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INTERDISCIPLINARY DISCOURSE

COMMUNICATING ACROSS DISCIPLINES

Interdisciplinary Discourse

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Communicating Across Disciplines

palgrave
macmillan

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Acknowledgements

The authors would like to thank all those who participated so willingly in this research. Their patience and cheerful cooperation made the process of data collection an enjoyable experience and without them this book could not have been written.

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Introduction

Reading it Differently

*Extract 1.1

```
01    Dave:    We could actually do the analysis of variance of the time series
02             (if the xxxx are good)
03    Joan:    Yeah!
04    Dave:    (xxx) make any difference
05    Doug:    No
06             (4.0)
07    Joan:    As [long as it's not] a problem when we publish it that's=
08    Dave:        [(It'd be good.)]
09    Joan:    =what-[(we'd need.)
10    Lucy:          [They're unlikely to read it back.
11             (1.0)
12    Joan:    Exactly. I mean [certainly] if a biologist reads it they won't=
13    Lucy:                   [It's okay]
14    Joan:    =even think about it. But (2.0) if a statistician reads [it
15    Doug:                                                           [If a
16             statistician reads it they'll (.) tell you it's wrong to the analysis
17             (and xxxxx) theory
```

```
18            (0.5)
19   Dave:   Mm
20   Joan:   Well it is [a standard] (xxx) condition [(xx xxxxx)
21   Doug:            [It assume-]                  [It assumes that the
22            time question…
             (WSBPR0526/5-00:27:40)
```

*For details of transcription conventions used, see Appendix 1

The above extract is taken from a systems biology meeting forming part of a shared project involving specialists with different disciplinary backgrounds. Members of the team have been discussing a problem in their analysis and considering whether a reanalysis of some of the data is necessary, a discussion that comes to be framed in terms of what the implications might be if they publish a paper including the analysis. The extract begins with the end of a suggestion from Dave that prompts agreement from Joan and Doug and, after a reasonably lengthy pause, a response from Joan suggesting that what matters is whether this will represent a problem if it's published. Lucy adds support to the idea that it will be unproblematic by suggesting that 'they' (the prospective reviewers of the paper) will be 'unlikely to read it back'. Having agreed with this suggestion, Joan then raises an interesting distinction between two possible categories of reader: biologists and statisticians (lines 12–14). She claims that the former will not give the issue a second thought but implies that it might be problematic for the latter, a point taken up emphatically by Doug, who goes on to indicate where the problem might lie.

This short extract highlights a number of interesting issues that bear on the relationship between disciplines, three of which will be considered here. The first and most obvious point is that reference to disciplines is seen as unproblematic: When Joan refers to biologists and statisticians, these labels are treated as adequate descriptors for the purposes of the discussion that follows. While many of those present would describe themselves as systems biologists, the success of their interaction in these meetings depends in large part on their contributions as specialists in what might be described as their parent disciplines. This is reflected in a second aspect of the extract: the way in which participants speak as members of their discipline and are careful not to cross unstated but

implicitly accepted boundaries dividing this from other disciplines. In lines 12–14 Joan, a biologist herself, speaks confidently and authoritatively about what a biologist will 'certainly' do, but she stops short of making claims about how a statistician might respond. She marks the coming contrast with the adversative conjunction 'but', then pauses for two seconds, leaving the floor open. When no response is forthcoming, perhaps because the nature of the contrast has not been made explicit, she goes on to indicate the nature of the distinction involved. Once this is clear, she does not even finish the subordinate clause that precedes details of the contrast (line 15) before Doug, a statistician, speaks for his discipline. The fact that Joan makes no effort to complete her statement in the face of this interruption confirms that she has designed her turns to allow a representative of the relevant discipline to speak. This does not mean that she will necessarily agree with the general position (the fact that line 20 is prefaced with 'Well' implies a lack of alignment with Doug's claim), but if she disagrees it will be as a biologist.

