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Unpacking Spinoza: Sustainability Education Outside the Cartesian Box

Daniel Hansson
University of Idaho

sustained.conatus@live.com
danielh@vandals.uidaho.edu

Abstract: By its nature and scope, the concept of sustainability is a challenge to traditional education. Where most academic institutions still value and promote narrowly conceived fields of expertise, sustainability requires a comprehensive, wide-angle approach to problem definitions as well as solutions. This challenge highlights the need for a bold reassessment of a number of epistemic assumptions; one of them being the validity of the Baconian-Cartesian reductionism at the core of the scientific method. This paper presents a novel, non-reductionist approach to understanding and teaching sustainability grounded in an analogy from the systems philosophy of Baruch Spinoza (1632-1677). This approach is an alternative that transcends the traditional dichotomy between reductionism and holism in their various forms. I discuss how Spinoza's approach to parts and wholes can be applied to a transdisciplinary, systems-based sustainability education addressing systems of varying size and complexity. A multitude of systems theories and methodologies have failed in the role as widely accepted and used meta-languages that effectively transcend disciplinary confines. As applied in this paper, Spinoza's philosophy can effectively be used as such a discipline-transcending facilitator of understanding. To my knowledge, Spinoza's fundamental contributions to the philosophy of systems and transdisciplinarity presented in this paper have not been recognized in the literature, including the research on Soft Systems Methodology and other "constructivist" systems approaches.

Keywords: course design; philosophy of sustainability; Spinoza; sustainability pedagogy; systems thinking; transdisciplinarity

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Daniel Hansson is a curriculum designer, research support scientist, and lecturer in Sustainable System Design in the Department of Bioregional Planning & Community Design at the University of Idaho. He also facilitates workshops for sustainable organizational development and community transformation. In his novel application of Spinoza's philosophy to sustainability, systems design, development, and transdisciplinary pedagogy that is introduced in this paper, Daniel also integrates topics like the history and philosophy of science, globalization, the convergence of worldviews, ethics and action; food and water security and justice; carbon management, alternative fuels, biopesticides, and the management of climate-change related risk and disaster.

Every forest branch moves differently
in the breeze, but as they sway
they connect at the roots.

Rumi (1207-1273) (**1993, p. 27**)

1. Introduction: Reductionism and the Challenge of Complexity

The dynamism of complex systems is a major challenge to traditional higher education. The historical roots of the problem go back to the early 17th century when the work of Francis Bacon (1561-1626) and René Descartes (1596-1650) successfully promoted *reduction* as the only method to gain proper knowledge. Even though Bacon was an empiricist and Descartes was a rationalist, they agreed on the fundamental assumption that wholes are ontologically reducible (as discussed below). In their own time, this assumption of ontological reductionism – as old as the Milesian school of ancient Greece – became fundamental to the scientific (Baconian) method. For reasons beyond the scope of this paper, the non-reductionist alternative presented by Baruch Spinoza (1632-1677) was overlooked historically and became something of a curiosity delegated to the obscure corners of classical philosophy. As we will see below, Spinoza's systems approach to parts and wholes resonates strongly with the ideal of sustainability and provides a foundation for a new, transdisciplinary curriculum designed to address the complexity of a world in transition.

History has given us ample proof that the Baconian-Cartesian reductionist worldview motivates inherently unsustainable "solutions" to many different kinds of problems. Earlier in history, this was often far from obvious. And in the cases where the lack of sustainability was obvious, this fact could always be effectively contested by the establishment. Now, in our age of globalization and large-scale anthropogenic environmental degradation, the ecological limitations of reductionism are becoming increasingly apparent to both the academic and the global community **(Weaver, 1948; von Bertalanffy, 1969; Weinberg, 1975; Patten, 1978, 1991; Capra, 1982; Odum, 1983; Popper, 1990; Klir, 1991; Rosen, 1991; Richmond, 1993; Ulanowicz, 1997; Jørgensen, 2002; Gattie et al. 2007).** Our collective experience is showing us that we need new, innovative approaches to take on the challenges that come with complex systems and wicked problem situations; "units" that cannot be understood by reducing them to parts studied in isolation (**Ackoff, 1974; Rittel and Webber, 1984**).

Even while the problems generated by various forms of reductionism have been recognized in fields as different as medicine (**Joyner, 2011**), environmental ethics (**Nelson, 2010**), and aerospace engineering (**Sherwin, 2010**), the *method* to deal with them successfully is less obvious. How do we understand complex and dynamical "wholes"? Especially when they involve many layers of complexity, such as simultaneously relevant spatial and temporal scales? And how do we teach students in a way that imparts this understanding and makes it practically applicable in a professional sense? This is the challenge and also, as I see it, the potential of an integrative, non-traditional sustainability curriculum. Today, in a situation where we face the consequences of lacking sustainability in almost every area of human life, Spinoza's alternative to reductionism holds an untapped pedagogic potential. This paper presents an application of this alternative in the context of sustainability education.

