



Embedded literacy: Knowledge as meaning

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ABSTRACT

This paper takes as point of departure the register variable field, and explores its application to the discourse of History and Biology in secondary school classrooms from the perspective of systemic functional linguistics. In particular it considers the functions of technicality and abstraction in these subject specific discourses, and their relation to the high stakes reading and writing expected from students. The paper shows how the practical concepts of power words, power grammar and power composition can be developed from this work as tools for teachers to use for purposes of knowledge building. Specific attention is paid to the role of specialised composition and classification taxonomies and activity sequences in specialised fields, and the relation of this valeur to the concept of semantic density in Legitimation Code Theory.

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1. Transition

Across cultures, the development from childhood to adolescence is regularly accompanied by the movement from primary to secondary school education. And this movement is accompanied in curricula by a shift from a concern with basic literacy and numeracy, often taught in general terms, to subject-based teaching and learning involving highly specialised discourse of various kinds. From functional linguistic perspective, what changes gears for successful students in this transition is the relationship between wording and meaning – between grammar that transparently encodes semantics to grammar which often symbolises indirectly what it means – between congruent and grammatically metaphorical modes of expression in Halliday's terms (Christie & Derewianka, 2008; Colombi & Schleppegrell, 2002; Halliday & Martin, 1993; Halliday & Matthiessen, 2004; Halliday, 1998, 2004; Simon-Vandenberg, Taverniers, & Ravelli, 2003).

Historically speaking, the various ramifications of this transition have strongly influenced the nature of the genre-based literacy programs associated with the so-called 'Sydney School' (Martin, 2012c; Rose & Martin, 2012). Infants and primary school interventions in the 80s focused strongly on genre – the mastery of writing for different purposes in a range of genres (e.g. recount, narrative, report, procedure, explanation, exposition and so on). In the 90s, when secondary school and workplace literacy was addressed (Christie & Martin, 1997; Rose, McInnes, & Korner, 1992), more attention had to be given to the disciplines in which reading and writing took place (Science, History, Mathematics, Geography, Economics, Creative Arts, English and so on). The nature of knowledge in particular became a key concern, varying as it does from one subject to another, including its technicality and abstraction, and the role of grammatical metaphor in construing this knowledge. Students continue to read and write genres, of course; but these literacy practices are devoted to developing uncommon sense understandings of the world – understandings upon which their success in education, and thus their prospects in the wider world, critically depends.

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Accordingly in this paper my main focus will be on what in systemic functional linguistic (hereafter SFL) models of context is referred to as field. I am concerned in particular with what knowledge looks like from this linguistic point of view. The point of this discussion is to better articulate what it means to have an embedded literacy program (as opposed to a generic one), where students read and write to learn, and where **what** they are learning is the key factor that needs to be addressed whenever shaping curriculum and designing the pedagogy through which they are taught. I write this in the context of ongoing dialogue with sociologists concerned with reclaiming knowledge, both in their own discipline and in education, negotiations documented in Christie (1998), Christie and Martin (2007), Christie and Maton (2011), Martin (2011), and Maton, Hood, and Shay (in press).

2. Field

SFL has evolved as a multiperspectival model of language (Halliday & Matthiessen, 2009), involving a series of strata of increasing levels of abstraction (phonology/graphology, lexicogrammar, discourse semantics) and a trinocular perspective on meaning (the ideational, interpersonal and textual metafunctions). Context is generally privileged as one or more additional strata of meaning, with the intrinsic functionality of metafunctions used to map one layer as field (construed ideationally), tenor (enacted interpersonally) and mode (composed textually); Martin and his colleagues (e.g. Martin, 1992, 2012a, 2012b; Martin & Rose, 2008) include an additional level of context called genre, which accounts holistically for relations among the field, tenor and mode combinations that a culture recurrently stages as phases of unfolding discourse. A schematic outlined of these dimensions is provided in Fig. 1.

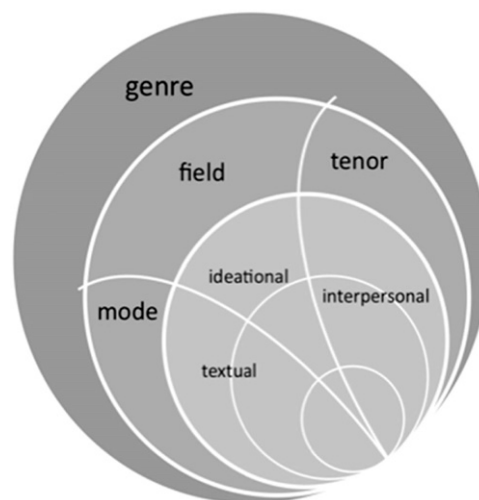


Fig. 1. The dimensions of strata and metafunction in SFL.

Martin (e.g. Martin, 1992) characterises a field as a set of activity sequences oriented to some global institutional purpose, alongside the taxonomies of entities involved in these sequences (organised by both composition and classification). In the penultimate chapter of Martin and Rose (2008) a multimodal text concerning mulga trees from a secondary school geography textbook is analysed (Scott & Robinson, 1993); throughout the textbook verbiage and image cooperate to build knowledge of Australian desert environments and their fauna and flora (cf. Martin, in press). Mulga trees for example are construed compositionally; they have roots and branches, and the branches are in turn composed of stems, flowers, seeds and leaves (Fig. 2). The desert environments they inhabit, the mulga plains, are construed through classification as desert ranges & rocky outcrops, plains or rivers, and if plains, then as mulga plains, spinifex plains or saltbush & blue bush plains (Fig. 3). The crucial point here from the perspective of geography is that recognising a mulga tree, as a visitor to central Australia

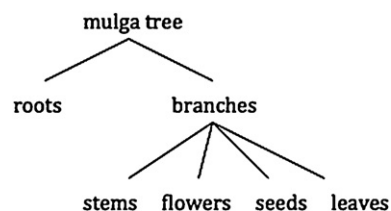


Fig. 2. Composition of the mulga tree.

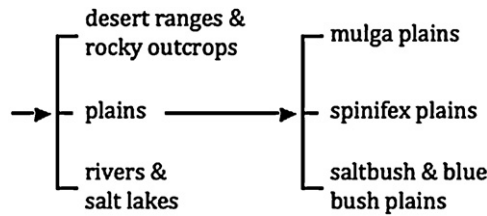


Fig. 3. Classification of desert environments.

or in photographs, is not enough; its uncommon sense composition and uncommon sense classification are central to its meaning in the field.

