

Conceptualizing Transdisciplinary Human Ecology

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Abstract

Broadening theoretical and methodological underpinnings will help human ecology professionals remain effective in responding to complex crises facing humanity (e.g., climate change, environmental degradation, social inequality). Diversified theoretical offerings strengthen academic and professional work, because diversity drives innovation in practice. This paper explores *transdisciplinary human ecology*, a neologism proposed in the early 1990s by both ecological scientists and home economists. After describing home economics and ecological sciences' approaches to human ecology theory, the Nicolescuian transdisciplinary methodology, and transdisciplinary human ecology as conceived by home economics and ecological sciences, the paper shifts to an inaugural discussion of how human ecology theory can be augmented with Nicolescuian transdisciplinary axioms and transdisciplinary human ecology. This paper served as a seed catalyzing the uptake of transdisciplinary human ecology.

Keywords: ecological sciences, home economics, human ecology, transdisciplinarity, transdisciplinary human ecology

Introduction

Individuals and families face an array of deeply complex problems: “The severe challenges of climate change, resource depletion, environmental and social disintegration, and national and international inequality, are converging into a global crisis that confronts humanity as a whole” (Wahl, 2006, p. 288). Scholars in many disciplines are calling for transdisciplinarity, because they realize that knowledge from one discipline is insufficient. *Trans* means between, across, and beyond academic disciplines to include knowledge from the lifeworld (Nicolescu, 2002, 2014). Transdisciplinarity provides a solid foundation for investigating the complex interactions of human and socioecological systems that inform today's complex crises (Vaughan et al., 2019).

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Vaughan et al.'s (2019) comment links two long-standing lines of thinking: human ecology and transdisciplinarity. This paper focuses on *transdisciplinary human ecology* as understood within home economics (Brown, 1993) and ecological sciences (e.g., Dyball, 2010). Ecology is the science of the relationships between *living organisms* and their environments. *Human ecology* is the study of the relationships of a particular living organism—*people*—and their environments (Marten, 2001). “Ecologists study systems of interactions among differentiated organisms and between them and the nonliving components of their environment. ... Human ecology then, ought to mean simply and straightforwardly *the study of ecosystems that involve humans*” (Catton, 1994, p. 77, emphasis in original).

But human ecology is not a speciality contained within one discipline (Catton, 1994). Dyball (2010) concurred, explaining that human ecology “is adisciplinary, in that it is inclusive of the disciplines but is not bound by any” (p. 13) (see also Christensen, 2014). Biologists use it to study interactions between living organisms and their environments. Sociologists apply it to study human communities. Psychologists use it to explore interpersonal behavior and the adaptation of groups to resources available in their environments. Environmental design and engineering apply it to understand environmental psychology. Anthropologists, archaeologists, and geographers use it to study cultures and civilizations in environmental contexts. Political ecologists employ it to study the impact of colonialism, neoliberalism, and transnational corporations on resource management and environmental problems (Knapp, 2007; Touliatos & Compton, 1988; Wolanski, 1990).

Of interest in this paper is that the ecological science discipline's approach to human ecology, as exemplified by Marten (2001), focuses on the interactions between *social systems* and *ecosystems* using complex adaptive systems theory. The home economics discipline is more narrowly focused on the *family ecosystem* as it interacts with levels of environments using general systems theory (Bubolz & Sontag, 1993; Touliatos & Compton, 1988). Indeed, home economics has long been concerned with human ecology; a fact recently recognized by leading ecological scientists in a paper titled “Ellen Swallow Richards: Mother of Human Ecology?” (Dyball & Carlsson, 2017).

Dyball and Carlsson (2017) also acknowledged Richards as the founder of home economics during the late 1800s and early 1900s Lake Placid conferences in New York state. Richards's desire to call the new discipline human ecology was thwarted, because the name was already being used in the Dewey Library Decimal System with another definition (Joyce Beery Miles, personal communication, January 15, 2019). Richards is credited with being the first person to use the term *human ecology* in her 1907 book *Sanitation in Daily Life*, but attendees at the founding conferences (1899–1909) settled on *home economics* for the name of the new academic discipline and profession (Dyball & Carlsson, 2017; Merchant, 2007).

As a caveat, home economics is both a discipline (academic area of study) and mission-oriented profession (licensed, sanctioned provider of public service). Each depends on and thrives because of the other (McGregor, 2011a). *Discipline* is used herein, because professional practitioners depend on fellow academicians to develop theory. Also, American practitioners changed the name in 1994 to “family and consumer sciences” (FCS) (Vincenti, 1997). While respecting this preferred identity shift, the term home economics² is used in this paper unless deemed too narrow in scope for the idea being developed.