Ontological Reductionism: Nothing Greater than the Sum of Parts

Before we proceed it should be noted that reductionism, as I define it in this paper, is different from *analysis* – the conceptual differentiation of parts and wholes. True *reductionism* explains away wholes as ontologically non-existent and/or epistemically meaningless (**Overton, 2002**). The rejection of reductionism is not the same as the rejection of analysis as a useful approach in research and education.[1] As we shall see below, Spinoza provides a sustainability-promoting alternative to reductionism that is a sound foundation for analysis and synthesis alike.

Descartes compared complex systems, like the human body, to clocks (**Jonas, 1965; Des Chene, 2001**). To understand the functioning of such a system in a Cartesian way you have to disassemble it – in other words, you reduce it to a collection of parts. The interrelation of these parts is mechanistic in a linear, additive sense. Ontologically, the whole in itself is thereby understood as *nothing but* the sum of parts assembled together properly. From this fundamental onto-epistemic assumption follows that we can understand a whole simply by studying the arrangement of parts of which that whole consists. In essence, "the whole" is thereby reduced to nothing but a heap (or sum) of discrete elements.

In the Baconian-Cartesian worldview, the whole *in itself* is rejected as a fundamental unit worthy of our attention, despite Aristotle's ancient observation that "the totality is not, as it were, a mere heap, but the whole is something besides the parts" (**in Ross, 2006**).[2] In modern terms, this "something" refers to non-reducible whole-system properties and behaviors such as synergy and emergence.

In the Baconian-Cartesian perspective, there is no such thing as something besides (or greater) than the sum of the parts. If we can identify and quantify the properties of these parts, then we know everything that can be known. Nature in itself is a machine; big, indeed, and consisting of many parts, but nevertheless a machine. The Baconian-Cartesian project, empowered by Newtonian mechanics, is to study that machine and to manipulate and tinker with it to achieve desired outcomes that maximize human utility.

The assumption that reduction gives proper and sufficient knowledge has become fundamental to modern Western civilization in general, and the bedrock of science (and engineering!) in specific. It is widely (not always consciously) embraced in the academic community. College students are exposed to the reductionist worldview at every turn of their education. Indeed – by choice or sheer historical inertia – it saturates and permeates almost every curriculum in the world.

2. Spinoza's Perspective on Parts and Wholes

René Descartes, who had left a lasting impression on Western thought, died when Baruch Spinoza was still in his late teens. In his posthumously published letters and books, Spinoza offers an alternative to the reductionistic Baconian and Cartesian methods to obtain knowledge. According to Spinoza, we need to recognize the contextual interrelation of parts and wholes to

[1] Analytic investigation in general is sometimes referred to as "methodological reductionism" which is not to be confused with the more far-reaching onto-epistemic reductionism promoted by Bacon and Descartes.

[2] The phrase "The whole is greater than the sum of the parts" most likely began as a paraphrase or misquote of this statement from Aristotle, and it is often but wrongly attributed to him.

properly understand the functional organization of the world. Today, this approach is often called "systems thinking". Even though this fact has not been widely recognized, Spinoza's philosophical system is the first developed philosophy of systems[3] to emerge in the history of Western thought.[4]

There is a hurdle to overcome when approaching Spinoza. He is notoriously difficult to read. This is especially true for Spinoza's final philosophical statement, *Ethics: Demonstrated in Geometric Order*, posthumously published in 1677. The logical rigor of Spinoza's "geometric method" of argumentation, implied in the subtitle of his *Ethics*, partly explains why Spinoza remains more famous than well known. Nevertheless, the presently growing appeal of his general attitude toward nature as a unified system is equally understandable. In the words of Spinoza scholar Genevieve Lloyd, "the study of Spinoza is crucial" when we explore the "idea that we are part of nature" (**Lloyd, 1994, p. 1**). And as Arne Næss observed, "No great philosopher has so much to offer in the way of clarification and articulation of basic ecological attitudes as Baruch Spinoza" (**quoted in Houle, 1997, p. 417**).

To use modern terms, Spinoza's universe is an integrated, all-encompassing system. Spinoza calls this totality "Nature" with a capital N (***Ethics*, Part I, Proof to Proposition 15, Proposition 28; Part II, Lemmata 3-7, and Scholium to Proposition 7; Preface to Part III**). Note that this conception of nature subsumes our less inclusive modern-day conception of "the environment". Like all organisms, humans are part of this system and not superior to nature. Instead, all organisms are ecologically dependent on their larger, functional environment (**Spinoza, 1665, Letter 32; *Ethics*, Part IV, Propositions 2-4, and Scholium to Proposition 57; Appendix to Part IV, sections 1, 6, 7, and 32**).[5]

To be able to understand nature as an integrated system, Spinoza claims that we need a perspective that recognizes our own less-than-perfect ability to comprehend complexity. Our limited cognitive faculties simply make it impossible for us to embrace anything beyond a partial scope of reality in its totality. This recognition is the starting point of Spinoza's non-reductionist theory of knowledge.