The third aspect of this exchange that we wish to highlight relates to the way that the talk develops and points to something quite fundamental about the nature of disciplines. At issue here is the importance—or perhaps more precisely, the relevance—of a piece of analysis. On the surface at least, the claim that a biologist (lines 12–14) won't give a second thought about something that for a statistician would represent a fundamental flaw (lines 15–17) might be seen as critical of the former, positioning the biologist as in some way more slapdash than the statistician. And yet it is a biologist who makes this claim and nowhere in the talk, either in this extract or anywhere else, is there any suggestion that a biological analysis would be defective or in any way inadequate. One of the most basic challenges in interdisciplinary engagement arises from the fact that different disciplines have very different ways of understanding things, dealing with things and representing things: What may be of fundamental importance in one discipline may be of no more than peripheral relevance in another. When disciplines engage, these differences need to be negotiated, usually without the convenience of being able to frame them in terms of reviewer differences.

Finding the 'Inter' in Interdisciplinarity

The US National Academies are unequivocal: 'At the heart of interdisciplinarity is communication' (National Academies 2005: 19). It is odd then that so little attention has been paid to this aspect of interdisciplinarity in the research that is currently available. Reference is made to it in models and typologies, researchers reflect on their experiences of it and case studies underline its importance, yet the communication itself remains largely unexamined, a mystery at the heart of the interdisciplinary enterprise. The aim of this book is to penetrate some of that mystery and at the same time to demonstrate why it is important to understand better the nature of interdisciplinary interaction.

The small taste of interdisciplinary engagement in Extract 1.1 highlighted just some of the issues that arise when different disciplines are brought together in order to achieve shared objectives, though as an analysis it lacks the depth and range that is necessary to expose the interactional mechanisms that enable interdisciplinary work to get done—or undermine its effectiveness. It is beyond the scope of any single book to consider all of these or to cover the many different forms of interdisciplinarity that exist, but in what follows we use discourse analysis to shine a light on aspects of them, providing support for some of the findings of current research into this area and challenging the accuracy of others. In doing so, we hope to contribute to the rich fund of insights that already inform interdisciplinary activity.

As Chap. 3 will show, interdisciplinarity is a relatively recent phenomenon but already a fixed feature of the academic landscape. It may be overstating the case to claim, as do Henkel and Vabo (2006: 135), that it is 'regarded as a precondition for innovations and collaboration between industry and the overall needs of the knowledge society', but its burgeoning presence has much to do with its capacity to deliver practical solutions to pressing problems that are beyond range of single disciplines. It is important therefore to understand interdisciplinary research, and in particular what factors promote or inhibit its success, in order to design support and training that will maximise its impact and thereby its contribution to society. In order to do this we need to identify not only the

institutional and academic contexts in which it can be nurtured and the internal structures and configurations that promote success, but also how the day to day business of interdisciplinary research gets done. This takes many forms, but at its core are the research meetings in which the different disciplines involved engage in order to accomplish a range of things including establishing shared understanding, resolving differences, confronting challenges, planning, agreeing action and building a community of researchers—all of which are achieved through talk. Such meetings and the interaction of which they are constituted make an essential contribution to the success of interdisciplinary projects and in examining the discourse through which interdisciplinary business is talked into being, this book takes up, like Klein (2005: 7), 'one of the most neglected topics in the literature—How does one actually *do* interdisciplinary work?'

The Structure of the Book

The book is divided into two parts, the first introducing interdisciplinarity and identifying key issues that bear on our understanding of it. It is designed to provide an overview of the subject and more specifically to establish why the research featuring in this book is necessary. The second part of the book presents the findings of the research itself and concludes with a discussion of how these might inform interdisciplinary practice.

Chapter 2 focuses on the disciplines because these are the foundations of all interdisciplinary work. It provides a historical context for understanding some of the forces that influence the development of interdisciplinarity, working towards a conclusion that makes the case for the importance of interactional relationships in interdisciplinary communities. The chapter includes three cases that illustrate the complex relationship between disciplines and interdisciplines, and the different ways in which new interdisciplines emerge.

Chapter 3 also includes a very brief historical overview, but its main concern is with different forms of interdisciplinarity and the typologies and models that have been advanced in order to represent these. It uses this as the foundation for discussing the experience of interdisciplinarity

and the factors influencing interdisciplinary success, highlighting the need for greater understanding of how research teams interact.

