

Transformative Learning for Climate Change Engagement: Regenerating Perspectives, Principles, and Practice¹

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Abstract: In this position paper the worldview from which climate change continues to occur is identified as late modernism. This worldview is critiqued as being unduly economic, reductive, mechanistic, and fragmented. There is a clear requirement for an inclusive and transcending transformation of this worldview toward one substantively more able to meet the challenges that climate change presents, as well as an understanding of the processes that facilitate such a transformation. This paper foregrounds transformative learning as a generic process that might well be key to this transformation. The paper addresses transformative learning both as an active process and as a feature of a regenerated worldview, identified here with respect to Griffin's reconstructive postmodernism, which goes beyond deconstructive postmodernism in its proto-integral orientation. Transformative learning is exemplified by the seminal approach of Mezirow as well as Scharmer's *Theory U*. The discussion of worldview is vertically differentiated in terms of principles, worldview perspectives, and sectoral practice with reference to the depth ontology of Inayatullah's *Causal Layered Analysis*. Principles addresses the regeneration of the philosophy of science, and explores the critical contrast between atomism acting as attractor for modernism, and complex integration acting as attractor for reconstructive postmodernism / the ecological worldview; it indicates the fecundity of Bhaskar's critical realism for aptly addressing climate change. Sectoral practice is represented by higher education, specifically addressing andragogy, heutagogy, the transformative learner, and the transformative educator. Climate change is a complex, big-picture issue, one that requires a complex, integrative epistemology and transdisciplinary orientation.

Keywords: Causal layered analysis, climate change, complex integration, ecological worldview, transdisciplinarity, transformative learning, sustainability, worldview.

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Introduction

Contemporary climate change⁴ is induced by one species, the same species that is now considering its possible, probable, and preferred futures arising from the consequences of its actions. Yet all species are affected, as indeed is the entire biospherical fabric of our shared existence. Contemporary climate change is quintessentially a big-picture issue. Planetary, long-term, complex, deep, multifaceted, and involving all cultures, all memes, and all known life-forms, climate change calls out for approaches of engagement which aptly address and carefully integrate a myriad of fields including those addressing the physical, the ecological, and the psycho-socio-cultural. To understand how we reached this point, sufficient depth of philosophical, historical, and depth-cultural analysis is necessary; to most effectively move toward our best realistic futures, we not only require futures thinking but also suitable processes which enable us to make the necessary transformations of thought, affect, and behaviour authentically and efficiently. We need to regenerate our world into something we want before it degenerates us into something we do not want.

In this article we suggest that transformative learning is a useful signifier to encompass the cluster of various processes – able to be used in a variety of individual and collective contexts – which adequately enable such transformations at both individual and collective levels. We believe that the potential usefulness of transformative education in addressing climate change has not been explored sufficiently and this paper therefore attempts to valorise transformative learning as one appropriate approach to facilitating the worldview shift required to address this wickedly complex challenge. We attempt to unpack transformative learning through the lenses of (philosophical) perspectives, (scientific) principles, and (sectoral) practice. Each of these provide useful – to some degree irreducible – lenses to assist piecing together the numerous angles, which the complexity of climate change demands. This symbolises the understanding that climate change is a complex but singular ontology requiring an aptly analogous complex but incisive epistemological tapestry. Specifically, the lenses used here can be interpreted according to a vertical schema such as Causal Layered Analysis (Inayatullah, 1998).

After situating the current interest within a review of climate change discourse, we address the layers of perspective and principle, respectively. This is followed by a discussion of the social sector of higher education. Finally, a “hermeneutic circle” of learning is also facilitated through the deepening iteration of transformative learning as a topic in the perspectives and practice sections.

The key normative orientation regarding the need for – and direction of – regeneration is given by the critical contrast between the worldview of modernism (with its underlying principle of atomism), deconstructive postmodernism and that of reconstructive postmodernism⁵ (with its

⁴ For current data concerning climate change, see Brown (2008) and the Earth Policy Institute’s website (http://www.earth-policy.org/data_center/). One should also note the various “revealing and concealing” related to each term in the cluster of signifiers that includes *climate change*, *global warming*, and *global heating*.

⁵ The term *reconstructive postmodernism* was coined by Griffin (2002). He identifies it as “a diffuse sentiment...that humanity can and must go beyond the modern” (p. vii), where the modern worldview is identified in relation to “Galilean-Cartesian-Baconian-Newtonian science” (p. vii). Griffin differentiates

underlying principle of complex integration). The central idea is that the latter, but not the former, is suitable for an eco-logical future - one in which climate change is most adequately addressed in thought and action. Transformative learning is both an object of inquiry and the process by which many of the insights discussed in the paper have arisen and can continue to arise. It forms the core process within the preferred emerging worldview, and so forms the introduction to that section.