A Worm's-Eye View of the Larger Whole

Spinoza's epistemic approach is simple yet profound. In a famous letter from 1665 to Henry Oldenburg, the first Secretary of the Royal Society (**Letter 32, in Curley, 1994**), Spinoza explains the relationship between parts and wholes by using an organic analogy, intuitively more fitting than a machine analogy when we describe a complex, natural system.[6] Spinoza asks the

[3] Here it should be noted that Spinoza himself does not use the term 'system' in any sense that even resembles our modern use of the word.

[4] To my knowledge, the first known developed philosophy of what is today called 'systems' was presented in China by Chuang Tzu (Zhuangzi) around the 4th century B.C.E. in the famous book that bears his name.

[5] Hans Jonas (**1965**) observed that Spinoza understood individual organisms as non-mechanical, complex and dynamical systems. Spinoza also directs us to the modern notion of an ecosystem by his functional understanding of interrelations within and between such organism-systems and their total environment (**Lennox, 1976**).

[6] Spinoza also discusses this interdependence of 'parts' and 'wholes' in the *Ethics* (**Part I, Proof following Proposition 12**). Likewise, in an earlier book criticizing Descartes, Spinoza claimed that "*Unity*… is only a mode of thinking by which we separate the thing from others which are like it or agree with it in some way…. To unity is opposed *multiplicity*, which, of course, also adds nothing to things, is nothing but a mode of thinking…." (**Spinoza,**

reader to conceive an imaginary "little worm living in the blood" of a larger organism. This worm is so tiny that it is able to distinguish by sight the individual "particles of the blood" and how these particles bounce into each other, "communicate part of their motion, and so on" (***ibid***). Spinoza explains that because of this experience, the worm would have a worldview very different from our own:

> Indeed, it would live in this blood as we do in this part of the universe, and would consider each part of the blood as a whole, not as a part. Nor could it know how all the parts of the blood are restrained by the universal nature of the blood, and compelled to adapt themselves to one another, as the universal nature of the blood requires, so that they harmonize with each other in a certain way (***ibid***).

In other words, the worm is unable to see the bloodstream in itself as a 'whole' (a unified system), and even less to recognize the *whole body* containing the blood as being a 'whole' in itself. The perspective of the observer (the worm) has thereby determined what is viewed as parts and wholes. In contrast to the worm, we ourselves would consider the blood to "have the nature of a part and not of a whole" (***ibid***).

According to Spinoza, "all bodies in Nature" have to be understood in the same way – from a *contextual* and *relational* perspective: "every body… must be considered as a part of the whole universe, must agree with the whole to which it belongs, and must cohere with the remaining bodies" (***ibid***). Therefore, proper knowledge of *any* individual thing must be based on contextual understanding, including the recognition of *how* we organize the world around us as 'parts' and 'wholes' – entities that are constructed by our limited mind, seeking to structure our experience in comprehensible patterns, labeled to organize our perceptions in the form of sense-making units.[7]

In his letter, Spinoza explains that a complete understanding of what we today would call a complex system would require knowledge of *all* interrelations that unify the parts of that system internally and at the same time with the rest of the universe. Since each individual "thing" in itself is conditioned by countless causes external to itself, we can never know – and even less, in the Cartesian sense *quantify* – all of them.[8] Instead, we need to understand the relative (but not arbitrary!) nature of 'parts' and 'wholes'.

In Spinoza's view, this relativity depends on scale and observational vantage point. We *perceive* something as a 'part' of a larger 'whole' when we experience the 'whole' as an integrated unit within which the component 'parts' coexist in a state of perceived mutual harmony. The 'whole' is therefore a more or less imaginary unit constructed by our cognitive

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1663, p. 311; italics in original). Spinoza's views on parts/wholes and unity/multiplicity are also discussed by Sacksteder (**1985**).

[7] The constructivist epistemology of John Dewey and Jean Piaget shares this fundamental assumption with Spinoza, as well as Spinoza's focus on relative (but not arbitrary) frames of reference.

