Understanding Relations between Disciplines in the Information Field.  

**A Multidimensional Approach**

Dorte Madsen

Copenhagen Business School, Denmark


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Abstract

The purpose of this paper is to explore the challenges of developing a shared conceptual framework for the Information Field, based on interdisciplinary theory. This paper argues that to study the Information Field, we need a multidimensional framework that includes disciplines and discipline-based assumptions. The paper makes a case for an analysis of disciplinary components and suggests a 3-dimensional matrix with material fields (information, technology, people) along a horizontal axis, analytic levels of disciplines along a vertical axis, and problems along a depth axis. The proposed model is an attempt to conceptualize some of the elements that should be included in a framework, and it represents a first step towards understanding and identifying the complex underpinnings of the relations between disciplines in the Information Field. The 3-dimensional matrix offers a lens through which to view the contributing disciplines.

Keywords: interdisciplinarity, conceptual framework, information field, material fields, disciplinary components

1. Introduction

The purpose of this paper is to explore the challenges of developing a shared conceptual framework for the Information Field, based on interdisciplinary theory.

The Information Field (or iField) is a term created by the Information Schools (iSchools). On their collective web page it is stated that “The study of information is interdisciplinary, fed by multiple diverse fields.” and “The study of information focuses on the intersection of information, technology, and people, which requires a broad interdisciplinary approach to those phenomena, the relationship between them, and their relationships to other aspects of culture and human endeavor.” (iSchools Organization, 2012a).

Multi- and interdisciplinarity are assumed to be a defining characteristic of the Information Field (Bruce, Richardson and Eisenberg, 2006; Debons and Harmon, 2006; Dillon and Rice-Lively, 2006; Harmon, 2006; King, 2006; Thomas, Von Dran, and Sawyer, 2006; Zhang and Benjamin, 2007; Larsen, 2010; Wu, He, Jiang, Dong and Vo, 2011; Dillon, 2012; Madsen, 2012, and Wiggins and Sawyer, 2012). There seems to be a need for articulating a conceptual framework for the Information Field. Thomas et al. (2006, p. 17) call for an “integrative framework” and stress the power of a “synergistic approach” drawing from multiple theories, methods, disciplines and perspectives (p.18). Leveraging the power of this synergistic approach, they state “the I-School community will be able to both articulate and engage the grand challenges that encompass an increasingly digital, global society” (p. 18). According to Bruce et al. (2006, p. 12). “The information field is not simply a confluence of other fields, but rather it is a science in its own right with theoretical foundations, understandings and principles.” But which are these theoretical foundations, understandings and principles?

The focus on “the intersection of information, technology, and people” has no theoretical foundation. The entities: information, technology and people are referred to in the Information Field literature as “phenomena” (iSchools Organization, 2012a), “the three foundation elements of the information field” (Eisenberg and Dirks, 2008, p. 1), “components” (Olson and Grudin, 2009, p. 17) and “fundamental components” (Zhang & Benjamin, 2007). According to these authors, these entities interact, intersect and/or integrate. But little is known about the nature of these entities, are they fields, disciplines, concepts? Do they have some sort of specific ontological status in the Information Field? Or have they developed into taken-for-granted entities that were a useful
common denominator when the Information Field was created? At the same time as relying on these entities, Information Field authors claim that interdisciplinarity is required. But how can an approach to information, technology, and people be interdisciplinary if we do not know exactly what it is that intersects, interacts or integrates? “Phenomena”, “foundation elements”, “components” and “fundamental components” cannot interact or integrate; disciplines can.

In general, little attention is given to the role of disciplines in the Information Field literature. It is argued that to be able to develop an analytical framework for the Information Field and to discuss interdisciplinarity, the disciplines serve an important function in bridging, analytically, the gap between the entities: information, technology, people and interdisciplinarity. And the paper further argues that such an analytical framework should be informed by the literature on interdisciplinarity.

This paper makes a case for an analysis of disciplinary components (Note 1) and suggests a 3-dimensional matrix with material fields along a horizontal axis, analytic levels of disciplines along a vertical axis, and problems (i.e. research questions) along a depth axis. The entities: information, technology, and people are analyzed as material fields in the understanding of Klein (1996), and are consequently considered disciplinary components. The proposed model is an attempt to conceptualize some of the elements that should be included in a framework, and it represents a first step towards understanding the gap between information, technology and people on one hand, and interdisciplinarity on the other, and towards identifying the complex underpinnings of the relations between disciplines in the Information Field. Substantial work remains to be undertaken to analyze which disciplinary insights should be integrated to produce an inter- or transdisciplinary understanding. The 3-dimensional matrix is a multidimensional framework that builds on a continuum of integration from multidisciplinary to interdisciplinary to transdisciplinary, and a problem-based approach in accordance with Aboelela et al.’s (2007) typologies of interdisciplinary research as demonstrated in Madsen (2012). It is argued that when identifying an emerging field, a problem-based approach can provide the rationale behind a need for combining, integrating or creating syntheses between disciplines.

The proposed framework lends itself to a nuanced analysis of the components and dimensions involved in multi-, inter- and transdisciplinary work. The 3-dimensional matrix offers a lens through which to view the contributing disciplines. The matrix may be further developed as a tool to operationalize multi-, inter- and transdisciplinarity. The framework may be used by scholars who are seeking theoretically based approaches to development of conceptual frameworks for interdisciplinary and transdisciplinary research projects as well as inter- and transdisciplinary curricula. Information Field scholars may find the framework useful for addressing questions that can contribute to the advancement of inter- and transdisciplinarity.

