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Creating Interdisciplinarity: Grounded Definitions from College and University Faculty

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Abstract

Definitions of interdisciplinarity often focus on the integration of disciplinary concepts or perspectives. Few definitions, however, are grounded in the work of faculty who conduct interdisciplinary scholarship. To better understand the practice of interdisciplinarity in research and teaching, and its implications for academics' professional lives, I interviewed college and university faculty affiliated with a variety of liberal arts and sciences disciplines in four U.S. institutions of varying size and mission. The study explored how interviewees practiced interdisciplinarity; how institutional, departmental, and disciplinary locations affected their scholarly identities, professional associations, and work lives; and the kinds of rewards they reaped from interdisciplinary work. In this article, I analyze a subset of the interviews, examining explicit and implied definitions of interdisciplinarity and their relationship to faculty members' understandings of disciplinarity and scholarly work. The analysis reveals that definitions of interdisciplinarity that emphasize integration exclude some forms of interdisciplinary work. I therefore suggest an alternative, more inclusive conceptualization that strives to encompass a range of interdisciplinary practices. Further study of interdisciplinary research and teaching might confirm that all interdisciplinary scholarship can be categorized according to the typology described here – or it might provide evidence of additional forms of interdisciplinarity.

Introduction¹

In *Crossing Boundaries: Knowledge, Disciplinarity, and Interdisciplinarity*, Julie Thompson Klein suggested that the first use of the term “interdisciplinary” may have been by members of the Social Science Research Council (SSRC) in New York City in the mid-1920s, where it originated as bureaucratic shorthand for research that involved two or more of the several professional societies that comprised the SSRC. Since then, many definitions of interdisciplinarity have been advanced. Many of these definitions emphasize the integration of disciplinary perspectives as a marker of interdisciplinarity (e.g., Birnbaum; Cotterell; Hanisch and Vollman; Hausman; Klein; Kockelmans; Epton, Payne and Pearson; Hermeren). Proponents of integration-based definitions often argue that interdisciplinary projects achieve a higher level of integration than multidisciplinary projects that merely concatenate disciplines or their components (e.g., Rossini and Porter). Faculty working on multidisciplinary projects are presumed to behave as disciplinarians with differing perspectives, whereas participants in interdisciplinary projects are

believed to purposefully seek integration of disciplinary perspectives and thus engage in more cross-communication and cross-coordination.

Many early definitions of interdisciplinarity presumed that scientific inquiry, as it occurs in the natural and physical sciences, was the model for all inquiry; interdisciplinary inquiry therefore, regardless of the disciplines involved, would resemble scientific inquiry. Today, scholars are less apt to assume that interdisciplinary inquiry should mimic scientific research. Recent explorations of interdisciplinarity in fields beyond the sciences acknowledge the existence of a variety of interdisciplinary approaches (e.g., Messer-Davidow, Shumway and Sylvan; Klein; Salter and Hearn). For example, by highlighting scholarship in women's studies, ethnic studies, cultural studies, and literary studies, Klein (*Crossing Boundaries*) illustrates how calls for interdisciplinarity are frequently part of a larger project to redefine knowledge. While the redefinition project might logically include integration of disciplinary perspectives, for some scholars, it requires dismantling disciplinary perspectives rather than integrating them. These newer conceptualizations call attention to the varying epistemological commitments and goals of interdisciplinary scholars (e.g., Lattuca; Salter and Hearn).

Although the picture of interdisciplinary scholarship is expanding, we still have few empirical studies of interdisciplinarity. In this paper, I utilize data from a study of interdisciplinary research and teaching among college and university faculty to construct a grounded definition of interdisciplinary scholarship. This approach reveals the limitations of some accepted definitions and provides an alternative conceptualization intended to encompass the range of interdisciplinary work done by college and university faculty.

An Overview of the Study

These data on which this work is based were collected as part of a larger study that examined the processes by which faculty pursued interdisciplinary scholarship, the effects of institutional, departmental, and disciplinary locations on their work, and the professional and intellectual outcomes they realized from interdisciplinary work. The dataset consisted of interviews with college and university faculty involved in a variety of interdisciplinary scholarly activities at four different U. S. institutions (for further details, see Lattuca).

The definition that guided the study specified a range of potential interdisciplinary interactions and accommodated different, even competing, types of interdisciplinarity:

Interdisciplinary — An adjective describing the interaction among two or more different disciplines. This interaction may range from simple communication of ideas to the mutual integration of organising concepts, methodology, procedures, epistemology, terminology, data, and organisation of research and education in a fairly large field. An interdisciplinary group consists of persons trained in different fields of knowledge (disciplines) with different concepts, methods, and data and terms organised into a common effort on a common problem with continuous intercommunication among the participants from the different disciplines. (OECD 25-26)

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This definition assumes a disciplinary basis for interdisciplinarity, but it does not exclude forms of interdisciplinarity in which the disciplines are not central. It also recognizes a wide array of interdisciplinary work; rather than establishing a fixed point at which interdisciplinary integration occurs, the definition suggests that interdisciplinarity exists on a continuum. On one end of this continuum is the informal communication of ideas, such as might occur in a conversation between colleagues from different disciplines; on the other end is formal collaboration, such as research or teaching teams comprised of faculty from different disciplines.

