Second, theories that embrace the idea of converting tacit knowledge to explicit are based on two mutually incompatible epistemologies. The concept of tacit knowledge is obviously adapted from Polanyi's theory of knowledge, whereas the characterization of explicit knowledge corresponds objectivist theory of knowledge. The most crucial contradictory feature is the view that these theories take on the requirement of justification. Interestingly, many authors seem to bypass this controversy. Hence, the focus seems to be on the questions concerning application of tacit knowledge whereas the considerations concerning the theory of knowledge that the application of the concept presupposes are almost completely bypassed.

Polanyi's theory does not signify that people could not share knowledge or have same conceptions concerning reality. Knowledge does not have to be entirely objective for that people could act efficiently together. The guidance of an expert undoubtedly is an immense help when a non-professional tries to assimilate a certain skill. Therefore we do not want to question the methods and goals of the theories of knowledge creation. However, this does not change the fact that the concept of tacit knowledge is being used in a questionable, simplified and even incorrect way in some of the KM literature, which has separated its meaning from its original role as a foundation of conscious acts, reducing it to refer to any type of knowledge that is difficult to manage.

Tacit knowledge is first and foremost a theoretical concept (i.e. a concept introduced by a theory), and hence, its application even in more practical environment should be based on the original theory. However, many authors seem to base their conception of tacit knowledge on the loose idea "knowledge difficult to articulate" that can refer to virtually any mental or social phenomenon. As the extension of a concept grows this way, it is in danger to become unclear, even meaningless, nonsense.

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Externalization of Tacit Knowledge Implies a Simplified Theory of Cognition

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Abstract. Externalization of tacit knowledge has been on the focus of both human-centric and ICT-centric knowledge management theory for over fifteen years. The whole conception of tacit knowledge in the knowledge management literature has been criticised of being based on incorrect interpretation of Polanyi's original theory of knowledge. At the same time, it has been reported that many knowledge management projects related to externalization of tacit knowledge do not meet their objectives. The above-mentioned findings suggest that there is something wrong in the dominant epistemology of knowledge management theory. We analyzed the conception of externalization of tacit knowledge from the perspectives of epistemology and theory of cognition. We identified various problems related to the dominant conception of mind in the knowledge management literature. We argue that the conception of externalization of tacit knowledge is based on the simplified view on human mind, which also questions the idea of management of tacit knowledge.

Keywords: Cognition, epistemology, externalization, mind, Polanyi, tacit knowledge.

1. Introduction

Externalization of tacit knowledge is argued to be a critical procedure in the knowledge management (KM) theory (Steward, 1997; Kikoski and Kikoski, 2004; Nonaka and Takeuchi, 1995). As Irick (2007, p. 1) puts it, "The primary task of managers is the conversion of tacit, human capital into explicit, structural capital." Although the conception of externalization of tacit knowledge was originally mostly the problem of the human-centric approach to KM, later the problem has been addressed also from the ICT-centric approach by converting tacit knowledge to explicit by the means of information technology.

The conception of explication of tacit knowledge is based on epistemological assumption that there exist two kinds of knowledge, tacit and explicit. This view *is said* to be adopted from Polanyi's philosophy, and it was introduced to KM theory by Nonaka and Takeuchi's (1995) theory of organizational knowledge creation. However, Nonaka and Takeuchi's theory did not become popular only as model of process of innovation but it has been generally adopted as a model of externalization or codification of tacit knowledge in the KM literature. Since then, the epistemological foundation of Nonaka and Takeuchi's theory, namely the classification of knowledge into tacit and explicit, has gained a dominant role as the basis for epistemology in the KM theory (Maasdorp, 2007; Stacey, 2001).

Many ICT KM projects have stated as their primary aim the conversion of tacit knowledge to explicit knowledge, namely the "externalization" component of Nonaka and Takeuchi's theory (Grant and Qureshi, 2006). Nevertheless, the ICT-aided attempts to externalize tacit knowledge usually have had very limited success (Grant, 2007). Lucier and Torselieri (2001), in their study of 108 companies, remark that they did not find correlation between systematic management of knowledge and improved performance. Moreover, Akhavan et al (2005) suggest that the failure rate of KM projects is 50-70%. It seems justified to ask, whether there is something wrong in a deeper level beyond these practices—namely in the theory that underlies them.

We analyzed the theoretical foundations of the conception of externalization of tacit knowledge in order to identify the potential problems. By 'theoretical foundations' we refer to the predominant epistemology, adopted from Nonaka and Takeuchi's theory, in KM literature. Since any epistemology implies some kind of theory of cognition/mind, we also discuss the theory of cognition/mind that the conception of externalization of tacit knowledge seems to imply.

We show that the conception of externalization of tacit knowledge does not have coherent, theoretical bedrock that would underlie it. It is based on a simplified conception of mind, which in turn is based on misunderstanding of Polanyi's philosophy in various levels. We claim that this directs both the research and the practices of KM to wrong directions.

2. The theoretical background of the conception of externalization of tacit knowledge

In the early 1990's knowledge became not only a basic, but also the most important resource of production and economy of organizations. This meant that knowledge assets (intellectual capital) became more important to organizations than physical or financial assets; the implication of this shift in thinking was that to prosper in "the new economy" and to exploit the vital knowledge assets, new management techniques, new technologies, and new strategies were needed (Stewart, 2001). Moreover, learning and creation of new knowledge were rapidly concluded to be of prime importance (Nonaka and Takeuchi, 1995). The field of KM emerged in this knowledge-centric atmosphere, and since then KM has been one of the most influential new organizational practices.

From the epistemological perspective contemporary KM is characterized by a commonly accepted view according to which there exists two kind of knowledge, tacit and explicit (Lakowski, 2005). This view is said to be adopted from Polanyi, and it was introduced and made famous by Nonaka and Takeuchi's (1995) theory of organizational knowledge creation. Nonaka and Takeuchi argued that tacit knowledge had been overlooked in organizational context in Western countries, but in Japan tacit knowledge was an important source of companies' competitiveness. Hence, they (Nonaka and Takeuchi, 1995 p. viii) stated the epistemological presupposition, upon which their theory was based in the following way:

"...we classify human knowledge into two kinds. One is explicit knowledge, which can be articulated in formal language including grammatical statements, mathematical expressions, specifications, manuals, and so forth. This kind of knowledge can be thus can be transmitted across individuals formally and easily. This has been dominant mode of knowledge in the Western philosophical tradition. However, we shall argue, a more important kind of knowledge is tacit knowledge, which is hard to articulate with formal language. It is personal knowledge embedded in individual experience and involves intangible factors such as personal belief, perspective, and the value system."

Nonaka and Takeuchi (1995) argued that the dynamic model of knowledge creation is anchored to an assumption that human knowledge is created and expanded through social interaction between tacit knowledge and explicit knowledge, which they called 'knowledge conversion'. The key to knowledge creation lied in the mobilization and conversion of tacit knowledge to explicit knowledge. Externalization referred to the articulation of one's own tacit knowledge (ideas, beliefs, intuitions etc.) in words, and on the other hand, eliciting, deducing and translating tacit knowledge of others into an understandable form (Nonaka and Takeuchi, 1995; Nonaka and Konno, 1998). Nonaka and Takeuchi mentioned metaphors, analogies and

figurative dialogue as suitable methods for the process of externalization. The idea was that something previously inexpressible can be expressed by using a non-analytical method.