[8] The goal of Cartesian science is to know *everything* about all parts of all there is; not to acquire knowledge *sufficient* for proper understanding. This monolithic objective of complete description, idealized and codified by René Descartes, has contributed to a widespread "Cartesian anxiety" (**Bernstein, 1983, p. 16ff**) – a paralysis of analysis stemming from the belief that we need to engage in an infinite regress of increasingly detailed analysis to establish perfectly objective scientific certainty. This belief is at the core of the onto-epistemic reductionism promoted by Descartes and Francis Bacon.

process.[9] And when we *perceive* that something is not sharing a mutual harmony with its surrounding environment, then we recognize this thing as a separate individual, distinct from the contextual background. Therefore it is a 'whole' in itself and not a 'part' of its surrounding context (which is perceived as a separate 'whole' or collection of 'wholes' in relation to the given thing).[10]

Spinoza, Holism, and "Soft" Systems

Spinoza's relativity of parts and wholes helps us understand how we "make sense" of perceptions by organizing them in meaningful cognitive patterns, or *Gestalten*, according to our more or less limited contextual understanding. Where Bacon and Descartes prescribe fragmentation as the proper method for understanding composite, interactive, and organic systems, Spinoza instead asks us to first look at the "Big Picture" of the larger context and *how we condition it by the incompleteness of our own perception*. From that perspective we can then understand the functional roles of individual parts as well as their systemic interaction. Spinoza is therefore not denigrating the importance of the parts of larger wholes (an implicit consequence of many holistic theories). On the contrary, he explains *both* 'parts' and 'wholes' as being *constructs* defined by our pattern-seeking attempts to structure the world.

Similar to the superficial use of the term 'sustainability', 'holism' is too often used interchangeably with 'wholesome' – as a catch-all for just about anything considered as good. In contrast to many other proposed alternatives to reductionism, Spinoza provides both a tangible understanding of *why* reductionism is a failing strategy, and a practically useful alternative to it. Even though Spinoza has sometimes been called a "holist" (**de Jonge, 2004; Næss, 2005, p. 407; Della Rocca, 2008**), he would most likely – and for several reasons – have rejected the modern term 'holism' as a label for his onto-epistemology, which in the practical sense is no more a philosophy of wholes than it is of parts!

According to Spinoza, Nature as a whole is a unified, self-contained totality (or, in the language of 17th-century philosophy, a 'substance') of which every individual thing is a 'mode' – a unique expression defined by a unique set of causal interrelations to all other things in Nature.[11] However, for all practical purposes, our understanding of 'parts' and 'wholes' is

[9] In Spinoza, correct "ideas" (understood as acts of understanding) are correct to the extent that these ideas map the systemic interrelation of things accurately. Spinoza famously stated: "The order and connection of ideas is the same as the order and connection of things" (***Ethics*, Part II, Proposition 7, in Curley, 1994**). By this proposition, Spinoza emphasizes that knowledge derived by reductionism is incomplete because it doesn't account for systemic interconnections.

[10] Spinoza's perspectival view of cognitive wholes likely inspired Johann Wolfgang von Goethe – an ardent Spinoza defender – in developing his *Gestalt* theory, fundamental to various modern theories of perception.

[11] In the *Ethics*, Spinoza defines "things" of any kind as composite individuals (i.e. systems) of varying complexity within the nested structure of systems that is Nature as a whole (**Part II, Definitions, Explication 7; Proposition 13, Lemmata 4-7 and Scholium**). Mode (Latin, *modus*) literally means 'modification' or 'expression', and a mode in Spinoza is a unique, individualized and limited expression of Nature as a unified totality (or 'substance') (**Part I, Definition 5, Axiom 1, Proposition 4, 15**). Spinoza obviously chose the term 'mode' to emphasize that any "individual thing" (material or cognitive) must be understood from a relational, non-reductionist point of view as a "thing" only *in relation* to its larger causal context – not as an ontologically separated 'substance' in itself. Spinoza explains the apparent separation of the 'parts' of Nature as a whole with a somewhat dry and technical statement: "parts are distinct, not really but only modally" (***Ethics*, Part I, Scholium to Proposition 15;**

limited to the world we can perceive and relate to with our limited understanding. Therefore, both 'part' and 'whole' are perspective-dependent constructs in Spinoza's theory of knowledge, which transcends the reductionism/holism dichotomy altogether.[12] In Spinoza's own words: "'part' and 'whole' are not true and real entities, but only 'things of reason', and consequently there are in Nature neither whole nor parts" (**Spinoza, c. 1660, Part I, Ch. 2, in Curley, 1994**).[13] Instead of being real entities, 'parts' and 'wholes' are therefore, in a sense, "in us" as cognitive units bounded by our incomplete awareness of interrelation.[14]

When we recognize this perspectival relativity, we are vested with a greater capacity to understand the world and interact with it properly. Spinoza's perspectival philosophy shares this fundamental assumption with the "soft" systems thinking developed in the 1970s by Peter Checkland and his team at Lancaster University (**Checkland, 1993**). Checkland's Soft Systems Methodology (SSM) is based on the re-discovery of an insight clearly expressed by Spinoza at least as early as 1662 (**Spinoza, c. 1660, Part I, Ch. 2**), almost to the year three centuries before Checkland and his team recognized the limitation of what they called "hard" systems thinking – the engineering-based assumption that systems are entities in the real world, modeled more or less accurately, rather than conceptual constructs of greater or lesser epistemic utility. Thereby, Checkland made the distinction between a "hard" systems approach that objectifies systems as concrete realities without bringing the discussion to an epistemic *meta-level* that explains 'systems' as useful, but perspective-dependent constructs in contrast to real entities modeled more or less accurately (**Checkland, 1999**).