In section 2, I will identify the Information Field and address its disciplinary character; section 3 provides the theoretical grounding in the literature on interdisciplinarity to situate the framework developed. In section 4, a 3-dimensional matrix is suggested, and finally, in section 5, the perspectives and limitations of the proposed matrix are discussed.

This paper builds on Madsen’s (2012) examination of Zhang & Benjamin’s (2007) paper Understanding Information Related Fields: A Conceptual Framework. The horizontal dimension of the model which is proposed in this paper, and which includes the material fields, builds on Madsen’s (2012) analysis of Zhang & Benjamin’s (2007) “fundamental components”. This paper extends the analysis by elaborating a 3-dimensional matrix in which material fields is one dimension.

2. The Information Field
2.1 Brief History of the Information Field

The Information Field (or iField) is a term created by the iSchools. Bonnici, Subramaniam, and Burnett (2009), and Bonnici, Julien and Burnett (2013) explain how the newly formed iSchools Caucus announced its intention to form a new field in 2005. The Information Field was defined as:

an academic field of study and a professional career field that deals with all the issues, opportunities, and challenges we face in our emerging Information Age... The iField addresses this fundamental issue: how do we harness that incredible flow of information for the betterment of society, rather than get swamped by it? (iSchools Caucus, n.d.)

The explicitly stated goal was, according to Bonnici et al. (2009, 2013) the coming to grips with the “elusive identity [that] poses a challenge for the I-School movement” (King, 2006). The iSchools Caucus, the official organizational entity enfolding the iSchool network, created the term iField to capture this elusive identity. The history of the iSchool movement is documented by Larsen (2010), and Wiggins & Sawyer (2012, p. 9) offer an
overview of what iSchools are as well as their historical roots.

2.2 Is It Multi- inter- or Transdisciplinary?

Dillon (2012) offers a succinct account of the rationale of the iSchools’ embrace of interdisciplinarity,

iSchools recognize that pressing problems of information access, use, storage, and exploitation in our world are beyond the purview of one single discipline. In the parlance of interdisciplinary advocates, universities are organized around disciplines, while problems are not. No matter the claims for authority from one field or another, seriously tackling the information concerns of privacy, security, quality, accessibility and usability, to name but a few, requires knowledge beyond any single extant field (p. 270).

Wu et al. (2011) stress the multi- and interdisciplinary nature of the iSchools. They present a study on academic research and graduate education in iSchools by examining publically available online data with the goal of creating a snapshot of the research efforts and education programmes at the iSchools over the initial five-year period (p. 16). One of Wu et al.’s (2011) conclusions is that:

The ‘i’ in iSchools is also often interpreted as interdisciplinary, where faculties with different disciplinary backgrounds work together and students are familiarized with multidisciplinary knowledge and skills. Our results also demonstrate this interdisciplinary characteristic. iSchool faculty members come from different educational backgrounds, including computer science, LIS, business & economics, engineering, education, arts & humanities, psychology, and so on. In addition, the journal categories in which most iSchool faculties publish their research work clearly support this multidisciplinary pattern. These categories are: information science & library science, science, engineering, computer science (theory and methods) and computer science (software engineering) (Wu et al. (2011, p. 34)).

However, Wu et al. (2011) do not engage in a discussion of what interdisciplinarity is, and they do not differentiate between multi- and interdisciplinarity.

Wiggins and Sawyer (2012) appear to distinguish between multi- and interdisciplinarity. They observe that “The iSchools can be considered multidisciplinary environments as they are home to academics from multiple disciplinary backgrounds” and they continue “This type of environment can foster the pursuit of interdisciplinarity through the integration of multiple domains of study” (p. 9) and they go on to indicate (p. 10) that “Faculties with a range of degrees among the members are typically seen as being more multidisciplinary. This, in turn, fosters the possibility of doing interdisciplinary work by integrating knowledge from different disciplines.” Wiggins & Sawyer (2012) are not explicit about a distinction between multi- and interdisciplinarity, but they appear to present the multidisciplinary environments as the facilitating context of and as a prerequisite for interdisciplinarity, by integrating knowledge from different disciplines. However, they do not discuss the concept of integration or of interdisciplinarity.

Both Wu et al. (2011) and Wiggins & Sawyer (2012) measure interdisciplinarity by means of institutional factors such as doctoral degrees (Wiggins & Sawyer 2012, p. 8) and educational backgrounds, research interests, journal categories as proxies (Wu et al. 2011, p. 16). None of the authors engage in a discussion of what interdisciplinarity or multidisciplinarity is conceptually. What does it mean to integrate knowledge from different disciplines? What is it that happens between disciplines?

Where the iSchools (iSchools Organization (2012b), Olson and Grudin (2009) and Dillon (2012) mention interdisciplinarity, Wiggins and Sawyer (2012) state that “The iSchools can be considered multidisciplinary environments as they are home to academics from multiple disciplinary backgrounds.” Larsen (2010), on the other hand, introduces transdisciplinarity, although in quotation marks and under the heading of “vision” “An iSchool provides the venue that enables scholars from a variety of contributing disciplines to leverage their individual insights, perspectives, and interests, informed by a rich, “trans-disciplinary” community.” And at the same time, Larsen indicates that “iSchools foster the development of an intellectual space where true interdisciplinarity plays out”. Bruce et al. (2006, p. 12) indirectly refer to transdisciplinarity when stating: “The information field is not simply a confluence of other fields, but rather it is a science in its own right with theoretical foundations, understandings and principles.” However, none of the authors discuss how they understand multi- inter- or transdisciplinarity. And therefore, it seems fair to assume that the iSchools are multidisciplinary in that they are home to academics from multiple disciplinary backgrounds (Wiggins and Sawyer, 2012), that the rationale of the Information Field is interdisciplinarity, and that the vision for the Information Field is transdisciplinarity, in that it will develop into an intellectual space in its own right with its own theoretical foundations, understandings and principles (Bruce et al., 2006).

