

Modeling the Demands of Interdisciplinarity: Toward a Framework for Evaluating Interdisciplinary Endeavors

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Abstract: I suggest there are two key factors that bear on the quality of interdisciplinary endeavors: *the complexity of cognition and collaboration* and *the epistemological structure of interdisciplinary validity claims*. The former suggests a hierarchical taxonomy of forms of inquiry involving more than one discipline. Inspired by Jantsh (1972) and looking to Fischer's (1980) levels of cognitive development, I outline the following forms: disciplinary, multi-disciplinary, cross-disciplinary, inter-disciplinary, and trans-disciplinary. This hierarchical taxonomy based on *complexity* is then supplemented by an epistemological discussion concerned with *validity*. I look to a handful of philosophers to distil the general *epistemological structure of knowledge claims implicating more than one discipline*. This involves differentiating between levels-of-analysis issues and perspectival issues. When all is said and done, we end up with a “language of evaluation” applicable to interdisciplinarity endeavors. Ultimately, this suggests an ideal mode of interdisciplinary endeavoring roughly coterminous with Wilber's (2006) Integral Methodological Pluralism.

Keywords: cognitive development, epistemology, integral methodological pluralism, interdisciplinary, language of evaluation, levels-of-analysis, perspectival, transdisciplinarity

Introduction: My Agenda

"...there are no standards of excellence for interdisciplinary work in general" (Klein 1990, p. 94).

"A crucial consequence resulting from the shift in knowledge production from Mode 1 [disciplinary] to Mode 2 [interdisciplinary] bears upon quality control" (Gibbons, et al., 1994, p. 18).

The quotes above are taken from two of the most influential books about interdisciplinarity. They reflect a general concern about interdisciplinary endeavors. How do we detect the “symptoms of quality” in interdisciplinary work (Mansilla & Gardner, 2003)? That is, how do we understand the demands of interdisciplinary work, such that we can know when they have been met? How do we evaluate interdisciplinarity?

Such an evaluation entails more than a description of what passes as interdisciplinary work. Much of the scholarship *about* interdisciplinarity amounts to descriptions of the state of the art (Klein, 1990, 2005; Lattuca, 2001; Gibbons, et al., 1994). This work is important and informs my account. Yet, the thrust of what I have to offer is normative. Not what interdisciplinarity *is*—but

what it *ought* to be. Of course, we'll have to move from *is* to *ought*, offering some descriptions before issuing some prescriptions.

My plan in this article is as follows. I will look to the descriptive accounts in order to arrive at a loose definition of the phenomenon in question. We'll see just what people think interdisciplinarity is. This will involve a brief historical overview and a discussion of three types of initiatives: interdisciplinary education, problem-focused interdisciplinarity, and synoptic interdisciplinarity.

Then we will go on look at some evaluative accounts. These discuss the demands of interdisciplinary work. The goal here is to tease out the key factors bearing upon the quality of interdisciplinary endeavors. Two factors fall out of the discussion: *the complexity of cognition and collaboration* and *the epistemological structure of interdisciplinary validity claims*.

With the first factor involving the *complexity* of the practices and concepts being employed, we see that interdisciplinarity is not an all-or-nothing thing; there are gradations of interdisciplinarity. We will differentiate four types, each more complex than the next: multi-disciplinary, cross-disciplinary, inter-disciplinary, and trans-disciplinary. Each is a valid and valuable type of engagement. But there are important differences between them, which, as we will see, make them important to distinguish for the purposes of quality control.

With the second factor we find that interdisciplinary endeavors face unique and exacting epistemological demands. In this discussion, issues of *reductionism* take center stage. Here we see that the *unwarranted privileging of certain disciplinary perspectives* is a concern. This concern motivates a more careful and explicit account of the epistemological structure of interdisciplinary knowledge claims. It turns out that there are both *levels-of-analysis issues* and *perspectival issues*, which are not to be confused.

The considerations about complexity give us a hierarchical taxonomy based on the complexity of concepts and practices. The epistemological considerations give us a horizontal taxonomy based on epistemological relations between different types of methodologies. Combining the typologies will give us a robust model concerning the demands of interdisciplinarity.

In short, we will end up with a "language of evaluation" applicable to interdisciplinarity endeavors. This language is capable of disclosing how some interdisciplinary endeavors fall short in terms of complexity and how others flirt with epistemological fallacies. This language of evaluation suggests an ideal mode of interdisciplinary endeavoring, in light of which we may judge those who claim to proceed as such. Wilber's (2006) philosophical position of *Integral Methodological Pluralism* is nearest to this ideal. However, the version I endorse is highly formalized and thus stripped of many Wilber-specific accoutrements.

But first things first: what are we talking about?

On Definitional Deficits

"That's a great deal to make one word mean," Alice said in a thoughtful tone. "When I make a word do a lot of work like that," said Humpty Dumpty, "I always pay it extra."

Lewis Carol, *Alice in Wonder Land* (Quoted in Klein, 1990)

All top American universities boast some species of interdisciplinarity. Most offer interdisciplinary majors of some sort. Some have interdisciplinarity as an aspect of their mission. Interdisciplinarity has garnered the support of elite universities. It has academic credibility. It is

also supported outside the academy. There are innumerable organizations that claim it as their *modus operandi*. It is the preferred label for a variety of initiatives, from international NGOs to local artist-cooperatives. The connotation is such that to be interdisciplinary is to be at the vanguard.

So, there is much interdisciplinarity to be found. But the types are so various and the levels of sophistication so variable that the category has become too encompassing. We have put elite think tanks run by people with more Ph.D.s than fingers in the same category as middle school students painting pictures of historical events. Broad categories are not necessarily bad. I'm a big fan of universals. But we need well-behaved words—terminological clarity. Interdisciplinary is ill defined—it's dysfunctional. We need words to work so we can.

Of course, there is a general consensus that interdisciplinary work involves more than one discipline. This is an insufficient answer for a variety of reasons. It is too simple, and mainly aids those who have trouble with prefixes. Moreover, now we are stuck hunting for a definition of *discipline*. Surprisingly, few who are content with the definitional gloss offered above even follow out this next step.