Reviewing Climate Change Discourse

Climate change discourse can be identified in relation to sustainability discourse and, more generally, to environmental discourse, which itself has begun as a complementary movement to modern times out of the Romantic streams of philosophical thought following the Enlightenment (see Hampson, 2010c, 2013). *Silent Spring*, Rachel Carson's (1962) expose on the harmful effects of industrial pesticides is largely credited with launching the contemporary environmental movement by awakening an awareness of the urgency of the ecological crisis in popular consciousness (Glausiusz, 2007).

Following the 1972 UN Conference on the Human Environment in Stockholm – the same year as the Club of Rome's *Limits to Growth* report (Meadows *et al.*, 1972) – the somewhat contested notions of “sustainability”⁶ and “sustainable development” (the latter developing from around 1980⁷ at the beginning of the neoliberal era) have gradually systematized environmental discourse in various ways (Kaivo-oja, Luukkanen, & Malaska, 2001). A spectrum involving economic (neoliberal) imaginaries at one end and deep ecological attractors on the other can be identified. To date, the former appears to be the dominant mainstream interpretation (Howarth & Norgaard, 1992). The genealogy of the economic interpretation (Lerch & Nutzinger (2002) and Kaivo-oja, Luukkanen, & Malaska (2001)) includes: early neoclassical economic growth theories that incorporate natural resource constraints on the economic doctrine (e.g. Hicks, 1946; Solow, 1974; Page, 1977; and Hartwick, 1977), The Safe Minimum Standards approach (Ciriacy-Wantrup, 1952; and Bishop 1978, 1993), The London School Approach (Pearce *et al.*, 1990; Klaasen & Opschor, 1991; Pearce & Turner, 1990), Daly's Steady-State approach (1990, 1992), The World Bank's neoclassical approach (1992), and The Wuppertal approach (Femia, Hinterberger, & Renn, 1999). Selby & Kagawa (2010) offer a firm critique of this perspective with respect to its uptake in education:

between re/constructive and deconstructive (or relativistic) postmodernisms, inferring a complex relationship between them such that they both share the idea that “a massive deconstruction of many received concepts is needed,” yet the deconstruction “is not so totalizing as to prevent reconstruction” (p. ix). The vector of this reconstruction is toward “a new unity of scientific, ethical, aesthetic, and religious intuitions” (p. ix) involving “a creative synthesis of modern and premodern truths and values” (p. x).

⁶ There is no complete agreement concerning the meaning of sustainability. In an attempt to clarify the multiplicity of opinion, Varey (2003) has collated over 100 separate definitions from a wide diversity of sources.

⁷ World Conservation Union's strategy document (IUCN, 1980); elaborated upon at length by the so-called Brundtland commission's report, *Our Common Futures* (WCED, 1987) and the 1992 UN World Conference on Environment and Development, Rio de Janeiro (United Nations, 1993).

Education for sustainable development (ESD) is the latest and thickest manifestation of the ‘closing circle’ of policy-driven environmental education. Characterised by definitional haziness, a tendency to blur rather than lay bare inconsistencies and incompatibilities, and a cozy but ill-considered association with the globalisation agenda, the field has allowed the neoliberal marketplace worldview into the circle so that mainstream education for sustainable development tacitly embraces economic growth and an instrumentalist and managerial view of nature that goes hand in glove with an emphasis on the technical and the tangible rather than the axiological and intangible. Runaway climate change is imminent but there is widespread climate change denial, including within mainstream ESD. A transformative educational agenda in response to climate change is [called for]. (p. 37)

In response to such critiques – i.e. interpretations at the other end of the spectrum – lie the more complex perspectives of the deep ecological approaches which tend to support the evolutionary emergence of a zero-growth society (Daly, 1992). They variously include Capra’s (1982) web of life, Naess’s (1989, 2005) *Ecosophy T*, Guattari’s (1989) ecosophy, Shiva’s (1988, 2007, 2008) Vedic ecofeminism, Berry’s (1991) ecotheology, Macy’s (1991, 2005) work that reconnects, and Lovelock’s (2000) Gaia hypothesis.

Facilitated by popular accounts of the crisis such as Gore’s (2006) *An Inconvenient Truth*, the profound effects of climate change have now become part of mainstream discourse. Unfortunately, mainstream media continue to present a decidedly biased account of the science (Readfearn, 2013) such that the American public, for example, think that only approximately half of climate scientists are in agreement regarding the understanding that climate change is human-induced, whereas in reality over 97% of climate scientists have been in consistent agreement for at least twenty years (Cook et al., 2013). It is clear that such data indicates the urgent necessity of advancing the *social (e.g. political) science* of climate change and its importance to mainstream understanding.

