

Transdisciplinary Hermeneutics: A Symbiosis of Science, Art, Philosophy, Reflective Practice, and Subjective Experience

by

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Abstract: This article explores the concept of transdisciplinarity as a cultural endeavor. It centers on the concept of transdisciplinary hermeneutics, as a form of contextualizing science in the framework of cultural ideas, subjective experiences of the researchers involved in the research process, and of imagination and the artful creation of possible new realities. The concept is rooted in the work of Basarab Nicolescu and the Paris based CIRET, the “Centre International de Recherches et Études Transdisciplinaires.” In this approach, reality is seen as complex and multilayered, and cannot be known only through the lens of modern science. Philosophy, art and subjective experience are essential and complementary ways of knowledge production that provide context to scientific knowledge, giving it meaning and perspective. To be able to engage in transdisciplinary hermeneutics, researchers need to complement cognitive knowing with embodied and enacted knowing. They as well need to combine the formal and science-based language of what is seen and measured, with the poetic, polyphonic and metaphorical language of what is unseen but sensed, felt and envisioned. The article finally sketches the importance of two competencies that transdisciplinary researchers need to acquire, the competencies of mindfulness and of transdisciplinary dialogue of knowledges.

Keywords: transdisciplinary hermeneutics, teamwork, culture, embodied cognition, reflective practice mindfulness, bodywork, dialogues of knowing

1. Introduction

As Julie Klein rightfully argues, the concepts of multi-, inter- and transdisciplinarity are still not very clearly defined, despite the ever-growing quantity of publications on these topics (Klein, 2008, p. 116; Dieleman,

2015a). It is therefore important to be precise in delineating the version of a concept one is working with. Usually, transdisciplinarity is seen as a means of collaborative research and joint societal problem solving, involving various stakeholders such as academics and representatives of private industry, governments, and societal interest groups (Hirsch Haddorn, 2008). An important objective is to address the complex challenges of the 21st century and to find solutions for problems that reflect and integrate various societal perspectives. As McGregor formulated it, the idea is that we need a symbiosis of the perspectives of science, economics, technology, and politics, and that transdisciplinarity is a way to provide such a symbiosis (McGregor, 2015).

The approach I present here is different. It does not look for a symbiosis of science with economics, technology and/or politics, but rather for a symbiosis of modern science with philosophy, art, reflective practice and subjective experience. The objective is to contextualize science in the framework of cultural ideas and concepts, values, emotions and visions, rather than in the framework of technology, economics and politics. It is rooted in the work of Basarab Nicolescu and the Paris based CIRET¹, the “*Centre International de Recherche et Études Transdisciplinaires*.” Nicolescu founded CIRET in 1986, together with the philosopher of complexity thinking Edgar Morin, the philosopher and inventor of ternary logic Stéphane Lupasco and the art historian René Berger. The four men together provided important inputs for Nicolescu’s transdisciplinary thinking, which is based on particular ontological and epistemological assumptions. Over the past two decades, the CIRET approach attracted considerable attention in especially the non-Western parts of the world. Nicolescu served during several years as Professor Extraordinary at the Stellenbosch University in South Africa, and is a Doctor *Honoris Causa* of the University of Veracruz in Mexico, as in the University of Craiova, Craiova, Romania. In Veracruz, Mexico, Dieleman and Nicolescu were part of a team that developed a doctoral program in Transdisciplinary Studies based on the CIRET approach, a program that has been operational since 2014².

In the thinking of CIRET and Nicolescu, reality is complex and discontinuous, and we cannot know all of reality through the lens of modern science alone. Nicolescu, a theoretical physicist by training, sees reality as made up of distinct levels, each fundamentally different than the others, that can only be disclosed when we apply an epistemology or way of knowing that corresponds to a particular level. Nicolescu mentions the microphysical world of quantum particles, but equally makes reference to the level of subjective experiences

¹ http://ciret-transdisciplinarity.org/index_en.php

² <https://www.uv.mx/detransdisciplinarios/>

or the level of imagined worlds. These are all levels of reality where modern science falls short. That is why we need to complement modern science with knowledge coming from other epistemologies. Only through fusing these ways of knowing – Nicolescu calls this transdisciplinary hermeneutics – are we able to see the richness and complexity of the world around us. This allows us to create meaning and purpose beyond the insights science provides us with, an aspect that is very crucial for Nicolescu's view on transdisciplinary.

In this way of thinking, reality is plastic, as it changes according to how we feel, think and act. It is not something "out there" that we know or capture in words or mathematical equations. It is the fruit of our own creation, which constantly changes according to our feelings, thoughts, and actions. Reality depends on us, Nicolescu argues, on our imagination, motivation, actions and behavior. As a consequence, knowing is a constructive act of creating a *particular* reality out of many possible realities we potentially can create. Nicolescu sketches several important consequences of the principle that reality is plastic. This first of all means that we need to be very self-reflective and we should constantly question the knowledge we develop. Within this context, Nicolescu criticizes modern science for the almost total exclusion of the subject of knowing from the knowing process. What is needed – as an essential part of transdisciplinary knowing – is to pay as much attention to the subject of knowing as to the object of knowing, including attention that goes beyond the subject's intellect. Our imagination, our emotions and our bodily interactions with the environment equally should be included in such evaluations and reflections.

In the first part of this article, I will present an extensive overview of Nicolescu's work, which is mainly theoretical. I will make extensive use of two decades of Nicolescu's publications, ranging from his 1996 *Manifesto of Transdisciplinarity* up to his 2014 book *From Modernity to Cosmodernity. Science, Culture, and Spirituality* (Nicolescu, 2002, 2006, 2008, 2010, 2012, 2014a, & 2014b). In the second part of the article I will build upon Nicolescu's ideas, and especially his concept of transdisciplinary hermeneutics. I will contextualize this discussion in terms of embodied cognition, describe the relevant knowledge components, and provide an example of transdisciplinary hermeneutics applied to a city. Finally, I will present two key competencies of transdisciplinary hermeneutics in terms of mindfulness and dialogue, competencies in which we should train our students so as to allow them to engage in transdisciplinary hermeneutics.

2. Nicolescu's Transdisciplinarity Emerging out of the Quantum Revolution

Nicolescu contextualizes his transdisciplinarity project within a large historical movement that encompasses the era of modern science and modernity, including pre-modern times and particularly the Renaissance, through the current period that he proposes to call “cosmodern” (Nicolescu, 2014b). In the Renaissance, Nicolescu argues, science and culture asked the same questions; they were interested in the meaning of the universe and in the meaning of life (Nicolescu, 2014b, p. 7). This changed with the gradual introduction of Enlightenment thinking, and in particular with the introduction of the principles and axioms of modern science. According to Nicolescu, modern science – like modernity itself – started with the axioms Galileo Galilei introduced in 1632 in his book *Dialogue Concerning the Two Chief World Systems*.

In this book, Galileo compared the Copernican system (in which the earth orbits the sun) with the Ptolemaic system (in which everything circles around the earth) and introduced a number of fundamental axioms regarding the nature of reality and the way we can know reality. In essence, Galileo introduced a world that is “out there,” independent of our own observations, that is characterized by order and regularities, and can be known and understood in mathematical and objective ways, independent of subjective influences or interpretations (Nicolescu, 2014b, pp. 3-11).

Nicolescu, a theoretical physicist by training, argues that we still largely live with a seventeenth century (Galilean) concept of science as well as of reality, because we still largely ignore how the quantum revolution has changed the fundamentals of how science sees reality. He takes the position that scientists (social and applied scientists included) have not really incorporated the insights of quantum physics. For Nicolescu, the quantum revolution is as profound as the shift from the Ptolemaic towards the Copernican worldview, and it needs to be matched with a science that is as different from modern science as modern science was different from Renaissance science. To explain how the quantum revolution should change our view of reality and science, Nicolescu introduces various concepts such as “Levels of Reality,” “Ternary Logic,” “Plasticity of Reality,” “Unity of the Subject and the Object of Knowing,” and “Transdisciplinary Hermeneutics.”