Suppose we follow Gardner (2000) and talk of *disciplines* as concepts and methods for thinking about specific types of questions and phenomena; *concepts* and *methods* that have been cumulatively accepted by experts as providing standards for determining the validity of answers. That works fine: disciplines are *methodological lenses* employed by communities of investigators relative to particular phenomenon. Yet, even if we posit such a definition as correct we are still without a definition of *inter-disciplinarity*. The prefix is the problem.

Inter- as a prefix is generally taken to mean roughly *between* or *among*. Put this together with the definition of discipline offered above, and we are almost back where we started. We know more about *what* we are between and among, but not what it means be this way. I'm *between* breakfast and lunch right now, and *among* my things. Locate me appropriately in the library or science center and now I'm *between* and *among* the disciplines. Put a microscope in one hand, a copy of *King Lear* in the other, and now I'm interdisciplinary!

Thankfully, we don't have to construct a definition out of thin air. It's possible to bootstrap a definition by looking at the "evolution of interdisciplinarity" (Klein, 1990).

Interdisciplinary Progenitors: A Rough Sketch

Humans have always wanted to be know-it-alls. Traditionally in the West philosophers have been the most avid interdisciplinarians.¹ Aristotle delineated various forms of inquiry, such as "Politics," "Poetics," "Metaphysics," etc., and maintained that the philosopher's task was to subsume them encyclopedically. The great schoolmen of the Middle Ages founded the first universities and began labeling things like theology, law, and medicine, as *disciplines* (Klein, 1991, p. 20). But as signified by the prefix, with the idea of the *university*, philosophers still maintained their vision of the *unity* of knowledge.

However, with the Enlightenment scholarly and professional specializations began to proliferate exponentially. Here is the birth of science from the womb of modern socioeconomic conditions. The "scientification" of knowledge and the "professionalization" of science resulted in the structuring of the modern university along disciplinary lines. Alarmed by this trend, philosophers began—and haven't since stopped—continually expressing concern about the

¹ We will see that most philosophers are really meta-disciplinarians. But that is ahead of the story.

fragmentation of knowledge. As Klein (1990) notes there have always been impulses "to retain, [and] in many cases, reinstall historical ideas of [the] unity and synthesis [of knowledge]" (p.22). By the 19th century explicitly *interdisciplinary* endeavors were underway.

To make a long and very interesting story short, the modern evolution of interdisciplinarity has been shaped by at least five factors (Apostel, Berger, Briggs, & Michaud, 1972, pp. 44-55). The following list is adapted from Klein (1990, p. 41).

1. *The development of science:*
 - Increasing specialization leading to the intersection of two disciplines, splitting up of an over-ridged discipline, or setting off into new fields, etc.
 - Attempts to define elements common to disciplines.
2. *Student needs:* The result of direct student pressure or faculty anticipation, most of the time as a protest against the parcelization and artificial subdivisions of "reality."
3. *The need for professional training:* Educational needs based on student demands and in some cases as a result of contracts extending outside the university, therefore being linked with the 4th demand.
4. *Original needs of societies:* Particular needs and new subjects which cannot, by definition, be contained within a single disciplinary frame, such as environmental research.
5. *Problems of university operation or even admission:* The result of increasingly elaborate equipment in research centers and the need for budget management in universities, especially in regard to contract with government or the advent of a major technology such as a computer.

Clearly this is but a sketch of how interdisciplinarity came to be what it is. But even from this cursory glance both the *significance* and the *variety* of interdisciplinary motivations should be noted. We've inherited the unavoidable and crucial task of interdisciplinarity; the goal of this paper is to parse out the task demands. The goal of the next section is to give an overview of interdisciplinarity today.

Today: The Lay of the Land

Following our historical sketch I'd like to offer a way to define what passes as interdisciplinary today. The general trends and impulses noted above continue on today in three forms of interdisciplinary activity.

Interdisciplinary education (see Kockelmans, 1979; Jacobs, 1989; Wineburg & Grossman, 2000). Some educational initiatives explicitly label themselves as such, accurately or not. Others, like most liberal arts colleges, consider themselves as proponents of "general education," but are labeled as interdisciplinary by others. Some that receive this label are more akin to professional training programs. The common denominator is the idea of exposing students of any age, *in some way*, to a variety of disciplines.

Problem focused interdisciplinarity (see Gibbons, et al., 1994; Klein, Grossenbacher-Mansuy, Haberli, Bill, Scholz, & Myrtha, 2001). These initiatives blur the lines between academia, business, and government. Here we find think-tanks, NGO's, and specially crafted graduate programs. The common denominator here is the combining of a variety of disciplines, *in some way*, in order to solve specific problems. The problems are various: big "real-world" issues like

global warming; high-level theoretical issues like those found in the complexity sciences; minute problems in some specific discipline likely to be solved via techniques from other disciplines, etc.

Synoptic interdisciplinarity (see Laszlo, 1972; Wilber, 1995; Wilson, 1998): These types of initiatives continue an ancient ambition, striving for “theories of everything.” The common denominator here is the summarizing or utilizing of a variety of disciplines, *in some way*, so as to give an account of very general phenomena, e.g., state of the Sciences, the World, Nature, or the Kosmos.

I see these as the three main areas of interdisciplinary energy. Of course, the lines are not set in stone. The areas bleed into one another. Proponents of synoptic accounts would like to see their theories used to solve problems. Some problem-focused interdisciplinarians have their hands in some educational endeavors. A number of educationalists shape their interdisciplinary curriculums around real problems, or synoptic theories. But generally speaking, when looking at a specific example, it is often best characterized as belonging in only one of these areas.

These labels aid us in our defining of interdisciplinarity. We've seen the history of the motivations, which have become embodied in a variety forms. There are reasons for people to pursue interdisciplinary endeavors. And there are at least three types of endeavors currently being carried out.