The institutional challenges connected with obtaining interdisciplinarity, which are an important part of the
iSchool discussions, are beyond the scope of this paper. This paper focuses on the conceptual, theoretical challenges of creating common ground. As the purpose of this paper is to explore the challenges of developing a conceptual framework for the Information Field, it is essential to have a closer look at the relations between disciplines and the concept of interdisciplinarity. My interest here is not to look at the institutional prerequisites for interdisciplinarity or proxy measures of interdisciplinarity, but the concept of interdisciplinarity itself. A distinction is therefore made between interdisciplinarity at an institutional level and interdisciplinarity at a conceptual level. But first, it will be useful to have a closer look at the iSchools’ focus on information, technology and people.

2.3 Information, Technology, and People

As seen from their collective web presence (iSchools Organization, 2012b), iSchools present themselves as dedicated to advancing the information field and sharing a fundamental interest in the relationships between information, people, and technology. In the following quote (iSchools Organization (2012a) information, technology, and people are mentioned as “phenomena” and as entities that intersect: “The study of information focuses on the intersection of information, technology, and people, which requires a broad interdisciplinary approach to those phenomena, the relationship between them ...”

Eisenberg and Dirks (2008, p. 1) refer to people, information, and technology as “the three foundation elements of the information field”, whereas Olson and Grudin (2009, p. 17) refer to information, technology, and people as “components” that interact. They state “The core vision is that information, technology, and people are considered to interact and to be of roughly equal significance. Launching this required a decidedly interdisciplinary approach, with experts in each area sharing insights into meaningful syntheses of the three components.” Zhang & Benjamin (2007) add a fourth entity, they operate with information, technology, people, and organization/society, and they refer to these as “fundamental components”. Furthermore, they refer to “information related fields”, which they claim are all interdisciplinary. Zhang & Benjamin claim (2007, p. 1937) that the four fundamental components information, technology, people, and organization/society interact and integrate with each other. Madsen (2012) argues that Zhang & Benjamin’s “fundamental components” must be seen as embedded in disciplines, and that their assumption that the four “fundamental components” interact and integrate disregards the existence of disciplines, disciplinary assumptions and worldviews. So must the entities referred to as “phenomena”, “foundation elements”, and “components” respectively. Little is known about the nature of these entities. And considering two claims: a claim for intersection, interaction and/or integration, and a claim for the approach to be interdisciplinary, the question is, how can an approach to information, technology, and people be interdisciplinary if we do not know exactly what it is that intersects, interacts or integrates? It is now necessary to have a closer look at disciplines and their role in creating interdisciplinarity.

2.4 Disciplines in the Information Field

Olson and Grudin (2009) use the metaphor of populating to relate the “components” information, technology, and people to disciplines. They mention that launching the iSchools required a “decidedly interdisciplinary approach, with experts in each area sharing insights into meaningful syntheses of the three components.” And they continue,

The information component was populated from the fields of library science, archives, and information retrieval. Technology came mostly from computer science, but could include a range of information appliances, such as telephones, handhelds, and embedded systems. People were initially represented by psychologists, sociologists, anthropologists, and management specialists. How to meld this interdisciplinary mix became a central energizing thrust at the early iSchools (p. 17).

The iSchools (iSchools Organization, 2012b) seem to take educational programs instead of disciplines as their point of departure. They state,

The iSchools organization was founded in 2005 by a collective of Information Schools dedicated to advancing the information field in the 21st Century. These schools, colleges, and departments have been newly created or are evolving from programs formerly focused on specific tracks such as information technology, library science, informatics, and information science. While each individual iSchool has its own strengths and specializations, together they share a fundamental interest in the relationships between information, people, and technology.

However, in their description of the Information Field (iSchools Organization, 2012a) it is stressed that, “The study of information is interdisciplinary, fed by multiple diverse fields” and it is specified that “Librarianship and computer science have historically been the primary feeders of the field, but information studies is also fed
by fields such as education, psychology, anthropology, business, journalism—indeed, the range of social sciences.” What are mentioned as “specific tracks” by iSchools Organization (2012b) and as fields by iSchools Organization (2012a) are not directly comparable and this creates some confusion as to which fields or disciplines are involved in the Information Field. iSchools Organization (2012b) mentions information science, iSchools Organization (2012a) does not, but rather information studies and the fields that information studies are fed by are mentioned. This description raises the question of whether information studies are only part of the Information Field together with, for example, computer science, or if information studies is also used synonymously with Information Field. If information studies is used as a synonym for Information Field, it not only adds to the confusion but also dilutes the concept of the Information Field. (Note 2).

The confusion as to which fields or disciplines are involved in the Information Field is reduced by Wiggins and Sawyer (2012) who present an empirically based analysis of the intellectual distribution and faculty composition of academic units involved in the iSchool community. Their analysis uses the educational background of iSchool faculty “as a means for understanding the intellectual composition of the unit, using the doctoral degree earned as a proxy for individuals’ intellectual perspectives.” (p. 8). The authors develop a classification of iSchool faculty members’ academic disciplinary training and education, cf. Table 1 (p. 11), where the areas of faculty training are coded into nine broad disciplinary categories, based on logical groupings of related fields of study: Computing, Information, Library, Social & Behavioral, Management & Policy, Science & Engineering, Education, Humanities, Communication. These categories are further illustrated by each category’s “component areas” (p.11).