2.1 Reality as Complex: Levels of Reality and Ternary Logic

Nicolescu looks at his concept of “Levels of Reality” as a key to understanding

his transdisciplinary approach to nature and knowledge (Nicolescu, 2010, p. 25). In developing this concept, he combined insights from quantum physics with various philosophical ideas that go back as far as the seventh century monk and writer John Climacus (John of the Ladder), the philosopher Nicolai Hartman, and the physicist Werner Heisenberg (Nicolescu, 2014b, p. 205). They all conceptualized reality as being made up of various levels with a consequence that, even though reality is one, it is discontinuous and therefore complex.

Central in this notion of “Levels of Reality” is the rejection of the (Galilean) axiom of the existence of universal laws in nature that apply everywhere in the same and unequivocal way. This axiom is obsolete, Nicolescu argues. Quantum particles in the microphysical world radically depart from the laws of the macrophysical world, because their level of reality has a different space-time. They are subordinate to different laws and fundamental concepts than the laws of gravity, the speed of light, logic or causality (Nicolescu, 2010, p. 25). The complexity of reality, with its ambiguity and incongruence, is a constituent force that accounts for dynamics, movement, and transformation. Instead of trying to eliminate such forces conceptually, it is important to recognize them and see them as creative forces in any reality. This view has far-reaching consequences.

Under the rules of classical physics, reality requires uniformity, and contradiction always means that one of two opposing views is false. This is expressed in Aristotelian binary logic stating that A is A and can never be Non-A at the same time. Nicolescu replaces this logic with the concept of “Ternary Logic” that allows for unity in a contradictory reality. The concept of Ternary Logic, or the logic of the third included, was first introduced by Stéphane Lupasco, one of the cofounders of CIRET (Lupasco, 1987). Within Ternary Logic, A can be A and Non-A at the same time, yet on a different Level of Reality (like superposition in the quantum world). What is true on one level of reality – nothing can go faster than the speed of light – may be at the same time untrue on another level (as quantum entanglement suggests), and what may appear as a mutually exclusive contradictory on one level – imagination versus reality – may not be contradictory over multiple levels of Reality. Ternary Logic allows for coherence among different levels of one and the same reality, even though there are contradictions and ambiguity (Nicolescu, 2014, pp. 194-195).

2.2 Knowing over Various Levels of Reality

Subsequently, Nicolescu explored the epistemological consequences of his ontological notion of complexity and Levels of Reality. The level of the macrophysical *material* world can very well be known and understood

using classical logic, he argues, as it gives us meaningful information in terms of cause-effect relationships and related theories. The microphysical world of quantum particles, however, cannot be properly understood in such a way, and – a crucial assumption – this is equally true for other levels of reality, especially levels of non-material reality. Nicolescu criticizes the “materialism” of modern science, formulated in the second axiom of Galileo, stating that true knowledge can only be generated in empirical ways based on the results of scientific experiments.

For Nicolescu, an imaginative world is as real as a material world, which he says as follows: “The human being is the unique being in the universe able to conceive an infinite wealth of possible worlds. These ‘possible worlds’ are certainly corresponding to different Levels of Reality” (Nicolescu, 2012, p. 25). Indeed, reality consists of an infinite number of levels of which many are possible or invisible realities, created by imagination, dream, subjective experiences, and more (cf. Nicolescu, 2010, p. 27). We are able to disclose these levels when we use an appropriate “methodology,” way of knowing, or epistemology to connect with them. Imagination, associative thinking, the use of metaphors, image thinking, dreaming, feeling, sensorial perception, and intuiting are some of these “methodologies” that allow us to disclose other-than the empirically identifiable levels of reality. Essential in this way of thinking is that science can never replace these other methodologies or ways of knowing.

Frank Jackson provides us with an interesting example of the limits of science, in his article “Epiphenomenal Qualia” (Jackson, 1982). He presents Mary, the color scientist who “knows all the physical facts about color, including every physical fact about the experience of color in other people.” But she was confined, since she was born, to a black and white room, only being able to observe the outside world through a black and white monitor. “When she is allowed to leave the room,” Jackson argues, “it must be admitted that she learns something about the color red the first time she sees it – specifically, she learns what it is like to see that color” (Jackson, 1982, p. 130). With this example, Jackson wants to show that modern science can never fully capture the subjective experience of direct perception. The methodologies and tools of modern science simply do not “match with” or correspond to the Level of Reality of the Qualia. Jackson talks in his example about the experience of color, but the same is true for other subjective experiences such as pain, beauty, love, dream, imagination, etc.

Modern science is very powerful in advancing knowledge on the material and the macrophysical level of reality, but we must recognize

that it is limited in disclosing all the richness of reality. That is why it is important to seek knowledge throughout various Levels of Reality, which implies “*knowing in between, across and beyond the scientific disciplines,*” the precise words that Nicolescu uses in his definition of transdisciplinarity (Nicolescu, 2002, 2006; italics added). As a consequence, Nicolescu argues, there is no “overall methodology” that can capture all of reality in the same way, and “knowing in between, across and beyond the scientific disciplines” inevitably means knowing using multiple ways of connecting with, penetrating, and understanding reality. For Nicolescu this means that modern science needs to be complemented with culture, philosophy, art, subjective experiences, spirituality, and oriental wisdom.

It is important to understand, as well, that knowing throughout various Levels of Reality through Ternary Logic allows us to know the complexity of reality that is one yet discontinuous and contradictory at the same time. What may be true for modern science may not be true according to our experience or intuition. What is true in our imagination or dream may not be scientifically proven and is therefore scientifically untrue. Instead of rejecting insights – knowledge, realities – coming from dreams or imagination as fantasy or mere subjectivity, Nicolescu’s transdisciplinary approach gives room for the simultaneous existence of multiple truths. Transdisciplinary knowing is not a mutually excluding either-or knowing (true-untrue), but is an inclusive knowing (both-true). This inclusiveness is a key characteristic of Nicolescu’s thinking on transdisciplinarity, the approach presented in this article.

2.3 Reality is Plastic, Disclosure and the Subject of Knowing

A next crucial ontological idea that Nicolescu introduces is the idea that reality is plastic, meaning that we are the creators of our own reality. “Reality changes according to our thoughts, feelings and actions,” he writes; “it is not something outside or inside of us; it is simultaneously inside and outside of us” (Nicolescu, 2014b, p. 215). To understand this well, it is important to know the distinction he makes between the Real and Reality. For Nicolescu, the Real is simply “all that is.” It is in principle infinite and “forever veiled” in its totality, as we never will be able to “grasp” it completely (Nicolescu, 2010, p. 25). It includes material reality, invisible reality, and all the possible realities we are able to conceive. Reality is what we know or in other words, what we are able to disclose from the totality of the Real.

Nicolescu’s thinking can be interpreted in terms of Hans-George Gadamer’s concept of disclosure as allowing the world to disclose itself

(Gadamer, 1975; Healy, 2015). As John van Breda rightfully emphasizes, the words “how *we allow* the world *to disclose itself*” are essential (Van Breda, 2007, p. 23; italics added). We only see, hear, interpret, feel, or understand the world to the degree that we allow ourselves to do so, and subsequently allow the world to unfold itself. Nicolescu sketches several important consequences of the principle that reality is plastic, and that we know it through disclosure.

This first of all means that we need to be very self-reflective and we should constantly question the knowledge we develop in terms of its possible biases, which are not only rooted in the way we think and analyze, but equally in the way we see, feel, and act. This concurs with the importance of individual and team metacognition, i.e. “thinking about thinking and knowing” as analyzed by Machiel Keestra in this volume (Keestra, 2017). Edgar Morin, another founder of CIRET, formulates this thought in the following words: “Knowledge is not a mirror of things or of the outside world, all perceptions are cerebral translations and reconstructions of stimuli and signs captured and coded by the senses” (Morin, 2001, p. 5). This being the case, he goes on further down the same page: “As we well know this entails countless errors of perception, though these perceptions come from vision, our most reliable sense.” Knowledge in the form of words, ideas and theories is the fruit of translation/reconstruction by way of language and thought and, as such, subject to error. Projection of our fears and desires and mental perturbation from our emotions multiply the risk of errors.” Morin distinguishes among intellectual errors, errors of reason, mental errors, and blinding paradigms (Morin, 1986).

