

Discipline[†]

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Abstract: "Discipline" is commonly used to denote particular areas of knowledge, research and education. Yet, the concept is often not very well defined or even explicitly discussed when used in knowledge organisation and related fields. The aim of this article is to encourage and facilitate further reflections on academic disciplines, while at the same time offering insights on how this elusive concept might be understood. An overarching argument is that "discipline" should foremost be understood in relation to institutional and organisational features, and this is what distinguishes it from related terms such as, field, domain or topic. The etymology and history of the concept are reviewed along with a discussion of attempts to define and conceptualise disciplines. Insights are offered on how disciplines might be studied. Regardless of our views of disciplines, either as inherently out-dated constructs or as important features of a well-functioning academia, it is concluded that further precision or care in explicating the concept is needed.

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1.0 Introduction

"Discipline" is a key concept in knowledge organisation (KO) and related fields, yet it is often not very well understood or defined. It is commonly used to define and delineate knowledge areas, often when referring to academic fields of research and education. Clearly, it is a central concept in the broad understanding of KO as the study of "the conceptual systems, the social fields, and the activity system of knowledge" (Hjørland, 2016). Yet, discipline is also important in relation to what Hjørland (2016) describes as a more precise definition of KO; the study of specific knowledge organising systems in terms of the organisation of bibliographical databases and libraries.

Within library classification, "disciplines" have often been used as the fundamental principle of organization. The *Dewey Decimal Classification (DDC)*, for example, states (Dewey 1979, xxxi; emphasis added): "a work on water may be classed with many disciplines, such as metaphysics, religion, economics, commerce, physics, chemistry, geology, oceanography, meteorology, and history. *No other feature of the DDC is more basic than this: that it scatters subjects by discipline.*" Classifying by disciplines is also called "aspect classification."¹

Similarly, library and information science scholars as well as bibliometrists often use the term discipline to depict and separate knowledge, institutional structures, researchers and resources; "disciplines have been a standard framework for bibliometric analyses of bodies of literature and studies

of scholarly communication and user communities" (Palmer and Cragin 2008, 172). However, "discipline" is usually not very well defined, if defined at all. The aim of this article is to encourage and facilitate further reflection on how this concept is used and to contribute to discussions regarding how "discipline" can be defined, operationalised and studied. I build on an ongoing discussion about how academic disciplines should be understood and more broadly defined, and draw on literature from a range of fields. An important point of departure for the paper is that discipline points to institutional and organisational characteristics such as departments, conferences and labour markets that distinguish it from concepts such as field, domain or topic.

The article is structured as follows: first the etymology and definitions of "academic discipline" are given and the historical roots of the concept are discussed. This background offers a vantage point from which the future of disciplines can be discussed. Thereafter, derivatives of "discipline," such as cross-, inter-, trans- and post-disciplinary are considered with a particular focus on what these concepts infer in connection with the concept of "discipline." Subsequently, insights are offered into how disciplines can be theorised. Related concepts, such as field, domain and topic are examined in light of their relation to the concept of discipline. Some of the main insights derived from the broad and extensive literature on disciplines are summarized by outlining a few directions for how "discipline" might be fruitfully conceptualised and understood in information studies and knowledge organisation.

2.0 Etymology

Discipline is derived from the Latin *discipulus*; however the etymology of this word is not entirely clear and none of the existing theories fully satisfy etymologists (see De Vaan 2008). In old English, it is supposedly derived from *discipul* (fem. *discipula*), meaning the "one who follows another for the purpose of learning," especially "the personal followers of Jesus Christ during his life, the twelve Apostles chosen or called by him to be his immediate associates," a Biblical loan from Latin *discipulus* "pupil, student, follower" (*Online Etymology Dictionary* 2019).

The term discipline has a long history in English, where the earliest use according to *The Oxford English Dictionary* (*OED*), is recorded in 1398. Chaucer used it in relation to science as early as 1405: "Assaye in myn absence This disciplyne and this crafty science" (*OED* 2019). A more specific use of the term in relation to areas of teaching and scientific inquiry occurs in English from mid seventeenth century and onwards.

Discipline bears similar meanings in Sanskrit: "instruction," "education" (Monier-Williams [1851] 2019) and in Greek: "training to obey rules," "self-control" (*Wordrefer-*

ence.com 2019). In ancient Rome, "disciplina" was a minor goddess who represented martial discipline. She was primarily worshipped by soldiers and is likely to have been a creation of Hadrian (*Encyclopedia Mythica* 2019).

A German etymological dictionary (Kluge [1891] 2019), on the other hand, gives the following explanation of the origin of the German "Disziplin:" *Disziplin* comes from "disciplina," which in turn is derived from "discipulus." *Discipulus* in turn relates to "discipere," where the latter is marked as a deduced form ("erschlossen") meaning to grasp ("erfassen"). A similar explanation is offered by Stichweh (1992, 4) who describes the term's etymology in the following manner:

The term 'discipline,' deriving from the Latin *discere*, was of course already known in the early Middle Ages (Marrou 1934; cf. Evans 1980, 96-97). Until the eighteenth century, the history of the term *disciplina* was closely linked to the history of the term *doctrina*. In fact, the terms are frequently indistinguishable. Characteristically, they are used in the context of teaching and instruction, and refer to a systematic entirety of doctrines with which a student is presented in the context of instruction. If the two terms are to be differentiated, then *doctrina* refers to the teacher's side of instruction and *disciplina* to the student's side.