Although Wiggins and Sawyer’s (2012) empirical findings are important for understanding the faculty composition of iSchools, an analysis of their results is beyond the scope of this paper. The classification of component areas is not related to the entities: information, technology, and people, and the authors do not address how their “component areas”, which might be interpreted as disciplines, relate to each other or are influenced by the multiple disciplinary backgrounds of faculty. That is, they do not address interdisciplinarity at a conceptual level, but use the doctoral degree of faculty as a proxy measure of interdisciplinarity, which is interdisciplinarity at an institutional level.

A conceptual framework for the Information Field must include disciplines. Disciplines are addressed in the Information Field literature, but they do not appear to be a central concern, they are not addressed as analytical units that may contribute to developing a conceptual framework for the Information Field and to discuss interdisciplinarity. We know little about how the multiple disciplines in the Information Field relate to each other, and how disciplines are used to address common problems: Are they multi- or interdisciplinary? Are they integrated? etc. A discussion of interdisciplinarity and its implications is important if the aim is to begin to put down some of the foundations for achieving a conceptual framework for the Information Field. The purpose is to open up a discussion of the components of such a framework, and to try to shed light on the interplay of disciplines. Furthermore, common conceptual frameworks tend to be associated with transdisciplinarity rather than interdisciplinarity (Aboelela et al. 2007), and therefore, when developing a shared conceptual framework for the Information Field, there is a need to look at the whole continuum of integration from multidisciplinary to interdisciplinary to transdisciplinary.

3. Interdisciplinary Foundations

To explore the challenges of developing a conceptual framework for the Information Field, it is essential to have a closer look at the concept of interdisciplinarity, to open up a discussion of the components of such a framework and to try to shed light on the interplay of disciplines. What is it that is combined, drawn upon or integrated, and which disciplinary components are typically involved when we try to describe relations between disciplines?

Common conceptual frameworks tend to be associated with transdisciplinarity rather than interdisciplinarity (Aboelela et al. 2007). And as at the same time, a distinction should be made between multidisciplinarity and interdisciplinarity, we need to look at the whole continuum of integration from multi- to inter- to transdisciplinarity. A conceptual framework for the Information Field should build on the continuum of integration.

Parts of the following section, including Table 1, have previously appeared in Madsen (2012) which introduces central concepts from the literature on interdisciplinarity in order to examine the assumptions of Zhang & Benjamin (2007). This paper, besides addressing central concepts from the literature on interdisciplinarity, gives a more thorough review of the concept of transdisciplinarity to be able to examine more closely what it takes to develop a shared conceptual framework and to develop arguments for a multidimensional approach to describing relations between disciplines.
3.1 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 organization 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 organized into a common effort on a common problem with continuous intercommunication among the participants from different disciplines.

This definition of interdisciplinarity refers to interaction as well as mutual integration between disciplines. On one end of a 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 one or more faculty from different disciplines (Lattuca 2002 p. 712). Some authors focus specifically on inter- and transdisciplinary science (Aboelela et al., 2007; Klein, 2004, 2006; Rosenfield, 1992 and Stokols et al., 2003), Franks et al. (2007) examine interdisciplinary teaching and learning, whereas more general approaches to interdisciplinarity are represented by Klein (1990, 1996, 2002), by Lattuca (2001, 2002, 2003) and by Repko (2008). Klein (2010) offers a synthesis of discussions of “the genus Interdisciplinarity”, including multidisciplinarity, interdisciplinarity and transdisciplinarity.

Aboelela et al. (2007) conducted a systematic literature review of interdisciplinary research based on interviews and field tests with interdisciplinary researchers. They summarized the key definitional components from their literature review in Table 1, which is reproduced below. Aboelela et al. state that “As the literature review proceeded, the existence of a continuum from multidisciplinary to interdisciplinary to transdisciplinary was apparent. Attempting to define interdisciplinary research without attention to the precursor and subsequent approaches made no sense.” (2007, p. 339). Thus, Aboelela et al. (2007) identify three qualitatively different modes of interdisciplinary research represented by different degrees of synthesis along a continuum from the least degree of synthesis, proceeding to a moderate degree and finally arriving at the greatest degree of synthesis. These typologies are categorized in Table 1 below (Aboelela et al., 2007, p. 337). For the least degree of synthesis, Aboelela et al. use the term “multidisciplinary”, for the moderate degree “interdisciplinary”, and for the greatest degree of synthesis “transdisciplinary”. However, the authors cited in Table 1 use a terminology that is not quite consistent. In this paper I adhere to the terminology of Aboelela et al. (2007).

Aboelela et al.’s typologies of interdisciplinary research (Aboelela et al., 2007, p. 337) identified in Table 1, are based on their literature review of interdisciplinary research. For a general overview of the defining characteristics of interdisciplinarity, see Klein (2010) who provides a taxonomy of interdisciplinarity. And for alternative and more nuanced categorizations of interdisciplinary research, see Huutoniemi, Thompson Klein, Bruun, and Hukkinen (2010, p. 81).