However, even if these areas accurately describe the current scene, they tell us nothing about what makes for a better or worse piece of interdisciplinary work. This latter way of viewing interdisciplinarity leads to the evaluative methods this paper targets. So, with our admittedly ambiguous sense of what interdisciplinarity means, we move on.

Interdisciplinarity: Admitting the Demands and Talking About Them

Too often in discussions of interdisciplinary training one hears calls for breadth, for comprehensiveness. Too often we attempt to produce professionals who have mastered two or more disciplines.... This orientation I will parody as the "Leonardesque aspiration": the goal of creating current day Leonardos, who are competent in all of science. As a training program it is bound to fail.... At its worst it produces a shallowness, a lowest common denominator breadth, an absence of the profound specialization which is essential for scientific productivity (Donald T. Campbell, 1969, p. 329).

Now we get to the heart of the matter. We've gathered a rough sense of what passes as an interdisciplinary endeavor. But the word still means too much. Having a label doesn't mean deserving it. We need to develop a shared sense of what *ought* to pass as interdisciplinary work. What are the real demands of interdisciplinary work? It will become clear that the demands are high.

As mentioned in the introduction, we will be comparing several theoretical models concerning the demands of interdisciplinarity. Let's be more specific. What we want could be called a language of evaluation. Yes, we want to sort the good work from the bad. But that task is secondary. First we need a way to justify such evaluations. We need a language that will disclose the symptoms of quality. With the right language, we can isolate and talk about the various properties of interdisciplinary work that bear on their worth. These kinds of languages are

everywhere: from rubrics for grading papers to codified sets of professional standards. Languages of evaluation are valuable.

To be very clear: in this paper I don't want to actually begin sorting the wheat from the chaff. I want to begin to find a language we can use to do so. We can't argue about the relative worth of various interdisciplinary endeavors because we haven't decided what's worth arguing about. We need to admit that there are demands and agree on what they are. This entails finding ways to talk about various aspects of interdisciplinarity.

Campbell (1969) speaks to this in the quote above. In a seminal paper on interdisciplinarity he writes of "the profound *specialization* that is essential for scientific productivity" (p. 329). He contrasts this with the "Leonardesque aspirations" of most interdisciplinarians, which result in "shallowness, [and] lowest common denominator breadth" (p. 329). But make no mistake: he offers these critiques while nevertheless admitting the need for true interdisciplinarity. He's just worried about the demands of such undertakings.

To make his point, he outlines how hard it is to have an expertise in *one* discipline. You have to master the unique and specialized languages, the burgeoning bibliographies, proliferating publications, and multifaceted methodologies. Competencies are complicated. Moreover, we don't work alone: *the locus of scientific knowledge is social* (Campbell, 1969).

This is a major point. Disciplines, as mentioned in Gardner's definition above, are like communities. Disciplinary expertise is akin to a kind of membership. One needs certain competencies to participate in the community, but the inquiries undertaken out-strip any one individual. If you speak as an expert you represent your discipline. You speak on behalf of those whose expertise justifies your own.

In light of these considerations, Campbell (1969) noted another demand: overcoming the ethnocentrism of the disciplines. Because disciplines are like communities, they're subject to the same political dynamics. They become insular. They have rights of passage. They get caught up in territorial disputes with other communities: academic politics as usual. Campbell saw this as a major problem. He suggested that instead of Leonardesque aspirations we should have aspirations to collaborate across disciplinary boundaries. The ethnocentrism of the disciplines inhibits this. Ideally, instead of looking to master more than one discipline (which is very hard), we should look to the competencies of others and work towards interdisciplinary knowledge collaboratively. But that's demanding, personally and professionally.

With Campbell's analysis we have begun to see what we're after. The competences of both individuals and groups must be taken into account. In light of even a rough sense of the requisite competencies, it looks like what is required for interdisciplinary work is more demanding than most think. We need to solidify disciplinary expertise, as embodied by individuals in groups, *before* we come to true interdisciplinarity. Most individuals and groups can't pull this off. More often than not, we end up with individuals who have a shallow sense of a bunch of disciplines, instead of individuals who are prepared to collaborate across disciplines as experts established in one.

Modeling the Demands of Interdisciplinarity

Step 1, Part 1: A Hierarchy of Competencies

The foregoing discussion indicates why Campbell maintains that interdisciplinarity is a complicated competence. And talking about competencies means talking about hierarchies. A

long history of cognitive developmental research suggests that skills and competencies develop hierarchically (Fischer, 1980; Fischer & Bidell 2006). Tasks make demands. Meeting these demands requires skill. In light of this research it's undeniable that less complex skills come to be subsumed by more complex ones. There are stages in the acquisition of any complicated competence. Abilities range across a developmental continuum. Interdisciplinarity, as a very complicated competence, is no different.

