Knowledge-building
Educational studies in Legitimation Code Theory

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5 LCT and systemic functional linguistics

Enacting complementary theories for explanatory power

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Transcending the divide between disciplines in research.

Introduction

Interdisciplinarity is the future. Such is the thrust of pronouncements repeatedly heard across the social sciences and humanities. Interdisciplinarity is often equated with intellectually and socially progressive stances and greater responsiveness to business and workplace needs. Yet such axiological and economic benefits are more often assumed or proclaimed than evidenced or demonstrated (Moore 2011). Moreover, what is declared to be 'interdisciplinary' often comprises the appropriation by literary or philosophical discourses of ideas from other fields rather than genuinely *inter*disciplinary dialogue. Nonetheless, to highlight the vacuity of much written in its name is not to dismiss the potential of interdisciplinarity itself. There are serious ontological and epistemological arguments for bringing disciplines together in substantive research (Bhaskar and Danermark 2006). Simply put, the social world comprises more than the phenomena addressed by any one discipline. Education, for example, involves at least knowledges, knowers, knowing, and the known, implicating insights from, among others, sociology, linguistics, psychology, and philosophy (Maton 2014b: 212–13). This is not to suggest a single study must encompass the disciplinary map in order to recreate reality in its entirety. Rather, it highlights that drawing on more than one disciplinary approach may offer greater explanatory power when exploring a specific problem-situation.

This chapter illustrates how such gains can be made by research using Legitimation Code Theory (LCT) and systemic functional linguistics (SFL) together. A rapidly growing number of studies are enacting both LCT and SFL within research into social fields of practice as varied as education, law, art, and politics. Such studies are utilizing these sociological and linguistic approaches to offer complementary insights into their objects of study. They are also stimulating advances in the theories themselves, as each framework poses new questions to its companion or sheds fresh light on its concerns.

In this chapter we illustrate how such interdisciplinary research can be conducted to offer explanatory power and drive theoretical innovation. There is a long history of dialogue between these traditions but few accounts of the processes of working together, particularly in the kind of intensive collaboration characterizing recent encounters. Thus, rather than delineating ontological, epistemological or discursive features of the frameworks that enable their fruitful relation within research, our aim is more practical: to describe processes whereby they can be articulated through the course of a substantive study. To ground our discussion, we focus on a recent major project that brought together LCT and SFL to explore cumulative knowledge-building in school classrooms.

We begin by placing this project in context by briefly summarizing the evolving history of encounters between the two traditions. We highlight how the emergence and development of LCT is reshaping the concerns of established phases of interaction, opening up new areas of exchange, and stimulating close collaboration. Second, we introduce the research project on classroom practices, summarizing key findings. Third, we discuss the ways of working that evolved through the project to achieve those findings. We argue that interdisciplinary collaboration necessitates maintaining 'essential tensions' between the theories in their encounters with data. We then describe the practical strategies for negotiating these tensions developed during the project in terms of three dynamics: *zooming* between the bigger picture and specific issues, *refocusing* between fuzzier and more precise analyses, and *alternating* between parallel analyses by each theory and joint analyses using both frameworks. Finally, we illustrate how interdisciplinary research offers greater explanatory power and stimulates advances by highlighting how each theory has perturbed existing ideas and provoked new thinking in its companion.

We should emphasize this chapter is neither a definitive methodological guide nor a restrictive template for enacting LCT and SFL within research. As we shall discuss, the specificities of our example – object of study, forms of data, selected concepts, personnel, time, and budget – mean the strategies we outline may require adaptation for other projects. We were also often feeling our way through issues raised for the first time by collaborative analysis of shared data using LCT and SFL. As more studies using both theories in this manner come to fruition it is likely that further lessons learned from those experiences will lead to improved ways of working that enable even more productive collaboration. Here, to shed light on the often hidden craft of interdisciplinarity, we simply offer methodological reflections on our experiences of research practices that enacted LCT and SFL together to build knowledge.

An evolving relationship

Current collaboration builds on a long tradition of intellectual exchanges between the code theory created by Basil Bernstein and SFL. Space precludes discussing this rich past in detail. Here we limit ourselves to briefly

drawing on a recent account of these relations. Maton and Doran (2016) build on Martin (2011) to discuss five principal phases of exchange between code theory and SFL, each phase adding new points of contact to ongoing conversations. Table 5.1 outlines when each phase began and the concepts most engaged in these dialogues. As Maton and Doran (2016) emphasize, this represents a heuristic schema of encounters between the frameworks rather than an intellectual history of each theory. However, given our focus on LCT, it is pertinent to note that the first three phases involve Bernstein's framework and the most recent two phases involve LCT. Thus, to place our case study in context, we shall briefly summarize, first, the tradition of dialogue on which LCT builds and, second, the role it is now playing in generating the kind of intimate and intensive collaboration we discuss in this chapter.

Phases I–III: Coming together

The first phase began by the 1960s with discussions among Basil Bernstein, Michael Halliday and Ruqaiya Hasan. These exchanges centred around Bernstein's conceptualization of actors' socialized dispositions as 'coding orientations' (1971) and the social distribution of these orientations to meaning (Hasan 2009), or what later became known as 'semantic variation'. This phase involved mutual influences on ways of thinking. For example, Bernstein (1995: 398) later stated: 'It became possible for me to think about linguistics in sociological terms and sociology in linguistic terms' (cf. Halliday 1985). Dialogue also fundamentally shaped empirical studies. Halliday's emerging meaning-based grammar provided a means for enacting code theory in studies of language undertaken at Bernstein's Sociological Research Unit during the late 1960s (see Bernstein 1973). Conversely, concepts developed in these code theory studies (particularly semantic networks) formed the basis for theoretical elaborations of SFL in substantive research by Hasan and colleagues from the 1980s onwards (Hasan 2005).