Table 1. Typologies of Interdisciplinary Research (Aboelela et al., 2007:337)

<table>
<thead>
<tr>
<th>Author</th>
<th>Degree of synthesis</th>
<th>2001</th>
<th>1996</th>
<th>1992</th>
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<tbody>
<tr>
<td>Least</td>
<td>Informed disciplinarity:</td>
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<tr>
<td></td>
<td>disciplinary questions may be informed by concepts or theories from another discipline</td>
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<td></td>
<td>Synthetic disciplinarity:</td>
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<tr>
<td></td>
<td>questions that link disciplines (question either belongs to both or neither disciplines)</td>
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<tr>
<td>Moderate</td>
<td>Synthetic disciplinarity</td>
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<td></td>
<td>Epistemological disciplinarity:</td>
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<td></td>
<td>restructuring a former approach to defining a field</td>
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<tr>
<td>Greatest</td>
<td>Transdisciplinary:</td>
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<tr>
<td></td>
<td>the application of theories, concepts, or</td>
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<td></td>
<td>a movement toward a coherence, unity,</td>
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<td></td>
<td>Multidisciplinary:</td>
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<tr>
<td></td>
<td>teams work in parallel or sequentially from their specific disciplinary base to address a common problem</td>
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<tr>
<td></td>
<td>Interdisciplinary:</td>
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<tr>
<td></td>
<td>teams work jointly but still from a discipline-specific base to address a common problem</td>
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<tr>
<td></td>
<td>Transdisciplinary:</td>
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<tr>
<td></td>
<td>teams work using a shared</td>
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</table>
It is argued that the continuum of integration from multi- to inter- to transdisciplinarity is useful for a distinction of different degrees of synthesis, as common conceptual frameworks tend to be associated with transdisciplinarity, which represents the greatest synthesis of approach. From Aboelela et al.’s (2007) overview in Table 1, we can get an indication of the conceptual foundations for discussing degrees of integration that might lead to shared conceptual frameworks. In it we can also see that “defining a field”, “developing an overarching synthesis” and “using a shared conceptual framework” are classified as either interdisciplinary or transdisciplinary endeavors, between moderate to greatest synthesis. According to Aboelela et al.’s (2007) literature review, interdisciplinary research may result in the development of a new field, but at the same time they find that transdisciplinary endeavors that set out to create synthesis between disciplines are the most likely to result in the development of a new field (p. 339).

Based on the dimension of the degree of synthesis, Aboelela et al. (2007) furthermore identify different degrees of cooperation or interaction between members of the collaborative teams, the amount of contact between team members, and the degree of sharing of information. For modes of interdisciplinary research with low degrees of synthesis, very little, if any, cooperation between researchers is required, but for modes of interdisciplinary research with even a moderate degree of synthesis, greater degrees of interaction between researchers are required. Thus, Aboelela et al. (2007) establish a correlation between the degree of synthesis, which is between disciplines, and degree of cooperation and interaction, which is between people. It is suggested that the distinction defined in section 2.2 between interdisciplinarity at an institutional level and interdisciplinarity at a conceptual level may be seen as a parallel to the distinction established by Aboelela et al. (2007) between cooperation and interaction between people on one hand, and synthesis between disciplines on the other. It is the synthesis between disciplines that is addressed at a conceptual level of analysis, and it is the conceptual level that is required for exploring the challenges of developing a shared conceptual framework for the Information Field.

3.2 Transdisciplinarity

For the greatest synthesis of approach, transdisciplinarity, Aboelela et al. state (2007, p. 339), “In this mode, teams not only share a common question but also often share and borrow methods, create a common conceptual framework, and either learn each other’s disciplinary language or create a new common language” as opposed to modes with a moderate degree of synthesis where team members will often share a research problem “but still employ their respective disciplinary methods, conceptual frameworks, and languages.” (p. 339).

According to Lattuca (2001) as quoted in Table 1, transdisciplinary, the greatest degree of synthesis is “the application of theories, concepts, or methods across disciplines with the intent of developing an overarching synthesis”. However, there seem to be different interpretations of transdisciplinarity and of the dividing lines between inter- and transdisciplinarity. Klein’s definition of transdisciplinarity (Klein, 1996), also in Table 1, is “a movement toward a coherence, unity, and simplicity of knowledge”. In later work, however, Klein (2006) differentiates the original meaning of transdisciplinarity, introduced in the 1970s, from the emergence of a new form of transdisciplinarity with Rosenfield’s (1992) call for “transdisciplinary science”, (Klein, 2006, p. 77). According to Rosenfield (1992, p. 1351), as also stated in Table 1, transdisciplinarity is a process by which researchers work jointly to develop and use “a shared conceptual framework, drawing together discipline-specific theories, concepts, and approaches to address a common problem”. This is supported by Stokols et al. who highlight (2003, p. 24) that Rosenfield’s requirement that participants in transdisciplinary research develop a shared conceptual framework, which integrates and transcends their respective disciplinary perspectives, is a stringent criterion for scientific collaboration. And Klein (2006, p. 77) concurs with Rosenfield on the potential of transdisciplinary science for going beyond interdisciplinary combinations of existing disciplinary approaches to generate new topic-based domains, new hypotheses for research, integrative theoretical frameworks for the analysis of particular problems, and novel methodological and empirical analyses of the problems in a field (Stokols et al., 2003; Rosenfield, 1992).

Lattuca’s understanding of interdisciplinarity rests on one of the few empirical studies of interdisciplinarity that have been made. That is, her approach to interdisciplinary studies is grounded in the work of faculty who
actually conduct interdisciplinary scholarship (Lattuca, 2003). According to Lattuca (2003, p. 7) transdisciplinarity differs from what she labels 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.

What is significant is that for modes of interdisciplinary research with a moderate degree of synthesis, team members will typically employ their respective conceptual frameworks, whereas creation of “a shared conceptual framework” is associated with transdisciplinarity, the greatest synthesis of approach. Therefore, if defining a new field requires transdisciplinarity, the whole continuum with the precursors multi- and interdisciplinarity must be included in a conceptualization of the Information Field. If we want to address the challenge of creating common ground and provide a framework for interaction between people and integration between disciplines, the continuum of integration may serve as the background against which it is possible to discuss relations between disciplines and the degree to which they should be integrated.

