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Transition Design and Ecological Thought

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Abstract: Multiple findings across various sciences have demonstrated the complexity of human-nature relations and exposed the limitations of normative philosophical traditions that discount, dismiss, or even deny the importance of life-sustaining processes that enable human existence. This paper reviews historical and contemporary ecological thought as a basis for Transition Design. Ecologically engaged design presents profound challenges to a variety of assumptions embedded in design cultures. Associated tensions are explored in this paper along with some of the ways that ecologically literate Transition Design can drive the creations of sustainable futures.

Key words: ecological thought - complexity - ecology - epistemological error - ecological literacy - modernity - sustainability - Anthropocene - Capitalocene - Ecocene.

[Abstracts in spanish and portuguese at pages 147-148]

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Over the past half century, the ecological and Earth sciences have revealed the complexity, vitality, and fragility of the global ecological context. Transition Design is informed by this new more integrated understanding of the complexity of human-nature relationships than by the formulations that unpinned the Industrial Revolution and the modern era. Over the past five decades, individuals in diverse fields have contributed to the development of an ecological theory that can better meet the challenges associated with increasingly severe eco-social problems, including climate change. This ecologically engaged worldview recognizes the limitations of philosophical traditions that discount, dismiss, or even deny the importance of life-sustaining processes that enable human existence. With

this perspective, designers can more effectively address complex problems. This paper reviews historical and contemporary ecological thought as a basis for Transition Design, describes the tensions ecological thought presents to neoliberal frameworks, and explains some of ways that ecologically literate Transition Design can drive the creations of sustainable futures.

The Emergence of Ecology and Ecological Thought (Pre-1960)

Ecology (from the Greek *oikos*, "household") is the study of relations (in the household that is the Earth). The term ecology was coined by German biologist, philosopher, and artist Ernest Haeckel (1839-1919) in 1866 as a "science of habitat". Haeckel's drawings of embryos, plants, and microscopic life forms illustrated his scientific findings, philosophical ideas, and his own visual interpretations of these findings. As an artist-scientist, Haeckel linked the study of ecology with images from its conception, and images have remained a powerful means for capturing ecological knowledge and systems thinking ever since. The new science of ecology emerged as biologists began to study communities of organisms, and the biologists' focus shifted from the individual to groups in an environment. This study required new ways of thinking about relationships, connectedness, patterns, and context. This expansive focus revealed principles that life uses to organize its processes. Some notable features include "the double role of living systems as parts and wholes" that require "the interplay of two opposite tendencies: an integrative tendency to function as part of a large whole, and a serf-assertive, or self-organizing tendency to perceive individual autonomy" (Capra & Luigi Luisi, 2014, p. 65). Another key feature includes the tendency to make multileveled structures of systems within systems: "life is an integrated process of nested living systems" (Feibleman, 1954; Günther & Folke, 1993, p. 257). These and other principles of ecology inform ecological theory described in this paper.

Unfortunately, but perhaps unsurprisingly considering the historical context, the new discipline was immediately used in racist ways with attempts to categorize, characterize, and arrange races in hierarchal orders such that "differences of culture or power become expressions of an order of nature" (Wark, 2015, p. 139). The concept of ecology was harnessed to serve the racist assumptions of the privileged White men who were in positions of power in the society in which the concept was conceived and developed. These totalizing interpretations of ecological science developed "a biopolitics whose apogee is the Nazi concentration camp" (Morton, 2017, p. 34). The German Third Reich had elements of a reactionary green movement and used references to nature to promote the Aryan race as the master race. The ways in which references to nature can be linked to racist and sexist political projects remain a warning for everyone who references nature today.

Despite these problems, ecology as a branch of science that focuses on the environment has become an important field of study in an increasingly complex world. The focus on environments has created new ways of thinking about communities and networks, as well as new understanding of how life organizes itself as complex adaptive systems. Ecologists study *relationships* between human and nonhuman nature, including organisms, parts of organisms, and communities of organisms. These living systems are organized as net-

works within networks. Complexity science informs ecological theory and systems thinking. It reveals relationships and patterns where nonlinear dynamics "embodies a shift in perspective that is characteristic of systems thinking –from objects to relationships, from measuring to mapping, from quantity to quality" (Capra & Luigi Luisi, 2014, p. 99). These ideas are foundational to ecological thought's concern with addressing fragmenting and overly reductive perspectives of previous ways of thinking.

