

Disciplinarity in the Pursuit of Knowledge

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1. Introduction

From the perspective of systemics, Minati and Collen (1997) have described disciplinarity in terms of phases or forms of human activity to seek, develop, and produce knowledge. Disciplinarity manifests in four forms: singular, multiple, inter-relational, and boundary-breaking pursuits. Although there is the notion that knowledge resultant of each form is reflective of and delimited by its characteristic form, the presentation falls short in its depiction of the scheme as a whole to be a higher order conceptual system.

The purpose here is to reconsider and extend their presentation. By doing so, disciplinarity becomes a conceptual chameleon-like system, a way of systemic thinking, and a dynamic process by which human beings engage reflectively and communicatively with each other to come to know and share more informatively their worlds.

The premise taken in developing the conceptual system is to conceive disciplinarity as a conscious, creative, decision-oriented, dynamic, meaningful, and productive activity of the inquirer. The strategy behind this development is, at its core, an elementary methodology, which follows related publications (Collen, 1994; Collen et al., 1996; Linstone, 1995). The defining constructs comprise the elements. These elements provide the base and platform of departure from which the relations among them are examined. This exercise leads one to explicate the conceptual system and then to consider some consequences and implications in regard to its application.

The organization is sequenced in four parts. First, disciplinarity requires some definition. Second, there is a synopsis of forms found in Minati and Collen (1997), with the addition of a fifth form not included in this source. Third, the five forms are brought together to be compared,

contrasted, and integrated into a more wholistic conceptual system. Finally, select implications, having methodological, philosophical, pragmatic, psychological, and theoretical import, are discussed.

2. What is Disciplinarity?

Dictionaries provide the narrower definitions of the construct. In contrast, broadened meanings are found in the meta sciences, under such phrases as the cognitive arts, cognitive sciences, the sciences of the artificial, sciences of complexity, design sciences, and systems sciences. After following some denotative transitions from discipline to disciplinary to disciplinarity, there is a more contemporary treatment among the forms of the construct.

To paraphrase *The Compact Oxford English Dictionary* (1991, p. 442), where *discipline* points to specific instruction, practice, and exercise of that which one is learning and has learned, such as a lesson or teaching, it can also mean a particular course or branch of knowledge, instruction, education, art, and science. Typically, it suggests a known direction for a particular course of action, such that the inquirer (learner, disciple) acquires the appropriate, proper, and correct course of action, namely the training effect (trained condition) of experience, having carried out the lesson or teaching.

Even more relevant to this paper is the denotative emphasis given to discipline defined as "a system or method for the maintenance of order" or "a system of rules" for the conduct of inquiry, practice, and training. However, this intention is not to carry a tone of inflexibility to the detriment of advancing the knowledge and skill of the discipline. Contrary to popular interpretation of the construct, discipline should not lead to rigidity. In fact, the opposite is the intended result. Disciplined inquiry, for example, should enable a researcher to use and communicate to other researchers a sufficiency of specific rules and procedures to further the inquiry without stultifying it. Discipline is taken to be a necessary and advantageous condition for scientific and methodological advancement, which is quite the contrary to those who would imply discipline is a

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There is a last and equally popular definition that defines discipline as "the correction, chastisement, or punishment inflicted by way of training." As with the notion of rigidity, it leads to another misunderstanding often imparted to discipline in the sense being developed here. In other words, this lay definition is also not the preoccupation of disciplinarity in regard to research, science, and the pursuit of knowledge.

It follows that we can expect *disciplinary* to be "of or pertaining to the character of discipline." The relevant definition would heavily emphasize the learning and mental training involved in any focused investigatory pursuit.

The care taken to situate the denotations of discipline can be directly applied to *disciplinarity*. Simply stated, it refers to being in the state or condition of a discipline, or manifesting the characteristics of a discipline.

3. Forms of Disciplinarity

The five forms to be discussed here are: mono, multi, inter, trans, and meta. This five-fold scheme is not meant to exhaust the possibilities. The subject matter domain includes terms like cross and pluri, to be found for example in the *International Encyclopedia of Systems and Cybernetics*, and Internet sources as the "Encyclopedia of World Problems and Human Potential," and the "International Center for Transdisciplinary Research."

Any scheme is for conceptual convenience to comprehend relations, systemicity, and complexity. We impose our conceptual divisions upon our observation and study of phenomena. Our taxonomies, classes, and schemata organize and group that which we study, but at the same time, they place boundaries that separate, albeit artificially, many of the linkages we revisit to integrate what we come to know, after acquiring more

knowledge about what we observe. These boundaries come to be known by the focus, that is for illustrative purposes, the biological, cultural, economic, physical, political, psychological, social, and spiritual. Again, the previous terms are not meant to be complete but merely representative of the variety of perspectives possible.