Chapter 4 takes up this theme, providing a rationale for the approach adopted in the book. It begins by explaining why and how interaction is fundamental to the success of interdisciplinary research before moving on to consider previous work on communication in this context, recognising its contribution but also highlighting its limitations. Particular attention in this discussion is drawn to assumptions that have been made about the nature of interaction and the emphasis that has been placed on terminological challenges at the expense of interactional ones. The second half of the chapter examines previous approaches to researching interdisciplinarity, highlighting the limitations of the case study and interview-based methods that have so far predominated. This sets the scene for a discussion of discourse-based research and a description of the approach used in the book.

Chapter 5 is the first of two chapters with an epistemological focus. These examine the extent to which a standard model of stages in interdisciplinary research can be applied to the data set used in the book, beginning in this chapter with interaction in initial meetings. It begins with an introduction to work on epistemics in talk then develops an analysis of two initial interdisciplinary meetings on different subjects and with different aims. For the purposes of comparison, it also includes a brief consideration of an initial meeting in an interdiscipline, systems biology.

Chapter 6 completes work begun in the previous chapter on stages in interdisciplinary research. This time attention is directed to the way in which knowledge is constructed collaboratively. The analysis draws on data from a number of interdisciplinary meetings, some from within systems biology involving different projects and others from a specific research project bringing together the social sciences, biology, mathematics and economics. The second part of the chapter identifies a discourse marker that plays an important part in the building of understanding and draws attention to a significant interactional pattern in which it features. In its conclusion the chapter returns to the issue of terminology in interdisciplinary engagement and challenges a widely accepted claim.

Chapter 7 is concerned with identity and most of the analysis is dedicated to the ways in which this plays out in systems biology research

meetings. This interdiscipline is particularly relevant because it is at an interesting evolutionary stage and involves two groups of disciplines: those concerned with conducting experiments (known as 'wets') and those who work with the data from these experiments (known as 'dries'). The analysis of their interaction in the chapter indicates that in some situations there may be serious but hitherto unnoticed interactional problems of which even the participants themselves are unaware.

Chapter 8, the final analytical chapter in the book, explores the dynamics of leadership and the different forms it can take in research project meetings. It addresses the ways in which leadership activities and processes such as decision-making, negotiating and reaching consensus are discursively constructed by team members, and how different forms of leadership are instantiated through research interactions.

Chapter 9, the Conclusion, summarises the main findings of the research in the book and its contribution to our understanding of interdisciplinary research. It highlights outcomes that either reinforce or call into question current thinking on the nature of interdisciplinary engagement and makes some tentative suggestions on how interdisciplinary engagement might be improved and how trainers, leaders and the researchers themselves can contribute to this. The book concludes with a plea for a significant broadening of research perspectives on interdisciplinary work and indicates what approaches this might embrace.

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2

The Disciplinary Landscape

Introduction

Interdisciplinarity begins with the disciplines because, as Aldrich (2014: 13) so succinctly puts it, 'there is nothing to be "inter" about without disciplines coming first.' Disciplines, as Lattuca (2001: 23) has noted, are complex phenomena. At their most basic level, and as used in the extract that opened this book, they provide convenient labels as points of reference, widely used and largely unquestioned; but when the substance behind the label is tested, as it must be in interdisciplinary contexts, its complexity represents a significant challenge. Bluntly put, disciplines cannot be neatly characterised in ways that will allow them to be used as building blocks in the construction of new academic entities.

This chapter therefore begins with a consideration of the nature of the disciplines and the issues associated with them, moving from a historical overview, through an examination of the essential characteristics of the discipline and some relevant epistemological considerations, to a consideration of the ways in which disciplines might be brought together. This provides the basis for describing the different forms of collaboration and the terminology associated with these.

A Brief History of the Discipline

Many researchers would agree at least to some extent with Strathern (2004: 45) that disciplinary distinctness is a convenient fiction, but this is not the same as denying the very real and powerful presence of disciplines in the worlds of education and research. This section provides a brief account of the development of the disciplines focusing on the nature of this presence and its implications.

