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EXTENSIONAL DEFINITION OF INTERDISCIPLINARITY

by

Rick Szostak
Professor of Economics, University of Alberta

Abstract: An extensional definition of interdisciplinarity – that is, a definition that identifies the types of practices that are interdisciplinary – is explained, advocated, and developed. The criteria for identifying appropriate interdisciplinary practices are outlined. Such a definition is useful both for interdisciplinary teachers and researchers who reflect on the nature of interdisciplinary practice, and for students and administrators who wish to better appreciate what interdisciplinarity involves. Critically, it facilitates identification of where along a continuum from interdisciplinarity to disciplinarity a particular field, course, or project lies. Some scholars or fields might then decide, and – importantly – know how, to become more interdisciplinary. Such a definition is arguably necessary, though hardly sufficient, in our efforts to advocate for better administrative treatment of interdisciplinarity.

Keywords: extensional, definition, interdisciplinarity, best practices, assessment, advocacy

Introduction

Philosophers distinguish intensional from extensional definitions (e.g. Cook, 2009). Intensional definitions describe the essence of a thing, ideally referring to necessary and sufficient conditions for being such a thing. By contrast, extensional definitions describe the members of a certain class: An extensional definition of “bachelor” would be a list of unmarried men. An intensional definition of interdisciplinarity would describe what interdisciplinarity is, whereas an extensional definition would identify the practices that qualify an enterprise as interdisciplinary. An extensional definition, then, would shift the focus from “what” interdisciplinarity is

toward an analysis of “how” it is performed.

This article provides an extensional definition of interdisciplinarity. But this is only possible after we have first addressed the nature and purpose of extensional definition, and then the relationship between interdisciplinarity and disciplinarity. Subsequent sections of this article in turn make the following related arguments:

1. Existing intensional definitions of interdisciplinarity are valuable but should be supplemented by extensional definition. Intensional definitions sometimes hint at extensional elements but do not provide an explicit extensional definition.
2. An extensional definition need not limit interdisciplinary freedom.
3. Extensional definition requires the existence of at least one alternative class in which practices might be placed, in this case disciplinary research and teaching. We must thus discuss the nature of disciplinarity before proceeding to an extensional definition of interdisciplinarity.
4. These two alternatives can be seen as opposing ends of a continuum. This complicates, but in no way obviates, the achievement of an extensional definition. But again we must discuss the nature of the continuum before an extensional definition is possible.
5. A manageably small set of key criteria – all necessarily associated with interdisciplinary practice – allow us to evaluate where along this continuum a particular field, course, or project lies.
6. These criteria can be summarized in an extensional definition a few sentences in length.
7. There are several important and positive implications of such an extensional definition. Any scholar or administrator who wishes to pursue or support interdisciplinarity should first know what practices this involves.

A brief concluding section follows.

Why seek an extensional definition?

The definitions generally employed in the field of interdisciplinary studies are intensional. These have proved very useful but do not fully meet the definitional requirements of interdisciplinary practice. We reprise here two of the five definitions surveyed in Repko, Szostak, and Buchberger (2014), and later in the article will address briefly extensional elements in the other three definitions. Note that these definitions, and this article, focus on what

is often termed “instrumental interdisciplinarity” or “problem-oriented interdisciplinarity” and is contrasted with “conceptual interdisciplinarity,” which involves a critique of the disciplinary structure of the academy (Salter and Hearn, 1996, is still the best source on the latter).

Klein and Newell (1998) offer the following widely-quoted definition of interdisciplinary studies:

A process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession... [It] draws on disciplinary perspectives and integrates their insights through construction of a more comprehensive perspective. (pp. 393-4)

The National Academies (2004) definition is also broadly intensional:

Interdisciplinary research (IDR) is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice. (p. 26)

The Klein-Newell definition emphasizes complex problems, disciplinary perspectives, and integration. The National Academies definition also stresses integration but adds an emphasis on techniques, tools, data, theories, and concepts as well as information and perspectives (but does not mention disciplinary insights). It is noteworthy that both definitions indicate a symbiotic relationship between interdisciplinarity and disciplines. These provide the insights (and theories, methods, and concepts) that interdisciplinarians build upon in creating a more holistic understanding. Repko, Szostak, and Buchberger, following Repko (2012, p.16), derive an integrated definition from the five definitions they survey. This adds to “drawing on disciplines” and “integrating” the idea that understanding is enhanced in a way that is potentially useful:

Interdisciplinary studies is a cognitive process by which individuals or groups draw on disciplinary perspectives and integrate their insights and modes of thinking to advance their understanding of a complex problem with the goal of applying the understanding to a real-world problem. (2014, p.28)

There are both philosophical and pragmatic reasons for pursuing extensional definitions. Wittgenstein (1953) famously questioned the very possibility of intensional definitions. Given the ambiguity of language, he believed that it was simply not feasible to precisely identify the essence of one

thing in terms of other things. He instead urged extensional definition. The best (though still necessarily imperfect) definition of the word “game” was a list of games. Philosophers have largely accepted the inherent ambiguity of intensional definitions (Margolis and Lawrence, 2011, provide a good overview of contemporary concept theory). But philosophers were arguably striving for absolute precision in definition whereas non-philosophers often find a definition that reduces but does not eliminate ambiguity to be quite useful. We need not and should not jettison the intensional definitions that have served the field well, but can accept a philosophical argument that we might be able to achieve greater precision through also pursuing extensional definition.