Nonaka and Takeuchi's theory of knowledge creation is considered one of the most significant theories in the history of KM (Maasdorp, 2007). However, their theory did not become popular only as a model of process of innovation but it has been generally adopted as a model of externalization or codification of tacit knowledge in the KM literature. Hence, the epistemological foundation of Nonaka and Takeuchi's theory, namely the classification of knowledge into tacit and explicit, has gained a dominant role as the basis for epistemology in the KM theory (Maasdorp, 2007; Stacey, 2001).

3. Externalization of tacit knowledge and its implicit presuppositions of cognition

The methods of externalization or codification of tacit knowledge presented in the KM literature originally included the use of metaphors, analogies and dialogue (e.g. Nonaka and Takeuchi, 1995), and storytelling (e.g. Schilcher 2009; Perret et al, 2004). Also several ICT-based systems has been developed and suggested as tools for the externalization. Despite the method of externalization the requirement for the externalization is a linguistic presentation of the externalized material. The use of metaphors and analogies trivially means communication via language. In the case of the use of information systems the captured and analysed knowledge is based on users' input. Fergus et al (2003, p. 161) explain:

“Tacit knowledge is inherently communicated via face-to-face interactions; therefore we need to integrate these social activities within a technological environment. Merging the social with the technical allows us to develop knowledge extraction algorithms that attempt to gain a conceptual understanding of these interactions in order to extract tacit knowledge and codify it in a knowledge management system. The challenge is to realise such an environment and develop algorithms that effectively extract and codify tacit knowledge.”

The use of language further implies that the knowing subject (whose tacit knowledge is being externalized) is conscious of the source (the representation) to which his linguistic expressions refers, because we can only articulate and describe things that we are conscious of (Ledoux, 2002). Moreover, the use of metaphors, analogies and illustrative dialogue implies that the knowing subject focuses on his contents of the mind and in a reflective and creative manner analyzes tries to articulate them. From a psychological perspective this refers to introspection, a technique in which subjects aim to report their conscious experience (Eysenck and Keane 2005).

The idea of externalization of tacit knowledge implicitly assumes that once the knowing subject has formulized his tacit knowledge into linguistic expression, the meaning of the knowledge is included more or less unchanged in that expression. Hence, it is assumed that beliefs, perceptions, assumptions, values, preferences etc. are states of tacit knowing, and as the knower identifies these states, they can be transformed into natural language. Moreover, this view assumes that shared understanding is possible once tacit knowledge is made linguistic. Churchland (1986) calls this kind of theory of cognition “sentential”. By this she means that human cognition is portrayed as a dance of sentential or propositional states, with the basic unit of computation being the inference from several such states to some further sentential state.

In sum, the implicit assumptions of mind that the idea of externalization of tacit knowledge makes described above are 1) tacit knowledge to be externalized must be conscious; 2) the method of externalization is essentially introspective; 3) the meaning of the state of tacit knowing is passed on in a form of linguistic expression.

4. Problematic epistemology and theory of cognition

In this section we consider the three assumptions presented above further, arguing that they are problematic from various perspectives.

Assumption 1: externalized tacit knowledge is conscious.

In his analysis of the structure of knowing Polanyi made a distinction between focal and subsidiary awareness. Basically, subsidiary awareness covers the realm of tacit knowledge whereas explicit knowledge belongs to focal awareness. Focal awareness is always conscious (Polanyi, 1968). As Polanyi said, what I am seeing, I am focally aware. Hence, focal awareness refers to the anything on which focal attention is directed, whether it is a perceived object or a mental representation. The content of subsidiary knowledge, in turn, is “essentially unspecifiable” (Polanyi, 1968, p. 31). Polanyi distinguishes two types of unspecifiability, the difficulty of tracing tacit knowledge (unconscious nature of tacit knowledge) and logically necessary sense deprivation (loss of meaning of tacit knowledge if it is tried to attend focally). In both cases the knower is unaware of tacit knowledge; he is not conscious of it, it is untraceable.

Based on Polanyi’s and KM author’s ideas of tacit knowledge we can crudely distinguish three different levels of content of mind from the perspective of its accessibility.

1. Conscious linguistic representations, or representations that are easily made linguistic (e.g. declarative knowledge, propositional thoughts, texts etc.).
2. Conscious representations that are difficult to articulate because of, for example, lack of words (e.g. an unusual colour), modality of the representation (e.g. a vision or a multimodal experience) or not-yet analyzed nature of representation (an incomplete idea or assumption not yet submitted to verification). In other words, compared to the representations of level 1, the representations of this level are more phenomenological in nature.
3. Unreachable content impossible of becoming a conscious representation.

Based on the characterizations of tacit knowledge made by Polanyi and many KM authors applying his theory for externalization, it is evident that they are not talking about the same mental phenomena when referring to tacit knowledge. To Polanyi tacit knowledge is a phenomenon of the level 3, whereas tacit knowledge in the KM literature refers to both level 2 and 3. However, the focus is on the level 2 since externalization of tacit knowledge is generally considered to be one of the main functions of organizations (e.g. Irick, 2007; Stewart, 1997; Kikoski and Kikoski, 2004). The difference between the views is illustrated in figure 1.

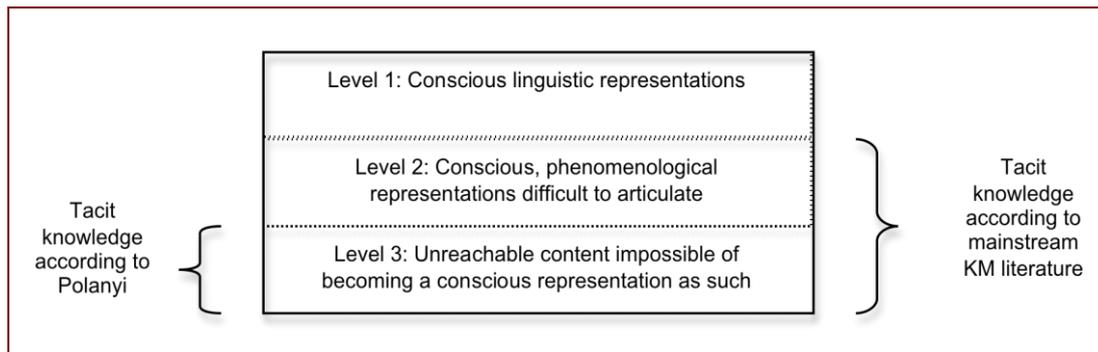


Figure 1. Tacit knowledge according to different sources.

A broader use of a concept of tacit knowledge in a more practical context would not be necessarily problematic if the concept was defined accurately. However, in this case the application of Polanyi's concept has led to significant confusion. First, as most of the authors mention and refer Polanyi as the primary source of the distinction between tacit and explicit knowledge, it is about misreading Polanyi. Second, levels 2 and 3 (in figure 1) cover so many mental phenomena that the concept has become meaningless buzzword that can refer to almost anything. This has led great confusion of the meaning of the concept. Third, KM is a multidisciplinary field of science, which means that it should communicate with other relevant fields of science. This naturally becomes difficult if central concepts adopted outside the field are redefined. Theoretical statements from different disciplines should refer to the same set of phenomena (Bunge, 1967).

Assumption 2: The introspective method of externalization of tacit knowledge.

