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Live Lectures: The Significance of Presence in Building Disciplinary Knowledge

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Abstract

Radical changes in modes of pedagogy are currently being implemented in higher education internationally. Most significantly there is a rapid movement away from face-to-face, or 'live' teaching in lecture mode toward online-only resources, or to 'flipped classrooms'. The arguments mounted in support of such changes vary from economic imperatives to lifestyle preferences to pedagogic benefits. However, the research base in relation to the latter remains disturbingly thin. There is an overreliance on small-scale opinion survey data in the immediate context of changed practice and very little exploration of the nature of pedagogic practice in online modes or in the face-to-face lecturing they replace. Significantly lacking are attempts to tease apart the impact of technologies, modes of communication, pedagogic models and disciplinary knowledge structures in the building of knowledge. This study makes an initial contribution to this substantial project in an exploratory analysis of the dynamic unfolding of meaning in the spoken discourse of a face-to-face lecture in health science. The approach is trans-disciplinary, drawing both on systemic functional linguistics (SFL) and Legitimation Code Theory (LCT). Findings reveal ways in which meanings shift between the here-and-now of the shared sensible material space and elevated reflective perspectives on the field, and in doing so support the apprenticeship of students into the specialized, uncommon-sense knowledge of their field.

Keywords: lectures; systemic functional linguistics; presence; Legitimation Code Theory; semantic gravity; knowledge-building.

1. Introduction

Both the practices of teaching and learning in higher education, and the way they are talked about in host institutions, are currently in a process of rapid transformation. In favour is a model branded as *flipped learning* or the *flipped classroom*. The essence of the model, as presented on multiple institutional websites, is the online delivery of 'content' followed by opportunities for students to interact with groups of peers; there, in conjunction with facilitating academic staff, they are expected to apply the specialized uncommon sense knowledge which they are assumed to have acquired independently and on-line. This radical change, currently underway, necessarily raises important questions about the potential for such practices to support the apprenticeship of a broad base of students into the specialized and uncommon-sense knowledge of their respective disciplines.

Alongside the promotion of online modes as the preferred means for introducing students to new specialized disciplinary knowledge is the dismissal of dominant modes of knowledge transmission that have gone before. Face-to-face lectures are typically positioned in a 'constellation' of terms with negative values (see Maton, 2014b: 148-70). The descriptor 'traditional' almost always features in these constellations, as do attributes such as 'teacher-centred', with a general implication that we are looking at old-fashioned teaching featuring a lack of interaction. The negative values attached to lectures are also construed by implication, in relation to a swirl of positively charged terms promoting the counter-practice of 'flipped learning'—terms such as *interaction*, *collaboration*, and *creativity*.

Worryingly, the research base which informs claims of the comparative effectiveness of pedagogic modes for disciplinary knowledge-building is disturbingly thin. There is an over-reliance on small-scale opinion survey data, in the immediate contexts of teaching programs (e.g. Pierce & Fox, 2012; Galway et al., 2014). Claims of relative knowledge gains are largely reliant on self-reporting, a practice shown to have questionable reliability (e.g. Jaeger & Wiley, 2015). These claims are rarely supported in comparative examination results, and results are not compared to other practices (e.g. Papadopoulos & Roman, 2010, in Hamden et al., 2013; Galway et al., 2014). Rather 'flipped learning' practices are typically presented in heavily axiologized terms that remain experientially unspecified, terms such as 'student-centred' or 'active learning'. Descriptions of the promoted practices reveal little of what actually goes on in interaction among peers, and rarely do research papers include any data or analysis of exemplary practice for scrutiny. Of relevance here is Maton's warning of the dangers of "complacent, uncritical acceptance of the veracity of claims, [which] in turn encourages further certainty, as the number of publications repeating the claims grows" (Maton, 2014b: 161). It is clear that a great deal more scrutiny of practice is needed before confident claims can be made about the potential for particular pedagogic practices to effectively and democratically introduce students to, and build their uncommon-sense knowledge of specialized fields. An important step in this direction is to tease apart the technologies in play, the modes of

communication they afford, the pedagogic models enacted, and the disciplinary knowledge structures they serve.

The research presented in this paper responds to this challenge by orienting in the first instance to what is currently being portrayed as the 'traditional' practice of face-to-face lectures. The data comprise videos of live undergraduate lectures in science and the humanities in an Australian university. The larger project from which this paper is drawn explores disciplinary differences. Here, however, the focus is on science, in particular a health science lecture on the urinary system. We look in particular at the lecturer's spoken language, with reference made to collaborating systems of meaning making in body language alongside the images and written text displayed on presentation slides. The aim is to explore the texturing of knowledge in this mode and how this might function to scaffold students into the high stakes written texts of their field.

The data is explored from a transdisciplinary perspective. The two informing theories are those of systemic functional linguistics (SFL) (Martin, 1992; Halliday, 2004; Martin & Rose, 2007), and Legitimation Code Theory (LCT) (Maton, 2014b). The trans-disciplinary nature of the study thus involves a social semiotic exploration of patterns of meaning in live lectures alongside a sociological perspective on lectures as a kind of academic knowledge practice.

SFL theory underpins a significant number of studies of academic practice. Much of that work has focused on written texts, including student writing for assessment purposes (e.g. Hao & Humphrey, 2012; Lee, 2010), textbooks (e.g. Jones, 2007), academic research writing (e.g. Coffin & O'Donohue, 2014; Hood, 2010), and online asynchronous discussion threads (Lander, 2014a, 2014b). A number of recent studies of face-to-face teaching of academic knowledge have focused on schools (Martin & Maton, 2013; Rose, 2014) and pre-tertiary support programs (Hood, 2011; Macnaught, 2015). Nonetheless, the mode of lecturing in tertiary contexts remains a relatively under-represented field of research, although one that can be usefully supported by work in systemic functional semiotics and multimodal discourse analysis (e.g. Kress & van Leeuwen, 2006; Martinec, 2002; Nascimento, 2012; Painter et al., 2013).