By establishing the etymology of the concept, we find an emphasis either on social aspects (followers) or on the content of knowledge (doctrines). This tension between discipline as a concept explaining social relations and organisation, and its role in demarcating specific areas of knowledge is a recurrent theme in attempts to define the concept.

3.0 Understanding disciplines

3.1 Definitions

According to the *OED* (2019), the noun "discipline" has two meanings:

- 1) the practice of training people to obey rules or a code of behaviour, using punishment to correct disobedience, and
- 2) a branch of knowledge, typically one studied in higher education.

In addition, discipline can be used as a verb in the sense: "train (someone) to obey rules or a code of behaviour, using punishment to correct disobedience."

Discipline is commonly used in contexts where a distinct chain of authority exists, such as the church or the military. In this sense "academic discipline" can be seen as a form of

specific and rigorous training that will turn out practitioners “who have been ‘disciplined’ by their discipline” for their own good” (Krishnan 2009, 8). To Michel Foucault, “discipline,” in its more general sense, is part of an often brutal political force that police certain behaviours while excluding those that deviate from the norm, and eventually “discipline” is internalised by the subject itself (Foucault 1995, 223): “The disciplines characterize, classify, specialize; they distribute along a scale, around a norm, hierarchize individuals in relation to one another and, if necessary, disqualify and invalidate.”

Here we are interested in “discipline” as it is used to denote a “branch of knowledge” or more specifically, its use in labelling fields of research and education within the academic system. Academic disciplines are less associated with violence and obedience, although power relations and boundary keeping are certainly important aspects when defining the concept. There is, in fact, a strong connection between discipline and power, as Pierre Bourdieu [1984] 2003) asserts in his study of the struggle for power between faculties (and disciplines).

The concept “discipline” is less straightforward or well defined than one might think. Disciplines could be viewed as systems that produce statements about the world, but disciplines are limited and restricted in themselves while the “discursive formation” in which they are constituted goes far beyond disciplinary boundaries (Foucault 1971, 179). Disciplines should not, therefore, be confused with topics, discourses, subjects or interests; rather they should be understood as knowledge institutions or knowledge systems. A discipline is partly defined by institutional structures within departments, but “international currency is an important criterion, as is a general though not sharply defined set of notions of academic credibility” (Becher and Trowler 2001, 41). As formulated by Lenoir (1997, 46), disciplines embody “the infrastructure of science” through publication outlets, academic conferences and associations. A further defining trait of an academic discipline is the existence of undergraduate and graduate education as well as textbooks and a core of canonical publications.

3.2 Characteristics

Due to the ephemeral nature of disciplines, many authors abandon attempts to come up with exact definitions and opt instead for broader conceptualisations of what a discipline is and how it can be characterised. In an attempt to discern the characterises of an academic discipline, Krishnan (2009) posits six qualities. In his view, disciplines have:

- 1) a particular “object of research,”
- 2) a body of “accumulated specialist knowledge” referring to their object of research,

- 3) “theories and concepts” that can organise knowledge effectively,
- 4) specific “terminologies or technical language,”
- 5) developed particular “research methods,”
- 6) an “institutional manifestation” in the form of a subject taught in universities academic departments and professional organisations.

An important additional point in the establishment of disciplines is control over specific channels for disseminating knowledge (journals, book series and conferences). The importance of communication is, for example, emphasised by Simon (2011, 1) in his study of the formation of physics during the second half of the nineteenth century, as such a perspective may be “an efficient way of combining the focus on knowledge and practice with that on institutional, occupational and social roles.”

International recognition and generally shared norms regarding academic credibility are other characteristics that are often associated with academic disciplines (Becher and Trowler 2001, 41). Control over how knowledge is disseminated and acknowledged is emphasised by Lenoir (1997, 47) who asserts that: “disciplines are the institutional mechanisms for regulating the market relations between consumers and producers of knowledge.” In regulating the market of knowledge, disciplines distribute status and rewards. In this regard, disciplines are closely related to “professions” (Abbott 1988), and the two are often tightly intertwined. Indeed, establishing an “academic discipline” is often a key strategy for strengthening the autonomy and status of a profession. For example, Danziger (1997) described how the discipline “psychology” annexed many fields in which psychology had not made important contributions (such as personality, motivation and areas of applied psychology). Grouping these diverse areas together as branches of one discipline undoubtedly had practical advantages. It advanced the cause of professionalization by implying that the more practically oriented branches had a respectable link to basic science, and it legitimized the otherwise esoteric interests of the academics by implying that their work had significant practical applications. But, for the most part, such implications were nothing more than promissory notes to be cashed in at some time in the future. In short, it was much easier to annex such fields institutionally than to assimilate them intellectually, and psychology, therefore, became extremely fragmented and incoherent.

