The Transdisciplinary Moment(um)

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Abstract: There is no universal theory, methodology, or definition of transdisciplinarity (TD). Nevertheless, keywords reveal similarities and differences across explanations. This overview tracks five major clusters of meaning: (a) meta-level conceptions of interdisciplinarity, (b) the changing nature and status of unity in the discourse of TD, (c) new alignments with participatory and collaborative problem-oriented research, (d) the forms of knowledge that TD engages, and (e) a transgressive imperative that interrogates the existing structure of knowledge, culture, and education. These categories of meaning are not air-tight. However, with widening use of the core word "transdisciplinarity," it is important to be alert to these patterns and their underlying values and priorities.

Keywords: Collaboration, complexity, integration, interdisciplinarity, participation, transcendent, transdisciplinarity, transformation, transgression, trans-sector, unity.

Introduction[2]

This special issue of *Integral Review* appears at a time of heightened momentum for transdisciplinary approaches to research, education, and problem solving. In their introduction to another special issue focused on the concept, editors Roderick Lawrence and Carole Després (2004) called Transdisciplinarity a "word a la mode." Understanding reasons for the current momentum is an appropriate task for this journal's goal of exploring boundary crossing at the level of meta theories, methodologies, and practices. There is no universal theory or methodology of Transdisciplinarity (TD), nor should we expect a universal definition. The English word "definition" derives from a Latin word, *dēfīnītiōn-em* that refers to both an act of stating the meaning of a word and an act of setting bounds or limits of explanation (*Oxford English Dictionary*, 1971). Keyword clusters reveal similarities and differences across explanations. Distinctions in meaning, to echo philosopher Joseph Kockelmans' (1979) explanation of differences in explanations of Interdisciplinarity, vary because they are shaped by differing philosophical outlooks, contexts of practice, and views of the socio-political function of science and the educational system. Yet, the clusters reveal patterns across what Christian Pohl (2010) calls a "structured plurality of definitions" of TD. They are not air-tight categories, but they do reveal important differences in how the concept is constructed.

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From Disciplinarity to Interdisciplinarity

The term "transdisciplinarity" is dated conventionally to a typology of terms devised for the first international conference on interdisciplinary research and teaching in OECD-member countries. Understanding core distinctions in that typology is a necessary first step toward understanding the meanings of TD. The conference occurred in France in 1970, and the book based on the meeting became a seminal reference on the topic for decades to come. Interdisciplinarity (ID) was defined as interaction among disciplines that may range from simple communication of ideas to mutual integration of organizing concepts, methodology, procedures, epistemology, terminology, data, and the organization of research and education (Apostel, et al., 1972). Cluster #1 highlights some of the major traits associated with ID, key among them integration, synthesis of knowledge, interaction of disciplines, and holistic thinking. These traits counter segmentation and fragmentation of knowledge resulting from specialization and internalist approaches to theory and practice.

Keyword Cluster 1

• **interdisciplinarity**

>> •• integration, synthesis, interaction, holistic thinking

>> •• boundary crossing, boundary blurring, transcendence

The OECD definition of ID is quite wide, encompassing any form of interaction from simple borrowing of a method to a new paradigm for research and education. Some forms, though, foster meta-level approaches. In Margaret Boden's (1999) definition of *Generalizing ID*, a single theoretical perspective is applied broadly to a wide range of disciplines, such as cybernetics or complexity theory. In *Integrated ID*, new conceptual categories and methodological unification emerge when the concepts and insights of one discipline contribute to the problems and theories of another, in for example computational neuroscience and the philosophy of cognitive science. In the history of social sciences, macro social theory and the behavioral science movement have also aimed to create a new coherent whole. The concept of "behavior," for instance, posited an alternative method of organizing social inquiry through a new theoretical coherence and convergence. Traditional categories anchoring the disciplines were questioned and lines between them began to blur. Comparably, the concepts of area, information, communication, and decision-making promoted new integrative conceptual categories with greater analytic power (Landau et al. 1962; for a fuller taxonomy of interdisciplinarity, see Klein 2010.)