In the early 20th century, quantum physics provided insights into observation and perception, participation, relationships, and influences. The scientific findings that an observer is a participant within a process of knowledge-making demonstrated errors with the old subject/object dualism of traditional scientific methods. But the revolution implied by these discoveries has not yet, even a century later, been fully embraced and embedded in all disciplines and practices. Although science suggests that we live in a participative universe that is so complex that it must be approached with methods responsive to this complexity, the study of ecology has been dominated by positivist methodologies (Sachs, 2010, p. 30). These methods have led to the development of ecosystems theory as a science of feedback mechanisms with the goal of understanding and ultimately controlling natural processes. This reductive and instrumental approach to ecology continues with projects such as the financialization of the nature agenda of the United Nations' Environment Program (UNEP) Green Economy. Here, ecology functions to monitor nature's overload capacity and adjust feedback mechanisms to enable continued development. Two distinct approaches to ecology can be identified: (a) one in which nature is conceived as resources to be managed and (b) one in which ecology is approached as a science of complexity and is often associated with a participative worldview oriented toward preserving the commons. Ecological thought as presented in this paper is associated with the second approach.

Early Ecological Thought, 1960-2000

Ecological thought refers to the ways in which ecology has informed new ways of thinking about relationships, commonality, and complexity. Although there are a variety of formulations of ecological theory, a dominant theme is a critique of the objectivist, positivist, reductive, and dualist tradition of modernity and some of what is referred to as postmodernist thought. These philosophical traditions have their origins in the traditions of empiricism, rationalism, and mechanism in the scientific revolution. For many ecological theorists, these traditions are valuable but incomplete approaches to knowledge. Ecological theorists describe the processes through which knowledge is generated in positivist science as responsible for a dualist split (between subject and object, sensing and thinking, mind and body, humankind and nature) that results in a conception of nature as a series of mechanical and inert objects. For these reasons, some ecological theorists refer to postmodernity as "hyper-modernity" or "ultra-modernity" (Griffin, 1992; Sterling, 2003, p. 222). These authors claimed that a better critique of modernity "would counter the modern ideological flight from body, nature, and place" (Spretnak, 1997, p. 223). This position asserts that modernity "denies the ecological by placing itself both outside of

nature and in control of nature, while ultra-modernism denies the ecological by focusing exclusively on the social" (Boehnert, 2018a, p. 55). The proposal is to engage with the ecological domain –not by rejecting what came before but by enveloping it in more inclusive ways of knowing.

Feminist and ecofeminist historians, philosophers, and activists have described how traditional conceptual frameworks justify the industrial exploitation of certain classes, races, and genders of people and the planet. Modernity's conception of the world takes the regenerative capacities of nature for granted and exploits natural resources until the regenerative capacities of nature are severely eroded. Ecofeminists describe a logic of domination that has been historically been used to oppress women and nature. Val Plumwood (1999) explained: "Injustice does not take place in a conceptual vacuum, but is closely linked to desensitizing and othering frameworks" (p. 197). Plumwood (2002) described "a crisis of reason" that is propelled through backgrounding, remoteness, instrumentalization, and disengagement. Ecofeminists and feminists helped reveal the error of presenting knowledge as universal and value-free by demonstrating how women's and nature's interests have been denied using these frameworks. These authors advocated more situated and caring approaches to relating to each other and the Earth. These contributions have been central in the development of ecological thought.