Sugimoto and Weingart (2015) adopt a similar approach to that of Krishnan in their review of central aspects of academic disciplines. Depending on the chosen perspective they suggest that disciplines can be discussed in terms of their cognitive, social and communicative characteristics. Moreover, aspects such as separateness, tradition (history) and institutional anchorage play important roles. In partic-

ular, Sugimoto and Weingart highlight the importance of “narratives” in developing a “disciplinary” identity. The importance of a shared and reiterated history of the field is indeed an important feature of a discipline. Such histories can take different forms, but a key event in these stories is often the “birth” of the discipline. Sugimoto and Weingart (2015) distinguish a few typical narratives: that of the founding fathers or mothers, a key event (for example a landmark conference), or publication (a specific journal or book). However, the story can also be about a movement (women’s rights or environmental concerns) originating outside “academia.” Yet, this shared history is constantly re-written as disciplines develop, and a change of focus may result in new histories being written. As concluded by Hjørland (1998, 166) in his study of the formation and classification of psychology: “disciplines can continue to exist and grow even if the criteria that played a critical role in their establishment are later abandoned.”

3.3 The size of disciplines

Jacobs (2013, 27), builds on Turner in his definition of disciplines when stating: “A discipline is defined as a broadly accepted field of study that is institutionalised as a degree-granting department in a large number of colleges and universities.” He continues by stating (Jacobs 2013, 28) that disciplines are “organised groups that certify knowledge in the university context.” However, the definition used by Jacob differs from that of Turner in its emphasis on the size. Hence, in order to be a “proper” discipline an academic field needs to have a certain size. Accordingly, Jacobs (2013, 30) suggests that physics, which is represented in a vast majority of colleges and universities, might be defined as a discipline, while it can be questioned if the smaller field of astronomy, which is not represented at a majority of universities, is a discipline. Clearly there is a good argument to be found here, as a certain size is a requisite for achieving the status of being a discipline. Yet, making discipline about size bears problems. First, where do we draw the line: how large must a field be to count? And second, what happens to disciplines that are on a downward trajectory in terms of size? If, for example, fewer institutions offer education and research in “classical languages,” do they then risk becoming “de-disciplined?” Still, size does matter when discussing disciplines, and this issue becomes especially noteworthy in relation to neighbouring concepts such as research field, knowledge domain and research specialty.

The size and growth of disciplines have consequences for their ability to communicate. In large heterogeneous disciplines a given member may only grasp certain aspects of the knowledge produced. Indeed, Dogan (2001) argues that disciplines are no longer the most important units in scientific communication. In his view, it is impossible for any re-

searcher in disciplines like sociology today to master the entire knowledge of a whole discipline. Dogan states (2001, 14851): “The process of specialization has tended to disjoin activities which had previously been united, and to separate scholars belonging to the same formal discipline, but who are interested in different fields.”

3.4 Disciplines as social and epistemological entities

One of the more elaborate attempts to define discipline is provided by Turner (2000, 47) who writes:

Disciplines are kinds of collectivities that include a large proportion of persons holding degrees with the same differentiating specialization name, which are organized in part into degree-granting units that in part give degree-granting positions and powers to persons holding these degrees; persons holding degrees of this particular specialized kind are employed in positions that give degree-granting powers to them, such that there is an actual exchange of students between different degree-granting institutions offering degrees in what is understood to be the same specialization.

This rather lengthy definition focuses on disciplines as organisations regulating how rewards and positions are allocated, and it explains how a discipline reproduces itself. Richard Whitley (2000) provides us with a similar definition of disciplines although focusing less on the formal apparatus of degree granting. In his words (81), academic disciplines are “units of labour market control which trained knowledge producers in particular skills that monopolised contributions to particular intellectual goals.”

Thus, to be defined as a discipline requires that a particular area of research is recognised and acknowledged, not only by researchers themselves but by outsiders as well. Similarly, demarcation and control are emphasised by Kohler (1982 quoted in Gieryn 1999, 34): “Disciplines are political institutions that demarcate areas of academic territory, allocate the privileges and responsibilities of expertise, and structure claims on resources.”

The definitions above highlight different aspect of defining the concept of discipline, yet they all confer a view of disciplines as social, and foremost organisational units, rather than intellectual or epistemological ones, with a main focus on training and teaching as well as on upholding and protecting boundaries. Indeed, proponents of interdisciplinarity would argue that new knowledge could be seen as threatening “disciplinarity” rather than strengthening it. Importantly then, disciplines are not to be confused with topics, areas, subjects or interests; rather they should be understood as social institutions or social systems, with the main focus of reproducing themselves through the training

of new “disciples.” The heterogeneous nature of disciplines, due both to differences in national contexts and between branches of knowledge (social sciences, natural and medical sciences and the humanities), makes it hard to arrive at a definite definition. While recognising these challenges, it is evident that the most ambitious attempts to formulate a definition all point to the importance of organisational features, where control over educational degrees, communication channels and labour markets are key features.