The starting point for a historical overview in itself offers an interesting insight into ways in which the discipline might be viewed. Moran (2010), for example, begins his account in the ancient world, tracing the roots of the discipline to Greek philosophy and in particular Aristotle's hierarchical organisation in terms of theoretical, practical or productive orientations. This starting point directs attention to the relationship between disciplines and the organisation of knowledge while at the same time serving as an interesting reminder that prejudice in favour of theoretical fields at the expense of applied subjects is longstanding. Other writers (e.g. Salter and Hearn 1996) begin their accounts in the Middle Ages with the formation of the first European universities, in which students followed a standard core curriculum before going on to specialise. Three aspects of this are particularly salient from the perspective of disciplines today. The first is the concept of the institution as a community of scholars, an idea that still has some resonance, and the second is the link between the specialisms and the professional world beyond the institution, exemplified in the study of medicine and the law. This development was to become more relevant as disciplinary configurations hardened in the nineteenth century, but it is the third aspect, the embedding of the discipline within formal structures and systems, which is perhaps of most interest. In order to understand this it is necessary to trace the process by which the first universities emerged.

Universities grew out of the cathedral schools, which, as the name suggests, were centres of learning attached to major religious institutions. At first relatively informal, these schools burgeoned as part of what has become known as the twelfth-century renaissance, though without the formal structures associated with universities. Rather, they were points of attraction for scholars, who were free to set up their own schools provided that

they could attract a sufficiently large body of students. Perhaps the most well-known scholar of the period, Abelard, serves as a useful illustration of the very individual character of these precursors to universities. He first joined the Cloister School of Notre Dame in Paris, where he challenged the authority of the leading realist philosopher, William of Champeaux, attracting students away from the latter. Ill health brought on by overwork eventually led to Abelard's departure from Paris, but he returned after six years to set up his own school in Mont St. Geneviève again attracting a significant following, and even when later in life he retreated to a hermitage near Troyes, students sought him out in large numbers. Gradually, however, the relatively open and peripatetic system in which Abelard flourished gave way to the development of more stable institutions. The shift, and its significance, is admirably captured by Lloyd (1939: 70):

> Everything which divides modern Cambridge from twelfth-century Paris is then only a matter of time and logical development. The closed corporation, with rules, privileges, strict conditions of entry, undertaken for the purposes of mutual help and protection – this makes the university. It may be a corporation of masters as at Paris, or a corporation of scholars founded as protection against the greed of landladies and shopkeepers as at Bologna. It does not matter by which route the essential goal is approached. Once the germ of the guild system of trade and industry is applied to any educational centre, it has ceased to be a school and becomes a university.

The contrast between, on the one hand, the pursuit of knowledge through intellectual rivalry independent of institutional constraints, and on the other access to it via the structures and systems of a formally established university could not be more profound. It is within the context of the latter that disciplines—and following from this the structures of interdisciplinarity—need to be understood, and it is within this framework that the force of Foucault's conception of the 'disciplining' of knowledge, in which the discipline serves to regulate conduct, finds purchase.

The historical moment at which the discipline evolves into its modern form from this context is conventionally located in Prussia in the early nineteenth century with the development of secular research-oriented universities under state control. The intellectual foundations of this can be traced to the rise of the natural sciences and the Enlightenment drive

to encyclopaedic classification, but the main drivers were to be found in developments outside the institution. The most powerful of these were increasing industrialisation and associated technological developments, creating the demand for a system that would supply trained technicians and professionals for industry while also feeding the results of research into industrial development. The resulting specialisation in turn contributed to the development of hierarchical systems within hardening disciplinary boundaries, a process strengthened by competition for funding and links with associated learned societies. The effects of these developments are reflected today in the departmental organisation of universities, the award of degrees in specific subjects, the existence of learned bodies with clear disciplinary affiliations, associated journals, and so on, and at the heart of the disciplinary enterprise is a relationship between universities and society, including the professions.

It is commonly claimed that the Prussian system was the prototype for the modern European and North American university. Moran (2010), for example, argues that although the resulting proliferation of disciplines attracted some criticism aimed at over-specialisation, the close links between education within the discipline and the pursuit of a career associated with that discipline, combined with the institutional power and independence of the university, ensured that such reservations were essentially peripheral. Abbott (2001: 122–131), however, proposes a different perspective on disciplinary history, one which places the US system at the heart of developments. This system, he argues, is unique and has remained largely unchanged for a century, influencing developments in Europe and elsewhere. While recognising the historical significance of nineteenth-century developments in Germany, he argues that the system there left little scope for expansion and that career development depended on moving from institution to institution, maintaining the same narrow research focus even when the move involved a nominal change of field. The consequences of this, he claims, were that the disciplines in the modern sense did not develop; instead '[t]here was intense cultivation of small areas, which were then surrounded by large tracts of empty intellectual space' (2001: 124).