I selected faculty participants for the study from four sites: a research I university, a doctoral I university, and two liberal arts colleges.² Using a purposeful sampling strategy, I first identified faculty on each campus who had participated in interdisciplinary activities during the two years prior to the study and then chose a heterogeneous sample of participants who varied by type of interdisciplinary activity and by characteristics that might influence perceptions of, and participation in, interdisciplinary (and collaborative) scholarship, such as disciplinary affiliation (see Biglan; Becher), gender (see Roberston; Cameron and Blackburn), and academic rank (see, for example, Birnbaum; Hurst; Nilles; Fox and Faver).

Twenty-two of the study participants were full-time university faculty; the remaining 16 held full-time faculty positions at the two liberal arts colleges. All were tenure-track faculty. Participants received their doctoral degrees in sixteen different academic disciplines. Compared to the general population of faculty in the U.S., social science faculty and women are over-represented in this sample, and humanities and science faculty are under-represented. (Table 1 provides a demographic profile of the participants.) The majority of the 38 informants participated in both formal and informal interdisciplinary activities.³ Most had interdisciplinary teaching and research experience; all but two considered at least one of their research projects to be interdisciplinary and all but six taught at least one interdisciplinary course in the two years prior to the study. Several served as directors of interdisciplinary seminar programs in the sciences, social sciences, or humanities. About one-third served as members of committees that created or monitored programs such as Black studies, urban studies, women's studies, and environmental studies.

Table 1
Characteristics of Study Informants

	Number	%
Gender		
Men	20	52.6%
Women	18	47.4%
Race/Ethnicity		
White	34	89.5%
Minority	4	10.5%

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Rank

Assistant Professor	5	13.2%
Associate Professor	15	39.5%
Professor	18	47.4%

Type of Employing Institution

Research university	12	31.6%
Doctoral university	10	26.3%
Liberal arts college	16	42.1%

Doctoral Institution

Research I university	35	92.1%
Research II university	2	5.3%
Doctoral I	1	2.6%

Doctoral Discipline

Natural/physical science	10	26.3%
Social science	20	52.6%
Humanities	8	21.1%

I analyzed the interview data using an iterative process of analytic induction, identifying categories and subcategories in the data and then clustering these into larger patterns and themes. Although the literature suggested some *a priori* definitions and categories of interdisciplinary scholarship, I did not use these to search for the themes and patterns. Rather, during the many iterations of the analysis, I continuously compared informants' statements, descriptions, and observations to build a grounded understanding of how different understandings and conditions influenced informants' work and professional experiences.

The picture of interdisciplinary work presented here may be constrained because I interviewed only faculty with doctoral degrees in traditional liberal arts and sciences fields. I made that decision because I assumed that these individuals would have stronger disciplinary views than faculty from professional fields, like business and education, which typically include the study of a variety of disciplines. (However, as I interviewed faculty, I found that the amount of work they did outside their discipline during their doctoral programs varied considerably, and I could not therefore assume that liberal arts Ph.D.s were "less interdisciplinary" than Ph.D.s in applied fields.) I also assumed that faculty with strong disciplinary backgrounds would most readily note tensions between disciplinary and interdisciplinary scholarship. A study which included faculty from applied fields and/or from professional or other

interdisciplinary units might have elicited different or more definitions of interdisciplinary work.

Grounded Definitions of Interdisciplinary Research and Teaching

Most definitions specify the integration of different disciplines as the litmus test for interdisciplinarity. In contrast, the definition that guided this study broadly defined interdisciplinarity as an interaction that involved different disciplines (but not necessarily different individuals). This definition left the question of integration open and made it possible to explore informants' understandings of interdisciplinarity without making assumptions about what these understandings should entail. I did not ask participants to define interdisciplinarity; rather I analyzed informants' accounts of research and teaching for implicit definitions of interdisciplinary research and teaching. This approach avoided the assumption that faculty agree that *integration* of the disciplines is the defining characteristic of interdisciplinary work. It also eliminated the possibility that informants might second-guess themselves, omitting experiences they might have considered interdisciplinary had they not been asked for a definition beforehand.

As I read and analyzed the words of the study participants, I compared their descriptions of interdisciplinary work to the definitions in the literature on interdisciplinarity. I found that the participants' descriptions of their interdisciplinary projects were not adequately captured by extant definitions such as multidisciplinary, auxiliary interdisciplinarity, instrumental interdisciplinarity and so on. In time I realized that informants' descriptions of their research and teaching activities could be categorized according to the kinds of questions that prompted them. Different kinds of questions led to different kinds of interdisciplinarity. Table 2 presents a typology of interdisciplinary teaching and research based on the categories of questions that faculty pursued. In the case of the category of transdisciplinarity, my definition is in substantial accordance with that of earlier theorists (e.g., Jantsch; Miller). In the case of conceptual interdisciplinarity, I happened to choose the same name for the category as another team of researchers (i.e., Salter and Hearn); my definition, however, is substantively different from Salter and Hearn's and will be explored shortly.