Beyond this the mulga tree is involved in a number of activity sequences which are fundamental to its survival in its desert environment (Unsworth, 1997). For example, as the text explains and an image illustrates, its branching leaves and stems catch more rain than if the tree grew straight up, and they help it trickle down to the soil; the water is then stored in the soil to be used by the tree during the next drought. The semantics of this implication sequence is outlined more formally below (based on Martin, 1992; Martin & Rose, 2003/2007¹); the part of the image used reinforce its construal is presented in Fig. 4. From the perspective of Legitimation Code Theory (hereafter LCT) the strength of the semantic density of the entity mulga tree, as understood in physical geography, includes its 'valeur' in the composition and classification taxonomies exemplified above, alongside the role it plays in any implication sequences in which it is involved (see Maton, this issue). There is thus much more to the meaning of the term than a simple definition affords (Halliday & Martin, 1993; Martin, 1989; Wignell, Martin, & Eggins, 1990) – relatively stronger semantic density is involved as well. In our work with secondary school teachers we highlight potential for greater strength of semantic density afforded by these technical terms by referring to them as **power words**.

[branching + leave & stems] + x catch + rain
 ^
 rain + trickles x soil
 ^
 water + stored x soil
 ^
 tree + x use + water x drought

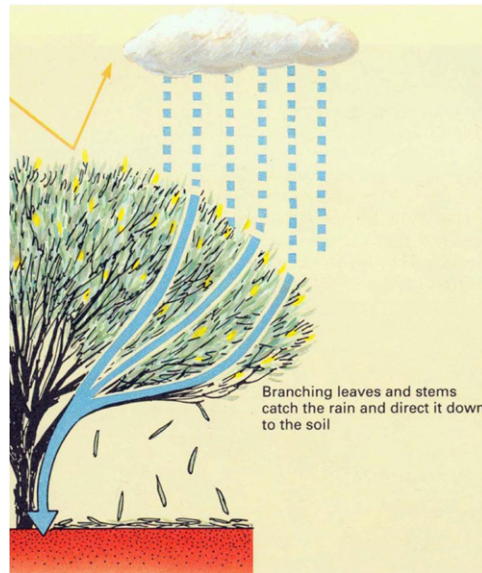


Fig. 4. Imagic construal of water catching implication sequence (Scott & Robinson, 1993: 23).

3. Knowledge structure in Biology

Maton (this issue) introduces the notion of semantic wave in relation to a lesson on cilia in secondary school Biology, as part of a unit of work on the body's defences against infection. As he notes, knowledge about the nature and function of cilia

¹ For this display \hat{s} stands for sequence, and x, x+ and + relate participants, processes, circumstances inside each step in the sequence.

were reviewed and then consolidated in a table classifying them alongside other lines of defence (see his Fig. 6). As far as composition is concerned hairs, body, nose, cells, air passages, lungs, stomach and acid are all mentioned, but the precise relations among these parts is not made explicit, verbally or in a diagram. Nor, as far as we know, were cilia examined under a microscope, to see what they look like to the naked eye, augmented by technology; nor, as far as we know, was the internal structure of a single cilium considered, as it has been construed on the basis of decades of research. Fig. 5 outlines some of the various degrees of composition and decomposition that might have been considered had this potential strength of the semantic density of cilia been developed further in the classroom.

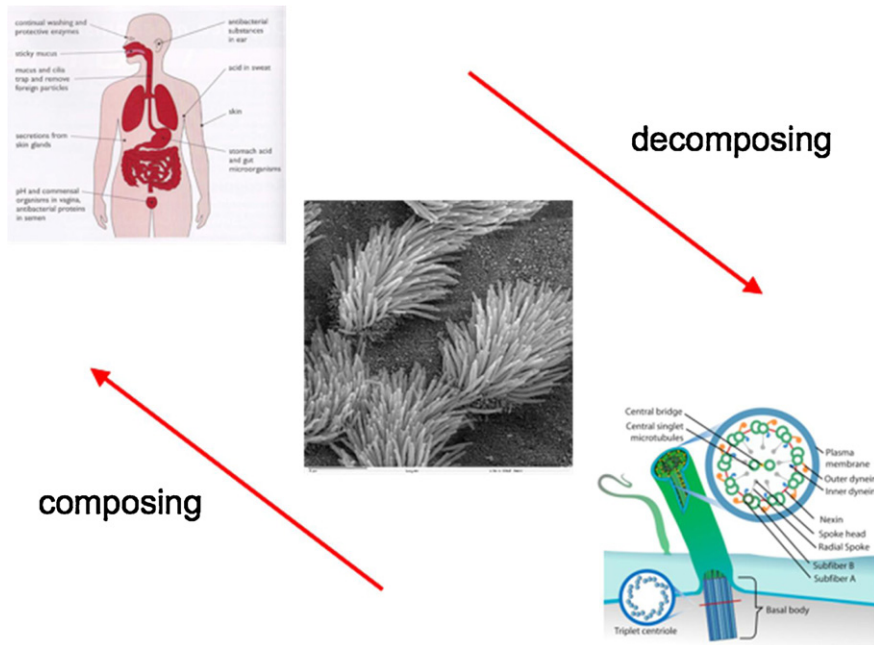


Fig. 5. Degrees of de/composition for cilia (from Evans, Ladiges, McKenzie, Batterham, & Sanders, 2011: 178, <http://en.wikipedia.org/wiki/Cilium>, http://en.wikipedia.org/wiki/File:Eukaryotic_cilium_diagram.en.svg).