On a more epistemological level, the formation of disciplines can be related to how “paradigms” are formed in Kuhn’s theory on the structure of science (2012). “Discipline” is not explicitly used by Kuhn, rather he used the term “scientific community.” Yet, in his 1969 postscript, Kuhn introduces the concept of “disciplinary” matrix in order to explain and clarify his use of the term paradigm. A key element of the disciplinary matrix is, according to Kuhn (186), the “concrete problem-solutions” or “exemplars” that students encounter in their education. Kuhn emphasises the learning of conventions and practices as an important feature in the formation of a disciplinary matrix, yet he also emphasises that this training becomes less relevant when research becomes more specialised: “As their training develops, however, the symbolic generalisations they share are increasingly illustrated by different exemplars.” In conclusion, what Kuhn calls “paradigm” or in later writings “disciplinary matrix” is important to consider when discussing the nature of disciplines, not least as many subsequent theories on “disciplines” and “fields” are directly inspired by the Kuhnian view (for example, Whitley 2000; Becher and Trowler 2001). However, it is important to emphasise that “academic disciplines” often contain several “paradigms” (multi-paradigmatic fields) or they may be viewed, as is the case with many disciplines in the humanities and social sciences, as “pre-paradigmatic.” This means that several competing “ways of doing” research exists (multi-paradigmatic), or it might be that few agreed-upon conventions and practices exist thus making the field pre- or non-paradigmatic.

Importantly, disciplines change and develop over time. Toulmin (1977) suggested that a science [discipline] develops continually as either the content or the institution will remain stable as the other changes; if a discipline encounters a theoretical crisis, its institution will insure its survival for a time until a new theoretical foundation has been established. If its institutional existence is threatened, its theoretical contributions may survive in a new organisational setting. Moreover, loosely defined fields may gradually develop into more stable disciplines. Library and information science, for example, started as a multidisciplinary field based on literary studies, children’s culture studies, psychology, sociology, management, computer science, etc., and then developed towards a monodiscipline in its own right (Tengström 1993, 12).

4.0 The history and future of disciplines

The need to define and separate different areas of learning and knowledge has a long history. In western thinking, this tradition can be traced back at least to Plato and Aristotle where the latter in his Lyceum divided areas of learning into three kinds: productive (for example engineering, strategy and rhetoric), practical (politics and ethics) and theoretical (physics, mathematics and theology) (Kenny and Anselm 2019). Later, the “seven liberal arts,” which were established in ancient Rome, formed the basis for separating teaching areas in the medieval universities and onwards. The liberal arts grew out of several traditions where in particular the influence of Islamic learning has been emphasised in more recent scholarship (Kimball 2010: 1-12) The seven liberal arts, “trivium”(grammar, rhetoric and logic) and “quadrivium” (geometry, arithmetic, music and astronomy) shaped educational institutions for a considerable time, and the tradition of “liberal arts” is still strong today, especially in an American tradition. Similar to Aristotle’s theoretical sciences, the liberal arts are foremost viewed as part of an effort to become educated in a general sense (“bildung”), rather than to acquire specialist knowledge. The establishment of disciplines can be seen as continuing the tradition of “artes” and several fields of learning, such as literature and physics, are also considered to be contemporary disciplines. However, the emergence of disciplines can also be seen as a distinct shift from the generic to the specific, and from the education of “full citizens” to the training of specialists. Moreover, disciplines are tightly connected to the emergence of the modern research university, and the idea of teaching and research as the two main missions of scholars. In contrast, the liberal arts have mainly been associated with the teaching of a tradition rather than the production of new knowledge.

4.1 The emergence of disciplines

Academic disciplines, in their more modern form, were first developed in Germany during the eighteenth and early nineteenth century. Notably, the term “discipline” was used long before the eighteenth century as Stichweh (2001, 13727) notes: “There exists a long semantic prehistory of disciplina as a term for the ordering of knowledge for the purposes of instruction in schools and universities. But only the nineteenth century established real disciplinary communication systems.” Hence, the term “discipline” has a much longer history than the modern concept of academic disciplines as relatively well-defined fields of knowledge production.

In explaining the emergence of disciplines, Stichweh (1992) points to three related developments:

- 1) the stabilisation of scientific communities and the establishment of formal organisational structures in universities,
- 2) the separation of disciplines from recognised professions like law, theology and medicine, and
- 3) the development of a formal and well functioning scholarly communication system.

The importance of communication structures is emphasised also by Bawden (2017) in his description of the development of chemistry: "Chemistry was in the lead in the development of disciplinary speciality generally, with its associated science communication system, in the latter part of the nineteenth century, with initiatives including learned societies, specialist libraries, conferences and their proceedings, journals, monographs, abstracts, reviews, and guides to the literature."

Similar explanations are provided by Whitley (2000, 57): "By systematically connecting organisational status and authority to extra-local reputations for contributions to collective intellectual goals, the nineteenth- century university system bureaucratized intellectual production and organized into distinct, specialized disciplines." Similarly, Clark (2006, 55), in his study of the establishment of the modern university, exemplifies how disciplines emerged at the University of Göttingen in mid-eighteenth century in order to "facilitate ministerial paperwork." Hence, the emergence of disciplines as a prime unit for the organisation of knowledge is largely a history of stabilisation, formalisation and bureaucratisation.