**Table 2:
A Typology of Interdisciplinary Scholarship**

Type of Scholarship	Teaching	Research
informed disciplinary	disciplinary courses informed by other discipline(s)	disciplinary questions requiring outreach to other disciplines(s)
synthetic interdisciplinarity	courses that link disciplines	questions that link disciplines

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transdisciplinarity	courses that cross disciplines	questions that cross disciplines
conceptual interdisciplinarity	courses without a compelling disciplinary basis	questions without a compelling disciplinary basis

Although the first category, *informed disciplinarity*, may appear more disciplinary than interdisciplinary in nature, I included it because participants consistently identified this form of scholarship as interdisciplinary. The typology is therefore descriptive, not evaluative; the presentation should not be construed as a hierarchy. The categories of interdisciplinary scholarship are distinguished by the type of research question asked, not by the degree of interdisciplinarity, the merit of the approach, or its perceived desirability.

Further study of interdisciplinary research and teaching might confirm that all interdisciplinary research and teaching can be categorized this parsimoniously, but it might also uncover additional kinds of interdisciplinary work. With the exception of transdisciplinarity, these categories and their definitions are new. In the sections that follow, I define each category and offer examples from informants' accounts of their research and teaching.

Defining the Categories of the Typology

Theorists often contend that disciplines are distinguished, at least in part, by the questions they consider legitimate (e.g., Kuhn; Becher; Phenix). In the case of interdisciplinarity, the decision to focus on questions that prompt a project, rather than on the level of integration it achieves, is further supported by informants' comments. Several participants in this study noted how learning about another discipline expanded the range of research questions that they could ask and answer. In this section, I first briefly define the categories of the typology by contrasting the kinds of research questions and teaching issues central to each. Illustrations of each category, excerpted from the faculty interviews, follow.

Informed Disciplinarity

The teaching issues and research questions of *informed disciplinarity* are essentially disciplinary in nature; that is, they are motivated by a disciplinary question. In *informed disciplinary* teaching, faculty make use of examples from other disciplines to help students make connections between disciplines, but the use of these examples does not change the disciplinary focus of the class. In research, disciplinary questions may be informed by concepts or theories from another discipline or may rely upon methods from other disciplines, but these contributions are made in the service of a disciplinary question. When does the borrowing of methods, theories, concepts, or other disciplinary components constitute interdisciplinarity? Perhaps the answer is, when that borrowing is motivated by an interdisciplinary question.

Synthetic Interdisciplinarity

Synthetic interdisciplinarity occurs when teaching issues and research questions bridge disciplines. These bridging issues and questions are of two subtypes: 1) issues or questions that are found in the intersections of disciplines, and 2) issues and questions that are found in the gaps between disciplines. In the first type of synthetic interdisciplinarity, the issue or question belongs to both disciplines; in the latter, it belongs to neither. In both subtypes, the contributions or roles of the individual disciplines are still identifiable, but the question posed is not necessarily identified with a single discipline.

Transdisciplinarity

Transdisciplinarity is the application of theories, concepts, or methods across disciplines with the intent of developing an overarching synthesis. It differs from informed disciplinarity and synthetic interdisciplinarity in that the theories, concepts, or methods are not borrowed from one discipline and applied to another, but rather transcend disciplines and are therefore applicable in many fields. The disciplines do not contribute components, but rather provide settings in which to test the transdisciplinary concept, theory, or method. Miller defined transdisciplinary approaches as “articulated conceptual frameworks which claim to transcend the narrow scope of disciplinary world views and metaphorically encompass the several parts of the material field which are handled separately by the individual specialized disciplines” (21). The disciplines therefore become subordinate to the larger framework, subsumed under what Newell calls “superdisciplines” such as Marxism or general systems theory. Sociobiology, which applies the principles of natural selection and evolutionary biology to the study of animal social behavior, is an example of a transdisciplinary approach.

Conceptual Interdisciplinarity

The final category of interdisciplinary scholarship, conceptual interdisciplinarity, includes issues and questions without a compelling disciplinary basis; these can only be answered by using a variety of disciplines. Conceptual interdisciplinarity often implies a critique of disciplinary understandings of an issue or question, as in the case of cultural studies and feminist and postmodernist approaches. In some cases, critique may be both the motivation and the desired end product. In other cases, the critique may be accompanied by an equally salient concern for integration of disciplinary perspectives.

To elucidate each type of interdisciplinary scholarship, I provide examples and compare and contrast these with other forms. For the sake of clarity, I discuss teaching and research separately, but this choice should not obscure the basic similarities between teaching issues and research questions.