Powerful as these examples are, however, Transdisciplinarity represents another level implied by the difference in prefixes. "Inter" is conventionally taken to exist <u>between</u> existing approaches, while "trans" moves <u>beyond</u> them. In the OECD typology, TD was defined as a common system of axioms that transcends the narrow scope of individual disciplines through an overarching synthesis, such as anthropology construed as a science of humans. The notion of transcending is linked historically with the concept of unity, although underlying assumptions have changed.

From Unity to Complexity

The English word "unity" derives from the Latin *unus*, meaning a fact or condition of being one in sameness or agreement (*Oxford English Dictionary* (II, 3516). Cluster #2 depicts a change in thinking about the thematic of unity.

Cluster #2

• complexity, uncertainty, diversity, non-linearity, multidimensionality, emergence

    •• heterogeneity, hybridity, unify<u>ing</u> approaches, relationality, coherence,

    •• interplay, intersection, interdependence

The quest for unity spans Western intellectual history. Greek philosophers disagreed on whether one universal explanation was possible or some principles and subject matters should be privileged above others. In the medieval era, the *summa* posited a Christian synthesis of knowledge and belief. In the 18th century, the Enlightenment beckoned universal reason, followed by a number of modern initiatives including Transcendentalism, Umberto Eco's speculation on a perfect language, and the Unity of Science movement in 1930s and 1940s. The search for unification theories in physics also fostered common principles of intelligibility, and more recently E. O. Wilson's theory of consilience. Each effort found support but also encountered limits. The Enlightenment project of the *Encyclopediae*, for example, was a multidisciplinary alignment rather than a complete integration of what was known at the time. The Unity of Science movement sought to integrate scientific statements into a common foundation and terminology for the philosophy of natural and social sciences. However, it became an object lesson in reductionism. Wilson's (1998) *Consilience* hearkened back to the ancient "Ionian Enchantment" of belief in the primacy of a few natural laws. Yet, the problem of reductionism resurfaced in his privileging of biochemical explanation.

In reviewing the history of discourse on TD, Kockelmans (1979) found that TD has tended to center on educational and philosophical dimensions of sciences. Opinions differ, however, on whether the focus should be unification of sciences through an all-encompassing theory or a unified worldview that provides common ground for understanding culture, science, and education. The search for unity today, Kockelmans emphasized, does not follow automatically from a pregiven order of things. It must be continually "brought about" through philosophical reflection. The task is not restricted to the discipline of philosophy. It requires a critical "attitude" on the part of everyone. Kockelmans identified four stances. One group, deeming ID a symptom of the pathological state of theoretical knowledge, contends that interdisciplinary reorganization of higher education fails to address the larger problem of the disintegration of unity and the need to overcome obstacles to realizing the whole of human existence. A second view offers a more optimistic call for renewed philosophical reflection on presuppositions and unity of theoretical knowledge in all disciplines. The third view appeals to the social relevance of higher education, in calls for reorganizing theoretical knowledge to address problems of the modern world and forming new interdisciplines and integration of existing sciences. A fourth view situates the meaning and function of science in the modern world all-encompassing philosophy of science.

Kockelmans' analysis of the discourse reflects a philosopher's perspective on the definition of TD. Three other approaches emerged in the pioneering 1970 OECD conference. Participants Jean Piaget (1972) and Andre Lichnerowicz (1972) regarded TD as a conceptual tool capable of producing interlanguages. Piaget treated it as a higher stage in the epistemology of interdisciplinary relationships based on reciprocal assimilations. When physics encompassed biology and psychology, he envisioned, it could become a truly "general" science and "full transdisciplinarity" be reached. Lichnerowicz promoted "the mathematic" as a universal interlanguage. In the most widely circulated model of the three, Erich Jantsch (1972) embued TD with a social purpose in a hierarchical model of the system of science, education, and innovation that moved from empirical, pragmatic, and normative to purposive levels. Jantsch envisioned all disciplines and interdisciplines coordinated by a generalized axiomatics. The ultimate degree of coordination required mutual enhancement of epistemologies, effecting Ozbekhan's notion of "synepistemic" cooperation.