The pragmatic reason for developing an extensional definition of interdisciplinarity is the current state of the field of interdisciplinary studies. As was indicated in Szostak (2013) the main challenge to quality interdisciplinarity today is not those who would assert that it is impossible (as was the case decades ago) but those who would assert that it is easy. They then claim to be interdisciplinary without reflecting on what this means.¹ As a result, long-standing interdisciplinary teaching programs have been closed because scholars acting within disciplines claimed that these programs were no longer necessary since interdisciplinarity was now ubiquitous (there are many examples in Augsburg and Henry, 2009). Intensional definitions on their own have not provided a powerful academic response to such claims.

An extensional definition potentially allows us to say convincingly that a certain practice is not really interdisciplinary.² The two types of definition are best pursued in concert: Intensional definitions outline essential features of interdisciplinarity while extensional definitions describe the practices that comprise interdisciplinarity. The former may resonate more with deductive thinkers (for they involve statements of principles), the latter with inductive thinkers (for they involve lists of interdisciplinary practices). Of course, a new definition will not immediately lead to superior administrative

¹ Jacobs (2013) is suggestive. His “defence of disciplines” arguably critiques a “straw man,” an alleged form of interdisciplinarity – identified early in the book with adisciplinarity – that few associated with the Association for Interdisciplinary Studies would recognize. Notably an appreciation of the symbiotic relationship between disciplines and interdisciplinarity, which will be noted multiple times below, would remove any possibility that a book recognizing the value of specialization (which is the main thrust of Jacobs’ book) was either necessary or indicative of any challenge to interdisciplinary practice.

² We shall see below that some practices may best be viewed as only partially interdisciplinary.

understanding of interdisciplinary practices. But such a definition may provide a potential basis for a reasoned discussion within the academy regarding the sort of practices that need to be encouraged. If we allow any department to claim without question that it is inherently interdisciplinary then it is quite possible that real interdisciplinarity will be squeezed out of many institutional settings.

An extensional definition will hardly be sufficient to achieve a revolution in the way that universities – or indeed granting agencies – conceive of interdisciplinarity, but it is arguably necessary. Without a clear vision of what practices deserve to be called interdisciplinary we can hardly hope to convince the powerful to support those practices when they wish or claim to support interdisciplinarity. We may also, of course, have to convince them that these particular practices are advantageous but can hardly proceed to that step without first identifying what sort of practices we are fighting for.

An enhanced appreciation of the practices that collectively constitute interdisciplinarity should also support the evaluation of interdisciplinary enterprises of all sorts. There is, it might be noted, a disconnect between the assessment instruments that have been developed within the field and the intensional definitions noted above. Take, for example, the rubric for assessing student research developed by Wolfe and Haynes (2003). The purpose of the rubric is to measure “interdisciplinary thinking” in a reasonably objective manner. Beyond its potential utility to interdisciplinary instructors and students, the authors hope that the rubric will allow the measurement of interdisciplinary learning outcomes in a manner that can convince administrators and funders of the value of interdisciplinary education. To be sure, students would be rewarded for work showing elements of the intensional definitions above: integrating and drawing on multiple disciplines and generating a superior understanding. But they are expected to do much more than that. To get a good grade they would have to articulate a sound research question that meets various criteria; justify their choice of theories, methods, and disciplines; evaluate disciplinary insights; display an understanding of the perspectives of the disciplines that are drawn upon; draw upon multiple perspectives on the issue at hand; explicitly reflect on their research process; and integrate in order to produce and apply a more comprehensive understanding. If we are to judge the “interdisciplinarity” of our students in terms of such criteria, they and others might reasonably expect that these criteria would be reflected in our very definition of interdisciplinary studies. Notably, Wolfe and Haynes (2003) do not take intensional definitions of the field as their starting point

– though they do cite the Klein and Newell definition – but rather a set of articles outlining theories of how interdisciplinarity should be pursued. In the absence of an extensional definition these were their best sources for establishing the interdisciplinary practices they would seek to evaluate. An extensional definition of interdisciplinarity could and should tie directly to our assessment instruments. We can then potentially say to ourselves and to others: “This is what interdisciplinarity is in practice; this is how interdisciplinarity can be objectively measured; and these are the results of interdisciplinarity.”

Intensional definitions refer mostly to what a thing is whereas extensional definitions tend to stress how it operates. The definitions of interdisciplinarity cited above address for the most part what interdisciplinarity is rather than how it is performed. Indeed Repko (2012, p.16) recognizes that his synthesis definition, and the (intensional) definitions he surveyed, mostly address “what”; he appreciates that “how” can be addressed only as the process of interdisciplinary research is outlined. We will indeed find below that an extensional definition of interdisciplinarity forces us to address in greater detail the “how” of interdisciplinarity practice. And note that the assessment instrument of Wolfe and Haynes (2003) addresses mostly the “how” of interdisciplinary research.