Ecological theorists have sought to revise contemporary understanding of human–nature relations in various ways. The deep ecology school of thought, founded by Arne Naess (1912-2009) in the 1970s in Norway, emphasizes distinctions between shallow ecological thinking (anthropocentric) and deep ecological thinking (where humans are understood as part of a web of life and as fundamentally interconnected with the ecological context). Meanwhile, in the United States, Murray Bookchin (1921-2006) founded the social ecology movement that linked ecological thinking to critical theory such that all environmental problems are approached as socioecological problems (White, Rudy, & Gareau, 2015, p. 27). Over the last 40 years, these two prominent schools of thought have often had intense disagreements, and yet both have profoundly challenged mainstream environmentalism and pushed ecological theory and practice into more intelligible directions.

An underappreciated but significant theorist from this early period is Gregory Bateson (1904-1980). Bateson was an anthropologist who laid a foundation for contemporary ecological theory with his *Steps to an Ecology of Mind* (1972). Bateson described fundamental errors in human ways of conceiving of ourselves in relation to ecological context. This epistemological error is at the root of our inability to engage with the complexity of contemporary problems. The consequences are severe. Bateson (1972) stated:

> I suggest that the last 100 years or so have demonstrated empirically that if an organism or aggregate of organisms sets to work with a focus on its own survival and thinks that is the way to select its adaptive moves, its "progress" end up with a destroyed environment. If an organism ends up destroying its environment, it has in fact destroyed itself. (p. 457)

The error determines that humankind effectively ignores information vital for our own survival. This ignoring enables the destruction of the conditions that humankind needs

to sustain itself. This error is evident in approaches to knowledge that serve instrumental ends to serve immediate human desires, often with a complete denial of the consequences for the ecological context.

Bateson's ideas were used by Felix Guattari in his own formulation of ecological (and cultural) thought in The Three Ecologies (published in French in 1989 and translated into English in 2000). Following Bateson, Guattari described mental ecology, social ecology, and environmental ecology as three realms that cannot be disconnected. The three ecologies (the mental/human subjectivity, the social/social relations, and the environmental) must be encountered simultaneously in theory and practice. A fragmenting approach to knowledge only creates endless contradictions. Guattari (2000) observed:

> So, wherever we turn, there is the same nagging paradox: on the one hand the continuous development of new techno-scientific means to potentially resolve the dominant ecological issues and reinstate socially useful activities on the surface of the planet, and, on the other, the inability of organized social forces and constituted subjective formations to take hold of these resources in order to make them work. (p. 22)

This paradox creates crises in all three spheres. In response to this problem, Guattari (2000) proposed a new theory of ecosophy, an "ethico-political articulation" (p. 19), that "create[s] new systems of valorization, a new taste for life, a new gentleness between the sexes, generations, ethnic groups, races" (1995, p. 92). This theory of relations between the self, the social, and the environmental is a useful model for designers who typically work creating design outcomes that mediate experiences between these three domains.

Guattari brought ecology together with culture. With the recognition that culture is always implicated in the development of subjectivities, he called for communicational interventions for the reinvention of the ways in which we live by "the motor of subjectivity" (1995, p. 24). This appeal for attention to the production of subjectivity is relevant for all cultural workers concerned with eco-social problems. Cultural practitioners can nurture a new praxis to "ward off, by every means possible, the entropic rise of a dominant subjectivity" (Guattari, 2000, p. 45) associated with reproducing environmental harms. Guattari invited all cultural practices "in a position to intervene in individual and collective psychical proceedings" (2000, p. 27) to cultivate a new ecological subjectivity. This revolution must engage with the "domains of sensibility, intelligence and desire" (2000, p. 20). Guattari's psychological and sociological analysis of the ways in which culture works to influence subjectivities can help designers understand how they can work to nurture ways of thinking and acting to enable sustainable transitions.