Turning to classification, cilia were grouped in the table alongside skin, mucous membranes, chemical barriers and other body secretions as lines of defence. Further study of the body’s defences against pathogens (cf. Fig. 6) might position this column of the table as defence barriers (as opposed to defence adaptations and immune responses); or as the first line of defence (as opposed to the second and third); or as one type of non-specific defence, attacking any pathogen (alongside

Summary of the body’s own protection and immune response

Defence barriers	Defence adaptations	Immune response
the skin mucous membranes body fluids pH saliva tears secretions cilia	Phagocytes found in the blood found in the tissues inflammation response macrophage lymph system cell death to seal off the pathogen non-specific	Immune response cellular — performed by a special group of lymphocytes T cells — sensitised in the thymus secrete substances that destroy the antigen attract macrophages and activate phagocytes specific performed by antibodies produced by a type of lymphocyte B cells — made in bone marrow B cells differentiate into: plasma cells that make antibodies memory cells stored in lymph nodes; subsequent exposure to specific antigen changes the memory cells to plasma cells
1st	2nd	3rd

Fig. 6. Alternative terms for the classification of lines of defence (Alford & Hill, 2003).

defence adaptations), as opposed to a specific response involving white blood cells. Each such elaboration of the classification elaborates the structure of the knowledge in which cilia have biological meaning, thereby strengthening the semantic density of the term.

Additional work on the kind of organ cilia are would strengthen semantic density still further. Basically cilia are a kind of organelle found in eukaryotic cells. The lung cilia in question here are motile (undulipodia) as opposed to non-motile (or primary cilia; e.g. cilia functioning as ‘sensory antennae’); and they undulate in a wave motion, as opposed to flagella (e.g. sperm cilia) which deploy whip action for propulsion. This kind of classification ultimately depends on the genetically inherited form of cilia, as opposed to their pathogen response function, and illustrates the critical role that classification criteria play in knowledge structure.

As Fig. 6 indicates, there is more to the body’s defence systems than the biological entities involved, since the entities participate in processes that discourage and destroy pathogens. One such process is inflammation, which in the Biology class dealing with cilia above was consolidated in board notes as follows:

Inflammatory Response

Fever helps reduce the reproduction of pathogen cells in localised areas. There is increased blood flow to the infected area due to VASO-DILATION (widening of capillaries). This means more phagocytes and macrophages can quickly travel to the infection site.

Vasodilation is positioned as the first stage of inflammation in Fig. 7 below, and involves blood vessels increasing their diameter and permeability; this allows phagocytes (both neutrophils and macrophages²) to squeeze through blood vessel walls to engulf and destroy pathogens. What is important here is the nature of the technical terms arising from these implication sequences, which refer not to entities but to processes (e.g. *inflammatory response*, *reproduction of pathogen cells*, *blood flow*, *vasodilation*, *inflammation*, *phagocyte migration*, *tissue repair* in the board notes and Fig. 7). This brings us to the essential role played by grammatical metaphor in construing the uncommon sense knowledge structure of all academic disciplines, and the critical role played by the recontextualisation of these disciplines in secondary school as resources for students to begin their apprenticeship into the language that enables these specialised fields of inquiry (Martin, 1993a, 1993b, 2007).

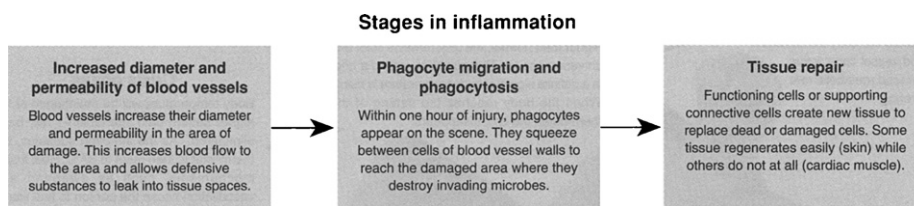


Fig. 7. Stages of inflammation (Allen, 2003: 119).

As noted above, grammatical metaphor affects the coding relation between semantics and grammar; nominals like *inflammation* for example don’t encode entities – the people, places and things they regularly encode before a language invents or borrows a writing system (or before puberty and in casual conversation). Rather they symbolise semantic figures involving both entities and the actions engaging them. *Vasodilation* for example encodes the semantic figure ‘(blood) vessels dilate’ as a nominal group rather than a clause; similarly *phagocyte migration* grammatically encodes the semantic figure ‘phagocytes migrate’ as if it was an entity. In secondary school we are expected to learn to understand that *phagocyte migration* is a grammatical ‘thing’ encoding a semantic figure. In a sense we are expected to learn to unpack the nominal as involving two layers of meaning, one symbolising the other – as exemplified below using unpackings found in the Biology lessons and textbooks we considered.

nominal grammar

vasodilation
phagocyte migration
tissue repair
increased blood flow

semantic figure (entity + action)

blood vessels increase their diameter
phagocytes appear on the scene
functioning cells create new tissue
blood flows more voluminously

It may be helpful to represent the difference between congruent encodings of figures as clauses involving a process, participant and circumstance with metaphorical encodings of figures as a participant or circumstance in a diagram such as Fig. 8. In technical terms grammatical metaphors involve stratal tension (i.e. a coding mismatch between levels of language), since figures do not map congruently onto clauses.

² The board notes are misleading in this respect, since neutrophils and macrophages are in fact sub-types of phagocyte (a classification diagram of some kind might have discouraged this confusion); the graphology (upper case letter and inserted hyphen) focuses attention on the term *vasodilation* and its etymology (literally ‘vessel widening’).

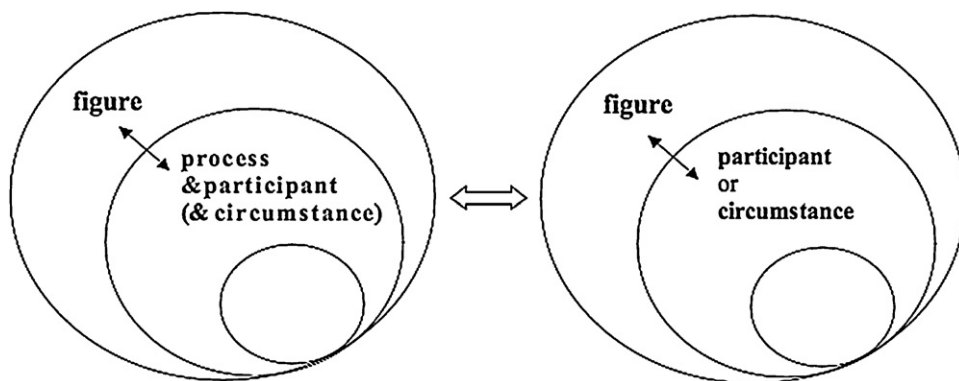


Fig. 8. Congruent and grammatically metaphorical relations between figures and grammar.