To my knowledge, Spinoza's fundamental contributions to the philosophy of systems have not been recognized in the literature on transdisciplinarity and systems, including Soft Systems Methodology and other "constructivist" systems approaches.

From "Confused and Fragmentary Knowledge" to Relational Understanding

As Spinoza clearly affirms, the understanding of the world in its *total* complexity eludes the human mind and historical memory. As humans, we simply have to recognize the limitations of our cognition:

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trans. Shirley). In other words, the 'parts' of Nature are distinct only as individualized *expressions* (Latin, *modi*) of the entire causal context that defines them – Nature as the total system of interdependent modes.

[12] A discussion sufficient to clarify this subject is beyond the scope of this present paper.

[13] It should be noted that Spinoza's approach to parts and wholes is fundamentally different from Arthur Koestler's "holarchy" – a hierarchy of what Koestler calls "holons", which "like the Roman god Janus, all have two faces looking in opposite directions: the face looking towards subordinate levels is that of the self-contained whole, the face turned upward towards the apex, that of the dependent part" (**Koestler, 1967/1976, p. 48**). Koestler's "holon" is therefore an entity existing within a *stratified two-way system*. Koestler agreed with Spinoza that parts and wholes do not exist in the absolute, ontological sense. However, Koestler's stratified "holarchy" objectifies the entities that he claims are ontologically non-existent (parts and wholes) in a rigid hierarchical arrangement implying a functional dependency resulting from two-way (i.e. linear) causation. As I understand it, this thinking imposes a hierarchical arrangement on nature that is based on the limitations of human cognition. I find the non-linear organization of Spinoza's universe to be very different from that of Koestler's "holarchy". A more extensive discussion of this topic is however, again, beyond the scope of this paper.

[14] In the words of William Sacksteder, "both *part* and *whole* indicate modes of interconnection" in the philosophy of Spinoza (**1985, p. 398; italics in original**).

> I say expressly that the mind does not have an adequate knowledge, but only a confused and fragmentary [*mutilam*] knowledge of itself, its own body, and external bodies whenever it perceives things from the common order of nature (***Ethics*, Part II, Scholium to Proposition 29, p. 262 in Shirley; original Latin added**).

And nevertheless, according to Spinoza this limitation does not prevent us from attaining the *partial* knowledge that is *sufficient* for a sustainable civilization. We don't need to know everything about the *parts* of all systems, but we need to know certain essential facts about system *structures* and *behaviors* (to use modern terminology). This focus stands in stark contrast to the aims of science in the Cartesian tradition.

According to Spinoza, the "confused and fragmentary (or: *mutilated*) knowledge" that we derive from the separation of parts from their larger wholes (i.e. by reductionism) is a universal cause of error – of both the epistemic and the moral kind. In order for us to be able to "see things clearly and distinctly", we need to regard "several things at the same time, to understand their agreement, their differences, and their opposition" (***ibid***).

By writing these words, published in 1677, Baruch Spinoza codified the basic realization behind the "systems approach": that we cannot understand individual things properly by separating them from their larger, causal environment. Or to paraphrase John Donne: No man, or natural system, is an island; entire of itself (**Donne, 1623**). To understand, we have to look at the larger picture with a sufficiently inclusive scope. Instead of engaging in reductionistic "mutilation" which results in confusion, we need to choose a degree of magnification appropriate for the scale of the system we seek to understand. Thereby we can derive proper understanding of both individual things in the world and their functional interrelations. This, according to Spinoza, is the only true and lasting foundation of education (**Spinoza, 1662, in Curley, 1985, p. 10-11**).

3. Spinoza as an Educator

Nimrod Aloni (**2008**) discusses the educational implications of Spinoza's philosophy. In Spinoza's approach, he finds a previously untapped potential to empower students through self-realization. I would add that especially in the context of sustainability education, Spinoza also offers a vital alternative to traditional Baconian-Cartesian pedagogy.

Based on his experience of teaching Spinoza's philosophy, Arne Næss claimed that Spinoza's work the *Ethics*

> has inspired, and will in the future inspire those who… try to contribute… to the solutions of the ecological crisis. It is clear to those who teach Spinoza at the universities that the appeal of Spinoza is close to universal. It is not astonishing that he is sometimes called THE philosopher (**Næss, 1992, p. 418**).