In this paper we draw on the shared interest of SFL and LCT in the notion of 'context dependency'. In SFL context dependency has primarily been explored as an issue of mode, realized through the textual metafunction of language. Martin and Matruglio (2013), responding to the concept of 'semantic gravity' from LCT (Maton 2009, 2013, 2014a, 2014b), revisit earlier discussions (e.g. Martin, 1992; Cloran, 1999, 2000) to interpret the concept of 'context dependency' more comprehensively on a metafunctional basis. The term *presence* is proposed in Martin and Matruglio (2013) as an encompassing construct to account for 'context dependency' from the perspective of field, tenor and mode. Presence from the perspective of mode, in other words textual presence, concerns the relative *implicitness* of discourse. From the perspective of tenor, interpersonal presence concerns the potential for immediate *negotiability*. From the perspective of field, ideational presence concerns relative congruence or *ico-*

nicity. In each specific metafunctional realm, presence puts at risk choices with respect to relevant metafunctionally organized systems in discourse semantics (Martin, 1992; Martin & Rose, 2007), and discourse semantic patterns are themselves realized in lexicogrammatical choices. The implicated systems are introduced and exemplified at later points in the paper.

Analyses of patterns of choices in the discourse of the lecture are interpreted in the first instance as realizing degrees of iconicity, negotiability and implicitness. Findings are then re-interpreted in LCT terms with reference to the dimension of Semantics—in particular the principle of *semantic gravity* (SG) (Maton, 2009, 2014b; see Martin & Maton, this issue). The principle is explained in the following terms:

> When semantic gravity is relatively stronger, meaning is more closely related to its social or symbolic context of acquisition or use; when it is weaker, meaning is less dependent on its context (Maton, 2014b: 110).

For discussion of the complementary principle of 'semantic density' (SD), see papers by Martin and by Maton in this volume.

The relative strength or weakness of semantic gravity can be traced over time, and encapsulated in the notation SG↑/↓. Relative movement over time as SG↑/↓ (and/or SD↑/↓) can be mapped as a wave profile, providing a useful visualization tool for representing pedagogic practices in the service of knowledge-building (Martin & Maton, 2013; Maton, 2013, 2014a, 2014b). Semantic profiles can also be used to support comparative analysis across discourses—across modalities of communication (e.g., speaking, writing, imaging, gesturing), or across disciplinary fields.

2. The Social Semiotic Context of the Lecturer's Spoken Language

The first step in the analysis of the data was to segment the approximately 60 minutes of audio-visual lecture recording. The segmentation was done on the basis of the discourse associated with individual presentation slides, as well as thematically differentiated slide segments. The slides function to punctuate the lecture as a part-whole structure, with sections and sub-sections. Typically in this lecture, slide headings indicate sub-topics within the general field of the lecture. The slides represent a relatively stable construal of meaning around which more fluid constructions of meaning unfold in spoken language and body language.

2.1. Slide Images

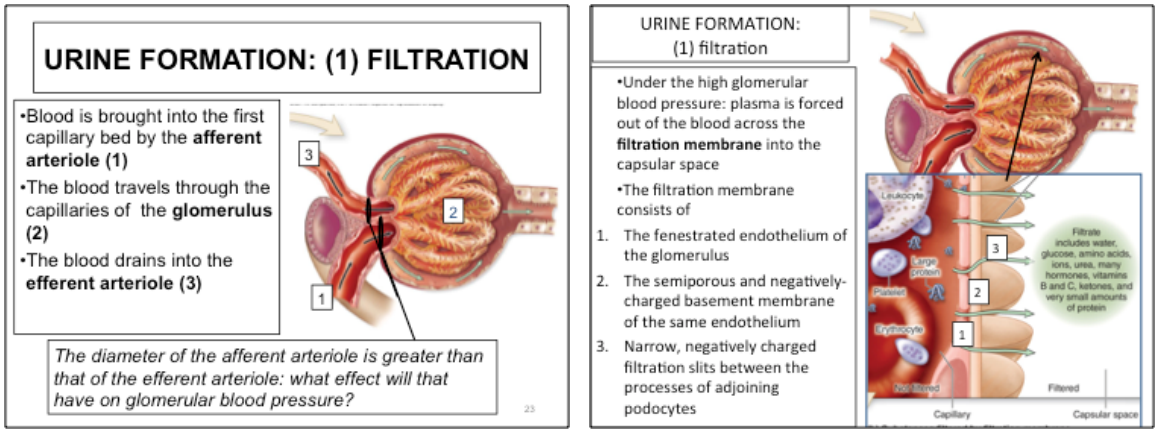
A majority of the slides include technical images alongside written text. Those with written text alone regularly appear in segment-initial and/or segment-final position where they func-

tion to predict or consolidate thematically coherent units of meaning. Analyses reported in this paper focus on the longest slide segment of the lecture. This is composed of eight slides, the first seven of which include both image and written text. The subfield in focus in this segment is 'URINE FORMATION: (1) FILTRATION'. The discourse in and around two of the slides is presented in this paper as indicative of the larger set.

From the perspective of field, one dominant feature of the slide images is their *technicality*. Visualization resources deployed in Figures 1 and 2 include cross-sectional perspectives, magnification (with arrow indicating inter-image relations in Figure 2), sharp focus, colour differentiation, and numerical and verbal labeling. These resources differentiate *entities* in *dimensions* of shape, relative size, position and so on (Hao, 2015). They function to construe taxonomies of *composition* (parts of) and *classification* (kinds of) relations between entities. Technical sequences of activity are also represented in arrows internal to the images. Together the taxonomies and activities construed in the images contribute to building the field of urine formation (see Martin, 1992).

FIGURE 1 (on left) and FIGURE 2 (on right)

Slide images and text (reproduced from McKinley et al., 2012 with permission)[1]



2.2. Written Text on Slides

Activity is also a feature of the written texts on the slides in Figures 1 and 2. If we consider the relations between the two slides, the visual and verbal texts present sequence on two levels. Figure 1 articulates a higher-level tier for the system of 'filtration' as a whole:

1 The full reference for the source text is M. P. McKinley, V. D. O'Loughlin & T. S. Bidle, 2013: *Anatomy & Physiology: An Integrative Approach*, New York: McGraw Hill.

Blood is brought into …
The blood travels through …
The blood drains from …

In Figure 2, a second more specific tier of sequencing that is made visible in the magnified section of the image is also articulated in the written text in:

Under the high glomerular blood pressure: plasma is forced out of the blood across a filtration membrane into the capsular space.

Here a hierarchy of sequencing is intermodally construed in verbiage and image.