Within this context, Nicolescu criticizes modern science for the almost total exclusion of the subject of knowing from the knowing process. “Modern science” he argues, “was founded on the idea of a total separation between the knowing subject and Reality, which was assumed to be completely independent from the subject who observed it. With very few exceptions – Husserl, Heidegger, Gadamer, or Cassirer – modern and postmodern thinkers gradually transformed the Subject into a grammatical subject. The Subject is today just a word in a phrase” (Nicolescu, 2014b, p. 186). What is needed – and needs to be an essential part of transdisciplinary knowing – is to pay as much attention to the subject of knowing as to the object of knowing, including not only the intellectual level. Senses, emotions, and our bodily interactions with the environment equally should be included in such evaluations and reflections.

Nicolescu introduced in this context the concept of “Levels of Reality of the Subject,” emphasizing the various sources of knowing we can find within

the subjects of knowing, such as perception, emotions, intuition, revelations, or imagination. He frequently emphasizes the importance of phenomenology, which underlines the relevance of embodied knowledge, perception, and lifeworlds in which we operate. He talks about the knowledge of the artist as knowledge that comes from “somewhere else” (compared to the world of science), namely from the inner world of imagination of the artists or from the invisible world of revelations (Nicolescu 2014, p. 12). Disclosure does not only depend on the outcome of empirical research, and equally is not only oriented towards disclosing parts of the Real outside of us. We can equally gain knowledge when we disclose knowledge that is stored inside of us, as in imagination, subjective experiences, dreams, emotions, or desires.

2.4 Transdisciplinary Hermeneutics

Combining the previously mentioned concepts – levels of reality of the object of knowing, ternary logic, the plasticity of reality, disclosure, and levels of reality of the subject of knowing – Nicolescu introduces the concept of transdisciplinary hermeneutics. Essentially, it is a form of transdisciplinary knowing – *simultaneously* – through various levels of reality of both the object and the subject of knowing. It unites, Nicolescu writes, what is measured, observed, and seen using the language of the material like concepts, theories, and equations, with what is unseen using the language of the imaginary like parables, symbols, myths, legends, and revelation (cf. Nicolescu, 2002, p. 144). Essentially, transdisciplinary hermeneutics is an art rather than a science, because it has the potential to make us combine what is with what may be, and what is measured with what is felt and intuited. It is in this context that the symbiosis between science, art, philosophy, and subjective experience, mentioned in the introduction, must be understood.

Others have mentioned such symbiosis as well. Patricia Pisters, professor of Media Studies at the University of Amsterdam, made a similar plea, without explicitly referring to the concept of transdisciplinary hermeneutics. She talked about the collaboration among science, art, and philosophy. Each of these fields, she explained, has its own way of contributing to our understanding of reality. Philosophy provides us with broad and abstract concepts that represent ideas regarding immaterial reality, while science works through an in-depth investigation of small parts of material reality. Art is situated in between the previous two fields, as it creates a materialized reality, while it simultaneously visualizes certain abstract philosophical notions or ideas. Science investigates functions, philosophy concepts and

ideas, and art images, emotions, and movement. We need all three to be able to create an adequate understanding of the complexity of reality, she concluded (Pisters, 2012). Interestingly, Pisters added to her plea the following thought, making a reference to neuroscience, yet perfectly capturing the essence of Nicolescu's transdisciplinarity. The images of reality created in our brain, she argued, as a result of the interaction between the outside world, our body, and our brain, are fundamentally different, when created by science, by art or by philosophy. We therefore literally create different realities.

3. Transdisciplinary Hermeneutics and Embodied Cognition: Components and Application

It is a surprise to me that Nicolescu, when mentioning levels of reality of the subject, never made any explicit reference to neuroscience and the concept of embodied cognition (Wheeler, 2005; Wilson, 2002). Because of that, he never questioned another deeply rooted seventeenth century idea. In the seventeenth century, in the very same period when Galileo published his *Dialogues* and other writings, René Descartes was working on problems of “knowledge” and the “human mind” (Lokhorst, et al., 2001). He formulated the notion that human beings are composed of a physical body and an immaterial mind, while feelings and emotions are independent from brain activity, and vice versa: Reasoning (“cogito”) takes place independent from the bodily processes of feeling and experiencing emotions.

Many neuroscientists today however, have come to the – empirically grounded – conclusion that this idea needs to be replaced with that of the human being as a much more integrated whole, with an indivisible brain-body-environment complex (Damasio, 1994, 2003; Varela, Thompson, & Rosch, 1991). Feelings and emotions are not independent from reasoning; they form part of a complex system where emotions are indispensable for our thinking processes (Hardy-Vallée, et al., 2008). According to Kiverstein and Miller, cognitive processes such as memorizing, reasoning, or planning, which we associate with the highly evolved neocortex, constantly interact with emotions that can be localized in networks in the brainstem, the older – and often perceived as more primitive – part of the brain. There is no hierarchy among them, rather a relationship of “reciprocal interconnection” (Kiverstein & Miller, 2015, p. 3).

Emotions, or better, emotional experiences, are part of our life-regulating, homeostatic and metabolic bodily processes, in response to and in interaction with the surrounding environment. Kiverstein and Miller look at emotions as “action readiness” in the context of our ongoing engagement with the

environment, which involves the whole living body. “Since emotions and cognition are inseparable processes in the brain,” they argue, “it follows that what is true of emotion is also true of cognition. Cognitive processes are likewise processes taking place in the whole living body of an organism as it engages with relevant possibilities for action” (Kiverstein & Miller, 2015, p. 1). In a comparable way, Benjamin Bergen argues that imagining a reality is based on the experiences of our body in particular environments (Bergen, 2012). Lamm, Batson, and Decety conclude that the capacity to feel empathy – which they divide into affective sharing, perspective-taking, and cognitive appraisal – is realized in a similar way, through the interactions of bottom-up motivational and top-down cognitive processes. Perceiving an external environment (the bodily input) produces – through mutually interacting emotional and cognitive processes – the experience of empathy (Lamm, Batson, & Decety, 2007, p. 56). Activity in the brain is accompanied with activity of the body, as this body engages in a certain environment.

3.1 Components of Transdisciplinary Hermeneutics

The concept of levels of reality of the subject of knowing can easily be interpreted in terms of embodied cognition. I conclude from this that a *transdisciplinary subject of knowing* is a truly *embodied cognitioner*. Over the past years I have worked on a conceptualization of such an “embodied cognitioner” who engages in transdisciplinary hermeneutics, distinguishing among three basic knowledge categories or components: cognitive knowing, embodied knowing, and enacted knowing (Dieleman, 2012, 2013, 2015a, 2015b, 2016a, 2016b, 2017a, & 2017b). These ways of knowing together provide the basis for embodied cognition that is truly transdisciplinary and hermeneutic.

3.1.1 Cognitive Knowledge

What I call “cognitive knowledge” is realized through the generation of generalized images of reality, providing us with information about the world around us. Such images are not person-specific or context-specific, but are abstracted representations of reality in linguistic or semiotic forms, in words, concepts, theories, maps, codes, equations, and more. They provide us with socially shared insights, and provide important building blocks for a shared culture and social communication. We know in cognitive ways thanks to – especially – thinking processes in the neocortex of our brain, and thanks to our memory that is capable of storing the generated representations in terms of what we usually simply call “knowledge.” It provides us in first instance

with knowledge of “what is,” followed by explanations and contextualization in the form of questions as “how, why, who, when, and where.” Following Nicolescu’s thinking, it is justified to mention that modernity made us create cognitive knowledge as much as possible independent from subjective experience or imagination. The knowledge thus produced was declared to be superior, as it was supposed to be “true” knowledge, “objective” instead of “subjective.” The distance created between knowledge, meaning and the knowing subject finds its origin in these assumptions.