Academic discourses on climate change have been primarily oriented by technological innovation (e.g. regarding alternative energy), with additional reference to social innovation and systems transformation perspectives (e.g. Hardin Tibbs, 1993) – or an integration of these (e.g. McDonough & Braungart, 2012; James & Lahti, 2004). Despite these burgeoning innovations, however, evidence continues to indicate that the crisis is worsening. Why might this be the case? Unruh (2000) argues that technological industrial complexes emerge through complex adaptive interactions among technologies and institutions. Once lock-in to a particular technological industrial complex occurs (in response to a “strange attractor”) it can become extremely difficult to displace, and can serve to lock-out other emergent technologies. The lock-in conditions are often exacerbated by governmental and legal structures. The whole system can then form dynamically stable sociotechnical regimes (Geels & Schot, 2007). This is the case for late modernity’s addiction to both carbon technologies and industrial-scale livestock agriculture – both in the face of viable alternatives. The latter, which accounts for approximately 18% of greenhouse gases, is of critical importance, given its relative under-emphasis not only in popular discourse but also in the academic literature.

This highlights the importance of exploring the cultural and relational aspects of sustainability in terms of social and individual transformation. For instance, Bouwen & Tailleau (2004) point to an important dialectical relationship between relational and problem-solving strategies, which

may be seen as an integration of interior and exterior perspectives (Wilber 2000). Some attempts have been made to expand beyond traditional definitions of sustainability in light of these limitations; these include work by Brown (2006); Zimmermann (2005); Herrera (2005); Esbjörn-Hargens (2005); Varey (n.d.); Reason, Coleman & Ballard *et al* (n.d.); and Ballard (2005). In addition there is a growing body of work explicitly addressing the psychological aspects of sustainability, including the psychology of sustainable behaviour (Manning, 2009), conservation psychology (Saunders, 2003), and the development of the ecopsychological self (John & McDonald, 2007). Of particular note is the role of worldview (Lynam, 2012; De Witt, 2013).

Whilst transformative learning is identified as being very useful for education regarding ecological sustainability and climate change (Lange, 2004; Wals, 2010), it is considerably under-emphasised. We hope to contribute to rectifying this situation, and in so doing, to help regenerate perspectives from those of late modernism and early postmodernism to those of an ecological or reconstructive post-postmodern worldview.

Regenerating Perspectives

This section addresses the regeneration of worldview. The first part introduces transformative learning as key process through which worldview can be regenerated, whilst the second part addresses the overarching conceptualisation of worldview change. We start with transformative learning – as represented by a focus on the work of Mezirow as well as Scharmer's (2009) *Theory U*.

Transformative Learning

The term *transformative learning* was originally coined by Mezirow (1978a). He first identified transformation as a valuable educational idea while conducting research in the late 1970's with women returning to postsecondary education or the workplace after a protracted absence. He was interested in exploring the factors that impeded or facilitated meaningful and successful re-entry experiences; his discoveries led him to a number of valuable realisations concerning the nature of learning. Notably, he evolved a new definition of transformation as "the process of using a prior interpretation to construe a new or a revised interpretation of the meaning of one's experience to guide future action" and concluded that "transformative learning occurs when there is a transformation in one of our beliefs or attitudes (a meaning scheme), or a transformation of our entire perspective (habit of mind)" (Merriam, Caffarella, & Baumgartner, 2007: 132). Mezirow's original model (1978a, 1978b) is normally understood in terms of ten stages of transformation, namely:

1. A disorienting dilemma;
2. A self-examination with feelings of guilt or shame;
3. A critical assessment of epistemic, sociocultural, or psychic assumptions;
4. Recognition that one's discontent and the process of transformation are shared and that others have negotiated a similar change;
5. Exploration of options for new roles, relationships, and actions;
6. Planning a course of action;
7. Acquisition of knowledge and skills for implementing one's plans;

8. Provisional trying of new roles;
9. Building of competence and self-confidence in new roles and relationships; and
10. A reintegration into one's life on the basis of conditions dictated by one's perspective.

At first blush, one can begin to see a mapping (from individual to collective) onto the issue of climate change. For example:

1. Climate change as a disorienting dilemma, one which humanity has not had to face before;
2. What collective guilt lies lurking beneath our hubris and denial regarding the mass extinction of species that is concurrently occurring?
3. The need to perform a socio-cultural psychoanalysis;
4. Joining forces;
5. Exploring possible and likely future scenarios;
6. Identifying paths toward our *preferred* scenarios (within the bounds of realism) – what complex socio-cultural structures are involved?
7. What competencies and capacities do we need?
8. What prototyping might we conduct?
9. The need for ongoing co-empowerment;
10. Identifying the ideal of the regeneration of our socio-cultural fabric into one that is (at the very least) ecologically sustainable.