The continuum of integration may help us create a shared understanding of where we are, shed light on our disciplinary assumptions and decide which type of common conceptual framework we are striving for. It may be that the continuum of integration cannot help us directly in conceptualizing a framework but it may serve as a foundation to help us sort out and describe the relations between disciplines and consider different degrees of synthesis.

To further discuss the relations between disciplines, it is necessary to have a closer look at what a discipline is. What is it that is combined, drawn upon or integrated in the continuum? And which disciplinary components are typically involved? In the following section 4, a 3-dimensional framework is proposed. Two dimensions reflect the disciplinary components and the third dimension reflects “the problem”.

4. 3-dimensional Matrix

As part of a process towards developing a shared conceptual framework for the Information Field, a 3-dimensional matrix will be elaborated below. It is argued that this matrix may provide a foundation for mapping out the most important factors involved in creating an integrative framework. The matrix may be further developed as a tool to operationalize multi-, inter- and transdisciplinarity. Two of the three dimensions of the model reflect disciplinary components, and the third dimension reflects “the problem” that provides the rationale behind a need for engaging in a multi-, inter- or transdisciplinary research process.

4.1 Horizontal Dimension: Material Fields

The horizontal dimension of the proposed model builds on Madsen’s (2012) analysis of Zhang & Benjamin’s (2007) “fundamental components”. According to Zhang and Benjamin (2007) the Information Field contains four fundamental components: information, technology, people, and organization/society. They are the “fundamental components” that “function as the pillars or foundations and thus are central to all of these information related fields” (2007, p. 1935). Zhang & Benjamin (2007) assume that “core components from other fundamental fields interact and integrate with each other to form dynamic and interesting information related fields that all have to do with information, technology, people, and organization/society” (2007, p. 1934). Madsen (2012) argues that Zhang & Benjamin’s (2007) “fundamental components” must be seen as embedded in disciplines. The assumption that the Information Field contains four “fundamental components” disregards the existence of disciplines, disciplinary assumptions and worldviews. The notion of disciplines is absent in Zhang & Benjamin’s framework. Their assumption that it is the “fundamental components” that interact and integrate does not take into account that interaction and integration normally refer to what happens between disciplines and is a matter of degree along a continuum. Zhang & Benjamin (2007) do not differentiate between multi- and interdisciplinarity nor do they differentiate between interaction and integration or relate these concepts to multi- or interdisciplinarity. In general, Zhang & Benjamin’s (2007) model assumes interdisciplinarity but does not draw on interdisciplinary theory.

Therefore, Madsen (2012) suggests that it is not the “fundamental components” that interact; it is rather the disciplines in which they are embedded (p. 6). The “fundamental components” should be seen as embedded in disciplinary approaches and the disciplines’ ways of thinking. It is the theories about and approaches to the “fundamental components” that may provide the ground for interaction or integration. The assumption in Zhang and Benjamin’s model (2007) that “fundamental components” interact and that they have something in common in the Information Field, fails to acknowledge that the disciplines represent what Klein calls independent matrices of thought (Klein 1996, p. 222).
Two dimensions of the matrix that is proposed in this section, take as their starting point the following definition of a discipline:

The term discipline signifies the tools, methods, procedures, exempla, concepts, and theories that account coherently for a set of objects or subjects. Over time they are shaped and reshaped by external contingencies and internal intellectual demands. In this manner a discipline comes to organize and concentrate experience into a particular “world view”. (Klein, 1990, p. 104, emphasis in original).

This means that we need at least two different dimensions to describe a discipline, we need both “a set of objects or subjects” as well as what may “account coherently for” those objects or subjects. And one dimension does not make much sense without the other. To describe this “set of objects”, Klein (1996) uses the notion of material field.

Material field comprises a set of objects that presumably reside within a discrete domain. Physicists and chemists study material objects, botanists study plants, anthropologists study humans, and so on. Because material fields overlap, though, the notion of a field of objects must be supplemented by recourse to how objects are defined and treated. (p. 46).

Madsen (2012) argues that Zhang & Benjamin’s (2007) “fundamental components” only reflect the material objects or subjects in the understanding of Klein (1996), and therefore concludes that the “fundamental components” are material fields in accordance with Klein (1996). In this paper it is suggested that these material fields constitute the horizontal axis of the matrix. The horizontal axis with the material fields is, however, only one dimension of depicting disciplines. Thus, to be able to describe the dimensions of a discipline, and to relate disciplines and disciplinary elements to each other in the continuum of integration, there is also a need to include a vertical dimension to capture the “how objects are defined and treated” according to Klein’s definition above. In this way, it will be possible to specify at which analytic level we relate the disciplines or disciplinary elements to each other. It is along a vertical axis that we can find connecting points between disciplines or disciplinary elements. These connecting points are what Klein calls “nodal points of connection” (1996, p. 46).

4.2 The Vertical Dimension – Analytic Level

The disciplinary components such as theories, methods and approaches are depicted along a vertical axis in the matrix. These disciplinary components are supposed to capture the “how objects are defined and treated” according to Klein’s definition above.

A brief look at the above definition of interdisciplinarity and Aboelela et al.’s (2007) typologies of Interdisciplinary Research in Table 1, may give an indication of which disciplinary components are involved in an inter- or transdisciplinary research process. The OECD definition for example mentions: “… the mutual integration of organising concepts, methodology, procedures, epistemology, terminology, data, and …” (emphasis added), Lattuca’s (2001) definition of transdisciplinary, cf. Table 1, mentions “theories, concepts, or methods …”. These analytic levels may be any elements that can serve as a nodal point of connection, a point of entry into a discipline.