The development of disciplines was enabled when distinct knowledge areas separated themselves from the three faculties of the traditional university. Furthermore, the stabilisation of disciplines in the nineteenth century was dependent on the development of "occupational roles." The gradual processes of professionalisation and specialisation were instrumental in positioning "discipline" as the primary unit of academic activity (Stichweh 1992). In an American context, disciplines emerged as important organisational and institutional entities even later, as Jacobs (2013, 45) writes: "Before the Second World War, the idea of discipline-based departments was well ensconced. As a practical matter, however, at most colleges and universities, departments were usually remarkable small in size."

During the twentieth century, disciplines came to be the main organising principle for the division of labour in academic institutions, and while increasingly questioned they still play a central role in structuring and organising knowledge. Hence, an important attribute of an academic discipline is the time horizon under which it functions, and while research policy and institutional arrangements may change rather rapidly, disciplinary structures tend to remain largely unchanged. At the same time, academic disciplines in their present form are rather recent inventions, a little

more than hundred years old (Klein 1996, 6). Consequently, it should be remembered that disciplines refer to a specific organisation of knowledge production that can be situated historically, and while this organisation principle has dominated knowledge production over the last hundred years, it is by no means given that they will play the same role in the future.

4.2 Challenges to academic disciplines

The organisation of academic research has gone through profound changes in the late twentieth century, and the importance and relevance of "disciplines" has been challenged with developments described under labels such as, "mode 2 knowledge production" (Gibbons et al. 2001) and "post normal science" (Ravetz 1999). According to these authors, science is now entering a phase where knowledge production is thoroughly integrated in society, and in which the control of science is no longer only in the hands of a disciplinary elite, but involves also an "extended peer community." The terms "post-normal" signals that this is not what Kuhn defines as "normal science" but rather a type of knowledge production in which "facts are uncertain, values in dispute, stakes high, and decisions urgent" (Ravetz 1999, 649). Similar developments are described by Gibbons and colleagues in their argument for a "new mode 2" in the production of knowledge. In this narrative disciplinary structures and boundaries are seen as hindering knowledge production: "Conformity is encouraged by disciplinary collegiality, by expectations and rewards from disciplinary peers" (2001, 149). According to Gibbons and colleagues, disciplines are foremost articulated in teaching and education. While disciplinary identity matters greatly inside the university, it is less relevant when communicating with society at large. Such accounts suggest that disciplines are too narrow to address key problems in society, and disciplinary boundary keeping hinders the production of knowledge. The ideas of "mode 2 knowledge production" and "post-normal science" have had considerable impact on policies and research agendas despite being criticised for being largely "political" constructs rather than empirically grounded observations (Godin 1998). In the wake of these criticisms, the disciplinary structuring of research and education is questioned on several counts. Jacobs (2013, 13) summarises the five main criticisms of disciplines, they:

- 1) hinder communication,
- 2) suppress innovation,
- 3) hamper economic contributions from universities,
- 4) hinder the development of integrated solutions to urgent social problems and
- 5) result in the fragmented education of undergraduates.

4.3 The future of disciplines

Disciplines, it should be emphasised, do not play the same role across fields and contexts. In older traditional disciplines, for example philosophy or history, disciplinary identity is strong, despite recurring calls for interdisciplinarity. Moreover, as “disciplines” have strong connections to educational programs, teaching and training, the concept seems to be more central to academic fields in which teaching traditionally has been important. This is reflected in the way disciplines appear to play less important roles in fields where a considerable part of research is conducted outside the university system and in fields with a “vocational” focus (Klein 1996, 39).

The importance of “discipline” is not least visible in the appointment of professors where a candidate may be excluded, not on the basis of merits, but purely on the basis of not having the “correct” disciplinary background. A discipline that demands proper training (e.g., PhD education) in order to qualify as a professor is history, while the situation is different in a field such as economics where the ability to contribute to the field (e.g., publish in economic journals) warrants inclusion in the discipline (Hammarfelt 2017). Thus, the borders surrounding disciplines are sometimes defended fiercely, while others are more permeable. Moreover, when discussing “academic disciplines” it is important to emphasise that this organisation of knowledge production is more pronounced in continental Europe than in the United Kingdom and the United States (Lawn and Furlong 2009; Gibbons et al. 2001, 149).

Despite heavy criticism, disciplines remain important for organising contemporary knowledge production and higher education. For example, while Gibbons et al. mainly view disciplines as out-dated and conservative constructs, they still contend that “disciplinary structures are long-term and relatively stable.” Moreover, as Stichweh (1992) notes, researchers still believe in the intellectual rationality of a principal disciplinary identity. The importance of disciplinary identity is illustrated in that almost all “interdisciplinary” gatherings start with participants referring to their “parent” discipline: origin still matters, even among highly interdisciplinary researchers.