The aim of externalization is to convert tacit knowledge to explicit knowledge that Nonaka and Takeuchi (1995) define as justified true belief in a traditional way. Introspection is a controversial psychological method whose acceptance as a scientific method depends on the psychological school. However, it has been suggested (e.g. Rakover, 1990) that introspection is a useful tool for providing further understanding in explaining data, confirming/falsifying a theory and generating hypotheses in psychological research. Nevertheless, the question that we are interested in here is whether introspection is a useful tool in creating justified true beliefs. Whereas Nonaka and Takeuchi (1995) explain that the externalized (introspected) tacit knowledge (belief) is justified in a social process, the majority of KM authors do not state how the introspected material becomes justified and true (for example in the case of an ICT-system taking care of the capture, the codification and the sharing of tacit knowledge). This suggests that the introspected "tacit knowledge" is considered valid as such.

This obviously is an incorrect assumption. The traditional definition of knowledge stresses objectivity as the most important feature of knowledge. However, introspected material is not originally publicly available. Moreover, the requirement of objectivity of the traditional definition of knowledge that Nonaka and Takeuchi (1995) use assumes that neither the observer nor the instrument he uses affects the phenomenon being observed. Also the repeatability of introspective reports has been questioned (Rakover, 1990). In consequence, the truthfulness and justification of introspected material cannot be assessed objectively as such, which makes us to formulate a new question: can introspective belief be trusted on even as *potentially* justifiable and true belief? In fact, there are various factors that question the validity of introspective reports as knowledge.

First, introspective reports are incomplete, mainly for two reasons.

- A knowing subject is aware only a small part of an experience—much of it is simply unattended (Marcel, 2003).
- Secondly, for example automated processes occur so quickly that they are out of knower's scope of attentional control and hence cannot be introspected (Rakover, 1990). Naturally, the incompleteness of the reports does not mean that the reported material could not be useful. However, the incompleteness makes the reports more difficult to understand by others, and also proves that there are things that we cannot tell as Polanyi claimed.

Second, attending to one's own mental representation changes the content, nature and form of the representation (Marcel, 2003). Polanyi (1975) called this 'sense deprivation', and it was one of his main arguments why the true meaning of tacit knowledge cannot be captured—a fact that has been completely ignored in the KM literature. For example, if one performs an activity "normally" (that is, not monitoring his own performance), or perceives reality in a usual way, and does not make phenomenal separation of it. However, as Marcel explains, differences in the mode of attention yield different phenomenology. The more analytical one's attention is, the more the experience itself is abstracted and decontextualized, consisting of separate components.

Third, attention adds to its objects (Marcel, 2003). For example, if a subject is asked to imagine a woman's face and is later asked about the colour of her lipstick, the subject may give a definite answer although the mental image contains no information concerning the lipstick until the question. The original image contains only what has been imaged as canonically necessary (Marcel, 2003). Again, in the context of externalization the added information might not be problematic. However, the point is that even the knower has no *sure* way to know what information belongs originally to the representation to be reported.

Fourth, one's prior theories about our experiences and about ourselves can intervene in his understanding of it (Lambie and Marcel, 2002). Indeed, it is very difficult to distinguish our theories of how things should be from the experience or the representation itself. In the end, there is no way to be sure up to a which point the externalized material is just a backward explanation of how things are assumed or deduced to be. In fact, the findings made in the field of cognitive psychology shows that people's self reports are systematically biased and misleading (Eysenck and Keane, 2005; Lakowski, 2005).

In conclusion, the content of our consciousness is opaque and affected by paying attention to it (Marcel, 2003). This suggests that we should at least question the validity of "externalized tacit knowledge" that introspective methods produce. Interestingly, in the KM literature more attention seems to be paid to the methods of externalization than to the procedures of assessing the validity, usefulness and justification of externalized material. Since awareness of private representations comes as a result of drawing inferences from later observations of those representations, mind cannot be expected to know of its own activities (Hebb 1977).

If Polanyi's conception of tacit knowledge is compared with the conception of tacit knowledge in KM literature from the perspective of introspection, even more severe theoretical problem emerges. If the methods of externalization (or introspection) are assessed from the temporal perspective, externalization is obviously a retrospective method; externalization is about attending to one's past experiences, current action or current contents of the mind. In each case, there is an interval of time between the occurrence of the representation and the report of it. Hence, in the process of externalization tacit knowledge is *derived* from the focal

representation.

One of the basic features of Polanyi's theory is that knowing is directed from tacit knowledge to the focal representation. In fact, Polanyi (1968) called the realm of tacit knowledge (subsidiary awareness) 'from-awareness'. The knower is subsidiary aware of tacit knowledge; it serves as a guide to the focal representation that the knower focuses his attention (Polanyi 1966). In this important sense, *tacit knowing precedes the explicit representation* that thus is the result of tacit knowing. One of the Polanyi's most significant epistemological results was that knowledge could not be wholly justified because of its tacit, untraceable roots. According to him, knowing is not a reversible process: it is not possible to go back from the integrated focus to its subsidiaries (Gill 2000). Hence, tacit knowledge cannot be derived from explicit knowledge. The differences between the view of KM literature and Polanyi from the temporal perspective are presented in figure 2.

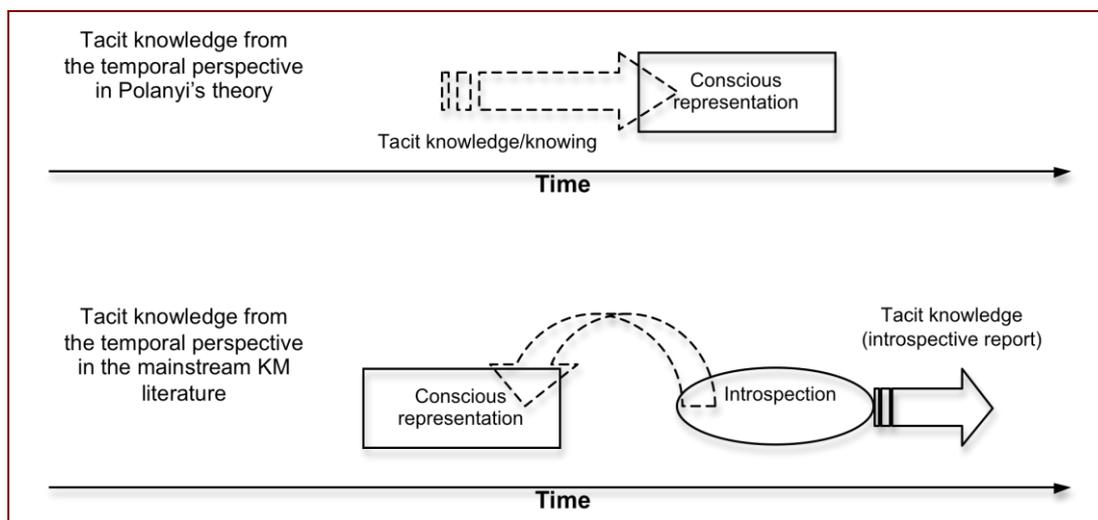


Figure 2. Tacit knowledge from the temporal perspective according to different authors.

Assumption 3: The meaning of the state of tacit knowing is passed on in a form of linguistic expression.

This assumption basically says that appropriate linguistic expressions are translations of experiences or mental representations, which can be transmitted as such to other individuals. The content of internal representation is identified by means of language, and an isomorphism is assumed between the internal representation and the relevant linguistic set of sentences. Hence, it is assumed that what we know is expressible in the symbolic form and can be coded back to internal representation of others—as long as the externalization is successful. However, Boland et al (1994), among others, have questioned the possibility to reach shared understanding of complex representations. They argue that interpretation is personal, and in the end, there is no way to ensure the compatibility of various interpretations. Indeed, Polanyi (1962, p. 252) argues: “It is not words that have meaning, but the speaker or listener who means something by them”. Polanyi meant that the mind creates the meaning of the attended objects. All objects and all knowledge presented in explicit form are dependent on non-critical pre-linguistic capacities based on our experiences, our use of certain language and our participation of certain traditions. We attend the objects of knowing from these capacities, from ourselves, and make sense of reality this way. This is the true meaning of Polanyi's (1966, p. 4) famous phrase “...we can know more than we can tell”. Interestingly, when this phrase

has been combined with the idea of externalization of tacit knowledge, it seems to have transformed in the form 'we know only what we can tell' in the KM literature.

