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The General Characteristics of Transdisciplinary knowledge

(Montuori- various papers)

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In the words of theoretical physicist Paul Davies (1989):

For three centuries, science has been dominated by the Newtonian and thermodynamic paradigms, which present the universe as either a sterile machine, or in a state of degeneration and decay. Now there is the paradigm of the creative universe, which recognizes the progressive, innovative character of physical processes. The new paradigm emphasizes the collective, cooperative, and organizational aspects of nature; its perspective is synthetic and holistic rather than analytic and reductionistic.

....our thinking is ruled by a profound and hidden paradigm without our being aware of it. We believe we see what is real; but we see in reality only what this paradigm allows us to see, and we obscure what it requires us not to see...We need a kind of thinking that relinks that which is disjointed and compartmentalized, that respects diversity as it recognizes unity, and that tries to discern interdependencies. We need a radical thinking (which gets to the root of problems), a multidimensional thinking, and an organizational or systemic thinking-----Edgar Morin

The Newtonian Paradigm

* The Newtonian revolution represented the first real coherent triumph of what we now call science. With his Principia, published in 1687, Newton presented in the form of mathematical equations the three laws that govern the motion of material bodies. Newton's work was particularly important because it presented Universal Laws of Nature. These laws seemed to give a window into the functioning and nature of Nature itself. Particularly powerful in Newton's work was its focus on prediction, order, and determinism.

 * The laws and principles created the foundation for general theories and predictions that could be tested through experiments. These experiments, conducted following the scientific method, consisted of breaking down systems to their simplest components, a method now referred to as reductionism. This reflected an assumption that the world was made of basic building blocks called atoms. The underlying assumption was that these atoms exist in isolation from their environment, and that knowledge of the behavior of the atoms could be used to predict the future of the system as a whole.

 * Two fundamental things make up the Newtonian world: matter and energy. Matter and energy exist in the emptiness of absolute space and time. Matter is composed of atoms and even subatomic particles such as electrons and protons. Knowing the location, mass, and velocity of all the particles in the universe, it would be possible to predict the future. With progressive improvement in scientific knowledge, in other words, it was believed that eventually it would be possible to predict every event. The Newtonian world was therefore deterministic. Every event had to happen by necessity.

* There is an unquestionable order to the universe, and anything we consider disorder or complexity was simply a function of our limited knowledge. Simplicity, predictability, and determinism were central to the Newtonian worldview.

* The Newtonian worldview had very clear implications for our thinking. The power of prediction and control that the scientific method provided was staggering. The technology driving the Industrial Revolution was the result of the application of the new scientific method. The social sciences wanted to import the scientific method, in order to enjoy the same legitimacy as real sciences. Being a real science was defined largely by the capacity for prediction and control. The scientific method led to technology and industry, which in turn led to progress.

*As human beings have developed more and more knowledge, there has been a concomitant division of labor. Disciplinary fragmentation is the result of increasing specialization. This is fundamentally an issue of *organization*. Industrial organization used division of labor and specialization, to increase, articulate, and facilitate production, and the production of knowledge has, for all intents and purposes, followed the same organizational model.

fragmentation of disciplines

* The key principles of reduction and disjunction meant that inquiry went increasingly deeper into smaller and smaller subsections of knowledge, and disjunction meant separation—in other words, every smaller sub-section of knowledge was separated out into its own world, and became an "identity," an "A" which could not be "B." The creation of sub-disciplines, therefore, could be said to have created sub-cultures with their own identities and their own "turf" to protect. The organization of knowledge-producing institutions is paralleled by the organization of thought.

*Disciplinary fragmentation is not simply a division of labor that helps us to address the increasingly overwhelming amount of knowledge that is being generated. Disciplinary fragmentation is not just a response to knowledge: it actually frames knowledge. It is a way of organizing knowledge by making distinctions, including distinctions (often implicit) about what is and is not knowledge. And because the sub-systems of the larger system of disciplinary knowledge are mostly closed systems, disciplinary fragmentation creates blind spots by framing the world in a discipline-driven way that actually prevents certain subjects from being 'seen'.