Abbot's views of the French and English university systems at this time are also worth noting in passing because of the way in which they draw attention to important cultural differences within a broadly disciplinary

structure. French university education in the late nineteenth century, he argues, tended towards the vocational, with powerful chairs but no research institute structure. Paris was seen as the elite centre, attracting the best minds at the expense of the regions and allowing the development of a career advancement system dependent on patronage groups and clusters. In contrast, he claims, English universities were resolutely unprofessional and often anti-research, with a strong—usually college-based—patronage structure. Exam content rather than disciplinary orientation was central to the system, producing what was in effect a pedagogically oriented approach.

The development of US universities, Abbott argues, involved combining undergraduate teaching systems based on the English model, with graduate research institutions on the German model, producing strong departmentalisation reinforced by the formation of national disciplinary societies. The implications for career development in this system are particularly striking. Advancement is necessarily within disciplines, with disciplinary networks providing candidates for appointment by national disciplinary bodies. All universities have roughly the same departments and since career prospects depend on the disciplinary system as a whole, universities are obliged to work within this. Hence, disciplinarity is reinforced, and attempts to reconfigure disciplinary structures within an institution are likely to flounder because of the resulting negative impact on the career prospects of academics working outside the conventional framework. Even the removal of a department has no significant impact because in such cases, Abbott argues, a 'bubbling' system closes the resulting disciplinary gap, and the integrity of the system as a whole is preserved. There is in any case, he claims (2001: 43), considerable overlap between disciplines, allowing them to 'rejuvenate each other by a system of reciprocal theft'.

The system of majors in US universities further reinforces this disciplinary structure, representing a serious challenge to interdisciplinarity that is not present in the UK system, where undergraduate programmes are not necessarily disciplinary. Abbott refers to 'dual institutionalization' in the case of the former: 'on the one hand in an interuniversity labor market annually transacting tens of thousands of faculty and on the other in an intrauniversity curriculum annually "disciplining" millions of students' (2001: 28).

Whether or not Abbott's positioning of the US system in the historical development of the discipline is accepted, his insightful analysis of the relationship between individual disciplines and the broader disciplinary structure produces a telling account of the power of the discipline to influence both the student curriculum and the career structures of academics. A corollary of this is that interdisciplinarity might serve to undermine the power of disciplines as mechanisms of control and hence threaten the positions of those involved in exercising such power, though what interdisciplinarity might represent will depend in part on an explication of the nature of the discipline itself. The next section addresses this.

Characterising the Discipline

Although there is no general agreement on how academic disciplines should be characterised, the history of their development has already pointed to aspects that would need to feature in any comprehensive formulation. This section explores ways in which the disciplines have been characterised, using this to identify core aspects and develop a description that can form the basis for a working definition. Its aim is to convey a sense of their complexity and how deeply they are embedded within broader social, institutional and intellectual structures.

As an initial approach to understanding the nature of disciplines, building on the historical perspective already established, it is helpful to consider them as entities within a broadly institutional framework. This produces a list of aspects that would be relevant to the activities of any discipline:

- *Organisational* (Henkel)

  We have therefore taken the discipline and the enterprise, or the higher education institution, as the main institutions or communities within which academics construct their identities, their values, the knowledge base of their work, their modes of working and their self-esteem. (Henkel 2000: 22)

The historical development of the discipline has taken place within the context of the university as an institution and in order to understand it we therefore need to take account of the institutional context and the community of scholars associated with it.

- *Epistemological* (Aldrich)

  To speak of scholarship as disciplinary, or by extension interdisciplinary, means one expects the scholarship to be interconnected with other organized knowledge, and to be part of an intellectual and organizational framework that is commonly recognized by a community of scholars. (Aldrich 2014: 16)

  Perhaps the most fundamental aspect of the discipline, though in terms of precise delineation the most challenging, is its connection with a body of knowledge and associated ways of deriving, organising and representing this. This provides a foundation for the mechanisms of control and evaluation that were mentioned in the previous section.