Informed Disciplinary Courses

In describing their courses, faculty in the study often talked about how they used examples from other disciplines to help students achieve a broader picture of the topic or phenomenon being studied. Some explained that interdisciplinary examples were either necessary or useful for helping students make connections in discipline-based courses. Courses that introduced students to a discipline seemed to often fall into this category of interdisciplinary teaching. A biologist, for example, spoke about helping students make connections between biology and physics by providing interdisciplinary examples:

When our biology students take physics, they often don't understand why. The reason they don't understand why is that physics probably does little to transfer the physics back to biology, and we do nothing to receive the physics back to biology to show it's relevant. . . . So, when I teach animal behavior and we talk about the echo location ability of bats and signals that are in kilohertz, we do a little physics. . . . [Recently] we have been talking about electric fish. . . . There are two kinds of electric fish: some that had their batteries arranged in a series and some of which are in parallel, basic ideas in electricity, depending on whether they have a lot of voltage or a lot of amperage in their charge. And this has to do with whether they live in salt water or fresh water. So there is a biology and a nice little physics story that go side by side.

The extent to which faculty informants used interdisciplinary examples varied considerably. Some faculty reported including a few examples in their classes while others claimed to infuse entire courses with interdisciplinary contributions. A professor of Romance languages reasoned that students in her classes had to understand the political context of the literature they read: "I'll have them watch the debates going on [about] Quebec independence, even though they are reading a poem, because I want to talk about nationalist discourse. You can't get it in the poem if you can't see what's happening up there on TV." Informed disciplinary courses may be liberally sprinkled with examples from other disciplines, but these examples are not central. In this literature course, students read literature, not political treatises or histories of Quebec, despite the stated importance of the political context. The course is enhanced by the inclusion of interdisciplinary examples, but the focus is still literature.

It is important to note that the typology categories apply to *projects*, not individuals or to their scholarship generally. This Romance languages professor also taught women's studies courses that I would classify as conceptual interdisciplinary courses; the biologist team-taught synthetic interdisciplinary courses. Faculty may use different approaches depending on the subject matter and goals of the activity.

Informed Disciplinary Research

While informed disciplinary courses were common in this study, examples of informed interdisciplinary research were rare. This may reflect scholarly norms. As one informant suggested, the depth of understanding needed to teach an interdisciplinary course is less than

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that needed to do interdisciplinary research. Among my faculty informants, informed disciplinary research was limited to borrowing of disciplinary methods.

A cell biologist considered her research interdisciplinary because the technology she used was developed by individuals from different disciplines and was utilized in different disciplines. Although the technology allowed her to ask more sophisticated questions, the questions and answers she described were still solidly within the field of cell biology. She noted that the field of cell biology would not have been possible without this technology; as she put it, "It's not important to our field. It is our field. It's not dissociable." When she learned cell biology in graduate school, she used this same technology. "Microscopy is a well-respected, venerable, ancient tool in cell biology, so that's accepted interdisciplinary work. In fact, it is not even considered interdisciplinary anymore, the set of technologies."⁴

In the social sciences, where methods such as survey research, ethnography, and narrative are more often shared among disciplines, there were few examples of borrowed methods. One informant, a political scientist doing research in area studies, described his research as a form of interdisciplinary outreach, explaining

My method is to choose, increasingly, a commodity and to look at the politics of that because the instruments that are used to affect production, distribution, and growth in production of a particular commodity vary from commodity to commodity. So my method is to learn about the commodity, the nature of the production, learn about the nature of the interventions and read in a parallel manner, the general stuff about politics of the country and then look for the political explanation of why the interventions were done the way they were. The most important methodological impact on me has been economics. . . . There is a well-known book published ten or fifteen years ago by an economist who did his dissertation research in Zambia. He developed his technique into a method that drew very heavily on economics but applied it to politics. . . . I have been very influenced by that.

His goal in applying this borrowed method was to understand the distribution of political power, a traditional concern of political scientists. As he explains, the economic data answer a political science question:

When governments control prices or get involved in monopoly marketing or subsidize inputs, manipulate the exchange rate, so forth and so on, all these economic instruments have an income distributive effect. In places that don't have elections, they tell you a lot about the distribution of political power. That's the assumption. As a political scientist, what I do is I infer . . . the distribution of political power and the problems of changing the distributing of political power by watching what happens when economic instruments are manipulated in a certain way. It is kind of a roundabout way of saying I just use the economic data to tell me something about distribution of power.

As was true of teaching activities, individuals were not limited to pursuing one form of interdisciplinary research. Faculty moved back and forth among these types of scholarship.

Synthetic Interdisciplinary Courses

Synthetic interdisciplinary courses link disciplines, but unlike informed interdisciplinary courses, they focus on the contributions of only a few disciplines that illuminate an issue or question. For example, an interdisciplinary program in urban studies was composed almost exclusively of courses from the departments of sociology, economics, and political science. However, two courses in the program, an introduction to urban studies and a senior seminar, attempted to combine these three disciplinary perspectives, offering an overview of urban economics, urban sociology, and urban political science.

Elective courses or advanced courses in a major program might link disciplines in a similar manner. An economist who taught with a colleague from the religion department provided a good example of the influence of individual disciplines on a team-taught course:

We built a balance between theological arguments and economic ones. . . . I spent some time talking about different kinds of models that economists had historically used to explain development and bring it about and to show why a lot of those had limited application because they didn't fit the right settings. At the same time, my colleague was doing similar kinds of things with theology. What we tried to do when we taught the course — although, by definition it almost has to be segmented — [was that] we tried to avoid the segmentation in the sense that we didn't want the students to say, "Oh, this week is theology and the next week is economics."