Ecological Literacy

David Orr published the seminal book Ecological Literacy in 1992 in which he introduced the concept of ecological literacy (or ecoliteracy) as a foundation for sustainable education. In this text, Orr (1992), like Bateson, described ecological problems as linked to how we think:

> The disordering of ecological systems and of the great biogeochemical cycles of the earth reflects a prior disorder in the thought, perception, imagination, intellectual priorities, and loyalties inherent in the industrial mind. Ultimately, then, the ecological crisis concerns how we think and the institutions that purport to shape and refine the capacity to think. (p. 2)

Ecologically literacy describes a type of education dedicated to shifting mindsets to support ecological imperatives. Daniel Wahl (2016) described ecoliteracy as an "understanding of the organization of natural systems and the processes that maintain the healthy functioning of living systems and sustain life on Earth ...[and the ability] to apply this understanding to the design and organization of human communities" (p. 154).
Ecoliteracy involves an understanding of the basic principles of ecology and the development of the various capacities needed to help integrate these ideas into the design and development of sustainable everyday ways of living. Emma Dewberry (2016) emphasized ecological literacy as supporting new agencies:

> Ecoliteracy represents a shift in (the industrialized) mind-set that asks people to understand the fundamental role of natural systems and the relationship between their own well-being and the health of those natural systems. It is not only the theoretical underpinning of the interconnectedness of systems that is important but also the value of action-oriented ecoliteracy. (p. 4)

Sustainable transformations depend on work developing cognitive, critical, perceptual, and social capacities to design ecologically sustainable ways of living. Along with ecological knowledge, an ecologically literate culture must learn to organize cultural, political, legal, and economic priorities in ways that will enable it to sustain itself over time.
The ecoliteracy concept can be characterized as evolving in two complementary directions that emphasize different approaches to sustainable transitions. An experiential mode of ecoliteracy draws insights from philosophy and holistic science and provides "a conceptual foundation for the second mode, which in turn has greater capacities to critique and transform unsustainable institutional practices" (Boehnert, 2018a, pp. 80-81). For children and adults, this approach emphasizes "a dimension of ecological understanding that has to be subjectively embodied and adapted to the particular local conditions of natural processes in which we participate" (Wahl, 2016, p. 87). This tradition has been popular outside formal education.
A second mode of critical ecological literacy has a sharper sociopolitical critique. In the context of a deeply unsustainable culture, individuals need critical skills that enable the identification of the forces that reproduce the unsustainable and the development of new agencies to enable transformative work. Engagement with the controversies and politics of change-making are a basis for the critically engaged ecological literacy. Not everyone who is interested in presenting themselves as committed to sustainability is familiar enough with ecological concepts and critical approaches that enable an integrated analysis of environmental problems. Those pushing forward ecological transitions need analytical skills to approach economic, political, and cultural issues critically to understand how

they intersect with environmental harms and injustices. Media literacies of various types are needed to decode how environmental ideas are embedded in images, news, metaphors, myths, cultural stories, digital media, infographics, charts, and designed artefacts. Critical thinking helps individuals identify misinformation in cultural messaging. Ecological literacy education must help individuals develop a variety of new agencies to do the often-difficult work of disrupting the unsustainable status quo.

Contemporary Ecological Thought (2000-2018)

Anthropocene, Capitalocene, and Ecocene

A historical moment occurred in 2000 in the middle of a heated debate on human impacts on the Earth at a scientific conference in Cuernavaca, Mexico. In *The Shock of the Anthropocene,* Christophe Bonneuil and Jean-Baptiste Fresso (2016) explained what happened:

> Paul Crutzen, an atmospheric chemist and Nobel Prize winner for his work on the ozone layer, stood up and exclaimed: "No! We're no longer in the Holocene but in the Anthropocene!" This was the birth of a new word, and above all of a new geological epoch. Two years later, in an article in the scientific periodical Nature, Crutzen developed his assertion further: the stratigraphic scale had to be supplemented by a new age, to signal that mankind had become a force of telluric amplitude. After the Pleistocene, which opened the Quaternary 2.5 million years back, and the Holocene, which began 11,500 years ago, "It seems appropriate to assign the term 'Anthropocene' to the present, in many ways human-dominated, geological epoch". (p. 16)

Crutzen and other scientists describe the Anthropocene as a new geological epoch where humankind has become a force that is dramatically changing the ways Earth systems operate (Crutzen, 2002; Steffen et al., 2015). The Anthropocene concept has gained cultural currency as a scientific description of what is occurring as Earth systems are being transformed and destabilized by human activities. Bonneuil and Fresso's book questions who is allowed to speak about the Anthropocene and challenge the monolithic scientific discourse. Critics have warned that although the Anthropocene concept can work as a scientific descriptor of the current epoch, the era defined in scientific terms does not capture the social forces that drive change in society and ultimately the environment. What is needed is not only descriptions of environmental changes but also ideas and ways of thinking that will enable appropriate responses, on a scale that will make a difference.