3.1. Mono

As the inquirer comes to know one focus (perspective, domain, position), there is great temptation to specialize in that focus, gain confidence and comfort in this knowing, and resist foraging into neighboring fields when it may complicate and jeopardize that which one has invested much time and resources in acquiring. The inquirer becomes established and affiliated with the focus, which typically solidifies into mono-disciplinarity. The resultant expertise of course is to be valued as long as it remains uncompromised by ideology and methodolatry.

Mono-disciplinarity works with fragmented knowledge attained through effective pursuit strategies associated with its subject domain. Science has repeatedly proven itself to operate quite effectively by the process of separating, dividing, and specializing.

The observables, pedagogy, research methods and strategies, and theory of a discipline tend to be relatively homogeneous in relation to other disciplines. Descriptions of phenomena and organizations of them (taxonomies) tend to be widely shared among those affiliated with the subject matter domain of the discipline.

In the pursuit of knowledge of a relatively sparsely explored domain, this initial phase makes a great deal of sense, for without the establishment of the various disciplines, there is little reason to imagine the inquirer to have what is necessary to move toward more involved forms of disciplinarity.

To picture the prevalence of mono-disciplinarity is to comprehend the internal activities of each discipline, operating in parallel with others, yet not communicating and sharing knowledge actively with others. These solo pursuits are metaphorically like a room full of persons at their workstations, keeping to themselves, and when the need to communicate with another person does arise, it happens only with one whose affiliation

is in common between inquirers.

Today the problems and phenomena are less likely with satisfaction to be addressed and studied, respectively, through one discipline alone. This realization compels an advance in our thinking beyond mono-disciplinarity.

3.2. Multi

One means to transcend the restraints of mono-disciplinarity is to gather together a set of experts representing their disciplines to examine a particular phenomenon or problem. The unilateral look and contribution of each representative conveys the process known as multi-disciplinarity. The result is a knowledge product considered more a collection of positions, views, and expositions of the nature of a roundtable and cafeteria-like display of what can be known about the focus. This is the general manifestation of multi-disciplinarity, and nothing more. At some stage, this bibliographic and encyclopedic form of disciplinarity has an important place as a depository and resource of knowledge as understood by those representatives at that time in human history. Where multi-disciplinary collaboration tends to be of some value in providing a broadened and deepened range of the contributions brought to bear by the participating parties, the products tend to be limited in moving the process toward more integrative work that considers the complexification and systemicity of phenomena and problems.

In this form of disciplinarity we can imagine for example, symposia, conferences, and consultations convening to solicit the views of the experts. Anthologies, proceedings, and edited books of readings make available to others the range of views on the focus of study and discussion. As to the metaphor of the room full of active workstations, sharing information through contributions to and use of institutional archives, databases, and web sites provides multi-disciplinarity in the human organization.

However, for the same reasons as mono-disciplinarity, multi-disciplinarity is severely limited. The participating disciplines in and of themselves need not achieve any systemic and wholistic form devoted to their focus.

Here the terms multi- and pluri are applied interchangeably to mean the simultaneous use of a set of relatively autonomous disciplines to address a focus, interest, problem, and issue, without requisites imposed for the linkage, synthesis, and integration of knowledge. For example, pluridisciplinarity may mean the employment of a plurality of research methods, some of which may be stock-and-trade of a discipline outside the researcher's affiliated discipline. Finer distinctions among these two and other forms of disciplinarity may be found elsewhere, namely, Francios (1997) and the International Center for Transdisciplinary Research on the Internet.

However, the view taken here is that there is no mandate to restrict and define the forms solely according to centrality (requirement of a centralizing discipline), classification (systematic description and taxonomic aggregation of phenomena), formalization (extensive concretization of rules and procedures), method (infusion of methodology from one discipline into another), or theory (presence of a falsifiable body of propositions, axioms, and laws).

3.3. Inter

When the representatives of disciplines truly communicate with mutual respect and learning, there can be attained a form of disciplinarity well beyond separate and parallel contacts. Participants come to view their interests, issues, problems, questions, answers, and solutions with common concern and the seeds of collaboration germinate. Colonizing and condescending attitudes of the practitioners in a discipline give way to the recognition there is value in multiple perspectives and a need for a diversity of expertise to advance a step in a more integrative and synthetic fashion the knowledge of all disciplines. The delineation of common interest and the contribution from difference become accepted and important characteristics of disciplinarity.

We can imagine a Venn type diagram of overlapping circles, in which each circle represents a discipline. The circles overlap such that there is a common core, yet each circle also overlaps with its neighboring disciplines. This picture generates a rich set of possibilities for collaboration. An outstanding example of inter-disciplinarity is the specialty focus known as

psychoneuroimmunology. More informed considerations of many human maladies may benefit selectively from what is known in biology, chemistry, cytology, epidemiology, endocrinology, hematology, neurology, and psychology. And this pursuit is meant of course to be inclusive of relevant inter-disciplines like biochemistry, neurochemistry, and neuropsychology.