In each of these examples, the disciplinary contributions to the course are apparent, and faculty members represent their own disciplines in the classroom. Reliance on disciplinary experts to explicate particular aspects of a course seems to attest to the synthetic character of the teaching approach. Synthetic interdisciplinary courses, however, differ from the informed disciplinary courses; rather than focusing on one discipline, they make substantial connections between two or more disciplines and thus have an interdisciplinary focus. Often, such courses are team-taught and/or cross-listed between or among departments.

Synthetic Interdisciplinary Research

Several scientists in the study identified the problems they worked on as sitting in the interstices between fields, and they borrowed theories and methods from other disciplines to answer their questions. In synthetic research, however, questions are not framed within a single discipline. An anthropologist explained that his research was motivated by questions from different disciplines, which had ramifications for the choice of method, the type of data generated, and the type of arguments used:

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The algorithms for determining who belongs to what race, what it means to belong to a race, differ dramatically from one culture to the next and from one historical epoch to the next, although in all cultures and all historical epochs, people seem to believe that these enormously varying racial politics are grounded in the reality of biology. So, I started looking at these things and obviously it's interdisciplinary in the sense that it's motivated by questions from different disciplines, it uses methods that come from different disciplines, [and] as a result, it uses data that are associated with different traditions and arguments about what's persuasive and what's not that come from different disciplines. So, it's almost by definition from the start, given the kind of problem that I'm looking at, interdisciplinary because it uses methods and concerns and theories from different disciplines, and it also ignores the fact that there are gaps in method and theory in each of the home disciplines.

His current research revealed the differing concerns of the disciplines of anthropology and psychology:

Anthropologists are not very concerned about how children learn about anything, the assumption being that it's a fairly straightforward process, kind of a photographic paper theory of learning. You expose children to some patent variation; they have a way of recording that variation and then come to recognize it. Psychologists have long acknowledged that learning is a much more complex process than that. On the other hand, psychologists have not explored really at all what it means to be a member of a human group and how it is that we represent knowledge about human groups, which is a starkly anthropological concern.

Synthetic interdisciplinary research questions can also be explored using research teams composed of disciplinary experts. In the following example, a member of an interdisciplinary team describes how disciplinary experts on the team each identify a piece of the puzzle to solve; eventually, the separate pieces are assembled to answer the synthetic question:

I direct a team of researchers based at five universities. Our project is to study the effects of elevated atmospheric CO₂ on whole ecosystems. We are simulating a doubling of CO₂ in the atmosphere at a biological station. . . . The team consists of five PIs [principal investigators] who are all faculty members at different institutions. . . . There is a microbiologist, a soil invertebrate specialist, a root specialist, a team meteorologist, and [a] plant physiologist. And so we recognized from the outset that it had to be a very interdisciplinary approach. We are about to add some geochemists and hydrologists. . . . The research questions demand teams. There is no way an individual can be broad enough and have enough expertise across the range of disciplines.

This model of interdisciplinary research may be more common in the sciences where research questions and methods are divisible. Here, researchers divided the ecosystem into component parts to study the effects of elevated levels of carbon dioxide on plants, microorganisms, etc.

Transdisciplinary Courses

Transdisciplinary courses focus on a concept, theory, or method that can be applied across disciplines. Informants did not provide any examples of transdisciplinary courses, although they did provide examples of transdisciplinary research. However, there is no reason to believe that transdisciplinary courses don't exist; they may simply be a less common form of interdisciplinarity. Their scarcity may also suggest that the departmental structure of colleges and universities discourages transdisciplinary courses, which, unlike other kinds of interdisciplinary courses, have even more tenuous ties to particular disciplines and departments than synthetic or even conceptual interdisciplinary courses. Alternatively, the lack of examples may reflect the extent of interest in transdisciplinary approaches.

Transdisciplinary Research

Transdisciplinary research is driven by a belief that natural and social systems, such as those studied in economics, biology, and physics, have common underlying structures or relationships. In this study, two individuals described transdisciplinary research projects in which they applied theories and/or methods wherever they thought they might be useful. A political scientist's early transdisciplinary leanings influenced his choice of graduate programs. As a math major, he looked for "a science to apply the math to." Now, as a faculty member, he pursued disciplinary projects in a well-established political science specialization as well as transdisciplinary research involving mathematical models. He offered an example of a transdisciplinary theory of cooperation that he eventually applied to evolutionary biology:

I was interested in . . . understanding how cooperation can evolve. . . . I originally conceived of this politically, for example, how to deal with the arms race, but I thought these findings would be important for biology, because . . . the rule that won was tit for tat, which is so simple, birds can use it. So I went looking for a biologist to work with and make the applications. [Name of colleague] was here at the time and he is one of the world's leading evolutionary biologists and he had a background in game theory. We were able to talk to each other — I knew enough evolutionary biology that I could talk to him on those terms. But, game theory was also a language that we could communicate in. So we wrote an article that helped establish the work in the evolutionary biology field.