Kitchenham (2008) indicates the major influences on Mezirow's early work as being Thomas Kuhn's (1962) notion of paradigm shifts (regarding the structure of scientific revolutions); Paulo Freire's (1997) notion of conscientisation and dialogical action; and – from 1981 – Jürgen Habermas's (1971, 1984) domains of learning, namely, the technical, the practical, and the emancipatory.

Mezirow has continued to refine his theory over the last three and a half decades. Specifically, Mezirow (1985) distinguishes three types of learning – the instrumental, the dialogic, and the self-reflective – each of which comprise three possible learning processes – learning within meaning schemes, learning new meaning schemes, and transforming by learning through meaning schemes. Another significant refinement is Mezirow's (1998) distinction between two types of critical reflection on assumptions: (i) *objective* reframing of narrative and/or action; and (ii) *subjective* reframing of critical self-reflection on assumptions manifesting as narrative, systemic, therapeutic, and epistemic. A third significant contribution to the theory is the addition of four domains of transformation: (i) elaborating upon existing frames of reference,⁸ (ii) learning new frames of reference, (iii) transforming points of view, and (iv) transforming habits of mind (Mezirow 2000).

Broadly speaking, transformative learning integrates multiple understandings of the notion of transformation (Dirkx, 1998), including (i) transformation as critical reflection – the category with which Mezirow is most identified, (ii) transformation as consciousness-raising – identified primarily with Freire (1997), (iii) transformation as development – most explicitly identified with

⁸ Frames of reference, in this sense, may be understood as embodying two components: habits of mind, which are broad-based assumptions that serve to filter our experience of life, and resulting points of view, attitudes, beliefs, and judgments.

Larry Daloz (1986) but also those who understand development as a transformation in consciousness (Merriam, 2004) – such as Sri Aurobindo (1975), Jean Gebser (1956), and Robert Keagan (1994), and (iv) transformation as individuation – primarily associated with Robert Boyd (1991; Boyd & Myers, 1988).

The vectors identified above (from Mezirow’s points of departure) constitute a variety of ways in which there can be a transformative regeneration of perspectives. This ecosystem of understanding can be fruitfully complemented by a more recent addition to transformative learning – that of Otto Scharmer’s (2009) *Theory U*.

Theory U facilitates an experience of social presence which enables a group to illuminate collective blind spots inherent in social systems with the aim of co-generating and co-leading transformation. The process takes the general shape of a “U”:

1. The left hand “downward” movement comprises (from top down) *suspending* patterns of the past through open mind > seeing with fresh eyes > *diving deep* through open heart > sensing from the field > *letting go* through open will;
2. The bottom of the U comprises *presencing* (connecting to Source (Jaworski, 2012));
3. The right hand “upward” movement comprises (from bottom up) “*letting come*” through open will > crystallising vision and intuition > *enacting* through open heart > prototyping (co-creating strategic manoeuvres) > *embodying* through open mind.

It can be noted that the holistic dimensionality of this process resonates with a “head, heart, hands” framing, which has been identified as useful for transformative learning with respect to sustainability (Sipos, et al., 2008).

Scharmer proposes that the process necessitates a deep quality of attention and identifies the U as a progressive movement through four fields or structures of attention: field one involves operating from the old “me-world;” field two comprises moving into the current *it* (exterior) world; field three involves operating from the current “you-world;” whilst field four addresses the highest future possibility that is wanting to emerge. He argues that a movement from the reactive postures of field one to the more integrative and transformative impulses of field three and four are needed in order to create change throughout a complex system. On a micro (individual thinking) level this correlates to moving through four levels of *listening*: (i) downloading habits of thought, (ii) object-focused listening, (iii) empathic listening, and (iv) generative listening. The act of opening and surrender empowers the emergence of novelty by illuminating blind spots that we normally allow to be obscured by assumptions and superfluous thought. The process can be identified as involving five movements:

1. *Co-initiating*: generating collective intent, taking time to listen deeply to others, and tune into where life is leading us;
2. *Co-sensing*: opening ourselves to emergent possibilities and potentials through careful observation;
3. *Presencing*: surrendering our wills and connecting to the deep and still source of inspiration; in the midst of this deep silence an inner sense of embodied knowing is empowered to arise to the surface;

4. *Co-creating*: exploring what prototypes of the new might look like and imagining how they might translate into real world action;
5. *Co-evolving*: holistically embodying and facilitating the ecosystemic emergence of the new.

In relation to climate change, the proposition is that the efficacy of appropriate transformative change would be significantly enhanced through employing Theory U processes.

