PHILOSOPHICAL CONDITIONS FOR SUSTAINABLE OUTCOMES TO COMPLEX SYSTEMIC INTERVENTIONS

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ABSTRACT

Consideration of Alexander Laszlo's inspiring vision for a sustainable thriving eco-civilization shows that it is grounded in three important assumptions. These may seem unremarkable at first sight but an analysis of their implications reveals that they commit us to positions that are deeply problematic in the academy. The systems movement will have to help find ways to resolve these issues as a prerequisite for attaining the presented vision. In my view this can be done, and in my presentation I will show what these problems are and how we might approach helping to resolve them.

Alexander Laszlo's three assumptions are that (1) a sustainable thriving eco-civilization is possible, (2) we can bring it about, and (3) it is important that we bring it about.

I will show that these three assumptions confront us with three problems the systems movement has struggled with since its inception: (a) the disunity of knowledge and fragmentation of worldviews, (b) the semantic divergence between different disciplines, and (c) the absence of scientific support for non-constructivist theories about values.

In situations characterised by complexity and value conflicts these problems subvert collaborative solution design, impede efficient execution of interventions, and undermine broad adoption of the solution features.

I will argue that in order to overcome these problems we have to work towards broad acceptance of (i) a moderate ontological realism according to which the world has at least some properties that are stable and independent of our cognitive acts and that can bracket the possibilities for change, (ii) a modest epistemological realism according to which we have at least some access to true knowledge about these properties and boundary conditions, (iii) a robust model of the connectedness between, but distinctness of, objective and subjective kinds of knowledge, (iv) a principled way of developing a semantic framework that makes different disciplines mutually accessible, and (v) a moderate axiological realism according to which at least some values have an objective grounding in the nature of Reality.

The problems surrounding unity, realism, knowledge, semantics and values are substantial ones, and the subject of deep divisions in the academy. However, I will argue that due to recent developments the systems movement is now positioned to make crucial contributions towards their resolution, and that it is likely that they will be resolved in a way that will support the validity of Laszlo's assumptions. More broadly, such progress can help to reinvigorate the systems

movement in general by improving the possibility of providing reliable interventions with sustainable outcomes.

Keywords: sustainable eco-civilization; unity of knowledge; ontological realism; systematic semantics; axiological realism

INTRODUCTION

In an inspiring *Incoming Presidential Address* setting the theme for the 57th Meeting and Conference of the ISSS, Alexander Laszlo set out a vision and a call to action: to curate the conditions for a thrivable planet by extending the range and scope of the systems sciences in a way that reinvigorates the systems movement and enables it to leverage the emergence of a global eco-civilization (A. Laszlo, 2013).

On reflection, this ambitious goal is grounded in three assumptions, namely that (A1) a sustainable thriving eco-civilization is possible, (A2) we can bring it about, and (A3) it is important that we bring it about. These assumptions may seem unremarkable at first sight, but an analysis of their implications reveals that they carry controversial connotations.

I will show that for A1 to A3 to be valid we have to find ways of meeting the challenges posed by (C1) the disunity of knowledge and the fragmentation of worldviews (C2) the semantic divergence between different disciplines, and (C3) the absence of scientific support for non-constructivist theories about values.

C1-C3 represent challenges the systems movement has struggled with since its inception, and I will argue that resolving them commits us to positions that are highly controversial in both the current academy and the contemporary systems movement.

Nevertheless, it is important that we find ways forward with this, not only to support Alexander Laszlo's vision but because in all situations characterised by complexity and value conflicts these problems subvert collaborative resolution design, impede efficient execution of interventions, undermine broad adoption of the emerging system's features, and erode on-going support for the systems outputs.

In my view these challenges can be met, and hence I regard Alexander Laszlo's assumptions as reasonable. In this paper I will defend these views by proposing ways in which these issues can be addressed, and argue that resolving these challenges depends crucially on taking a systems approach. On this basis I think that systems thinking not only has the potential but will be crucial to bringing about the vision presented by Alexander Laszlo.

CONDITIONS FOR THE THEORETICAL POSSIBILITY OF SUCCESSFUL COMPLEX INTERVENTIONS

Transitioning from our current situation to a sustainable thriving eco-civilization is clearly going to be a complex effort on all levels (technical, social, political, economic, ecological, spiritual) and thus involve all areas of human knowledge. It will take more than just specialists from different disciplines working together: it requires that their different inputs can be joined up in a coherent and synergetic way, to show an actionable way forward. Beyond this, we need not only a way forward that we can *agree* on but that we can *rely* on, that is, one which is such that if we execute it well we have a good chance of actually getting to the desired outcome (in this case, a sustainable

thriving eco-civilization). The requirements that our knowledge forms a coherent whole and be reliable embroil us in two important academic debates, one about the unity of knowledge, and the other about foundational paradigms.

The coherence condition: unity of knowledge

The idea that knowledge from different specialised domains should be mutually consistent and hence form a coherent whole is known as "the unity of knowledge". Up to the mid-20th century almost all academics thought it obvious that, at least in principle, such a unity existed. Moreover, between about 1870 and 1970 most thought that it would be achieved by reducing all facts to micro-physical facts. Nowadays thing are much less certain, on both counts. Many (perhaps most) now reject the idea of physicalistic reductionism, but for many this does not just entail some other kind of unification. Many now doubt that unity is possible in principle (even on a basis that is broader than Physicalism), because many of the properties of natural systems resist explanation in terms of the properties of what are presumed to be the constituent parts of the system. For many this casts doubt on unification programs grounded in physics, and hence suggests either giving up on the foundational unity of knowledge altogether, or grounding the unity in something other than physics (e.g. consciousness or God), or something broader than physics (e.g. some kind of psychophysical stuff), or something more fundamental than physics (e.g. an undifferentiated primordial substance like the tao), or a plurality of fundamental substances (e.g. mathematical stuff and minds). In addition, some academics resist the idea of the unity of knowledge on ethical principles, suggesting that it places limits on the freedoms of persons with specific interests to interpret 'their' subject in an unfettered way. Moreover, some academics completely dismiss the idea of there being any objective facts at all, even in principle. Such a view entails that there is no way the world is in and of itself, or at least that there is no privileged perspective on it that can be referred to in deciding questions about the interdisciplinary coherence of knowledge.

In consequence, most current academics would probably deny that the sort of unity of knowledge required to design and execute interventions in very complex situations exists in principle, or can be attained in practice. Promoting the unity of knowledge was included in the founding principles (1956) of the ISSS (ISSS, n.d.), but this goal remains elusive (Hammond, 2005; Wilby, 2011, p. 438).

The link between foundational paradigms and the unity of knowledge.

As suggested above, there is a link between ideas about foundational paradigms and ideas about the sort of unity of knowledge that is possible. Before taking a closer look at how this link works, it is worth noting that disciplinary worldviews have become dramatically fragmented over the last century (Aerts et al., 1994), and ontological frameworks are now in many ways incommensurable between disciplines (as indicated in a simplified way in Table 1 below).

The situation is not helped by the fact that the systems movement's ideas about the unity of knowledge have tended to support, rather than resolve, the fragmentation of disciplinary views on foundational questions. At first there was a focus on attaining only a kind of overarching unity via General System Theory (GST). As von Bertalanffy scholars David Pouvreau and Manfred Drack explain,

> [GST's] major goal is to generate a new type of unity of science: not a unity based on the reduction of the concepts, methods or even laws of all sciences to the ones of a single science regarded as more essential; but rather a formal unity based on the generality and ubiquity of the system concept and on the 'isomorphisms' it induces between sciences of

which the logical and methodological autonomy is guaranteed (Pouvreau & Drack, 2007, p. 283).

Even this limited goal has since been softened, and Michael Jackson recently affirmed that Critical Systems Thinking and Practice (CSP) "no longer aspires to meta-paradigmatic status. … CSP sees its job as to protect paradigm diversity" (Jackson, 2010, p. 136).

Table 1: Different academic perspectives on the nature of reality and the possibility of true knowledge

[reproduced from Rousseau, D. (2013), Systems Philosophy and the Unity of Knowledge. Forthcoming in *Systems Research and Behavioral Science*, DOI: 10.1002/sres.2189, Table 1., with permission from Wiley]

Academic Sector	Dominant Perspective	Model of Reality	Model of Knowledge
Fundamental Physics	Idealism (Copenhagen version)	consciousness collapses 'probability wave functions' to produce 'physical reality'	we cannot have exact knowledge but we can make accurate statistical predictions
Macro-Physical Sciences	Physicalism	every concrete thing is 'at bottom' wholly physical (deterministic or stochastic)	if we know the physical facts then in principle we know all the facts
Life Sciences	Physicalistic Emergentism	new systemic properties arise from complex interactions between physical parts	if we know the parts and the relationships we can explain everything about the system
Social Sciences	Constructivism	reality is a subjective cultural construct	knowledge is a subjective cultural construct
Humanities	Constructivism	reality is a subjective cultural construct	knowledge is a subjective cultural construct
	Intuitionism	we have innate knowledge of what we really need to know	intuition is a more reliable guide to truth than dogma, reasoning or empirical testing
	Theism/Deism/ Mysterianism[1]	the world has both natural and supernatural or unknowable components	the world is only partially knowable, and only partially predictable
	Critical Realism	there is an objective reality behind the appearances	via science and reason we can progressively come to have true knowledge of reality

[1] The term "Mysterianism" was introduced into philosophy by Owen Flanagan (Flanagan, 1991, p. 313) to designate the view in philosophy of mind, proposed by Colin McGinn, that the nature of consciousness is inherently beyond explanation but does not involve supernatural factors. The use of the term has since expanded to cover the general position that Nature contains phenomena that are inherently inexplicable but not due to supernatural factors, in order to similarly resist pressure to explain other deeply challenging phenomena such as quantum entanglement and fundamental particle decay. In the systems community Mysterianism is usually called "Postmodernism". I will use Mysterianism because Postmodernism is sometimes also used to represent *Pluralism*, which embraces such ideas as that mutually inconsistent theories about the same phenomenon might be equally valid, or that theories about different classes of phenomena are logically isolated from each other.