Of course, the definitions cited above do hint at how interdisciplinarity should be pursued. Repko’s synthesis definition mentions drawing on disciplines, integrating, and the generation of a more comprehensive understanding. But without clarification it would seem that anybody reading just one paper in another discipline and drawing on it in his or her own published work in order to produce a novel understanding might legitimately claim to be interdisciplinary. Such people may thus remain firmly anchored within their own disciplinary perspective, firmly attached to their discipline’s theories, methods, and phenomena, and yet casually assert interdisciplinarity. The strategic goal of a definition of interdisciplinarity – that it clearly identifies interdisciplinary practice– is not well served in such a case. And the philosophical pursuit of precision is less well served than it might be. The simple fact is that intensional definitions alone do not adequately distinguish interdisciplinarity from disciplinarity.

It might be argued that we all know how interdisciplinarity should be pursued and what sort of practices thus deserve to be called interdisciplinary; we thus do not need an extensional definition of interdisciplinarity. Such an argument can be challenged on both empirical and philosophical grounds. First, consensus around a set of interdisciplinary practices is very

recent. It would thus be presumptuous to assume that these are common knowledge, even among interdisciplinarians who reflect on what it means to be interdisciplinary. The much larger body of people who self-identify as interdisciplinary without worrying much about what this means are even less likely to know about interdisciplinary best practices. Second, and more centrally, the purpose of definitions is to capture what is known about the essence of a term. It makes little sense to suggest that we all know what an extensional definition of interdisciplinarity would look like but stop short of actually providing an extensional definition. We might similarly have argued that we know the essence of interdisciplinarity and thus do not need intensional definitions. Definitions are ubiquitous in the world because they are useful. An extensional definition of interdisciplinarity provides useful clarity, both to those who may think they already know what interdisciplinarity is all about and to those –including our students and our administrators – for whom we might wish to clarify the true nature of interdisciplinarity.

Extensional Definition and Interdisciplinary Freedom

The task of determining which practices deserve to be called interdisciplinary may seem unattractive to many practitioners of interdisciplinarity. One of the advantages of interdisciplinarity is, after all, the freedom associated with it. Disciplines necessarily discipline. The benefits of specialization can only be achieved if there are strong pressures to conform to disciplinary preferences regarding theory, method, and subject matter. The community of interdisciplinarians naturally shrinks from the idea of limiting interdisciplinary practice. But our embrace of freedom need not imply a refusal to define interdisciplinarity as precisely as possible. And it would make little sense for us as a community to advocate for interdisciplinarity or investigate strategies (best practices) for performing interdisciplinary research and teaching while remaining uninterested in clarifying what then qualifies as interdisciplinary research or teaching.

There is an important difference between being vague and being open. We want openness. We do not want to constrain interdisciplinary scholars from any sort of valuable teaching or research practice. We must insist that an extensional definition not place arbitrary limits on interdisciplinarians. But it would be a mistake to think that we can only achieve openness by being vague about what interdisciplinarity actually means in practice. Happily, we shall see that we need not limit the freedom of interdisciplinarians to do

anything interdisciplinary. We need only carefully distinguish disciplinary from interdisciplinary practices.

Disciplinarity and Interdisciplinarity

An extensional definition would identify which practices belong in the class of “interdisciplinarity.” Indeed this set of practices can be said to determine the class. An extensional definition requires, therefore, that there must be at least one alternative class into which certain practices might instead be placed. The obvious alternative here would seem to be “disciplinarity.” Before we can identify an extensional definition of interdisciplinarity we must then first discuss this alternative class of practices. (Two other sets of practices will be addressed briefly below: Multidisciplinarity can be seen as intermediate between disciplinarity and interdisciplinarity; transdisciplinarity can be seen as interdisciplinarity plus some additional practices.)

Unfortunately a problem immediately arises. The literature on interdisciplinarity has in fact distinguished interdisciplinarity not so much from disciplines as they exist but from an ideal of specialized disciplinary research: the application of a constrained set of disciplinary theories, methods, and concepts to the study of a limited set of phenomena. It is well appreciated that there are huge advantages to specialization. A community that shares understandings of theories, methods, definitions, and phenomena can communicate easily. One need not start each article or class by reprising assumptions or definitions that are common to the community. There are also disadvantages to disciplinary specialization that create the need for interdisciplinarity. Insights that might be gained by applying theories or methods from other disciplines, redefining terminology, or investigating links with other phenomena are eschewed.

If we accept that the justification for disciplines is the advantages of specialization (as Jacobs, 2013, and many others surely do), then it must follow that each discipline should be characterized by one or a small and closely related set of research questions for which there is value in employing a constrained set of theories, methods, and concepts. It has long been recognized, though, that disciplines are historical creations. They evolve through time, taking on new questions and theories and methods, and (less often) shedding old (Repko, 2012; Weingart, 2010). If not for this historical evolution, one would have to wonder why the treatment of culture by sociologists is linked institutionally to demography and criminology rather than to the study of culture by anthropologists (and in turn wonder why that

is housed institutionally with physical anthropology). The different fields in sociology and anthropology not only investigate quite different subjects but employ quite different theories and methods. An attempt at an extensive definition of these disciplines – or most if not all other disciplines– would thus have to struggle with a congeries of quite distinct research and teaching practices.³ Our extensional definition of interdisciplinarity would suffer if contrasted with a “disciplinarity” that was identified with disciplines as they exist and thus lent itself to convoluted extensional definition.⁴