Reconfigurations of figures as participants or circumstances allow for a further degree of stratal tension where semantic sequences are realised within rather than between clauses. The board notes introduced above provide a clear example of this when they sum up the effect of vasodilation on blood flow: *There is increased blood flow to the infected area due to VASODILATION (widening of capillaries)*. Here, there are two semantic figures: 'blood flows more voluminosly' and 'capillaries widen', both realised nominally as participants. But they are realised as a single clause involving a participant (*increased blood flow*) and a circumstance (*due to vasodilation*). Note that causal relation between the semantic figures is coded as a preposition (*due to*), not as a causal conjunction between clauses. The relation between figures can also be realised grammatically as a process (*increased blood flow leads to vasodilation*) or a participant (*increased blood flow is the cause of vasodilation*); this kind of stratal tension is outlined in Fig. 9.

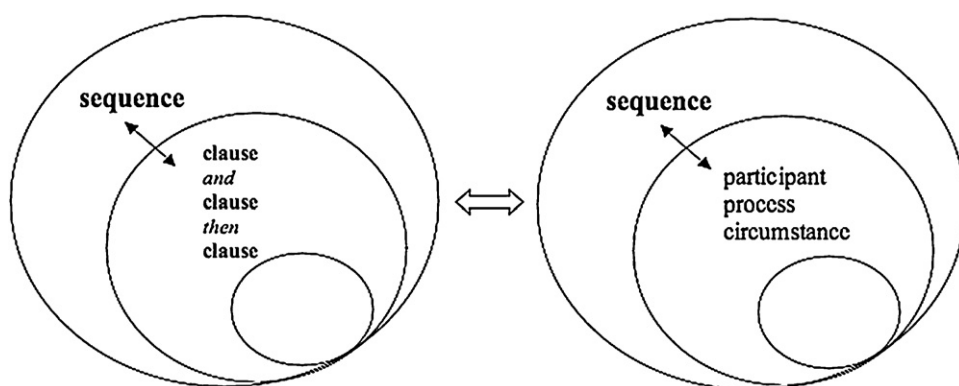


Fig. 9. Congruent and grammatically metaphorical relations between sequences and grammar.

In SFL the coding of a figure as a participant (or as the nominal group in a circumstance) is referred to as experiential metaphor; the coding of sequences as clauses (with the conjunctive relation connecting figures realised as a participant, process or circumstance) is referred to as logical metaphor. Taken together the two sub-types are referred to as ideational metaphor (Halliday, 1998; Halliday & Martin, 1993; Simon-Vandenberg et al., 2003).

As we can see, grammatical metaphor is essential for both defining technical processes (*vasodilation is the process whereby blood vessel increase their diameter and permeability*) and explaining them (*vasodilation causes increased blood flow*), and thereby strengthens the semantic density of any terms involved. It would be impossible to produce scientific knowledge without grammatical metaphor. And it is thus impossible to learn science without being able process the stratal tension when reading and hearing, and impossible to be successful in assessment processes without being able to write it. The semantic density of science depends on grammatical metaphor, and apprentices depend on secondary schooling to access the code. In our work with secondary school teachers we highlight knowledge construing power of grammatical metaphor by referring to it as **power grammar**.

4. History

History, like Biology (and all academic discourse) deploys both power words and power grammar to construe knowledge. As far as composition is concerned, History is comparably technical in its division of the past into periods and cultures into

societies. Examples of historical periods include New Kingdom Egypt to the death of Thutmose IV, The Greek world 446–399BC, Rome: The Augustan Age 44BC–AD14; examples of ancient societies include Society in Old Kingdom Egypt, Persian Society at the time of Darius and Xerxes, Mycenaean society. Archaeological sites, including buildings, are also carefully decomposed – often with precise maps and architectural diagrams in support.

Turning to classification, it is important first of all in History to distinguish between specialised and technical terms (White, 1998). The specialised terms refer to concrete material objects from another time and place, objects that can be illustrated and described – for example *garum*, *inn*, *tavern*, *peddler*. Romans living in Pompeii would have learned the meaning of these terms ostensibly, by experiencing them in everyday life; but this life is of course well beyond the experience of contemporary students and has to be introduced to them. *Garum* for instance was a type of fermented fish sauce condiment that was an essential flavour in Ancient Roman cooking; it was prepared from the intestines of small fishes, macerated in salt and cured in the sun for one to three months, where the mixture fermented and liquified in the dry warmth, the salt inhibiting the common agents of decay. Because of the many containers found in the ruins of Pompeii, and its role as a key item of trade, it is often mentioned in accounts of the explosion of Mount Vesuvius in AD79. In general specialised terms like *garum* tend not to be composed and decomposed, or classified and subclassified, as thoroughly or tightly as power words in Biology. We do not for example learn precisely how *garum* fits into an exhaustive account of the diet in Pompeii or read an ingredient list for recipes in which it plays its part; the focus on *garum* is simply due to the abundance of evidence (e.g. artifacts, frescoes, written records) reflecting its significance in the economy of another place in another time.

Alongside these specialised terms, History also makes use of a number of technical terms – terms like *trade*, *economy*, *society* and *culture*. These terms do not refer to concrete entities and so cannot be learned ostensibly; they have to be construed through language. These power words are also less thoroughly composed and decomposed, and less clearly classified and subclassified, than those in Biology. Depending on the unit of work, textbook or exam to hand, *society* seems to cover some or all of economy, culture, social structure, politics, religion and possibly other things as well. Similarly *economy* variably covers trade, commerce, industry, agriculture, etc. – depending on support provided or not by primary sources and the significance of some particular aspect of the economy in explaining historical processes. From the perspective of science we might characterise these relatively loosely composed and classified technical terms as a kind of ‘flexi-tech’, whose weak classification allows them to be applied to a range of different historical societies and periods.³

To exemplify this point, we return here to an example discussed by Maton (this issue), where a History teacher is explaining the influence of Greek and Egyptian culture on life in Pompeii:

[Text 1]

- T This is a little bit hard, H. THE INFLUENCE OF GREEK AND EGYPTIAN CULTURES. What does that mean. What would the influence of Greek and Egyptian cultures mean, okay? No idea, right. What it means is, if we started to, look at all the things in Pompeii and Herculaneum, what objects may be showing Greek design? Or Egyptian design? Or Greek mythology? Or Egyptian mythology? Or what building techniques, like columns? Are there Greek columns? Do, you know, are the themes of their artwork reflecting it? So, it's saying . . . remember when we started, we said that Pompeii had originally been settled by Greeks? Okay? . . . It looks hard, but all you've gotta do is have a look and think what things are there. Let me give you a big clue some of them are massive. Laah-la-lah-la- la-la-la-la-lahh, la-lah
- S Theatres
- S La-lahh
- T Theatres. Okay theatres are a Greek design. The Greeks invented the theatre, and then the Romans take the idea because they like it too. So, some of them are very obvious.