Transforming Worldview

Theory U employs a vertical schema to facilitate the regeneration of perspectives. As indicated in the introduction, a further vertically oriented model that orients the paper is that of Causal Layered Analysis, and its explicit inclusion of the worldview layer. To recap, Causal Layered Analysis conceives four layers of social reality. From surface to depth, these comprise:

- The litany layer;
- The policy or systemic layer;
- The worldview layer; and
- The layer of myth, metaphor and principles.⁹

News broadcasts and newspapers tend to focus on the litany layer, whilst policy-making operates at the systemic level below. In contrast to these two, the underlying layers of worldview and myth-metaphor tend mostly to operate unconsciously. Therefore, the system by which policy is oriented does not tend to question its basic premises. It tends to rest upon a business-as-usual paradigm as much as possible. The scope of climate change, however, demands a deeper engagement. It demands explicit address of the worldview and its concomitant “essences,” metaphors, principles.

The work of Annick Hedlund-de Witt (2013) explicitly addresses worldview in relation to sustainability, entailing implications for climate change. She identifies that the structural (economico-socio-cultural) barriers to changing lifestyles are deeply embedded in worldviews and that research indicates that the dominant worldview is the central barrier for the transition to a more sustainable society. Yet “despite their apparent importance, worldviews tend to be underemphasized in the sustainability field” (p. 12). Moreover, she expresses the idea that a certain form of science can actually hamper efforts to the extent that it falls prey to *scientism* – involving an “excess of objectivity” Sarewitz (2004) – to the detriment of apt inclusion of interior (Wilber, 2000) perspectives (e.g. aesthetic experience, emotional responses, psychological dynamics, religious meaning, ethical issues, and cultural values (Esbjörn-Hargens, 2010a)) as indicated by *worldviews* (De Witt, 2013).

There are various levels of generality one might identify with respect to the concept of worldview. At one end of the spectrum, it could be understood that each person carries a different worldview. Heading toward more clustering of understanding, a wide range of worldviews could be identified regarding the wide range of demographic categorisations such as culture, age, or socio-economic status. At the most general level, however, we might wish to consider broad

⁹ Principles being an extension of the original conception, as explained above.

sweeps of zeitgeists, both dominant and more marginal. At this level, we can identify such worldviews as “traditional,” “modern,” and “postmodern.” Given that undesired climate change is associated with modernism – through such activities as fossil fuel use and industrial husbandry, it would be hard to adequately argue (though many attempt to) that we should somehow pursue a slightly modified business-as-usual approach. No. A more developed reconstructive postmodern worldview is called for. Such worldview comes in a variety of shapes and sizes, and not all might be fitting for the adequate address of climate change. The worldview proposed here is in the general camp of an ecological or reconstructive post-postmodernism [refs], one involving complex-integrative, postformal-integrative or integral thinking [refs]. Such thinking requires not only the address of its own understanding of climate change, but it also needs to be able to adequately understand and communicate with interpretations of climate change stemming from other worldviews.

Regenerating Principles

Underlying the worldview layer could be myths, metaphors, values, patterns, principles, habits, templates, etc. The following addresses one of these, perhaps a key one – the transformation of modern atomism to complex integration or “eco-logics” (Hampson, 2010a, 2010b, 2011).¹⁰ Such a transformation of principles underlying worldview can be understood in relation to Kuhn’s (1962) notion of “paradigm shifts” which makes space for the inclusion of sociological, psychological, and historical viewpoints in the development of scientific knowledge.

We first discuss the general context of paradigm change in the philosophy of science. This is followed by a more explicit address of the principles of modern atomism and complex integration.

Philosophy of Science

It can be argued that a hindrance to apt climate change engagement comprises the current ideology or (mythic aspect) of science as distinct from the essence or core of scientific process, one involving appropriate inquiry at all levels. A pertinent context is that natural science to some interpreters often appears to be in inadequate dialogue with its philosophical roots whereby the role of scientist devolves into that of mere technician. The following historical context provides a lens that might be helpful in addressing the contemporary configuration of the philosophy of science.

Although science substantively developed in the classical Islamic civilisation (see Hampson, 2010c), its dominance only took hold in the modern era. Somewhat in response to the abuses of the Christian Church in the Middle Ages, modernism – and thus modern science – increasingly rejected metaphysical perspectives. A consequence of this is that it “flattened” the once-existing

¹⁰ The atomistic↔eco-logical dimension is, of course, not the only one that can be used to distinguish the preferred worldview to the present hegemonic one. It is, for example, important to address “principles of affect,” so to speak – emotional values which charge the worldviews. This is a complex matter, but certainly a move from *greed* as (mostly) unconscious motivator to *care* as (more) conscious motivator would be in order. To assist in this, the classical question *What is the Good Life?* needs to re-enter the centre of the conversation of culture and politics.