The segments of talk explored correspond to the appearance and disappearance of each of the slides on a large projection screen at the front of the lecture theatre. The space the lecturer occupies is in front of and below the screen. He interacts with the slides both verbally and through systems of body language. The focus in this paper is his spoken language; however reference is made to some aspects of his body language where it is critically relevant to what is said.

3. Phasing Field in the Spoken Language of the Lecture

The discourse of the lecture is first analyzed from a dynamic perspective by identifying *phases* in the flow of the lecturer's talk (Gregory, 1985; Gregory & Malcolm, 1985; Malcolm, 2010). Gregory (1985: 127) refers to phases as "stretches of text in which there is a significant measure of consistency in what is being selected ideationally, interpersonally and textually". More recently Rose (2006: 187) refers to phases as "waves of information carrying pulses of field and tenor". For Rose, phases constitute general options for structuring registers within genres; the patterning of phases constitutes a patterning of register (see also Martin & Rose, 2008; Macnaught, 2015). Hence, from the perspective of field, phases constitute patterns in taxonomy and activity; as tenor they negotiate and evaluate the field; as mode they compose texts monologically and dialogically, as action and reflection (Martin & Rose, 2007).

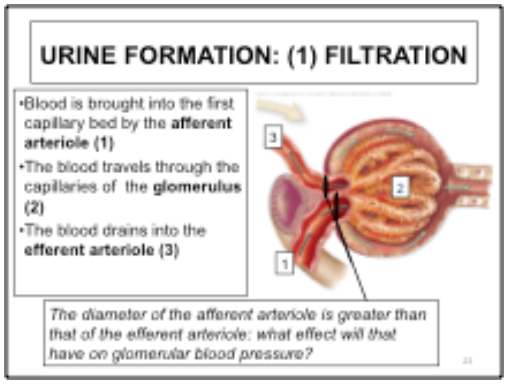
In these terms shifts in register patterns indicate shift in *phase*. In this study, consistency in field terms is privileged. In field terms phases are differentiated on the basis of their relative foregrounding of taxonomies of items or of activities, especially those that unfold as implication (rather than expectancy) (Martin, 1992). These field perspectives are realized at the discourse semantic stratum in the representations of entities, qualities, events and sequences (Martin & Rose, 2007, Martin, this volume; Hao, 2015).

Tables 1 and 2 present the transcribed talk accompanying the slides in Figures 1 and 2, respectively. Line breaks separate ranking clauses and student contributions are bracketed to distinguish them from the teacher talk that is the focus. Field phase boundaries are shown with

segmenting lines, and the different kinds of phase are identified in the left hand column and further explained below. The underlined wordings in the opening phases in each Table indicate wording read from the slides. A thumbnail representation of the relevant slide is included as a point of reference. In the Tables below, *explaining phases* focus on sequences of activity in the field, *reporting phases* focus on entities taking part in those sequences and *descriptive phases* focus on the images in the slides (the nature of these phases is discussed in more detail below).

TABLE 1

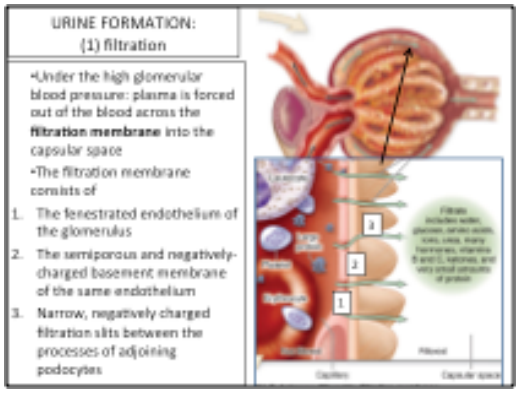
Phases in the lecturer's spoken language corresponding to Figure 1



PHASES	SPOKEN LANGUAGE
explaining	All right. Blood is brought to the first capillary bed via an afferent arteriole—afferent for going inwards. The blood travels through the capillaries of the glomerulus.
describing	You can see them underneath this. It's not this brown structure, it's the red pipes underneath. And the blood drains out of the efferent arteriole. But look at this. Who can tell…who can see that there's a difference between the efferent and the afferent arteriole? (Sts: *It's bigger*) Not bigger. What's the word? (*St: Wider*) Wider. This is much wider than this.
explaining	So the inlet is wider than the outlet. So what must the hydrostatic pressure be like in here? (*Sts: High*) It's high.
reporting	The hydrostatic pressure in the glomerulus is something like four times what you see in a normal capillary bed—in a capillary bed outside the kidneys. There's nothing abnormal about that, in the kidneys. But in capillary beds outside the kidney, the hydrostatic pressure is much lower. So that's the first thing which is unusual about this capillary bed.

TABLE 2

Phases in the lecturer's spoken language corresponding to Figure 2



PHASES	SPOKEN LANGUAGE
explaining	So, under the high glomerular blood pressure, plasma is forced out of the blood across a filtration membrane.
reporting	The filtration membrane comprises of the fenestrations, and the endothelium is an example of a simple squamous epithelium. Every epithelium has a basement membrane. It's the thing that sticks it to the next surface.
explaining	So things have got to get through the filtration slits, through the basement membrane and then through … sorry through the fenestrations, through the basement membrane, and through the filtration slits of the podacytes before they can get into the capsule. So yeah, it is like a sieve. But as you can see part of the Bowman's capsule contributes to that sieve-like effect as well. Do you see that? ['see' = mental process] Good.
reporting	The basement membrane is strongly negatively charged—as are the walls of the slits.
describing	Hopefully you can see that they're small, but they're not too big, because look at what is much bigger than the slits. (*St: White blood cells*) White blood cells, red blood cells, and platelets, and big proteins. They're too big to go through the slits.
reporting	So you shouldn't find in a normal person cells in their urine. Okay? They stay in the blood.

The spoken language in Tables 1 and 2 is shown to unfold as iterations of phases of *explaining*, *reporting* and *describing*. These three phase types are the main ones in the spoken discourse of the health science lecture as a whole, and are characteristic of other science lectures analyzed in the project. Each type is characterized below.

3.1. Phases of reporting

Phases of reporting in the spoken discourse construe the field of urine formation taxonomically as generic categories of entities. In the extract below, for example, the field is configured as taxonomic relations of both classification and composition. Realizations of such relations are underlined in the instances below:

Classification:

and the endothelium is an example of a simple squamous epithelium.

Composition:

The filtration membrane comprises of the fenestrations,

Every epithelium has a basement membrane.