In this lesson culture seems to refer to design (e.g. theatres), mythology, building techniques (e.g. columns) and artwork (e.g. themes). Culture is the more abstract term, apparently condensing design, mythology, architecture and art, with theatres, building columns and fresco themes as evidence of imported design, architecture and artwork respectively. Fairly abstract relations of composition and classification are at play here, a rough sketch of which is provided as Fig. 10.

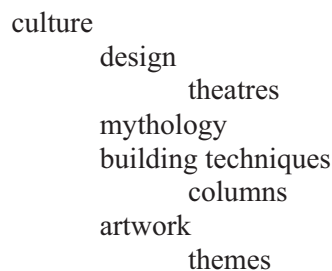


Fig. 10. Knowledge structure relations in text 1.

³ For discussion of weakly classified –ism terms in Modern History see Martin, Maton, and Matruglio (2010).

Similarly in text 2 the flexi-tech term *trade* is sub-classified as involving commercial trade and aesthetic trade (glossed as ‘trade in ideas’); and aesthetic trade is exemplified in terms of people visiting and diplomats going back and forth. But we can’t be sure how exhaustive or precise an account of trade this is meant to be (cf. Fig. 11).

[Text 2]

- T So, there would be massive amounts of trade going on, and umm, you know people visiting their diplomats you know or their, their, ambassa... like their envoys and things like that all going back and forth across the countries. Sooo, ideas. When you get trade in ideas – you wouldn’t have heard this word before – we call it ‘aesthetic trade’. Have you heard of it? Yeah
- S You told us before
- T Ohh! Told you before great, *excellent!* You remember aesthetic trade! ‘Trade in ideas’. So, of course, when you’ve got contact with the country you’re gonna get the trade in ideas coming as well.

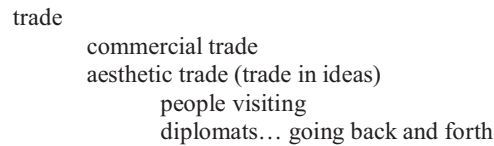


Fig. 11. Knowledge structure relations in text 2.

There is in fact more technicality to History than we recognised in our early work (Eggins, Martin, & Wignell, 1993); as Martin et al. (2010) point out Modern History deploys a range of terms canonically ending in –ism and involving axiological condensation from the perspective of LCT.

capitalism
 communism (Marxism)
 socialism
 democracy
 despotism (oligarchy, autocracy, monarchy, fascism)
 imperialism (colonialism)
 nationalism
 internationalism
 militarism
 racism
 ...

Often these –isms will be precisely defined (from Dennett & Dixon, 2003):

Capitalism is as economic and social system under which most of the means of production are controlled by private individuals or companies. [195]

Imperialism is the rule of one country or a group of countries by another, more powerful, country. [475]

Nationalism is a fierce loyalty to your country above all others. [196]

Some of these terms may be organised in relations of complementarity to one another (e.g. *capitalism & socialism, autocracy & democracy, imperialism & nationalism*). Beyond such complementarities, compositional and classificatory relations among –isms in History discourse are not well developed. The –isms also arguably qualify as flexi-tech in the sense that their definitions are loose enough that they can be applied to a wide range of situations (e.g. the Cold War, Indo-China, Palestine). Indeed, the meaning of some of these terms may be ideologically contested, as when historians argue about whether a country’s government is truly democratic, or politicians and the media oppose communism to democracy or freedom to socialism – as if the terms opposed deployed were of the same conceptual order. A student jokes about axiological loading of this kind in text 3, positioning communism as ‘un-Christian’ for humorous effect:

[Text 3]

- T (teacher lets out a big breath) Where are we? David you’re sitting there by yourself; you can tell us about communism. OK.
- S (David) Don’t make me do that. That’s against my Christian beliefs.
- Ss (laugh)

This reminds us that while the semantic density of a term may involve formal definitions as reviewed above, a term can also be loaded with feelings, political sensibilities, taste, values, morals, affiliations, and so forth (Maton, this issue).

Turning from power words to power grammar, History discourse is if anything more grammatically metaphorical than science. Semantic figures such as ‘Mt Vesuvius erupting’, ‘Fiorelli excavating Pompei’ or ‘Pliny the Elder dying’ are highly likely to be written and read as *the eruption of Mt Vesuvius, Fiorelli’s excavations* or *Pliny the Elder’s death*. And writing by senior students regularly codes semantic sequences as clauses, by way of explaining the past for assessment purposes. Here’s an example with power grammar deployed to realise a causal relation between figures as a circumstance inside a clause (for this logical metaphor, the circumstance is underlined, its causal preposition is in italics, and nominal figures involving experiential metaphor are in bold):

Andrew Wallace states that while Pompeii is one of the most studied of the world’s archaeological sties, it is perhaps the least understood, due to past**neglect, damage,** and a **failure to document carefully if at all**.

The next example uses a process (*italics below*) to encode a sequential relation between figures:

The revolution at Pompeii in regards to archaeological methods *began* with Fiorelli's stage of occupation in the 19th century.

And the following example realises temporal (*eventual*) and causal (*allowed for*) relations among figures inside the clause:

...Fiorelli's stage of occupation *allowed for* greater documentation, more archaeological artifacts left in site and the breakthrough process of injecting liquid plaster into the body-shaped cavities made by solidified ash and the *eventual* decomposition of bodies.