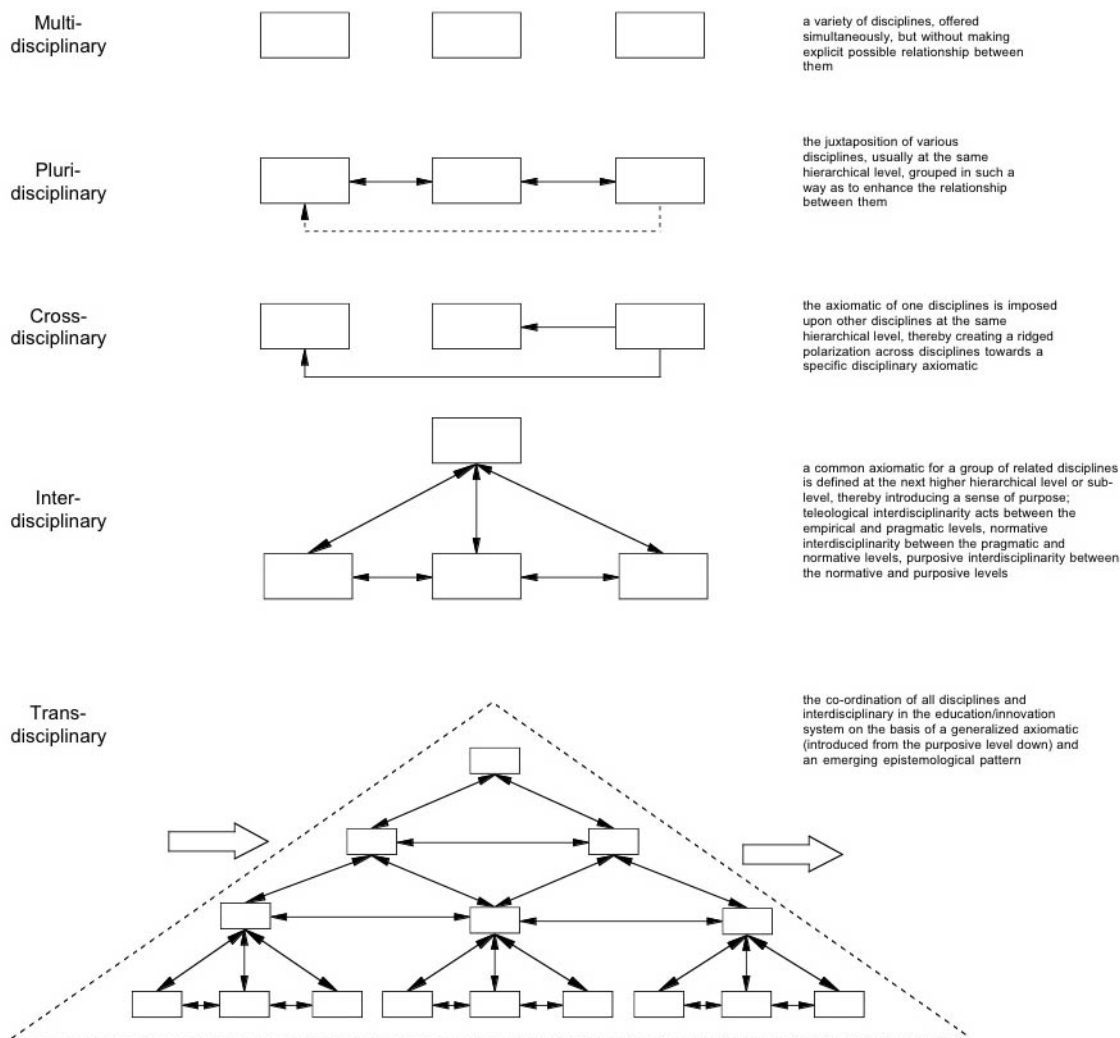


Figure 1. Successive Steps for Increasing Co-Operation and Co-Ordination in the Education/Innovation System

From "Towards interdisciplinarity and transdisciplinarity in education and innovation," by E. Jantsh, in G. Berger, A. Briggs & G. Michaud (Eds.), 1972, *Interdisciplinarity: Problems of teaching and research. Proceedings of seminar on interdisciplinarity in universities, organized by the center for educational research and innovation* (pp. 97-121). Copyright 1972 by the Organization for Economic Co-operation and Development. Reproduced with permission of the publisher.

Some have seen this. Jantsh (1972) did. He suggested that interdisciplinarity is best understood as an attainment (see Figure 1). It is a particular type of endeavor with a particular set of demands. He outlined a hierarchy of forms of inquiry, defining each according to the structure and complexity of its practices. He made it very clear that interdisciplinarity is relatively complicated, as compared to say, disciplinarity. He also made it clear that more complex forms of inquiry build upon less complex ones. That is, you can't be an interdisciplinarian before you are a disciplinarian. This is great. We've got the beginnings of a normative account. But his model is not sufficient for our purpose of developing a language of evaluation.

One reason is that he blurs the distinction Campbell alluded to between the two types of competencies involved: the competencies of people and the competences of groups. We need to address both what it takes for an individual to meet the demands of interdisciplinarity and what it takes for a group to do so.

There is also a certain arbitrariness to Jantsh's hierarchy. Why that many levels? Why those structures? There are well-established models outlining the structural properties of cognitive developmental stage growth (Commons, Trudeau, Stein, Richards, & Krause, 1998; Fischer & Bidell 2006). That is, we know what the hierarchical nesting of competencies looks like. We don't have to guess. Even if we are speculating, we can keep in touch with what we know. In light of these two issues I've revised Jantsh's model. Table 1 displays a *speculative* cross-sectional, hierarchal taxonomy of forms of inquiry based on Fischer's (2006) levels. Competencies of groups are built from various competencies in people, but levels aren't correlatives, e.g., a bunch of multi-disciplinary people don't necessarily form a multi-disciplinary group; a trans-disciplinary group is not necessarily filled with trans-disciplinary people.

Table 1. A Cross-Sectional, Hierarchal Taxonomy of Forms of Inquiry

Form of inquiry	Competencies of people	Competencies of groups
Disciplinary	<p>Requisite level of cognitive development: Highly Elaborated Abstract Mappings.</p> <p>Individuals demonstrate understanding of one set of conceptions and one methodological approach. They are able to generate unique questions and contribute new research and findings in this area.</p>	<p>Group is able to produce new knowledge (or confirm exiting knowledge) in a specific discipline by employing one set of concepts and methodologies.</p>
Multi-disciplinary	<p>Requisite level of cognitive development: Abstract systems.</p> <p>Individuals demonstrate disciplinary competence, and understand that their endeavors must be related to the endeavors of others in surrounding disciplines. They therefore come to know and use some concepts used in these disciplines.</p>	<p>Group is able to demonstrate disciplinary competence and relate the results produced by surrounding disciplines to its own, and relate its own results to others (e.g., communication between disciplines).</p>
Cross-disciplinary	<p>Requisite level of cognitive development: Highly Elaborated Abstract systems.</p> <p>Individuals demonstrate disciplinary competence and know how concepts and methodologies from other disciplines relate to in their own, having mastered some concepts therein. They are able to constructively communicate with those from other disciplines in a problem-focused manner.</p>	<p>Group is able to demonstrate disciplinary competence and to constructively collaborate with groups from other disciplines in a problem-focused manner.</p>