- *Cultural* (Becher)

  …each discipline clearly has its own particular qualities. These are not, of course, purely epistemological. Disciplines are also cultural phenomena: they are embodied in collections of like-minded people, each with their own codes of conduct, sets of values and distinctive intellectual tasks. (Becher 1981: 109)

  Disciplines are also collectivities, groups of individuals within departments, learned organisations, panels, etc. who develop ways of doing things that are not merely local but in many respects common across the discipline. These would be realised through what Trowler (2014) calls 'disciplinary practices' such as research, teaching and administration. He notes, however, that such practices will be inherently unstable and contextually contingent. Huber (1990: 242–244) has taken this further, extending the 'traits associated with the disciplines' to 'practices and preferences in private lives' and social background, while Murray and Renaud (1995) provide evidence that teachers in different academic disciplines approach teaching differently.

- *Moral* (Ylijoki)

  I am proposing that at the core of the disciplinary culture can be conceptualized as a moral order. The moral order constitutes the main distinctions concerning the vices and virtues of the local culture: what is considered to be good, right, desirable and valued as opposed to what is regarded as bad, wrong, avoidable and despised. (Ylijoki 2000: 341)

  One aspect of the cultural dimension of a discipline is the ways in which moral beliefs and norms of behaviour are associated with membership so that, for example, while one discipline might tolerate public attacks on the academic integrity of claims made by conference speakers, members of another discipline might consider this reprehensible. Strober (2011: 33–34), for example, describes how in an interdisciplinary meeting a participant from the religious studies department publicly chastised an economist for his forthright criticism of a paper given by a mathematician, a response that he considered acceptable in his own field.

- *Political* (O'Neill and Meek)

  … the self-regulation of professions has as much to do with the politics of knowledge as with anything else. This is especially so for the academic profession, with its stake in controlling knowledge production and dissemination. (O'Neill and Meek 1994: 97)

  The fact that disciplines are institutionally embedded brings with it an inevitable political dimension, but from a disciplinary perspective it is the politics associated with the control of knowledge that has definitional purchase.

This characterisation captures some key aspects of the discipline, but it fails to do justice to its intellectual dimensions, the aspects most associated with academic endeavour with roots that go further back than the foundation of universities. The model proposed by Repko (2008), on which a number of researchers have drawn (see, for example, Kalra and O'Keeffe 2011), is based on the notion of *disciplinary perspective*: 'the ensemble of a discipline's defining elements that include phenomena,

assumptions, epistemology, concepts, theory, and methods' (2008: 58). The relevant elements can be described as follows:

Phenomena: These are aspects of human existence that are the object of scholarly interest.

Assumptions: These are the taken-for-granted principles underlying the discipline as a whole.

Epistemology: A discipline's epistemology represents its ways of knowing those aspects of the world that fall within its purview.

Theory: This Repko (2008: 101) sums up as 'a generalized scholarly explanation about some aspect of the natural or human world'. As generally understood, a theory has a predictive or explanatory function.

Method: This refers to how research is conducted, how data are collected and analysed as part of the process of creating new knowledge.

In keeping with his perspectival approach, Repko (2008: 53) suggests that disciplines act like lenses through which the world is seen and interpreted. Unsurprisingly perhaps, metaphor has offered a way of characterising disciplines that may be illuminating but is at the same time highly selective. Kellert (2008: 36–39) summarises some of the metaphors that have been proposed:

Disciplines as nations: Disciplines have territory, domains; there are borders, limits (if not precisely defined at least there in the sense that some things are in and some out); there may be Balkanisation or tribalism; migration is possible (e.g. Klein 1990: 77).

Disciplines as tiles: Kellert mentions Giere's (1999) collage of pictures (multiple perspectives) and Campbell's (1969) ideal fish-scale pattern in which narrow specialities overlap, where in reality they tend to pile up leaving interdisciplinary gaps. However, Campbell's metaphor produces a very different picture from Abbot's (2001: 126) concept of bubbling, 'in which disciplines like drops of oil scatter more or less uniformly over a surface and expand toward each other'.