Since the 1970s, the home economics discipline and profession have consistently drawn on human ecology theory (e.g., Bubolz & Sontag, 1988, 1993; Touliatos & Compton, 1988) with recent entreatment to embrace transdisciplinarity (McGregor, 2004, 2010, 2019a). The original thesis of this paper was that neither the home economics discipline nor profession has taken up *transdisciplinary human ecology* as recommended by Brown in 1993. In the course of developing this thesis, the author discovered that ecological scientists have been (and continue to be) drawn to and advocate for its usage (antithesis). This discovery shaped the argument herein.

After describing both home economics’ (Brown, 1993) and ecological science’s (Marten, 2001) approach to human ecology theory followed with Nicolescuian transdisciplinarity, the discussion turns to an overview of how both home economists and ecological scientists envisioned *transdisciplinary human ecology*. The paper ends with inaugural thoughts on how human ecology theory can be augmented with Nicolescuian transdisciplinary axioms and transdisciplinary human ecology (synthesis).

Home economics’ approach to human ecology theory

A theory is a system of ideas intended to account for a phenomenon—Greek *phainomenon*, “a thing appearing, then seen or viewed.” Theory is Greek *theoria*, “contemplation, speculation” (Harper, 2020). Theories help researchers explain, describe, predict, or control a phenomenon by arranging what is known about it “into a logical and understandable framework” (Touliatos & Compton, 1988, p. 12). Any theoretical framework comprises three key building blocks: (a) assumptions (premises, tenets) about the phenomenon; (b) constructs and concepts with attendant definitions; and (c) propositions about how these concepts are related (McGregor, 2018b).

² Ideas in this paper pertain to home economics (a term commonly used outside of the United States), FCS, human ecology, home sciences, home ecology, consumer sciences, family studies and other monikers for home economics around the world.

In their scholarship focused on the well-being and quality of life of individuals and families in communities, home economists rely on several dominant theories including systems, conflict, exchange, symbolic interaction, family development, communication, and life course theory (Boss et al., 1993). The discipline also draws on consumer behavior, education, psychology, sociology, economic, political, and other theories (McGregor, 2009). Human ecology theory was introduced to home economics in the 1970s and early 1980s (see Bubolz et al., 1979; Bubolz, et al., 1980; Hook & Paolucci, 1970). As noted, the discipline's founders considered *human ecology* as its preferred name, but they were told they could not adopt it, because the biological sciences were already using it (Bubolz & Sontag, 1993; Dyball & Carlsson, 2017; Vincenti, 1997).

In their seminal work about human ecology theory, home economists Bubolz and Sontag (1993) identified a comprehensive list of assumptions and premises about the phenomenon of individuals and families (including households) in interaction with their environments (see pp. 425–426). Briefly, human ecology theory assumes that families are: (a) an *ecosystem* where the parts and the whole are interdependent; (b) a key democratic social *institution* that carries out functions for its members and the common good; and (c) a key player in the *ecological* health of the Earth and the world—families are part of the total life system of the planet and deeply intertwined with nonhuman life and environments. It further assumes that: (d) all of their decisions impact society, culture, and environments; and (e) humans (families) can control their decisions, which are not determined by environments. Instead, environments pose restrictions on and provide opportunities for human action (Bubolz & Sontag, 1993).

Bubolz and Sontag (1993) then identified and defined an array of constructs and concepts shaping human ecology theory (pp. 429–437) with propositions (pp. 438–439). Briefly, when using human ecology theory in their practice with individuals and families, home economics and FCS practitioners can *assume* that individuals, families, and households procure, use, and dispose of resources over time to meet basic needs and fulfill the basic functions of the family as a democratic unit. They do so by engaging in reciprocal relationships along four levels of environment: (a) human group, (b), human-built, (c), sociocultural, and (d) natural (Bubolz, 1990; Bubolz & Sontag, 1988, 1993; Toulaitos & Compton, 1988) (see Figure 1).

Conceptually, these reciprocal relationships (i.e., humans with environments) require interaction, interdependence, adaptive behavior, and self-organization. People work with matter (material objects and artifacts), energy, resources, information, space, and time, augmented with technology. They engage in decision-making, choice-making, communication, and management. They exhibit a concern for values, norms, goals, attitudes, perceptions, and complexity as they strive to optimize the quality of both human life and environments (Bubolz & Sontag, 1993).