Petrie (1976) uses the notion of cognitive maps that he understands as “the whole cognitive and perceptual apparatus utilized by any given discipline” (p. 35). According to Petrie (1976), different disciplines have different cognitive maps and he suggests (p. 35) that “these maps may well get in the way of successful interdisciplinary inquiry.” According to Petrie (1976), while every discipline has its own individual cognitive map, every discipline has the following elements:

- basic concepts
- modes of inquiry
- what counts as a problem
- observational categories
- representation techniques
- standards of proof
- types of explanation
- and general ideals of what constitutes the discipline

To these elements are added, in my matrix, in line with Klein (1996, p. 222) “worldview” and “underlying assumptions”, to emphasize that disciplines represent independent matrices of thought. And for present purposes, only the major elements from Petrie’s cognitive map are included.
The matrix covers a horizontal dimension with the material fields, and a vertical dimension to make it possible to incorporate the elements of any given discipline that may account for the “how objects are defined and treated” within a discipline and may thus serve as units of analysis and function, as what Klein calls nodal points of connection (1996, p. 46).

4.3 The Third Dimension: The Problem

The horizontal and vertical dimensions of the matrix are the most static dimensions, reflecting disciplinary components, and cannot explain how the vertical, analytic levels and the horizontal material fields can be related to each other. This is why the “problem” is suggested as a necessary third dimension. This dimension is more dynamic, as the problem or task at hand is the reason why there is a need for engaging more than one discipline or disciplinary perspective. By means of a problem it is possible to contextualize the other two dimensions of the matrix, to find out which of the disciplinary components are relevant to the problem at hand. Thus, it is suggested that the matrix reflects the three most important dimensions involved in creating an integrative framework, the disciplinary components: material fields and analytic levels, and the problem, see Figure 1.

By means of this matrix, we can map out the disciplinary components and the analytic levels required to solve a problem, address a challenge and illuminate a research question. However, the matrix cannot show if multidisciplinarity, interdisciplinarity or transdisciplinarity will be the outcome, but only provide a theoretical foundation for describing relations between disciplines and disciplinary components in the light of a given problem.

The basis of multidisciplinary, interdisciplinary and transdisciplinary research is “a common problem” cf. also Table 1. In interdisciplinary theory, the problem is an object of scientific inquiry in its own right, Lattuca (2003). In Petrie’s (1976) understanding of interdisciplinary inquiry, “what counts as a problem” has a disciplinary basis, however in interdisciplinary theory, the problem may be located anywhere in the continuum of integration from multidisciplinarity to interdisciplinarity to transdisciplinarity, cf. also Table 1, or even outside the continuum of integration.

![Figure 1. 3-dimensional matrix illustrating disciplinary components contextualized by a problem.](image)

In terms of theory building, the problem can be seen as an analytic construct. It is argued that the role of the problem is closely connected to the conceptualization of a field because it is the problem that provides the whole rationale behind a need for multi- inter- or transdisciplinary solutions or answers.

Lattuca (2001, 2002, 2003) has explored the issue of the problem in detail. According to her, the problem as a disciplinary component is defined within a single discipline, unlike problems “without a compelling disciplinary basis” (2003, p. 6). As previously mentioned, Lattuca’s understanding of interdisciplinarity rests on one of the few empirical studies of interdisciplinarity that have been made. That is, her approach to interdisciplinary studies is grounded in the work of faculty who actually conduct interdisciplinary scholarship (Lattuca, 2003). Lattuca (2001, 2003) introduces a typology of interdisciplinary scholarship based on the categories of questions pursued by the faculty she interviewed. She defines the categories of the typology by contrasting the kinds of research
questions and teaching issues central to each.

Lattuca’s typology is summarized in Aboelela et al. (2007, p. 337), cf. Table 1 in section 3.1. However, to substantiate the problem dimension of the matrix proposed in this paper, a closer look must be taken at Lattuca’s original typology and the categories of research questions she applies (2001, p. 81; 2003, p. 5).

4.4 Lattuca’s Categories of Research Questions

**Informed disciplinarity.** According to Lattuca (2003), research questions of informed disciplinarity are essentially disciplinary in nature; that is, they are motivated by a disciplinary question. 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.” (p. 6).

**Synthetic interdisciplinarity.** This occurs, Lattuca explains (2003, p. 7), when research questions bridge disciplines. According to her there are two types of bridging questions, namely 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.” (2003, p. 7).

**Transdisciplinarity.** This is characterized in “questions that cross disciplines”, Lattuca (2003, p. 6). According to Aboelela et al.’s (2007) Table 1, transdisciplinarity is “the application of theories, concepts, or methods across disciplines with the intent of developing an overarching synthesis.” According to Lattuca (2003, p. 7) “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”

**Conceptual Interdisciplinarity.** Lattuca’s final category of interdisciplinary scholarship, conceptual interdisciplinarity, includes issues and questions without a compelling disciplinary basis, as also shown in the Aboelela et al. Table 1: “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 …” (Lattuca, 2003, p. 7).

Thus, based on Lattuca (2003), the problem dimension of the matrix, Figure 1, may reflect the following types of questions:

- Questions that are identified with a single discipline (questions have a compelling disciplinary basis).
- Questions that are found in the intersections of disciplines; the question belongs to both disciplines.
- Questions that are found in the gaps between disciplines; the question belongs to neither.
- Questions that cross disciplines.
- Issues and questions without a compelling disciplinary basis.