The Anthropocene concept has been critiqued as uncritically importing Western rationality, imperialism, and anthropocentrism –assumptions that all narrow humankind's options for developing sustainable alternatives (Haraway, 2015, 2016; Malm, 2015; Moore, 2014, 2015). Critical theorists argue that responsibility for ecologically destructive modes of development is not distributed evenly across humanity but is concentrated on those who have greater power. Bruno Latour (2014) claimed:

> The "anthropos" of the Anthropocene is not exactly any body, it is made of highly localised networks of some individual bodies whose responsibility is staggering...this dispersion of the "anthropos" into specific historical and local networks, actually gives a lot of weight to the other candidate for naming the same period of geohistory, that of "capitalocene", a swift way to ascribe this responsibility to whom and to where it belongs. (p. 139)

The Capitalocene concept draws attention to a specific model of development. Capitalism is a project developed during an era when nature's regenerative processes were taken for granted. Capitalism was not designed to value the human/social and ecological domains. What it does instead is transform these realms into the types of capital that can contribute to the accumulation of financial capital (for those who have capital to invest). This analysis highlights the role of capital accumulation in driving environmental problems. As a system developed during an epoch when the Earth's needs were dismissed, capitalism functions without regard to its own social and environmental context. Jason Moore (2014, 2015) claimed that the Anthropocene concept obscures these systemic processes that drive ecological crises. As analysis of the problem is bound to effective responses, the naming (and framing) of the current epoch matters.

While the Anthropocene describes changes to Earth systems and the Capitalocene describes why these changes are happening, what is urgently needed now are visions of how humanity will respond. At the Urban Ecologies design conference in Toronto in June 2015, design theorist Rachel Armstrong (2015) announced: "There is no advantage to us to bring the Anthropocene into the future. The mythos of the Anthropocene does not help us. We must re-imagine our world and enable the Ecocene". The Ecocene is a generative concept that provides a conceptual space for redirected, responsible, and regenerative design. The Ecocene will be generated by those well versed in the scientific knowledge of the Anthropocene, the critical perspective of the Capitalocene, and in design skills to make new communication, products, fashion, services, and spaces to sustain civilization over time. The people who design the Ecocene will be ecologically literate. They will have an ontology, epistemology, and ethic emerging from ecologically engaged ways of knowing.

New Formulations of Ecological Thought

In the context of clear warnings from scientific communities on the risks associated with Earth system destabilization and the announcement of a new geological epoch, the 21st century has seen an acceleration of articulations of ecological theory. Many of these new ideas respond to the failures of anthropocentric, reductionist, and instrumentalist ways of understanding the world. Reductionist approaches to knowledge are described as erasing complexity such that "knowledge gains in rigour what it loses in richness" (Santos, 2007, p. 27). Although there are differences in emphasis and some disagreement, the common vision of the vast majority of ecological theory asserts that "knowledge gained from observation of the parts [alone] is necessarily distorted" (Santos, 2007, p. 28). This perspective has created a foundation for the development of more inclusive and participatory

approaches to knowledge generation and a more radical scope for action based on an ecologically engaged way of knowing.