A second phase of exchange involved Bernstein's account of 'pedagogic discourse' (1977, 1990) and genre-based literacy programmes of the 'Sydney School' of SFL (Martin 2000). From the early 1990s onwards educational linguists developed forms of pedagogy capable of enabling learners from a wider range of social backgrounds to succeed. Bernstein's theorization of social struggles over pedagogic discourse were drawn upon by the Sydney School to help interpret why their democratizing pedagogies were subjected to vitriolic contestation within and beyond education. In this phase, the interaction was less dialogic. Most code sociologists were not fully acquainted with Sydney School work due to the geographic distance of principal players in each approach and a withdrawal from interventionist educational research by British sociologists of education during the 1990s in response to political attacks on the field. Nonetheless, this work productively continued within SFL (Martin 2011) and has become integral to more recent exchanges.

Table 5.1 Summary of principal phases of exchange between code theory and systemic functional linguistics

Phase	Period began	Concepts central to phase of exchange from:	
		code theory	systemic functional linguistics
I	1960s,1980s–	coding orientation	linguistic variation, semantic variation
II	1990s–	pedagogic discourse	genre-based literacy
III	early 2000s–	knowledge structure	field
IV	mid-2000s–	LCT: Specialization dimension (specialization codes, knowledge–knower structures, insights, gazes, etc.)	individuation/affiliation, field, appraisal, and many others …
V	2010s–	LCT: Semantics dimension (semantic gravity, semantic density, semantic profiling, etc.), constellations and cosmologies	mode, field, appraisal, grammatical metaphor, technicality, individuation/affiliation, literacy, iconography, and many others…

During the 2000s a third phase of exchange centred on the nature of intellectual fields as different kinds of 'knowledge structure' (Bernstein 2000) and their semiotic resources, particularly the register category of field. Here encounters became more dialogic. Interdisciplinary conferences in Sydney in 2004 and 2008 brought code sociologists and systemic functional linguists into closer personal contact and resulted in two collections that included discussions of relations between the approaches (Christie and Martin 2007; Christie and Maton 2011). These events laid foundations for the invigoration of these relations that followed.

Phases IV–V: Working together

Throughout the history of their dialogue developments *within* each theory have been a major impetus to developments of exchanges *between* the theories. Not all new ideas become involved in dialogue and decades can lapse after inception before a concept becomes active (see Maton and Doran 2016). However, the development of code theory into LCT since the turn of the century has proven a major and rapid inspiration to engagement with SFL.[1] By the mid-2000s the development of the Specialization dimension of LCT had energized a fourth phase and by the 2010s the Semantics dimension was catalysing a fifth phase. Extensive discussion of these concepts is beyond the scope of this chapter (see Maton 2014b; Chapter 1, this volume). The wide range of concepts implicated in these exchanges also precludes summarizing phases here (see Maton and Doran 2016). As Table 5.1 suggests, Specialization concepts are resonating with many aspects of SFL, including field (Martin *et al.* 2010) and individuation (Martin 2012), while relations between Semantics and concepts across the metafunctions and strata of SFL are reshaping both frameworks in ways only beginning to be understood. We illustrate these ongoing developments shortly. Before doing so, two characteristics of these interactions that help contextualize our case study are worth noting.

First, these newest phases of exchange are touching on issues from across the history of dialogue. This partly reflects the way in which LCT concepts build upon concepts inherited from Bernstein's framework. They not only reveal new aspects of phenomena, sparking new issues for dialogue with SFL, but also shed fresh light on established concerns. For example, the notion of 'knowledge structure', central to phase III, is retheorized within Specialization as 'knowledge–knower structures' (Maton 2014b). The extended concept both explores new issues (such as the basis of achievement in the arts and humanities) and, by integrating the inherited concept, recasts the focus of work in phase III using that notion. Similarly, LCT concepts extend and integrate existing theorizations of 'coding orientation' from phase I and 'pedagogic discourse' from phase II (see Maton 2014b). In short, by both opening up new areas of dialogue and rejuvenating the focus of established encounters, these new phases are characterized by more of each theory coming into contact with its companion.

Second, exchanges have again become intensive and dialogic, with influence flowing both ways. Renewed intimacy has been encouraged by geographic proximity among participants; for example, our case study emerged from a sustained engagement between Karl Maton and a productive group of linguists associated with J. R. Martin that was made possible by Maton's emigration to Sydney in the mid-2000s. Crucially, such engagement is engendering intensively collaborative research. Rather than distanced interactions between scholars engaged in distinct analyses of different data, recent phases are characterized by research that enacts both theories in complementary analyses of the same data. Bringing the theories into 'creative dialogue and tension' (Bernstein 1995: 398) is thus becoming increasingly common *within* studies, including research into academic writing (Chapter 6, this volume), music education (Chapter 10, this volume), restorative justice (Martin *et al.* 2012), and sociology (Luckett 2012). Moreover, a new generation of theoretically 'bilingual' scholars is emerging, illustrated by a growing number of successful and ongoing doctoral theses using both LCT and SFL (e.g. Meidell Sigsgaard 2013; Vidal Lizama 2014; Weekes 2014).

In short, the emergence of LCT has contributed to evolution of the focus, form, and dynamic of exchanges with SFL: concepts implicated in dialogue are proliferating, collaboration is intensifying, and influence is mutual. This forms the context for our case study, a project that brought scholars from LCT and SFL together to explore knowledge-building and which formed the basis for a range of further studies.

The DISKS project

The DISKS project into 'Disciplinarity, Knowledge and Schooling' was a nationally-funded, three-year research study (2009–11) based at the University of Sydney.[2] Peter Freebody, J. R. Martin and Karl Maton were chief investigators; Erika Matruglio, a former teacher undertaking doctoral study using SFL and LCT, was research associate through the project; and Lucy Macnaught assisted with stage 3 (see below). The overarching aims were to analyse the bases of knowledge-building in secondary school classrooms, explore their variation across different kinds of subject areas, and develop pedagogic practices that could enable such cumulative progress. The study comprised three principal stages: data collection, data analysis, and a pedagogic intervention.