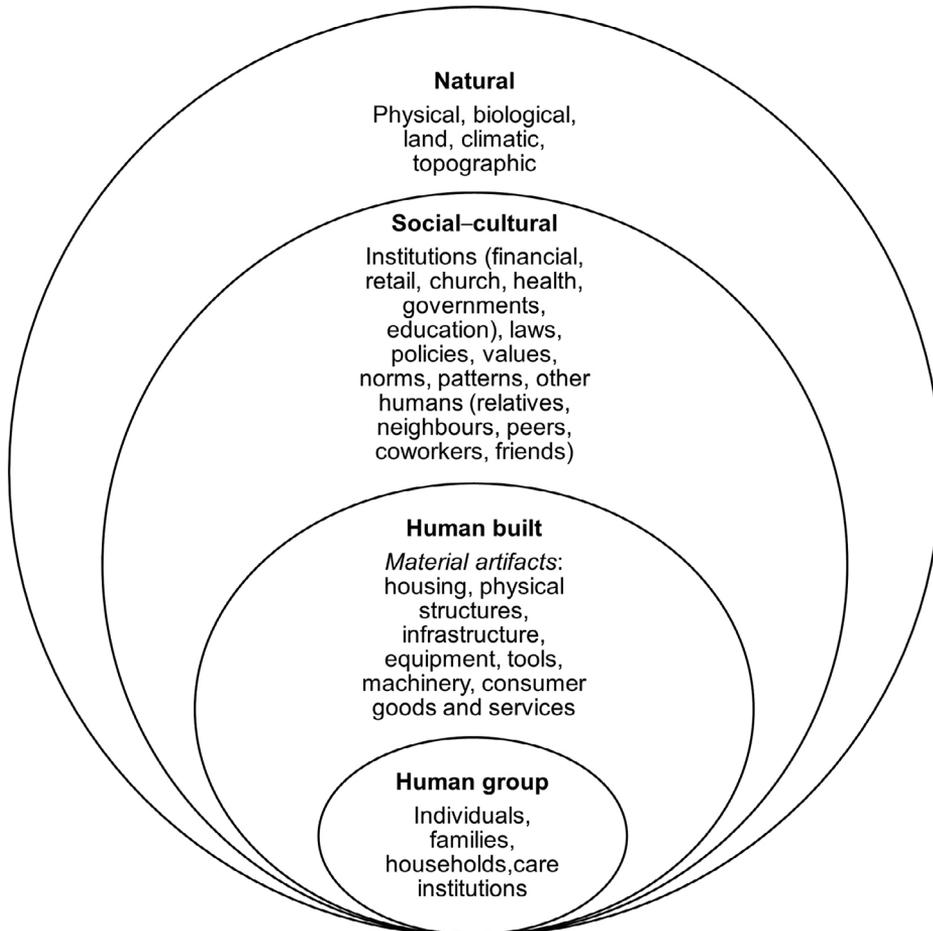


Figure 1. Levels of environment in home economics' human ecology theory.

Source: Author's summary of principles.

Ecological scientists' approach to human ecology theory

Home economics views human ecology theory as grounded in general systems theory concepts. They believe this theory provides a valuable perspective from which to focus on human–environmental interactions (Bubolz & Sontag, 1993). Marten (2001) took a different approach. An ecological scientist, he turned to complex adaptive systems (CAS) theory to develop a theory of human ecology. As an aside, McGregor (2015b, 2019a) has also urged home economists to engage with CAS theory.

Systems theory deals with input, throughput, output, and feedback while striving for equilibrium—picture a thermostat or paddling a canoe. On the other hand, CAS theory deals with complexity, chaos, and impermanent equilibrium—picture an undulating swarm of birds or a shifting herd of wildebeest. These complex systems are leaderless with no coordination; yet, things still happen. Patterns emerge, but no one was told to make a pattern. They are governed by chance and randomness, yet people trust that something will emerge (Mason, 2008). Other examples of CAS include the stock market, an anthill, and a family.

Using this well-established theory, Marten (2001) conceived human ecology theory through the lens of CAS principles and concepts. The most important of these are now introduced. A key concept is complexity, which refers to many intertwined, interdependent parts creating a complex whole that is difficult to untangle. CAS have the key property of emergence, which means gradually coming into existence. Emergence involves coadaptation, community assembly, and coevolution. CAS are resilient due to redundancy (i.e., the intentional duplication of system parts and functions to increase dependability). Of special importance, CAS are self-organizing—that is, they are adaptable (flexible) and can adjust to change without the need of external control or directions. They are also prone to interconnections and forming networks.

CAS are counterintuitive (do not act as expected) and unpredictable. They are chaotic, meaning order is emerging unpredictably. But they have stability domains (i.e., instances when they are stable) that accommodate tensions and switching in ecosystem states. They can experience distortion followed by a complex system cycle wherein they move from growth, equilibrium (stability), dissolution, and reorganization to a new stability domain. And they can create ecological niches whereby they respond to environmental conditions and create a suitable and sustainable role for themselves. Marten presented these and other CAS constructs as a “clear, understandable and coherent system of concepts for comprehending how ecosystems function and how human societies interact with ecosystems” (2001, p. xvi). Since then, other ecological scientists have acknowledged the merit of drawing on CAS theory to inform human ecology theory (Reyers et al., 2010).

Nicolescuian transdisciplinary methodology

Theories conceptualize a phenomenon. To learn more, scholars use research *methodologies* to gain knowledge of the phenomenon. Methodology (not the same as methods) is a “branch of logic that shows how abstract logical principles [axioms] are to be applied to the production of knowledge” (Harper, 2020). Home economics and FCS academics and practitioners basically draw on three methodologies: empirical, interpretive, and critical (Brown & Paolucci, 1979). McGregor (2018a, 2018b)

explained elsewhere the respective philosophical axioms for each methodology: (a) what counts as reality, being, and existing—*ontology*; (b) what counts as knowing and knowledge—*epistemology*; (c) *logic* and reasoning (habits of the mind); and (d) the role of values in research—*axiology*.