The intellectual and socio-political climate of the times is evident in these definitions. Piaget and Lichnerowicz were structuralists, and the organizing languages of Jantsch's model were logic, cybernetics planning, general systems theory, and organization theory. Even so, Raymond Miller (1982) explained, all TD movements have aimed to transcend the narrow scope of disciplinary worldviews by reorganizing the structure of knowledge, including the exemplars of general systems, structuralism, Marxism, sociobiology, phenomenology, and policy sciences. Holistic in intent, they metaphorically encompassed the parts of material fields that disciplines handle separately. Miller rejected Kockelmans' call for an all-encompassing philosophy, though, deeming it an impossible ethical quest. All syntheses, he added, are not identical. Some proponents claim to replace existing disciplinary approaches. Others propose alternatives, and some devise sources of coherence for working across disciplines. Moreover, they claim differing types of isomorphism with the "real" world they purportedly represent, and have differing receptivity to quantitative manipulation and empirical application. The search for formal deep structures reflecting a cognitive, biologically-derived pattern of human thought also clashes with approaches grounded in material forces of production.

Over the past several decades, a broad-based set of changes in the nature of knowledge and culture further challenged the prospect of TD as unity. Older epistemological classifications and domains of expertise became more permeable. The underlying tenets of the classical model of unity were also called into question, signified by the shift of keywords in Cluster #2. Older values of certainty, universality, simplicity, linearity, one-dimensionality were supplanted by complexity, uncertainty, diversity, non-linearity, multidimensionality, and emergence. And, the expanding number of disciplinary specialties coupled with formation of new interdisciplinary communities of practice led to greater heterogeneity and hybridity of knowledge. As a result, the logic of "unity" moved toward the logic of "unifying" approaches, relationality and coherence became prime values, and interplay, intersection, interdependence became defining characteristics of knowledge production. The implications of this shift are readily apparent in the conception of TD developed by the Centre International de Recherches et Études Transdisciplinaire (CIRET) in Paris.

In 1987 Basarab Nicolescu called for a new broad-based scientific and cultural approach informed by the worldview of complexity in science. CIRET is a meeting-place for specialists from different sciences and other domains of activity, committed to long-term dialogue based on

the three pillars of complexity, multiple levels of reality, and logic of included middle. The discovery of bridges between domains and interactions permits the emergence of unity amidst diversity and coherence among different levels of reality. An open structure of unity replaces reduction with a new plurality and principle of relativity. It also encompasses ethics, spirituality, and creativity. TD vision does not simply transfer a model from one branch of knowledge to another. Nor does it propose a complete theory for moving from one level of reality to another, nor constitute a new super discipline or science. It achieves its fullest expression as a "moral project" that is simultaneously transdisciplinary, transnational, and transcultural (http://basarab.nicolescu.perso.sfr.fr/ciret/).

Participation and Collaboration

Another definition of TD became evident in the late 1980s in Swiss and German contexts of environmental and sustainability research. It shares some tenets of Nicolescu's vision, including complexity, multidimensionality, and diversity. Yet, it prioritizes collaborative problem-oriented research for the "common good," This definition lies at the heart of the Swiss-based Transdisciplinarity Net (td-net) (http://www.transdisciplinarity.ch/e/index.php). Td-net colleagues offer a schematic based on the current discourse of Transdisciplinarity. Four features appear in differing weights and combinations depending on a particular school of thought: socially-relevant issues, transcendance and integration of disciplinary paradigms, conduct of participatory research, and the search for unity of knowledge (Pohl and Hirsch Hadorn, 2008, 69-88; and Pohl, 2010. Cluster #3 highlights a broad shift associated with the first three features:

Cluster #3
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• participation, cooperation, collaboration, partnering, networking, mutual learning

  •• postnormal science

The underlying premise of Cluster 3 is that societal problems need to frame research questions and practices now, not academic disciplines (Transdisciplinarity Net, 2009). The problems of society are increasingly complex and interdependent. They are not isolated to particular sectors or disciplines. Moreover, they are not predictable. Modern societies are ruled increasingly by unwanted side effects of differentiated subsystems, such as the economy, politics, law, media, science. This realization aligns TD theoretically with Funtowicz and Ravetz's (1993) notion of "post-normal science" (1993). Both TD and "postmodern science" break free of reductionist and mechanistic assumptions about the ways things are related, how systems operate, and the expectation that science delivers final, precise estimates with certainty. "Unstructured" problems are driven by complex cause-effect relationships, and they exhibit a high divergence of values and factual knowledge. They are emergent phenomena with non-linear dynamics, uncertainties, high political stakes in decision making, and divergent values and factual knowledge. Stakeholder and community inputs in local environments also shape values and knowledge.