Inter-disciplinarity begins with a particular tie or bridge that connects two disciplines. There are many examples where knowledge domains become interrelated, such as astrophysics, biochemistry, ecopsychology, psychohistory, and sociobiology. Two disciplines may join through infusion of one into the study of the other, or from symbiotic benefits of synthesizing aspects of their subject matter. For example in psychohistory, psychology brings a particular viewpoint by way of theoretical organizing frameworks and the emphasis on personhood to view historical accounts. As to a particular history, when infused with cartography, economics, political science, psychology, and sociology, it reaps many mutual benefits that enables the researcher to weave a richer collective tapestry of any human event, movement, and trend than could be conveyed solely through one of the disciplines.

To follow further the workstation metaphor, inter-disciplinarity would mean a higher level of interaction among workstations and additional layers of organization memory devoted to collaboration and synthesis of what the various contributors bring to the work flow. Electronic trails give evidence to the productivity, progress, and eventual information and knowledge products produced in the process.

3.4. Trans

As the considerations of the interrelations become more evident and intricate, it necessitates the realization that the complexification of the focus as well as involved relations among the disciplines compels us toward trans-disciplinarity. At this point, cybernetic and systemic constructs become paramount, such as positive and negative feedback loops, the co-evolving nature of any conceptualization of system with its context (environment), and the embeddedness of any conceptualization of system in regard to its subsystems and interrelations with adjacent, sister,

and superordinate systems.

Like inter-disciplinarity, trans-disciplinarity fosters a common language, usable knowledge among disciplines, and shared methodologies. But trans-disciplinarity gears the endeavor more to match the systemicity and complexity of the focus. In distinction from the previous forms described, trans-disciplinarity takes the pursuit beyond any consideration and limiting factor, problem, and theory within and between the disciplines. Other forms of disciplinarity cannot achieve these aims very well.

It is instructive at this juncture to note the use of cross-disciplinarity as a construct. It is sometimes used to distinguish the basic form (mono-disciplinarity) and the more complex form (trans-disciplinarity) from the intermediate forms (multi- or pluri- and inter-disciplinarity). The prefix "cross" implies a breaking through, transgression, and perhaps the bridging of disciplinary boundaries, but it does not inform us about what happens and what is accomplished when the inquirer goes beyond the confines of particular disciplines. This prefix is not used in the present scheme here, because of the ambiguity of meanings among the intermediate forms. Although the phenomenon of crossing disciplinary boundaries is an important and often courageous professional undertaking worthy of study in its own right, cross-disciplinarity may refer to any of the intermediate forms, hence it is of limited usefulness in exploring the progression of forms as a conceptual system.

It is out of trans-disciplinarity that an integrated body of knowledge springs through the integrated work of collaborators among the participating disciplines. It is difficult to imagine such a body of knowledge from earlier forms of disciplinarity because of the absence of participation from key disciplines. Each core discipline has key parts of the puzzle to contribute and until the pieces are present, the new whole has little chance of being achieved.

From the integrated character of this new body of knowledge, reaped from the interrelations of the contributing disciplines, we can comprehend its systemicity. Systemicity is emergent from trans-disciplinarity. Systemicity is an emergent property from the complexification of the disciplines when integration occurs.

However, despite the wholistic realizations of trans-disciplinarity, the

individual disciplines remain somewhat autonomous. This autonomy is evidenced through all forms of disciplinarity covered to this point in the pursuit of knowledge.

3.5. Meta

The last form of disciplinarity to be discussed is meta-disciplinarity. The boundaries distinguishing disciplines dissolve to a degree in inter- and trans-disciplinarity, but they become more than meaningless, in fact non-existent, at the meta level. Meta-disciplinarity shows the interwoven qualities of the blended disciplines working collaboratively and collectively, making the pursuit of knowledge more than tangibly trans-disciplinary. In short, the extent of integration suggests a superordinate and emergent mono-disciplinarity of greater complexity.

Bateson (1979) was widely recognized for his reach to encourage and model meta-disciplinarity. More recent acknowledgement of Bateson's influence is given by Folk (1995), who points out that "a metapattern is a pattern so wide-flung that it appears throughout the spectrum of reality . . . a pattern of patterns . . ." (pp. viii-ix). The meta-disciplinarian seeks to synthesize, integrate, and convey the wholism of a body of knowledge, whose saliency may be characterized and thematized in terms of its meta-patterns.