Transdisciplinarity is offered here as a fourth research methodology in its own right with its own take on the four axioms. Transdisciplinarity refers to creating knowledge using a combination of disciplinary knowledge *and* ways of knowing in sectors other than the university setting (Nicolescu, 2002, 2014). To clarify, *interdisciplinary* knowledge creation is limited to *between* or *among* disciplines with no concern for *beyond* the higher education academy (Nicolescu, 2014). For more than a century, home economics has been interdisciplinary (Vincenti, 2009). Ecological science is also interdisciplinary (Dyball, 2010; Reyers et al., 2010; Wolanski, 1990).

Daniels (1980), a British home economist, first called for a shift to transdisciplinarity in the profession, followed 13 years later with Brown's (1993) recommendation. Another decade lapsed before home economist McGregor (2004) took up the cause. How the discipline and profession view transdisciplinarity has changed over time (McGregor, 2010) with McGregor (2018a, 2019a) now using the Nicolescuian formulation rather than the Zurich approach (distinctions at McGregor, 2015a). Each would offer a different conceptualization of transdisciplinarity, with this paper opting for Nicolescu's (2002) approach. Ecological scientists are also advocating for a shift to transdisciplinarity with most not referencing any particular approach (e.g., Brown et al., 2010; Reyers et al., 2010; Steiner, 1993; Vaughan et al., 2019).

Nicolescuian transdisciplinarity

Drawing on complexity science (including CAS theory), chaos theory, and quantum physics (rather than classical, Newtonian sciences), Basarab Nicolescu (2002, 2014), a quantum theoretical physicist, formulated a transdisciplinary methodology (shortened in his explanations below to TD) with its own unique axioms (see Figure 2). McGregor (2018a) tendered a detailed discussion of these axioms, presented here in their most rudimentary format. Nicolescu's (2014) intent was to push back against disciplinary fragmentation and specializations, reductionism, dualism, positivism (the scientific method), capitalism, and corporate- and technol-ogized globalization. The alienation of humans from science and technology has created the crises that Wahl (2006) lamented, crises that cannot be solved using just disciplinary or sectoral knowledge (Brown, 1993; Nicolescu, 2002). Uniting humans (subjective) and science (objective) will nullify dualism, unify knowledge, and augment understandings of complexity and the world (Nicolescu, 2014).

ONTOLOGY <i>Reality, Being and Existence</i>	EPISTEMOLOGY <i>Knowing and Knowledge</i>	LOGIC <i>Reasoning and Judgments</i>	AXIOLOGY <i>Values</i>
<ul style="list-style-type: none"> • Reality exists on many levels organized by (1) internal to humans (TD-Subject where perspectives and consciousness flow) and (2) external to humans (TD-Object where information, facts and objective data flow). The subject and object are able to temporarily come together because their interface is (3) mediated by the Hidden Third (a unifying, spirit-opening force at play in the zone of non-resistance). A new trans-Reality is formed for that initiative. 	<ul style="list-style-type: none"> • TD knowledge is co-created in the zone of non-resistance to others' ideas. This knowledge is emergent, cross fertilized (many sectors), complex (can adapt and self-organize) and embodied (made whole by and owned by everyone involved). TD knowledge is said to be alive, always information, and perpetually changing with the context. 	<ul style="list-style-type: none"> • Replacing the logic of exclusion (contradictory ideas cannot be joined), <i>inclusive logic</i> assumes that many perspectives must be included to address complex problems. Each viewpoint is integral to the solution; its absence is noteworthy. <i>Complexity logic</i> facilitates weaving independent ideas into a new whole. 	<ul style="list-style-type: none"> • Individuals' values initially inform the interactions among a variety of actors and transdisciplinary values arise from mediated interaction in the zone of non-resistance. The latter supersede the former.

Figure 2. Nicolescuian transdisciplinary methodology axioms.

Source: Author's summary of axioms.

Ontology

Nicolescu believed that mixing what is inside people's minds (subjective, value-laden perceptions and consciousness) with what is outside their minds (external flow of objective, value-free information, facts, data, and statistics) is possible *if* the "included middle" interface is mediated with what he called the Hidden Third in conjunction with movement along multiple levels of Reality (ontology) (he capitalizes Reality—a convention used in this paper). The internal TD-Subject comprises individual (psychology and personal philosophy), social and cultural, political, and historical levels of Reality. The external TD-Object comprises other levels of Reality: economics and business, science and medicine, technology, environment and ecology, and planetary and cosmic (universe). Human movement between and among these levels of Reality is difficult because of their contradictory assumptions of the world (Nicolescu, 2002, 2014).