5. Discussion

One of the biggest challenges of KM theory has been the following controversy. First, Nonaka and his colleagues were one of the first to understand and explicitly argue that codified, objective knowledge could not explain individuals' competences and creation of new knowledge. Hence, they focused on the individuals and "the softer side" of knowledge accepting the subjective dimension of knowledge. Nevertheless, their starting point and the interest of knowledge are purely managerial, which calls for objectivist and positivist perspectives; otherwise knowledge cannot be managed. The question is, is it possible to get these two opposite perspectives to communicate.

However, this attempt seems to have headed to problems from the very beginning, because the novel assumptions it makes at first are soon discredited. One of the most fundamental reforms of Nonaka and Takeuchi was to "provide a fundamentally new economic and management perspective" and that way overcome the limitations of Cartesian dualism assumed traditionally in the organizational theory (Nonaka and Takeuchi, 1995). Yet their epistemology, namely the dualism of explicit and tacit knowledge, is a "hallmark of empiricist theory" because it makes a difference between scientific, or empirically adequate knowledge and non-scientific knowledge (Lakomski 2005). As Lakomski remarks, this implies a theory of cognition that privileges the processing of symbols echoing a spirit of Cartesian dualism.

In a same way, drawing from Polanyi, Nonaka and his followers stress the importance of the role of the individuals and tacit knowledge possessed by them in the organizations. But again, the dualist epistemology and the stressing of the importance of codification of tacit knowledge turn the argument up side down. Tacit knowledge is seen as a reservoir of secondary knowledge that is useless as such unless converted to "real" knowledge. Explicit knowledge is clearly privileged compared to tacit knowledge, although Nonaka and Takeuchi (1995, p. viii) first argue: "a more important kind of knowledge is *tacit knowledge* [compared to explicit knowledge]".

In a theoretical level there also three other significant problems. First, epistemologically Polanyi has been misread in the KM literature. A typical reference to Polanyi in the mainstream KM literature is that Polanyi was the first to distinguish tacit knowledge and explicit knowledge. Polanyi, however, did not make an ontological distinction between tacit and explicit knowledge, but stressed that the structure of an act of knowing always had tacit and focal ("explicit") dimensions. Hence, tacit knowledge is a feature in all forms of knowledge; it is not a kind of knowledge as such as presented in KM literature. This is a well-known issue highlighted by e.g. Maasdorp (2007), Tsoukas (2003) and Mooradian (2005).

Second, the above mentioned misunderstanding and the problems highlighted in the previous section suggest, Polanyi, on the one hand, and Nonaka's followers on the other, refer by tacit knowledge a different sets of phenomena (although the sets also partly overlap). From the scientific perspective the situation is unfortunate because re-defining the concept of tacit knowledge in a rather ambiguous manner leaves it without a theoretical foundation, transforming it as a label of *all* unclear social and mental phenomena.

Third, the conception of explication of tacit knowledge implies a somewhat simplified theory of cognition at least in two senses.

1. According to the contemporary neuropsychological research, the presumed direct access to the contents of our mind is only a fragment of our imagination and our mental capacity (see e.g. Ledoux, 2002; Damasio, 1999; Paivio, 2007). Instead, much, even the majority, of cognitive work goes on at an unconscious level (Reber, 1993). This means that we simply cannot see or describe what is going on in our brains when we are learning, remembering, solving a problem or using our expertise. Moreover, what we can describe might be as well guessing as knowing.
2. The conception seems to assume some kind of language dominance view of mind. Instead of accepting the nonlinguistic modes of thought, the conception of explication of tacit knowledge seems to assume that language and thought are more or less inseparable because even the foundations of our representations (tacit knowledge) can be articulated (albeit difficultly). This idea reminds behaviourist Watson's (1930) simplified claim that thinking is nothing but talking to ourselves. As Damasio (1999), among others, has suggested, words and sentences denote entities, actions, events and relationships, and translate concepts. Concepts, in turn, consist of the *nonlinguistic* idea of what these things are. Hence, concepts precede word and sentences of necessity, both in evolution and in everyday life of humans. It is becoming clear that that thinking is multimodal, imaged and nonverbal (see e.g. Eysenck and Keane, 2005; Paivio 2007; Damasio, 1999). The fact that our brain creates automatically a verbal version of the "story" and there is no way of stopping it is probably the source of the incorrect notion that consciousness might be explainable by language alone (Damasio, 1999).

The criticism towards the idea of the primacy of symbolic representation argued above does not mean that symbolic representations are not important and a great part of what is being a human. The symbolic form of representations makes it possible to present, assess and apply them publicly (Lakomski, 2005). However, such representations do not appear from nothing before them. Our thoughts and concepts, and all other aspects of cognition, are based on the perceptual system, past interactions with our environment and our understanding of the world that has is included into the body and the brain. Hence, the division of knowledge into propositional and non-propositional, or into tacit and explicit, is not based on the realistic theory of cognition, but purely on the needs to manage knowledge.

6. Conclusions

We started by pointing out that many authors have questioned the benefits and the efficiency of the KM practices, which according to our understanding suggests that there might be some problems in the KM theory itself. As the conception of externalization of tacit knowledge is still in the focus of KM practices, we analyzed its foundations from the perspective of epistemology and theory of cognition. We have identified significant problems in KM theory in this respect. The conception of externalization of tacit knowledge does not have coherent, theoretical bedrock that would underlie it. It is based on a simplified conception of mind, which in turn is based on misunderstanding of Polanyi's philosophy in various levels. This directs both the research and the practice to wrong lines. For example, many KM projects have stated as their aim the conversion of tacit knowledge into explicit knowledge, storing and sharing it by developing and using ICT-systems. These projects, however, often are reported to have very

limited success, which is not surprising if it is not very clear what they are even trying to capture and convert. As Grant (2007) suggests, this might have very negative effects on organizations. Moreover, it seems that the tacit/explicit dichotomy puts too much weight on the process of codification although more attention should be paid on the question concerning what kind of knowledge is valuable for the organization in the first place. A second somewhat bypassed problem seems to be the possible means and circumstances to gain some kind of shared understanding of the externalized information; the process of externalization might be of no use if the material difficult to articulate is also difficult to comprehend.

Despite the understandable need of KM theory to unite subjective and objective views on knowledge, Polanyi's theory cannot be united with objectivist theory of knowledge. In fact, Polanyi's theory itself already unites subjective aspects of knowing with objective ones, and as such might function well as a basis for KM theory if read correctly. Polanyi's theory, however, implies that tacit knowledge cannot be managed. This suggests that the concept of tacit knowledge is not as useful concept in the knowledge *management* theory as it has been argued.