For some, like Stichweh (1992, 14), disciplines are important as counterweight to rapid and extreme specialisation. In fact, disciplines such as history and many other fields in the social sciences and humanities, which require certain broadness in both teaching and research, appear to be most inclined to defend disciplinary borders. Moreover, disciplines are important in relation to professional autonomy and collegiality, as these function as “reputational organisations” (Whitley 2000), which act alongside and beyond institutional hierarchies and thus offer alternative venues for recognition and reward. In such interpretations, the

movement towards “postdisciplinarity” may be seen as an attempt to lessen the professional autonomy of academic researchers.

5.0 Concepts for disciplinary boundary crossing

Boundaries between disciplines are sometimes well defended, and disciplinary identity plays an important role in many fields. Yet, due to intrinsic and extrinsic reasons “boundary crossing” has become pervasive in contemporary academia, to the degree that “boundary crossing has become part of the process of knowledge production, not a peripheral event.” (Klein 1996, 56). Klein identifies six partly overlapping reasons for crossing disciplinary borders:

- 1) changes in cognitive and epistemological structure,
- 2) borrowing of tools, methods, theories and concepts,
- 3) the pull of urgent social and intellectual problems,
- 4) the current complexity of disciplinary research,
- 5) relations with neighbouring disciplines and
- 6) redefinitions of disciplinary borders.

In addition, it might be added that changes in research policy, for example regarding funding opportunities, may be a further factor that encourages disciplinary boundary crossing.

Interaction between disciplines takes many forms, and depending on the level of depth and integration such activities may be labelled as: “crossdisciplinary,” “multidisciplinary,” “interdisciplinary,” “transdisciplinary” or even “postdisciplinary.” While these concepts overlap somewhat, they also carry specific connotations in terms of how boundary crossing occurs. Just as in the “concept” of discipline, these concepts are rarely properly defined in the literature. However, a few attempts to differentiate between them have been made, and the following characterisation, which partially is derived from Van den Besselaar and Heimeriks (2001), a few distinctive traits are outlined:

- “crossdisciplinarity” is any interaction between disciplines, for example referencing literature from another field, but it must not involve attempts of integration,
- “multidisciplinary” research suggests that a subject is studied using different disciplinary approaches, yet there is little integration in terms of theory and findings,
- “interdisciplinarity” involves a further integration of concepts, theory and methods, resulting in a more cohesive and integrated approach to a certain problem,
- “transdisciplinarity” is based on a shared theoretical framework and methodology, which transcends research projects and problems.²

Due to the high level of integration of both theories and methods transdisciplinary fields may over time evolve into new “disciplines.” This development is for example visible in the field of gender studies. Finally, the concept of “post-disciplinarity” is used less often in actual studies of science, and is used more as an argument for an academic system that completely has abandoned disciplinary borders, including departmental structures within universities.

6.0 Theories for understanding disciplinary differences

A comparative approach to studying academic disciplines is common, where practices, patterns and structures in one field are related to another field. In the literature, we find two frequently used theoretical frameworks for explaining disciplinary differences; one developed by Whitley (2000) and the other by Becher and Trowler (2001) (Whitley’s framework focuses on organisational aspects while Becher and Trowler’s focus is anthropological thus giving slightly different interpretations of the object under study).

6.1. Social and intellectual structure

A framework for studying disciplinary differences, or rather differences between research fields, is introduced by Richard Whitley, in *The Intellectual and Social Organization of the Sciences* (2000). The aim of the book is to contribute to an understanding of research fields “as particular kinds of work organizations which construct knowledges in different ways in different contexts” (6). Whitley’s theory is based on two main axes: mutual dependency and task uncertainty. Mutual dependency is a measure of how much the individual researcher is dependent on colleagues in his research. The second axis in Whitley’s theory is the degree of task uncertainty, which in turn depends on the intellectual organisation of a research field. The “Kuhnian view” would be that “the more paradigm bound a field is, the more predictable, visible, and replicable are research results and the more limited is permissible novelty” (119). In short, such a perspective entails that a field with a high level of agreement on overarching goals, theories and methodology is less likely to develop path breaking discoveries.

There is a strong focus on the organisation of work and the practices of researchers in Whitley’s framework. The significance given to these aspects partly explains its common use in studies of differences in scholarly communication between fields (Talja et al. 2007) as well as in the development and institutionalisation of research fields (Åström 2004). However, it can be argued that disciplines and research fields are more than work organisations, and the conclusion that “the social organisation” and “the intellectual organisation” (or cognitive organisation) of research fields are de-

pendent upon each other can, in fact, be questioned. The view of science as a type of “work organisation” might be insufficient for explaining the distinctiveness of scientific reasoning across disciplines, but Whitley’s theory provides an analytical position from which differences in communication structures between research fields can be studied.

6.2 Disciplinary tribes

Tony Becher and Martin Trowler in *Academic Tribes and Territories: Intellectual Enquiry and the Culture of Disciplines* (2001) offer an anthropological view of how disciplines are organised. They build upon differences between research fields that can partly be explained by categorisations such as “soft/hard” and “pure/applied” research. These characteristics were identified previously by Biglan (1973), who in turn based his categorisation partly on the concept of “a paradigm” (Kuhn 2012). According to this characterisation pure science is, in general, self-regulating whereas applied science is open for influence from outside.