The link between foundational paradigms and the unity of knowledge is worth looking at in some detail, because it is easy to mistake how diverse the options and current positions are, and think that any challenge to one's own paradigm suggests an extreme alternative.

Our academic knowledge about the world is developed in specialised disciplines, and in each case the knowledge attained carries implications for the relationship between it and other knowledge domains. At present different disciplinary perspectives project a spectrum of different views about the kind of unity of knowledge that is possible.

At the one extreme we have assumptions about an absolute unity of knowledge predicated on Reductionistic Physicalism, according to which all phenomena arise in mechanistic ways from the interactions of physical particles. In this model all knowledge is explainable in terms of physical knowledge, and there is only one correct way of understanding the world. In this model all the facts are either primordial facts (true always and everywhere) or determined (contingent, epiphenomenal or supervenient on the primordial facts), and all the primordial facts are physical facts. This was once the dominant view in academia but developments in quantum physics, philosophy of mind and sociology have rendered it much less influential than it once was.

At the other extreme we have an absolute diversity of knowledge postulated by Social Constructivism. In this model all knowledge is constructed relative to other knowledge and contexts such as culture, environment, cognitive capacities, expectations and so on. In this model there are no truths, only perspectives and conventions; there is no inherently privileged way of viewing the world, and no insights that can be generalised to apply elsewhere. This is presently the dominant view in the social sciences.

In between these extremes we have a range of more moderate views according to which some facts are primordial, some are determined and some are constructed. This is illustrated in a very simplified way in Figure 1. As the figure shows, each position is characterised by a worldview that entails fundamental commitments about the ultimate nature of the world, and these carry entailments for the sort of unity or diversity of knowledge that ensues. Such commitments are unavoidable: to quote Alfred North Whitehead, "every proposition refers to a universe containing some general systematic character … Thus every proposition posing a fact must, in its complete analysis, propose the general character of the universe required for that fact" (Whitehead, 1929, p. 11). Figure 1 is necessarily a very simplified presentation, but it illustrates the fact that there are a range of ontological views in the academy, forming a spectrum of views between absolute unity of knowledge and absolute diversity of knowledge, and even the polar types can be realised in multiple ways. The academic ontological space is *not* a simple one, and in the present state of knowledge perhaps no-one can claim to have it exactly right.

The standard views are deeply entrenched in their respective disciplines, and feelings about their merits (and the deficits of others' views) run deep. The question, in the face of this diversity of perspectives, is on what basis one might think that some sort of unity of knowledge is possible. Interestingly the contemporary systems movement does not have a unified perspective on this.

Within the hard systems sciences (e.g. *Systems Dynamics* and *Systems Engineering*) the dominant view is an onto-epistemological position known as "Critical Realism" according to which there is a concrete reality that exists independently of being observed or conceived of, and that underpins

our experiences, and although we typically experience it in a conditioned way we can come to have true knowledge of it via scientific and philosophical methods (Bunge, 1977, p. 16).

In contrast the Soft and Critical Systems Movements do not have a dominant onto-epistemological view, but are marked by their theoretical eclecticism, with different methods

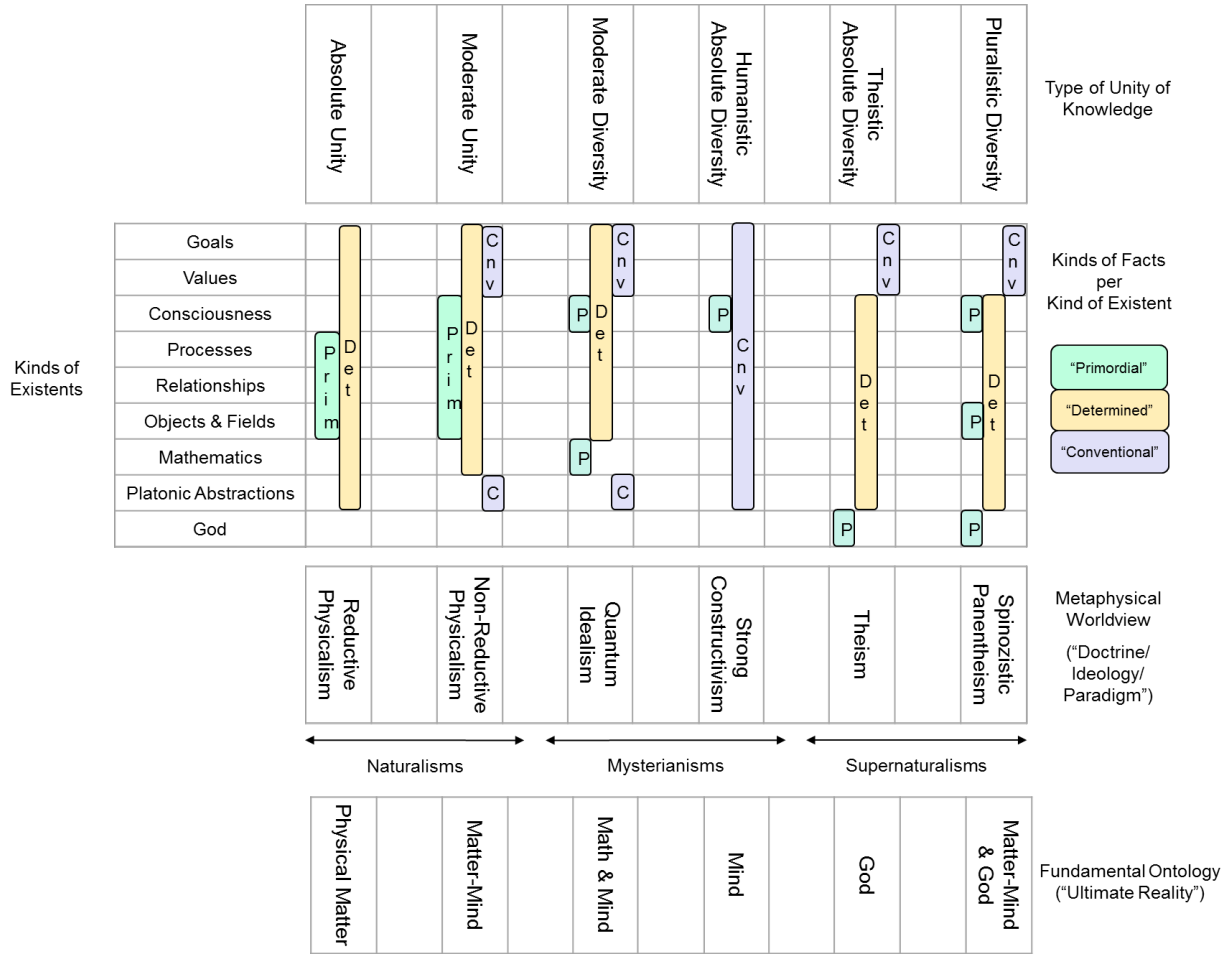

Figure 1: Kinds of Unity of Knowledge entailed by different Ontologies and Paradigms

drawing on a range of apparently mutually incompatible paradigms (Bowers, 2010, 2012, p. 3,4), and no widely agreed typology of methods and paradigms (Wright, 2012, p. iii). Michael Jackson's classical division into Functionalism, Interpretivism, Postmodernism and Emancipationism is well known, but has not become standard usage in the systems movement, nor is it always consistent with the paradigm nomenclature of other disciplines (but to be fair other disciplines are not very consistent either). Roughly, his Functionalism is related to others' Critical Realism, his Interpretivism to Constructivism and Idealism, his Postmodernism to Mysterianism and varieties of Pluralism, and his Emancipationism to Holism, Marxism and Feminism.

All these views are represented in the Soft and Critical Systems Movements, for example, and very roughly, Checkland's *Soft Systems Methodology* is Interpretivist, Beer's *Viable Systems Model* is Postmodern (Wright, 2012, pp. 59–62), Ulrich's *Critical Systems Heuristics* is Constructivist, and Ervin Laszlo's *Systems Philosophy* is Critical Realist. Diverse foundational views occur even amongst systems thinkers working within the same methodology, for example in the arena of

Boundary Critique Gerald Midgley is (conditionally) a Postmodernist, Werner Ulrich is a Constructivist, and C. West Churchman is an Idealist (Midgley, 2001, p. 150). Some systems thinkers support a single paradigm across multiple methodologies (e.g. John Mingers widely supports Critical Realism (Mingers, 2004, 2011)), while some support pragmatically switching between or mixing paradigms based on contextual factors (e.g. Michael Jackson).[2]

The diversity of methods is clearly valuable and each represents a view with some merits that other methods are less sensitive to. However, if we are to have a unity of knowledge we have to resolve the mutual inconsistencies in foundational views. The problem is that as long as we do not have an underlying unified theory we cannot know whether multi-method interventions worked because of essential characteristics or just by chance (or even by convention!), and hence we cannot have any confidence that complex interventions will be resilient. The challenge is how to get there without just sliding back into the discredited ways of thinking such as reductionism or authoritarianism.

Again, the question, in the face of this diversity of perspectives, is on what basis one might think that some sort of unity of knowledge is possible.