Form of inquiry	Competencies of people	Competencies of groups
Inter-disciplinary	<p>Requisite level of cognitive development: Single principles.</p> <p>Individuals demonstrate at least two disciplinary competences. One is primary, yet they are able to employ the concepts and methodologies of other another discipline well enough to contribute to the questions and findings therein. New understandings of the primary discipline result.</p>	<p>Group subsumes at least two disciplinary sub-groups, with one as primary focus of expertise. Capable of solving problems that cannot be addressed by either discipline, typically in a problem-focused manner.</p>
Trans-disciplinary	<p>Requisite level of cognitive development: Beyond single principles.</p> <p>Individuals demonstrate at least two disciplinary competences, neither of which is primary. They work and contribute to both and generate unique findings, conceptions, and artifacts as a result of an emergent trans-disciplinary perspective. They are able to communicate with those from a variety of disciplines in a synoptic manner.</p>	<p>Group subsumes at least two disciplinary sub-groups, neither of which is primary. Produces both problem focused and synoptic knowledge, which cannot be reduced to either of the sub-group competencies. It is capable of spawning new disciplines, and reforming existing ones in light of emergent perspectives.</p>

I've based this taxonomy on Fischer's model of cognitive development, which entailed that one of Jantsh's levels be removed (pluri-disciplinary). I've also clearly differentiated the competencies of people from the competencies of groups. The result is a detailed taxonomy of forms of inquiry and their demands on individuals and groups.

With its base in Fischer's established research, the taxonomy is presented as a hypothesis that could be empirically refined and tested. No doubt, it's a simplification. But relative to the rampant *over-simplifications* involved when we apply the label interdisciplinary to everything and anything, I propose this taxonomy as a useful *complexification*.

It also provides the beginnings of a language of evaluation. We can now look at an endeavor and argue about where it belongs in this taxonomy. Moreover, because we can talk about the demands, we don't have to compare the results of two very different forms of inquiry. We can calibrate our expectations. We can more precisely zero in on the symptoms of quality. For example, a group of experts claiming to do interdisciplinary research should be meeting the requisite demands and not just disguising some other form of inquiry with a buzz-word; a group of undergraduates struggling to solidify disciplinary expertise should not be expected to be interdisciplinary, but should strive for multi-disciplinarity and be evaluated accordingly. The words *developmentally appropriate* come to mind.

Step 1, Part 2: What About the Young Ones (and the Philosophers)?

There could be concerns that the forgoing scheme is too elitist. What about all the great stuff that happens when students, who are by no means experts in any discipline, are exposed to a wide range of approaches and concepts? Am I suggesting that there should be no such exposure? Am I relegating everyone to parochial disciplinary channels until they've paid their dues? Am I suggesting that we have to be specialist before we become generalists?

No. I just think we should clarify what is really going on.

Figure 2 offers some clarification. This figure is primarily about how individuals come to acquire capabilities. I am suggesting that *general education* be defined as an exposure to multitudinous *pre-disciplinary* endeavors. I believe that this kind of broad exposure is

invaluable. However, at some point, for many people, disciplinarity should be acquired. This means that one limits one's focus for a time. Expertise, and the process of developing it, is exacting. As Campbell said, "we need to gain the profound specialization that is essential for scientific productivity" (1969, p. 326). Only then we can we begin to branch out and relate our expertise to the expertise of others.

This dynamic is illustrated in Figure 2. Various pre-disciplinary arrangements constitute a well-rounded general education. Eventually, disciplinary expertise is acquired. This expertise is progressively supplemented by knowledge of other disciplines. Finally, trans-disciplinary expertise is achieved, where emergent perspectives become available. Meta-disciplinary reflections about epistemological relations between the disciplines, goals of inquiry, etc., should exist alongside the growth of knowledge.