Twenty-first-century theorists have constructed formulations of ecological theory that engage concepts such as complexity, solidarity, commonality, and vitality. Donna Haraway (2016) asked: "What happens when human exceptionalism and bounded individualism, those old saws of Western philosophy and political economics, become unthinkable in the best sciences, whether natural or social?" (p. 30). Haraway described troubling the many contradictions generated by eco-social breakdown to nurture well-being on a damaged planet toward enabling multispecies recuperation. Along similar lines, Timothy Morton (2017) mapped antioppressive approaches to ecological theory by describing a mode of "solidarity with nonhuman people." Morton (2017) unpicked humans and nonhumans relations and described how antiracist struggles relate to environmental ones:

> The struggle against racism thus becomes a battleground for ecological politics. "Environmental racism" isn't just a tactic of distributing harm via slow violence against the poor. Environmentalism as such can coincide with racism, when it distinguishes rigidly between the human and the nonhuman. Thinking humankind in a non-anthropocentric way requires thinking humankind in an anti-racist way. (p. 45)

Similar to Haraway, Morton troubled ecological theory in ways that suggest that addressing environmental problems is linked to new capacities for solidarity and allyship.

Morton's (2007) *Ecology without Nature*, Jerediah Purdy's (2015) *After Nature*, and other texts called for a move beyond the concept of nature due to the terms historical associations with authoritarian constructions on the natural and linked the various types of oppression of humans and exploitation of the ecological. Purdy (2015) described a posthumanist worldview that understands "the ethical complacency that enables humans to remake and destroy nonhuman worlds" (p. 274). I think the concept of nature does not have be abandoned with anthropocentric humanism. In the context of a society that has consistently and systematically denied the value of the environmental, we need more words to talk about nature (rather than fewer words). These words must include words (like nature) that are not anchored to science (like ecology). Instead, we can reject the erroneous ways that nature has been conceptualized. For example, one of the problems with some new theory on the environment is the idea of a new "entanglement" as the merging of the natural and the artificial (Ito, 2016). I have described elsewhere why this market-facilitating concept is "an error of order and value" (Boehnert, 2018a, p. 96). Whether we chose to use the word nature or not, the critique against the wide variety of ways that the concept of nature can used in oppressive ways is foundational for justice-oriented ecological thought.

Black feminist interventions further trouble ecological theory in ways that disrupt environmental studies frameworks and offer alternative conceptions of ecological ethics (Frazier, 2016, p. 40). Chelsea Frazier (2016) argued for de-stabilizing and reshaping the hierarchies, classifications, and "visual, spatial and philosophical assumptions" (p. 69) beyond "hierarchical myopia and politics of exclusion that have plagued environmental

discourses" (p. 68). She described Black feminist theory as emerging from an experience of being relegated to an "illusory subject/object status [that] has always already paved the way for their extreme instrumentalization" (2016, p. 69). Drawing on political theorist Jane Bennett's (2010) vital materialism, with its commitment to commonality and vitality or aliveness of all matter, Frazier (2016) advocated for a vital materialist stance as superior to an environmental one (p. 68). Frazier (2016) troubled the new materialist position, as informed by the Black experience of "discursive objectification" (p. 69). In the tradition of ecofeminists, Haraway, and Morton, Frazier linked the experience of human oppression to exploitation of nonhuman nature. In its most emancipatory formulations, ecological thought links ecoism to racism, sexism, and other oppressive ideas, behaviors, and system structures.

Tensions and Controversies with the Ecological

Despite advances in sustainability sciences and environmental movements, risks associated with climate change and other environmental problems continue to accelerate. As a civilization, we are not currently effectively responding to environmental imperatives. Government policy on issues of the environment in the United States and the United Kingdom has suffered major setbacks over the past decade. Environmental groups claim that international biodiversity and climate negotiations have not resulted in adequate, legally binding legislation at the major United Nation environmental conferences Rio+20 (2012) or COP-21 Paris (2015). Design has a role to play in sustainable transformations, but ultimately, the potential for design to leverage its full potential depends on the political context in which design is situated. Structural factors enable or disable sustainable transformations.