Happily our problem is a semantic challenge that can be addressed through the interdisciplinary technique of redefinition. We would have a sloppy and misleading extensional understanding of “interdisciplinarity” if we did not carefully distinguish the alternative of “disciplinarity” from meaning simply “the way disciplines are constructed at present.” We must stress that an intensional definition of “disciplinarity” as applied in this article involves the use of a constrained set of theories, methods, and concepts to study a limited set of phenomena and research questions. It does not at all imply an extensional definition of “disciplinarity” that would seek to justify why demography and criminology are housed in the same department. We can applaud the value of specialized research⁵ without necessarily approving the precise form that modern disciplines take or the hegemonic position that disciplines have assumed within the academy. We can leave to other papers the question of whether there is a better institutional structure for both

³ If we were to evaluate the degree of interdisciplinarity (see below) within sociology this would best be done by considering demography and criminology separately rather than perhaps mistakenly celebrating the diverse theories, methods, and phenomena studied by the diverse set of sociological fields taken together. The same can be said of many/most other disciplines.

⁴ One of the points made in the literature on conceptual interdisciplinarity is indeed that the structure and power of disciplines in the academy cannot be justified with a direct appeal to the advantages of specialization (Salter & Hearn, 1996).

⁵ There would be a rhetorical challenge in using “specialized” rather than “disciplinary” to define our alternative to interdisciplinarity. The word “specialized” itself has multiple meanings. We would mean it in the sense of “concentrating on a small area of a subject.” But an alternative definition of “specialized” would instead stress “requiring detailed and specific knowledge or training.” We would not want to leave the mistaken impression that interdisciplinarity does not require specific knowledge or training. Interdisciplinarity, as we shall see, involves a deep understanding of particular techniques for interdisciplinary analysis. And of course interdisciplinary scholars often ask precise questions but integrate multiple insights in answering them.

interdisciplinary and disciplinary teaching and research than the present system of disciplines and departments.

Extensional Definition along a Continuum

Are these two classes of scholarship – interdisciplinary and disciplinary – distinct? We have argued that there is a symbiotic relationship between interdisciplinarity and disciplinarity (as we have defined it). But symbiosis need not imply that these two types of research provide a clear dichotomy. Indeed the interdisciplinary strategy of transformation urges us to cope with seeming dichotomies by imagining a continuum between the two. All disciplines, and perhaps especially former interdisciplines, at least occasionally look outside for alternative theories, methods, and research questions. This practice is essential for integrative and specialized disciplinary research to be truly symbiotic; disciplines must from time to time incorporate ideas from outside if they are to benefit from interdisciplinary integration. And historically this sort of borrowing has proven an important source of disciplinary evolution.⁶

Such a continuum necessarily complicates an extensional definition. But this is a typical problem in the world of classification. The fact that class boundaries are fuzzy does not mean that we stop classifying but that we take care in doing so. If we will allow the slightest *souçon* of “interdisciplinary” activity – reading a paper from another discipline or having a chat with someone from another department – to qualify a program or field or scholar as interdisciplinary, then indeed the whole academy is interdisciplinary. A more reasonable approach – if we accept the importance of a symbiotic relationship between integrative and specialized disciplinary research – is to identify those efforts toward one end of the continuum as interdisciplinary, identify efforts at the other end as disciplinary, and confess that there may be cases in the middle that are hard to judge. Alternatively we might wish to name one or more intermediate classes (we will see below that this is the best way to address multidisciplinary).

If an economist cites one work by a sociologist, he is still operating very close to the disciplinary end of the continuum, and should certainly be considered to be performing disciplinary research (but might, as noted above, fit an intensional definition of interdisciplinarity). If the economist reflects on the disciplinary perspective of sociology, evaluates the work read

⁶ Jacobs (2013) celebrates and likely exaggerates an alternative evolutionary mechanism, that disciplines evolve in response to changing societal challenges.

in sociology in light of that perspective, and reflects on how the disciplinary perspective of economics influences economic research, he moves much farther along the continuum toward interdisciplinarity. If he integrates results from the two disciplines he moves certainly into the interdisciplinary end of the continuum.

Criteria for Extensional Definition

We can now turn our attention to outlining the nature of the continuum between disciplinarity and interdisciplinarity. It is not the intent here to identify which fields or programs deserve to be called interdisciplinary but rather to identify the criteria by which such a decision might be made. The former enterprise would be beyond the scope of one article. Moreover, it is generally advisable to achieve some acceptance of criteria for evaluation before applying such criteria. Otherwise, disagreements regarding the application of the criteria become conflated with acceptance of the criteria themselves. And the evaluation of a particular field or program will provide a moving target; it can be hoped that the existence of criteria for evaluation will in some cases encourage their achievement.

We need then to outline a series of questions that can help us to identify where along the continuum a particular enterprise might lie. Each of the questions below is asked in such a way that a positive answer implies interdisciplinarity. This is done for convenience and should not be taken to imply that interdisciplinarity is viewed as superior to disciplinary research and teaching. Once again a symbiotic relationship is advocated.

Where do these questions come from? They can only be derived from the emerging literature on interdisciplinary best practices. Repko (2012), *About Interdisciplinarity* (2013), Bergmann et al. (2012), and other works have now identified a set of strategies that seem to work in interdisciplinary research

and teaching.⁷ Happily but not surprisingly, there is considerable consensus across these works regarding the nature of best practices. We can derive a set of questions from these that achieve our goal of openness while avoiding vagueness. For ease of replication we draw here on practices identified by Repko (2012) for various steps in the interdisciplinary research process. They serve very well to distinguish interdisciplinary from disciplinary practices.