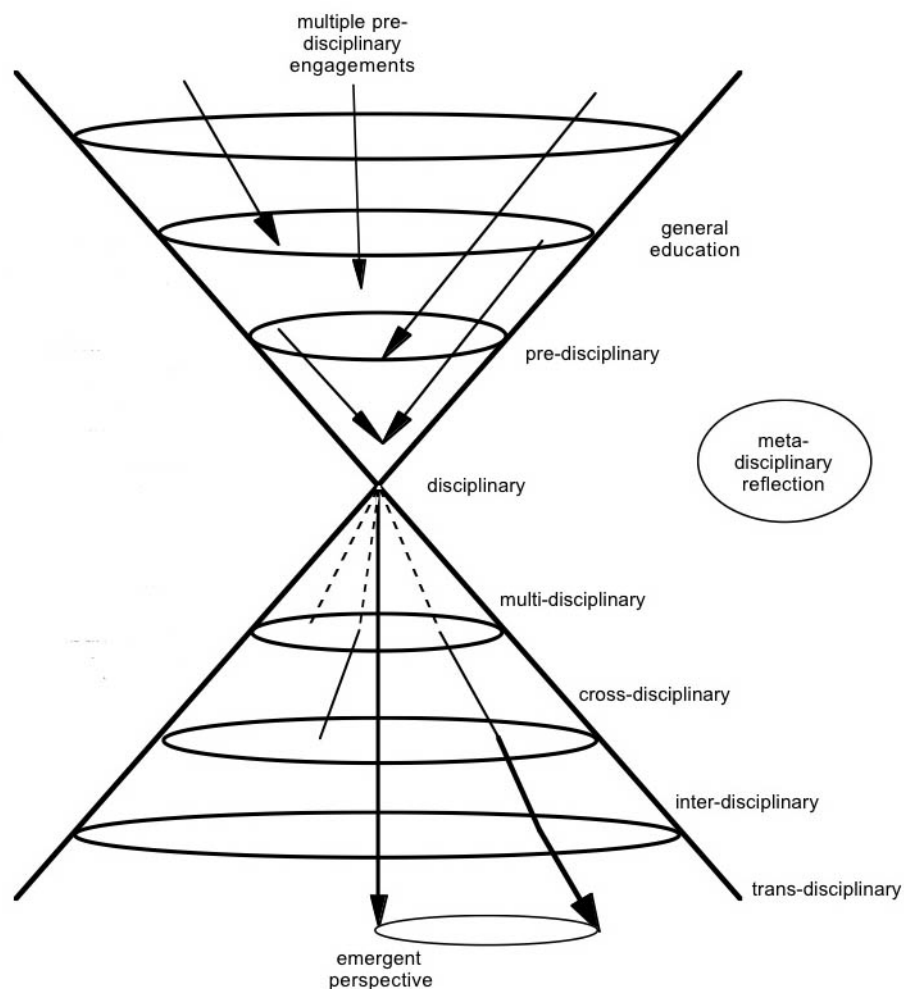


Figure 2. Funnel of Expertise

Also note that in Figure 2 I've singled out the idea of meta-disciplinary reflection. This is also addressed to those feeling claustrophobic about being forced into disciplinary channels. Meta-disciplinary reflections are often neglected. Ideally they would serve to give even the most focused expert a broader view about the nature of their discipline. The goals of inquiry would be put on the table. It would be admitted that other disciplines exist and generate valid knowledge, that each discipline knows only a piece of the world. And so, even the disciplinarian with no interdisciplinary ambitions would take a big view. In many ways this is the role of philosophy.

Moreover, because the demands of interdisciplinarity are so complicated (as we are beginning to see) I claim that meta-disciplinary reflections should accompany endeavors at any level of sophistication. They ought to run in parallel. This means that meta-disciplinary reflections don't sprout out of the top, like trans-disciplinary perspectives. They frame and facilitate. They're not the capping stone; they're the scaffolds. They're not the product but the catalyst, not the endeavor but its justification. I will say more about this when we discuss Wilber's meta-disciplinary model of integral methodological pluralism.

But first we need an introduction to the epistemological issues.

Modeling the Demands of Interdisciplinarity: Step 2 - Epistemological Issues

What have we done so far? We have dissected a vague concept: *interdisciplinarity*. A model has been presented suggesting that there is a hierarchy of forms of inquiry. The claim is that in light of such a model, undertakings that involve more than one discipline can be analyzed and grouped according to the complexity of the concepts and practices entailed. This claim stands even if the demands outlined above are inadequate or inaccurate. The main point is that we need a more precise language with which to talk about these kinds of endeavors. Maybe some other one is preferable. Fine. But *something* like what I've suggested needs to be devised and widely employed.

The same can be said about the models laid out in this next section. The demands outlined above help us diagnose and categorize forms of inquiry involving more than one discipline; some are more complex than others. The demands outlined here help us condemn or condone certain inquiries, regardless of their complexity; some are more valid than others. This second field of considerations is epistemological. And the territory is contested.

There is not one way to view the epistemological tangles surrounding inquiries involving more than one discipline. I base my account around some *very general* issues. I'm laying out the forest and ignoring some of the trees.

We've already met one very basic epistemological difficulty by claiming that multi, cross, inter, or trans-disciplinary work must build upon disciplinary work. We don't have to deal with epistemology *qua* the problem of knowledge, because we've seen that disciplines have their own internal methods of quality control. It's part of what makes them what they are. Remember that Gardner's definition went something like this: disciplines are sets of *concepts* and *methods* aimed at certain phenomena, which have been accepted by experts as providing *standards for determining the validity of answers*. This definition removes some of the most basic epistemological / philosophy of science concerns. For our purposes we'll take the disciplines at their word: they generate knowledge. But what about endeavors involving more than one discipline? How should we characterize relationships between different disciplines?

Jean Piaget (1972) maintained that there are symbiotic relations between the disciplines. None are more primary than others. They feed off one another. The knowledge produced by one is

often taken as the data used by another. He also maintained that there is some common core to all science: *structures*, the formalized systems of relations that are required to do any kind of science. Phenomena make sense in light of the structures we posit to understand them. Moreover, he was intrigued by the similarities between the structures posited by the various sciences, and even prophesized their convergence in a kind of universal “genetic [i.e., developmental] structuralism.” So homogeneity was grist for his mill. But overall, he saw heterogeneity as a virtue. There is unity in diversity, not just unity.

So despite the fact he saw certain formal similarities between the disciplines, he was still cautious about forcing homogeneity. That is, he was concerned about reductionism. He would have us note the differences between *levels of analysis* and the differences between *the human and the natural sciences*. Piaget's two notes of caution are the two main points covered next.

Step 2, Part 1: Levels of Analysis

The idea that there are levels-of-analysis issues is widely touted. Roughly speaking it means this: that with regards to some type of phenomenon and from some basic perspective there are different valid descriptions and explanations. A classic levels-of-analysis issue is the relation between physics and biochemistry (see Sellars, 1963/2007). The question here is about the relation between the theoretical concepts and methods of biochemistry and those of physics. We have two disciplines, both setting out from the same basic perspective towards the physical world, but addressing ostensibly irreducible phenomena via distinct methods. I say that the phenomena are ostensibly irreducible because there are many who maintain that the explanatory concepts of biochemistry are in fact reducible to those of physics. The point here is not to take a stand on the issue, but to note the debate. And there are many such debates regarding level-of-analysis issues.

In these debates, according to some, levels-of-analysis issues always amount to this: with regards to some type of phenomenon there are different descriptions and explanations, and only those positing the smallest / simplest / most material, / etc. are valid. This is suggesting that there are levels of illusion layered on top of some most basic, most real, foundation. We could label this as a type of reductionism. Now, I'm not saying there are no illusions. Nor do I think that all the disciplines are equally valid in their descriptions of phenomena. However, if two disciplines are cooperating in a common endeavor there should not be unwarranted privileging of certain disciplinary perspectives.

This is just to say that we need to be careful when different disciplines get together. As noted by many philosophers, including Piaget (1972), Sellars (1963/2007), Habermas (1984), and Wilber (1995), there is a tendency towards reductionism in interdisciplinary endeavors. This tendency makes levels-of-analysis issues an important addition to our language of evaluation.