By way of another illustration, at some point in the development of the subject domain, many will argue that psychoneuroimmunology will cease to be inter- and trans-disciplinary in character, and be truly meta-disciplinary, at which point its parent disciplines will become indistinguishable and meaningless to those who affiliate with this emergent meta-discipline.

As a horizon, one may take a similar view of those disciplines contributing to the study of consciousness. Such a cluster of disciplines appears to be undergoing the progression described in this paper. In other words, there are collectivities from among the sciences and various fields of study, which one might consider to be progressing toward meta-disciplinarity, such as the earth sciences, human sciences, and life sciences. These collectives serve to illustrate further some likely candidates for meta-disciplinarity.

4. Summary and Integration

The five forms of disciplinarity covered in the previous section may be summarized by means of a table and two figures. Each summary sets the stage for the subsequent discussion.

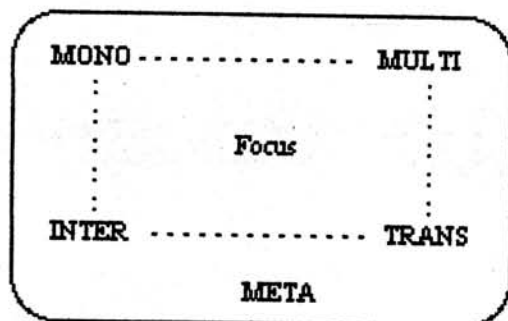
The table compares the types of disciplinarity in two important respects. From the table we can see a progression toward more systemicity and increasing complexity.

Table 1. Select properties distinguishing types of disciplinarity

<u>Disciplinarity</u>	<u>Relation</u>	<u>Systemicity</u>	<u>Complexity</u>
Mono	Within	-	0
Multi	Among	-	1
Inter	Between	+	2
Trans	Beyond	+	3
Meta	Above	+	4

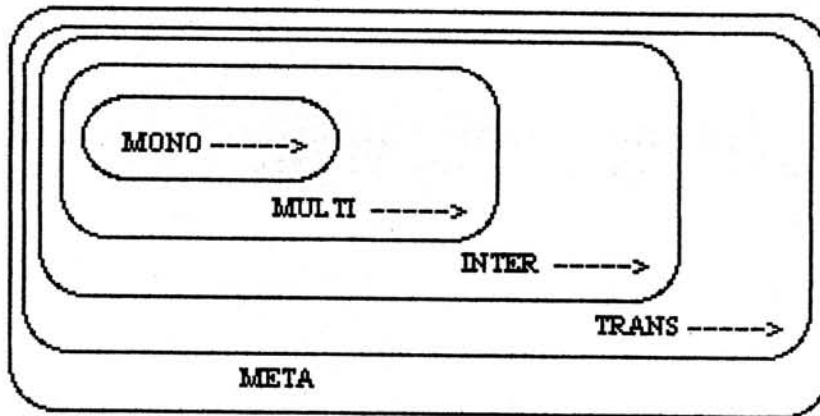
The first figure is meant to convey that the forms of disciplinarity work as a conceptual system. We can move among the forms to study any given focus (interest, phenomenon, problem). The trend in the pursuit of knowledge today is a progression of a discipline from mono- to multi- and/or inter- to trans-disciplinarity. Meta-disciplinarity represents a culminating state for the process to begin all over again as knowledge continues to be revisited, revised, and reformulated. Meta-disciplinarity is the four forms taken as whole.

Figure 1. Meta-disciplinarity as a conceptual system



The relations among the forms are relevant to working with them as a whole system. It is important to emphasize that as tempting as it may seem, the scheme does not unfold as a simple linear phase progression that enables an accounting of the conceptual system. The second figure depicts the progression over the five forms of disciplinarity as an unfolding of nested manifestations, in which each emergent form encompasses earlier forms. There is not a replacement of one form by another, but a development that is an advance, such that the inquirer has more choices to advance knowledge and can always regress to, or draw advantageous upon, an earlier form while continuing to progress to higher order and more challenging, complex forms. Meta-disciplinarity encompasses all forms and may be seen as a higher order and much more complex, integrated, and advanced form of mono-disciplinarity.

Figure 2. The embeddedness of disciplinarity



Finally, it is equally important to view the scheme as a conceptual system of complementary forms, for in the more complex and systemic applications, the inquirer can move among them to reap the greatest benefits from the contributing disciplines and facilitate the advancement of knowledge.

5. Discussion

When we speak of the meta- level, there is scanty much left but historical vestige to regress to anything mono-, multi-, inter-, and trans-. One might think of meta as a higher order emergent synthesis—a super mono-disciplinarity. In human history there is both a proliferation in specialization (mono- and multi-disciplinarity) as well as the turn toward generalization and unification (inter- and trans-disciplinarity). While there is certainly the necessity of more specialists as knowledge domains mushroom ever more beyond the comprehension of a single human being,

there is concomitant and complementary need for more generalists to synthesize in parallel fashion.