3.2. Phases of explaining

Phases of explaining build the field of urine formation as sequences of activity. These may relate as *implication sequences* (consequentially) or as temporal unfolding. However, in the field of scientific knowledge, temporally-organized sequences also imply logical relations of cause, as in "(if)'a' happens then 'b' happens" (cf. Halliday & Martin, 1993).

An 'implication sequence' construing "a series of events, in which an obligatory [external] causal relation is implied between each event" (Martin & Rose, 2008: 150) is illustrated in:

Blood is brought to …
The blood travels through …
The blood drains from …

Cause is also implied where sequence is explicitly encoded as temporal:

things have got to get … through the filtration slits of the podacytes before they can get into the capsule

or in abstract locative circumstantial phrasing:

under the high glomerular blood pressure, plasma is forced out of the blood across a filtration membrane.

An important note here is the distinction between external cause, that is, causal relations in the scientific field (here the field of 'urine formation') and internal cause, that is the deductive reasoning that composes a culminating claim. Instances of internal cause are not criterial to

the identification of explaining phases. However, where a deductive 'so' culminates an implication sequence in a phase of explaining it is included in that phase. In the following:

> *… the inlet is wider than the outlet. So what must the hydrostatic pressure be like in here?*
> *(Sts: High)*
> *It's high*

it is assumed that in arriving at the answer the students have accounted for an elided implication sequence, something along the lines of:

> *the inlet is wider than the outlet*
> [which causes blood to flow more freely through the inlet of the glomerulus than it does through the outlet, which increases the pressure in the outlet relative to the inlet]
> *So what must the hydrostatic pressure be like in here?*

3.3. Phases of describing

Phases of describing realize the field of urine formation dominantly in terms of specific *entities*, their *qualities* and *dimensions* (Martin & Rose, 2008; Hao, 2015). In these data the specific entities are depicted in images, and indicated by the exophoric reference underlined below:

> *You can see them underneath this.*
> *It's not this brown structure, it's the red pipes underneath.*

> *Hopefully you can see that they're small, but they're not too big, because look at what is much bigger than the slits.*

In the verbal text the meanings of entities are extended and elaborated in terms qualities and *dimensionalities* of e.g., size (*small, big, bigger*), location (*underneath*), colour (*not … brown … red*), and so on (Hao, 2015).

To this point I have considered a field perspective on phases in the science lecture and are privileging patterns in *taxonomy* and *activity*. The next step in analysis refocuses attention on the key distinguishing feature of the lecture as a pedagogic mode, namely its enactment in a shared material setting in real time for lecturer and students. Having identified the construal of phases as patterns of field realized in choices in discourse semantic systems of IDEATION and CONJUNCTION, we now review them from the perspective of instantiation to consider how presence is relatively instantiated within and across phases in the urine formation lecture. The questions addressed are whether different phase types instantiate variations in a shared you-and-me, here-and-now experience of the lecturer and students, and what significance might this have for apprenticing students into the uncommon sense field of urine formation?

4. Phases and Presence
4.1. Presence as a Metafunctional Theorization of Context Dependency

The concept of *presence* was introduced earlier as generalizing an interpretation of context dependency across metafunctions (ideational, interpersonal and textual). It thereby implicates field, tenor and mode dimensions of register (Martin & Matruglio, 2013).

From the perspective of field, presence concerns degrees of ***iconicity*** in the expression of ideational meaning. Iconicity is analyzed as the relative congruence of language and the activities and entities of a specific field. The discourse semantic systems at risk are those of IDEATION and CONJUNCTION. In terms of IDEATION we are concerned with congruent versus experientially metaphoric realizations of meaning (e.g. *the blood drains from* vs. *blood drainage from*). In CONJUNCTION, at issue is the degree of congruent relations versus the use of logical metaphor. Congruence in:

> *things have got to get … through the filtration slits of the podacytes before they can get into the capsule*

contrasts to logical metaphoric in:

> *their passage through the slits enables entry into the capsule.*

CONJUNCTION also concerns the degree to which the text is structured in terms of external relations in the object of study or in relations internal to the spoken or written text (Martin, 1992: 178-181).

From the perspective of mode, presence is interpreted as relative ***implicitness***. This concerns the extent to which language relies on recoverability of meaning "from the shared sensible material environment of the utterance" (Martin & Matruglio, 2013: 191). The discourse semantic systems at risk are IDENTIFICATION and PERIODICITY. In terms of IDENTIFICATION relative implicitness is indicated by the amount of exophoric reference to sensible entities. In terms of PERIODICITY, the less a text can be interpreted as accompanying or recounting embodied activity, the more likely it is to be organized with hierarchies of PERIODICITY (i.e. layers of higher level Theme and New; Martin & Rose, 2007).

From the perspective of tenor, presence is interpreted as ***negotiability***. This concerns the degree to which meanings are made more or less arguable in the you-and-me, here-and-now. The systems at risk are NEGOTIATION, to do with the "interaction as an exchange between speakers" (Martin & Rose, 2007: 17), and APPRAISAL, to do with systems for expressing evaluation. Within NEGOTIATION, relative immediacy is expressed, for example, in the choice of 1st or 2nd (over versus 3rd person) for the nub (Subject) of a proposition. In the Finite element of the (English) clause, tense is implicated – with primary present tense offering more immediacy than past or future. The subjective or objective stance of modality can also come into play. Negotiabil-

ity is greater with subjective modalization (e.g. *it might happen*) than objective (e.g. *there's a possibility it will happen*). With respect to APPRAISAL, Martin and Matruglio (2013) suggest that AFFECT is more significant than JUDGEMENT or APPRECIATION as far as the immediate exchange of attitude is concerned. It is the only kind of attitude that can be inscribed in facial expression, and available in that sense in the shared here-and-now of interaction. For a more detailed account of discourse semantic systems at risk in the metafunctional construal, enactment and composition of presence, see Martin and Matruglio (2013). In the accounts to follow I discuss the profile of presence characterizing each phase type in the lecture.

4.2. Reporting and presence

Reporting phases reveal limited presence. Although they are relatively congruent in the construal of entities, activities and sequences, as far as interpersonal negotiability and textually iconicity are concerned the discourse is removed from the you-and-me, here-and-now of the lecturer's talk. The linguistic evidence is set out below.