People need help to do this. To that end, Nicolescu conceptualized the mediating Hidden Third (like a third party during contentious negotiations), which entails culture, art, spirituality, religions, faith, and the Sacred (connections). These unifying modalities are a means to create a fertile space (called the *zone of non-resistance*),

whereby antagonistic ideas from the TD-Subject and TD-Object can be smoothed over (ontology) so that new, integrated TD knowledge can emerge (epistemology). A new trans-Reality (beyond all Realities but existing at the time) arises that is multifaceted, pliable, in flux, and unique to the problem scenario being addressed (ontology) (Nicolescu, 2002, 2014).

Epistemology

Nicolescu's (2002, 2014) basic premise is that researchers and problem solvers need a way to reconcile natural resistance to contradictory ideas so they can integrate divergent worldviews. Knowledge can arise from this fusion of viewpoints when people willingly set aside their own views to make room for others. The resultant knowledge created in the fertile space where diverse minds interface (called the "fertile included middle") is emergent, complex, cross-fertilized, and embodied. It is cocreated and belongs to everyone involved (epistemology).

Logic

This conceptualization of ontology (Reality) is possible, because people can draw on both inclusive logic and the logic of complexity (Nicolescu, 2002)—Latin *complexus*, "plaited, interlaced strands" (Harper, 2020). Respectively, these logics (i.e., habits of the mind) (a) temporarily reconcile contradictions and antagonisms inherent in multiple perspectives and information (Realities), and (b) allow for different ways of knowing to be interwoven to form new TD knowledge (epistemology) (Nicolescu, 2002, 2014).

Axiology

Inherent in this process is a respect for both (a) personal value sets held when people enter the TD inquiry process, and (b) resultant TD values that emerge during and at the end (axiology) (e.g., respect, compromise, innovation). The new TD knowledge that is formed would not exist without these particular TD values (McGregor, 2018a; Nicolescu, 2014). Although Nicolescu (2006) did not formulate an axiology axiom, it is included here because home economics has long been concerned with values, values clarification (own values), values analysis (others' values), and values reasoning (Brown & Paolucci, 1979). For those who are interested, McGregor (2011b) has made a case for a TD axiology.

To summarize, because transdisciplinary research is inquiry based (*not* discipline based), the focus is on investigating a complex issue and seeking information (object) and perspectives (subject) from academic disciplines *and* other sectors (e.g., civil society, industry, and government). Those involved integrate rather than exclude everyone into the inquiry process. All perspectives must be vetted to accommodate the complexity of the situation. Some points of view and/or facts may be integral to the final solution; their absence would be noteworthy and consequential. They are necessary for completeness (McGregor, 2018a; Montouri, 2013).

To continue, TD researchers work across and with many sets of assumptions; that is, they use a meta-paradigmatic approach (Montouri, 2013). *Meta* is Greek, “across, with” (Harper, 2020). While accepting that each discipline and sector draws on its own set of assumptions (intra-paradigms), transdisciplinary researchers go further and tease out and challenge these assumptions (meta-paradigms). If unquestioned, they can place blinders on the inquiry process and preclude TD knowledge creation. Finally, reductionist, dualistic thinking is rejected in favor of complexity thinking (Montouri, 2013). The former reduces things to their bare essence, while the latter weaves things together to create a new essence (Nicolescu, 2016).

Home economics’ conceptualization of transdisciplinary human ecology

Although it took ecological scientists until the end of the twentieth century to acquiesce to humanity’s centrality to ecology (Reyers et al., 2010), Ellen Swallow Richards had proposed this connection at the end of the 1800s. Yet home economists did not embrace human ecology until the late 1970s (Brown, 1993; Dyball & Carlsson, 2017; Vincenti, 1997). And unlike the growing cadre of ecological scientists who have conceptualized transdisciplinary human ecology (see next section), Brown (1993) is the only home economist who has engaged with the construct. She said that if the discipline intended to continue to align with human ecology, it should be a “broad, transdisciplinary human ecology” (Brown, 1993, p. 413). She reasoned (at pp. 408–409) that, because home economics is concerned with human problems that do not fit within one discipline, any human ecology framework it adopted must be transdisciplinary.

Brown (1993) envisioned a transdisciplinary human ecology framework as overarching, embracing the global level, far beyond the human group. It would be normative in nature (i.e., asking should and ought questions privileging justice and rights) and focused on achieving valued ends that contribute to the potential of humankind, not just individuals and families. Transdisciplinary human ecology would also embrace all ways of knowing and be concerned with all “forms of relationships between humans and their environment” (p. 408). A transdisciplinary human ecology would assume that what constitutes a human problem is broadly defined, meaning it is large in scope while conceptually clear. It is a problem if it interferes with humans meeting their potential in society, which has implications for the human condition.