Complexification (Casti, 1994) brings both differentiation within as well as unification beyond given disciplines. Although a cyclic process has been suggested earlier when examined transitionally from a side view, the growth of the disciplines is really a spiral-like process when viewed historically from above. Both volume and density of the body of information and knowledge expands, even though paradoxically, the horizons become clearer in the pursuit of how much we do not yet know and how much there is still to know. It is a never-ending process.

To design a system able to act on the processes of knowledge production is to design an inquiry system. The history of science may be viewed in this fashion. Churchman (1971) provides an informative and useful description of such a sequence of paradigmatic systems for inquiry, that is to say, broadly conceived research traditions in the history of Western science. Although granted the phrase "inquiring system" does convey an enlivened connotation—used to stress the dynamics and process of the search for knowledge—appearances of the phrases "disciplined inquiry," "inquiry system," and "system of inquiry" are not intended to diminish that vitality. In addition, Churchman contributes an important perspective to his history of inquiry systems by reminding us that our design and use of them must take into account future generations, else we fail to include fully the ethics of our pursuit.

We may speculate that with further globalization of information and knowledge, there will be a general enhancement of disciplinarity in all its forms. The Internet and World Wide Web, for example, are making it rapidly possible for an unprecedented proportion of humanity to develop more personalized forms of mono-disciplinarity that transcend physical limitations and traditional disciplines. The mutual presence formerly required between inquirers (co-researchers, mentor and apprentice) may be less necessary in coming generations, even though established traditions will be heavily used nevertheless, making full use of globalizing trends. Given a preliminary focus, the researcher can draw upon the global network of archives, experts, and related sources to cull, define, circumscribe, situate, contextualize, critique, evaluate, synthesize, theorize, and apply the focus. It is from these research-oriented activities that the

disciplinarity of the inquirer emerges. Once established, the inquirer can offer his and her domain and expertise to others. With one's fellow inquirers, one can engage in multi-, inter-, and trans-disciplinary forms of inquiry. Finally, it is from the more collective pursuits that manifestations of meta-disciplinarity will become more prevalent by way of knowledge communities and cultures denuded of classical subject matter labels and boundaries among the disciplines.

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Emergence in Complex, Cognitive, Social, and Biological Systems

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to be limited in moving the process toward more integrative work that considers the complexification and systemicity of phenomena and problems.

In this form of disciplinarity we can imagine for example, symposia, conferences, and consultations convening to solicit the views of the experts. Anthologies, proceedings, and edited books of readings make available to others the range of views on the focus of study and discussion. As to the metaphor of the room full of active workstations, sharing information through contributions to and use of institutional archives, databases, and web sites provides multi-disciplinarity in the human organization.

However, for the same reasons as mono-disciplinarity, multi-disciplinarity is severely limited. The participating disciplines in and of themselves need not achieve any systemic and wholistic form devoted to their focus.

Here the terms multi- and pluri are applied interchangeably to mean the simultaneous use of a set of relatively autonomous disciplines to address a focus, interest, problem, and issue, without requisites imposed for the linkage, synthesis, and integration of knowledge. For example, pluri-disciplinarity may mean the employment of a plurality of research methods, some of which may be stock-and-trade of a discipline outside the researcher's affiliated discipline. Finer distinctions among these two and other forms of disciplinarity may be found elsewhere, namely, Francios (1997) and the International Center for Transdisciplinary Research on the Internet.

However, the view taken here is that there is no mandate to restrict and define the forms solely according to centrality (requirement of a centralizing discipline), classification (systematic description and taxonomic aggregation of phenomena), formalization (extensive concretization of rules and procedures), method (infusion of methodology from one discipline into another), or theory (presence of a falsifiable body of propositions, axioms, and laws).

3.3 Inter

When the representatives of disciplines truly communicate with mutual respect and learning, there can be attained a form of disciplinarity well beyond separate and parallel contacts. Participants come to view their interests, issues, problems, questions, answers, and solutions with common concern and the seeds of collaboration germinate. Colonizing and condescending attitudes of the practitioners in a discipline give way to the recognition there is value in multiple perspectives and a need for a diversity of expertise to advance a step in a more integrative and synthetic fashion the knowledge of all disciplines. The delineation of common interest and the

contribution from difference become accepted and important characteristics of disciplinarity.

We can imagine a Venn type diagram of overlapping circles, in which each circle represents a discipline. The circles overlap such that there is a common core, yet each circle also overlaps with its neighboring disciplines. This picture generates a rich set of possibilities for collaboration. An outstanding example of inter-disciplinarity is the specialty focus known as psychoneuroimmunology. More informed considerations of many human maladies may benefit selectively from what is known in biology, chemistry, cytology, epidemiology, endocrinology, hematology, neurology, and psychology. And this pursuit is meant of course to be inclusive of relevant inter-disciplines like biochemistry, neurochemistry, and neuropsychology.