Modern science – basic, social, and applied sciences included – does have a responsibility here, as it has become the key agent of knowledge production in contemporary society. Scientific research is based on particular rules and principles of knowledge production that explicitly separate the knowing subject from the knowing process. The knowledge thus created is impersonal and formal, aiming at descriptions that are monophonic and unambiguously, leaving no room for subjectivity. Subsequently, this kind of knowledge is taught in schools and universities, seen as the cornerstone of education, called “knowledge transfer.” Through education we learn by means of storing knowledge in our memory. On a societal/institutional level, this knowledge is stored in many carriers of information outside of us, such as in books, manuals, articles, movies, poems, novels, libraries, the Internet, etc.

3.1.2 Embodied Knowledge

What I call “embodied knowledge” is realized through feeling, intuiting, imagining, and sensing the world around us, as well as our inner self. Knowing in embodied ways is, in contrast to cognitive knowing, very personal, contextualized and subjective. It is in large part homeostatic, as we automatically feel, sense, perceive, or use intuition. We do have the capacity though to improve our embodied knowing processes, through training and conscious practice. In terms of Joseph Horvath, embodied knowledge is stored in our body, and/or generated through bodily processes, while the process of becoming aware and conscious is a process of mindfulness, or disclosing the knowledge stored in our body (Horvath, 2001, p.1). Embodied knowledge has the great virtue of placing the cognitive and formal – impersonal – knowledge, previously mentioned, in the context of our personal subjective experiences. It enables us to turn factual and impersonal information into meaningful information, seen from a personal point of view.

Sensorial perception, using our senses of seeing, hearing, tasting, touching, and smelling, is an essential form of embodied knowing. Our organs of perception are our windows to the outside world and provide us with

valuable information on the world around us, in terms of categories such as aesthetics, form, color, texture, vibrations, tensions, harmony, and more. The results of our sensorial activities are perceptions in the form of awareness of colors, odors, movements, sounds, etc., and help us positioning ourselves physically within a given environment. As Morin observed, sensing results in perceptions that are cerebral translations and reconstructions of what we sense. This underscores the conclusions drawn by Kiverstein and Miller that there always is a reciprocal interconnection, involving cognitive processes and bodily movements.

Emotional perception, or emotional experience, is a second important form or component of embodied knowing. Essentially, emotions help us create normative and affective relationships with the outside world. Emotions are on the one hand reflections of our inner personality and disposition, intertwined with specific and usually temporal moods, temperaments, and motivations. On the other hand they are provoked or get a certain form in response to outside stimuli that we receive in the form of being pleasant, threatening, inviting, useless, etc. Emotions provide “color” to what we know, in terms of meaning and significance, and influence our selective perception of reality. They filter out, enlarge, and/or transform certain aspects or characteristics of the reality we perceive. Emotions as well work in reciprocal interconnection, involving the neocortex, the senses, and bodily movements in a particular environment.

I distinguish feelings from emotions, and look at them as providers of information on our internal bodily processes such as breathing, and conditions such as pain, fatigue, hunger, or itchiness. They as well provide information regarding external situations and conditions, such as certain tensions, vibrations, or atmospheres. Feelings not only “color” what we know, but are genuine sources of information about both our internal and our external world. They disclose information that otherwise cannot be disclosed. Feelings as well work in reciprocal interconnection with the brain, the senses, emotions, and our bodily movements in a particular environment.

Intuition is another category or component of embodied knowing. It manifests itself when we are able to use our body as an antenna for receiving information that neither comes through perception nor through conscious cognitive thinking processes. This has affinity with Damasio’s “somatic marker hypothesis,” attaching emotional value to environmental cues/objects, or persons (Damasio, 1994). Charles Sanders Peirce called such processes of intuitively receiving information “abduction.” He characterized abduction as acts of insight that come to us when we try not to think: “the abductive suggestion comes to us like a flash” (Peirce, 1988, p.113). Abductive information ranges from receiving simple ideas to profound

revelations. In economics and management studies, the importance of intuition has been widely recognized since the work of Herbert Simon on bounded rationality (Simon, 1991), while people in religious and spiritual studies pay close attention to the reception of profound revelations, as manifestations of certain spiritual wisdom. William James described such religious insights as “unplumbed by the discursive intellect,” showing us reality outside of established categories of cognitive knowing (James, 1902). James called such revelations “illuminations full of significance and importance, all inarticulate though they remain; and as a rule they carry with them a curious sense of authority” (James, 1902, p. 380).

I look at imagination as yet another form of embodied knowing, which is highly interrelated with cognitive processes associated with the neocortex, and simultaneously with insight that comes to us when we try not to think. Following Csikszentmihalyi, I believe an interesting characteristic of creative/imaginative people is hybridization between states of mind that are often seen in terms of opposites. Creative people tend to have a great deal of physical energy, but are also often quiet and still. They combine playfulness with discipline, and responsibility with irresponsibility. They are both extroverted and introverted, and are both rebellious and conservative (Csikszentmihalyi, 1996). I interpret this hybridization as reflecting the fact that people are in various levels of reality, an essential characteristic that Nicolescu attributes to the arts, artists, and creative processes in general. Montuori adds to the characteristics of creativity by pointing at the system dimensions of creativity, seeing it as the result of certain environmental and process characteristics. Personal characteristics, ways of working, and characteristics of the environment in which a person operates, all contribute to imagination and creativity (Montuori, 2011).

As mentioned, embodied knowledge helps us place cognitive knowing (“knowledge”) in the context of our action, subjective experiences, desires, and motivations. This process of contextualization is a natural process that is in a way “aborted” by the particular rules and principles of knowledge production developed by modern science. Nicolescu’s transdisciplinarity proposes a reevaluation in this respect, and proposes restoring the relationship between cognitive and embodied knowledge. He expects that this will create engaged academic researchers, who ask questions regarding the meaning of life. It also stimulates imagination and intuition, and helps researchers perform tasks outside of, and in addition to, mere logical and analytical thinking processes. This contributes to the process of knowledge as creation, within a reality that is essentially plastic.

3.1.3 Enacted Knowledge

While “embodied knowledge” is locked in our body, “enacted knowledge” is locked in our experiences and actions (Polanyi, 1967). It is to a large extent “know-how” that we subconsciously or automatically apply when we perform various tasks. Because of that, it is closely linked to experience. When we learn how to ride a bike, drive a car, give classes, or a presentation, we consciously need to take many heterogeneous aspects into consideration (look at this!, be aware of that!, don’t forget!, etc.). Once we get experienced, the knowledge gets embedded in the activity, up to the point that we do not know any more in a conscious way how we do what we do (that information is locked). As a consequence, a part of what we know is “veiled,” and can only really be unlocked or disclosed, when we perform the action in a conscious and reflective way.

According to Donald Schön, reflective practice is a process of consciously using our memory of previous life experiences, that Schön describes as reservoirs of stored images and previous life experiences (Schön, 1983). Disclosing enacted – tacit – knowledge is realized in processes of consciously reflecting on what we do, when we perform tasks and are in interaction with others. The great virtue of enacted knowledge is, in the words of Gregory Bateson, that it has the capacity to integrate “hard” data and “soft” data present in any situation (Bateson, 1973, pp. 250-273). While analytical and logical thinking is crucial in formal knowledge, associative and metaphorical thinking is key in enacted knowledge. Schön describes this as follows: “When a practitioner makes sense of a situation he perceives, he sees the unfamiliar, unique situation as both similar to and different from the familiar one, without at first being able to say similar or different with respect to what” (Schön, 1983, p. 138). We constantly “map” situations we encounter by comparing them with the maps and images that we have stored in our reservoir of knowledge and experience.

Enacted knowledge has the big advantage that it links what we do with what we (implicitly) know. As such it is an important condition for bringing the subject of knowing to the forefront of the knowing process. Enacted knowledge, as it is predominantly based on associative thinking, has a great potential for stimulating creativity, especially process-based creativity.

4. An Example of an Application of Transdisciplinary Hermeneutics

Many applied sciences – like, for instance, sustainability sciences, management sciences, or health sciences – often combine different ways

of knowing. Working with the arts, professional practice, and subjective experience is not uncommon, and such practices change the rules and principles of knowledge production that are traditionally prescribed by modern science. One may argue that such projects apply transdisciplinary hermeneutics, and in principle this is correct. The motives to do so however are often rather pragmatic, and people involved in the projects do not take notice of the principal differences between distinct epistemologies and levels of reality. Even though the arts, or subjective experience, are involved, the results of such “transdisciplinary explorations” are eventually converted into standard academic language, thus losing the richness of viewing reality over various levels of reality and applying distinct ways of knowing. This concurs with what is described in Keestra’s contribution to this volume, about the importance of employing multiple and distinct representations of the same phenomenon (Keestra, 2017).