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In Search for a Theoretically Firmer Epistemological Foundation for the Relationship Between Tacit and Explicit Knowledge

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Abstract. Tacit knowledge has become one of the most used buzzwords in many scientific areas, especially in the area of knowledge management, during the past twenty years. In the mainstream of contemporary KM literature the concept of tacit knowledge has been brought in a relatively rough way alongside the traditional conception of knowledge (explicit knowledge) without further analysing the theoretical coherence of the resulting epistemology. Moreover, tacit knowledge is usually defined only vaguely as “knowledge difficult to articulate” as opposed to articulate, explicit knowledge. These factors have led to puzzling or even internally contradictory epistemological views. We critically analyse the predominant epistemological views in the knowledge management literature from the theoretical perspective. We outline a theoretically firmer epistemological model based on Polanyi’s original conception of tacit knowledge. We claim that although knowledge management is relatively new scientific area, its roots should be firmly grounded in the philosophical problems concerning knowledge if it is expected to present credible theories that could support knowledge management practices.

Keywords: epistemology, explication, explicit knowledge, Polanyi, tacit knowledge, theory of knowledge

1. Introduction

For over two decades tacit knowledge and its relation to explicit knowledge have been widely discussed topics in the fields of management studies, information system science and particularly in knowledge management (KM). In the 1990’s the concept, originally adopted from Polanyi’s theory of knowledge, became related in the KM literature to the widely supported claim that organizations could achieve competitive advantages by using effectively their unique knowledge (see e.g. Nonaka and Takeuchi 1995). As a result, the focus of KM literature shifted from explicit forms of knowledge to softer and more complex resources of knowledge that were not stored in information systems but held in human minds. Since then hundreds of scientific papers and reports have presented possible procedures, models and theories for making tacit knowledge representable by converting it to explicit knowledge. The innermost aim of these suggestions is to harness valuable personal understanding and insights to common benefit in organizations.

However, analysis of epistemic views discussing the relation between tacit and explicit knowledge, and particularly the ones that stress the importance of making tacit knowledge explicit, shows that the concept is often used in inconsistent, even misleading ways. According to Cowan et al (2000), very often the meaning of the concept itself remains literally tacit. Various authors (e.g. Grant 2007; Wilson 2002; Tsoukas 2003) have argued that the fundamental content of the concept has been misinterpreted. This suggests that the subject area is still inadequately studied.

Conceptual clarity is not important only from the perspective of internal theoretical consistency of KM; KM is a multidisciplinary field of science, which means that it should communicate with other relevant fields of science. This naturally becomes difficult if central concepts adopted outside the field are redefined. Instead, theoretical statements from different disciplines should refer to the same set of phenomena (Bunge 1967).

The focus of KM is evidently on the management and use of knowledge, which means that the area is above all practical. In this sense it may seem doubtful to introduce profound epistemological considerations to the practices of the field. However, the moment we begin to discuss *theories of knowledge creation* and *explication of tacit knowledge* we cannot avoid epistemological consideration because we have to know what we are theorizing about; from the scientific perspective the problem is significant because theories based on vague concepts are themselves vague and hence close to meaningless.

The question about the relationship between tacit and explicit knowledge is important because it lies in the very heart of the KM theory. Although Nonaka and Takeuchi's original theory has been revised and modified (see e.g. Nonaka and Peltokorpi 2007), the epistemological foundation (namely the classification of knowledge into tacit and explicit) of their original theory has gained a dominant role as the basis for epistemology in the KM theory (Maasdorp 2007; Stacey 2001). Moreover, since the publication of Nonaka and Takeuchi's theory the epistemological distinction between tacit and explicit knowledge has been so influential that even the whole field of KM has been defined basing on it. For example, according to different authors KM means

"...systemic and organizationally specified process for acquiring, organizing, and communicating both tacit and explicit knowledge..." (Alavi and Leidner 1999: 6);

"The identification, optimization, and active management of intellectual assets, either in the form of explicit knowledge held in artefacts or as tacit knowledge possessed by individuals or communities." (Snowden 2002: 63);

"...the formalized, integrated approach of managing an enterprise's articulated and tacit knowledge assets." (Capeda-Carrión 2006: 34).

Theories can be considered as a systemization of practice, and as such they serve as a framework for making sense of the subject area. Respectively, indefinite theoretical frameworks may cause wider problems for the practices of the field by directing research to wrong lines. For example, technology developed to mine tacit knowledge of the users is of little value if it is unclear what exactly should be mined. Grant and Qureshi (2006) remark that many KM projects have stated as their aim the conversion of tacit to explicit knowledge, and storing and sharing it by developing proper ICT-systems for the purpose. These projects, however, often have had very limited success (Grant and Qureshi 2006). As Grant (2007) suggests, this might have very negative effects on organizations.

Tacit knowledge is usually defined simply as "knowledge difficult to articulate" or "unexpressed knowledge" as opposed to articulate, explicit knowledge (e.g. Nonaka and Takeuchi 1995; Baumard 1999; Steward 1997). We argue that one key factor behind the conceptual vagueness of the concept of tacit knowledge is the lack of profoundly studied epistemological foundation of the relation between tacit and explicit knowledge. Generally, the meanings of theoretical concepts are determined by the scientific theories in which they occur (Tuomela 1973). Accordingly, to attain a better theoretical understanding of tacit knowledge and its relation to explicit knowledge we have to go back to Polanyi's epistemology—and not just for picking up one concept but to assess the theory as a whole because not only the expression providing a definition of the concept but that entire theoretical context signifies the concept to be defined (Tuomela 1973).

We claim that Polanyi's theory has not been taken into account as a whole in the epistemological foundations upon which the theories of application of tacit knowledge rest—despite the fact that Polanyi's theory is mentioned and referred basically by every author. The concept has been brought alongside with the traditional conception of knowledge, which leads to theoretical confusion as will be shown. We critically analyse the two epistemological theories (knowledge as tacit and explicit categories; knowledge as spectrum) that seem to have wide influence in the contemporary KM literature. Based on Polanyi's epistemology, we sketch an epistemological model that aims to conceptual clarification of tacit and explicit knowledge and the relationship between the two. We examine in this work the components of which different conceptions of knowledge consist in order to compare them and to assess their internal consistency. The aim of this work is to point some flaws in the mainstream epistemic view of KM and present more coherent epistemological model, still based on Polanyi's theory.

2. Epistemologies of KM literature—how Polanyi's theory has been interpreted

Based on the foundations of positivist epistemology, the majority of the contemporary knowledge literature develops typologies that distinguish between different types of knowledge (Hislop 2005). The most common distinction, and also the one that we are interested in, is between tacit and explicit knowledge. This view can be considered significant because the most cited authors of knowledge management and intellectual capital literature¹ (e.g. Nonaka and Takeuchi 1995; Davenport and Prusak 1998; Steward 1997) embrace it, and many

¹ According to Serenko and Bontis' (2004) meta-review of knowledge management and intellectual capital literature that surveyed all citations of the topic (about 60 publications in total) in three major knowledge management journals (Journal of Intellectual Capital, Journal of Knowledge Management and Knowledge and Process Management).

authors after them have adopted it (e.g. Johannessen et al 2000; Kikoski and Kikoski 2004; Seidler-de Alvis and Hartmann 2008). The tacit/explicit distinction came to prominence in KM literature through the work of Nonaka and Takeuchi's theory of knowledge creation (Mooradian 2005). Nonaka and Takeuchi (1995: viii) express the foundation of their epistemology clearly:

"In this book we classify human knowledge into two kinds. One is explicit knowledge, which can be articulated in formal language including grammatical statements, mathematical expressions, specifications, manuals and so forth. This kind of knowledge thus can be transmitted across individuals formally and easily. ... However, we shall argue, a more important kind of knowledge is tacit knowledge, which is hard to articulate with formal language. It is personal knowledge embedded in individual experience and involves intangible factors such as personal belief, perspective, and the value system. "

This view treats (explicit) knowledge in a traditional way, namely defining it as justified, true belief. For example, Nonaka and Takeuchi (1995: 58) state: "In our theory of organizational knowledge creation, we adopt the traditional definition of knowledge as 'justified true belief.'" A fundamental assumption that this view makes is that (explicit) knowledge is objective and discrete entity (Hislop 2005). As tacit knowledge is seen convertible into explicit knowledge, the most crucial KM process is to identify the sources of significant tacit knowledge and codify that tacit knowledge to explicit (Nonaka and Takeuchi 1995; Steward 1997; Kikoski and Kikoski 2004).