vertical ontology into a single strata; moreover, the single strata that it adopted was the lowest stratum, that of “fundamentals” (as represented by physics and chemistry). One might say that molecules were prioritised over meaning. However, whilst address of fundamental layers is important, they are not necessarily the most significant aspects of reality. The short-term (in historical time) success of scientific address of these fundamentals to produce modern technology and its concomitant material comforts consolidated this “lowest common denominator” tendency. But we now find ourselves with a human-induced atmospheric-heating feedback loop, the cause of which we are not only not abating, but actually increasing. The good news is that modern science has adequately delineated the physical condition (i.e. that at the fundamental ontological stratum of atmospheric chemistry). The bad news is that humanity’s collective actions to date give the impression that “no one is listening,” or, perhaps more accurately, that those that are listening do not appear to have sufficient power in relation to the structures which govern collective human activity, that there are conflicting voices, many of which are fuelled by partisan interests. This understanding can be unpacked yet further, of course. And it needs to be. But this is precisely where social science and the arts and humanities step in with respect to climate change. Yet the most helpful insights that could be found here are thwarted by:

- The lower status (overall) of this aspect of contemporary academia as opposed to natural science and the “pragmatic” subjects of business, accountancy and technology (noting that “pragmatic” is rarely interpreted as “pragmatic for the planet”);
- The undue “weight” of natural science paradigms attempted to be applied in the social sciences – notably regarding positivism; and
- The dominance of institutional disciplinarity – a form of modern atomism – such that there is insufficient integration or coherence between insights arising from natural science and those from the arts, humanities and social sciences.

Another is that the entire academic endeavour – regardless of philosophy of science employed – appears to be thwarted by an apparent anti-intellectualism in the political sphere whereby there is insufficient adherence to policy recommendations. Humanity’s academic mind is working but the political “body” seems to be governed instead by lower drives – short-termism, greed; a global politics blinkered, obfuscating, partisan. Of course, there are many exceptions. Indeed, there is a groundswell of alternative thinking and action, too. Such transformative approaches have the potential to transform the collective outcomes of human activity – but only if there is a change of societal status of pertinent knowledge in the transition to a more ecologically sustainable world.

In relation to the above, transformative principles would include:

- The regeneration of politics through adhering far more closely to policy recommendations arising from such transdisciplinary climate change research; and
- The prioritisation of pertinence (Morin, 1999) – along with the paradigms that support this – in the arts, humanities and social sciences. Such pertinence is facilitated by apt coherence between “the two cultures” of natural science and the humanities – empowering transdisciplinary understandings, and entailing the reinvigoration of philosophy and meta-theorising suitable for a deep ecological era.

The paradigms, philosophies and meta-theories entail regeneration via the principle of complex integration. It is the contrast between this prospect and the current default of the principle of modern atomism to which we now turn.

Beyond Modern Atomism

As indicated above, climate change is a quintessentially complex, big-picture issue. So, it would be hard to argue that apt engagement with it does not therefore require a like-minded epistemological orientation. The current default way of engaging does not adequately meet this requirement. Rather, it falls prey to modernism's – often hidden – tendency to be oriented by atomism or fragmentation. Where integration *is* attempted through modernism, the default is toward a reductionism or over-simplification (e.g. a “theory of *everything*” – in physics discourse – as constituted merely by *fundamental* particles rather than recognising more complex ontological levels include realities irreducible to fundamentals). Modern atomism shows itself in myriad ways throughout the institutionalisations of this kind of thinking in society. In academia, an instance where it shows itself in an undue reliance on disciplinary structures to the detriment of transdisciplinary orientations (Nicolescu, 2008).

Modern atomism is a remnant of the import of classical physics' conception of atoms as billiard balls. It underlies much technological and bureaucratic thinking. Its imaginery comprises units of similar character with non-complex identities; it focuses on these units to the detriment of both the relations between them and the identity of the whole system within which the atomistic identities are situated. Consequently, the pertinence of contexts, diversity, interactivity, and complex causal patterns is underplayed (Hampson, 2010b, 2011).

The principle of atomism that forms part of the layer beneath the modern worldview needs to be regenerated into a more complex and integrative one, one more resonant with the ecosystemic complex that is humanity-within-biosphere. Ecologies of the life-world require the development of ecologies of mind (Hampson, 2012). These ecologies of mind, or eco-logics, could manifest in a variety of ways. But a sense of the whole and a sense of the various dimensions of complexity need to form part of the mind-set. Oriented by this regenerated principle – that of complex integration – the approaches of critical realism, ecosophy, and postformal integral theorising variously represent facilitations toward an eco-logical future.

With respect to the explicit conceptual location of philosophy of science, critical realism counters both fundamentalised positivism and fundamentalised constructivism or relativism through adopting a more realistically complex picture of the whole, including the normative. In this way, critical realism comprises a philosophy of science adequate to meet the challenges and complexity of climate change (Hedlund-de Witt, 2013) (with its ecosystem of current and potential normativities), particularly with regard to the different understandings required to confluentlly address the physical world, biospherical ecosystems, and the psycho-socio-cultural sphere.