Becher and Trowler differentiate between “urban” and “rural” sciences and between sciences that are “convergent” as opposed to “divergent.” The distinction between rural and urban reflects how circumscribed a discipline or a research area is; if many researchers are focused on the same problem, then the research area can be categorised as urban, while the opposite is true for a rural one. Convergence indicates the degree to which standards and procedures are agreed upon. A convergent discipline is guided by a controlling elite of researchers, while a researcher in a divergent discipline has greater freedom in choosing problems and methods (Becher and Trowler 2001, 184-5). A related concept is Andersen’s (2016) idea of differences between disciplines in terms of “cognitive convergence,” which focus on similar aspects but from a more epistemological (and philosophical) perspective.

Becher and Trowler (2001) propose an accessible theory in which commonly used metaphors describe the characteristics of research fields. Moreover, the concepts used by Becher and Trowler are drawn from different theories, and are, therefore, not part of a unified system, unlike Whitley’s framework. The terms used to describe the different categorisations hard/soft, pure/applied and urban/rural are first of all not specialised, and secondly, they are value laden. Usually something “pure” is regarded as better than the “applied,” and “urban” is connected to the modern while “rural” could be associated with the past.

The choice of theory can be said to be dependent on how “discipline” was defined in the first place; and the perspective of “disciplines” as either social or epistemological entities is of great importance. Notably, both these theories try to combine elements relating both to the social structure and to intellectual and epistemological characteristics, and

some of their concepts, like divergence/mutual dependency, overlap considerably. While still very much used in studies of academic fields it can be argued that Whitley's and Bechers and Trowler's theories do not fully reflect contemporary structures and developments in academic knowledge production. Attempts have, therefore, been made to extend these frameworks in order to develop updated and more detailed accounts (cf. Gläser et al. 2018).

7.0 Related concepts

Discipline is often used in relation to similar concepts, such as research field, research area and knowledge domain. It is not uncommon that these terms are used as synonyms in written text (Hammarfelt 2018), yet, as we will see below, these concepts all carry different meanings and connotations. Notably, topographical metaphors, such as field and area, are often used to describe scientific disciplines and research specialties. Research directed at a specific topic is described as a "field" with "boundaries" to other neighbouring fields. Such metaphors also extend to concepts like "research front" and "disciplinary landscape."

7.1 Research field / intellectual field

The intellectual field is an expansive and more general social unit of knowledge production and co-ordination. Whitley (2000, 7) defines "intellectual field" as a "broader and more general social unit of knowledge production and co-ordination" compared to discipline. In several ways "intellectual fields" share many similarities with disciplines, as they are distinct and well-defined organisations that control how research is done. Importantly, however, as Whitley points out, intellectual fields "are by no means always identical with employment or educational unit boundaries." Hence, "intellectual field," can be regarded as a broader concept than discipline as it incorporates activities outside academia, although both concepts share a connection to social and organisational structure. The broader scope of intellectual field, sometimes referred to more loosely as "research field," may explain why the term is preferred when explicitly criticising traditional academic disciplines (c.f. Gibbons et al., 2001). Intellectual field or research field seems to be a viable alternative for describing units or groupings that have resonance in the social organisation of research (for example, through reward structures) while reaching beyond the limitations of traditional disciplines.

7.2 Research Area

Research area is a loosely defined term, which in its geographical connotations relates to field. While the concept "research field" is quite often used to connote discipline-

like structures, "research area" often targets smaller units. Typically, it is used to refer to the research interests of individuals or institutions (e.g., "scholarly communication" or "urban living"), which often span across disciplinary borders.

7.3 Knowledge domain

Domain is used in LIS to represent a specific area of knowledge. The concept is associated with "domain analysis," an approach introduced by Hjørland and Albrechtsen (1995), which emphasises the social and contextual nature of knowledge. Domain, in the definition provided by Hjørland (2017) could take the form of a discipline, but it can "be distributed in multiple disciplines or specialties, or be a non-discipline, such as a hobby. Subject in this encyclopedia [ISKO] is understood as the object of subject analysis, which is also a different concept. A domain, on the other hand, is a specialisation in the division of cognitive labor that is theoretically coherent or socially institutionalised." The important distinction is here made in terms of theoretical coherence, which rarely is found in disciplines, expect perhaps in a few "paradigmatic" fields (such as physics) (for in-depth definition and conceptualisation see, Hjørland (2017) "domain analysis" http://www.isko.org/cyclo/domain_analysis).

7.4 Specialty

In terms of size, specialty has much in common with "research area" but it is often used in more specific terms. A specialty is often regarded as a limited and coherent area of research. A definition given by Morris and Van der Veer Martens (2008, 213) is that: "Research specialties consist of relatively small self-organising groups of researchers that tend to study the same research topics, attend the same conferences, publish in the same journals, and also read and cite each others' research papers." De Solla Price estimated that a scientific specialty or community comprises about 100 authors or 10, 000 articles (Price 1963). Later calculations increase these estimations to 250-600 authors (Wray 2010). Research specialties can be seen as "the largest homogenous unit in the self-organising system of science" that share knowledge, vocabulary and archival literature (Morris and Van der Meer Martens 2009, 219). In this view, research fields and disciplines are viewed as larger units where "local homogeneities are mixed together and cannot be studied in local terms" (219). Obviously, there are major differences across disciplines regarding the size of specialties, and particularly large-scale collaborations in physics, for example, may involve larger groups.