The next section deals with another set of distinctions worth preserving.

Step 2, Part 2: The Human Sciences and the Natural Sciences

That this topic has its own section may be confusing to some. Many think that this topic is a levels-of-analysis issue. Following Piaget and others, I want to argue that it is not. The idea is this: levels of analysis are different descriptions of phenomena viewed *from the same basic perspective*; while the human and natural sciences actually involve *different basic perspectives*. Kant, Habermas, and Wilber make this point very clearly.

Kant (1787, A 550/N 578) makes a distinction between two *basic perspectives* we can take on human actions. From *the theoretical perspective* (the view of natural science) causes and forces *determine* human actions. Humans are objects nested in systems of causes with other objects. From *the practical perspective* (the view of a participant observer) actions result from the spontaneity of the agent, and occur for reasons typically available to that agent. Humans are subjects reasoning and acting autonomously. For Kant this is an antinomy: both views are equally valid.

Habermas (1984, 1990) concurs. He proposes a model of communicative rationality in which different forms of argumentation and language-use reveal different incontrovertible perspectives on the world. He notes two forms of language use (1990, p. 24), one in which *you say (to yourself) what is the case*, the other in which *you say something to another and establish mutual understanding*. He sees these as indicative of basic perspectives: in the first perspective *we relate to objects*; in the second *we relate to others like ourselves*. No doubt, all sciences involve communications between scientists. But in the human sciences the communicative perspective is ubiquitous; we are necessarily *participant observers*. Natural scientists talk to one another, but not to the objects they study; they take an *overtly objective* view of these phenomena.

Wilber (1995, 2006) gets right down to the point. He posits several “primordial perspectives,” and following Habermas and Kant links them to our most basic pronouns: I, WE, and IT. There is a big difference between relating to objects (I - It) and relating to other subjects (I - thou = WE). He suggests that some of the most important methodological differences between the disciplines hinge around these primordial perspectives. He offers a model based on these perspectives that can serve to scaffold a taxonomy of methodologies.

With these basic ideas the point should be clear. Not all complications that arise in inquiries involving more than one discipline are levels-of-analysis-issues. There are more basic *perspectival issues* as well. The paradigmatic cases of such issues can be found when we try to merge the human sciences with the natural sciences.

For example, medical diagnostics and neurological accounts of the mind entail applying the basic perspective of the natural sciences to human subjects. We set out from a perspective in which we face only objects; here we take an *overtly objective* view of a human. That's fine. We need that kind of knowledge. But more often than not these come to be nested in broader efforts involving multiple disciplines, such as efforts towards healthcare or education. In cases like these we run the risk of denying the validity of disciplines setting out from other basic perspectives, such as richly *inter-subjective* practices like psychotherapy, ethics, or pedagogy. *These* set out from a perspective in which we face other subjects like ourselves. We may gather data and strive for objectivity as participant observers, but when we study humans we never relate to mere objects.

So the human sciences set out from a fundamentally different basic perspective than the natural sciences. Blurring the distinction is not only dangerous; it's fallacious. Human scientists misunderstand their endeavor if they think they can simply treat subjects as objects. I don't have space to outline the methodological and ethical implications of this (but see Habermas, 1984, 1987, 1990; Wilber, 1995).

Summary of Step 2's Epistemological Point

We've seen two different epistemological issues that are relevant to endeavors involving more than one discipline. There are *levels-of-analysis issues*, and *perspectival issues*. Both should be

on every interdisciplinarian's radar. And they should be added to the language of evaluation we've been constructing. But before discussing this, I offer Figure 3 as a way of making the epistemological points stand out.

Disciplines set out from different basic perspectives and so face different domains of phenomena, where they home in on different levels of analysis. Inquiries involving disciplines setting out from the same basic perspective deal with levels-of-analysis issues. Inquiries involving disciplines setting out from different basic perspectives deal with perspectival issues.