Inter-disciplinarity begins with a particular tie or bridge that connects two disciplines. There are many examples where knowledge domains become interrelated, such as astrophysics, biochemistry, ecopsychology, psychohistory, and sociobiology. Two disciplines may join through infusion of one into the study of the other, or from symbiotic benefits of synthesizing aspects of their subject matter. For example in psychohistory, psychology brings a particular viewpoint by way of theoretical organizing frameworks and the emphasis on personhood to view historical accounts. As to a particular history, when infused with cartography, economics, political science, psychology, and sociology, it reaps many mutual benefits that enables the researcher to weave a richer collective tapestry of any human event, movement, and trend than could be conveyed solely through one of the disciplines.

To follow further the workstation metaphor, inter-disciplinarity would mean a higher level of interaction among workstations and additional layers of organization memory devoted to collaboration and synthesis of what the various contributors bring to the work flow. Electronic trails give evidence to the productivity, progress, and eventual information and knowledge products produced in the process.

3.4 Trans

As the considerations of the interrelations become more evident and intricate, it necessitates the realization that the complexification of the focus as well as involved relations among the disciplines compels us toward trans-disciplinarity. At this point, cybernetic and systemic constructs become paramount, such as positive and negative feedback loops, the co-evolving nature of any conceptualization of system with its context (environment), and the embeddedness of any conceptualization of system in regard to its

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Like inter-disciplinarity, trans-disciplinarity fosters a common language, usable knowledge among disciplines, and shared methodologies. But trans-disciplinarity gears the endeavor more to match the systemicity and complexity of the focus. In distinction from the previous forms described, trans-disciplinarity takes the pursuit beyond any consideration and limiting factor, problem, and theory within and between the disciplines. Other forms of disciplinarity cannot achieve these aims very well.

It is instructive at this juncture to note the use of cross-disciplinarity as a construct. It is sometimes used to distinguish the basic form (mono-disciplinarity) and the more complex form (trans-disciplinarity) from the intermediate forms (multi- or pluri- and inter-disciplinarity). The prefix "cross" implies a breaking through, transgression, and perhaps the bridging of disciplinary boundaries, but it does not inform us about what happens and what is accomplished when the inquirer goes beyond the confines of particular disciplines. This prefix is not used in the present scheme here, because of the ambiguity of meanings among the intermediate forms. Although the phenomenon of crossing disciplinary boundaries is an important and often courageous professional undertaking worthy of study in its own right, cross-disciplinarity may refer to any of the intermediate forms, hence it is of limited usefulness in exploring the progression of forms as a conceptual system.

It is out of trans-disciplinarity that an integrated body of knowledge springs through the integrated work of collaborators among the participating disciplines. It is difficult to imagine such a body of knowledge from earlier forms of disciplinarity because of the absence of participation from key disciplines. Each core discipline has key parts of the puzzle to contribute and until the pieces are present, the new whole has little chance of being achieved.

From the integrated character of this new body of knowledge, reaped from the interrelations of the contributing disciplines, we can comprehend its systemicity. Systemicity is emergent from trans-disciplinarity. Systemicity is an emergent property from the complexification of the disciplines when integration occurs.

However, despite the wholistic realizations of trans-disciplinarity, the individual disciplines remain somewhat autonomous. This autonomy is evidenced through all forms of disciplinarity covered to this point in the pursuit of knowledge.

3.5 Meta

The last form of disciplinarity to be discussed is meta-disciplinarity. The boundaries distinguishing disciplines dissolve to a degree in inter- and trans-disciplinarity, but they become more than meaningless, in fact non-existent, at the meta level. Meta-disciplinarity shows the interwoven qualities of the blended disciplines working collaboratively and collectively, making the pursuit of knowledge more than tangibly trans-disciplinary. In short, the extent of integration suggests a superordinate and emergent mono-disciplinarity of greater complexity.

Bateson (1979) was widely recognized for his reach to encourage and model meta-disciplinarity. More recent acknowledgement of Bateson's influence is given by Folk (1995), who points out that "a metapattern is a pattern so wide-flung that it appears throughout the spectrum of reality ... a pattern of patterns ..." (pp. viii-ix). The meta-disciplinarian seeks to synthesize, integrate, and convey the wholism of a body of knowledge, whose saliency may be characterized and thematized in terms of its meta-patterns.

By way of another illustration, at some point in the development of the subject domain, many will argue that psychoneuroimmunology will cease to be inter- and trans-disciplinary in character, and be truly meta-disciplinary, at which point its parent disciplines will become indistinguishable and meaningless to those who affiliate with this emergent meta-discipline.