When studying a city for instance (but it can also be an organization, a landscape, or any other object of study), it is important to *deliberately* and *consciously* differentiate between levels of reality, and to apply epistemologies or methodologies that are appropriate for each level distinguished. In the example I provide here, I work with a basic, but rather universally applicable, distinction between four levels of reality and corresponding epistemologies: reality as an object of study, an idea, a creation and an experience. Applied to a city this boils down to the city as an object of study, as an idea, a creation and an experience, with a corresponding set of sources of knowledge and ways of knowing, among which academic disciplines. Obviously various other levels and perspectives can be designed or disclosed, and applied.

Table 1. Level of Reality and Epistemology

Level of Reality	Epistemology
Reality as an object of study	Basic, social and applied sciences
Reality as an idea	Philosophy, literature, poetry
Reality as a creation	Art and design
Reality as an experience	Embodied cognition

When we systematically differentiate among such levels and corresponding epistemologies, we become aware of the principally different ways we can know a city. We know – or disclose – a CITY AS AN OBJECT OF STUDY through science-based epistemologies of generating data (numbers, trends, cause-effect relationships), theories, or conceptual models, often contextualized by the disciplines applied, as economics, history, demographics, governance, anthropology, or built environment. In this way we obtain detailed, qualitative end/or quantitative information about parts of the city. The data gathered through science only receive meaning however, when we place them in a certain context or perspective (Dieleman, 2013). This can be a purely theoretical/disciplinary context, but in applied sciences and transdisciplinary projects, this is often a normative/societal context. Such contexts are, for instance, to make a city sustainable, to make it flourish economically, be more socially integrated, less violent, or to reduce numbers of obese, or hospitalized. Such normative characterizations come from outside the mere scientific realm and because of that, they are often, wrongfully, taken for granted. The objectives may be turned into ways of knowledge production as well, with a genuine capacity of disclosing new levels of reality, or new possible worlds. They often correspond to reality as an idea.

Concepts like “the sustainable city,” “the creative city,” “the floating city” or “the city as a space of possibilities” all refer to a CITY AS AN IDEA. This is a form of disclosing reality and knowledge production, albeit not through description and data generation but through a general characterization, often in the form of a metaphor. It is a way of disclosing reality in a non-reductive way, from a cultural perspective or perspective of meaning, and as a whole: a system, organism, or complex entity. This allows us to capture an “essence,” or a “character” that is not present in the material reality, or to place that which we know in a context of meaning, showing us previously unseen characteristics. The knowledge thus generated never passes a scientific test of being true or accurate. It equally does not pass the test of robust knowledge, defined as a mix of scientifically accurate and socially acceptable knowledge (Nowotny, Scott, & Gibbons, 2001). The creation of such broad cultural concepts or metaphors of meaning however, can be very useful for action or identifying policy direction. They possibly generate discussion and opposition and may, precisely because of that, help shape our *understanding* of what is and/or what is desired.

A next way to disclose a city is to see a CITY AS A CREATION, as a work of art or as an environment to work with in artistic terms. While the science-based and the philosophical approach disclose what is, though in different and complementary ways, the artful or arts-based approach explicitly

focuses on what is not, and on what may become. This involves working over more than one level of reality, the level of material reality combined with that of a possible reality. It asks for imagination, desire, and vision, and exceeds in considerable ways the thinking processes typical of scientific research, like logical thinking, analysis, data generation, and data processing. Imagination comes, as Nicolescu mentioned, from somewhere else, and is widely seen as a form of embodied knowledge, applied in action. It involves associative thinking and reflection-on-action, and is realized in iterative and open processes, characterized by abduction rather than by deduction or induction. Working with a city as a creation is a form of genuine knowledge production, as it produces knowledge of how a city may be or may become, and creates new levels of possible realities. This knowledge as well is not robust, but serves as a source of inspiration, and it may lead to results that are ready to be implemented, installed and/or used.

Finally, I propose to see THE CITY AS AN EXPERIENCE. I do *not* propose here to study experiences of others, through anthropological, psychological, or sociological research. The aim is to invite the transdisciplinary researchers to go out in the city themselves, to leave the office space and to explore the city in embodied and enacted ways (Dieleman, 2017a). They go out themselves to perceive, hear, see, taste, smell and touch, and to make records of the sensory information thus obtained. Equally, they go out to feel, vibrations, tensions, movements, and to make records of the results obtained in these ways. They deliberately create moments to be in the city while they try not to think but to feel, to be open to receive abductive insights that otherwise would be missed. They intentionally seek to make emotional relationships with the city (people, places, buildings, etc.) and to explicitly look for appreciations and emotional disapprovals (Dieleman, 2017b). The obvious purpose is to place the information, gained through the three above-mentioned epistemologies, in the context of the researchers' own subjective experience.

Obviously it is also important to generate enacted knowledge, rooted in action. Participants of projects can produce such knowledge through intentionally acting within the city, while they consciously reflect on the actions they realize. Those actions are in principal many, like walking, cycling, driving a car, observing while participating, realizing an arts-based intervention in a public space, taking a meal, working and sleeping in various locations. Such activities generate particular experiences and creating those experiences should be seen as a form of knowledge production that is complementary to the above-mentioned forms.

The goal of working over various levels of reality, and integrating the insights coming from several epistemologies, serves various objectives. The

first is to arrive at an understanding of a city (or any other object of study) as a complex, discontinuous, and ambiguous whole. The goal is to make this manifest, instead of eliminating it conceptually. A rather crucial notion in this context is that of ternary logic, meaning that A can be simultaneously non-A, but on different levels of reality. Information gained through science (data on economics, demography, etc.) may strongly contrast with feelings or experiences that people have (with the economy or shifts in demography). A second objective is the contextualization of data and information in societal and personal contexts, which allows us to create meaning. The third is to become aware of the plasticity of reality, and to see a city as a potential of realities, actualization of which depends on our capacity of disclosure and subsequent realization through processes of imagination and creation. Lash-Marshall et al. describe in their contribution to this volume different strategic interventions to facilitate and bolster fruitful and creative collaborations (Lash-Marshall, et al., 2017).

5. Competencies of Transdisciplinary Hermeneutics

The transdisciplinary approach proposed here asks for the application of competencies that are usually not taught in institutes of higher education. The Cartesian assumption of the separation between body and brain has been particularly influential in shaping scientific research methodology and academic teaching. Essentially, scientific methodology is designed to exclude as much as possible affect, emotions, intuition and norms/values from cognition, and to generate knowledge free from imagination and fantasy. This is ensured by procedures that cautiously prescribe how to create knowledge through the execution of precise and impersonal research protocols.

Today, a variety of paradigms exist, and the strict rules that were initially designed for the basic sciences (sometimes simply referred to as “science”) have been modified and loosened, especially in the social and applied sciences. Competence based education introduced the teaching of skills and attitudes in academic education, but these are usually not seen as part of the knowledge *production* process. Usually these are conceived as *conditions for applying* knowledge, especially in professional contexts (cf. Klein, 1990). More recently, various new academic careers have been introduced that explicitly consider subjective and embodied experiences as guiding principles in the knowledge production process. Some gender studies emphasize that all knowledge is filtered by subjective gender positions, and researchers alike see the world through an explicit female, male or LGBT-lens. Sustainability studies, especially those in the tradition of deep ecology,

emphasize the importance of emotional connectivity with the environment. Such approaches however are still rather peripheral.

What I am looking for is a much broader application of this new research practice that explicitly *re-includes* embodied and enacted forms of knowing in knowledge production, academic collaborations and communications. Such forms are particularly important to disclose reality as a creation and an experience, and open up possibilities to disclose the world outside the mere cognitive, logical, and analytical approach. This requires shifts in research protocols and research practices, and requires above all the acquisition of new competencies. I see two competencies as being especially crucial for engaging in the new research practice that I propose here, the competencies of mindfulness and dialogue.