In my view the systems movement has a historic opportunity to make a useful contribution here, due to a long- neglected insight by Ervin Laszlo, and recent breakthrough developments in science and philosophy. However, Ervin Laszlo's argument is grounded in Critical Realism, a stance that is clearly still very controversial within the systems movement, and probably a minority view amongst Soft and Critical Systems Thinkers. Therefore, before presenting Ervin Laszlo's insight and argument, it will be valuable to consider the reasons why it may be important to embrace Critical Realism, to review recent academic developments that lend support to the credibility of Critical Realism, and to dispel some confusions about what it does and does not actually entail.

The reliability condition: Critical Realism

The idea that we can *rely* on an action plan to give us a good chance of achieving the desired practical outcome in a complex situation entails that that what we regard as our (unified) knowledge at least to some degree reflects the way things really are, either actually or potentially. This idea corresponds with what above defined as Critical Realism.

The early systems thinkers typically *were* critical realists (von Bertalanffy called it "perspectivism"). This view is still dominant in the hard sciences (and the hard systems sciences), but is currently strongly opposed in the social sciences, where constructivism dominates instead. Constructivism asserts that truth is subjective and relative to context, and merely reflects our cognitive processes or cultural conditioning, rather than some postulated 'reality' lying beyond our experiences.

The human sciences, and the soft and critical systems sciences, embrace a range a wide range of views, but here critical realism is probably a *minority* view.

Overall, a poll of either current academics in general, or systems thinkers in general, would probably suggest scepticism about critical realism. Nevertheless, in the next section I will show

[2] With apologies to everyone mentioned in the last two paragraphs. In reality one cannot draw boundaries around another's philosophical views without creating a caricature (and probably a time-expired one at that).

that critical realism is making something of a comeback in academia, and is looking set to win the day, in line with the sentiments of the early systems thinkers. In my view this bodes well for the prospects of designing *reliable* interventions in complex scenarios (including ones as ambitious as Alexander Laszlo's).

Emerging academic support for Critical Realism

John Mingers noted that Critical Realism was a typical position amongst early systems thinkers, saying that for them concepts such as system, feedback and the nature of equilibrium "were genuine explanatory concepts in that the existence of such systemic processes in the world was necessary to explain the phenomena that were observed; [for them] to deny reality to systems concepts [would be] to reduce them to an essentially arbitrary language game" (Mingers, 2000, p. 749).

The validity of Critical Realism has come to be widely doubted in the postmodern academy (see e.g. Goodman, 1978; Rorty, 1998), but important lines of support for it have developed over the last 25 years or so, especially in the last few years.

Firstly, the philosopher John Searle has developed arguments that incidentally echoed the position of the early systems thinkers, pointing out that to use a public language is to assume that it encodes meanings that are common to its speakers, but this assumes that these speakers have shared access to a publicly available reality that some of the language terms refer to. In this sense it is incoherent to deny that a real world exists because the statement denying realism is using a language whose meaningfulness presupposes realism (Searle, 2005, pp. 189–191).

Secondly, the alternative to realism is some form of philosophical Idealism, but work done in the last three decades in the philosophy of mind showed that Idealism is based on logically circular arguments, and hence incoherent. Idealism is the view that there are no physical things, only minds having thoughts that present the appearance of a physical reality. It was the dominant metaphysical view in western academies for about 200 years, but lost its support amongst philosophers around the turn of the 20th Century on the basis of scientific findings such as evidence suggesting that a physical world existed long before conscious beings arose in the universe. However, Idealism was eventually shown be logically flawed. The refuting arguments are rooted in points developed by especially Bertrand Russell, G. E. Moore and A. C. Ewing, but finally completed by philosophers of mind such as John Searle and David Stove. The arguments take several forms and they are rather technical, but accessible discussions of them can be found in (Searle, 1995, Chapter 7,8; and Stove, 1991, Chapter 5,6). The logical inconsistency of Idealism has not been widely discussed because it came so long after Idealism lost its support in mainstream philosophy (on scientific rather than purely logical grounds).

Thirdly, absent realism we would have to explain why consistently acting in accordance with the supposition of realism works so well. As Hilary Putnam put it, "realism is the only philosophy that does not make the success of science a miracle" (Putnam, 1979, p. 73). Philosophers of science have broadly agreed, and argued that the scientific method systematically and convergently exposes the truth about the nature of reality (J. R. Brown, 1994; Psillos, 1999). This is not a claim that science knows everything or even that we will ever know everything, but that absent these extreme possibilities our knowledge still counts for something – it is not arbitrary but only incomplete and approximate, and it can get more complete and more accurate over time. The implication is that the categories of science increasingly accurately map the ontological structure

of the world, and the coherence of scientific theories increasingly maps the causal integrity of the world.

On this basis philosophers of science have over the last few decades worked out a range of "theoretical virtues", which are the qualities good theories have (Van Fraassen, 1983). These criteria reflect the nature of scientific theories *and* predict theory viability. They give an indication of which theories will win out in the long term, and enable us to assess, in a qualitative way, the size of the gap between theories and truth, at least compared to competing theories. These criteria are of the spirit of Popper's well known criterion of *falsifiability* and Occam's criterion of *simplicity*, but dozens of these criteria are now known, including conceptual clarity, internal consistency, explanatory power, scope, precision/specificity, depth (of mechanism), predictive power, retrodictive power, external compatibility, foundational conservatism, empirical adequacy, empirical versatility, logical plausibility, antecedent probability, synchronic likelihood, explanatory simplicity, ontological conservatism, limited ad hoc-ness, falsifiability, practical utility, productivity (including new applications, novel applications and new research angles), external relevance, and extendability. For useful discussions of such criteria, see e.g. (Chibeni & Moreira-Almeida, 2007; Kukla, 1990; Maxwell, 2004). For an example of how to use such criteria to guide selection between competing theories, see (Rousseau, 2012).

The success of science, and the ability to work out criteria that reflect the nature of scientific theories *and* predict theoretical competence, suggest very strongly that that we not only have epistemic access to the nature of reality, but that its nature reflects the structure of science, i.e. that reality is naturalistic.

It is important to note here this Naturalism does not equate to Physicalism – the term "natural" (in the sense of 'not supernatural') is polysemic (De Caro & Macarthur, 2008), but overall the most appropriate meaning seems to be that natural things are things that can change but are limited (finite) and constrained in every one of their aspects (Rousseau, 2011a). Naturalism can come in many forms, including versions that go well beyond Physicalism, see e.g. (De Caro & Macarthur, 2008, 2010; Goetz & Taliaferro, 2008).

The fourth line of support supplements the above work in philosophy of science with substantial new work in metaphysics by prominent philosophers and published by major academic publishing houses (e.g. Chalmers, 2012; Heil, 2012; Sider, 2011, all published by Oxford University Press). Metaphysics is firmly back on the academic philosophical agenda, and what is emerging is an 'ontological turn' in which philosophy finds its inspiration in fundamental science rather than language, and in which the positions are closely and extensively argued. David Chalmers's book *Constructing the World* weighs in at 494 pages, and develops a formidable theoretical position in favour of Critical Realism.

The 'new ontologists' assert that some of the claims formulated in the special disciplines and common sense are true, and then try to find out what makes them true, i.e., what is the fundamental nature of the world in which these claims are true. In general they all defend a version of the view that all truths are ultimately comprehensible given a compact class of fundamental truths. There are differences of opinion about what kinds of truths are amongst the fundamental ones, for example John Heil thinks they are all physical truths, Theodore Sider thinks they are all structural truths (relations and patterns), and David Chalmers thinks they include physical, phenomenal, indexical and 'that's all' kinds of truths. There is still much to debate here, but what is clearly emerging are strong philosophical arguments for the existence of some

fundamental truths, of objective facts about the nature of the world, of epistemic access to the nature of the world, and for the comprehensibility of the world (at least in principle).

These arguments are supplemented by arguments pointing out that a future metaphysics must both be built on the foundation of scientific thinking and describe an ultimate ontology that carries the conditions for the possibility of the emergence not only of physical structures but also physically irreducible phenomena such as life, self-awareness, intentionality, values and knowledge (Chalmers, 2010, 2012; Koons & Bealer, 2010; Nagel, 2012). Thomas Nagel, for example, asserts that

An adequate conception of the cosmos must contain the resources to account for how it could have given rise to beings capable of thinking successfully about what is good and bad, right and wrong, and discovering moral and evaluative truths that do not depend on their own beliefs. This is analogous to the previously defended implications for the natural order of the existence of consciousness and cognition, but it goes further (Nagel, 2012, p. 106).

Nagel is an atheist and a rationalist, and is here calling for a scientific account that embraces these features, so he is rejecting Physicalism and advocating a Broad Naturalism that does not involve supernatural or Mysterian elements. Nagel does not offer suggestions for how to proceed with building up such an account, but in my view it can be done, and I will in the last section discuss briefly how we can scientifically investigate ways in which axiology might be grounded in the natural order.

Much work will have to be done before our fundamental science will accommodate such a Broad Naturalism in an unforced way, but the newly emerging philosophical support suggests this view is both coherent and academically credible, and a bellwether for a broadening of views in science and scientific philosophy.

The fifth line of support comes from very recent developments in the philosophy of quantum physics. Until recently it was widely supposed that experimental tests in quantum physics of Bell's Inequality show that the outcomes of experiments involving entanglement indicate the *falsity* of realism (Aspect, Grangier, & Roger, 1982; Groblacher et al., 2007; Leggett, 2008). However, within the last half decade several researchers have mounted significant challenges against this conclusion.

Probably the most important challenge has come from the Oxford mathematician Joy Christian, who found that the derivation of Bell's Inequality contains an unwarranted topological assumption. John Bell assumed that if concrete but hidden variables were really behind quantum phenomena then these variables would be representable by ordinary numbers and be commutative. Christian pointed out that this is too restrictive, since many natural phenomena are non-commutative e.g. rotations in space.