Pohl (2010) traces the framing of TD around societal problems and trans-sector participation during the early 1990s to the journal _GAIA_ and large research initiatives in Switzerland, Austria, and Germany focused on environment and sustainability. By 2000 case studies were being reported in all fields of human interaction with natural systems (agriculture, forestry, industry, megacities) and technical development (nuclear- and biotechnology, genetics). This approach had

also proved effective in fields where social, technical, and economic developments interact with elements of value and culture (such as aging, energy, health care, nutrition, sustainable development, landscape, housing and architecture, and urban land and waste management). Prioritizing of socially relevant issues and participation is particularly strong in German-speaking countries of Europe, in North-South partnerships, and in northern countries such as the Netherlands, Denmark and Sweden (Klein et al., 2001; Hadorn, et al., 2008).

Two other initiatives in the early 2000s also prioritized societal problems with emphasis on participation, though with differing degrees of stakeholder engagement. The Australian-based Integration and Implementation Sciences (I2S) Network aims to create a new "discipline" that provides concepts and methods for conducting research on complex real-world problems for change in policy and practice, comparable to the discipline of statistics. I2S is committed to trans-sector participation in the mode of td-net. It supports research on social, health and environmental problems through synthesis of both disciplinary and stakeholder knowledge. I2S operates as an intellectual hub for teams working on different problems, including Drug Policy Modeling and Policing and Security and is a forum for evaluating quality, raising standards, and advancing education at multiple levels. The Network's online Integration Insights series presents digests of pertinent information and knowledge, and recent work has focused on dialogue methods (MacDonald, Bammer, & Deane, 2009; http://i2s.anu.edu.au/).

In the early 2000s, a parallel framing of TD was apparent in the USA. This initiative aims to build a form of "transcendent interdisciplinary research" capable of generating new methodological and theoretical frameworks for defining and analyzing social, economic, political, environmental, and institutional factors in health and well-being. The initiative began in the National Cancer Institute (NCI) and is currently being advanced in the Science of Team Science (SciTS) Network. SciTS includes scientists, trainees, funders, policymakers, and clinical and community partners, although direct involvement of community stakeholders in the mode of td-net and I2S is not a primary focus. The emphasis is on scientific discoveries, educational outcomes, translation of findings into new clinical practices, and public policies. SciTS is advancing understanding of the personal, social, and institutional dynamics of collaboration, and NCI has recently launched a new online resource toolkit ("The Science of Team Science" http://scienceofteamscience.northwestern.edu/team-science-resources).

Forms of Knowledge

New framings of TD have also produced a fourth cluster of keywords that highlight forms of knowledge.

Cluster #4

• system knowledge, target knowledge, and transformation knowledge

• socially robust knowledge, contextualization, new social distribution of knowledge, science in society, co-production of knowledge