Climate change and other severe environmental problems are indisputable within scientific circles –but not in the policy arena of the current U.S. government. Corporate environmental messaging offers what is presented as solutions to environmental problems often without rigorous scrutiny of key claims. Environmental theory is political and controversial. This was evident when the postenvironmentalists in the Breakthrough Institute (BTI), led by Ted Nordhaus and Michael Shellenberger, published *An Ecomodernist Manifesto* (2015). Bruno Latour (2015) was not impressed:

> Never in history was there such a complete disconnect between the requirements of time and space, and the utopian uchronist vision coming from intellectuals. Wake up you ecomoderns, we are in the Anthropocene, not in the Holocene, nor are we to ever reside in the enchanted dream of futurism.

Others offered even more scathing responses: "there is nothing really 'eco' about ecomodernism, since its base assumptions violate everything we know about ecosystems, energy, population, and natural resources" (Caradonna et al., 2015, p. 16). For many sustainability scholars, "eco-modernization is an oxymoron" (Kallis, 2015), but to those who are unfamiliar with the complexities associated with meeting environmental challenges, the

ecomodernist position can appear like a perfectly rational way forward. Ecomodernist and technofix (technological fix) discourses continue to dominant thinking in the media and in politics with the result that environmental problems are never adequately addressed.
Ecomodernism is an entrenched position aligned with neoliberalism. Neoliberal modes of governance result in a type of politics that dismantles democratic social institutions in favor of unaccountable private power. It is characterized by policies favoring marketization, metrics-driven modes of governance, financializing, privatization, deregulation, and reregulation facilitating market processes with benefits for the most powerful actors (Arsel & Buscher, 2012; Castree, 2008; Peck, 2010; Sullivan, 2013). These radical transformations are accompanied by rhetoric that obscures these processes with allusions to freedom and efficiency. Policy decisions are increasingly determined by market processes (as opposed to democratic or other political processes). The resulting circumstances are extraordinarily difficult to navigate for constituencies that experience increasing austerity, precarity, and insecurity –and news dominated by market interests.
Neoliberal theory (emphasizing competition and individualism) is an antithesis of ecological theory (emphasizing cooperation, solidarity, and commonality) described in this paper. Depoliticized design cultures typically reproduce the assumptions of the most economically powerful actors in society (who have the money to employ designers). Neoliberal ideology has stunted sustainability agendas in design as prominent design theorists and design journals have circulated ideas that dismiss ecologically progressive ideas. Design theory in leading journals and books has explicitly scorned emergent ideas in sustainability discourses with outright hostility (and vicious ad hominem attacks) on occasion. These attitudes have helped maintain the status and are responsible for the slow progress of sustainable design theory and practice.
Designers (like everyone else) are constrained by the incentives, priorities, and dynamics in the economic and political context in which we work –which is currently governed by neoliberalism and extreme forms of capitalism. Transition Design is based on a very different worldview and ideology. Thus, Transition Design is engaged with alternative economics theory and movements as an:

> Emerging body of thought that views the dominant economic paradigm and the consumer-based marketplace (capitalism) as one of the root causes of the complex problems of the late twentieth and twenty-first centuries. The authors identify the inherent, unsustainable problems in this paradigm and offer myriad alternatives and solutions. (Irwin, 2015, p. 241)

This engagement with ideas on the structures that determine the priorities embedded in the economic system (and therefore in the design industry) is key to "transforming the system that determines what is designed" (Boehnert, 2014, p. 120). Disengagement from political circumstances is not an option for those who understand the risks associated with continued unsustainable development and are committed to making transitions to more sustainable futures possible.

Ecological Literacy in Transition Design

Transition Design has greater potential to address sustainability agenda than previous formulations of sustainable design due to the integration of ecological literacy into its worldview (Irwin, Tonkinwise, Kossoff, & Scupelli, 2015, p. 4). It is a theory of design with "heightened awareness of a myriad of wicked problems confronting us in the twenty-first century and an increasing acknowledgment that they are interconnected and interdependent" (Irwin, 2015, p. 230). Transition Design harnesses ideas and discoveries from a diversity of fields such as physics, biology, mathematics, philosophy, sociology, and organizational development (Irwin, 2015, pp. 234, 242) to catalyze sociotechnological change. Ecological literacy provides the insights necessary to design within complex systems as the foundation for Transition Design.