Christian showed that if Bell's assumption is corrected then both quantum indeterminism and non-locality are revealed to be "illusions" resulting from "topologically incomplete accountings of the measurement results" (Christian, 2011, 2012). The implication is that the indeterminism in quantum theory is in fact a measure of our ignorance about hidden underlying mechanisms that are objectively real. So-called 'hidden variable' theories such as those developed by David Bohm, once thought ruled out by Aspect's and other experimental results, are not merely made viable again but are in fact more likely to be on the right track. Christian's work in this area is still hotly debated, but several other lines of argument now point in the same direction (e.g. Goodband, 2012;

Hardy, 2012; Pusey, Barrett, & Rudolph, 2012). The implication of this new work is that recent empirical results in Quantum Physics *support*, rather than oppose, Critical Realism.[3]

Overall, there seem to be good grounds for taking Critical Realism seriously, although the evidence supporting it has only really become strong very recently. This is good news for Alexander Laszlo's vision (and the potential reliability of complex systemic interventions generally). It also clears the way for a systemic argument for the unity of knowledge, originally due to Ervin Laszlo, which I present in the next section.

A systemic argument for the unity of knowledge

As discussed previously, in *logical* terms there several ways in which knowledge might be unified, depending on what kinds of objective facts are supposed to exist, and how they relate to other. The arguments in support of critical realism and naturalism given above have opened the way for us now to consider what empirically grounded arguments there might be for the unity of knowledge, and what sort of unity this implies.

We have such an argument within the systems movement, worked out by Ervin Laszlo and presented in his *Introduction to Systems Philosophy* (E. Laszlo, 1972, pp. 8–10, 18–21), and recently reiterated and expanded by David Rousseau (2013).

In his argument, Ervin Laszlo assumes that the world has some objective aspects, and that "it is open to rational enquiry", so he is a Critical Realist and Broad Naturalist. From this position he considers the findings of scientific disciplines and points out that the specialised disciplines (Physics, Chemistry, Genetics, Sociology, etc.) show that the concrete world is organised into intelligible domains. The systems sciences transcend the distinctions between the niche paradigms of the different academic sectors, by capturing functional patterns and principles that recur across many of the concrete knowledge domains, and these are captured in turn by the concepts and models in GST. GST therefore transcends the distinctions between the Systems Sciences by capturing the functional patterns and principles that recur across all Systemics. So far he is reiterating the general argument for the existence of a GST that links the sciences in an overarching way. Reflecting on this scenario, he then had a striking insight. He now points out that the existence of these transdisciplinary patterns and principles entails that the concrete world is intelligibly organised as a whole, and the nature of this global organisation is reflected in the principles and models of GST. The existence of global organising principles implies that the local organisation of the concrete world's special domains (as characterised by the niche paradigms of the specialised sciences) are contingent expressions or arrangements or projections of an underlying intelligibly ordered reality. In this way Ervin Laszlo argued that (a) the existence of a GST implies that there is an ordered reality *underlying* Nature, and (b) that GST provides a characterization of it. This is the *opposite* of the 'von Bertalanffy unity' mentioned earlier, in which "the logical and methodological autonomy [of the sciences] is guaranteed" (Pouvreau & Drack, 2007, p. 283).

In the light of Ervin Laszlo's argument it can now be seen that by implication GST is a *formal model* of the nature of this ordered (hence unified) ultimate reality underlying nature. Formal models capture the behaviour of something without making commitments about the ontology or mechanisms behind the behaviour – for that we need a concrete 'interpretation' of the formal

[3] For a more detailed discussion of these arguments see (Rousseau, 2011a, pp. 286–288).

model. Formal models provide us with practical tools (e.g. for calculating predictions) but concrete models represent our understanding of the situation. [4]

The implication of this is that there is an interpretation of GST in terms of concrete existents that describes the ultimate nature of Reality. Since Ervin Laszlo's argument is based on *scientific* findings this interpretation provides us with a description of the ultimate nature of *Nature*. Ervin Laszlo set as the first objective of Systems Philosophy to build this concrete model of the nature of Nature, and indeed the worldview he presents in his *Introduction to Systems Philosophy* has been characterized as a philosophy of *Natural Systems* (Skyttner, 2006, pp. 165, 167)). Of course, Ervin Laszlo is not a Physicalist, so this Naturalism must be seen as being of a broad or moderate kind.

We now have an argument for the unity of knowledge based on empirical findings from the sciences, and revealed via systems models and systems thinking. Moreover, this argument shows that the unity of the world, and hence of knowledge representing is, is grounded in the ontology of Nature, and is the same for all disciplines. By implication promoting the unity of knowledge then includes promoting unification between the foundational commitments of the special sciences.

These arguments are illustrated in the diagram given in Figure 2 below.

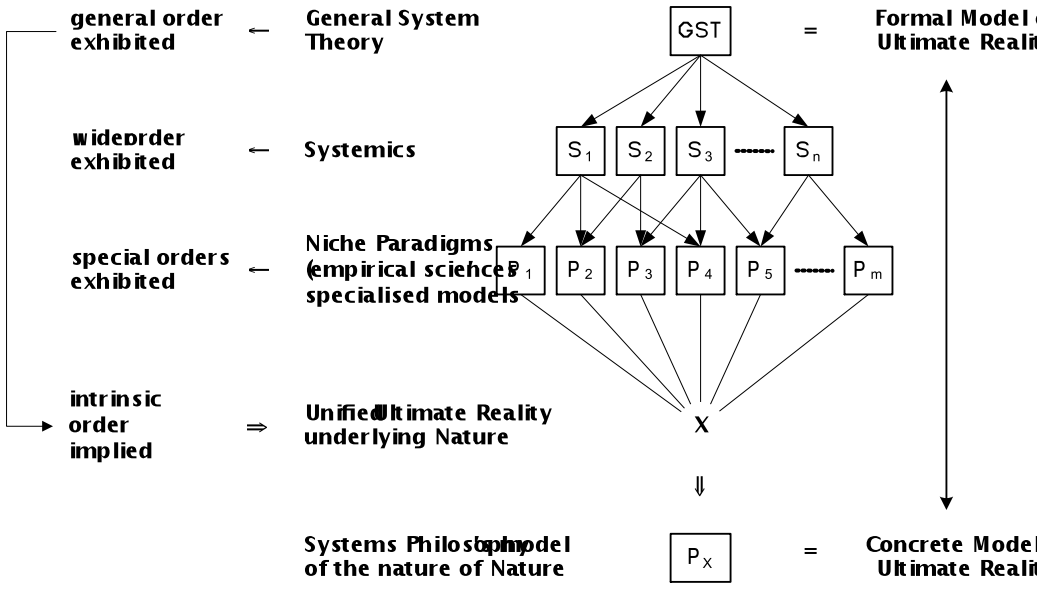

Figure 2: GST and the ordered reality that underlies Nature

[adapted from E. Laszlo (1972, Fig 1) and Rousseau (2010, Figs. 2 & 3)]

[4] For example, Quantum Mechanics is a formal model, and stands despite whichever concrete interpretation is proposed for it, such as Bohr, von Neumann & Wigner's "Copenhagen Interpretation" or Bohm's "Hidden Variable Interpretation".

The main challenge this vision faces is fears about a reversion to the discredited Physicalistic Reductionism, or capitulating to what Michael Jackson called "the dangerous authoritarian implication of hard systems thinking when it is applied to many kinds of social system" (Jackson, 1991, p. 86). However, in the current context such fears are unwarranted. As indicated above, contemporary critical realist philosophers increasingly argue that a future metaphysics will have to go well beyond both Physicalism and Reductionism to give an adequate account of the world, and find non-dismissive ways to embrace consciousness, subjectivity, values, meanings and goals within a wider notion of Naturalism. Such a Broad Naturalism presents a moderate 'middle ground' between the absolute authoritarianism of Reductionism and the absolute tolerance of Constructivism.

Present science is a long way from accommodating such a Broad Naturalism in an unforced way, but in light of recent academic developments this is a very real prospect. In later sections I will present some ideas about how the systems movement can contribute to bringing this about.

Implications for Alexander Laszlo's programme (and the reliability of complex systemic interventions generally)

The arguments just presented provide support for optimism that complex systemic interventions can be coherent (due to the unity of knowledge) and reliable (because our knowledge represents a reality with objective aspects), and hence for optimism about Alexander Laszlo's programme.

However, although the new unification possibility presented here reinforces confidence in Alexander Laszlo's manifesto, it also implies that in order to support the execution of his programme we have to pursue this unification insight, so that his programme will draw on appropriate knowledge. The current 'state of the art' in the unity of knowledge is however not very good: the foundations are radically fragmented, and some disciplines have had little attention from systems thinkers (e.g. consciousness studies, axiology, and spirituality). Systems thinking can contribute in significant ways in these areas, and I will outline some of these prospects further below.

CONDITIONS FOR THE PRACTICAL POSSIBILITY OF SUCCESSFUL COMPLEX INTERVENTIONS

The efficiency condition: semantic consistency

Bringing about a sustainable thriving eco-civilization requires not only a coherent and reliable knowledge base but also demands that people from different disciplines can work together *effectively*, by not miscommunicating as they discuss options, goals and actions. This however is a major problem, because as the disciplines have become more specialised their semantic frameworks have diverged, to the point where the term 'interdisciplinary' usually means "putting people together in a room and letting them talk past each other" (Meadows, 2008, p. 183) or "a group of disciplinarians holdings hands in a ring [while] the ostensible topic slips down the hole in the middle" (Beer, 1980, p. 64).

This problem has three significant dimensions.