•• local, indigenous, people's, traditional forms of knowledge

In Scholz and Marks' (2001) formulation of TD, integration is required across system knowledge, target knowledge, and transformation knowledge. They also comprise the foundation of *Principles for Designing Transdisciplinary Research*, depicted in Figure 5 of Pohl and Hirsch Hadorn 's book of that name (2007, 38):
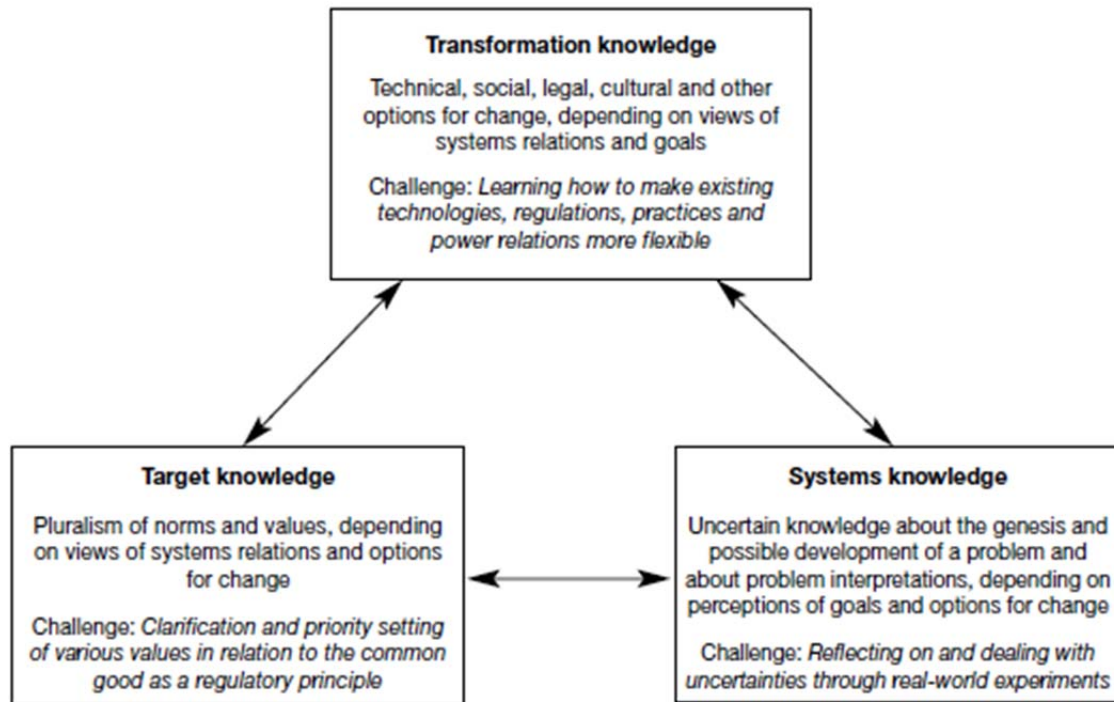
Figure 1. Interdependencies between the Three Forms of Knowledge

TD research, Pohl and Hirsch Hadorn emphasize, must accept the fact that definition and analysis of problems constitute disputed ground. Systems Knowledge confronts the challenge of how to deal with uncertainties that result from transferring abstract insights to a concrete case with specific conditions. Uncertainties also result from lack of empirical or theoretical knowledge about a problem, and depending on interpretation of a given problem, particular elements may be assigned different degrees of importance and thereby lead to diverging assessments of the need for action as well as target knowledge and transformation knowledge. Target Knowledge addresses what the multiplicity of social goals for research means for practice-related problems, and for collaboration between science and stakeholders in society. Positions must be clarified and prioritized in the research process according to significance for developing knowledge and practices that promote the common good. Transformation Knowledge takes established technologies, regulations, practices and power relations into consideration. In order to be effective, options for change have to rely on existing infrastructure, current laws, and current power relations and cultural preferences.

The balance of academic and stakeholder knowledge and participation differs from project to project. Yet, two books theorize the socially distributed process of knowledge production that underlies values in Cluster #4.

In 1994, in *The New Production of Knowledge*, Gibbons, et al. proposed that a new mode is fostering synthetic reconfiguration and recontextualization of knowledge. Its defining traits include complexity, non-linearity, heterogeneity, and transdisciplinarity. New configurations of research work are being generated continuously, and a new social distribution of knowledge is occurring as a wider range of organizations and stakeholders are involved, including NGOs, private firms, and governmental agencies. Gibbons and colleagues highlighted instrumental contexts of application and use, such as aircraft design, pharmaceutics, electronics, and other industrial and private-sectors of science and technology.

In 2001, three of the book's authors extended Mode 2 theory in *Rethinking Science.* They argued that contextualization of problems requires participation in the agora of public debate, incorporating the discourse of democracy. When lay perspective and alternative knowledges are recognized, a shift occurs from solely "reliable scientific knowledge" to inclusion of "socially robust knowledge," dismantling the academic expert/ non-academic lay dichotomy. Contextualization also blurs boundaries of control, "competence" is redefined, and new criteria of evaluation emerge (Nowotny Scott, & Gibbons 2001). Commitment to a socially inclusive thematic of knowledge production is strong in a number of local practices. Informed by the work of CIRET and writings of Edgar Morin, Latin American framings of TD have fostered community governance, and td-net partnerships in India and Africa have facilitated integration of local, indigenous, people's, and traditional forms of knowledge. A 2009 conference on "Knowledge Democracy" in Leiden, Netherlands also highlighted incorporation of lay knowledge on framing TD (in't Veld, 2010)

A final cluster of keywords extends alignment of TD with the transgressive imperative.