However, this view has some theoretical problems, and we next discuss briefly the two most significant of them.

First, Polanyi never said that there existed two types of knowledge ontologically although many authors claim so (e.g. Baumard 1996; Spender 1996; Jasimuddin et al. 2005). In Polanyi's theory tacit and explicit knowledge are related to two different kinds of awareness, subsidiary awareness and focal awareness respectively. The things that we are attending to and that we are consciously aware of (e.g. propositional belief, mental image, external object, read sentence etc.) belong to focal awareness. However, all focal awareness is dependent on subsidiary awareness that consists of variety of clues, elements and processes (personal knowledge structures, emotional processes, past experiences, motor responses etc.) that enable focal awareness giving rise to the personal meaning of its contents. This is the structure of all acts of knowing (Polanyi 1969). Hence, the focal object is always identifiable and in this sense explicit, whereas subsidiary content is unidentifiable, tacit. In addition, the two kinds of awareness are mutually exclusive; when the attention is switched to something hitherto subsidiary, it becomes focal losing its subsidiary meaning (Polanyi 1964). Most importantly, this tacit-explicit structure concerns *all acts of knowing*; tacit knowledge is not a separate category of knowledge but an integral component of all knowledge. Hence, to divide knowledge into two categories is not only misunderstanding of Polanyi's thinking but totally opposite approach to knowledge. Also other authors have addressed this problem (e.g. Hedesstrom and Whitley 2000; Tsoukas 2003; Grant 2007). Polanyi's theory is often referred as "theory of tacit knowledge" (e.g. Refaiy and Labib 2009; Mooradian 2005; Stenmark 2000), which might feed the misinterpretation. Importantly, Polanyi's theory is a *theory of knowledge*, whose vital component the tacit dimension is. Tacit dimension is present in *all knowledge*.

Second, the categorisation of knowledge into tacit and explicit and the idea of conversion of tacit knowledge into explicit knowledge leads to puzzling, even internally contradictory, overall epistemology. For example, Nonaka and Takeuchi (1995) originally saw rather unproblematic that something subjective and intangible (as they characterised tacit knowledge) became converted justified, objective and true belief. However, the process of explication (or externalization) does not explain how tacit knowledge becomes justified and true. The main point of Polanyi's epistemology was that specifically due to the tacit dimension of knowledge it could never be objective or fully justified.

The epistemology that divides knowledge into two categories has also one practical constraint that does not coincide with our everyday experience. For example, I might be able to articulate reasons why I choose one option over another being, however, unable to exhaustively explain all the factors that have affected my choice. In this sense the described epistemological view is a rather rigid because knowledge is defined either tacit or explicit but the forms of knowing "in-between" are not explained. A logical consequence is that the definitions of these two categories of knowledge become unavoidably vague in the case of borderline instances of knowledge.

It has been argued (e.g. Hislop 2005; Tsoukas 2003; Brown and Duguid 2001) that tacit-explicit dichotomy misunderstands Polanyi's analysis of knowledge. Indeed, it seems to give a simplified conception of knowledge in a sense that it is a compromise between polyanian epistemology and traditional definition of knowledge, which leads to non-realistic epistemic view. Supposedly for these reasons this perspective has been afterwards modified to more workable theory of knowledge that recognizes the inseparability between tacit and explicit knowledge better but still supports the idea of sharing of tacit knowledge.

The modified view is based on the idea that all knowledge exists on a spectrum (or continuum) that runs from tacit (uncodified) knowledge at one extreme to explicit (codified) knowledge at the other (Leonard and Sensiper 1998; Hall and Andriani 2003; Jasimuddin et al 2005). Leonard and Sensiper (1998) remark that most knowledge exists in between these two extremes, which is the main modification compared to the tacit-explicit dichotomy discussed above. This conception of knowledge takes into account Polanyi's thinking, namely the idea that knowledge has both tacit and explicit dimensions. The position of knowledge on the tacit-explicit spectrum is then determined by its tacit-explicit mix (Jasimuddin et al 2005). This epistemic perspective² is described (as we understand it) in figure 1.

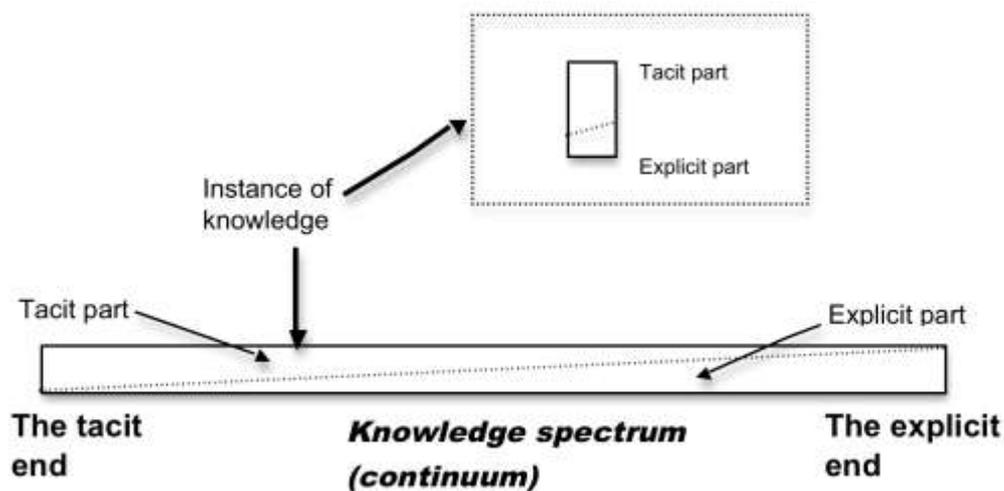


Figure 1: Knowledge seen as a spectrum. According to this view knowledge-spectrum has tacit and explicit ends. Hence, any given instance of knowledge has a tacit part and an explicit part unless not taken from either of the ends

However, as a theory of knowledge this view also has some illogical or at least unexplained features. First, the explicit pole of the knowledge continuum still is not in line with Polanyi's theory. Polanyi denied the existence of wholly explicit knowledge (because all knowledge is tacit or based on tacit knowledge, see Polanyi 1966). However, it would be obviously simple to modify the model and figure 1 so that in the explicit end knowledge only approached explicitness but the continuum ended before *total* explicitness. In fact, Leonard and Sensiper (1998: 113) seem to think so as they write: "At the other end of the spectrum, knowledge is almost completely explicit". However, most authors seem to think as does McAdam et al (2007: 47): "Knowledge can be viewed as a spectrum where one extreme is seen as completely tacit and implicit knowledge and the other as completely explicit or codified knowledge."