Data collection gathered curriculum documents, student work products, and video-recordings of 100 lessons in years 8 (ages 13–14) and 11 (ages 16–17) of six secondary schools in urban and rural New South Wales, Australia. Lessons were in Science (year 8) or Biology (year 11) and Ancient History or Modern History (depending on school). Analysis of classroom data focused on phases in which knowledge was actively transformed, such as unpacked, repacked, recalled from the past, built on, elaborated, projected into the future, and so forth. The analysis drew on the LCT

dimensions of Specialization and Semantics and on myriad areas of SFL focused on construal of uncommonsense discourse, including IDEATION, APPRAISAL, PERIODICITY, and grammatical metaphor in relation to field and mode. The considerable array of ideas this stage generated were then winnowed down for the intervention to those with direct implications for pedagogic practice that could be conveyed to teachers in a short period of time. Specifically, the intervention focused on the ideas of 'semantic waves' from LCT and 'power trio' from SFL.

The notion of 'semantic waves' arose from analyses of classrooms using concepts from Semantics (see Maton 2013, 2014b; Chapter 1, this volume). *Semantic gravity* refers to the degree to which meaning relates to its context; *semantic density* refers to the degree of condensation of meaning within practices. Each can be independently stronger or weaker along a continuum of strengths. Tracing these strengths over time (such as through a school lesson) generates a *semantic profile* that reveals how the knowledge expressed is changing in terms of its context-dependence and complexity. Several profiles were revealed in analyses of classroom data (see Maton 2013), including *semantic waves* that trace recurrent movements between relatively decontextualized and context-dependent meanings and between simpler and more complex meanings (see Figure 1.4, page 17). This waving pattern of changes in the strengths of semantic gravity and semantic density enables the knowledge expressed in practices to be transferred beyond any specific context and to connect up with other meanings over time. Simply put, generating semantic waves aids knowledge-building. SFL analyses highlighted how these movements in knowledge practices are associated with the appropriate employment by actors of complexes of linguistic resources. Of the wide array of such resources, control of technicality, grammatical metaphor and periodicity were highlighted as central to creating semantic waves, selected as teachable in a short period of time, and more accessibly described in terms of 'power words', 'power grammar', and 'power composition', respectively (Martin 2013a).

These LCT and SFL concepts formed the basis for the pedagogic intervention. Six teachers from four schools were trained to model semantic waves and bring to students' consciousness the 'power trio' of linguistic resources enabling these transformations of knowledge (see Macnaught *et al.* 2013). To do so, the intervention drew on the 'Teaching and Learning Cycle' developed in Sydney School literacy programmes and, specifically, the notion of 'joint construction' in which teachers and students work together to construct meanings (Rose and Martin 2012). After an initial training day, researchers worked closely with the teachers in preparing classroom materials and supporting them in a total of 14 lessons enacting the pedagogic strategies over one school term (approximately ten weeks).

A growing number of studies and pedagogic interventions (e.g. Blackie 2014; Clarence 2014) are being influenced by the outcomes of this project, which we have but touched upon here (see Martin and Maton 2013).

A second major project (named 'PEAK') involving LCT and SFL has also directly built upon DISKS to explore knowledge-building in detail across whole units of study.[3] This burgeoning body of work suggests that generating semantic waves is a key not only to knowledge-building but also to achievement across a variety of practices, such as student assessments (Maton 2014a). It is also revealing the elaborate assemblages of linguistic resources mastered by actors to build knowledge (Martin 2015). Here, though, our concern is not the product but the process. Specifically, we focus on the data analysis stage of the project to discuss, first, how the two frameworks were related together and, second, how this interdisciplinary approach stimulated theoretical innovation.

Essential tensions: three dynamics

Close encounters between theories can take different forms (Maton 2014b: 210–13). One kind is where a theory operates as an *organizing framework* that highlights what needs to be analysed and another theory is used as an *analytic framework* for analysing those issues. The theories thus serve different purposes within a single analysis. Chapter 2 (this volume), for example, discusses how Berry's 'acculturation' framework provided a means of organizing a study of constructivist pedagogy in which LCT concepts served as the analytic tools. A second kind of close encounter is where a conceptual framework is used to operationalize another framework in empirical research. For example, in phase I of exchanges (above), studies at the Sociological Research Unit enacted SFL concepts to translate between code theory and empirical data (Bernstein 1973). Here again theories serve different purposes within a single analysis: one provides an 'external language of description' or translation device for the other (Chapter 2, this volume). In contrast, close encounters of the third kind occur where theories are brought together to provide *complementary* analyses. That is, each framework is enacted to explore the same data and the resulting analyses are related to explain a shared problem-situation. This form of collaboration has grown in recent interdisciplinary dialogue between LCT and SFL. It describes the DISKS project, in which, to put it simply, LCT was enacted to analyse knowledge practices and SFL was used to explore linguistic practices.

Most major studies take a long and winding path. Chapter 2 (this volume) describes a qualitative study as involving innumerable movements between theory and data. Research using complementary theories is even more complex, as it involves at least two sets of relations between a theory and data, as well as relations between the theories. In our case study, pragmatic strategies for negotiating these relations were evolved through the course of the research rather than being established in advance. However, three overarching dynamics can be distinguished that came to structure the research process:

- *zooming* between the bigger picture and more delimited phenomena;
- *refocusing* between fuzzier and more precise analyses; and
- *alternating* between parallel analyses using each theory and joint analyses using both theories.

These three dynamics aimed at maintaining essential tensions between each theory and the data, and between the two theories. By 'essential tension' we mean an equilibrium between too much and too little distance. As discussed in Chapters 1 and 2 (this volume), too much distance between theory and data creates a disconnect, while too little distance can lead to either theoretical imposition or empiricism. Our principal focus here is a further essential tension: between two frameworks. If too much distance opens up between analyses enacting different theories they can drift apart and lose touch; if too little distance is maintained, each theory is in danger of losing its integrity and being consumed by its companion. Maintaining an equilibrium between contact and integrity is thus necessary to enable productive dialogue rather than silence or monologue. As we shall discuss, the three dynamics of zooming, refocusing and alternating helped maintain this essential tension in the DISKS project.