As an educator, I have also observed the "close to universal" appeal of Spinoza's philosophy. I have found that when this philosophy is introduced in its proper historical context and contrasted with the reductionism of Bacon and Descartes, it offers a much needed explanation of a turning point in Western history where many of today's sustainability issues have their root. Not only does Spinoza's philosophy offer an explanation to *why* reductionism is based on faulty epistemology, it also provides a sound alternative useful in the classroom, firmly

rooted in a worldview promoting sustainable solutions as an ethical obligation. In addition to this, Spinoza's philosophy provides an ontological and epistemic foundation for systems thinking and various systems-based sciences and strategies for sustainable change. Thereby, as I see it, Spinoza holds a key to the transdisciplinary integration of sustainability education from the stage of curriculum design to full program development.

Ethics of Sustainability in Spinoza

The goal behind the pedagogic approach that I describe in this paper is to make the experiential-learning experience of students a maturation process fostering empowered, self-aware, and responsible individuals, well equipped with the conceptual and ethical "Big-Picture" understanding required for building a sustainable world. In my courses and workshops, I use Spinoza's perspective on parts and wholes as a conceptual framework for understanding how complex systems function, and also for teaching the proper (i.e. sustainable) management of such systems.

As we have seen above, Spinoza maintains that our choice to call something a 'part' or a 'whole' is *entirely dependent on our perspective* – our vantage point in relation to the rest of the total universe. Only when we recognize this relativity resulting from our partial perception of the world will we be able to change our actions in a way that benefits the larger whole. According to Spinoza, we will then – by our spontaneous, natural inclination – act in a way that we today would consider 'sustainable' in the environmental, social, and economic sense. In Spinoza, the harmonious interrelation of parts with larger wholes is thereby also the pattern for proper ethical conduct (***Ethics*, Part V**).

As an instructor and facilitator I have found that an experientially grounded understanding of interrelation in a context of complexity makes a student empowered as an individual – recognizing that he or she as a 'part' will actively affect the larger 'whole' (and other 'parts'!) by personal choices, while at the same time being affected by interaction with other 'parts' and 'wholes' – socially, economically, and ecologically. This view, fully supported by Spinoza, stands in stark contrast to the forceful, anthropocentric conquest of the natural world that is directly advocated by Bacon and Descartes (**Merchant, 2006**).

In his magnum opus, the *Ethics*, Spinoza recommends that we always act in a way that is to our own individual advantage as humans, but only our *true* advantage, which by necessity must be based on a profound awareness of what we today would call sustainability (***Ethics*, Part IV, Scholium to Proposition 18**).[15] When we see ourselves correctly in relation to our larger relational environment we will conduct our lives to benefit ourselves *only* in accord with what benefits others in the long term (***Ethics*, Part V**). Spinoza claims that what is *ultimately* good for one *must* be aligned with the greater good on a global scale, because all are interdependent. I find this controversial prescriptive dimension of Spinoza (what we *ought* to do) conducive to sustainability. For these *descriptive* and *prescriptive* reasons, Spinoza's philosophy is a fruitful

[15] Previous attempts to use Spinoza's philosophy to substantiate and support various environmental philosophies and agendas have been problematic (**Lloyd, 1994; de Jonge, 2004**). However, as I see it, Spinoza's onto-epistemology, ethical theory, and general attitude toward the world as an interdependent whole is perfectly compatible with the concept of 'sustainability' understood from a systems perspective. I will develop this observation in future work.

alternative to Baconian-Cartesian reductionism when our objective is to motivate and build a sustainable civilization.

Spinoza's perspective on parts and wholes can be used as a conceptual framework for understanding how complex natural and designed systems are organized, and also for understanding if they are sustainable or not. By its very nature, this approach involves self-reflection whereby we consider how we ourselves interrelate with our world, and how our actions effect changes in a wider relational setting. Thereby Spinoza's ethics can be used to explain to students *why* sustainability is not only a desirable goal but also an ethical obligation, rooted in the very structure of the universe and our own core needs as living, breathing, relational organisms.[16]

Spinoza's Systems Philosophy as a Meta-discipline

In education and many other human endeavors, a systems approach can provide a basic language for communicating effectively and *meaningfully* about a most fundamental subject: organized complexity in any of its myriad forms (**Checkland, 1993, pp. 8, 98; Checkland, 1999, p. 48**). We can call such a basic language a 'meta-discipline'. As pointed out by Peter Checkland, "systems thinking" (in the widest sense) can function as a meta-discipline:

> What distinguishes systems is that it is a subject which can talk about the other subjects. It is not a discipline to be put in the same set as the others, it is a meta-discipline whose subject matter can be applied within virtually any other discipline (**Checkland, 1993, p. 5**).

Because of its multi-dimensional nature and inherent complexity, sustainability requires such an organizing, conceptual language beyond the confines of any single discipline. Without an appropriate meta-level of communication, 'sustainability' is often degraded to a catch-all buzzword devoid of epistemic precision, pedagogic power, and practical utility.