- *Was there recourse to multiple theories and methods, as opposed to a small subset of possible theories and methods (especially if these are associated with a particular discipline) being favored?* Of course, any one research project or course can only do so much. It is thus likely best to evaluate this criterion in terms of openness: Was the project or course open to diverse theories and methods or were these constrained from the outset? Did researchers consider various options before choosing a particular research strategy? Did they see value in alternative approaches? Were students encouraged to bring in alternative theories and methods in both class discussions and research papers? Since openness is generally difficult to evaluate in practice we can look for evidence that some coherent strategy for surveying relevant theories and methods and disciplines, and then choosing the most relevant, was pursued (see Repko, 2012, for examples of such strategies; Oberg, 2011, also stresses openness).
- *Likewise, was there openness to the investigation of relationships among a wide array of variables, as opposed to attention having been constrained from the outset to a small number, especially if these are generally studied within any one discipline?*
- *Was an effort made to integrate insights emanating from different disciplines (or perhaps different areas of specialization within a*

⁷These sources also recommend “reflection”: Interdisciplinary scholars should reflect on the nature of interdisciplinarity, and on their own possible biases. Schneider (2004) identifies reflection, along with drawing connections and integrating, as a key goal of integrative education. Reflection is not included here in part because it would be hard to assess (we can all pretend to reflect) and because disciplinary scholars should also reflect. Likewise, while testing and communicating (the other elements of Repko’s tenth step in interdisciplinary research) present particular challenges to the interdisciplinary scholar, these are tasks that disciplinary scholars also perform. The criteria below address the rest of Repko’s steps: choosing a suitable question; identifying relevant theories, methods, phenomena, and disciplines; evaluating disciplinary insights; and integrating these in order to achieve a more comprehensive understanding.

*discipline) in order to achieve a more holistic understanding?*⁸ Since integration is a creative exercise – and since interdisciplinarians themselves disagree about how much integration is possible, both in general and for particular areas of inquiry – we can be flexible in our judgment of how successful integration was in a particular instance. But the literature has identified a handful of strategies that have been employed in the pursuit of integration (Repko, 2012; *About Interdisciplinarity*, 2013; see next bullet). There may well be others. We can reasonably ask if researchers employed such strategies. Likewise, we can reasonably ask of a teaching program if students have been exposed to such strategies. Students may occasionally integrate by chance if exposed to multiple perspectives on a particular problem, but are far more likely to do so if given practical advice on the difficult step of integration. Note that we should, of course, be open to alternative strategies, but can nevertheless insist on clear evidence of a coherent strategy for the pursuit of integration.

- *Was a more holistic understanding generated?* Disciplinary conclusions are most often stated in terms of the application of one favored theory. Interdisciplinary conclusions center on some “common ground” that allows synthesis of competing insights. In some cases this common ground involves an extended theory that encompasses phenomena studied in multiple disciplines. In such cases it is a judgment call as to where on the continuum a research project may lie. One could look at how many phenomena from how many disciplines were embraced. But common ground may also involve the redefinition of key terms in order to clarify different meanings in different disciplines, the mapping of relationships among phenomena studied in different disciplines, or the placement of seemingly opposing theoretical positions (e.g. people are rational or people are non-rational) on a continuum (if people are somewhat rational we can borrow from both rational and non-rational theories) (see Repko, 2012). And the more comprehensive understanding can

⁸ The combination of integration and superior understanding lies at the heart of Boix Mansilla’s popular definition of interdisciplinarity: “the capacity to integrate knowledge and modes of thinking drawn from two or more disciplines to produce a cognitive advancement– for example, explaining a phenomenon, solving a problem, creating a product, or raising a new question – in ways that would have been unlikely through single disciplinary means” (2005, p.16). Note that while the definition distinguishes interdisciplinarity from disciplinarity it says little about how in practice interdisciplinary outcomes are achieved.

be stated as a metaphor, model, theory, or product.

- *Were insights from different disciplines evaluated within the context of disciplinary perspective?*⁹ That is, were researchers or students acquainted with the core elements of disciplinary perspective, and then guided to ask to what extent the results found in a particular piece of research were driven by the assumptions typically made (theoretically and methodologically) and variables typically included or excluded by that discipline? Disciplinary research rarely operates in such a self-conscious manner (though arguably it should). Disciplinarians are often unaware of the limitations of their approach or the viability of alternatives. Interdisciplinarity starts from a recognition that disciplines discipline, and cannot proceed very far unless the insights generated by disciplines are evaluated in the context of their perspectives. Again, we can be flexible in our judgment of how successful such analysis has been in a particular instance, but can look for the use of strategies such as those identified in the literature (Repko, 2012; Bergmann, et al., 2012; Repko, Szostak, and Buchberger, 2014, chapter 8, is devoted to critically reading disciplinary texts).
- *Are research questions stated and interpreted broadly as opposed to narrowly?* The question “What are the causes of economic growth?” was understood narrowly by economists for decades as implying the statistical analysis of the relationship between growth and a handful of economic variables. It can instead be understood to imply the complex inter-relationship among a much larger set of phenomena that have tended to be studied by several different disciplines. And if we decide that, say, certain cultural attitudes may be important then we are guided to ask why these emerge in some countries rather than others. We must thus interrogate not only the question to make sure that it is broad, clear, and jargon-free (see Repko, 2012, for a set of criteria for a good research question), but