Like walking along a high wire, such an equilibrium is not a fixed state but rather a moving and always tentative sense of balance that must be constantly negotiated throughout the research process. Enacting each dynamic is thus a matter of judgement that does not lend itself to being described as a simply sequenced recipe. Moreover, the distinctions between zooming, refocusing and alternating are analytic: in the project the three dynamics could be simultaneous, overlapping, and enacted in various combinations. A narrative of the DISKS project as it unfolded is, therefore, beyond our scope here. The large number of concepts involved also precludes extensive illustration. Instead, we draw on experiences from the project (using surnames for protagonists) to outline the rationale for each dynamic and refer to publications as examples of their outcomes that can be explored alongside this discussion.

Zooming

'Zooming' describes movements in either direction between *wide-angle* analysis of the bigger picture and *telephoto* analysis of a more limited phenomenon, such as a specific instance. The DISKS project began with a wide-angle analysis before zooming between telephoto analyses of selected examples and the bigger picture. At the outset Martin and Maton discussed together a series of video-recordings of secondary school lessons collected by Peter Freebody for a previous project. These wide-angle analyses explored issues that might be encountered in the study and so were open in terms of phenomena under consideration. As described in Chapter 2 (this volume), beginning with such 'bottom-up' analysis can help avoid

theory prematurely overwhelming data. It can also contribute to balancing complementary theories. Unsurprisingly, features initially highlighted in discussions, such as the presence of technical language (Martin) or different ways knowledge claims were valorized (Maton), reflected the theoretical background of each researcher. However, to enable another approach to shed fresh light on one's concerns requires ensuring neither theory races into the vacuum represented by raw data to construct the problem-situation in its own image. By beginning from a wide-angle view of the object of study, Martin and Maton aimed to establish that open space at the outset.

When examining data collected for the DISKS project, analysis then zoomed into detailed explorations of delimited phases of classroom interaction. For example, Maton and Martin each explored in depth a year 11 biology lesson dedicated to the role of 'cilia' as a biological line of defence (e.g. Maton 2013). These telephoto analyses ensured the conceptual frameworks engaged directly with data rather than remaining metaphorical or allusive. As we discuss in 'alternating' below, such close engagements with shared data are crucial to interdisciplinary dialogue by providing extra-theoretical points of contact. Each telephoto analysis was then followed by zooming out again to wider contexts. For example, the biology lesson was situated within a discussion of 'cilia' in curriculum, textbooks, and research (see Martin 2013a). Using LCT, such wide-angle analyses helped reveal the *relative* strengths of semantic gravity and semantic density of classroom discourse which could have remained concealed if focusing solely on the lesson data. Using SFL, they highlighted linguistic resources, such as grammatical metaphor, not necessarily enacted in classroom discourse but required for achievement in the subject area. Returning regularly to a bigger picture also ensured telephoto analyses did not remain segmented fragments of the whole problem-situation. For example, placing analyses into the wider contexts of years 8 and 11 helped generate the conjecture that semantic waves in lessons form part of larger semantic waves through the years of secondary schooling (Martin 2013a; Maton 2013), an issue being explored in PEAK, the successor project to DISKS.

In terms of maintaining an essential tension between the frameworks, zooming helped temper temptations towards more macro (LCT) and micro (SFL) levels of analysis that would have cast the approaches adrift. Determining legitimation codes of practices can often require more than a short extract of text, potentially pushing analysis using LCT towards exploring larger units of data. Conversely, the elaborate toolkit offered by SFL for fine-grained study makes possible the endless exploration of smaller units of data. In contrast, through repeatedly zooming in and out, the DISKS project helped encourage the creation of new LCT concepts capable of exploring discourse down to the word level and new SFL concepts that pursue phenomena across strata (see further below).

Refocusing

'Refocusing' describes movements in either direction between *soft-focus* analysis that sketches a fuzzier outline of key issues and *hard-focus* analysis that commits to a sharper, more precise conceptualization. As mentioned above, Martin and Maton began the DISKS project by examining previously collected videos of secondary school lessons. In these discussions the use of concepts from either theory was minimized. Such soft-focus analysis was intended (like its accompanying wide-angle approach) to allow data to speak in its own terms rather than become recast in the language of either theory (cf. Chapter 2, this volume). It also aimed at creating a space for dialogue between initial insights from the researchers. At this preliminary stage, Martin and Maton found that ideas requiring extensive conceptual definitions soon restricted free-ranging discussion and led to the theories constructing the object of study in ways that quickly diverged. Thus, to maintain an essential tension between the frameworks, discussion was couched in simpler terms, employing metaphors, similes, figures and body gestures to describe issues in relatively fuzzy ways. For example, one feature of knowledge-building in classroom practice was expressed by a snaking hand gesture or a wavy line and characterized as involving 'heavier' or 'lighter', 'tougher' or 'easier' and 'familiar' or 'unfamiliar' language. Such shared fuzzy categories, equidistant from either theory, could then be recontextualized into the specialized languages of each framework to explore their nature as either knowledge practices or language practices in (parallel) hard-focus analyses.

Beginning with a soft-focus (and wide-angle) view may seem obvious, but this starting point is typically obscured in published works, as they present the product rather than describe the process of research. Moreover, it is tempting to quickly refocus into theoretical terrain. LCT and SFL are complex frameworks that offer insights unavailable to commonsense. The explanatory gains on offer make their conceptual tools tempting to employ and thereby 'harden' analysis as quickly as possible. This is also seductive on a personal level. Mastering sophisticated theories requires considerable investments of time and energy. It can feel frustrating to seemingly eschew such hard-won knowledge by returning to less precise discourse. However, 'soft-focused' is not 'unfocused' – it does not negate a disciplined gaze. As noted above, during their soft-focus discussions Martin and Maton still viewed the data with sociological and linguistic gazes, whether or not they explicitly enacted concepts. Moreover, this was a starting point, not the final destination.