4.2.1. Reporting and ideational iconicity

Reporting phases display a varied profile in terms of iconicity in their representation of field. Experientially, an analysis of IDEATION reveals considerable technicality, but the representation of processes and relations does not involve grammatical metaphor (Halliday, 1998; Hao, 2015). The construal of experiential meaning remains largely congruent. So, for example, we find constructions such as:

> *Every epithelium has a basement membrane. It's the thing that sticks it to the next surface.*

rather than:

> *The surface adhesion function of the basement membrane …*

Logically, an analysis of CONJUNCTION in the representation of urine formation reveals reporting phases to be largely devoid of implication sequences, realized either congruently or metaphorically. Where sequencing is indicated in reporting phases it connects text-internal ideas not events in the field. Such use of internal conjunction is underlined in the following:

> *… There's nothing abnormal about that, in the kidneys.*
> *But in capillary beds outside the kidney, the hydrostatic pressure is much lower.*
> *So that's the <u>first</u> thing which is unusual about this capillary bed.*

4.2.2. Reporting and textual implicitness

From a textual perspective reporting phases display minimal implicitness and so reduced presence with respect to mode. In terms of IDENTIFICATION, we find the ratio of exophoric to endophoric reference very much in favour of the latter. Endophoric reference (referencing back to an entity within the text) is underlined in:

Every epithelium has a basement membrane.
It's the thing that sticks it to the next surface.

The hydrostatic pressure in the glomerulus is something like four times what you see in a normal capillary bed—in a capillary bed outside the kidneys.
There's nothing abnormal about that, in the kidneys.
But in capillary beds outside the kidney, the hydrostatic pressure is much lower.
So that's the first thing which is unusual about this capillary bed.

An analysis of IDENTIFICATION also reveals shifts within phases between exophoric (implicit) and endophoric (explicit) reference. In the following example the initial reference (underlined) is identified as exophoric on the basis of the visual data since it couples with gestural points to the image). Then there is a shift to endophoric reference (in bold) in the subsequent talk:

White blood cells, red blood cells, and platelets, and big proteins.
***They**'re too big to go through **the** slits.*
So you shouldn't find in a normal person cells in their urine.
Okay?
***They** stay in the blood*

Generalized rather than specific reference is also relevant to the degree of implicitness. Generalized reference makes explicit the categories of entity referred to in reporting phases, as exemplified in:

Every epithelium
a normal capillary bed
the kidneys
capillary beds outside the kidney

In terms of PERIODICITY, the relative explicitness of the reporting phases helps them play a role in higher-level periodic structures that organize longer segments of the talk (as hyper- or macro-Theme; hyper- or macro-New). They conclude segments in this way in Tables 1 and 2. An example of a reporting phase functioning as a consolidating hyper-New for the preceding explaining, describing and explaining phases of talk in Table 1:

The hydrostatic pressure in the glomerulus is something like four times what you see in a normal capillary bed—in a capillary bed outside the kidneys.
There's nothing abnormal about that, in the kidneys.
But in capillary beds outside the kidney, the hydrostatic pressure is much lower.
So that's the first thing which is unusual about this capillary bed.

4.2.3. Reporting and negotiability

An analysis of negotiability implicates the discourse system of NEGOTIATION, and grammatical systems of PERSON, TENSE and MODALITY. In English, the Mood element of the clause is a focal point for negotiability (Martin & Matruglio, 2013). The choice of TENSE in the Finite element adjusts the temporal grounds of negotiability, from the here-and-now of present tense to the relatively removed past or future. If MODALITY is chosen, then a range of more or less subjective assessments can be encoded. Choices in the pronominal system of PERSON in Subject position (*I*, *you*, *we*, *he/she/it*) can also ground negotiability (in speaker/addressee roles) or distance it from the you-and-me of the immediate context (in non-interlocutor pronouns).

Reporting phases typically display minimal negotiability. Primary present tense is a feature shared across all the phase types, but there is an absence of *I* or *you* as Subject in clauses. Both occurrences below of a pronominal 'you' in the illustrated data, are arguably generalized reference to health professionals in the field, and in the second the 'you' is part of a non-negotiable embedded clause):

So <u>you</u> shouldn't find in a normal person cells in their urine

The hydrostatic pressure … is something like four times what <u>you</u> see in a normal capillary bed

4.3. Explaining and presence

The profile of presence in explaining phases is one of relatively high ideational iconicity—the text is relatively congruent with respect to the material reality. Although in explaining phases interpersonal negotiability is still relatively removed from the immediacy of the you-and-me of the lecture theatre, it is higher than in reporting phases. There is more dialogic interaction and more subjective assessments of modality. Textually the profile of implicitness is mixed, with differences in the discourse within and across specific phases. Linguistic choices are explained below.

4.3.1. Explaining and iconicity

Explaining phases, like reporting ones, display considerable technicality but experiential meaning again remains largely congruent with respect to field. Causal relations, a defining feature of this phase type, are also realized relatively congruently. This is illustrated in the underlined examples of conjunctive relations in:

> things have got to get through (…) the fenestrations, through the basement membrane, and through the filtration slits of the podacytes before they can get into the capsule

and

> … *under the high glomerular blood pressure, plasma is forced out of the blood across a filtration membrane.*

There are no instances of logical metaphor in the explaining phases analyzed for his paper. Invented examples of such might be:

> *Passage through the fenestrations, through the basement membrane, and through the filtration slits of the podacytes enables entry to the capsule*

or

> *a change in blood pressure results in a change in the amount of filtrate production by the kidneys*

4.3.2. Explaining and implicitness

Textually, explaining phases reveal a mixed profile with respect to implicitness. In some instances, they contain wordings read from slides, where entities are explicitly identified. This is the case in the first explaining phases in both Tables 1 and 2. Explicitness is also realized in the endophoric reference in bold in the following example, where it refers back to the underlined '*like a sieve*':

> *So yeah, it is like a sieve.*
> *But as you can see, part of the Bowman's capsule contributes to* ***that*** *sieve-like effect as well.*

In other phases exophoric reference is the dominant pattern. The exophoric reference underlined in the following examples relies on the visibility of the lecturer's body language and pointing gestures for the elaborated meanings to be available to students. Each underlined

wording couples with a pointing gesture (mediated with a laser pointer) to a part of the image visible on the slide:

> *So things have got to get through (...) the fenestrations, through the basement membrane, and through the filtration slits of the podacytes*
> *before they can get into the capsule.*

> *So the inlet is wider than the outlet. So what must the hydrostatic pressure be like in here?*

From the perspective of PERIODICITY, the explaining phases, like the reporting ones, may assume positions of textual prominence as higher-level Theme or New in longer segments of talk. They initiate segments in this way in Tables 1 and 2. While not included in the tables above a phase of explaining which consolidates the whole section of the lecture on Urine formation: filtration is included below.