Brown (1993) proposed that transdisciplinary human ecology would provide a unified view of both the world and knowledge. It would appreciate “the contributions made by [all modes] of knowing” (p. 408). Unifying both the world and knowledge would require various disciplines and professions to work

together to solve society's fundamental problems. This would necessitate using both a holistic view and reflection, otherwise home economists would not be able to synthesize knowledge. Transdisciplinary human ecology would also require specializations to rethink their orientation, so they can effectively bring their "special competence [to] political–moral activity [that is focused on solving issues] within human–environment relations" (p. 409).

Ecological sciences' conceptualization of transdisciplinary human ecology

Neither home economics nor FCS has engaged with Brown's (1993) vanguard idea of transdisciplinary human ecology as a new direction. However, her ecological science contemporaries saw the connection (e.g., Steiner, 1993; Wolanski, 1990), and their colleagues have been advocating for human ecology as transdisciplinary for the last 30 years (Christensen, 2014; Dyball, 2010; Reyers et al., 2010; Wakefield-Rann & Fam, 2018).

To illustrate, Wolanski (1990) proposed that the human ecology discipline had moved through four stages—mono, multi, inter and transdisciplinary (spanning 70 years)—entering the last stage in the early nineties. This was evident by the concern for a "transdisciplinary synthesis of the study of 'man and his culture as a dynamic part of ecosystems'" (p. 110). Wolanski felt it timely to conjoin human ecology with transdisciplinarity because of "the necessity of understanding man's essence in the light of the infinite complexity and temporariness of relations in the universe" (pp. 110–111). To clarify, *man* inclusively meant "organism, population, society" (p. 111).

Shortly thereafter, Steiner (1993) wrote of "human ecology as transdisciplinary" (p. 47) calling it "a trans-scientific endeavour" (p. 49), because human ecology goes beyond science to include philosophy and the lifeworld. Humans encounter their world on these "three levels of world reference which should be connected to each other" (p. 50). From a transdisciplinary perspective, "human ecology ... as an undertaking ... develops a capability of establishing a conceptual framework within which structured conversations about problems can take place and a new kind of consciousness can develop" (p. 51).

Steiner called this framework "general human ecology" (1993, p. 56). For him, the transdisciplinary perspective included (a) *extended ecological* (the transformation of existing systems) and (b) *evolutionary* (the emergence of new systems). The former is recursive and acknowledges that "interactions make possible an enduring existence of the elements [of a system] and the elements continue their very existence by further interactions" (p. 56). *Evolutionary* pertains to the emergence of new systems that

arise from successive generations of recursive evolution and ongoing development. Steiner's (1993) approach to transdisciplinary human ecology thus depended on the transdisciplinary principles of recursive systems, self-organization, levels of reality, emergence, and evolution (in effect, CAS theory).

About 20 years later, Reyers et al. (2010) aligned transdisciplinarity with ecology. They explained that transdisciplinarity is best able to “tackle complexity and the fragmentation of knowledge, work with local contexts and uncertainty, and promote close collaboration and communication during all phases” (p. 503). This alignment happened because ecologists had finally accepted that ecosystem management and conservation is about people and their choices, not just about biology. For 50 years, ecologists had treated humans as external factors. No human ecological (reciprocal) relationship was appreciated, *until* it became self-evident that humans play a major role in what happens to natural environments and other biological species. Steiner (1993) agreed, claiming that “the ecological crisis is really a human crisis” (p. 57).

Dyball (2010) described human ecology as “necessarily transdisciplinary” (p. 274) because of its attributes. Human ecology “is about the interrelationships between humans, their cultures and their ecosystems” (p. 273). To that end, it uses a holistic approach, is concerned with the ethical dimensions of issues (especially for future generations), and is normative (asking should and ought questions). It also envisions a humane and sustainable future evidenced through a motivation of care and concern for a worthwhile world. These attributes make human ecology transdisciplinary whether intended or not (Dyball, 2010).

Christensen (2014) believed that “human ecology is inherently philosophical” (p. 47). He affirmed that “human ecology seeks knowledge useful for transforming human–environment interactions in the direction of sustainable living” (p. 44). Seeking such knowledge requires “reflectiveness, social and political engagement, and inner composure” (p. 44). He concluded that “human ecology [is] the distinctively philosophical appropriation of the results of whatever disciplines, techniques, and ... everyday knowledge are needed for ... generating a creative, practical response to the most serious crises human beings have ever confronted” (p. 47). With this description, he thus intimated that human ecology *is* transdisciplinary.

Very recently, Wakefield-Rann and Fam (2018) enticed their ecological science peers to view “indoor ecosystems as a complex issue [that requires the application of] the principles of transdisciplinarity” (p. 6). Transdisciplinary human ecology would involve “critical reflection in relation to one’s own and others’ perspectives, values, data, and methodological approaches [and conventions] that inevitably creates challenges” (p. 6). By engaging in collaborative research that transgresses disciplinary boundaries and uses multiple sources of knowledge from stakeholders and disciplines, ecological scholars could generate normative research yielding broad societal outcomes that would be communicated using language accessible across fields of inquiry and outside the academy.