⁹ The word “evaluate” does appear in the definition of interdisciplinary education proffered by Rhoten, Boix Mansilla, Chun, and Klein: “a mode of curriculum design and instruction in which individual faculty or teams identify, evaluate, and integrate information, data, techniques, tools, perspectives, concepts, or theories from two or more disciplines or bodies of knowledge to advance students’ capacity to understand issues, address problems, and create new approaches and solutions that extend beyond the scope of a single discipline or area of instruction” (2006, p.3). There is also a laudable mention of the goals of interdisciplinarity. But there is no mention of disciplinary perspective. Nor is there much detail on how these goals are achieved.

also how it is understood within a research enterprise or course. A good interdisciplinary research question is best judged by whether it encourages the various other interdisciplinary practices listed above.

To this list of criteria we might add an optional institutional criterion: *Are researchers, teachers, and students given appropriate incentives to be interdisciplinary?* We can applaud those who struggle to produce interdisciplinary research or teaching in unsupportive environments while nevertheless recognizing that interdisciplinary research and teaching are far more likely in supportive environments. Disciplinary perspective is reinforced by the actions of Ph.D. committees, hiring committees, and tenure and promotion committees. Interdisciplinary practice can also be supported by such committees, but often is not. Though the criteria above are more straightforward, for they capture the intentions and practices of researchers and instructors, this criterion is nevertheless indirectly important for it informs the likelihood that these intentions will be realized and such practices pursued. Will researchers be valued if they produce results slowly but eventually are able to publish in multiple fields (perhaps with many co-authors)? Will teachers be rewarded for the extra effort involved in interdisciplinary teaching, or will they be questioned for operating outside a narrow area of expertise? (Note here that some regional accreditation organizations in the United States are now suspicious of teaching outside one's area of expertise.) Will students be properly rewarded for performing interdisciplinary analysis? Several standards have been identified both with respect to general administration of interdisciplinary programs, and tenure and promotion of interdisciplinary scholars in particular (Lyll, et al., 2011; Klein, 2010; Augsburg & Henry, 2009; *About Interdisciplinarity*, 2013; the AIS is hoping to formally adopt some recommendations regarding tenure and promotion soon). Rubrics for evaluating the interdisciplinarity of student papers have also been developed (Wolfe & Haynes, 2003; Boix Mansilla, et al., 2009).

We should stress again that these various criteria do not discipline interdisciplinarity. Indeed, they actively encourage openness to the use of different theories and methods and investigation of connections among diverse phenomena. These practices lie at the heart of interdisciplinarity and moreover instantiate the freedom that is so important to interdisciplinarians. Note that we in no way limit the questions that interdisciplinarians seek to answer. We only encourage them to approach these in ways that are

interdisciplinary.

As suggested at the start of this article, an extensional definition necessarily delves deeply into “how” interdisciplinarity is performed. It has not been possible to outline extensional criteria in a manner that might be utilized in practice without doing so. The intensional definitions that have characterized the field till now have instead stressed the “what” of interdisciplinarity. It should not be a surprise that we can better defend and advocate interdisciplinarity if we define it extensionally as well as intensionally. Not only does such a practice accord with the advice of philosophers but it responds to the challenge of our time, namely the casual use of the word “interdisciplinary” by people who have reflected little on what this means. Nor should it be a surprise that an extensional definition leads us into questions of practice. It should be stressed that we cannot very well evaluate the degree of interdisciplinarity of any enterprise unless we have some good idea of how interdisciplinarity is best pursued.

The Extensional Definition

This paper has argued for the desirability and feasibility of extensional definition in general. Yet it makes sense to proffer a particular extensional definition that summarizes the discussion above. This definition can be used to guide interdisciplinary research and teaching, and to discuss with administrators the sort of practices that they should support:

Interdisciplinarity involves a set of practices: asking research questions that do not unnecessarily constrain theories, methods, or phenomena; drawing upon diverse theories and methods; drawing connections among diverse phenomena; evaluating the insights of scholars from different disciplines in the context of disciplinary perspective; and integrating the insights of those disciplinary scholars in order to achieve a more holistic understanding. Interdisciplinarity is most likely to be observed in institutional settings that incentivize the above practices. Interdisciplinary fields and teaching programs should exhibit all of these practices; individual courses or research projects so characterized should at least exhibit openness to the pursuit of these practices. Interdisciplinarity can be distinguished from disciplinarity, which applies a constrained set of theories and methods to a limited set of phenomena in the context of tightly focused research questions. Interdisciplinarity and disciplinarity should be seen as opposite

(and each valuable) ends of a continuum.