General characteristics of disciplinary knowledge

- Objective knowledge of objects in the exterior world, rather than subjective knowledge of interior moods, opinions, experiences, and so on;

- Quantification, and therefore "objective" data that could be measured as opposed to qualitative data that is "subjective" and cannot be measured;

- Reductionism, or a focus on parts rather than wholes (holism);

- Determinism—or finding laws of cause and effect that determine events as opposed to chance events that cannot be predicted by laws (contingency);

- Certainty, rather than uncertainty;
- Absolute, rather than "relative" knowledge;
- Universal knowledge (applicable anywhere and everywhere) rather than particular, local knowledge (applicable only to certain specific settings);
- One right way of looking at a situation, rather than a multiplicity of perspectives, and the search for that one right way;
- Either/or thinking, borrowed from Aristotle, which rejects any form of ambiguity or paradox.

Characteristics of Transdisciplinary Knowledge

* Transdisciplinary inquiry is not merely the additive use of knowledge from several disciplines to confront a problem, which characterizes interdisciplinary efforts. Transdisciplinarity is an attitude towards inquiry, informed by certain epistemological presuppositions, and an effort to frame inquiry as a creative process that recognizes as central the subjectivity of the inquirer and challenges the underlying organization of knowledge.

* Transdisciplinary inquiry can be thought of as having five main dimensions.These are: 1) Inquiry-based rather than discipline-based; 2) meta-paradigmatic rather than intra-paradigmatic; 3) integrating rather than eliminating the inquirer from the inquiry; 4) stresses the importance of striking a balance between rigor and imagination; 5) applying systems and complex thought rather than reductive/disjunctive thinking.

1- Transdisciplinarity is "inquiry-driven."

* Disciplinary inquiry is generally "discipline-driven." By discipline-driven is meant that traditionally one is socialized into a specific discipline that focuses on a specific set of issues, a disciplinary agenda, and the disciplinary "boundaries" that establish what topics belong, and do not belong, and even what questions may and may not be asked in the research agenda. In a university context, during the socialization of most academics, this agenda can sometimes more specifically be one's advisor's research agenda.

* Transdisciplinary inquiry is driven by the inquirer's agenda, by a question that emerges through a dialogue between the inquirer's experience and passion, the subject of inquiry, and the bodies of knowledge available. Inquiry-driven does not mean eschewing the contribution of disciplinary knowledge. On the contrary, it engages disciplinary knowledge and adds to it pertinent knowledge from a plurality of other disciplines, through the development of a plurality of perspectives on the same topic, and through a constant interaction with the inquirer's context and his or her own lived experience, values, and beliefs.

 2- Transdisciplinarity is meta-paradigmatic rather than exclusively intra-paradigmatic.

* If we are to bring a plurality of perspectives from a variety of disciplinary perspectives to bear on our topic, how do we organize and think about this knowledge? The traditional approach to inquiry has been reductive and disjunctive, with ever increasing separation and differentiation, but with little or no effort to connect and contextualize. When we draw on different disciplines, these disciplines, sub-disciplines and approaches often reflect very different paradigmatic assumptions. In disciplinary approaches, the underlying assumptions remain fundamentally unquestioned, and the same is true for interdisciplinary approaches.

* Transdisciplinarity should be a *meta-paradigmatic* approach. By this is meant that transdisciplinary inquirers should be able to understand not only the content of various disciplinary approaches to issues, but their underlying assumptions or paradigms, and how those paradigms shape the inquiry. This process would also, of course, put into question the inquirer's own paradigmatic assumptions, and offer an opportunity to question and explore one's own assumptions. It is in the exchange with different perspectives that our own perspectives become most clearly elucidated and articulated.

* As we become aware of the underlying assumptions of various perspectives on the same issue—as in the case of creativity—we can see that there is a pattern of oppositional identity that connects them. Psychologists studying creativity have largely been ontological atomists, and sociologists and anthropologists ontological holists. Tracing the history of these positions we can see how they have arisen and how the positions have identified themselves in opposition to each other. Indeed, once we begin to study the underlying philosophical assumptions of most forms of academic inquiry, we can begin to recognize this process of oppositional identity formation in any number of different areas, from idealism/realism in political theory to objectivism/constructivism in epistemology to atomism/holism in ontology.