As a horizon, one may take a similar view of those disciplines contributing to the study of consciousness. Such a cluster of disciplines appears to be undergoing the progression described in this paper. In other words, there are collectivities from among the sciences and various fields of study, which one might consider to be progressing toward meta-disciplinarity, such as the earth sciences, human sciences, and life sciences. These collectives serve to illustrate further some likely candidates for meta-disciplinarity.

4. SUMMARY AND INTEGRATION

The five forms of disciplinarity covered in the previous section may be summarized by means of a table and two figures. Each summary sets the stage for the subsequent discussion.

The table compares the types of disciplinarity in two important respects. From the table we can see a progression toward more systemicity and increasing complexity.

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Table 1. Select properties distinguishing types of disciplinary

Disciplinary	Relation	Systemicity	Complexity
Mono	Within	-	0
Multi	Among	-	1
Inter	Between	+	2
Trans	Beyond	+	3
Meta	Above	+	4

The first figure is meant to convey that the forms of disciplinary work as a conceptual system. We can move among the forms to study any given focus (interest, phenomenon, problem). The trend in the pursuit of knowledge today is a progression of a discipline from mono- to multi- and/or inter- to trans-disciplinary. Meta-disciplinary represents a culminating state for the process to begin all over again as knowledge continues to be revisited, revised, and reformulated. Meta-disciplinary is the four forms taken as whole.

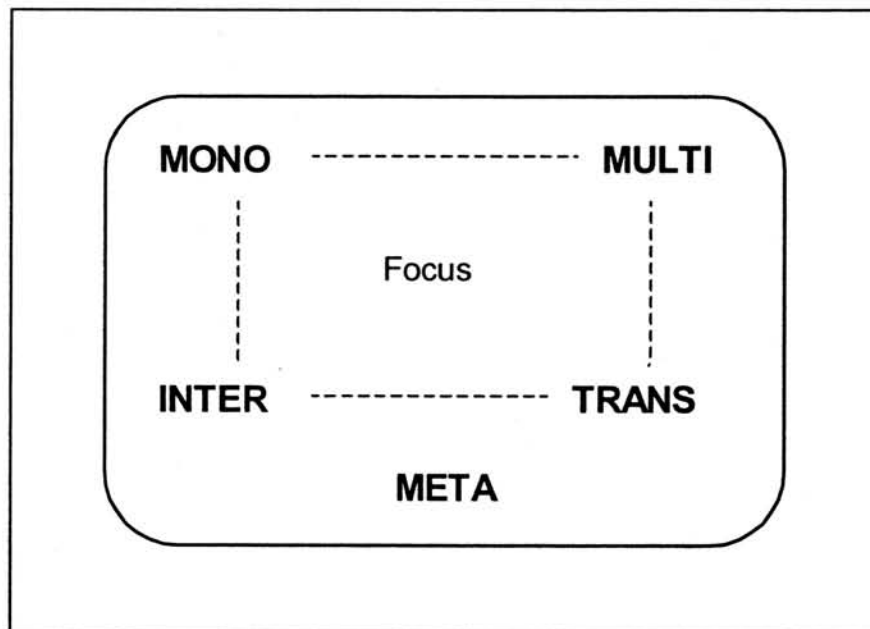


Figure 1. Meta-disciplinary as a conceptual system.

The relations among the forms are relevant to working with them as a whole system. It is important to emphasize that as tempting as it may seem, the scheme does not unfold as a simple linear phase progression that enables an accounting of the conceptual system. The second figure depicts the progression over the five forms of disciplinary as an unfolding of nested manifestations, in which each emergent form encompasses earlier forms. There is not a replacement of one form by another, but a development that is an advance, such that the inquirer has more choices to advance knowledge and can always regress to, or draw advantageous upon, an earlier form while

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continuing to progress to higher order and more challenging, complex forms. Meta-disciplinarity encompasses all forms and may be seen as a higher order and much more complex, integrated, and advanced form of mono-disciplinarity.