This work, he contended, did not have a disciplinary basis at all and attracted the interest of economists, sociologists, philosophers, and mathematicians. He explained,

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It doesn't look to me like I am borrowing like Darwin would borrow from Malthus. It looks to me like I am working on a fundamental problem and the way I have formulated it, such as when you can get cooperation from others, just happens to be abstract enough that the applications apply to many places. It is not that I got an idea from social psychology and I used it in biology. It strikes me as having more coherence than that. . . . In a way, you might say it's nondisciplinary.

Another participant in the study, a high-energy physicist, segued from physics to statistical mechanics to dynamic systems to times series analysis, applying tools and theories in the fields of economics, biology, and finance. He described an ongoing project in which data from simple physical systems were analyzed and understood using techniques based on the ideas generated by the study of non-linear dynamic systems. "These techniques, with modifications," he explained, "can be applied, seem to be applied usefully, to a wide variety of systems such as economic systems and some biological systems."

Klein (*Interdisciplinarity*) reported that the term "method interdisciplinarity" has been used to denote methods, presumably statistical techniques, computer modeling or simulation, which can be used in more than one discipline. What is missing in this definition, however, is the recognition that a search for underlying structures or universalistic theories motivates the use of the method. The term "method interdisciplinarity" therefore only partially describes the type of interdisciplinary work performed by these two informants.

Miller intended the term "transdisciplinary," which he applied to approaches such as structuralism, general systems, and sociobiology, to connote a more comprehensive effort to identify connections or underlying similarities in natural and social phenomena. Whereas some supporters of transdisciplinarity hope their preferred conceptual frameworks will replace existing disciplinary approaches, others see transdisciplinarity as a source of coherence for interdisciplinary efforts. These two informants seem to be searching for ideas and methods that can be used across disciplines, but they are not necessarily interested in a grand synthesis of knowledge. The term transdisciplinary, despite its multiple connotations, is appropriate.

Conceptual Interdisciplinary Courses

Conceptual interdisciplinary courses assume that a variety of perspectives must be brought to bear on a particular issue or problem. Organized topically or thematically, these courses often lack a disciplinary home. First-year seminar courses that introduce new students to a variety of disciplines by exploring an issue or phenomenon are examples of such courses. Conceptual interdisciplinary courses may also serve the purpose of developing students' academic skills, such as writing or critical thinking. According to one informant, this focus on process, rather than discipline, is part and parcel of their interdisciplinary nature:

A group of us started a course for freshmen on the creation and manipulation of images. The general thrust was to help the students understand what happens when you look at things from different perspectives. . . . That course eventually

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went from that general framework to a course that really emphasizes critical reasoning. . . . That's the foundation upon which all my teaching now is built — you constantly have to be looking at alternatives, what's not being told, different perspectives. That, of course, then leads into the whole interdisciplinary thing.

Conceptual interdisciplinary courses may call on many disciplines, as a course focused on “Great Ideas in Humanity,” or a more limited number of disciplines, such as a first-year seminar in earth and mineral sciences. They may be offered as both lower- and upper-division courses, required or elective. A number of conceptual interdisciplinary courses described by faculty in this study were offered through interdisciplinary programs such as women's studies or environmental studies, serving as electives for students in other disciplines or as required courses for students in the programs themselves.

Unlike synthetic interdisciplinary courses, conceptual interdisciplinary courses are not arranged so that particular disciplinary perspectives dominate. In fact, such courses typically critique the disciplines' answers to the question they ask. One informant explained:

Part of what I see my work as doing is really exploding how people think about Black family issues. So in my marriage and family class, we start off looking at how people think about family -- What do people think family is? -- and dealing with that really fundamental question and looking at all these kinds of discussions about family over time and looking at all these images. Or saying, “What if we start thinking about culture?” Then they'll have a series of readings from different ethnic groups. “Well, what about context and class?” I'm trying to get them to say, “What if I thought about the world really differently than I'm thinking about it now. What if I really challenged some of the ways I think about family?”

In most cases, the answer to the question posed in a conceptual interdisciplinary course, and thus the course itself, has no compelling disciplinary basis. In the example above, it is difficult to determine the course's focus. Many disciplines could contribute, and it may surprise some to learn that the instructor, concerned with issues of class and culture, as well as family, is a psychologist by training.

Conceptual Interdisciplinary Research

Several informants in the social sciences and humanities rejected the widely accepted description of interdisciplinary work as borrowing and struggled for an alternative conceptualization. Some talked about the importance of theory or pointed to the lack of distinctive disciplinary questions. Overall, they suggested that interdisciplinarity constituted a different way of thinking about intellectual problems and a different way of asking questions. One informant explained,

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Maybe I even wouldn't find the borrowing of the particular theoretical concepts from particular subjects what I define as true interdisciplinarity. I think that's borrowing from a discipline to illuminate your own. But I think of interdisciplinarity as the creation of new intellectual space that's neither — it's more than the combination of the individual disciplines.