 * Transdisciplinarity is arguing for the creativity that emerges out of the interaction of multiple perspectives. The creative process has been defined as seeing *"a single idea in two habitually incompatible frames of reference."* The existence of a multiplicity of perspectives, at times mutually opposed, can therefore be transformed into an opportunity for creativity, *if* we accept the possibility of multiple ways of knowing, that there is more than one perspective that has something to offer, and no one perspective has the monopoly, *and* recognize the possibility that the perspectives can co-exist, and also be brought together to develop a creative integrations.

3-Transdisciplinary inquiry integrates rather than eliminates the inquirer from the inquiry. Since we start off with a way of thinking about inquiry that stresses passion, creativity, context and connection, the inquirer's subjectivity is an inextricable part of the inquiry's context and indeed not just deeply connected to, but constitutive of the inquirer's construction and interpretation of the context. The inquirer's own paradigmatic assumptions are surfaced and enter into a dialogue with a plurality of other assumptions from other perspectives which he has already cross examined.

* Since the work is inquiry-driven and not only discipline-driven, the inquirer's motivations are explored, assessed, and contextualized. One might ask oneself, why am I doing this? Not necessarily because it's my advisor's research agenda, for example. What do I bring to this subject, with my personal history, my academic trajectory? What are my biases, beliefs, blind spots? Every inquiry therefore becomes an opportunity for self-inquiry—indeed, self-inquiry becomes a necessary part of the research process.

 * Another key question that arises with the introduction of the inquirer into the inquiry has to do with our fundamental assumptions about the nature of human nature. What is our understanding of human capacities? If every inquiry is, indeed, an opportunity for self-inquiry, what can we hope to achieve? What is the human capacity for transformation? given the explicit focus on the inquirer and his/her subjectivity, context, motivations, etc., transdisciplinarity demands an ongoing process of self-and-other inquiry, inasmuch as the assumption is not that we are "discovering" "facts" about a world "out there," but rather that there is an ongoing inter-subjective co-evolutionary process of construction. Learning is not the acquisition of "things," but an ongoing process of self-eco-re-organization.

4- Transdisciplinarity stresses the importance of striking a balance between rigor and imagination. Whereas academia has focused on the context of justification (the development of a defensible "position"), it leaves the creative process leading up to the development of that position (the context of discovery) out of the picture. It is only in the biographies and autobiographies of scientists and other creative individuals that we get to see their creative process, with all its complexities, wrong turns, anxieties, imaginative twists, conflicts and collaborations. In the academic context, we largely get presentations, articles, and books, that stress the rock-solid defensibility of the position being presented. When not balanced by imagination, the quest for rigor leads to rigidity.

5- Transdisciplinary thought is systems and complex thought rather than reductive/disjunctive thinking.

* The transdisciplinary researcher is the one who must know the parts in order to know the whole, and the whole in order to know the parts. In other words, a transdisciplinary view, informed by systems and complex thought, addresses the larger whole, the context, the relationships and interactions, and the many dimensions or system levels that emerge in the process – whether the brain, individual person, group, community, nation, and the global context. The task – and art – of transdisciplinary research, is to assess to what extent these different system levels are sources of pertinent information.

* There are clear implications for practice. Say we are interested in fostering creativity in education. Traditional reductionist approach focuses on the single most important variable or system level, which would be one system and one system only, whether the individual student, or the classroom, or the economics of the school. Psychology has traditionally led us to study individual students, and their personalities or cognitive processes.

* Complex thinking, after developing a rich picture of the phenomenon looks at the interrelationship between the various systems we have selected as being of particular significance. Rather than focusing exclusively on the students' cognitive capacities for creativity through testing, for instance, the more expanded, contextual approach of complexity thinking might look at any number of factors from classroom size and pedagogy to the role of home environment. From a traditional perspective such an approach brings in many more variables and is therefore not just complex but complicated and difficult precisely because there are many new factors to contend with. Not addressing this complexity, on the other hand, is also very problematic. While we keep in mind the problems inherent in such an ambitious approach, we also recognize the necessity for epistemological humility and strategies of inquiry that elicit the creativity of the inquirer.

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