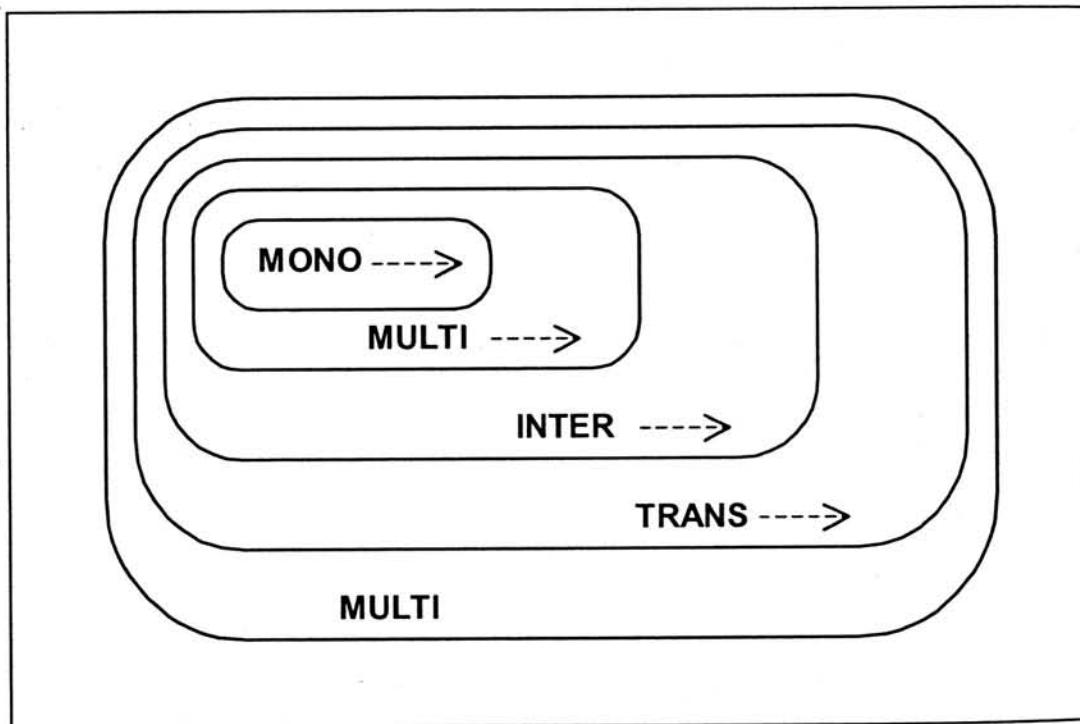


Figure 2. The embeddedness of disciplinarity.

Finally, it is equally important to view the scheme as a conceptual system of complementary forms, for in the more complex and systemic applications, the inquirer can move among them to reap the greatest benefits from the contributing disciplines and facilitate the advancement of knowledge.

5. DISCUSSION

When we speak of the meta-level, there is scanty much left but historical vestige to regress to anything mono-, multi-, inter-, and trans-. One might think of meta as a higher order emergent synthesis - a super mono-disciplinarity. In human history there is both a proliferation in specialization (mono- and multi-disciplinarity) as well as the turn toward generalization and unification (inter- and trans-disciplinarity). While there is certainly the necessity of more specialists as knowledge domains mushroom ever more beyond the comprehension of a single human being, there is concomitant and complementary need for more generalists to synthesize in parallel fashion.

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Complexification (Casti, 1994) brings both differentiation within as well as unification beyond given disciplines. Although a cyclic process has been suggested earlier when examined transitionally from a side view, the growth of the disciplines is really a spiral-like process when viewed historically from above. Both volume and density of the body of information and knowledge expands, even though paradoxically, the horizons become clearer in the pursuit of how much we do not yet know and how much there is still to know. It is a never-ending process.

To design a system able to act on the processes of knowledge production is to design an inquiry system. The history of science may be viewed in this fashion. Churchman (1971) provides an informative and useful description of such a sequence of paradigmatic systems for inquiry, that is to say, broadly conceived research traditions in the history of Western science. Although granted the phrase "inquiring system" does convey an enlivened connotation—used to stress the dynamics and process of the search for knowledge—appearances of the phrases "disciplined inquiry," "inquiry system," and "system of inquiry" are not intended to diminish that vitality. In addition, Churchman contributes an important perspective to his history of inquiry systems by reminding us that our design and use of them must take into account future generations, else we fail to include fully the ethics of our pursuit.

We may speculate that with further globalization of information and knowledge, there will be a general enhancement of disciplinary in all its forms. The Internet and World Wide Web, for example, are making it rapidly possible for an unprecedented proportion of humanity to develop more personalized forms of mono-disciplinary that transcend physical limitations and traditional disciplines. The mutual presence formerly required between inquirers (co-researchers, mentor and apprentice) may be less necessary in coming generations, even though established traditions will be heavily used nevertheless, making full use of globalizing trends. Given a preliminary focus, the researcher can draw upon the global network of archives, experts, and related sources to cull, define, circumscribe, situate, contextualize, critique, evaluate, synthesize, theorize, and apply the focus. It is from these research-oriented activities that the disciplinary of the inquirer emerges. Once established, the inquirer can offer his and her domain and expertise to others. With one's fellow inquirers, one can engage in multi-, inter-, and trans-disciplinary forms of inquiry. Finally, it is from the more collective pursuits that manifestations of meta-disciplinary will become more prevalent by way of knowledge communities and cultures denuded of classical subject matter labels and boundaries among the disciplines.

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