The following section exemplifies this panoramic sense of the critical and the real by focusing on the regeneration of the sector of higher education, a social location key to fostering a transformative worldview.

Regenerating Practice

The regeneration of principles and worldview perspectives has implications for practice. Education is potentially able to be efficient in facilitating the profound changes necessary, and, indeed, is potentially the dominant locus of transformative learning. In this article we have chosen to address higher education as indicative.

Higher education in late modernity is multifaceted. One could say it is both part of the problem (through its reinforcement of climate-change-inducing ways of thinking as per atomism) and part of the solution (such as through its constructive analyses of the problem). Higher education is also undergoing significant changes. Some are facilitative of new, apt ways of learning and being, whilst others reinforce late modernism's grip – the demise of the arts and humanities in favour of business-related courses, for example. We argue that such so-called economism is actually a form of sectarian, ego-driven, short-term interest; what is *pragmatic for the planet* is ignored. If a long-term systems perspective is considered then the arts and humanities become highly pragmatic given the desirability of global reflexive consciousness. Moreover, the strong institutional inclination toward disciplinary structures – in contrast to transdisciplinary frames – thwarts integrated attempts to address climate change as a quintessentially big-picture and multifaceted issue. What is needed is the new norm of a financially empowered, rigorous (but not rigid) transdisciplinary orientation toward climate change. This includes transformative engagements with the pertinent contexts of climate change (past, present and possible futures for humanity and other life forms), exploration of the various paradigms of consciousness and a focus on rational inquiry beyond the limitations set by conventional thinking.

In short, apt address of climate change requires transdisciplinary frames in order to prioritise and coordinate the various types of understandings arising from the natural and social sciences, the arts and humanities.

For further discussion of transdisciplinarity as a suitable complex integrative form of *curriculum* to facilitate futures adequately addressing climate change, please see Hampson (2012); and for further discussion with respect to complex integrative approaches in general regarding higher education, please see Hampson (2011) and Hampson & Rich-Tolsma (forthcoming). The discussion below focuses instead on transformative learning *processes*, and concomitant character of learner, teacher and occasion.

Andragogy and Heutagogy

As learners develop cognitively they become increasingly rationally emancipated, mature, and functionally autonomous (Mezirow, 1997). This development takes place in inverse proportion to their need for scaffolding, instructional support, and cultural mediation (Canning & Callan, 2010; Kenyon & Hase, 2010). Blaschke (2012) therefore proposes that there is a natural developmental progression from the concept of pedagogy (*leading the child*) built upon teacher-lead student engagement, to andragogy (*leading the person*) oriented by the student-centred notion of learning cultivation, to heutagogy (*leading the self*) resonant with the notion of self-realisation (Canning, 2010).

Transformative higher education addresses the last two. Whilst andragogy can be identified as self-*directed* learning (Knowles, 1975; Merriam, 2001), heutagogy may be understood as self-*determined* learning involving the development of competencies and capacities (Hase & Kenyon, 2000; 2007). Here, the learner becomes “the major agent in their own learning, which occurs as a result of personal experiences” (Hase & Kenyon, 2007: 112). One of the key characteristics of a heutagogical approach is double-loop learning and self-reflection (Argyris & Schön, 1996). As learners take ownership for the determination of their own learning and transformation they begin to interrogate deeply held beliefs and assumptions underpinning their actions (Eberle & Childress, 2005; Hase, 2009) thus initiating “virtuous cycles” of learning. Mezirow indicates that this process involves a critical reflectivity comprising four types of subjective reframing:

- *Narrative* – the application of narrative critical reflection of assumptions to oneself;
- *Systemic* – critical inquiry into inter-objective factors and influences (e.g. the organizational, political, social, and ethical);
- *Therapeutic* – a careful phenomenological appraisal of our feelings and reactive thought patterns in order to apprehend the foreseeable effect they may have on our actions; and
- *Epistemic* – the interrogation of the causes, nature, and consequences of our very frame of reference.

Such transformative learning processes can occur in both individual learning and collective learning (Kilgore, 1999) contexts. Regarding the address of climate change, empowerment of the latter would be particularly appropriate given the global nature of the crisis.

We end with indications regarding the changing roles of learner, teacher and learning occasion. The following account regarding transformative human identity (Hampson, 2005) presents an amalgam understanding oriented by approaches such as those of Mezirow (1981; 1991; 1997), Baumgartner (2001), Daloz (1986; 1999), Dirkx (1997), Taylor (1998), Morin (1999), Kincheloe (2005), and Montessori (1988) in addition to drawing upon the experience of the current authors.