5.1 Mindfulness

Mindfulness can be described as a state of heightened consciousness of our own physical experiences, feelings and thoughts. Becoming mindful means turning unconscious experiences into conscious ones, enabling us to deliberately and thoughtfully use – and improve – our embodied and enacted knowledge capacities. We always use our senses, emotions, feelings, intuition, instincts, and imagination, but usually in subconscious ways. Through exercises of mindfulness, we train and sharpen our embodied capacities of knowing, and we improve our overall capacity of cognition. This simply results from the principle of embodied cognition, that our cognitive processes take place in interaction with the whole of our living body, while we engage in action within a particular environment. Exercises in mindfulness vary from meditation towards the training of bodily processes, through a range of exercises like conscious breathing, yoga, martial arts or simply walking, listening, or tasting. In all of these exercises, the essence is to find a new equilibrium between brain, body and environment, overhauling the dissociation of the brain from the body and of awareness from experience (cf. Varela, et al., 1991).

Meditation is an important, and in a way a generic practice to train mindfulness, and to create a state of heightened concentration or attention to what is happening in the present moment (Davidson, et al., 2003). In meditation, this is usually oriented towards thinking processes as well as internal bodily processes. Two distinct objectives can be distinguished. The first is to create awareness through acknowledging what is present, without any judgment, elaboration, or reaction. This has proven to result in various health benefits and has been incorporated into many existing psychological

treatment approaches (Bishop, et al., 2004).

It also works well in stimulating abduction and intuitive knowing. Abductive suggestions come to us in a flash, Peirce observed, and we often perceive them as coming from somewhere else. It feels like we “receive” them rather than actively create or produce them ourselves. The essence is that we do not create them in cognitive and deliberate ways, but that we create conditions for them to manifest themselves. This condition essentially is realized by creating a new equilibrium between the brain and the body, in which the brain is not dominating the body. As William James described, insights thus received are often unplumbed by the discursive intellect, and show us a reality (or levels of reality) outside of established categories of cognitive knowing. Precisely because we loosen the control of the brain over the body, abduction or intuition often bring new ideas to the surface, or make us see reality through new perspectives, which is very valuable in the context of creativity and imagination.

A second important objective of mindfulness is to become aware of the present inside and around us, with the intention to improve or intervene in what we consciously experience. Here the intention is to show us that a lot of what we do and know is the result of habit and, very importantly, that these habits can be broken (Varela, et al., 1991, p. 25). In practicing conscious breathing for instance, we become aware of how we normally – unconsciously – breathe, and how this unconscious process is different and usually inferior to the conscious one. In a similar way, mindfulness can contribute to emotional regulation, particularly as a form of conscious reappraisal of our emotions (Chambers, et al., 2009). We can realize such reappraisal when we become conscious of how we emotionally respond to certain situations, and start to see them as the fruit of subjective interpretations that correspond poorly with a particular external reality, as it is dominated by the memory of fear or disappointment created in previous similar situations. The awareness normally loosens the importance of the appraisal, and opens ways for de- and reappraisal. Here as well, the equilibrium between the brain and the body – cognitive and embodied knowing – gets recalibrated.

Improving our senses through mindfulness principally works in a similar manner. We normally perceive the world around us in very selected ways, just extracting from the world what we need, to perform the tasks that we have set out to do and nothing more. This is a very efficient way to live and to survive on a daily basis. As a strategy of research and exploring reality – disclosing new levels of reality, creating innovative solutions for problems – it is by definition limited. Our day-to-day perception is too much steered by habit to be able to realize the goals of being creative and imaginative.

Equally, rephrasing William James, it is too much plumbed by the discursive intellect. When we develop our sensory awareness through mindfulness, our senses become more acute, and we start to notice more nuances in the world around us, with more detail and depth.

Mindfulness is important in “unlocking” the knowledge that is locked in our actions and our experiences, and to become aware and conscious of the tacit and implicit knowledge we use in our actions. Schön introduced the concept of “reflection-in-action” as a practice of constantly being mindful of what we are doing, why and how, while we are acting. He distinguished that from “reflection-on-action,” as a form of evaluation after an act has been finalized (Schön, 1983). As mentioned in paragraph 3.1.3, mindfulness is a practice of constantly mapping the situation we encounter and comparing the results with the maps and images that we have stored in our reservoir of knowledge and experience. Such a map makes explicit and visualizes all the connections we make in a particular action, such as the knowledge and skills we use, the goals we want to realize, the effects we are creating, the motives we have, the frustrations and joys we experience, etc.

Engaging in various artful practices like painting, sculpting, dancing or making music, are excellent exercises to train mindfulness. They make us more sensitive to what we do in action, and make us more sensitive to the characteristics of the material we are working with (paint, clay, rock, canvas, wood), the tools we use (brushes, knives, hammers, chisels), and the implicit and explicit ideas we use in creating what we want to realize (a landscape, a portrait, an abstract form). Exercises in reflective practice can be complemented with the Goethean pedagogy of “exact sensory perception” and “exact sensorial imagination” (Franses & Wride, 2015). These are exercises that aim at switching off as much as we can the cognitive filter we always use to see and interpret reality. It is a form of perceiving the world suspending all forms of personal characterization, judgment and evaluation.

Basically any training in mindfulness, like sharpening our organs of perception, our intuition, reflective capacities or emotional intelligence, is a combined process of practice and consciousness, where the practice feeds the consciousness, and vice versa. Prolonged practices of mindfulness enable us to recalibrate the equilibrium between the brain and the body, making us better embodied cognitioners, capable of transdisciplinary hermeneutics.

5.2 Transdisciplinary Dialogues of Knowledges

Working with transdisciplinary hermeneutics has important consequences for academic collaborations and communications. When no absolute

truth exists, no single best way of knowing, and no all-inclusive form of communication, the traditional debate or discussion form, predominantly used in most academic communication, needs to be modified. The dialogue model is much better suited for team-based transdisciplinary hermeneutics. It is a model that closely resembles David Bohm's concept of dialogue (Bohm, 1996), has many characteristics in common with the Latin-American concept of "Dialogues of Knowing" (Leff, 2006) and is closely related to the concept of "Dialogues among Knowledges" that Boaventura de Sousa Santos introduced as part of his concept of Epistemology of the South (Santos, 2014; Dieleman, 2016). It is a form of collectively exploring reality, not restricted to any particular form of knowledge (cognitive, embodied, or enacted), thinking (logical, analytical, associative, or intuitive), or fixed means of communicating (words, images, movements, symbols). I call them "transdisciplinary dialogues of knowledges."

Following Bohm, I see transdisciplinary dialogues of knowledges as "streams of meaning flowing among and through those engaged in the act of dialoguing" (Bohm, 1996, p. 2). In terms of content, participants contribute to the process in any form they want: descriptive, theoretical, persuasive, poetic, metaphorical, or through a body movement, an image, or a drawing. In terms of dynamics, participants build upon that which the others bring to the dialogue space but they do not interrupt each other. Discussions are avoided, and participants do not act upon each other by means of agreeing or disagreeing, as the aim is not to arrive at one single truth or best way of seeing reality. Bohm makes a highly relevant distinction in this context, between dialogue and discussion. He characterizes discussions as Ping-Pong games of true-not true, constantly batting arguments back and forth with the objective to win. The word "discussion," Bohm argues, has the same root as "percussion" or "concussion" meaning breaking things up (1962, p. 2). Discussions focus on arguments that are broken from their context, presented without making reference to a theory, worldview or belief-systems they originate from. The discussion model is essentially non-hermeneutical and reflects a way of knowing that takes the world apart, and focuses on decontextualized parts and single best ways of knowing. The dialogue model creates contextualized understanding, and is rooted in conjunction and hermeneutics, as a way of knowing the world through interpreting wholes in the context of their parts, and parts in the context of their whole.