Conceptualizing transdisciplinary human ecology

This final section draws on home economists' and ecological scientists' conceptualizations of transdisciplinary human ecology to formulate an inaugural discussion of (a) transdisciplinary methodology and human ecology theory compatibility, (b) suggested realignments of particular human ecology theoretical concepts with transdisciplinary methodology, and (c) augmentations to human ecology theory so it can accommodate both (i) Nicolescuian transdisciplinarity axioms and (ii) home economists' and ecologists' views on transdisciplinary human ecology. (d) Implications for research are briefly acknowledged.

Transdisciplinary methodology and human ecology theory compatibility

Brown (1993) felt that “a transdisciplinary framework of human ecology ... provides a perspective which home economists *could* use but it does not provide the answers as to *how* this perspective can be used in home economics. That home economists must do themselves” (p. 409, emphases in the original). In that spirit, human ecology professionals and researchers can rest assured that the two are deeply complementary. To explain, any research methodology (i.e., assumptions about reality, knowledge, logic, and values) must align with the chosen theory (i.e., assumptions about the phenomenon under study) (McGregor, 2018b). Fortunately, the transdisciplinary research methodology is concerned with inclusiveness, integration, complexity, and levels of Reality. This means it aligns closely with human ecology theory, which assumes people are in complex, reciprocal relationships within levels of environments.

Individuals, the family unit, and households are encountering incredibly complex problems that single disciplines cannot address (Brown, 1993). Fortunately, the transdisciplinary methodology is concerned with creating complex knowledge to address complex problems, which human ecology theory assumes people contribute to daily with their resource management choices (Bubolz & Sontag, 1993; Reyers et al., 2010; Steiner, 1993). Transdisciplinary human ecology is an even more promising way to address complex societal concerns.

On another encouraging note, transdisciplinarity takes different forms in different practices and contexts: “There is no single such practice” (Riedy, 2016, p. 93). Because there are many ways to *do* transdisciplinarity, home economics, FCS, and ecological science theorists can choose to bring transdisciplinarity to human ecology. Already interdisciplinarians and adherents of human ecology theory, home economics, FCS, and ecology researchers should feel comfortable embracing transdisciplinary human ecology.

Home economists and FCS theorists and practitioners already value humans, ecologies, levels, integration, holism, and cross fertilization (Bubolz & Sontag, 1988; McGregor, 2019b), which are all key components of transdisciplinary work. Similarly, human ecology theory and the transdisciplinary methodology share key concepts: interaction, adaptation, self-organization, interdependence, complexity, reciprocity, and a concern for environments. In short, transdisciplinary methodology (axioms) and human ecology theory (assumptions) are compatible.

Suggested conceptual realignments

Several human ecology theoretical concepts can be realigned with aspects of transdisciplinary methodology. First, both approaches have a concern for space, time, cyber technology, energy, and material artifacts. Nicolescu (1998, 2002, 2014) added the notion of *cyber-space-time* (CST) (ontology), which is a connecting principle bridging mind and matter to make levels of perception more evident as people cross Realities. CST is “the transcultural, transnational and transpolitical ... space of human choice” (Nicolescu, 2002, p. 82); that is, people choose to work with disparate minds to problem solve.

Inclusive logic (not leaving anything out) is at work in CST, which is simultaneously artificial (e.g., information technology, Internet, virtual reality) and real, just with different degrees of materiality (more than dualistic, either real or virtual) (Nicolescu, 2002). “Cyber’space is a ritually created space of liminality with transformative properties” (Barbatsis et al., 1999). Liminal space is barely perceptible, neither here nor there. When people enter it, they stand on a threshold, where something can cease to exist or can come into existence—transform (Turner, 1974). Respectively, people can let go of old ways of seeing things and create new knowledge in CST.

On a second front, transdisciplinarity’s respect for religion, faith, spirituality, and the Sacred are not an explicit part of human ecology theory now except for the inclusion of church and culture in the social-cultural environment level (Bubolz & Sontag, 1993) (see Figure 1). It makes conceptual sense to add these ontological elements of transdisciplinarity’s Hidden Third to human ecology theory. (a) Church represents institutionalized religion as a political and social force. (b) Religions are historical and cultural systems and rituals built around a deity. (c) Faith is an individual’s belief in the deity, Church, or religious system. (d) Spirituality is the essential essence of humanity—an inner force. (e) The Sacred represents an absolute respect for others and attendant life-affecting connections (e.g., humans and nature) (McGregor, 2018a; Nicolescu, 2002, 2014, 2016). Along with culture and art, these elements are considered “spirit-opening modalities” that relax people’s minds to receive others’ ideas (Eric Reynolds, personal communication, August 15, 2018).