Firstly, useful technical terms from one discipline are often poorly understood or mistaken by other disciplines and then applied inappropriately, for example in ways that mistake or distort the

original meaning (e.g. “non-local”, “dimension”, “vibrations”, “emergence”), or that conflate the meanings of originally distinguishing terms (e.g. physical/material, real/concrete, brain/mind, physical/natural).

Secondly, some natural language terms have become technical terms within disciplines, and thus become polysemic between disciplines. In one discipline “presenting an apology” means expressing regret, while in another it means defending a point of view. In one discipline “simple” means “indivisible” while in another it means “not complex”. In one discipline “having energy” means being motivated, while in another it means being able to change. In one discipline “to exist” means to be a bearer of properties, while in another it means to have causal powers. The list goes on. However, these differences represent different dialects rather than different *outlooks*, so perhaps this problem can be addressed via education.

Thirdly, we have a related but more serious problem, in that the same set of natural-language terms may refer to different ontological commitments in different disciplines, and be at odds with ordinary usage too. For example, in one discipline “time” might be understood to refer to real change in the states of things, while in another discipline it might stand for an illusion of change (e.g. as in the so-called “space-time block universe” model). The natural language meanings might be very different again, e.g., in natural language “time” might refer to a kind of thing rather than a kind of change (e.g. something that ‘flows’ and in which we are ‘immersed’). To make things worse, the meanings of ontological terms are not always clear or consistent even within a discipline, for example terms like “energy” “natural”, “physical” or “material” may be fuzzy or used in metaphorical ways that contradict their definitions. A good example is “energy” which is often talked about as if it is a kind of substance that can flow along causal paths, when in fact it is a property of concrete objects and not a substance (Bunge, 2000). Polysemy surrounding ontological commitments may be the biggest reason why scholars from different disciplines tend to talk past each other when engaging in multi-disciplinary discourse. Not only do they understand the terms being used in different ways, but their different ontological commitments entail differences in what is regarded as ultimately important, and hence about the purpose of the multi-disciplinary collaboration.

The link between unity, semantics and GST

A founding tenet of the ISSS (1956) was “to promote the unity of science through improving the communication among specialists” (ISSS, n.d.). These ambitions arose because the early systems thinkers saw a link between these issues and the potential of GST:

> The more science breaks into subgroups, and the less communication is possible among the disciplines, ...the greater chance there is that the total growth of knowledge is being slowed down by the loss of relevant communications. The spread of specialized deafness means that someone who ought to know something that someone else knows isn’t able to find it out for lack of generalised ears. It is one of the main objectives of General Systems Theory to develop these generalised ears, and by developing a framework of general theory to enable one specialist to catch relevant communications from others (Boulding, 1956, pp. 198–199).

However, following the implications of GST the systems movement did not espouse a unity *underlying* Nature (as Ervin Laszlo argued for) but rather an *overarching* framework provided by GST. The idea was to develop a general systems language based on the identification of isomorphies of concepts, laws and models across disciplines, and hence provide transdisciplinary language.

History has been unkind to this vision.

Firstly, although much has been done to promote a transdisciplinary language (e.g. Francois, 1998, 2004; Vesterby, 2013; Wilby, 2011), so far the attainment of a transdisciplinary language remains only "a dream" (Thompson Klein, 2004, p. 515), as recently affirmed by Jennifer Wilby (Wilby, 2011, p. 438, 2012, p. 464). In his 2013 *Call for Papers* Vince Vesterby, chair of the ISSS's SIG "Research Towards a General Theory of Systems" affirmed that "To date, relatively few isomorphies have been recognized – not enough to form the basis of a transdisciplinary language" (ISSS, 2013).

Secondly, and more seriously, the ontological commitments of the special disciplines have drifted apart, while the terms used to refer to those concepts have not. This is not only a problem of increasingly dissonant semantics, but also a sign of increasingly dissonant metaphysical outlooks, and *that* is inherently silo-reinforcing.

What was hoped for was "a new way of working that overarches disciplines and by doing so makes those boundaries melt" (Wilby, 2011, p. 438),but what transpired instead was a 'hardening of the boundaries', and an impasse about working together: "in current structures, whether University or societal, we do not know how to work in a transdisciplinary way without still trying to keep the silos. It is a leap of faith and most cannot do it" (Wilby, 2011, p. 441).

The semantic barriers between disciplines clearly limit our ability to effectively define and execute complex interventions, even ones much less complex than the one envisioned by Alexander Laszlo.

A new model for interdisciplinary communication

However, granted the proposed solution to the unity of knowledge problem, a way forward now presents itself. Following Ervin Laszlo, we can now see that in addition to seeking overarching isomorphies we have to *also* work towards:

(a) *consilience*, in which the models and concepts of the different special disciplines all carry the same implications for the metaphysical and ontological nature of the world (thus making the special disciplines compatible with each other) and

(b) *convergence of foundational discourse domains*,[5] so that disciplinarians can verify and discuss the level of agreement or difference between their own and others' fundamental commitments.

In this new vision we would attain a sort of "three-tiered scientific language", in which every discipline's total discourse domain (DD) consists of three contributory discourse domains:

DD1: a bespoke discourse domain which the discipline develops endogenously to capture the nique aspects of that discipline's subject matter, and

[5] A discourse domain is a semantic schema that provides, for a given knowledge domain, a specialised language consisting of a 'lexicon' of terms that are understood in a common way by the members of that discipline. This ensures a common understanding of core concepts, basic assumptions, fundamental facts, key observations and theoretical claims within the discipline.

DD2: an *overarching* universal discourse domain springing from GST,

DD3: an *underlying* universal discourse domain springing from metaphysical and ontological consilience.

In this model, we would *not* seek to dissolve the boundaries between the disciplines, since they each have a unique domain of knowledge to elucidate and apply, but the disciplines would be consistent with each other and together form a coherent whole, so the boundaries would be permeable to scholars from other areas. In my view this would fulfil the vision set out by Kenneth Boulding, according to which:

> General Systems Theory is the skeleton of science in the sense that it aims to provide a framework or structure of systems on which to hang the flesh and blood of particular disciplines and particular subject matters in an orderly and *coherent* corpus of knowledge (Boulding, 1956, p. 208, my emphasis).

In such a model we can value the boundaries around disciplines just as we do the boundaries around organs in the body, but see the disciplines working together in a holistic way just as organs do in the body. In this model the *actual* holistic unity comes from the (overarching) systemicity of the body as a whole, but the *possibility* of this integration comes the specialised organs' grounding in the (underlying) unity of the nature of Nature.

In order to work towards realising this vision of unity we have to support all three layers of semantic development. We not only have to continue to develop the overarching universal discourse domain springing from GST (DD2), and allow each of the special disciplines to develop a bespoke discourse domain for their special subject (DD1), but we also have to find a way to discuss and compare the different disciplines' foundational views, which demands that we develop a common semantic framework for describing foundational commitments, and promote this semantic framework's use in a collaborative effort towards consilience on fundamental issues (DD3).

This latter objective is a substantial new ambition to set before the systems community. However, I have recently proposed a systemic way in which this can be approached, as briefly outlined below (for more detail see Rousseau, in prep, 2011a, 2013).

Towards a systematic foundational semantics

The first element of my proposal is the idea that we can resolve the polysemy between ontological terms by seeing them in context, rather than treating them individually. For example, debates about the correct interpretation of the term "natural" seem to be unending, but if we could agree on the meaning of terms that recur in that debate such as "physical", "material", lawful", "coherent" and so on, then maybe the difficulty would not be so great. Of course an argument like this does not imply that defining those other terms are straightforward, but it does imply that one cannot hope to define any one of them without taking the others into account. Having to take them into account *collectively* implies (quite correctly) that *semantic terms form a system*, and that the meanings of terms are conditioned by their hierarchical relations to other terms and the boundaries drawn around the conceptual scope of other terms. For example in a hierarchical relationship the meanings of terms are subservient to the meanings put on 'higher level' terms, and condition the meanings that can be put on 'lower-level' terms. This is therefore a proposal for developing a systematic semantics that operates on the same principles as the organicism and boundary critique that has been so powerful for systems thinking in general. The real power of this approach, as

quickly becomes evident when one tries to implement it, is that it leads to significant increases conceptual clarity, and hence in the quality of thinking about the foundational claims one makes using these terms. Figure 3 below is adapted from (Rousseau, 2011a, p. 277), and it provides a simplified example of how one can use this approach to disambiguate between basic ontological terms, and reflect on the boundaries of their conceptual scope. Note that this semantic system does not promote a particular metaphysical or ontological position but simply seeks to specify the possible options, in this case as a hierarchy of meanings (every term inherits the qualities of its whole parental lineage), and to expose where traditional boundaries are questionable (e.g. around the scope of the term *Naturalism*.

Developing such a *Systematic Semantics* is an on-going project within the *Centre of Systems Philosophy*, and more detail about it can be found on the *Centre*'s website and Rousseau's in-work paper *Systemic Semantics: Framework for a Transdisciplinary Foundational Discourse Domain*.

Towards worldview coherence and comprehensiveness

The point of having such a systematic semantics is to enable one to specify the foundational commitments of a discipline in a universally understood way. Such a specification is subject to two requirements, namely *coherence* and *comprehensiveness*.

The first requirement once again ensures systemicity of an organismic kind, for it requires that all tenets specified be mutually consistent. "Tenets", in the sense meant here, specify the nature of Nature, and each one therefore picks out one possibility from the options available regarding each aspect of the world. As for the terms, the validity of specific tenets should not be debated in isolation but in combination – they limit and reinforce each other. For example, if one claims in one tenet that all concrete things have energy (meaning they have causal powers and can undergo change), one cannot then claim in another tenet that time is an illusion (for example by regarding time as part of 'space-time' in a kind of 'block-universe model).