At this point, it must be noted that the comprehensive systems theories and methodologies of the twentieth century have failed in the role as universally applicable and widely accepted meta-disciplines. One of them is General Systems Theory (**Checkland and Scholes, 1999, p. A3; Jackson, 2000, p. 100**). In part, this failure can be explained by the fact that a conceptual meta-language needs to have an intuitive directness and relative simplicity that makes it useful as *a facilitator of understanding* across artificial boundaries. To make sense to teachers and students alike, theory and method must be ontologically grounded and epistemically justified. In short, our methodology and the theory behind it must both be rooted in a philosophy explaining "what is" and how we can gain true knowledge about things in the world.

Considered as a meta-level facilitator of understanding, Spinoza's systems philosophy provides an onto-epistemic *foundation* for the individual systems-based disciplinary approaches that are essential to sustainability education. When this systems philosophy is taught as a meta-discipline explaining the systemic organization of nested 'parts' and 'wholes' in the world; then concepts from other systems-based disciplines and interdisciplines (including specific methodologies) are allowed to coexist functionally within a unified epistemic framework. This

[16] Spinoza's seamless fusion of epistemology, metaphysics and meta-ethics provides a bridge between 'is' (what exists and how it is organized) and 'ought' (what we ought to do in the ethical sense). Thereby, I find Spinoza to both motivate and substantiates a sustainability-promoting normative ethic.

framework is based on a view of the world as an integrated, complex 'whole' that is knowable not by means of reductionism but through awareness of functional interrelations. A universal framework of this kind is one of the fundamentals of a transdisciplinary approach unconfined by any single disciplinary conceptual framework (or any synthesis of such frameworks produced by *inter*disciplinary integration).

Grounding Transdisciplinarity in Spinoza

In higher education, profoundly discipline-transcending integration is rare indeed. Instead, most course- and program offerings with "interdisciplinary" aspirations remain *multi*-disciplinary (in the sense of adding parts from multiple disciplines without conscious, "organic" integration among them). According to this definition, 'interdisciplinarity' is greater than the sum of the parts (disciplines; disciplinary concepts). 'Multi-disciplinarity', on the other hand, is equal to the sum of parts. 'Transdisciplinarity', finally, is also, just like 'interdisciplinarity', greater than the sum of conceptual parts, but representing a *degree* of integration that is profound, inclusive, and systematic.[17] This unification mirrors the seamless integrity of complex systems. It also conveys a kind of understanding that, in Spinoza's words, "follows the order and connection of things" which in reality are organized in nested structures of relative 'parts' and 'wholes' (***Ethics*, Part II, Proposition 7**).

According to Basarab Nicolescu (**2002, p. 44**),

> transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines. Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge.

With this definition, the degree of cross-disciplinary integration increases from multi- to interdisciplinarity, culminating in transdisciplinarity where "disciplinary" aspects of understanding are considered as more or less limiting constructs vested with lesser or greater epistemic utility in relation to the undivided body of reality (the total structure of all 'parts' and 'wholes'). As Erich Jantsch (**1980**) observed, this integrative endeavor is of greatest need because "an intricately interconnected reality is a whole which cannot be described by the sum of its disciplinary aspects, just as no real system may be described by the sum of its parts".

The displaced application of the Baconian-Cartesian method to educational administration has resulted in fragmentation separating the practitioners of individual academic disciplines into camps. Spinoza's alternative to reductionism, however, could facilitate transdisciplinary integration and sustainable problem solving across cultural divides.

Being among the first to use the term coined by Jean Piaget in the 1970s (**Bourguignon, 1997**), Erich Jantsch called 'transdisciplinarity' "*a key notion for a systems approach to education*" (**1970**, **p. 414; italics in original**). In the same publication, Jantsch also foreshadowed today's emerging ideal of sustainability in education:

> It is important to understand the quest for knowledge as a form of interaction between living systems and their environment, no less essential than, say, breathing or feeding, and in the same sense subjective and objective at the same time.

[17] There is considerable disagreement in the literature on the scope and denotation of the term 'transdisciplinarity' and of the terms for other integrative disciplinary approaches; see **Thompson Klein, 2004**.

In this paper, I use the term 'transdisciplinarity' in the same vein: as a rather open label-concept for a practical approach to knowledge considered as a unified body, transcending the artificially imposed boundaries of the academic disciplinary structure; an integrative approach that requires a well-developed and articulated meta-level of communication which in itself is not limited by disciplinary confines. The purpose of this meta-disciplinary level of communication is to facilitate a meaningful dialogue about the simultaneously subjective and objective nature of systematically organized 'parts' and 'wholes'; subjective in the sense of being perspective-dependent (as discussed above), and objective in the sense of conveying understanding of reality with maximum accuracy.