Disciplines as languages: Bauer (1990) talks of different grammars as well as different words. To this might be added Shulman's (2002: vii) 'different ways of talking' that develop out of engagement with problems and topics associated with their field of study.

The multiplicity of perspectives on the discipline is almost as extensive as the range of disciplines themselves and the following might be added to Kellert's list:

Disciplines as families: Strathern (2004: 45) argues that disciplines 'are ways of keeping distinct the origins not just of ideas and materials, but of work practices, lines of authentication and accountability'. She argues that their distinctness is a convenient fiction and offers an interesting metaphor of the family, contrasting sustaining lineal identities with procreating new identities out of the engagement of parents with different origins.

Disciplines as cartels: Turner (2000: 51) takes even further Abbot's claims regarding the importance of disciplines in the employment market, characterising them as 'cartels that organize markets for the production and employment of students by excluding those job-seekers who are not products of the cartel'. Although this perhaps fails to give due weight to other forces in the market, it nevertheless reflects a potential of disciplines to be closed worlds dedicated to perpetuating the status quo.

An aspect not included in the above list is the relationship between the department and the discipline. It is excluded because nobody has seriously suggested that the two can be conflated. However, there is a strong association between them, and Aldrich (2014: 17) has claimed that the department is 'the smallest collective component of a scholarly discipline'. The problem with establishing too strong a link between the two is that it serves to reinforce the reductionist tendency in disciplinarity, as highlighted by Sarewitz (2010: 65):

…in general the disciplines support an inductive, reductionist view of understanding, where larger-scale insight is supposed to arise from the accumulation of facts and insights acquired through inquiry focused at

smaller scales. Reductionist, disciplinary approaches to knowledge acquisition thus encourage mechanistic views of nature and society, views that treat the subjects of reductionist analysis as more significant than the interactions among such subjects

The wide range of approaches to characterising the discipline not only reflect the difficulty of arriving at a definitive description but also point to the many dimensions that may need to be considered when researching in this area. When disciplines are brought together, for example, relational issues are bound to emerge and authority may well be a site of contestation; issues of who has the authority to speak on behalf of the group, on what basis and in what ways, and so on, will not be easy to resolve. Institutional authority, for example, is very different from epistemological authority, which in itself may operate with disciplinary boundaries: while group members may be expected to challenge epistemic authority within their own discipline, extending this to other disciplines may be proscribed, and directing challenges to institutional authority might even be regarded as a disciplinary matter.

At its most basic level, interdisciplinarity involves the engagement of different disciplines however this might be configured. What this might represent and how it might be operationalised will depend to no small extent on the nature of the disciplines involved, but if these are inherently resistant to precise characterisation and are multidimensional in nature, the interactional investment in developing productive ways of being and working will be considerable. The focus of this book is on the nature of that investment.

Towards a Definition

While some understanding of the nature of the discipline is essential for the analysis in the chapters that follow, it is also helpful to have in mind a definition that will serve as a point of reference. The foregoing characterisation of disciplinarity provides support for Trowler's (2014: 1721) suspicion of essentialist definitions, and while there are virtues in simplicity there are also dangers of imbalance, as the following examples show:

Disciplines are socially constructed traditions of inquiry that have been formalised within university structures but which fulfil cultural and epistemological purposes in addition to their organisational function. (O'Connor and Yates 2014: 3)

We have therefore taken the discipline and the enterprise, or the higher education institution, as the main institutions or communities within which academics construct their identities, their values, the knowledge base of their work, their modes of working and their self-esteem. (Henkel 2000: 22)

In fairness to the authors involved, these are not presented formally as definitions, but they seem designed to serve this purpose. The first covers an impressively wide range of aspects in a very short space, but attention is directed to the discipline as an intellectual enterprise functioning within an institutional context. The description is accurate as far as it goes, but the reference to social construction hints at, without fully representing, the importance of the community of scholars who make up the discipline. In contrast, the second quotation captures this very effectively, but the reference to a knowledge base is a rather restricted representation of the academic aspects of a discipline.