Realising cause in the clause in History (*Achugar & Schleppegrell, 2005*) not only allows for a precise nominal formulations of potentially complex causes (e.g. *past neglect, damage, and a failure to document carefully if at all above*) and effects (e.g. *greater documentation, more archaeological artifacts left in site and the breakthrough process of injecting liquid plaster into the body-shaped cavities made by solidified ash and the eventual decomposition of bodies above*), but also makes available resources for fine tuning the causal impact of one figure on another that are not available in congruent spoken discourse. Consider for example the range of processes that a student might use to relate the study of art and architecture to modern knowledge of Pompei's social structure below:

Study of art and architecture have also **influenced** modern knowledge of Pompei's social structure.

Study of art and architecture have also (**significantly**) **affected** modern knowledge of Pompei's social structure.

Study of art and architecture have also **conditioned (the nature of)** modern knowledge of Pompei's social structure.

Study of art and architecture have also (**helped**) **shape** modern knowledge of Pompei's social structure.

Study of art and architecture have also **impacted (heavily)** on modern knowledge of Pompei's social structure.

Appropriately nuanced causality is an important part any historian's toolkit as far as interpreting the past is concerned, and an invaluable resource in an apprentice historian's repertoire (*Coffin, 2006; Martin, 2002b; Veel & Coffin, 1996*).

5. Power composition

Crucial as power words and power grammar are to the construal of knowledge in Biology and History, knowledge is ultimately packaged as texts which store the descriptions and explanations constituting the field (*Martin, 2002a*). Each discipline draws distinctively on a range of genres for this purpose. One of History's genres (*Coffin, 2006; Martin & Rose, 2008*), the factorial explanation, is exemplified as text 4 below (based on the textbook explanation reproduced as Appendix A (*Lawless, Cameron, & Young, 2008: 273–274*)). Factorial explanations compile the factors resulting in a particular outcome, and as such are a favoured genre for assessment purposes (e.g. *What were the causes of WWI?, Explain the reasons for the success of the Long March?* and so on).

[Text 4]

Outcome

While Pompeii is one of the most studied of the world's archaeological sites, it has been plagued with serious conservation problems, including poor restoration work, damage from vegetation, pressure from tourism and poor site management.

Factor 1

Much of the restoration work on Pompeii has been done by local firms with no specialised knowledge of restoration techniques. For example the timber roof on the House of Maeger was so poorly designed it could not support the weight of the tiles and collapsed. Poor quality mortar has also been used to protect ancient stonework. Over time this mortar has cracked, allowing water and vegetation to penetrate.

Factor 2

A second problem is the incursion of uncontrolled weeds which have hastened the decay of the ruins. Over 30 different varieties have been identified, including ivy, fennel and fig. As the roots grow they open up further cracks, allowing even more weeds in.

Factor 3

Pompeii's position as an international tourist attraction brings half a million visitors each year. No special walkways for viewing platforms have been constructed, so tourists walk along ancient paths and enter buildings that are not roped off. In some places ancient lead water pipes have been exposed.

Factor 4

Finally, there seems to be no overall management plan for the site. Damaged paths and walls have not been repaired, frescoes have not been preserved, and mangy dogs roam the site. Available finance has been poorly managed and no proper conservation and interpretation program has been put in place.

Wrap up

As a result of these factors, the description of Pompeii as a victim of state neglect and indifference and an archaeological catastrophe of the first order is an apt one. It's ongoing destruction since its discovery in the 1590s has arguably resulted in a greater disaster than it's initial destruction by the eruption of Mt Vesuvius one and a half millennia earlier.

Reading and writing in secondary school depends on gaining control of the relevant genres, and this means that consciously, or next to consciously, students have to master their structure – Outcome, followed by Factors, with an optional Wrap-up in the case of factorial explanations. In addition they have to master **power composition** in order to successfully scaffold the organisation of these genres for examiners, and phase their power words and power grammar into predictable waves of information. Power composition basically means organising writing as a rhetorical sandwich⁴ in

⁴ In American composition teaching this rhetoric is informally referred to as 'hamburger writing' as a search for this phrase on a web browser will show.

which you tell readers what you are going to write, write it and then tell them what you've written. In SFL this compositional rhetoric is referred to as periodicity (e.g. Martin & Rose, 2003/2007), and theorised as waves of information reflecting the Theme and New organisation of clauses at higher levels of text organisation. Basically higher level 'Themes' predict what is going to come in a text, and higher level 'News' consolidate what has already been developed. In Text 4 for example the opening paragraph introduces the factors that will be explored in the explanation (i.e. poor restoration work, damage from vegetation, pressure from tourism and poor site management) – its Macro-Theme. Then the first sentence of each Factor further specifies the problem to be explored – Hyper-Themes (or Topic sentences in traditional composition terms). The explanation concludes with a Macro-New, summing up and further interpreting the significance of what has been explored. Text 4 has been re-formatted below to highlight its display of power composition; an overview of periodicity in relation to scaffolding genre and building field is outlined in Fig. 12 (where indentation shows the move from a higher level macro-Theme or hyper-Theme to the information it predicts; the final paragraph is macro-New).

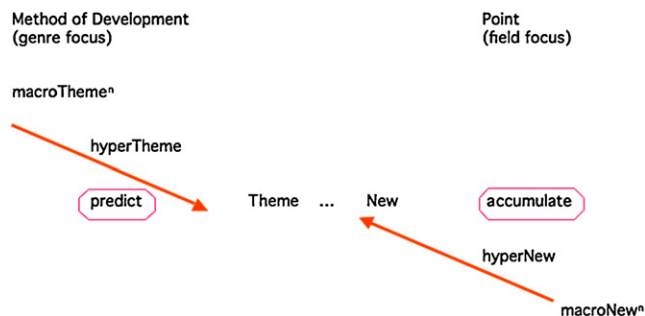


Fig. 12. Hierarchy of periodicity (power composition).

While Pompeii is one of the most studied of the world's archaeological sites, it has been plagued with serious conservation problems, including poor restoration work, damage from vegetation, pressure from tourism and poor site management.

Much of the restoration work on Pompeii has been done by local firms with no specialised knowledge of restoration techniques.

For example the timber roof on the House of Maeger was so poorly designed it could not support the weight of the tiles and collapsed. Poor quality mortar has also been used to protect ancient stonework. Over time this mortar has cracked, allowing water and vegetation to penetrate.

A second problem is the incursion of uncontrolled weeds which have hastened the decay of the ruins.