> *Any changes in blood pressure / blood flow, the integrity of the filtration membrane, or the amount of fluid in the capsule at any time will have an impact on the GFR*
> [GFR = Glomerular Filtration Rate]

4.3.3. Explaining and negotiability

From the perspective of presence, we are also concerned with the extent to which meanings are made negotiable in terms of you-and-me, in the here-and-now. Focusing on the Finite element of clauses we find that in explaining phases, as in other phase types, primary present tense is the main selection. This constitutes a generalizing present, which serves to ground negotiability in the temporal here-and-now although less so than present-in-present would. So, for example, *Blood travels through the capillaries* enacts less negotiability than does *Blood is travelling through the capillaries*.

Explaining phases also mobilize some subjective assessments of modal obligation, as underlined in:

> *So what must the hydrostatic pressure be like in here?*
> *things have got to get through the filtration slits*

Negotiability is also enacted in explaining phases in dialogue, as illustrated in:

> *So what must the hydrostatic pressure be like in here?*
> *(Sts: High)*
> *It's high.*

part of the Bowman's capsule contributes to that sieve-like effect as well.
Do you see that?
Good.

In the example above, the visual data reveals that what is made negotiable in the checking move (*Do you see that?*) is the students' understanding of the explanation provided, not their ability to locate an exophoric referent ('see' as mental cognition, not visual perception).

There are also some instances of 2nd person pronoun as Subject which serve to ground negotiability in the you-and-me of lecturer and students. In the following instances, the underlined Subject clearly refers to the students present in the lecture:

Do you see that?
Good.

and

But as you can see,
part of the Bowman's capsule contributes to that sieve-like effect as well

However, in the latter example it occurs in a dependent clause, and is thus removed from modal responsibility in relation to the arguability of proposition concerning Bowman's capsule.

4.4. Describing and presence

The profile of describing phases shows a relatively high degree of presence with respect to field (iconicity), tenor (negotiability), and mode (implicitness), as evidenced below.

4.4.1. Describing and iconicity

The phases of describing, as with other phases in the lecturer's talk, display considerable presence as ideational iconicity. There is very little experiential grammatical metaphor. Only a single instance is evident in Tables 1 and 2, as underlined in:

who can see that there's a difference between the efferent and the afferent arteriole?

In a more congruent construal, qualities would be expressed as attributes, as in:

who can see that the efferent and the afferent arteriole are different?

Congruent realizations of attributes are more common, as in:

> *look at what is much bigger than the slits.*

From the perspective of CONJUNCTION there are very few causal relations in describing phases. In the example below from Table 2, a causal relationship is congruently realized between clauses:

> *Hopefully you can see that they're small, …*
> *because look at what is much bigger than the slits.*

However, this example of a causal relation (of what can be seen and why) has to do the field of pedagogic practice, not the field of urine formation.

4.4.2. Describing and implicitness

Phases of describing (see Table 3) are distinguished from the other phase types by a significant degree of textual *implicitness*. This is encoded in multiple instances of presuming exophoric reference, as underlined in:

> *You can see them underneath this. It's not this brown structure, it's the red pipes underneath.*
>
> *This is much wider than this. Do you see that?*

The ratio of exophoric to non-exophoric reference is high, and instances are mostly located in Theme or New in clauses. In other words, what is made most textually prominent in these phases is what needs to be recovered from the shared sensory environment of the discourse. We can also note that describing phases do not take up segment-initial or segment-final positions in the spoken discourse, and so do not function as higher-level Theme or New in longer segments of talk. Higher-level Theme and New typically require a degree of elevation from the here-and-now if they are to function effectively to predict or consolidate meanings of segments (Martin & Rose, 2007).

4.4.3. Describing and negotiability

In describing phases, meanings are made negotiable in the you-and-me, here-and-now in a number of ways. Within the Mood component of the clause, the Finite element is dominantly primary present tense, thereby grounding negotiability of propositions in temporal immediacy:

It's not…
This is…
Do you…

In the Subject, 2nd person is found in commands (realized metaphorically in declarative mood), as underlined in:

You can see them underneath this.
Hopefully you can see that they're small

In the examples of congruent commands below, 2nd person you (bracketed) is the implied or "understood" subject (Halliday, 2004: 152):

But (you) look at this.
(you) look at what is much bigger than the slits.

Elsewhere, dialogue is enacted in instances of interrogative mood such as the following:

Who can tell…who can see that there's a difference between the efferent and the afferent arteriole?
(Sts: It's bigger)

Grammatically, it is the Subject itself that is at risk here (*who can*) rather than a proposition about urine formation (cf. *there's a difference between the efferent and the afferent arteriole*). Note that the anticipated response to the query above would be something like '*I can*'. The students' response indicates however that they have interpreted the meaning they should be negotiating as *'what (can you see) is a difference between the efferent and the afferent arteriole?*

The instances of '*can*' in the above examples encode potentiality or ability rather than probability. Halliday (1984: 339) suggests that this is "strictly not a kind of modality" as it does not have the full subjective/objective profile; there are no intermediate degrees in polarity (as with *possibly, probably, certainly*, for example).