Third, human ecology theory concerns the phenomenon of individuals and families in relation with environments (Bubolz & Sontag, 1993). If the ecological crisis *is* a human crisis (Reyers et al., 2010; Steiner, 1993), the human group at the center of human ecology theory would have to be reconceptualized. This could include adding subjective perceptions, perspectives, and consciousness as well as human psychology, and philosophy of life (ontology) (Nicolescu, 2014). Human ecology is, by its nature, philosophical (Christensen, 2014). The human group would also have to include ethics and morality and have a normative dimension (Brown, 1993; Dyball, 2010).

Augmented human ecology theoretical assumptions

If the home economics and ecological disciplines heed the call to move forward with transdisciplinary human ecology, they will have to augment some of human ecology theory's assumptions (Bubolz & Sontag, 1993; Marten, 2001) with transdisciplinary philosophical axioms (Nicolescu, 2002, 2014). The following augmentations are offered for consideration, organized by the four transdisciplinarity axioms. The preponderance of ontological ideas may align with Christensen's (2014) (ecological scientist) assertion that human ecology has a unique ontology, enriched here with transdisciplinarity ontology (i.e., multiple levels of Reality and the Hidden Third):

Ontology

- assuming humans are in relation with environments would require another, outermost, level of environment: the cosmos, universe, and lifeworld (see Figure 1);
- resources available for meeting basic needs and fulfilling the role of a democratic social institution would expand to include the CST construct;
- per the above, it is assumed that as they create their Reality, they will self-organize and move through complex system cycles;
- the inclusion of church and culture in the social-cultural level of environment would expand to include spirituality, religion, faith, and the Sacred;
- human consciousness would come into play during resource management and be affected by interfacing with others;
- although human ecology theory assumes humans can control their decisions and choices, this process would now be understood in the context of many other actors instead of just the home or household;
- as humans engage with four levels of environments, they would do so along multiple levels of Reality (internal subjective and external objective);
- the reciprocal relationship between humans and levels of environments would require mediation (the Hidden Third) if people intended to move through levels of Reality at the same time;

Epistemology

- because *family knowing* and *family knowledge* are key to transdisciplinary knowledge creation, how families come to know things and what counts as family knowledge must be conceptualized and studied. This knowledge would be complex (more than complicated), emergent, and embodied;
- as they interact to create new knowledge, they would be construed as counterintuitive and unpredictable yet able to deal with chaos, which is order emerging unpredictably;
- individual and family ecosystem resource management would be construed as complex, emergent, and evolving rather than just complicated and ongoing;
- individuals and families would be viewed as resourceful ecological niches;

Logic

- the above mediation would involve considering inclusive logic and complexity logic (habits of the mind) as part of family reasoning and judgments and any articulation of insights and perspectives;
- assuming individuals and families are key players in the health of the world means their voices need to be heard in transdisciplinary work (inclusive);
- people would come to expect patterns to emerge, which will inform their logic and reasoning;

Axiology

- values are part of human ecology theory (in the sociocultural environment). Transdisciplinary human ecology would have to expand to make room for the emergence of transdisciplinary values, which are not explicitly created by humans but arise from the mediated interface where incompatibility and complexity are addressed to mutual satisfaction.

Research implications

On the research front, the empirical, scientific, positivistic approach is still needed—just not privileged (Nicolescu, 2014). The interpretive and critical research methodologies align most closely with transdisciplinarity, a research methodology in its own right. Interpretive methodology focuses on the meanings people assign to their lived experiences, while critical methodology is concerned with the role of power in people's lives. Appropriate research methods (sampling, data collection, analysis, and reporting conventions) include phenomenology (assigning meaning to lived experiences), hermeneutic inquiry (interpreting communications to find meaning), and discourse analysis (revealing power). Narrative inquiry (people's stories), action research (personal research and activism combined), and participatory research (collective research and activism combined) are also relevant (McGregor,

2018b). Home economics, FCS, and ecological science practitioners should also engage with challenging but necessary collaborative initiatives (McGregor, 2017; Vincenti, 2009; Wakefield-Rann & Fam, 2018).

Conclusion

Home economics', FCS's, and ecological science's current theoretical understandings of human ecology would change if informed by Nicolescuian transdisciplinarity. Discourse, meanings, processes, and outcomes pursuant to the use of human ecology theory would change too. Taking inspiration from Riedy (2016), this paper served as a seed catalyzing the uptake of transdisciplinary human ecology. Diversifying theoretical and methodological offerings (i.e., embracing transdisciplinary human ecology) would strengthen disciplinary and professional work because "diversity ... drives innovation in practice" (Riedy, 2016, p. 105). Innovative next practice better ensures continued effectiveness in responding to complex crises.

With a synthesis of contributions from both home economics and ecological sciences, a conceptualization of transdisciplinary human ecology was offered. The ideas herein should stimulate future discussions about the diverse, overall conceptual framework of human ecology as it pertains to traditional and contemporary intellectual offerings. As a mix of long-standing historical traditions and current and complex thinking, this paper can serve as a stimulus piece for people from a range of disciplinary and theoretical dimensions to reflect and comment on conceptualizing transdisciplinary human ecology.

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