The second requirement demands a framework ensuring the completeness of the specification of the foundational view. This is important because it brings to light otherwise hidden or unconsidered commitments; exposing them and challenging them with the overall requirement for coherence can have far-reaching consequences. Many unscientific worldviews are only sustainable by their advocates because they are incomplete, and hence obfuscate the issues that would challenge them. My proposal for ensuring completeness is to refer to the architecture of a disciplinary worldview, as given in Figure 4 below.

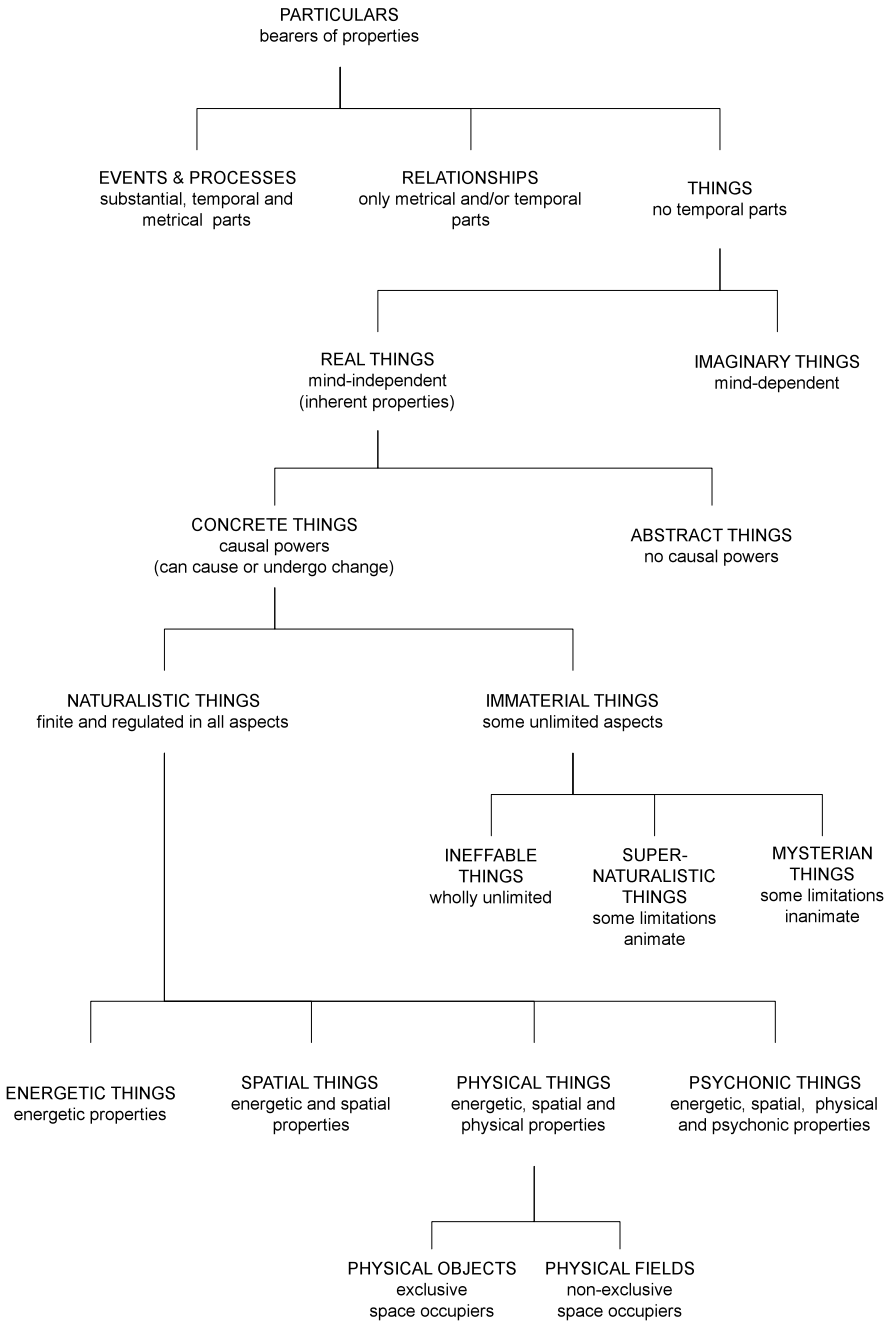

Figure 3: Dependencies Between Ontological Kinds (example)

[adapted from (Rousseau, 2011a, p. 277)]

A worldview is a specialised perspective that originates in the building up of paradigmatic models that attempt to reconcile knowledge from other disciplines with personal experiences and intuitions. The components of a *disciplinary* worldview are models and theories about what actually exists in the domain of study (disciplinary inventory), how these existents are organized (systemology), their origin, history, potential and possible destiny (cosmology), and how we can

come to know about all this (epistemology). The development of a disciplinary worldview is driven by its embedded value system (axiology), behavioural guidelines (praxeology) and focal questions (problematics). These models are described in a specialised language that constitutes a disciplinary discourse domain that contains terms to designate the natural kinds of the things studied in the discipline (a disciplinary ontology), the things that the discipline infers or assumes exist ultimately or essentially (fundamental ontology), and the inferred or presumed nature of the world/reality (metaphysics). In terms of the semantic analysis given above the disciplinary ontology is reflected in DD1, the fundamental ontology in DD3, and the metaphysics in DD2.

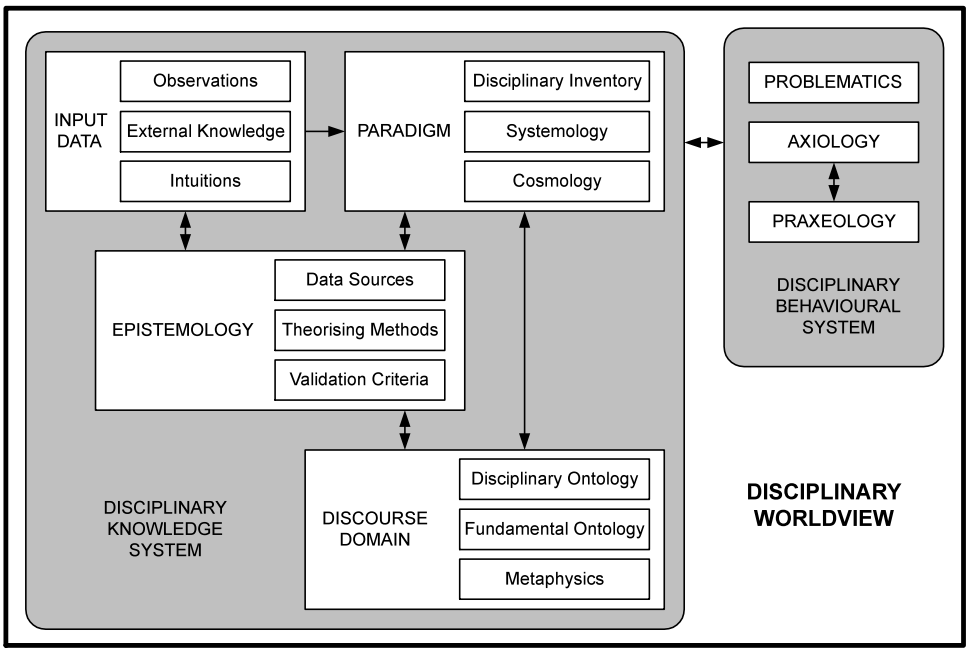

Figure 4: The Architecture of a Disciplinary Worldview

[reprinted from Rousseau, D. (2013), Systems Philosophy and the Unity ofKnowledge. Forthcoming in *Systems Research and Behavioral Science*,DOI: 10.1002/sres.2189, Fig. 5., with permission from Wiley.]

This model is discussed at greater length in (Rousseau, 2013). It formalizes many of the worldview aspects suggested in (Aerts et al., 1994, 1995) and subsequently studied under the auspices of the Leo Apostel Center for Interdisciplinary Studies at the Free University Brussels in Belgium (e.g. Aerts, D'Hooghe, Pinxten, & Wallerstein, 2011). It has some similarities with the (simpler) worldview model proposed by Francis Heylighen, on the basis of a cybernetic analysis of how worldviews drive behaviour (Heylighen, 2000; Vidal, 2008), and Ninian Smart's model of 'the dimensions of a worldview' derived from a socio-philosophical analysis of religious perspectives (Smart, 2000, p. 8).

The models developed in each architectural element of a worldview have a grounding in metaphysical and ontological tenets, and therefore to be comprehensive we have to say what these are in the case of each element. In this way, we can ensure that every discipline engaging in the debate makes their position clear in a comprehensive way.

Developing such a *Worldview Specification Framework* and a methodology for applying it is an ongoing project within the *Centre of Systems Philosophy*, and more detail about it can be found on the *Centre*'s website and Rousseau's in-work paper *A Systematic Framework for Comparing Worldviews*.

The reason for having such a wider project is that one can only develop such a universal semantics in the context of a dialogue about worldview dissonances – as Dana Meadows said, "Interdisciplinary communication works only if there is a real problem to be solved, and if the representatives from the various disciplines are more committed to solving the problem than to being academically correct. They will have to go into learning mode, to admit ignorance and be willing to be taught, by each other and by the system. It can be done. It's very exciting when it happens" (Meadows, 2008, p. 183).

Implications for Alexander Laszlo's programme (and the efficiency of complex systemic interventions generally)

The arguments just presented provide support for optimism that complex systemic interventions can be planned and executed in an efficient way (because we have a real possibility of developing an effective interdisciplinary language), and hence for optimism about Alexander Laszlo's programme.