Over 30 different varieties have been identified, including ivy, fennel and fig. As the roots grow they open up further cracks, allowing even more weeds in.

Pompeii's position as an international tourist attraction brings half a million visitors each year.

No special walkways for viewing platforms have been constructed, so tourists walk along ancient paths and enter buildings that are not roped off. In some places ancient lead water pipes have been exposed.

Finally, there seems to be no overall management plan for the site.

Damaged paths and walls have not been repaired, frescoes have not been preserved, and mangy dogs roam the site. Available finance has been poorly managed and no proper conservation and interpretation program has been put in place.

As a result of these factors, the description of Pompeii as a victim of state neglect and indifference and an archaeological catastrophe of the first order is an apt one. It's ongoing destruction since its discovery in the 1590s has arguably resulted in a greater disaster than it's initial destruction by the eruption of Mt Vesuvius one and a half millennia earlier.

Power composition interacts with power words and power grammar in significant ways. From the perspective of LCT it organises writing as a series of semantic waves, with semantic density peaking in higher level Macro-Themes and Macro-News; paragraph level Hyper-Themes and Hyper-News scale technicality and abstraction down to a level where it can be specified in lower semantic density discourse (the filling of the rhetorical sandwich). This makes it possible for academic writing to sound both critical and objective, with semantically dense interpretations firmly grounded in evidence.

In Text 4 for example, the predictive power of the Macro-Theme depends on power grammar as parts of the nominal group complex *poor restoration work, damage from vegetation, pressure from tourism and poor site management* are picked up in Hyper-Themes (*much of the restoration work, the incursion of uncontrolled weeds, an international tourist attraction, no overall management plan*). The power grammar enables the strength of semantic density required for one part of the text to predict another. It follows that without power grammar students will not be able to compose the waves of information that tell readers where a text is going and where it has been, and equally seriously may not be able to recognise this scaffolding of information in the reading on which so much of their learning depends.

Power words also interact with power composition, once again with stronger semantic density associated with higher level Theme and New. This association is exemplified for text 4 below, with specialised and technical terms highlighted in bold.

While **Pompeii** is one of the most studied of the world's **archaeological sites**, it has been plagued with serious **conservation** problems, including poor **restoration work**, damage from vegetation, pressure from **tourism** and poor **site management**.

Much of the **restoration work** on **Pompeii** has been done by local firms with no specialised knowledge of **restoration techniques**.

For example the timber roof on the **House of Maeger** was so poorly designed it could not support the weight of the tiles and collapsed. Poor quality mortar has also been used to protect ancient stonework. Over time this mortar has cracked, allowing water and vegetation to penetrate.

A second problem is the incursion of uncontrolled weeds which have hastened the decay of the **ruins**.

Over 30 different varieties have been identified, including ivy, fennel and fig. As the roots grow they open up further cracks, allowing even more weeds in.

Pompeii's position as an **international tourist attraction** brings half a million visitors each year.

No special walkways for viewing platforms have been constructed, so tourists walk along ancient paths and enter buildings that are not roped off. In some places ancient lead water pipes have been exposed.

Finally, there seems to be no overall **management plan** for the **site**.

Damaged paths and walls have not been repaired, **frescoes** have not been preserved, and mangy dogs roam the site. Available **finance** has been poorly managed and no proper **conservation and interpretation program** has been put in place.

As a result of these factors, the description of **Pompeii** as a victim of **state** neglect and indifference and an **archaeological** catastrophe of the first order is an apt one. It's ongoing destruction since its **discovery in the 1590s** has arguably resulted in a greater disaster than it's initial destruction by the **eruption of Mt Vesuvius one and a half millennia** earlier.

As we can see from the concentration of power words and power grammar in higher level Themes in text 4, the text does more predicting than consolidating – there is a Macro-New, but none of the Factors pull things together with a Hyper-New. This kind of front-loaded writing generally involves editing alongside writing to a plan. A more exploratory style might lighten up the power words and power grammar in the Macro-Theme, and replace the Hyper-Themes with Hyper-News. This style is equally powerful, and might be more suitable for writing under exam conditions, where little time for planning and scope for editing is available. In general, a text including a higher level Theme or New wherever possible will read as overly composed (and perhaps felt to be repetitive, pedantic, labouring the point and so on); a skewed front-loaded or back-loaded style tends to be preferred.

6. Let's go surfing now . . .

In general the Biology and History units we observed 'begin' with reading students are expected to have done (a textbook, screen text or photocopied handout) and 'end' with writing for assessment purposes. Since students have to learn more than can be covered in class and are evaluated based on their writing, reading and writing are high stakes tasks. Outside our interventions, we observed that reading and writing were not taught; rather it seemed to be assumed that students have acquired the necessary skills in primary school – an absurd assumption given the many unfamiliar genres packaging knowledge in secondary school and the unfamiliar power grammar students have not been expected to read or write before. In our observations, what knowledge building did occur happened in spoken interaction, ideally with teachers unpacking unfamiliar technicality and abstraction and then re-packing it orally and in notes on the board to consolidate it in preparation for writing – strengthening semantic density as the unit unfolds (as imaged in Fig. 13).

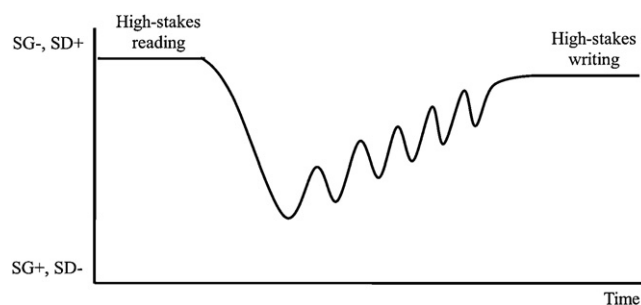


Fig. 13. High-stakes reading and writing in relation to knowledge-building.

Most of the time however, as Maton (this issue) highlights, teachers did not re-pack. Power words, and occasionally power grammar, were unpacked in common sense terms, as if everyday translations of Biology and History were all that was required for accumulating knowledge. In a sense, students were continually stranded in common sense, with lessons progressing by skipping from one fragment of knowledge to another instead of by building knowledge. A crude map of this process (deconstruction without reconstruction one might say) is presented in Fig. 14.