We have purposely not cluttered our definition by distinguishing interdisciplinarity also from multidisciplinary and transdisciplinarity. We should briefly note, though, that while multidisciplinary does juxtapose the insights of different disciplines, it does not pursue integration, and is also less appreciative of disciplinary perspective and drawing connections across disciplines. It can thus be seen as occupying an intermediate position along the continuum. Transdisciplinarity – as it is generally understood today, especially by the group of scholars associated with td-net (see Bergmann, et al., 2012) – embraces all of the practices we have identified as interdisciplinary above, but also stresses the value of integrating across insights generated beyond the academy. It also tends to advocate a team approach to interdisciplinarity. Many but far from all interdisciplinary researchers in the academy also engage beyond the academy and work in teams. We can thus consider these practices optional for interdisciplinarity but essential to transdisciplinarity.¹⁰

Some Implications of Extensional Definition

The AIS has always been a big tent, welcoming any with an interest in interdisciplinarity. Yet it has also long seen its purpose as identifying best practices in interdisciplinary teaching, research, and administration. An extensional definition of interdisciplinarity may possibly offend some whose own understanding of interdisciplinarity does not fit the definition. However, my interactions at over a dozen AIS conferences suggest that this risk is slight.¹¹ Moreover, intellectual integrity suggests that this risk would not in any case justify being unnecessarily vague in definition. An extensional definition – in concert with intensional definitions – makes it clear what interdisciplinarity is and what interdisciplinarians should do.

¹⁰ The literature on transdisciplinarity also stresses the importance of case studies. Case studies also are often but not always pursued by interdisciplinary researchers.

¹¹ There have long been scholars of interdisciplinarity who have doubted the very possibility of integration. Miller (2008) for example developed in detail three different perspectives on international political economy but did not feel that these could/should be integrated. Within the approach advocated in this article, Miller's analysis can still be considered interdisciplinary, but not completely so. Importantly other scholars might choose to build upon his work and attempt some sort of integration of insights from these three perspectives.

It thus accentuates the value of a community of scholars that pursues the identification of interdisciplinary best practices.

The AIS has recently announced the creation of “sections” that will explore (among other things) how interdisciplinarity is practiced within certain fields. Such fields may well lie at different points along the continuum described above. This article would suggest that such sections could encourage movement toward the interdisciplinary end of the continuum, if it is deemed that the field (or some working within the field) should indeed be more interdisciplinary. And they can do so by describing how strategies for asking sound interdisciplinary questions, evaluating insights, integrating insights, utilizing a more diverse range of theories, methods, and phenomena, and following recognized guidelines for evaluation, are valuable within the particular field. The AIS can thus serve as a home where interdisciplinary practice is encouraged across diverse fields in both teaching and research.

As suggested above, extensional definition should be linked to assessment. Assessment can serve both summative and formative purposes. Much of this article has focused on the summative. It has argued that an extensional definition is invaluable in encouraging and facilitating institutions that claim to be supportive of interdisciplinarity to indeed support the practices that actually comprise interdisciplinarity. The preceding paragraph has stressed the formative. Programs or individual researchers or teachers who wish to move toward the interdisciplinary end of the continuum can only do so if they understand in which ways they are not already interdisciplinary. An understanding of what needs to be done can also help people determine whether they do indeed wish to pursue a greater degree of interdisciplinarity. This formative aspect of extensional definition and evaluation can mitigate any hostility that summative application may encourage. It should be clear how to become more interdisciplinary. Recall also the symbiotic relationship between disciplinary and interdisciplinary research or teaching. Enterprises that are actually disciplinary but believe themselves to be interdisciplinary will benefit – intellectually if not always strategically (they may, for example, no longer feel comfortable applying for interdisciplinary research grants) – by recognizing what they really are.

We would do a disservice to our continuum if we left the impression that the only desirable points along it were the endpoints. Given the symbiotic relationship between disciplinarity and interdisciplinarity there may well be value in research and teaching practices that contain elements of each. But it is hard to say: Disciplinarity has received centuries of philosophical and practical

attention, interdisciplinarity a fraction of that, and the continuum in between virtually none. The literature on interdisciplinary best practices appreciates that certain strategies may prove more useful in some situations than others. One hypothesis would be that it makes sense for individuals, projects, and courses to lie at different points along the continuum, but that fields should be clearly either disciplinary or interdisciplinary. Further research is called for.

Interdisciplinary studies itself appears to qualify as an interdisciplinary field. Some pieces of research in the field, such as applying cognitive science to the pursuit of common ground, are themselves not very interdisciplinary. But the field as a whole certainly is interdisciplinary, not because it studies interdisciplinarity but because so many diverse fields have something to contribute to understanding interdisciplinarity. And it is unsurprising that scholars of interdisciplinarity have been inclined to draw upon multiple disciplines in attempting to understand their enterprise.

The arguments of the preceding paragraphs have broader implications. Research that is disciplinary or only partially interdisciplinary may nevertheless support an interdisciplinary research project. Likewise, an interdisciplinary course or project may have components that are disciplinary or only partly interdisciplinary. We are thus guided yet again to appreciate the entire continuum. And we are guided also to ask the question “Is it interdisciplinary?” at the most inclusive level possible: field rather than paper rather than research project; program rather than course rather than individual class.

The Case of Interdisciplines

What about interdisciplines? The similarity in terminology between “interdiscipline” and “interdisciplinarity” suggests that interdisciplines should be considered interdisciplinary. But Fuchsman (2012) has shown that interdisciplines with seemingly interdisciplinary titles can on close examination prove to be disciplinary in practice. Consider a field of study which emerges from two or more disciplines but comes over time to behave in a narrowly specialized manner. It identifies a small set of preferred theories and methods, it develops a shared vocabulary, and it develops its own departments and Ph.D. programs that emphasize not integration but rather this constrained set of theory, method, and concepts. In this (perhaps) extreme case, the conclusion must be that the field is no longer interdisciplinary but in fact is now effectively performing disciplinary research and teaching.