However, although the possibility of having a consistent semantic framework and a unified ontology presented here reinforces confidence in Alexander Laszlo's manifesto, it also implies that in order to support the execution of his programme we have to urgently pursue this unification and semantic standardization, so that his programme can draw on appropriate foundational assumptions and effective communications. The current 'state of the art' in these areas is not very good, but a way forward has now been identified in which a systematic approach can advance these two causes in tandem. The strategy is not complete, however, because we also have to find ways to significantly extend the integration effort into the social and human sciences. Here too there are systems insights and modern scientific and philosophical developments that suggest a positive way forward, as will become clear in the next sections.

CONDITIONS FOR STAKEHOLDER COMMITMENT IN COMPLEX INTERVENTIONS

Alexander Laszlo has stressed the *importance* of curating the conditions for the emergence of a sustainable thriving eco-civilization, pointing out that "it is the survival imperative of our times" and saying in relation to applying all areas of the systems sciences to this goal, that "There is perhaps no greater service calling at the systemic level of life on Earth, for it addresses the highest level of self-actualization on Maslow's hierarchy of needs" (A. Laszlo, 2012).

In this he reflects perspectives that have always been of central importance to the systems movement, including upholding certain kinds of value:

> Bertalanffy's GST is a humanistic one. Thus all his descriptions of humans and social systems serve the function to help to formulate guidelines for acting in ways that support humane norms and values (Hofkirchner & Schafranek, 2011, p. 192).
>
> Our culture, obsessed with numbers, has given us the idea that what we can measure is more important than what we can't measure. […] You can look around and make up your own mind about whether quantity or quality is the outstanding characteristic of the world in

> which you live. […] No one can precisely define or measure justice, democracy, security, freedom, truth, or love. No one can precisely define or measure any value. But if no one speaks up for them, if systems aren't designed to produce them, if we don't speak about them and point toward their presence or absence, they will cease to exist (Meadows, 2008, pp. 175–177).

recognising our global interconnectedness:

> The systemic view of the world has the most profound ethical implications. For it emphasizes the interdependence of all life on this planet […] System thinking pursued to the full has the most far reaching ethical consequences in politics […] It views struggles for power in the context of the entire global system and from this vantage point sees it as a scandalous dissipation of resources, attention, commitment, and efforts (Rapoport, 1976) cited in (Pouvreau, 2011).

and seeing links between these two aspects:

> Living successfully in a world of complex systems means expanding not only time horizons and thought horizons; above all it means expanding the horizons of caring. There are moral reasons for doing that, of course. And if moral arguments are not sufficient, then systems thinking provides the practical reasons to back up the moral ones. The real system is interconnected. No part of the human race is separate either from other human beings or from the global ecosystem. […] As with everything else about systems, most people already know about the interconnections that make moral and practical rules turn out to be the same rules. They just have to bring themselves to believe that which they know (Meadows, 2008, p. 184).

However, Alexander Laszlo's vision goes further – he wants to see an eco-civilization that not only promotes human values and human thriving per se but one that *sustainably* promotes global thrivability *in all domains* – intra-personal, inter-personal, inter-species and trans-generational (A. Laszlo, 2013, p. 8). This, as he rightly points out, calls for a global shift in worldview, one in which "We must no longer look out at the world through the eyes of exclusively individual interests. And above all, we must be ready to repudiate our gladiatorial existence and learn what it means to be a communal being" (A. Laszlo, 2012).

The sustainability condition: alignment and stability of stakeholder values

Alexander Laszlo's vision presents, in high definition, a generic problem that challenges sustainability in all complex systemic interventions: the alignment and stability of stakeholder values. This challenge is very evident in environmental management contexts, for example:

- Christian fundamentalists may disregard environmental degradation because in their view God gave people rulership over the world, and they expect that they will soon be Raptured to a new earth created for them by God, and that the present earth will be destroyed anyway in a near-future Armageddon.
- Materialistic capitalists may resist measures to halt global warming because they see potential profits from mining the arctic regions, building infrastructure for the colonisation of new land, and adapting existing infrastructure to new conditions.
- Some whale population are limited and grow naturally at < 5% p.a. If whaling nations view whales only as a commodity, then when financial investment returns are higher than 5% it may make sense to them to harvest all the whales straight away, sell the meat and the ships and invest the money.

Such examples illustrate in stark terms the need for alignment of stakeholder values in any complex system facing systemic challenges – not having aligned values subverts collaborative resolution design, impedes efficient execution of interventions, undermines broad adoption of the emerging system's features, erodes on-going support for the emerging systems outputs, creates opportunities for exploiters, and counter-acts the resolve of the ones who care.

This much is clear, but how can we hope to promote such an alignment on a global scale? On what basis can we hope to build a global consensus on values and a global commitment for full participation towards a thrivable eco-civilization? Clearly if we can find a way to do this, we will have provided a framework for addressing this challenge in smaller scale interventions too.

The link between science, worldviews and values

The systems movement has always placed a central importance on values and ethics, but apparently always as something outside of science, that has to be stood up for as a matter of principle, despite the inability of science to give an adequate account of it.

Soon after the founding of the ISSS in 1956 Ludwig von Bertalanffy wrote of his concern that positivistic science, by rejecting the reality of what it could not measure, was causing "the breakdown of a symbolic universe of values" (von Bertalanffy, 1960, p. 214), and said that "[such] scientism cannot provide a basis for the uniqueness of human individuality and values. In a reappraisal of the latter will be the clue to the future" (ibid p. 216). Already in 1928 he was arguing for a shift in worldview, towards one which mediates between scientific knowledge and social values, and by 1934 he was envisioning that the organismic perspective could broaden to a worldview with such a function (von Bertalanffy, 1928, p. 288, 1934) discussed in (Hofkirchner & Schafranek, 2011, pp. 191–192).

This reliance on *worldview* to make up the difference between what science tells us about values and what our 'intuitive' moral dispositions are is consistent with the dominant view in the natural and the social sciences that values are merely social constructions. But if this was the final world on the matter, and there is no objective aspect to values at all, then in ultimate terms nothing *really* matters except by convention. In such a scenario axiological agreements are always just social or cultural conventions, on which the sustainability of intervention outcomes will always be contingent.

On the other hand, any argument for some objective aspect to values is likely to be met with scepticism not only in the sciences but in the systems movement too.

Michael Jackson recently affirmed that he sees it as part of CSP that "ethical issues are put firmly on the agenda" (Jackson, 2010, p. 138), but also that "CSP sees its job as to protect paradigm diversity" (Jackson, 2010, p. 136). CSP is a multi-methods approach in which the methods employed draw on several distinct and incommensurable paradigms (Bowers, 2010, p. 3). This lack of a unifying theoretical underpinning for CSP raises questions about why it works when it does, and on what grounds one can anticipate that its solutions will work or bring enduring benefits. Recent attempts to provide such an underpinning have recommended frameworks that entrench, rather than resolve, the axiological relativism of CSP. Todd Bowers has suggested that the implied unified ontology of CSP represents a world that "has no [inherent] form or meaning or values or reasoning or reasons", leading to an integral theory that is "intentionally devoid of axiological concerns such as values or aesthetics" (Bowers, 2012, pp. 319, 327). Likewise,

Zhichang Zhu recommended a "blank ontology" that can be flexibly filled out depending on the context of the planned intervention (Zhu, 2010, p. 18).

While such a stance enables planners to engage with stakeholders from a wide range of perspectives, it carries, at least for complex situations, a hazard of solution fragility due to the context-sensitivity of stakeholder values.

Alexander Laszlo's vision suggests that we can do better, and I agree. I think that some things really do objectively matter, and I think we will be able to show that this is so, and in what ways it is so. Moreover, I think that the seeds for developing this understanding lie at least in part in systems thinking, in arguments developed by von Bertalanffy, and in questions that Alexander Laszlo is now posing. But before I present these ideas, it will be instructive to consider the basic options for how values might be grounded.

Options for the ontological nature of values

Broadly similar ideas about the options for how values might be grounded recur across the history of philosophy all the way back to Plato. A typical version is due to Leibniz:

> It is agreed that whatever God wills is good and just. But there remains the question whether it is good and just because God wills it or whether God wills it because it is good and just; in other words, whether justice and goodness are arbitrary or whether they belong to the necessary and eternal truths about the nature of things, as do numbers and proportions (Leibniz, 1703/1988, p. 45).

The argument could equally be posed in terms of other values kinds of values (e.g. Plato frames it in terms of piety). As Leibniz points out, if values are grounded in God's free decisions, then they are conventional, since God could change his mind at any time about what is good or just (or any other value). If the justice of God were invented by fiat, Leibniz says, he would not be praiseworthy:

> For why praise him for what he has done if he would be equally praiseworthy in doing exactly the opposite? Where will his justice and his wisdom be found if nothing is left but a certain despotic power, if will takes the place of reason, and if, according to the definition of tyrants, that which is pleasing to the most powerful is by that very fact just? (Leibniz, 1703/1988, p. 6)

The value-theories being compared here are traditionally called Divine Command Theory and Natural Law Theory, and Leibniz is clearly opting for some values to be a matter of natural law, or as we might now say, to be grounded in the nature of Nature. Of course Leibniz was no atheist: for him, God's moral commands follow from God's insight into the axiological nature of Nature.

Of course the argument need not be framed in terms of God's will, but in the conventions of society or culture, so we have a third option we might call Social Command Theory. In this way, the question about the nature of values stands irrespective of whether one believes in God or not, just as one can be a Natural Law Theorist even if one *does* believe in God (as Leibniz did). Natural Law Theory is a majority view amongst current moral philosophers, and we saw an example of such a position in the quote from Nagel given above in the discussion of Critical Realism.