4.5. Phases and comparative presence

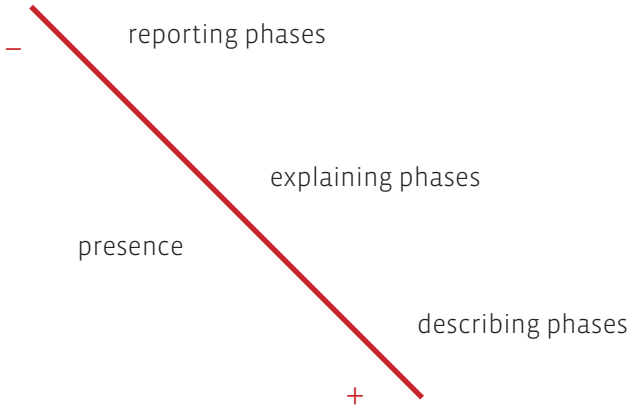
Analyses of phase type and presence in the health science lecture reveal patterns of similarity and difference. All phase types display features of ideational presence—the health science lecturer construes the field relatively congruently throughout. The lack of metaphoric abstraction is consistent with the fact that the lecturer in these data speaks by-and-large with-

out reading from written notes or source texts. However, the phase types do present contrasting profiles with respect to negotiability and implicitness. Reporting phases typically remove negotiability from the you-and-me, here-and-now of the lecture theatre; they thus display the least negotiability. In explaining phases, meanings are made somewhat more negotiable than in reporting phases, and describing phases display the highest degree of negotiability. Analyses of textual implicitness reveal a similar pattern of relative presence. Reporting phases are the least implicit, explaining phases are more so, and describing phases the most implicit.

Phases of describing are thus shown to rely most on meanings retrievable from the shared sensible environment of the talk. They rely in particular on the visual images on the slides, and the visibility of the lecturer's body as he gestures towards those images and parts therein. It is this type of phase that relies most on the shared physical environment of the lecture theatre, a point I will return below with respect to knowledge-building.

Generalizing across the three phase types and the associated patterns of presence, we can identify a cline of relative presence in the spoken language of the lecture, as illustrated in Figure 3.

FIGURE 3
A cline of phase type and relative presence in the analyzed data



Analysis of comparative presence reveals that collectively the phases extend the scope of iconicity, negotiability, and implicitness in the talk. They move meaning into and out of the you-and-me, here-and-now of the shared lecture theatre, and into and out of more generalized and abstracted representations of knowledge that are independent of the immediate environment, and that associate more strongly with the high-stakes representations of field knowledge in written texts.

A final step is to interpret the pedagogic significance of this generalized pattern in the spoken discourse of the science lecture, and additionally to establish a base for comparative

interpretations across other instances of pedagogic interaction. This might include other fields and disciplines, other modes and modalities in play in pedagogic encounters, and other pedagogic models. This suggests a need for a further step of theorization. Below I undertake a process of translation, from the linguistics of SFL into the sociology of LCT.

5. Presence in SFL and Semantic Gravity in LCT

The theoretical concept of *presence* in SFL emerged from ongoing dialogue with the sociological theory of LCT around the theorization of context dependency (see Martin & Matruglio, 2013; Maton et al., 2016; Maton & Doran, 2017). Within LCT the dimension in focus is *Semantics*, specifically one of its underlying principles, *semantic gravity* (the other being *semantic density*). Semantic gravity (SG) refers to the degree to which knowledge or practices are context dependent, that is, the degree to which "meaning is more [or less] closely related to its social or symbolic context of acquisition or use" (Maton, 2014b: 110). Semantic gravity conceptualizes one organizing principle of the knowledge practices that are being enacted by actors. The concepts of presence and semantic gravity thereby provide complementary understandings of educational practices. Presence offers insights into the complexes of linguistic features that actors marshal; semantic gravity offers insights into the nature of the knowledge practices that actors undertake. These concepts from different fields can be related through a process of interpretation to explore how the linguistic features 'play out' in knowledge practices, or how the knowledge practices are generated through language choices. From the latter perspective, we can interpret 'presence' as a means of translating between 'semantic gravity' and language, but what would be the value in such a step?

Central principles of LCT, such as that of semantic gravity, conceptualize the organizing principles of practices—practices that may be realized differently in different objects of study (Maton & Chen, 2016). As Maton & Doran (this issue) explain, what therefore becomes "a key task for LCT informed research is to establish the empirical realizations of the concept within a particular object of study". The empirical realizations are made explicit through the creation of a 'translation device' where the 'translation' is between the concept and features of the data. In other words, a concept such as semantic gravity may be operationalized differently with respect to different objects of study on the basis of different translation devices (see, for example, Woolf & Luckett, 2012). In this study linguistic choices and patterns are first analyzed with respect to systems of meaning in SFL, interpreted within that theory as construing relative presence. In turn, the SFL concept of presence operates as a means of translating between linguistically realized meanings in data and kinds of knowledge practices identified through the organizing principle of semantic gravity.

The different degrees of presence instantiation in different phase types identified above are interpreted into LCT as involving changes in the relative strength of semantic gravity.

Stronger SG and weaker SG are each associated with a complex of settings of the three SFL variables (iconicity, negotiability and implicitness)[2]. This makes it possible to visualize changes over time as a wave profile. In Figures 4 and 5, the profiles correspond to the duration of talk of single slides (Figures 1 and 2 above) as transcribed in Tables 1 and 2 above.

FIGURE 4
Lecturer's talk in Table 1 as a semantic gravity profile

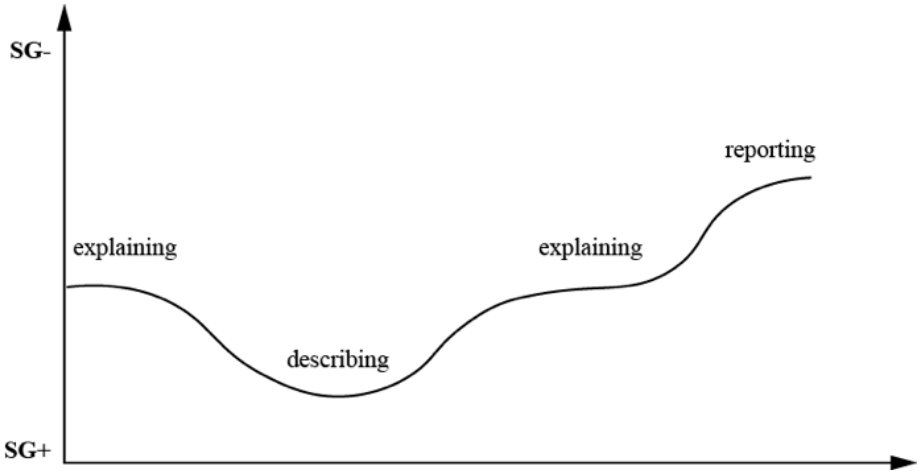
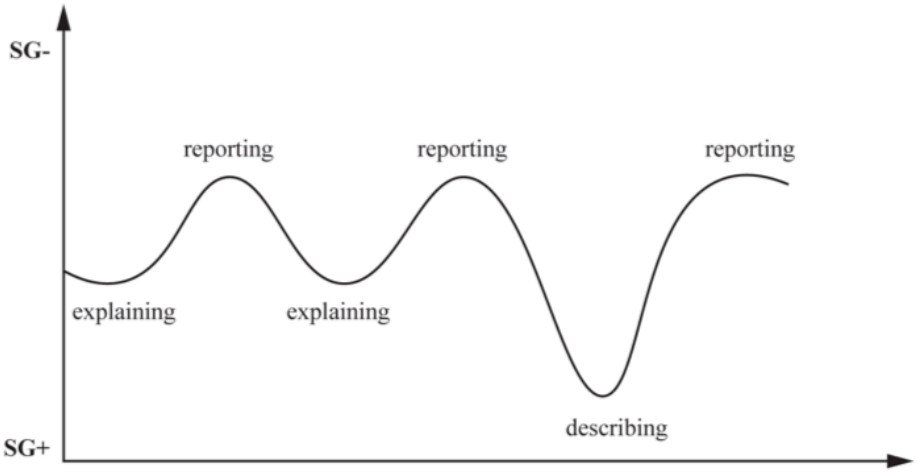