Context prevails over content. Every opinion or meaning must be understood in the context of certain – implicitly used – paradigms, worldviews, experiences, emotions or ways of thinking. As Richard Sennett puts forward, this asks for identification rather than for mere cognitive

understanding (Sennett, 2012), and it asks for listening to the intentions of the others, rather than only to their words (Bakhtin, 1981). Identification can take various forms, and Sennett makes an interesting distinction between sympathy and empathy. Sympathy results from understanding and agreeing with the other, and allows taking the role of the other. When we do not understand the other however, or when we do not agree, empathy should be the answer, and the empathic response should be in the form of: “I do not understand or I do not agree yet, I am interested, tell me more, I would like to know you better.” During the processes of communication, both the impacts of words and of body language are recognized, thus valuing the stringent relationship that exists between form and content. In this context, Sennett makes a plea for the use of subjunctive ways of talking, leaving room for doubt and ambiguity, rather than declarative forms of talking that close communication and have a dominating “I am right” form (Sennett, 2012).

The dialogue model echoes complexity thinking through what Mikhail Bakhtin called heteroglossia or multilingualness (Bakhtin, 1981). This involves understanding or describing reality through multiple perspectives or voices, resulting in different storylines that interact with each other. Each voice reveals a part of reality yet simultaneously obscures another part and because of that, it is only through the interaction of the different voices that we can have a more complete – yet complex and ambivalent – image of reality. Bakhtin talked about different voices as social dialects, professional jargons, languages of the authorities and more, and it is fair to extend that with voices of the heart, emotion, experience, the senses or intuition, thus opening heteroglossia to transdisciplinary hermeneutics (Panico & Dieleman, 2014). Creating shared meaning in a team does not imply arriving at one single way of seeing reality, but implies sharing the multiple and polyphonic ways in which a certain part of reality - a city, an organization, a team, a technology - can be seen and understood. It is a shared practice of allowing the world to disclose itself in as many ways as possible.

Synthesis does not take the form of unequivocal “conclusions,” but the form of tales or stories that combine multiple storylines. The transdisciplinary dialogues create two distinct yet interrelated outcomes, that O’Rourke and Crowley called “localization” and “philosophical abstraction” (O’Rourke & Crowley, 2013). Localization means making diverse storylines (interpretations, feelings, experiences) seem “familiar” to the collaborators of the team, while “philosophical abstraction” moves the participants away from their “locales” toward common ground, allowing them to see their own stories within a broader context of the team effort or common task

to accomplish. It must be mentioned once more, that abstraction does not take the form of seeing reality in simple and unambiguous terms, but invites seeing reality in terms of polyphonic and heteroglossic terms, leaving ample room for the existence of diverse storylines.

In terms of language, this has various consequences. As mentioned before, scientific language, in both spoken and written form, has a limited relevance in team-based transdisciplinary dialogues of knowing. This language seeks to depict reality in one clear and unequivocal way, and seeks eliminating ambiguity and subjectivity. The narrative is better suited than the standard scientific article or technical report, as a narrative has a much better potential to be polyphonic, to integrate form and content and to combine metaphorical, allegorical and rhetorical voices with analytical voices. Moreover, written language should be extended, as mentioned before, to include visual, bodily, kinetic, or any other form of language, such as drawings, sculptures, installations, interventions, dance, movies, music or theatre. Such artistic and semiotic forms are necessary to capture the results of processes of perceiving and sensing, which are essential parts of team-based transdisciplinary hermeneutics (Maggs, 2014).

After engaging in such dialogues, a logical next step for a team is to go out and explore a reality – a city, a landscape, an organization or basically any object to be studied and explored – not only through dialogue, but through a combined practice of perception, reception, interaction and codification. Obviously, the results of this combined practice of team-based transdisciplinary hermeneutics subsequently need to be shared in the team, following basically the same practice of dialogue as described before. In this way, an iterative process of transdisciplinary knowing through perceiving, receiving, interacting, codifying and dialoguing is realized.

6. Concluding Remarks

The transdisciplinary hermeneutical approach presented in this article is a form of knowledge production that contextualizes science, but not in terms of political, economic, or technological perspectives. It contextualizes science in the framework of cultural ideas, subjective experiences of the researchers involved in the research process, and in the context of possible realities, created in artful and imaginative ways. All of these frameworks provide meaning, and help creating a transdisciplinary practice outside of the technocratic approach, characteristic of many transdisciplinary projects (Elzinga, 2008, pp. 248-249).

The approach is based on a concept of reality far from seventeenth

century Galilean assumptions and axioms, and likewise distant from the seventeenth century Cartesian separation of the mind from the body. This article introduces a reality that is complex and multilayered, and introduces a subject of knowing with levels that correspond with sources of knowledge inside of the subject: cognitive, embodied and enacted sources of knowing. It finally sketches the importance of two competencies that transdisciplinary researchers need to acquire, the competencies of mindfulness and dialogue. Learning these competencies allows researchers – and research teams – to combine the mere cognitive with the emotional and imaginative, and to combine the language of what is seen and measured, with what is unseen but sensed, felt and envisioned (Kagan, 2011).

It contextualizes science, and changes the scientists involved, as they learn to know between, across and beyond levels of reality. Nicolescu describes such knowing as “a flow of consciousness that coherently cuts across different levels of Reality of the Subject and that must correspond to the flow of information coherently cutting across different levels of Reality of the Object.” (Nicolescu, 2012, pp. 21-22). In science we explore and test our concepts by putting them to the test of reality. Doing so, we receive “an answer from reality” that informs us on our concepts, feelings and understanding: whether they are right, accurate or wrong. Such resistance however does not exist in between levels of reality and because of that, Nicolescu calls that the zone of non-resistance. This zone allows us to see unity and connectedness but, this is crucial, seeing this essentially is a capacity we create inside of us. Transdisciplinary hermeneutical knowing is coming from within, as a result of working with our inner self (Dieleman, 2015b). Because of that, self-knowledge, self-reflection, mindfulness and having the capacity to dialogue are key competencies.

Eventually transdisciplinary hermeneutics will change science as well. The practice of transdisciplinary hermeneutics, both on an individual and on a team level, means stepping out of the framework of science, entering a frame of combining head, heart and hands. It will change science into art, as a combination of iterative practices of cognitive, embodied and enacted knowledge production (Dieleman, 2012). It will influence the kind of questions scientists will be willing to explore and answer. It will influence the models developed and the criteria included in such models. It will eventually influence the way to analyze and evaluate research outcomes.

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References:

- Bakhtin, M. (1981). *The dialogic imagination: Four essays*. M. Holquist (Ed.). (C. Emerson & M. Holquist, Trans.). Austin and London: University of Texas Press.
- Bohm, D. (1996). *On dialogue*. L. Nichol (Ed.). Routledge, London
- Chambers, R., Gullone, E., & Allen, N. B. (2009). Mindful emotion regulation: An integrative review. *Clinical Psychology Review, 29*, 560–572
- Csikszentmihalyi, M. (1996). The creative person. *Psychology Today*, 36–40.
- Damasio, A. R. (1994). *Descartes' error: Emotion, reason and the human brain*. New York, NY: Avon Books.
- Damasio, A. R. (2003). *Looking for Spinoza: Joy, sorrow and the feeling brain*. London: William Heinemann.
- Davidson, R., et al. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine, 65*, 564-570.
- Dieleman, H. (2012). Transdisciplinary artful doing in spaces of experimentation. *Transdisciplinary Journal of Engineering & Science, 3*, 44-57.
- Dieleman, H. (2013). Mexico City's sustainability and culture, A plea for hybrid sustainabilities for a baroque and labyrinthine city. *City, Culture and Society, 4*(3), 163-172.
- Dieleman, H. (2013). Mexico City's sustainability and culture, A plea for hybrid sustainabilities for a baroque and labyrinthine city. *City, Culture and Society, 4*(3), 163-172.
- Dieleman, H. (2015a). Prólogo, la relevancia de la transdisciplinarietà para la producción de conocimiento contemporánea. In S. Street (Coord), *Trayectos y vínculos de la investigación dialógica y transdisciplinaria; Narrativas de la experiencia*. CRIM-UNAM, CIESAS, México.