Cluster #5

• interrogation, critique, transgression, transformation

•• reconfiguring, reformulating, resituating

Transdisciplinarity is not only transcendental, it interrogates the protocols and truth claims of disciplinary conventions, expertise, and control. This extension was foreshadowed in the concept of Critical Interdisciplinarity, which problematizes the existing structure of knowledge and education (Klein 2010). In the 1990s, the term began appearing more often in humanities and fields of Critical ID as a label for critical imperatives that interrogated current approaches. Ronald Schleifer (2002) associates the idea of a "new interdisciplinarity" with theoretical approaches and transdisciplinary or cultural study of social and intellectual formations that have breached canons of wholeness and the simplicity of the Kantian architecture of knowledge and art. Moreover, Douglas Kellner (1995) specifies, the transdisciplinary operation of cultural studies pushes boundaries of class, gender, race, ethnicity, and other identities. Dölling and Hark (2000) relate TD in women's and gender studies with critical evaluation of terms, concepts, and methods that transgress disciplinary boundaries. In Canadian studies, Jill Vickers (1997) connects trans- and anti-disciplinarity with movements that reject disciplinarity in whole or in part, while raising questions of socio-political justice. And, this imperative lies at the heart of definitions of interdisciplinarity linked to struggles for social change begun in the 1960s and 1970s (Parker, Samantrai, & Romero, 2010).

More broadly, Upendra Baxi (2000) observes that calls for transdisciplinarity arrived at a moment of wider crisis in the discourse of human rights accountability. Baxi highlighted, especially, gaps between Western and non-Western traditions, esoteric and organic knowledges, colonial and indigenous traditions, official and people's knowledges. Privileged and dominant forms of knowledge establish genres, protocols, canons, and formations that deprivilege other modes of knowledge. One of the transgressive purposes of transdisciplinarity, therefore, is to renounce the logic of instrumental reason by creating new participatory modes of knowledge, discourse, and institutional frameworks across all sectors of academic, private, and public life.

Professional practice is implicated as well. Editors of a book on *Transdisciplinary Knowledge Production in Architecture and Urbanism*, Isabelle Doucet and Nels Janssen (2011), cite fusion of academic and non-academic knowledge as the key distinction between ID and TD knowledge production. New hybrid modes of inquiry, practice, and learning also have the capacity to overcome past schisms of theory/history and practice, critical theory and projective design. This framing of TD places ethics, aesthetics, and creativity inside of disciplinary and professional work while incorporating social and political questions. It brings new objects into view, places practices in new configurations, contextualizes and resituates theory and learning, and heightens awareness of hybridization by incorporating once excluded forms of knowledge, including the understandings of lay people. And, it magnifies the greater heterogeneity and relationality of knowledge today. Tasks lie at the boundaries and in spaces between systems and subsystems, requiring collaboration among a hybrid mix of actors.

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In the current heightened momentum for TD, the word is appearing in a widening range of contexts, as varied as learning assessment, arts education, mental health, sanitation, engineering, sustainability, ecological economics, human population biology, informatics, knowledge organization, team-based holistic approaches to health-care, and student-centered curriculum integration. Judging by patterns in the keyword clusters, imperatives will continue to differ. Moreover, even the same underlying principle may be framed differently. One strand of TD problem solving, for instance, centers on collaborations between academic researchers and industrial/private sectors for the purpose of product and technology development. It prioritizes design innovation and involvement of stakeholders in product development. A different type of TD problem solving occurs when academic experts and social actors cooperate in the name of democratic solutions to controversial problems such as sustainability and the risks of technological modernizations such as nuclear power plants. The current increased momentum for Transdisciplinarity reinforces the need for forums such as *Integral Review*, where can transdisciplinarians talk with each other about how to strength both their local projects and their common goals.

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