It is an interesting question how different instances of knowledge then are situated in the continuum. For example, Hall and Andriani (2003) situate 'intuitions' to the tacit end and 'theory of gravitation' to the explicit end. It might be possible to *present* the theory of gravitation "explicitly", but as a form of knowledge many scientific theories are anything but explicit; the theory of gravitation probably represents very different kind of things to a novice compared to its meaning to an experienced physicist based on their experiences and existing

² There are similar views to 'knowledge as spectrum'-view, only described in a different manner. For example, Edwards (2009) presents knowledge as two circles with the tacit part as a smaller circle within the bigger, explicit circle. The size of the inner circle (tacit part) varies depending on the level of tacitness/explicitness of the particular instance of knowledge. Hence, the relational amounts of tacit and explicit parts of any instance of knowledge can be presented with this model in an analogical way to the way an instance of knowledge is presented in figure 1. The obvious difference is that Edwards' model is not continuous in a same way that knowledge as spectrum-view.

knowledge structures, among others. Exactly this is the significance of the tacit dimension that enters into every act of knowing—and why completely explicit end of the spectrum is not very realistic.

Second, spectrum-view of knowledge also seems to lead to relatively sharp tacit-explicit dichotomy as many authors apply it as a background theory for sharing of tacit knowledge (e.g. Leonard and Sensiper 1998; Hall and Andriani 2003; Jasimuddin et al 2005). Let us observe any given instance of knowledge on a knowledge spectrum; it has a tacit and an explicit part. In order to share tacit knowledge we should codify it first (Nonaka and Takeuchi 1995; Hall and Andriani 2003). The process of codification means that tacit knowledge is converted explicit. Hence, a certain amount of the tacit part of that particular instance of knowledge would be replaced by explicit knowledge. This means that the proportion of explicit part to tacit part grows and hence, that particular instance of knowledge must shift towards the explicit end of the spectrum if the codification succeeds.

Consequently, the same knowledge can exist in various points in the spectrum. In a logical sense this means that the same instance of knowledge can exist in various forms in the knowledge spectrum. Thus, a presupposition of the process of explication/externalization/codification of tacit knowledge always presupposes also two different forms (or categories) of knowledge. For example, Hall and Andriani (2003: 146) explain: “Until the system of bass and treble clef notation was devised [in C12th] the knowledge of music could only be acquired by direct experience.” Hence, they situate ‘music pre C12th’ almost to the tacit end of the spectrum and ‘music post C12th’ almost to the explicit end of the spectrum. The authors seem to suggest that more or less the same knowledge of music can exist in two different forms of knowledge, tacit and explicit. Basically this leads back to categorization of knowledge and some kind of knower-independent, objective ideal of knowledge—which, again, are issues that Polanyi wanted to criticise with the concept of tacit knowledge.

Third, even if it were assumed that some tacit knowledge could be traced, supposedly most of it would remain hidden. This means that it is impossible to specify the amount of tacit knowledge that a given instance of knowledge includes. Following from that, it is also impossible to specify the location of any given instance of knowledge on the knowledge spectrum. Therefore we might ask what explanatory power the ‘knowledge as spectrum’-view actually provides? Compared to ‘knowledge as category’-view it takes into account that there exists forms of knowledge “between” tacit knowledge and explicit knowledge. Besides that it does not seem to resolve other problems of ‘knowledge as category’-view. Moreover, whereas the ‘knowledge as category’-view makes it rather clear that tacit knowledge is dependent on knower and explicit knowledge is independent of knower, the spectrum-view does not provide very clear explanation of the role of the knower in the process of knowing. Evidently, tacit end and explicit end represent knower-dependent and knower-independent knowledge respectively, but what about the instances in between? Accordingly, the spectrum-model is argued to provide a unified conception of knowledge but it cannot explain what the knower’s relationship to knowledge is. Hence, although it covers different types of knowledge, no supporters of this view have provided further explication of the nature of knowledge in general suggesting that the view has not been considered completely.

3. Towards theoretically firmer epistemology

We base our understanding of the nature of knowledge on the polyanian argument that knowledge requires active participation of the knower and is hence knower dependent. Knowing is an act of a particular individual. The claim that there is knowledge in itself, without a concrete knowing subject, is fantastic (Bunge 1974). Whenever we express what we know we can only do so by “sending” messages of some form. Such messages, however, carry for the most part information, which only a knowing mind can assimilate, understand and incorporate into its own knowledge structures (Wilson 2002). Despite the various ways to codify and store “knowledge”, stored knowledge does not seem to have much meaning until it is used for some purpose (by someone). When we know something, we engage in that what we know and cannot be neutral or indifferent in relation to it; we have no means to abstract the knowledge from our life and experiences by the means of which we understand that knowledge.

If the knower dependency of all instances of knowing is accepted it means that the tacit dimension of knowing also enters in all types of knowledge as Polanyi argues; knowledge is represented in the mind of the knower and it is thus necessarily dependent on the processes and elements that take part in the forming of that representation. In this sense even an instance of knowledge that is presented in an explicit form (e.g. a note written on the paper) has a tacit dimension. The conscious representation in turn forms the explicit dimension of knowledge.

It is important to bear in mind that knowledge presented in an explicit form can only be originated from a relatively clear representation in the mind; we can articulate and describe only things that we are conscious of (Ledoux 2002). In Polanyi's terms, explicit knowledge is created to focal awareness as a result of tacit processes in subsidiary awareness. In this sense for example any proposition is equally explicit whether we read it, hear it said by another person or come to think it spontaneously by ourselves. The main point is that explicitness of knowledge does not refer only to the form in which a given instance of knowledge is presented; the clarity of knowledge and the way we regard it is not dependent on the form of presentation of that knowledge. Hence, in the epistemic sense explicitness refers to the coherence of knowledge, which in turn refers to origins and justifiability of the belief in question.

In sum, given that knowing occurs within a human knower, all knowledge has necessarily a tacit dimension that refers to subconscious or otherwise subsidiary processes and elements that reflect the experiences of that particular knowing subject, but are also typical to any human cognition. As a result of the tacit factors the knower forms a focal conception of the matter, which represents more or less explicit knowledge. Hence, all instances of knowledge have tacit and explicit parts (Polanyi argued that all knowledge can be tacit, that is, an instance of knowledge that does not have an explicit part. However, in this case even the knower does not consciously know that he is knowing something tacitly and such a situation can be considered as a special case of knowing that simply cannot be commented on much). When this basic structure of knowledge is taken into account, knowledge can be further divided into categories in a suitable way (for example in a way adopted from psychological memory research: conditioned knowledge, semantic knowledge, episodic knowledge, procedural knowledge). Importantly, *all* categories in the model should manifest this structure. The basic structure of knowledge is described in figure 2.

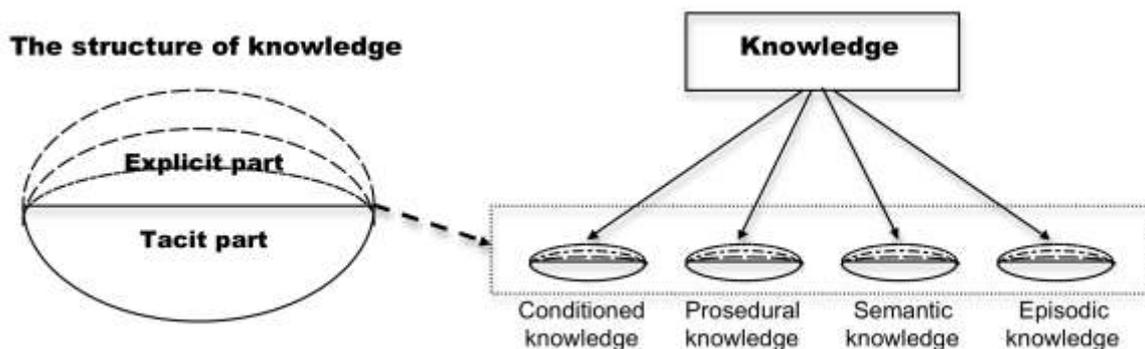


Figure 2: The structure of knowledge. Knowledge has a tacit part upon which the possible explicit part is founded.