Analyses progressively refocused to become more precisely theorized. In the detailed exploration of passages of classroom discourse, for example, fuzzy descriptions of weight became conceptualized in LCT terms as semantic gravity, notions of difficulty and familiarity were transformed into semantic density, and the snaking hand gesture was echoed in the profile of

semantic waves (Maton 2013). Similarly, SFL analyses refocused such fuzzy categories into more precise descriptions of linguistic resources, such as from unfamiliar words to identifying 'technical' and 'specialized' language or distinguishing types of grammatical metaphor such as ideational and interpersonal metaphors, and thence within ideational metaphors between logical and experiential metaphors, and so forth (e.g. Martin 2013a). Such separate hard-focus analyses increased the distance between accounts generated by the frameworks as they became couched in distinctive conceptual languages. However, such distance enabled the analytic precision required for each theory to reveal facets of the phenomenon unseen by its companion that could then be productively brought together (see 'alternating', below). Moreover, the project did not represent a one-way ascent into theoretical precision. When sharing the results of hard-focus analyses, Martin and Maton found it useful to occasionally return to fuzzier terms (such as the snaking hand gesture) to articulate between conceptual ideas generated by the two theories in relatively unspecialized terms. In addition, such simpler terms were invaluable for teacher training in the pedagogic intervention – they provided a non-technical shorthand.

Both forms of focus thereby contributed to productive collaboration. In addition, the process of refocusing itself helped maintain an essential tension between the frameworks by avoiding temptations to either fudge empirical referents or engage in theoretical fetishism. Hardening focus by sharpening precision helps identify concepts whose relations to referents were ambiguous and which could thereby confuse dialogue because of their fuzziness, while softening focus opened up each theory to input from beyond the framework. In DISKS these movements encouraged the creation in LCT of multi-level typologies for determining more precise distinctions of strengths for semantic gravity and semantic density and the development of new concepts in SFL for grappling with the implications of these concepts from LCT (see further below).

Alternating

A third dynamic informing the project comprised *alternating* or recurrent movements between parallel analyses of data by each theory separately and joint analyses using both frameworks. As discussed, DISKS began with joint discussions of existing data. Analysis of newly collected data similarly began with Martin and Maton jointly deciding which data to examine in greater detail and discussing (in soft-focus) the phenomena those selections exhibited. Joint analyses of data thereby established shared problem-situations and goals for parallel analyses. For example, phases of lessons were collaboratively selected to explore the snaking phenomenon (later conceptualized as 'semantic waves') using each theory separately.

Coming together in this way was crucial in establishing an essential tension between the frameworks in the project. Interdisciplinary conversations between

scholars working on similar general problematics may mutually inspire ideas but cannot directly relate their insights, for they remain too distanced by differences in objects studied, forms of data analysed, and specific issues addressed. This can then lead to misguided attempts to overcome the resulting distance by translating directly between concepts from each theory, such as wrongly identifying 'semantic density' with 'field' or reducing 'semantic gravity' to 'mode' (or vice versa). Such reductionism wrenches each concept from its constitutive position within the constellation of ideas comprising a theoretical framework and thereby fails to grasp its meaning. In contrast, by establishing common data and questions in joint analyses, Martin and Maton provided shared referents beyond the province of each theory through which the findings of their separate analyses could be integrated. Though each framework constructs objects of study in its own way, sharing clearly-defined referents in this way enables those constructions to be articulated. Thus, questions decided upon by Martin and Maton for their parallel analyses concerned not general topics, such as the nature of knowledge-building, but rather sharply defined substantive issues, such as how a specific phase of classroom interaction builds on what had been previously discussed in the lesson (Martin 2013a; Maton 2013), how actors and terms are related together in History lessons on war in Indochina to create different values (Martin *et al.*, 2010), or how a History teacher shifts between the present and the past to connect knowledge through time (Matruglio *et al.* 2013).

Having jointly discussed these examples (and others yet to be published), analyses using LCT and SFL separately provided the space for each framework to explore its distinct facet of the shared problem-situations. Parallel analyses provided sufficient distance between frameworks to enable the zooming into detailed examination and refocusing into precise theorization discussed above. Time apart is necessary for such analyses. When using SFL it may not be immediately apparent which systems – PERIODICITY, TRANSITIVITY, IDEATION, APPRAISAL, etc. – might be relevant. In the DISKS project, analyses of a wide range of different linguistic features were conducted by Martin and Matruglio that varied in their fruitfulness according to the specific case. When using LCT it may not be immediately apparent how concepts are realized within the specific data being studied and developing 'translation devices' for making visible code concepts is intensive and time-consuming (see Chapter 2, this volume). In short, space was required for each theory to engage in its own distinctive dialogue with the data. Parallel analyses thereby protected their integrity to ensure the project embraced 'bilingualism rather than pidginization' (Martin 2011: 53). Distance is also valuable for considering the implications for each framework of insights generated by its companion theory. As Martin (2011: 56) argues, interdisciplinary engagement requires 'breathing room: time to stop talking, take stock and develop knowledge on one's own terms'. We return to discuss such perturbations and provocations below.