An anthropologist argued that interdisciplinarity transformed disciplines: "I haven't ever thought that the historical work would *inform* my work. I think anthropology is sort of redefining what history is, even what constitutes history — what are the ways that we can know about the past. . . . [It's] a whole sort of way of thinking about the past and the present."

Such comments suggest that one way to think about academic questions is to ask whether there is any compelling reason that they should be asked from a particular disciplinary standpoint. A political scientist, for example, suggested that her questions could be asked from several different disciplinary vantage points:

I define what I do as organization theory. . . . Organization theory, for me, is a combination of political science and the study of bureaucracy and public administration, sociology, anthropology, and psychology. It could also be economics but . . . there are a few economists whose work I use. One of the areas that I specialize in is decision-making. The psychology kind of comes in the individual decision-making and issues of leadership. Sociology comes in when you're talking about social movements and such, and political science is kind of the public domain of decision-making. That's probably where I use the most economics — the economics of information issues — and then anthropology comes in for me mostly in the way I study things, which is by doing ethnographies, mostly. So, I rely a lot on anthropological methods and concepts for kind of thinking about how to organize the world.

Certain kinds of theoretical commitments led faculty to pursue conceptual interdisciplinarity. Many of the humanities and social sciences faculty I interviewed had been influenced by feminist theory, cultural studies, or postmodernist theories, which emphasize both interdisciplinary approaches and critiques of the disciplines. A number of informants articulated the difference between the integration of disciplinary perspectives and the critique that motivates conceptual interdisciplinarity. For example, a biologist associated with both women's studies and environmental studies compared the two approaches:

I am definitely attracted to a sort of meta-look at the disciplines. I am not sure that's the same thing, however, as putting together information and perspectives from different disciplines to arrive at something new. . . . A critique of a discipline, or a set of disciplines, or of disciplinarity is different from putting information and ways of knowing from two different disciplines together to arrive at new knowledge, to create new knowledge, or to look at things in a new way.

Other informants argued that the motivations behind conceptual interdisciplinarity differed in theory, but most thought that critique and integration could both define interdisciplinarity. As one informant put it,

I think they [critique and integration] are part of the contradictions. . . . They are a microcosm of the world, for better and for worse, and the impulses I think are not as distinct and specific as that. You have some people . . . — if you want to call them factions or groups or pressure points or whatever — who are going to act most on the critique side. But then you have other people and approaches that are going to act more on the integrationist side. And they are not fighting each other. I think both of those sides are doing something to the middle — which is the status quo, which is the rigid boundary-driven thinking. And [people] will choose different strategies if they think they are going to be useful.

Another informant argued that although epistemological foundations were “very open” for her, she was nonetheless striving for integration of the disciplines in her work. To do interdisciplinary work strictly focused on critique was “just not part of my experience,” she explained. She went on, “My experience starts with going into battle with a particular discipline.” Both this individual and the Romance languages scholar quoted above noted that at the time they attended graduate school, the discourse linking interdisciplinarity and critique had not yet taken hold.

Salter and Hearn consider transdisciplinarity a form of conceptual interdisciplinarity. Based on this study, I would argue that this categorization obscures an epistemological incompatibility between the two approaches: transdisciplinarity as described by faculty in this study appears to be a search for similarities, in this case transportable concepts that can describe disparate phenomena and bridge disciplinary divides; conceptual interdisciplinarity, in contrast, marks and privileges difference and particularity. Although many of the examples of conceptual interdisciplinarity in this study came from informants influenced by feminist, poststructuralist, and postmodernist approaches, we should not yet surmise that all conceptual interdisciplinarity is consistent with these approaches to knowledge production. Additional studies may resolve the question of whether conceptual interdisciplinarity and transdisciplinarity are, always, qualitatively different approaches to knowledge.

Epistemology, Disciplinary Boundaries, and Interdisciplinarity

In this study, informants from the sciences tended to pursue synthetic interdisciplinary research. Social scientists and humanities participants, however, were as likely to pursue one kind of interdisciplinarity as another. The types of interdisciplinarity discussed here, however, should not be conflated with disciplinary groupings. Rather than disciplinary training, it is the epistemological commitments of informants that result in an affinity for a particular kind of scholarship. These commitments can be categorized into two basic epistemological stances. One set of informants, including the majority of natural and physical scientists interviewed and a subset of the social scientists, adhered to modern (positivistic or post-positivistic) approaches to

knowledge. Another group was committed to postmodern or poststructural approaches to knowledge. Virtually all informants from the humanities disciplines and a good proportion of the social scientists are included in the latter group.

Lorraine Code contrasts *regulative* (what I call positivist and post-positivist) and *constitutive* (what I call postmodern or poststructuralist) principles. Regulative principles include objectivity, value-neutrality, rationalism, and “decontextualized, ahistorical and circumstantially blind” knowledge (33). Regulative knowledge is also more hierarchical: theories are composed of concepts composed of generalized facts. In the paradigm-like realm of regulative knowledge, current work shapes future work and knowledge grows in a cumulative fashion. Constitutive knowledge, Code argues, is plural, relational, and situated and does not tend to grow by accretion. It is non-reductive, oriented to letting the objects of study speak for themselves, and concerned with understanding difference, rather than dismissing it “as theoretically disruptive, aberrant, cognitively recalcitrant” (151).