All instances of knowledge manifest this structure, even if knowledge is further categorized in a suitable way depending on the context. In this figure is presented an example of categorization adopted from the psychological memory research

It is useful to relate this conception to the traditional definition of knowledge (knowledge as justified, true belief) in order to clarify it. The starting point of knowledge in the traditional definition is the belief; knowing something posits that the thing being known must be believed. However, according to this definition we must distinguish correct beliefs from incorrect ones. Thus, the belief must somehow correspond to the state of things in reality in order to be considered knowledge. This, however, is still not enough because for example a lucky guess could be interpreted to be knowledge. Therefore there has to be some grounds for holding a certain belief—the belief must be justified. Indeed, traditional theory of knowledge as a branch of philosophy is most basically a theory about epistemic justification (Pollock and Cruz 1999).

Whereas the traditional analysis of knowledge described above starts from the belief and the analyses truthfulness and justification of the belief, Polanyi's analysis is focused on the factors that *form the belief*. In this sense Polanyi's theory expands traditional view on knowledge. This idea is described in figure 3.

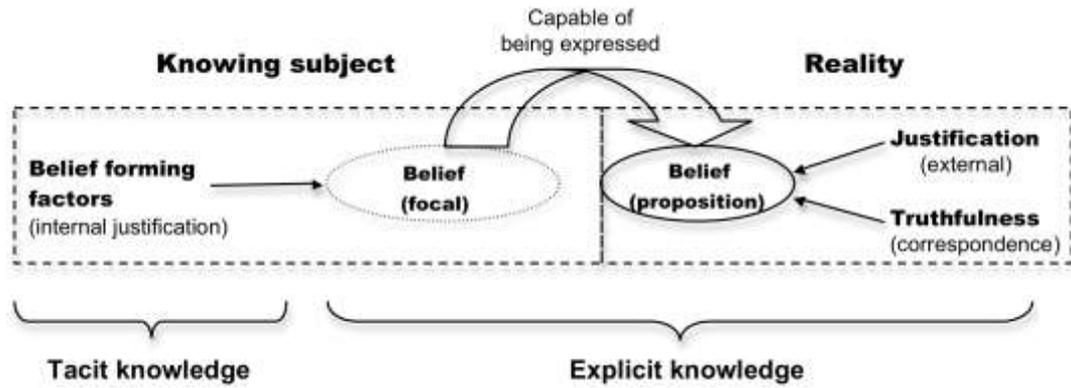


Figure 3: The relation between traditional definition of knowledge ('Reality') and Polanyi's theory of knowledge ('Knowing subject').

In Polanyi's theory both the focal belief in the knower's mind and articulate belief represent explicit knowledge. Tacit knowledge refers to belief forming factors that cannot be fully traced. In this sense tacit knowledge can be understood as an internal justification for the focal belief. Instead, the traditional approach to knowledge studies justification and truthfulness of propositional beliefs

This view suggests that knowledge has two types of justification. External justification refers to justification in the traditional sense; the requirement to objective explanation/argumentation of how that belief has been attained. It is specifically related to the ability to publicly present evidence supporting a claim (Niiniluoto 1999). Thus, (external) justification is directed at the belief or other form of representation that the knower holds. But all evaluations of beliefs derive from belief-forming processes (Goldman 1986). In this sense the idea of internal justification comes close to the basic argument of naturalized epistemology according to which epistemic status of a belief state depends on psychological processes that generate and sustain it (Kitcher 1992). Accordingly, natural cognitive and physiological processes involved in the process of knowing refer to internal justification of the formed belief and cannot be bypassed in an analysis of knowledge. Instead of being particularly interested in the norms that justify human knowledge, Polanyi stressed the importance of confidence in human cognitive capacities in understanding reality.

The epistemological conception presented above has considerable strengths compared to the two models predominant in the KM literature discussed in the section four. First, instead of simply picking up the concept of tacit knowledge from Polanyi's theory and transferring it to more objectivist epistemological environment, we have begun from Polanyi's theory and related it with the traditional conception of knowledge. The analysis shows that the traditional view and Polanyi's view are incompatible—mainly because of considerably different conceptions of the requirement of justification of knowledge. Second, we express clearly the knower-dependency of knowledge. Every individual knows in his own way, from his basis. Interestingly, this has been originally the starting point of knowledge sharing but from the theoretical perspective the idea seems to get lost somewhere *en route*. Third, as other critics have also suggested tacit knowledge is narrower phenomenon than KM literature intimates in the sense that our narratives, beliefs, impressions etc. do not represent tacit but focal ("explicit") knowledge whose interpretation is the charge of the receiver and his tacit mental capacity.

4. Conclusions

The predominant epistemological conceptions behind the relationship between tacit and explicit knowledge and the idea of explication of tacit knowledge are not based on the proper analysis of knowledge nor Polanyi's theory. As a result, the epistemological foundations behind the tacit knowledge discussion tend to wake more questions than provide answers. This has led to confusion and inconsistency in the discourse concerning tacit knowledge and its relation to explicit knowledge—even up to a point that some critics (e.g. Wilson 2002; Grant 2007) have claimed that the concept of tacit knowledge has become meaningless nonsense.

The origin of the problem of conceptual vagueness is that the concept of tacit knowledge is taken from an epistemological environment that differs radically from the theoretical environment that it has been brought to. In order to get the concept function in the new context it has been interpreted very loosely. Moreover, given that one of most important functions of theoretical models (for example the models of explication of

tacit knowledge) is to make predictions, it is obvious that models including poorly defined concepts make wider amount of predictions--up to a point at which the made predictions are anything but accurate, reliable or even very clear. Therefore not surprisingly, in the case of tacit knowledge it is somewhat simple to report positive results in the experiments concerning explication or externalization of tacit knowledge because some assumptions, beliefs, insights or previously unspoken "knowledge" can always be "externalized" out of the subjects regardless of the used method. Instead, a little attention seems to have been paid on the question, in which sense the "explicated tacit knowledge" has been previously tacit.

The application of Polanyi's theory of knowledge as the basis of KM theory is justified because knowledge understood traditionally as justified true belief simply is too narrow to explain human way to know and act in complex environments. One of the most significant contributions of Polanyi's epistemology is the consideration of pre-logical phases of knowing that unavoidably affect the way we know. Polanyi's theory broadens the scope of knowledge as he accepts feelings and intuitions not only as valid but also as necessary elements of knowing. Polanyi's argument concerning the knower-dependency of knowledge (that knowledge is necessarily dependent on the subjective processes and elements that take part in the forming of the focal part of knowing) is also well justified from the psychological perspective.

We have suggested a simple epistemological model that is in line with polanyian theory of knowledge. We argue that this model provides more coherent foundation for KM theory than the two epistemological views that are predominant in the contemporary KM literature. Given that tacit knowledge is inarticulate and inaccessible by definition, we suggest that in attempts to classify knowledge the focus should be on different forms of focal ("explicit") knowledge; instead of explication of tacit knowledge we should discuss crystallization of (focal) knowledge that is difficult to articulate. Hence, we would like to stress that our aim is not to criticize the goals and methods of knowledge sharing in general but to develop the aspects that are shown to be inconsistent in the present KM theory.

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