However, alternating involves separation in order to come together again. In the DISKS project, emergent results of these parallel analyses were regularly articulated in joint analyses. Moreover, Matruglio worked with both Martin and Maton, providing an additional channel of communication. This coming together comprised more than the addition of two separate accounts: genuinely interdisciplinary research is more than the sum of its parts. For example, through these joint discussions it became increasingly evident that diverse linguistic features came together in complexes that accompanied specific changes in knowledge, such as upshifts and downshifts in semantic gravity and semantic density, and that these further differed according to, *inter alia*, the specialization code characterizing the subject area. For example, Maton (2013: 16–17) includes a discussion of a semantic wave in a brief passage from a year 11 History lesson that SFL analyses reveal involves unpacking live grammatical metaphors, generic forms of participants and processes, nominalizations, technicalizations as dead metaphors, and many other linguistic resources. Reducing distance between them thereby helped reveal the ways in which, *for the purposes of this project*, the two frameworks offered complementary views. In the case of DISKS, enacting LCT provided analysis of changes in knowledge practices and enacting SFL revealed the linguistic resources by which actors achieved those changes. This relationship and those insights are not intrinsic to the frameworks but rather emerged from articulating parallel analyses of this specific object of study – other projects are likely to feature different relations. Maintaining an essential tension between the approaches through alternating offers a means of allowing these relations to become evident.

Doing the work

This brief summary of three dynamics characterizing the craft work of the DISKS project necessarily simplifies a messier process. Typically, analyses of several sets of data were ongoing simultaneously, progressing at different speeds, and requiring different degrees of collaboration. Throughout the project Martin and Maton adopted a flexible and pragmatic approach. Zooming, refocusing and alternating were based on judgement and involved trial and error, breakthroughs and false starts, and constant negotiation. Encouraging precedents offered by the existing history of dialogue between the frameworks (earlier above) suggested fruitful collaboration was possible. So questions of whether or why they could work together were set aside in favour of exploring how they could be put to work.

In all this, the problems addressed by the project – both the overarching concern with knowledge-building in classrooms and specific issues in particular phases of lessons – were the guiding light. This centrality of problems is important to emphasize because of the temptation to delay enacting theories to analyse empirical data, which is typically chaotic, messy and complex, in favour of meta-analysis of those theories, which is neater

and more stable. Such meta-theorizing can also feel more profound, particularly when couched in terms of establishing firm ontological and epistemological foundations. However, exploring such conditions for productive interdisciplinary collaboration requires evidence of productive interdisciplinary collaboration that can be analysed. Without actually doing the work, all else is speculation. Such issues were, therefore, not a primary focus of the DISKS project, though its fruitful outcomes offer a basis for further exploration.[4]

Turning the tools of LCT back onto itself does, however, reveal a theoretical basis for the methodological strategies we have outlined. 'Zooming' can be understood as maximizing the range of semantic gravity embraced by a project, from stronger for delimited cases to weaker for the bigger picture. 'Refocusing' can be conceptualized as maximizing its range of semantic density, from weaker for fuzzier descriptions to stronger for precise theorizations. Enacting these two dynamics thereby encourages research to reach across a greater semantic range, which studies are suggesting represents a key condition for cumulative knowledge-building (Maton 2014a). As such, both dynamics are valuable not just for interdisciplinary projects but for all research studies. 'Alternating' then provides the methodological framework within which two theories can be articulated while each is zooming and refocusing. It provides spaces for shared goals, individual contributions, and combined findings that maintain the essential tension between frameworks that underpins genuine dialogue.

Power, perturbations and provocations

The complexities of interdisciplinary research raise the question of whether it is worth the effort. The host of projects using LCT and SFL as complementary frameworks are demonstrating how such 'close encounters of the third kind' offer fresh insights into objects of study and encourage theoretical innovation. In short, together they generate greater explanatory power, perturb existing ideas, and provoke new thinking.

In productive interdisciplinary research each approach offers insights its companion may not have revealed by itself. In DISKS enacting LCT and SFL uncovered complementary facets of knowledge-building. As summarized earlier, LCT explored the organizing principles of knowledge practices to reveal the significance of semantic waves (Maton 2013) and SFL both showed the detailed resources that, as complexes, linguistically realize these changes in knowledge practices (Martin 2013a) and offered a pedagogy that enables students to master these resources (Macnaught *et al.* 2013). These outcomes have stimulated studies of curriculum, textbooks and student assessment across the disciplinary map – including cultural studies (Chapter 6, this volume), design (Chapter 7), physics (Chapter 9), and music (Chapter 10) – as well as underpinning pedagogic initiatives in schools and universities. Key here, though, is that each framework contributed

something distinctly its own, such that enacting them together generates greater explanatory power than using either alone.

These distinctive contributions are at the same time a source of perturbations and provocations. Each can reveal new issues that raise questions for the other framework. Each can also make demands on the other framework to help generate further insight into those issues. Martin (2011: 37) argues that interdisciplinary dialogue is fostered by the 'possession of a discursive technology which can make visible things the other discipline wants to know'. Conversely, what scholars using the other framework want to know can encourage the development of concepts that make new things visible. Crucially, collaborative analysis of shared data raises questions with an immediacy unknown in dialogue at a distance. 'That to be explained' is in plain sight – there is less space for uncertainty or ambiguity, less opportunity to obfuscate or fudge. Under such circumstances, questions can quickly reveal the limits of concepts – they put them to the test. If, as Maton (2014: 207) argues, 'for catalysing intellectual advance.... Data changes everything', then for interdisciplinary collaboration analysing *shared* data can change everything. Though theoretical developments are influenced by more than interdisciplinary dialogue, such collaboration has certainly helped shape advances within LCT and SFL.

Catalysing code theory

The capacity of SFL to zoom into fine-grained detail of discourse encouraged LCT prior to the DISKS project. During phase III of exchanges (see earlier above), attempts by educational linguists to enact Bernstein's 'knowledge structures' in research helped perturb belief that concepts from the inherited framework exhibited 'strong grammar' (Bernstein 2000) or relatively unambiguous referents. As Chapter 1 (this volume) outlines, in contrast to 'classification' and 'framing', much of the framework remained suggestive ideas whose empirical referents were unclear. The need to develop these ideas was already one impetus behind the development of LCT; SFL scholars contributed to bringing that need into sharper relief.