The problem dimension of the matrix, Figure 1, is assumed to reflect all of these types of questions. Thus, the range of possible questions emphasizes the flexibility of the matrix in that the matrix is not anchored in a specific discipline or specific material field but focuses on the components of any given discipline, to encompass any questions irrespective of their disciplinary, interdisciplinary or transdisciplinary nature.

5. Discussion

Two of the three dimensions of the matrix are developed on the basis of the concept of discipline. Inspired by Buanes and Jentoft (2009) who state that “The discipline offers its members a particular set of lenses” (p. 450) it is suggested that in the matrix, this “particular set of lenses” is represented by the vertical dimension, the analytic level, through which, knowingly or unknowingly, we view the material fields.

Analyzing the entities: information, technology and people as material fields embedded in disciplines, creates a foundation for discussing relations between disciplines and interdisciplinarity in the Information Field. Combining, in the matrix, the material fields with analytic dimensions of disciplines, connects the material fields with a “particular set of lenses” dependent on the relevant discipline(s). Further contextualizing these two dimensions of the matrix with the third dimension of “the problem”, creates a flexible conceptual framework for studying the Information Field, as the problem dimension is assumed to reflect any questions irrespective of their disciplinary, interdisciplinary or transdisciplinary nature.

“Information, technology, and people” are material fields, and in Figure 2 below it is shown that they have a
theoretical foundation. However, we do not know exactly which disciplines they are embedded in. The material fields are the common denominator for the Information Field. The conceptual framework presented here may be useful for mapping and analyzing exactly which disciplines subscribe to these material fields. A preliminary mapping will probably show that several disciplines subscribe to the same material fields, which raises the following question. How does a given discipline conceptualize a given material field?

Figure 2. 3-dimensional matrix illustrating the Information Field’s material fields together with analytic disciplinary components contextualized by a problem

Substantial work needs to be done to fine tune the matrix, especially its vertical dimension, and the relevant analytic levels to the needs of the disciplines in the Information Field. The worldview or perspective embedded in each discipline must be extracted and their underlying assumptions must be identified. Using the matrix for each discipline separately provides a framework for asking and answering questions that can contribute to discussions of inter- and transdisciplinarity: such as: Do the different disciplinary insights complement each other? Can they be compared? Do they conflict? To what extent can the insights be synthesized into a space that is more than the combination of the individual disciplines? Are new overarching conceptualizations required?

Furthermore, it may well be argued that such discussions of relations between disciplines in the Information Field to create inter- and transdisciplinarity, ought to be informed by Lattuca’s (2003) categories of research questions, cf. section 4.4. Only one of the five types of questions presented by Lattuca (2003) addresses intersections of disciplines which is the type of relation indicated by the iSchools Organization (2012a) “the intersection of information, technology, and people, which requires a broad interdisciplinary approach …” Bringing into play the whole range of possible research question types, beyond intersection, could further strengthen the foundation of an intellectual space in its own right with its own theoretical foundations, understandings and principles (Bruce et al., 2006).

Shared conceptual frameworks are associated with transdisciplinarity. In, for example, Rosenfield’s definition of transdisciplinarity (1992, as quoted in Aboelela et al. Table 1), cf. section 3.1, “drawing together discipline-specific theories, concepts, and approaches to address a common problem” requires the development and use of a shared conceptual framework. The question is to what extent the iSchools see themselves as moving towards what Klein (1996, p. 65) calls “an interface of theories and subject matters” where existing disciplines grow toward each other, or towards the creation of new intellectual space that, according to Lattuca (2002, p. 734) is more than the combination of the individual disciplines and a space with a “capacity to imagine new ideas, new projects and new futures”. Rosenfield (1992, p. 1352) advocates a new type of research that “enables the analysis of a particular problem to be located in the transdisciplinary conceptual framework”. According to Rosenfield (1992, p. 1354) “ ‘Transdisciplinary research’ has the potential to move beyond the process of interdisciplinary research to a stage where disciplines can build on their distinct traditions and coalesce to become a new field of research”.

The 3-dimensional matrix proposed in this paper offers a lens through which to view the contributing disciplines.
The proposed model is an attempt to conceptualize some of the elements that should be included in a framework, and it represents a first step towards understanding and identifying the interplay of disciplines in the Information Field. The horizontal and vertical dimensions of the matrix reflecting disciplinary components are the most static and cannot explain how the vertical, analytic levels and the horizontal material fields can be related to each other. This is why the “problem” is suggested as a necessary third dimension. This dimension is more dynamic, as, the problem or task at hand is the reason why there is a need for engaging more than one discipline or disciplinary perspective.

The matrix suggested in this paper, is, above all, a theoretical framework that sheds light on disciplinary components and what it is that is typically combined, drawn upon or integrated when we try to describe relations between disciplines. Empirical analyses should be designed to test how the framework could be operationalized. It may be argued that the elements of the matrix proposed do not add anything new to our understanding of a conceptualization of a field involving multiple disciplines. However, the dynamic between the elements, the separation of material fields from analytic level, and the problem’s possible independence from any specific disciplinary perspectives, may provide a foundation for figuring out which disciplinary components and problems we are dealing with, for evaluating to which degree disciplines should be integrated, and for understanding relations between disciplines.

References


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Notes

Note 1. There is an irony in using “disciplinary components” to criticize the use of “components” and “fundamental components” in the Information Field literature. However, “disciplinary components” are an established concept in the literature on interdisciplinarity, see e.g. Lattuca (2001) and Huutoniemi et al. (2010). Disciplinary components are embedded in disciplines.

Note 2. Hjørland (2014) offers an overview of information science and library and information science (LIS), information studies and information science(s) and discusses how the various names given to the field reflect underlying conceptions.

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