Sustainability is a discipline-transcending concept. The recognition of this fact has recently contributed to the growing interest in transdisciplinary approaches (**Thompson Klein, 2004**). In my courses and workshops, individual disciplines contribute conceptual tools, such as models and terminology, organized within a wider, transdisciplinary scope. I have found that Spinoza's philosophy provides epistemic integration and justification for such an approach, as well as a pedagogic "blueprint" for problem solving beyond disciplinary and cultural confines. In the context of sustainability education, Spinoza's "worm's-eye approach" to 'parts' and 'wholes' can function as a meaningful and practically useful epistemic meta-context for individual elements of disciplinary knowledge, understood as parts of a larger, in reality undivided whole. Thereby, this philosophy can provide the missing key to understanding our present sustainability crisis.

4. Conclusions: Education as the Union of Mind with Nature

Spinoza's worm-in-the-blood analogy effectively illustrates a systems perspective that has become "common wisdom" in some fields of ecology. Often, however, this perspective is implicitly taken for granted as the correct view of the world without giving students a practical tool to conceptualize it effectively and a language to discuss it. In sustainability education, where we have to integrate topics and materials from many different fields within a unifying, sense-making framework, this need for contextual integration is pronounced at every turn.

In my classes I have repeatedly heard students meeting Spinoza for the first time exclaim, "This should be taught at every level of education", and "I wish I could have taken this course at the beginning of my studies." In my experience, students tend to find Spinoza's adjustable "worm's-eye lens" highly useful for comprehending the layers of organization in complex systems; especially in situations involving simultaneously relevant spatial and temporal scales, and multiple human perspectives (including stakeholder worldviews). A common reaction has been that this lens "explains how the world actually works" in a way that is both simple and profound; and that it serves as a powerful conceptual tool for dealing with messes and wicked problems which by their complex nature defy both reductionistic problem definitions and solutions (**Ackoff, 1974; Rittel and Webber, 1984**).

Many of my students have been especially appreciative of the empowerment they experience from "finally getting the Big Picture" through Spinoza's description of parts in relation to larger wholes. Some of my students have also found this "eye-opening" change of perspective to practically explain what *lacking* sustainability consists of: the combined consequences of actions taken because of a lack of proper awareness of the interrelations among mutually dependent parts and wholes.

This realization that I have witnessed among my students was also Spinoza's own pedagogic objective. In a treatise from 1662, Spinoza maintains that "the highest good is to arrive – together with other individuals if possible – at the enjoyment of…. the knowledge of the union that the mind has with the whole of Nature [*tota Natura*]" (**Spinoza, 1662 in Curley, 1985, p. 10; original Latin added**).

In modern terms, Spinoza seems to describe an understanding of how we as individuals fit in inside the larger functional structure of the total universe, and how we need to conduct our lives based on that awareness. "This, then, is the end I aim at", Spinoza continues,

> to acquire such [understanding], and to strive that many acquire it with me…. To do this it is necessary, first to understand as much of Nature as suffices for acquiring such a nature [of understanding]; next, to form a society of the kind that is desirable, so that as many as possible may attain it as easily and surely as possible (***ibid*, p. 10-11; words in brackets added for clarity**).[18]

To make way for his sustainability-promoting civilization, Spinoza prescribes the proper "instruction on the education of children", functioning health care (Lat. *integra medicina*), and constructive applications of science and "mechanics" (in modern terms: technology). But, according to Spinoza – first and foremost – "before anything else we must devise a way of healing the intellect [*medendi intellectus*]" (***ibid*; original Latin added**).

To understand what Spinoza could have meant by this remarkable statement, we need to look closer at the translation. In the 17th century, the Latin word *intellectus* was used in a way quite different from how we today use the modern and narrowly mental (or even academic) English term 'intellect'. Therefore, a better translation of Spinoza's statement above is that we must devise a way of "healing our *understanding*" (**Næss, 1992, p. 400**).

According to Spinoza, this healing – fundamental to a sound education – must come from a rejection of the Baconian-Cartesian reductionistic onto-epistemology. His cure for confusion, discussed in this paper, is prescribed by Spinoza because, from his perspective, it imparts a profound awareness of how 'parts' and 'wholes' are organized within the total system of the world. This awareness requires the acceptance that we ourselves as individuals, as well as human communities, coexist within a profoundly integrated system – the laws of which we have to obey, or perish.[19] Indeed, it is becoming increasingly obvious on a global scale that true sustainability requires Spinoza's uncommon kind of awareness. And to make way for a society guided by its light, we need to put this awareness to practical use on every level of education.

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[18] In this quote from Spinoza, the first "Nature" (Lat. *Natura* capitalized) refers to the unified totality of the universe, while the second refers to a realized human disposition defined by a sufficient "ecological" understanding of this systematically organized totality.

[19] A discussion of Spinoza's *conatus* would be relevant here but is outside the scope of this present paper.

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