The resulting concepts in LCT enabled a greater grip on the empirical and revealed new facets of phenomena. However, they were not intended for analysing discourse at the level of detail often found in SFL. This is difference rather than deficit: LCT concepts were generated from and for studies of social practice rather than designed for analysing language. Working collaboratively across disciplines, however, can perturb precisely because of differences between approaches. As mentioned above, SFL analyses by Martin and Matruglio in DISKS revealed the detailed and complex linguistic choices associated with shifts in the strengths of semantic gravity and semantic density. These analyses were experienced by Maton as not only a complementary resource for explaining knowledge-building but also a challenge. They broached the question of how the properties conceptualized

by semantic gravity and semantic density are realized within discourse down to the level of wording. In addition, close collaboration gave greater salience to longstanding questions. For example, having identified 'grammatical metaphor' as crucial for constructing uncommonsense knowledge, educational linguists had been asking code sociologists, since at least phase III (e.g. Martin 2011), how it is realized in knowledge practices. These challenges and questions in the DISKS and PEAK projects encouraged the development of 'mediating languages of description' (Chapter 2, this volume) that comprise a series of multi-level typologies for separately calibrating the strengths of semantic gravity and of semantic density in English discourse at the level of wording, clausing, and sequencing (e.g. Maton and Doran 2015a, 2015b). They thus significantly increase the capacity of these concepts for telephoto and hard-focused analyses and, because they embrace any forms of data expressed in English, enable the integration of research into diverse objects of study.[5] Finally, they enable longstanding questions to be addressed; for example, the tools highlight the role grammatical metaphor can play in moving between strengths of semantic density (Maton and Doran 2015a, 2015b).

Stimulating systemicists

The capacity of LCT concepts to capture organizing principles associated with complexes of linguistic practices has stimulated SFL scholars into rethinking such fundamental concepts as the register variables field and mode. Moreover, that these complexes cross-cut strata and metafunctions perturbs the existing architecture of the theory. In DISKS, Maton's analyses of shared data using 'semantic gravity' encouraged Martin to reconsider the notion of context-dependence in ways that resonate across the linguistic framework. In SFL 'context' has been used to refer both to the concrete, material, sensible physical and biological environment of a text and to the more abstract web of cultural assumptions and understandings shaping discourse. To describe a text as 'context independent' makes sense in the first use of the term but not in the second use, as all texts manifest their cultural context. The challenge of interpreting 'semantic gravity' in linguistic terms when analysing data led Martin to develop a metafunctionally differentiated account of the relation of a text to its material environment in terms of the new concept of 'presence'. Martin and Matruglio (2013) factor 'presence' textually as degrees of implicitness, interpersonally as degrees of negotiability, and ideationally as degrees of iconicity. This conceptualization calls into question the typical association of material 'context dependence' with the register variable mode, since much more than textual meaning is involved. Rather, 'presence' is explored in relation to the coupling of meaning across metafunctions and as a dimension of instantiation rather than realization (see Martin 2010). Put simply, in interdisciplinary analyses of data the concept of 'semantic gravity' highlighted how context-dependence embraces

linguistic resources from across the framework of SFL in ways that required new concepts capable of embracing this diversity.

The concept of 'semantic density' has stimulated similar rethinking of the register variable field. Martin (1992) had characterized field in terms of a set of activity sequences oriented to some global institutional purpose, including the taxonomies of entities involved. This ideational perspective helped capture the linguistic nature of what Bernstein (2000) referred to as 'knowledge structures' by exploring the distillation of knowledge into technical terms (Martin 2007). However, working closely alongside LCT concepts in DISKS highlighted new features for analysis. Put simply, Martin's previous conceptualization mirrored Bernstein's focus on explicit features of knowledge; however, LCT extends Bernstein's framework to additionally embrace knowers. The concept 'semantic density' highlights that meanings condensed within practices may be not only epistemological but also axiological (Maton 2014b: 125–47). This was reflected in DISKS: Martin *et al.* (2010) illustrates how the teaching of wars in Indochina in a secondary school History lesson involves axiologically-charged sets of terms. Such a seemingly simple issue resonates across the framework of SFL. It means that the linguistic analogue of 'semantic density', which Martin (2015) terms 'mass', has to be explored in relation to the coupling of ideational with interpersonal meaning, which again must be modelled as a dimension of instantiation, because two metafunctions are involved. This in turn raises the question of how such couplings of IDEATION and APPRAISAL naturalize readings which align students in communities of shared values, bringing the hierarchy of individuation into the picture, since that is where SFL interprets communality as bond complexing (here a bond is defined as a shared coupling of IDEATION and ATTITUDE). The result is a reinterpretation of social practice not just in terms of what you know or know how to do (field) but in terms of fellowship (how you bond around the value of what you know or know how to do). Martin (2015) factors 'mass' textually as degrees of aggregation, interpersonally as degrees of iconization, and ideationally as degrees of technicality. These new concepts of 'presence' and 'mass' thereby identify the diverse ranges of resources at play in linguistic realizations of semantic gravity and semantic density, respectively.

In short, working closely with LCT has perturbed SFL to the point where more than five decades of work erecting its extravagant realization hierarchy (comprising axis, rank, metafunction and stratum, and the descriptions these concepts afford) must be reconceived as a first step towards an understanding of users in uses of language, and supplemented in the future with comparably populated hierarchies of instantiation and individuation, hierarchies with very little conceptual superstructure in the SFL that first began to engage with LCT. Fortunately, two decades of research on APPRAISAL and multimodality (Bednarek and Martin 2010) provide a strong base on which to meet this challenge.

Conclusions

Interdisciplinarity suffers from a rhetoric–reality gap. Arguments proclaiming its necessity outnumber examples of its actuality. In contrast, LCT is increasingly being enacted in research studies alongside theories from other disciplines. As we summarized from Maton and Doran (2016), there is a successful history of dialogue between the tradition developed by LCT and SFL. Henry Ford is credited as saying: 'Coming together is a beginning; keeping together is progress; working together is success'. The history of exchanges between these approaches reflects this adage as dialogue has become increasingly engaged, intense and intimate. Crucially, interdisciplinary research is bringing together LCT and SFL *within* research projects to analyse and articulate their complementary findings into the same data. These close encounters offer greater explanatory power by exploring different facts of meaning-making in its myriad guises and their social effects.