This argument shows that there is a credible option open to persons who believe that values are not just conventions. It cannot be denied that social and cultural influences *condition* values to some

degree, but by the lights of Natural Law Theory culture merely conditions something already available to us. Such a theorist might claim, for example, that although ways of honouring someone (e.g. ancestors or heroes) might be relative to culture, the notion of *honour* is universal, and grounded in the nature of Nature. There is, as it happens, substantial evidence for universals of this sort (see e.g. D. E. Brown, 1991).

Putting it all together, we can now see that a unity of knowledge that is grounded in a Broad Naturalism that allows values to be authentically grounded in some objective way has to embrace Natural Law Theory. That does not tell us how to get there from here, but as an academic position it has substantial credibility in the humanities, even if it is a minority view in the natural and social sciences.

Towards a scientific model of value realism

Everyone has a worldview, which conditions how they respond to their experiences. It frames for them what is real, what is important, and how to behave. People's worldviews changes all they time, as they integrate new knowledge and experiences. In maintaining their worldview people continuously try to reconcile their experiences with their scientific or cultural knowledge and their intuitions. These do not always align, and when there is a tension between two elements people appeal to the third one to decide (at least pro tem) their view on the matter in hand (Rousseau, 2013). A classic example is provided by von Bertalanffy, whose intuitions about values were in tension with the positivistic science of his day, and so he appealed to *experience*, and of an interesting sort:

> It is worthwhile to note that the error of scientism was committed by the positivists from Bacon to Comte to our time, but was not shared by the founders of pragmatism. William James' *Varieties of Religious Experience* is an everlasting document in this respect" (von Bertalanffy, 1960, p. 216).

William James used the term 'religious' in the way we would today use the term 'spiritual', using the term 'ecclesiastical' for what we would today use the term 'religious' (see James 1902/1928, p. 311). "Religious/spiritual experiences" are ones that people tend to describe in terms of ideas essential to religious conceptions (Davis, 1989, pp. 29–33), or the sort of experience that one could reasonably suppose religious sentiments or convictions to have been based on (Wiebe, 2004, p. v). Examples are a sense of a divine presence, apprehensions of sacredness in nature, or having prayers answered. Such experiences are not rare, e.g. in a large British survey in 2000, 76% of respondents admitted to at least one such experience (Hay & Hunt, 2000). James regarded [spiritual] experiences as having a kind of consistency from which one could "extract…general facts which can be defined in formulas upon which everybody may agree" (1902/1928 p. 433). i.e. facts that can stand as objective knowledge in the scientific sense, and modern academic research into large case collections of spiritual experiences supports this view (Davis, 1989; Fox, 2008; Rousseau, 2011a).

The existence of these experiences helps to sustain beliefs grounded in axiological intuitions, but they do not fully resolve the tension with the scientific denial of axiological realism. However, once we have the idea of Natural Law Theory, we can see new opportunities for progress. Consider, for example, the following excerpt from Alexander Laszlo's vision:

> *Homo Sapiens sapiens* is a species bound for extinction. … We must become *Homo Sapiens cosmicus* – capable of manifesting both our mundane individuality and our sacred

> connectivity as part and whole at one and the same time. *What are the forms of perception that propitiate such engagement?* (A. Laszlo, 2012, my emphasis)

From the point of view of a Natural Law Theorist, this is exactly the right sort of question to ask. If axiological factors are 'out there', somehow 'in' Nature itself, it must 'get into our system' somehow, by pathways other than culture and language. Von Bertalanffy would agree, because he suggested, in a different context, systemic principles that we can draw on to suggest scientific research strategies that can help us here.

The following description of Von Bertalanffy's views is lightly paraphrased from (Hofkirchner & Schafranek, 2011, p. 180), which in turn draws on (Pouvreau & Drack, 2007).

> Von Bertalanffy regarded scientific theories as "conceptual constructions" (1965), but "the actual world … does allow the application of our intellectual constructions" (1950). Von Bertalanffy holds "that the world (i.e. the total of observable phenomena) shows a structural uniformity, manifesting itself by isomorphic traces of order in its different levels or realms" (1968). Knowledge about these isomorphies is made possible in as far as the structure of the cognitive ability is isomorphic to the structure of reality. That is, isomorphism is a fundamental condition of the adequacy of thought to reality. It is not required that the categories of experience fully correspond to the real universe, even less that they represent it completely. It is sufficient that a certain degree of isomorphism exists between the experienced world and the real world, so that experience can guide the organism in such a way as to preserve its existence (1955). Bertalanffy followed Konrad Lorenz in that the so-called "'a priori' forms of intuition and categories are organic functions, based upon corporeal and even machine-like structures in the sense organs and the nervous system, which have evolved as adaptation in the millions of years of evolution. Hence they are fitted to the 'real' world" (1955).

Von Bertalanffy's argument clearly implies that if there is something 'out there' in Nature, of which perception would confer a survival benefit, then organisms are likely develop sensitivities to them, even if it only manifests in awareness as intuitions and mental categories. Hofkirchner & Schafranek point out that "In this respect, GST seemingly anticipated fundamental assumptions of what was later subsumed under the labels of Evolutionary Epistemology and Evolutionary Psychology more generally" (Hofkirchner & Schafranek, 2011, p. 180).

On the combination of Von Bertalanffy's ideas about cognitive isomorphies with reality, Alexander Laszlo's question about "forms of perception", and the possibility of a Natural Law Theory, we can now suggest several lines of scientific investigation into the ontological nature of values, of which I will here mention just three (a wider treatment and further discussion can be found in (Rousseau, under review, 2011a, 2011b, 2011c) .

Firstly, if we are cognitively adapted by evolution to be sensitive to axiological factors in nature, there may be evidence for such sensitivity across species boundaries, and evidence for human axiological dispositions that are constant across differences in culture, ethnicity, geography, contexts, and history. Such evidences do indeed exist, and is becoming stronger. Research into the psychology of morality has shown, via work with pre-verbal babies, that people have an innate system of moral reasoning (Bloom, 2010; Hamlin, Wynn, & Bloom, 2007), and, via work with adults in culturally unfamiliar scenarios, that culture modulates but does not *create* moral values (Pyysiäinen & Hauser, 2010). These findings are consistent with animal studies. There are many accounts of non-simian and non-cetaceous animals displaying behaviours that are properly interpretable as altruistic or empathetic in the wild (Wilson 1975/2000) (Barber, 1993; Masson & McCarthy, 1994), and recently empathy has been demonstrated in rats under laboratory-controlled conditions (Bartal, Decety, & Mason, 2011).

Secondly, if we have cognitive channels adapted for such perception, there may be evidence of the perception of axiological qualities in some natural systems even in the absence of cultural or social clues. We have suggestive evidence along these lines. For example, spiritually advanced people are sometimes reported to have refined or sensitive forms of a kind of such 'spiritual awareness', sometimes referred to as the ability to 'read hearts'. A well-documented case is that of the Catholic saint Padre Pio, who was apparently able to immediately discern people's sincerity, intentions, character and emotional state (Carty, 2009, pp. 24–30; Francis, 1999, pp. 150–1). These abilities may be related to a much weaker but general perceptive ability psychologists call 'empathetic acuity', characterized as the ability to accurately assess others' emotions from non-verbal cues (Goleman, 2005; Nowicki & Duke, 1989; Rosenthal, Hall, Archer, DiMatteo, & Rogers, 1977).

Thirdly, since perception involves a casual interaction between our sensory apparatus and the perceived object mediated by force fields, there may be evidence for causal interactions that have axiological qualities independently of psychological suggestion effects. Once again suggestive evidence exists. For example, long term meditators appear to 'radiate' beneficent influences, producing positive changes in people they come in casual contact with (Ekman, 2008; Goleman, 2005), and to (unintentionally) produce positive changes in welfare indicators in their general environment (for a review of more than 50 published research studies showing such effects, see Orme-Johnson & Oates, 2009). Other examples of such phenomena, involving both positive and negative effects, are discussed in (Rousseau, 2011a).

Implications for Alexander Laszlo's programme (and the sustainability of complex systemic interventions generally)

Scientific research into the ontology of values is obviously in a very early stage of development, but it is showing much promise. Several independent lines of evidence suggest that values are modulated by culture but in some sense grounded in axiological qualities inherent in aspects of nature. This suggests that spirituality is an authentic natural phenomenon, and bodes well for the development of objectively grounded value frameworks that can underpin consistency and stability of stakeholder commitments in complex scenarios.

This suggests that interventions, even on the global scale that Alexander Laszlo envisions, can lead to sustainable outcomes, since they can in principle build on naturalistic insights that support spirituality in an authentic way.

But for now, I agree with Kenneth Boulding when he says:

> Science, for all its successes, still has a very long way to go. General Systems Theory may at times be an embarrassment in pointing out how very far we still have to go, and in deflating excessive philosophical claims for overly simple systems. It also may be helpful however in pointing out to some extent *where* we have to go (Boulding, 1956, p. 208).

SUMMARY AND CONCLUSIONS

In this paper, I have argued that Alexander Laszlo's vision for curating the conditions for the emergence of a sustainable thriving eco-civilization confronts the systems movement with four long-standing challenges, namely the disunity of knowledge, the critical realism debate, the problem of sematic divergence between the special disciplines, and the lack of a scientific account of moral intuitions.

I have presented arguments, evidences and proposals that suggest that these challenges can be resolved on the basis of work guided by systems thinking, and argued that this is promising not only for the viability of Alexander Laszlo's vision but in general for the future possibility of efficiently providing coherent reliable interventions that even in complex situations can lead to sustainable outcomes.

Much work remains to be done but the proposed strategies suggest practical ways forward with activities which if executed well will extend the scope and range of the systems sciences well beyond their current capacities.

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