FIGURE 5
Lecturer's talk in Table 2 as a semantic gravity profile



2 Here I have analyzed from the linguistics and interpreted into LCT as SG. However, one could alternatively analyze the data as a profile of SG drawing on another translation device and then explore the SFL variables associated with changes in SG.

The semantic profiles show both segments of talk as highly dynamic with respect to context dependency. They also reveal something of the overall range of semantic gravity that is traversed in each timeframe. The phases of describing, the most dependent on the shared physical context (+iconicity; +implicitness; +negotiability), extend the semantic range maximally towards stronger semantic gravity (SG+). The phases of reporting (+iconicity; -implicitness; -negotiability) extend the range maximally towards weaker semantic gravity (SG-).

At points of strongest semantic gravity, the discourse of the lecturer construes and negotiates knowledge of the field in the immediate here-and-now of the material situational setting, and in the immediate you-and-me of the interaction. From the perspective of pedagogy and knowledge-building, one consequence of this extension to the range of semantic gravity (from SG+ to SG-) is that it expands the space available for the *scaffolding* of students into new uncommon sense knowledge. The metaphor of scaffolding is an important one in all contexts of education. It traces back to Wood, Bruner and Ross (1976) and connects to Vygotsky's 'zone of proximal development' (1978: 86) and Martin's "guidance through interaction in the context of shared experience" (Martin, 1999, after Painter, 1985). Critical to all is the recognition of an asymmetry of knowledge or expertise as the basis for learning, and that interaction on this basis allows learners "to achieve outcomes that they would otherwise not be able to achieve on their own" (Derewianka & Jones, 2012: 280). The range of semantic gravity evident in each segment of the lecture analyzed in this paper enables the lecturer to scaffold students from their varied points of entry towards the more decontextualized level required for mastery of their specialized literate disciplinary knowledge. Importantly, such opportunities are likely to prove significant in relation to the widening socio-cultural profile of students now entering higher education.

5.1. Embracing diversity

LCT also enables us to make meaningful comparisons across a diversity of specific practices, perhaps involving different translation devices. From an analysis of the profiles of semantic gravity in a single lecture in science, we have a basis for comparison of variation along many fronts. Given the problematic that has motivated the current study, one important direction for research is the dynamics of meaning-making and knowledge-building in live versus online pedagogic modes, especially where apprenticeship into new disciplinary knowledge is at stake. Initial research (Hood & Lander, 2016) suggests, for example, significant differences in profiles of presence in live lectures and voiced PPT slides, where each is matched for content, lecturer and cohort group. However, there is much more to be understood about the mode of face-to-face lecturing. More comparative studies are needed to explore similarities and variations in profiles of semantic gravity, especially with respect to how discipline/field impact on the phasing of discourse and the traversal into and out of the you-and-me, here-and-now. This issue of discipline remains largely invisible in current

discourses of a one-size-fits-all model of change in pedagogic modes. Studies of variation might also attend to the relative field expertise and/or experience of the lecturer, whether the context is one of introductory or advanced levels of study, and whether the lecture is largely spoken or largely read-aloud, and so on.

A further front is the development of additional translation devices to account for relative presence and/or relative semantic gravity in modalities other than language. These will include body language (drawing for example on Martinec, 2002; Hood, 2011; Hood & Maggiora, 2016; Lambrinos, 2015), image (e.g. Kress & Van Leeuwen, 2006; Painter et al., 2013), and space (e.g. Stenglin, 2009; Ravelli & McMurtrie, 2016).

Finally, it is important to note that both the linguistic concept of *presence* and the sociological concept of *semantic gravity* are each part of conceptual frameworks that include other complementary concepts that would be useful to employ in more comprehensive explorations of knowledge-building in pedagogic practices. These additional concepts address the distillation or condensation of knowledge. In this regard, *presence* is complemented by the concept of *mass* in SFL (Martin, this issue), and *semantic gravity* is complemented by the principle of *semantic density* in LCT (Maton, 2011, 2013, 2014a, 2014b; see Maton & Doran, this issue).

6. Conclusion

This study makes a contribution to much-needed research into the potential for knowledge-building in different modes of pedagogic encounter in tertiary sectors. It demonstrates the ways in which the spoken language of a live lecture provides multiple perspectives on the field of disciplinary knowledge, and in doing so both exploits the here-and-now, you-and-me of the immediate and shared setting to provide points of entry into specialized fields—in tandem with elevating the interaction in the direction of the decontextualized representations of knowledge constructed in written text.

The aim in this research is to reveal what can be gained from a close study of lecture talk. There are, as noted above, other modalities to be explored in lecture mode, other pedagogic modes and other kinds of disciplinary knowledge. It is hoped that the questions asked in this study and the approach taken in their exploration will inform related research. With respect to the mode of face-to-face lectures, I suggest that a clearer understanding of the long-evolved practice of lecturing can provide a valuable foundation for continuing evaluation, renewal or redesign of pedagogic practices. Given what is at stake, I would argue that such research is best undertaken as foundational to policy-making, rather than post hoc to the radical changes currently reshaping the nature of the pedagogic interaction through which students are apprenticed into the uncommon-sense knowledge of disciplines.

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