- Dieleman, H. (2015b). Transdisciplinary hermeneutics: Working from the inner self, creating ecologies of knowing. *Transdisciplinary Journal of Engineering & Science*, 6, 72-85.
- Dieleman, H. (2016a). Epistemology of the south and transdisciplinarity: A comparison. In Santos Boaventura de Sousa & Teresa Cunha, *Democratizing democracy*. University of Coimbra, Center of Social Studies
- Dieleman, H. (2016b). Steps to an ecology of knowing and teaching embodied transdisciplinary hermeneutics. *Transdisciplinary Journal of Engineering & Science*, 7, 79-92.
- Dieleman, H. (2017a). Arts-based education for an enchanting, embodied and transdisciplinary sustainability. *Artizein: Arts & Teaching Journal* [School of Art & Design, Southern Illinois University Carbondale], 2(2).
- Dieleman, H. (2017b). Enchanting sustainability: From enlightened modernity towards embodiment and planetary consciousness. In A. Sari, C. Brites, K. Plebańczyk, L. Rogač Mijatović, & K. Soini (Eds.), *Culture in Sustainability: Towards a transdisciplinary approach*. SoPhi University of Jyväskylä, Department of Social Sciences and Philosophy.
- Elzinga, A. (2008). Participation. In G. Hirsch Hadorn, H. Hoffmann-Riem, S. Biber-Klemm, W. Grossenbacher-Mansuy, D. Joye, C. Pohl, U. Wiesmann, E. Zemp, (Eds.), *Handbook of transdisciplinary research*. Springer, Dordrecht the Netherlands
- Franses, P., & Wride, M. (2015). Goethean pedagogy: A case in innovative science education and implications for work-based learning. *Higher Education, Skills and Work-Based Learning*, 5(4), 339-351
- Gadamer, H-G. (1975). *Truth and method*. London: Sheed & Ward.
- Hardy-Vallée, B., & Payette, N. (Eds.). (2008). *Beyond the brain: Embodied, situated and distributed cognition*. Cambridge Scholars Publishing
- Healy P. (2015). Hermeneutic truth as dialogic disclosure: A Gadamerian response to the Tugendhat critique. *Parrhesia*, 24, 173-88
- Hirsch Hadorn, G., Hoffmann-Riem, H., Biber-Klemm, S., Grossenbacher-Mansuy, W., Joye, D., Pohl, C., Wiesmann, U., Zemp, E. (Eds.). (2008). *Handbook of transdisciplinary research*. Springer, Dordrecht the Netherlands
- Horvath, J. A. (2001). Working with tacit knowledge. In J. W. Cortada & J. A. Woods (Eds), *The knowledge management yearbook 2000-2001*. New York, NY: Routledge.
- James, William (1902). *The Varieties of religious experience: A study in human nature*. New York, London and Bombay: Longmans, Green and Co.
- Kagan, S. (2011). *Art and sustainability - Connecting patterns for a culture of complexity*. Bielefeld: Transcript Verlag.
- Keestra, M. (2017). Metacognizing and reflecting interdisciplinary experts: Insights from cognitive science and philosophy. *Issues in Interdisciplinary Studies*, 35, 121-169.
- Klein, J. T. (1990). *Interdisciplinarity: History, theory, and practice*. Detroit, MI: Wayne State University Press.
- Klein, J. T. (2008). Evaluation of interdisciplinary and transdisciplinary research, A literature review. *American Journal of Preventive Medicine*, 35(2), S116–S123.

- Lash-Marshall, W. G., Nomura, C. T., Eck, K., & Hirsch, P.D. (2017). Facilitating collaboration across disciplinary and sectoral boundaries: Application of a four-step strategic intervention. *Issues in Interdisciplinary Studies*, 35, 200-221.
- Lokhorst, G.J.C., & Kaitaro, T. T. (2001). The originality of Descartes' theory about the pineal gland. *Journal for the History of the Neurosciences*, 10(1), 6-18
- Lupasco, S. (1987). Le principe d'antagonisme et la logique de l'énergie - Prolégomènes à une science de la contradiction. In Hermann & Cie, (Coll.), *Actualités scientifiques et industrielles*, n° 1133, Paris, 1951; 2nd ed. Le Rocher, Monaco, 1987.
- Maggs, D. (2014). *Artists of the floating world: Art-sustainability relations in the late days of modernity*. Doctoral Thesis, University of British Columbia, Okanagan Campus, Canada.
- McGregor, S. (2015). The Nicolescuian and Zurich approaches to transdisciplinarity. *Integral Leadership Review*, April – June.
- Montuori, A. (2011). Systems approach. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity* (2nd ed.), vol. 2 (pp. 414-421). San Diego, CA: Academic Press.
- Morin, E. (1986). *Method, volume 3: Knowledge of knowledge*. Milano: Feltrinelli.
- Morin, E. (2001). *Seven complex lessons in education for the future*. Paris: UNESCO.
- Nicolescu, B. (2002). *Manifesto of transdisciplinarity*. Albany, NY: State University of New York Press.
- Nicolescu, B. (2006). Transdisciplinarity, past, present and future. In H. Bertus and C. Reijntjes (Eds.), *Moving worldviews – Reshaping sciences, policies and practices for endogenous sustainable development*. Holland: COMPAS Editions.
- Nicolescu, B. (2010). Methodology of transdisciplinarity – Levels of reality, logic of the included middle and complexity. *Transdisciplinary Journal of Engineering & Science*. 1(1), 19-38.
- Nicolescu, B. (2012). Transdisciplinarity: The hidden third, between the subject and the object. *Human & Social Studies. Research and Practice*. 1(1), 13–28.
- Nicolescu, B. (2014a). *From modernity to cosmodernity. Science, culture, and spirituality*. New York, NY: SUNY.
- Nicolescu B. (2014b). The hidden third and the multiple splendor of being. In V. Bazhanov & R. W. Scholz (Eds.), *Transdisciplinarity in philosophy and science: Approaches, problems, prospects* (pp.62-79). Navigator, Moscow.
- Nicolescu, B. (Ed.). (2008), *Transdisciplinarity – theory and practice*. NJ: Hampton Press.
- Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science. Knowledge and the public in an age of uncertainty*. Cambridge: Polity.
- Panico, F., & Dieleman, H. (2014). The narrative as a way to construct transdisciplinary knowledge: Building upon experience in a polyphonic way. *Transdisciplinary Journal of Engineering & Science*, 5, 123-133.
- Peirce, C. S. (1988). Pragmatism as the logic of abduction. In *The essential Peirce: Selected philosophical writings, 1893–1913*. Bloomington, IN: Indiana University Press.

- Pisters, P. (2012). *The neuro-image, A Deleuzian film-philosophy of digital screen culture*. Stanford, CA: Stanford University Press.
- Polanyi, M. (1967). *The tacit dimension*. New York, NY: Anchor Books.
- Santos, Boaventura de Sousa (2014). *Epistemologies of the south: Justice against epistemicide*. Boulder, CO: Paradigm Publishers.
- Schön, D.A. (1983). *The reflective practitioner: How professionals think in action*. London: Temple Smith.
- Sennett, R. (2012). *Together: The rituals, pleasures, and politics of cooperation*. London: Penguin Books.
- Shapiro, S. L., Astin, J. A., Bishop, S. R., & Cordova, M. (2005). Mindfulness-based stress reduction for health care professionals: Results from a randomized trial. *International Journal of Stress Management*, 12(2), 164–176.
- Simon, Herbert (1991). Bounded rationality and organizational learning. *Organization Science*, 2 (1), 125–134
- van Breda, J. (2007). *Towards a transdisciplinary hermeneutics: A new way of building the scientific mind for learning in the perspective of complex and long-term change*. Stellenbosch University, School of Public Leadership.
- van Breda, J. (2008). Overcoming the disciplinary divide: Towards the possibility of a transdisciplinary hermeneutics. In M. Burns & A. Weaver (Eds.), *Exploring sustainability science: A southern African perspective* (pp. 99-134). AFRICAN SUN MeDIA, Stellenbosch.
- Varela F.J., Thompson E., Rosch E. (1991). *The embodied mind, cognitive science and human experience*. Cambridge, MA: M.I.T.Press.
- Wheeler, M. (2005). *Reconstructing the cognitive world*. Cambridge: Cambridge University Press.
- Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin & Review*. 9(4), 625-636.