Such an interdiscipline fits our definition of “disciplinary” precisely. It might, though, also fit an intensional definition of interdisciplinarity by claiming that it once borrowed from parent disciplines, that it once integrated theories or methods from parent disciplines, and that it produces insights different from its parent disciplines. But it will not fit our extensional definition of interdisciplinarity for such an interdiscipline fails to pursue most of the practices that comprise interdisciplinarity. It no longer draws new insights from multiple disciplines. It does not usually state research questions that require insights from outside the field. Its research tests a small number of theories with a limited set of methods, rather than seeking insights from diverse theories and methods. It does not engage with disciplinary perspective. Like any discipline it may occasionally borrow an insight from outside, but it remains very close to the disciplinary end of the continuum.

My sense is that biochemistry is now a “disciplinary” interdiscipline. Gender studies, on the other hand, is somewhere in the middle of the continuum (see Lichtenstein, 2012, for a discussion of how the word “interdisciplinary” is employed in that field). A teaching program (including a general education program) that exposes students to several different disciplines but makes no attempt to integrate these lies somewhat farther along the continuum toward interdisciplinarity (we might call it “multidisciplinary”). Only a program that then also guides students to integrate insights generated from diverse perspectives approaches the interdisciplinary end of the spectrum.

The key lesson here is that care must be taken in assuming that any field or program with a broad or compound title must be interdisciplinary. If such fields are implicitly included within an extensional treatment of interdisciplinarity (that is, one that lists types of interdisciplinarity) – by say being included in a survey of interdisciplinary fields or programs – then interdisciplinarity itself is rendered meaningless. The practices of a field or program must be examined, and only those toward the interdisciplinary end of the continuum should be considered interdisciplinary. (Szostak 2016, forthcoming, discusses how an interdiscipline can be encouraged to pursue interdisciplinary practices.)

Concluding Remarks

This article first promoted the value of an extensional definition of interdisciplinarity that would identify the set of practices that qualify as interdisciplinary. It then described a continuum between interdisciplinarity

and disciplinarity. It then specified criteria for identifying where along this continuum a certain research or teaching practice might fall. Those criteria are outlined in bullet points in the text above. An extensional definition was derived from those criteria. The article closed by exploring some implications of an extensional definition.

Gresham's Law states that "bad money chases out good money." In a time of coin currency people naturally hoarded unblemished coinage while spending clipped and damaged coins. Coins in circulation thus tended to be "bad" coins. A similar argument can be made about interdisciplinarity. Just as coins have an exchange value there is value in claiming to be interdisciplinary in an era in which granting agencies and university presidents laud interdisciplinarity. But why "exchange" good interdisciplinarity if these granting agencies or administrators are equally willing to accept false or superficial interdisciplinarity? Interdisciplinary research and teaching are immensely rewarding intellectually, but there is abundant evidence that they both are harder and take longer to achieve desirable results than disciplinary research and teaching (Lyall, et al., 2011). It is thus much easier to "exchange" the pretense of interdisciplinarity rather than the real thing. Gresham's Law could only be subverted if bad coins were not accepted in exchange. As long as clipped coins were legal tender they would be spent, while good coins were kept in case their metallic value might one day exceed their face value. The interdisciplinary counterpart to Gresham's Law likewise can only be subverted if granting agencies and university administrations have (and heed) a precise definition such that they can distinguish good coins from bad coins. Or, to return to our discussion of continua – and thus move away from emotive terms such as "good" and "bad" – only if these authorities know which practices are indeed interdisciplinary – and researchers and teachers themselves know how to move toward the interdisciplinary end of the continuum – will interdisciplinary projects thrive. Otherwise, many researchers and teachers will not even bother to "mint" real interdisciplinary projects. As suggested in the introduction, an extensional definition on its own is not sufficient to change the world, but may well be necessary. We must first clearly identify which practices are interdisciplinary before we can either advocate effectively for them or pursue them in our own teaching and research.

Biographical Note: Rick Szostak, Ph.D., is Professor of Economics at the University of Alberta, and was President of the Association for Interdisciplinary Studies 2011-14. He is the author of a dozen books and over forty articles, all interdisciplinary in nature. His research has focused for the last twenty years on facilitating interdisciplinary research and teaching. Key publications include *Classifying*

Science: Phenomena, Data, Theory, Method, Practice (2004), “Modernism, Postmodernism, and Interdisciplinarity,” *Issues in Integrative Studies* (2007), *The Causes of Economic Growth: Interdisciplinary Perspectives* (2009), “The State of the Field: Interdisciplinary Research,” *Issues in Interdisciplinary Studies* (2013), and *About Interdisciplinarity*, a website hosted by the Association for Interdisciplinary Studies (2013). He co-edited *Case Studies in Interdisciplinary Research* (2012) and was a contributing author to *Introduction to Interdisciplinary Studies* (2014). He is a contributing author to the forthcoming third edition of Allen Repko’s *Interdisciplinary Research: Theory and Process*. He has taught courses on how to perform interdisciplinary research and served as a consultant to interdisciplinary research groups. He has also published several articles and is co-authoring a book, *Interdisciplinary Knowledge Organization*, which argue for the desirability and feasibility of a new approach to classifying documents and ideas (for libraries and online) that would facilitate interdisciplinary research.

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