Epistemological stances influence how faculty ask research questions and teach courses. In this study, informants committed to modernist approaches chose theories and methods from different disciplines that were epistemologically consistent with their preferred ways of thinking and with one another. These scholars framed synthetic interdisciplinary or transdisciplinary questions in which content served as a link between disciplines or as a setting in which to test an application of theory or method. In conceptual interdisciplinary research and teaching, the contributions of individual disciplines were often so attenuated that the disciplinary source of the question was not clear. The critique of the disciplines that predicated conceptual interdisciplinarity led to questions and to answers that were not phrased within disciplines because disciplinary questions and answers required the exclusion of crucial perspectives.

Despite differences in epistemologies, informants from a variety of disciplines argued that disciplinary lines should not constrain the search for knowledge. They differed, however, in the extent to which they questioned the legitimacy of disciplinary boundaries. Those who worked in informed disciplinary, synthetic interdisciplinary, or transdisciplinary modes tended to be more tolerant of disciplinary boundaries than those whose interdisciplinary work was primarily conceptual interdisciplinarity. Informants with an affinity for conceptual interdisciplinarity tended to regard disciplinary boundaries as social artifacts rather than reflections of some external reality. Those who pursued modernist forms of inquiry tended to accept disciplinary boundaries as reasonable and useful, if not natural. Those who were most opposed to borders tended to work in interpretative social science or in the humanities.

Salter and Hearn suggest that transdisciplinarity and conceptual interdisciplinarity are so similar that they do not constitute different forms of interdisciplinarity. In this study, the epistemological commitments of faculty who worked on transdisciplinary and conceptual interdisciplinary projects differed on a critical dimension; individuals practicing conceptual interdisciplinarity began with a critique of disciplinarity that was not evident in the work or words of the transdisciplinary scholars who accepted the legitimacy and usefulness of disciplines and disciplinary boundaries. While the number of informants in the study is small, this difference suggests that further work is needed to better understand the epistemological commitments and distinctions among those who practice interdisciplinarity.

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Many faculty members in this study described the persistence of disciplinary perspectives in their thinking. Even individuals demonstrating consistent and deep levels of interdisciplinary engagement confessed, often with some surprise, that they still saw the world through the lens of their discipline (see Lattuca for a discussion). Contradictions and inconsistencies may be clues that individuals are grappling with their own definitions and commitments to interdisciplinarity and disciplinarity. Some may resolve such inconsistencies; others may never do so. The act of grappling, however, appears to be a valuable process by which faculty members articulate their epistemological beliefs and their willingness to enact them in their scholarship. Further study of this process may prove enlightening. For example, some have asked whether those who practice conceptual interdisciplinarity fail to recognize it as the kind of totalizing account of knowledge they profess to critique. Additional studies of the epistemological commitments of those doing interdisciplinary work are needed to explore such questions.

In this analysis I used informants' words to argue that interdisciplinary projects are motivated by interdisciplinary questions and to create a typology of interdisciplinary scholarship based on the nature of those questions. The focus on questions that inspire interdisciplinary scholarship contrasts with accounts of interdisciplinarity that assume the integration of disciplines is needed for interdisciplinarity. These definitions beg the question, "How much integration is enough?" If we do not assume that integration is the marker of interdisciplinarity and instead conceptualize interdisciplinary projects as beginning with interdisciplinary questions, our gaze shifts from the end products of interdisciplinary projects to their points of origin, and our understanding of those projects expands to include motivations, means, *and* ends.

Determining the type of question that is asked in interdisciplinary scholarship is a matter of interpretation. Gray areas between categories signal the need to refine the typology. Furthermore, a limited number of accounts generated the typology, and additional study (for example, of faculty from applied fields such as social work, education, and engineering) might suggest new categories. Still, because it is grounded in actual experiences, the typology proposed here may withstand scrutiny better than speculative definitions.

Notes

1. Portions of this paper appear in L. R. Lattuca (2001) *Creating Interdisciplinarity: Interdisciplinary Teaching and Research among College and University Faculty*, published by Vanderbilt University Press.
2. Institutional descriptions were based on the Carnegie classification in use at the time of the study.
3. Formal participation included engagement in interdisciplinary teaching or research projects on an individual or collaborative basis; informal activities included participation in interdisciplinary colloquia, symposia, workshops, or conferences, or participation in such activities in a discipline other than the home discipline (self-defined by the faculty member, but typically the doctoral degree discipline).
4. Heckhausen considered the borrowing of analytical tools, such as mathematical models and computer simulation, pseudo or auxiliary interdisciplinarity, depending on the transitory or enduring need for the method. Here, the strong association between the technology and the discipline suggest a form of

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auxiliary interdisciplinarity. But that categorization ignores the status of the field of cell biology and the fact that the borrowed tool is used in the service of a disciplinary question.

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