In this chapter we outlined some of the research processes whereby LCT and SFL can be used together productively – the craft work of interdisciplinary research. Dynamics of *zooming*, *refocusing* and *alternating* are, we suggested, valuable for maintaining an essential tension between theories that enables their complementary insights to be generated and articulated. However, their realizations within our case study are not the only forms they can take. The DISKS project engaged with specific objects of study, forms of data, and concepts, and was characterized by specificities of personnel, time and budget. Forms taken by the dynamics within other studies are likely to differ. For example, 'alternating' in DISKS typically involved *simultaneous* analyses using each theory, something made possible by a division of labour among the project team. For an individual researcher such parallel analyses are likely to be sequential (thereby also alternating between LCT and SFL analyses). Similarly, for individual researchers joint analysis is likely to involve an introjected form of the dialogue between scholars we described in this chapter; alongside discussions with peers and mentors, one may 'talk to oneself', as it were, in the tongue of each theory.

Intellectual developments may also reshape the forms taken by research collaborations. Typically, when reporting findings from DISKS, Martin and Maton began with LCT analysis of changes in knowledge practices before describing SFL analysis of the linguistic resources actors marshalled to achieve those changes. This ordering partly reflected historical characteristics of the theories: SFL is typified by exploration of more micro-level textual phenomena than was typical of code theory. However, the conceptualization of linguistic complexes as 'presence' and 'mass' and the development of tools for enacting LCT concepts in finer-grained analysis render these characteristics less significant. Indeed, these developments offer exciting possibilities for other forms of close encounters. They enable concepts from one theory to act as translation devices for operationalizing concepts from the other theory. 'Presence' and 'mass' offer a means of exploring the

linguistic features associated with strengths of semantic gravity and semantic density; mediating languages for calibrating semantic gravity and semantic density in discourse offer means for enacting linguistic analyses of knowledge practices. While one must always remain mindful of slipping from bilingualism to pidginization, for the theories are complementary because rather than in spite of their differences, these developments may inspire further advances that enable the approaches to work closer together. However, whichever form relations between the theories take, a key constant to the craft of interdisciplinary research is that the problem-situation remains central. Foregrounding the issues being addressed is crucial to productive interdisciplinary collaboration. As we have argued, talking through shared data and questions that lie beyond the exclusive reach of each theory offers a joint anchorage that enables grounded discussion rather than freely-floating speculation, and promotes dialogue rather than turn-taking monologues.

Such interdisciplinary collaboration on a shared problem-situation is exciting, energizing and engaging. Studies of research, curriculum, and pedagogy in education, as well as research into other social fields, such as law (Martin *et al.* 2012) or the armed services (Thomson 2014), are bringing LCT and SFL together to reveal the bases of achievement in meaning-making and their social effects. This burgeoning body of work is also pushing forward both theories in previously unanticipated ways. Of course, this may lead to less productive perturbations and provocations. It may perturb actors whose status rests on a fixed corpus of theory and are thus invested in reversion to a status quo ante. New ideas stimulated in part by interdisciplinary dialogue may thus provoke claims of being insufficiently (or overly) 'sociological'/'linguistic' or become labelled with such hybrid (and tacitly impure) appellations as 'sociolinguistics'. Ironically, such border policing can overplay the significance of interdisciplinary dialogue and ignore intra-disciplinary influences, such as the intrinsic logic of a theory or the impact of empirical studies on its development. It also fails to grasp the breadth of each framework. LCT is not restricted to the study of knowledge practices; SFL is not restricted to analysing language. Their increasingly multimodal reach – images, mathematical symbolism, physical movement – reflects their potential to provide social semiotic theories of practice. As Bernstein argued in response to 'purists' taking issue with the inclusion of 'sociology of language' in the subtitles of his first two volumes (1971, 1973), it is not merely the phenomena but also 'the conceptual system' being used that makes something 'sociological': 'There is no one particular which is unworthy of sociological study: what gives it its worth is an imaginative transformation which allows us a view of the latent and changing structure of society' (1973: 7). Similarly Halliday later stated that 'we've drawn disciplinary boundaries on the whole far too much' and that, rather than the object of study, a 'discipline is really defined by the questions you are asking. And in order to answer those questions you may be studying

thousands of different things' (in Martin 2013b: 128–9). In short, both Bernstein and Halliday emphasized that sociological and linguistic approaches may ask different questions of shared objects of study. Scholars using LCT and SFL are still doing so today.

The limited vision of counter-evolutionary reaction is, however, unlikely to hold sway. A new generation of scholars with direct experience of enacting both theories in empirical research is placing explanatory power into problem-situations at the centre of legitimacy. This rapidly growing body of work demonstrates what Bernstein (1977) called dedication to a problem rather than allegiance to an approach. Through dynamics such as zooming, refocusing and alternating, studies are articulating the complementary insights of different theories without losing their constitutive complexity of meanings. They are bringing together theories from different disciplines to provide greater understanding of their objects of study. They are thereby demonstrating how the reality can live up to the rhetoric. Such genuine interdisciplinarity may well be the future.

Notes

1 This is not to suggest developments in SFL, such as the appraisal system and individuation hierarchy, were not crucial to recent phases of exchange; our principal focus is situating the role of LCT.
2 DISKS was funded by an Australian Research Council Discovery Project grant (DP0988123).
3 The 'PEAK' project is led by Karl Maton, J. R. Martin, Len Unsworth and Sarah Howard, and is funded by an Australian Research Council Discovery Project grant (DP130100481).
4 See Bernstein (1995), Hasan (2005), Martin (2011), Maton (2012a), and Maton and Doran (2016) for insights into the ontological, epistemological, discursive and sociological conditions for exchanges between the two traditions.
5 Further mediating languages are being developed to engage with images (see LCT website at www.legitimationcodetheory.com).

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