David Orr stressed the importance of design in making sustainable futures. He claimed that environmental problems "are mostly the result of a miscalculation between human intention and ecological results, which is to say that they are a kind of design failure . . . [which signal] inherent problems in our perceptual and mental abilities" (2002, p. 14). Yet these design failures also suggest that improvements can be made through design. Recently, Orr wrote an introductory chapter in the 2018 *Routledge Handbook of Sustainable Design*: "The Political Economy of Design in a Hotter Time." Here, Orr (2018) published a list of criteria or basic rules of ecological design that draw on comprehensive engagements with the socioecological challenges:

1. Maximum uses of solar energy
2. Protect diversity of all kinds
3. Eliminate waste
4. Use nature as a model
5. Make it affordable
6. Design for repair and disassembly
7. Build in redundancy and resilience
8. Maximum public participation
9. Beauty. (p. 6)

Ecological literacy offers approaches to help designers to create communication, artifacts, spaces, and services supporting sustainable transitions. However, Orr stressed that the problems of our era also require political and economic shifts to direct the system in which designers operate. In this new work, Orr (2018) moved more explicitly into the political domain:

> However ecologically improved one building, neighborhood, city or enterprise may be, the entire system is still trending towards disaster. The problem is not in the particular techniques of design, which have become very sophisticated, but in the haphazard structures –economic, political, social– in which design occurs, which slows the efforts to take ecological design to the necessary scale. The rules of the larger system permit change only at the margins, which is to

> say only slight adjustments…To really improve the human prospects the precepts of ecological design must inform our politics, governance, law, and economics, not just buildings, technologies, manufacturing and landscapes. (p. 8)

Ultimately, legislators, officials, economists, political theorists, and all who work to develop social, economic, and political policy must "design social systems that work with, not against, natural processes" (Orr, 2018, p. 8). This critically and politically engaged ecological literacy recognizes that the political economy determines which problems are addressed by design –and which problems are ignored.

Integrating ecological principles into design theory while simultaneously challenging the system structures that enable ecological harms is a substantial task for Transition Design. Ecologically engaged Transition Design can respond to longstanding problems where sustainability agendas fail to adequately attend to the continuation of humankind and nature in all its diversity on the face of this planet. Informed by ecological thought, Transition Design is systems aware, enabling, participatory, collaborative, and aligned with the patterns and processes of nature. It enables responsible-ability in design. With this ecologically engaged approach, Transition Design can become a basis for understanding and responding to the complexity of contemporary problems.

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Resumen: Múltiples hallazgos en diversas ciencias han demostrado la complejidad de las relaciones humano-naturaleza, y han expuesto las limitaciones de las tradiciones filosóficas que minimizan, descartan o incluso niegan la importancia de los procesos que sostienen la vida y que permiten la existencia humana. Este artículo revisa el pensamiento ecológico histórico y contemporáneo como una base para el Diseño para la Transición. El diseño ecológicamente comprometido presenta desafíos profundos para una variedad de suposiciones incrustadas en las culturas del diseño. En este documento se exploran las tensiones asociadas junto con algunas de las formas en que el Diseño para la Transición, ecológicamente alfabetizado, puede conducir a la creación de futuros sostenibles.

Palabras clave: Pensamiento ecológico - complejidad - ecología - error epistemológico - alfabetización ecológica - modernidad - sostenibilidad - Antropoceno - Capitaloceno - Ecoceno.

Resumo: Muitas descobertas em diversas ciências demostraram a complexidade das relações do ser humano com a natureza e expuseram as limitações das tradições filosóficas que minimizam, descartam ou inclusive negam a importância dos processos que sustentam a vida e que permitem a existência humana. Este artigo revisa o pensamento ecológico histórico e contemporâneo como base para o Design para a Transição, ecologicamente alfabetizado, pode conduzir à criação de futuros sustentáveis.

Palavras chave: pensamento ecológico - complexidade - ecologia - erro epistemológico - alfabetização ecológica - modernidade - sustentabilidade - Antropoceno - Capitaloceno - Ecoceno.