The Transformative Learner

The student encountering transformative learning is no longer a mere educational consumer, but rather a transdisciplinary scientist-scholar-practitioner deeply engaged in self-determination and the apt transformation of their world. This requires that learners have sufficient developmental maturity to explore the perspectives of others and cope with their own shifts in paradigm; that they are ready and open for change; that they are willing to make self-reflection an integral part of their lives in multiple contexts; and that they strive for pertinent knowledge, courageously engaging the complex multiplicity of perspectives. Their journey forms part of a (perhaps non-linear but progressive) emancipation enabling them to name their own world (Freire 1997, p.89) , rather than merely regurgitating social realities defined by cultural institutions. It might also be seen that learners with diverse (positive and negative) life experience have an increased likelihood of cultivating transformation.

The Transformative Teacher

Analogously, transformative educators are no longer a mere technician charged with administering an educational commodity, nor are they a guide through the predictable terrain of a curriculum. Instead, they serve the roles of mediator and companion; they become the enabler of the students' self-determination and social emancipation: teacher as catalyst for transformation. This includes facilitating emotional intelligence,¹¹ and critical awareness (critical thinking and critical theory).¹²

The Transformative Occasion

The learning occasion as a whole thus becomes transformed into one in which the planetary, the complex, and the holistic are welcomed, encompassing multiple perspectives and states of awareness. Understanding is embedded within deep purpose and individual biography. Transformative processes such as Theory U are employed in order to access apt ways forward. These may also entail processes from the arts and the physical, as well as entailing a sense of exploration between different perspectives, toward the engendering of respect, empathy, deep dialogue and collegiality. Additionally, outer architecture is consciously designed as a reflection of the "inner architecture" of transformative curriculum. Overall, there is a sense of global citizenship deeply rooted in a worldview striving towards ethics for the human species and other sentient beings, a worldview that facilitates appropriate address of climate change through the many dimensions of transformative learning.

Ends-in-View

Apt engagement with climate change involves the transformation of the dominant worldview of humanity. Whilst it has achieved much, modernism has been insufficiently ecological; it has been overly simplistic, and inadequately attentive to the full range of human potential and social well-being. The new worldview needs to be deeply ecological, complexly integrative, and transformative. Transformative learning – both individual and collective – is a key process in helping regenerate our worldview in such a way. It also derives from the new worldview, one that pays apt homage to non-Western understandings, to the pre-modern West, and to alternative (e.g. Romantic) streams of human consciousness. The new worldview entails a major shift of principles, requiring the reinvigoration of epistemology and a highly developed review of the philosophy of science. Careful discernment should be applied to both science and economics to

¹¹ *Facilitating emotional intelligence.* *Interpersonally*, this includes facilitating and modeling sensitive relationships towards and among students, for instance by transcending (or at least acknowledging and suspending) one's own prejudices and striving for a fuller understanding and empathy towards others. *Intrapersonally*, this includes mentoring students in the habit of reflexive self-criticality, especially through constant humility and self-reflection (including blind spots).

¹² *Facilitating critical awareness.* Facilitating critical thinking involves the explicit qualities of open-mindedness and deep inquiry. This often leads to facilitating insights arising from a critical theory orientation. These could involve the planet as a whole, and the economico-socio-cultural context. They might also involve the more specific context of education – the different purposes that different educational institutions have pursued, any hidden curriculum, the influence of power relations, and the context of knowledge production, particularly with respect to alertness to reductionism.

separate out their core good from ideological distortions, including collusion with partisan interests. The latter should be deconstructed; the former should form the core of a new appropriate principle of science and economics. The practice of transformative learning should be understood as an open system, one occurring in many contexts, both formal and informal.

The depth of the climate change issue indicates the appropriateness of employing processes of engagement with it that have analogous levels of depth. Transformative learning is a signifier that coheres various processes that have such a depth – the depth, one might say, at which diamonds are made. This paper has indicated that such learning occasions enable the regeneration of deep layers of our individual and collective being – the regeneration of perspectives and principles which have the ability to most effectively engage with the uniquely challenging predicament which is now presenting itself to humanity. The particular depth regarding perspectives that we have addressed can be identified as – at least – worldview. Worldview is often unconscious and yet guides many of our activities. Even further: beneath worldview can be identified deep imaginal patterns and habits, archetypes, myths, metaphors, paradigms and principles – also mostly unconscious. These underpin, give life to, and maintain their respective worldview(s). In addition to addressing the layers of worldview perspectives and metaphors/principles in general, the paper has also focused on higher education as social sector to explore these deeper layers in particular contexts with regard to the challenge of climate change.

It is hoped that the advocacy of transformative learning as presented here inspires such depth-processes to be creatively employed in the myriad contexts of climate change engagement. May the movement outward and onward be accompanied by a development inward and upward. It should become natural to love the Earth.

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