The extent to which these dimensions feature in any particular discipline will vary and may depend in part on whether the discipline is, to use the distinction proposed by Salter and Hearn (1996), tightly bounded or loosely bounded, the former imposing more stringent criteria for membership and exercising greater control over members than the latter. Such variations add weight to Trowler's (2014) claim that disciplines are best understood as manifesting family resemblances rather than sharing essential characteristics. His definition represents an attempt to identify the range of considerations that might be applied to disciplines rather than a specification of core characteristics, and although this necessarily produces a rather long formulation, it is one that provides a helpful point of reference:

Disciplines are reservoirs of knowledge resources which, in dynamic combination with other structural phenomena, can condition behavioural practices, sets of discourses, ways of thinking, procedures, emotional responses and motivations. Together this constellation of factors results in

structured dispositions for disciplinary practitioners who reshape them in different practice clusters into localised repertoires. While alternative recurrent practices may be in competition within a single discipline, there is common background knowledge about key figures, conflicts and achievements. Disciplines take organisational form, have internal hierarchies and bestow power differentially, conferring advantage and disadvantage. (Trowler 2014: 1728)

Mapping the Disciplines

While disciplines enjoy a considerable degree of intellectual autonomy, they function within organisational contexts alongside other disciplines. The extent to which the relationships arising from this will impinge on any particular individual will vary, but the nature of academic work makes encounters with related fields inevitable and membership of an institution brings with it at least some basic awareness of other elements within the institution. When researchers become involved in interdisciplinary work they bring with them knowledge, assumptions and possibly prejudices about other disciplines and their ways of working that may influence the ways in which these scholars engage with their new colleagues. For this reason, it is useful to understand something of the disciplinary landscape.

The introduction of interdisciplinarity involves realignment that may be only temporary, sustained for no longer than the lifetime of a particular project or may involve the creation or evolution of a more permanent feature of the disciplinary landscape. It is therefore useful to know something of the way new disciplines or subfields emerge. An important aspect of this will be the relationship between the new discipline and the parent discipline, evolving in the form of either natural growth away from the latter or rejection by the former. The relationship between disciplines will be the theme of this section, which will begin with attempts to map the disciplinary landscape and what these have revealed in particular about the status of different disciplines. Issues of status have particular relevance to the ways in which new disciplines or subfields emerge, and this will form the subject of the second part of the section, which will be illustrated by reference to particular cases.

The classic typology of disciplines was first proposed by Becher (1989) and developed further by Becher and Trowler (2001), working from the assumption that the structure of knowledge within each discipline is the primary factor influencing disciplinary culture and that allegiances associated with this produce tribal characteristics. Becher (1989) produced a typology of disciplines organised in terms of their paradigmatic and theoretical orientation (hard or soft) and their knowledge application (pure or applied). This produces 'hard-pure' (natural sciences such as physics), 'soft-pure' (humanities and social sciences), 'hard-applied' (technologies such as mechanical engineering) and 'soft-applied' (applied social sciences such as education). He also identified epistemological and cultural characteristics associated with each discipline, though as Brew (2008) notes, the term 'tribes' is used far more sparingly in the second edition (Becher and Trowler 2001) than it is in the first. The rapidly changing higher education scene may have something to do with this, but the rise of collaborative research and the shifting disciplinary landscape must also be factors worthy of consideration. Interestingly, Krause takes this further, identifying evidence of a fragmentation of disciplinary tribes while noting that departmental and disciplinary units play a vital role in providing academic staff with a voice in the academy. He argues that although academics may have a strong affinity with a research community, 'academic staff feel more like nomads than tribal members when it comes to teaching in their discipline' (2014: 17).

While Becher's descriptions have been widely accepted, Repko's (2008: 60–112) application of his own notion of disciplinary perspective to different disciplines produces a comparative map of core disciplines in the academy, which is rich in telling detail. His representation of the learning and thinking processes of academics (2008: 78) may indirectly owe much to debates on paradigmatic differences that were characteristic of late twentieth-century paradigm wars, but it is suggestive of the conceptual gulfs that need to be bridged by academics collaborating across faculties. While the natural sciences adopt an inductive approach that is knowledge intensive and analytic in its orientation, producing a view of humanity as subject to natural laws, social scientists are more concerned with theory construction, measurement and textual analysis, a perspective that sees human behaviour as patterned and governed by identifiable laws and principles.