Specialty is not the only term used to denote a group of researchers focused on the same topic, method or theory; but a range of different concepts have been proposed, de-

pending on the focus of research. "Thought collectives" [Denkkollektiv], (Fleck [1935] 1979), "scientific communities" (Hagstrom 1965), "invisible colleges" (Crane 1972), "scientific collectivities," (Woolgar 1976), "scientific/intellectual movements," (Frickel and Gross 2005) and "epistemic cultures" (Knorr Cetina 2009) are but a few of the terms in use.

8.0 Discussion

The complexity of defining "discipline" is partly due to its dual role as both a social and organisational entity and as a description of specific areas of knowledge. This tension becomes visible when studying the etymology of the concept, where the origin can be traced back to both the one who studies ("disciple") and what is studied ("doctrina"). These two functions, as a way of categorizing and structuring knowledge and as a principle of dividing work in academic institutions, is evident also in theories developed for studying and comparing disciplines. Historical studies of disciplines might reveal how emphasis on either the social or the epistemological and intellectual has shifted over time. The organisational function, which by many authors is seen as central to the development of contemporary "academic discipline," is tightly connected to the emergence of the modern university, while "discipline" in terms of ringing in a more generic "area of learning" has a longer history. That our understanding of discipline is context dependent is further emphasised by differences in its use and significance across geographical regions, where its importance is greater in continental Europe compared to the United Kingdom and the United States. Similar differences can also be found between disciplines where traditional, teaching-oriented fields are more prone to exhibit a strong disciplinary tradition.

This is a conceptual paper and does not engage in longer descriptions and the analysis of specific fields and disciplines. However, the claim made is not that disciplines are for mostly conceptual constructs but rather that they are firmly grounded in research practices, organisational structures and materialities. Disciplines, in comparison with fixed constructs, are "enacted" in actions and activities (Pilerot 2014, 47). Indeed, an important function of disciplines is training in a specific tradition of doing things; or in a Foucauldian interpretation: the disciplining of the body to perform tasks in a certain manner. Ultimately, our perspective on disciplines is dependent on the purpose and the perspective taken; for an information researcher, communication patterns and publication practices may be of key importance, while a sociologist would focus on relations and organisational features. Epistemological aspects emerge in a philosophical perspective, while the historian would naturally focus on the historical development of disciplines. Clearly, these different perspectives will result in slightly dif-

ferent definitions, conceptualisations and operationalisations of the concept.

In fact, Sugimoto and Weingart (2015) argue for an understanding of disciplines as a boundary object in order to make room for "multiple interpretations." However, the labels we assign and the categorisations we create matter, not only when presenting a "result" but also when formulating fundamental research questions. Excessive precision in defining the concept of "discipline" is probably neither possible nor desirable, but there is undoubtedly a need for explicit discussions and justifications when using it and related concepts. Treating concepts such as "field," "subject" and "discipline" as synonymous results in a loss of conceptual diversification and exactness, which may hamper theoretical and methodological development, and the imprecise use of concepts can hinder the transfer and incorporation of research findings. Due to different understandings of what constitutes a discipline, areas related to knowledge organisation and LIS, such as the sociology of science, science and technology studies (STS), studies in higher education and research policy may thus find it difficult to communicate effectively and to incorporate insights from other fields. Moreover, vague use of "discipline" makes it difficult to draw conclusions that are valid beyond a specific study. Thus, if the studied "disciplines" have little overlap with academic disciplines as they manifest themselves as organisational units in contemporary academia, then the conclusions drawn from such studies have limited use. For example in the subfield of bibliometrics, the label "discipline" often serves the function of hiding what is really studied, a very specific set of published documents in a database, and not a standalone organisational unit that is manifested in social arrangements (Hammarfelt 2018).

In conclusion, contemporary academic disciplines should primarily be seen as social and organisation constructs. The historical emergence of academic disciplines supports such an understanding, as do theories on how knowledge is produced and organised. Nevertheless, it is important to recognise and study how intellectual and epistemological features interact with social structures, as disciplines are shaped and developed through the constant interplay of social organisation and intellectual formation.

Notes

1. Mills and Broughton (Bliss 1977, 37) argued strongly for the use of disciplines as the basic organizing principle in the introduction to the Bliss 2 system. The opposite viewpoint has been defended by, among others, James Duff Brown (cf., Beghtol 2004), Szostak (2008) and Gnoli (2016 and 2017).
2. As pointed out by Van den Besselaar and Heimeriks (2001), an older interpretation of the term points to "in-

terdisciplinarity" as a "meta-theoretical perspective" like structuralism or Marxism.

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