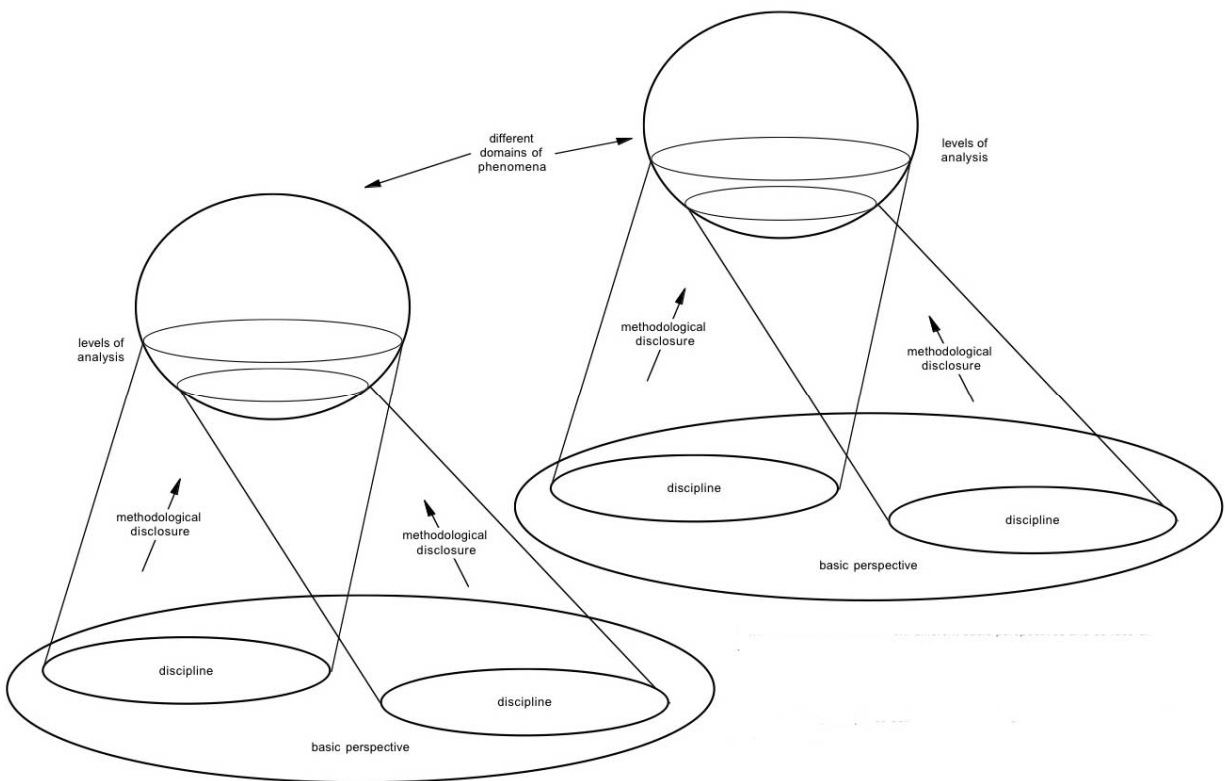


Figure 3. Sources of Levels-of-Analysis and Perspectival Issues

What Figure 3 adds to our language of evaluation should be clear. We've isolated two epistemologically-salient properties that bear on the worth of endeavors involving more than one discipline: *levels-of-analysis issues* and *perspectival issues*, which are not to be seen as coterminous. We can now argue about how various undertakings fare with regards to *the epistemological structure of knowledge claims involving more than one discipline*.

These reflections also suggest that reductionism is not so simple. If we're striving to envelop various disciplines—as educators, problem solvers, or researchers—we can't just presuppose that there are privileged perspectives and levels of analysis. If we keep the epistemological issues on the table, then we need reasons for every reduction. We need to account for every level or perspective we ignore. Otherwise, we fall back behind our claim to have employed more than just the discipline we favor. Disciplines demand differentiation *before* they are available for integration. This doesn't mean that everything out there is valid. But to spawn healthy endeavors

involving more than one discipline the default epistemic position should be one of open-minded disciplinary tolerance, not one of skeptical disciplinary xenophobia.

Conclusion: Integral Methodological Pluralism

I'll recap the story to this point. We began by noting that the term interdisciplinary means too much. It's over used. In search of a more specific definition, we discussed the progenitors of contemporary interdisciplinarity, which revealed the *significance* and *variety* of interdisciplinary motivations. Moving forward from this historical context we turned to the contemporary scene to see the various forms of what passes as interdisciplinarity today. This rounded out our descriptive account and provided a rough sense of what interdisciplinarity is generally taken to be. However, evaluating interdisciplinary endeavors, of whatever type, requires more than a descriptive undertaking. So the project of building a language of evaluation began where the descriptive accounts left off.

It became clear that the *competencies* of individuals and groups bear upon the quality of interdisciplinary work. By looking to work done in cognitive development, we formed a hypothesis that there is in fact a *hierarchical taxonomy of forms of inquiry involving more than one discipline* (Table 1). By taking the development of competencies seriously (both in individuals and in groups) we effectively differentiated the following set of endeavors, each more complex than the next: multi-disciplinary, cross-disciplinary, inter-disciplinary, and trans-disciplinary.

But this hierarchical taxonomy based on *complexity* was seen to be in need of supplementation by an epistemological taxonomy concerned with *validity*. So we looked to a handful of philosophers to distil the general *epistemological structure of knowledge claims implicating more than one discipline*. This involved differentiating between levels-of-analysis issues and perspectival issues. Perspectival issues concern fundamentally distinct and irreducible stances towards the world: most importantly the difference between standing in relation to *others* vs. standing in relation to *objects*. Levels-of-analysis issues concern differing descriptions of comparable phenomena disclosed from the same basic perspective: e.g., biochemistry vs. physics. These are two *types* of epistemological concerns that arise in endeavors involving more than one discipline. As such, they must be added to any language used to evaluate the quality and validity of these endeavors.

While our lexicon for interdisciplinary evaluation is not lengthy, it is robust.

We've sketched the contours of important competences and fallacies. Understanding these helps us understand what it really takes to be interdisciplinary. Moreover, and to conclude, it also suggests an ideal *modus operandi* for endeavors involving more than one discipline. I claim that the ideal of an Integral Methodological Pluralism (Wilber, 2006) is supported by both the hierarchal taxonomy of competencies and the epistemological concerns.

As it stands, Integral Methodological Pluralism is a meta-disciplinary framework that specifies a taxonomy of disciplines organized around eight primordial perspectives. It's laid out against a backdrop in which cognitive development figures prominently, knowledge is verified procedurally, and reductionism is on the radar as a major concern. All this makes it very close to the account offered here.

But more importantly, and to break slightly with the orthodoxy, I claim Integral Methodological Pluralism is less significant as a *substantive* view (e.g., *exactly this many methodologies; only this many levels*, etc.) and more significant as a *formal, normative*

perspective on how we ought to proceed when endeavoring to employ a variety of disciplines. This interpretation is not far from the one proposed by Crittenden (1997), where he suggests that the integral method trumps its substance, and that this method is best understood as a type of *critical theory*. That is, the “Integral Vision” does more than describe how various methods hang together; it offers a *regulative epistemic ideal* in light of which less than integral approaches can be criticized. Similarly, I see Integral Methodological Pluralism as a *normative meta-disciplinary inquiry catalyst* that can be unpacked at any level of competency to insure a healthy manifestation of interdisciplinary energies.

However, what has been laid out in this paper is not contingent upon this interpretation of Integral Methodological Pluralism. I mention it because meta-disciplinary languages of evaluation are in short supply. We should see what's available. And I see it, like I see the work done here, as an attempt to bring clarity to confusion by outlining a meta-disciplinary framework with normative bite. Of course, we need more meta-disciplinary knowledge workers and concomitant institutional structures if any of this is to fly. It is clear to me that new types of inquiry-based future-oriented communication communities will emerge and that meta-disciplinary models will be needed to orient their epistemic endeavors. The more we want and need to know, the more we'll need to clarify to ourselves what we are up to. Quality control becomes paramount as interdisciplinary knowledge production proliferates.

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