The dearth of repacking has serious consequences. It means that knowledge remains fragmented, with lessons keying on power words and skipping from one power word to another without mapping the composition and classification relations that relate power words to one another. It means that beyond their reading (if they in fact bother with it) students are not presented with additional models, spoken or written, of the consolidated knowledge they will need to produce for assessment purposes. It means that the issue of power grammar is not directly addressed, since stratal tension is not explicitly explored;

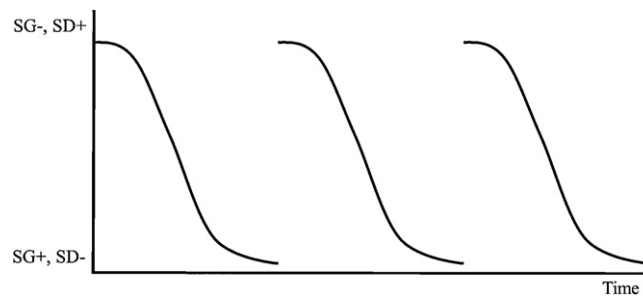


Fig. 14. Iterative unpacking in Biology and History lessons (without re-packing).

students have to learn from the occasional paraphrase what it means to realise figures as participants and causal relations inside a clause. And it means that power composition, which is more a feature of written than spoken discourse, is not considered, since teachers talk but never model writing for their class. All this, in conjunction with the fact that reading and writing are not taught, results in a highly stratified set of outcomes, since only students from the right background are positioned to learn by osmosis what has to be learned but is never made explicit.

In schools oriented to building semiotic resources in and across disciplines, students would be taught to read the power words, power grammar and power composition in the unfamiliar genres each discipline uses to package knowledge. In this power pedagogy students would be taught to write the power words, power grammar and power composition they need to compose semantic waves for assessment purposes. This would mean taking time away from the IRF 'guess what's in my head' routines teachers currently negotiate with a small group of three or four abler students and spend more time learning to read and writing to learn (Christie, 2002; Rose & Martin, 2012). The reaction of most secondary classroom teachers to proposals of this kind is that the curriculum is so full that they have no time to teach reading and writing. However, given the incredible inefficiency of most of the oral communication that goes on, stranding most students in common sense over and over again as it does, perhaps it is time for a re-appraisal of what matters as far as knowledge building is concerned. Accumulating disciplinary knowledge (Freebody, Maton, & Martin, 2008) is after all something every teacher (excepting of course mother tongue language teachers) can agree on. What seems to be missing is awareness of what knowledge is, how it is organised and how power words, power grammar and power composition privilege writing as the mode of communication where uncommon sense knowledge is stored. Spoken language has a role to play, and its role has been carefully designed in the genre-based reading and writing programs of the Sydney School (Feez & de Silva Joyce, 2012; Rose & Martin, 2012). But advanced literacy is the key. It's time to reclaim curriculum and pedagogy on behalf of all students, not just a privileged few, and start teaching the written discourse all students need to accumulate the high stakes knowledge secondary and tertiary education was intended to provide.

Appendix A.

The site today

As an archaeological site Pompeii has been described as a ‘victim of state neglect and public indifference’, ‘an archaeological tragedy of the first order’ and a ‘catastrophe’. How could such a significant site have fallen into this disastrous state? There are many reasons.

Poor restoration work

Much of the restoration work on the site has been done by local firms who have no specialised knowledge of restoration techniques. In some places wrong materials and incorrect construction methods have been used. A new timber roof was erected on the House of Meleager but it was poorly designed and could not support the weight of the tiles. It collapsed. Steel reinforcing beams have been used in contact with concrete. Where the concrete has flaked away and exposed the beams, the steel has rusted and expanded, causing more damage.

Poor quality mortar has been used to protect ancient stonework. Over time, this mortar has cracked, allowing water and vegetation to penetrate, contributing to further destruction. Attempts to re-attach ancient painted plaster to the walls have been unsuccessful. This process requires the replacement of ancient mortar behind the plaster with modern mortar. A reaction takes place between the two materials which causes cracks to form. Whole walls of plaster have been destroyed using this process of ‘restoration’.

Damage from vegetation

Weeds have invaded the ruins and are hastening their decay. Over 30 different varieties have been identified, including ivy, fennel, fig, valerian and a number of brambles. They take root in bare patches of earth, on the tops of walls, in cracks in the ruins and gaps in mosaic floors. As the roots grow they open up further cracks.

Vines and brambles attach themselves to walls, penetrating plaster surfaces. It has been estimated that thousands of square metres of floor surfaces, including mosaics, have been destroyed by the invading weeds.

Pressure from tourism

Pompeii is an international tourist attraction with over half a million visitors to the site each year, and more than 20 000 on Italian public holidays. No special walkways or viewing platforms have been constructed so tourists walk along ancient roads and footpaths. Any that are not paved with stone have been worn down. Along the Via dell’Abondanza the footpath has been worn down to the same level as the road. Footpaths were edged with volcanic tufa or limestone, relatively soft stones which are chipped and worn down by constant use. In ancient times they would have

Lead water pipes exposed where the surface of the footpath has been worn away



been replaced, but this is not happening today. In some places ancient lead water pipes laid under paths have been exposed and damaged.

Deliberate damage by tourists

Because the site is so poorly managed there are many opportunities for vandalism. In 1986, Henri de Sain-Blanquat described a group of tourists pushing over stone columns in the atrium of a house which was not open to the public. David Mellor, who visited the site in 1993, described extensive modern graffiti and a tourist banging her fist against a painted plaster wall. Mosaic tiles, pieces of painted plaster, fragments of pottery or marble are picked up and pocketed by tourists. Even copies of antique objects placed in the position of the originals have been stolen.

Poor site management

There seems to be no overall management plan for the site, instead there is an atmosphere of indifference and neglect. Damage from the 1980 earthquake has not been repaired, some painted plaster walls are not cordoned off, and whole areas of the site are unsupervised. A recent visitor found the Building of Eumachia in the

forum occupied by many dogs who terrorised tourists. Such inadequate supervision over the years has encouraged theft and vandalism.

Another major shortcoming of the site's management is the lack of educational information. Proper signs and explanations would encourage more interest and respect and help sensitise tourists to the great significance of this fascinating site and what it can tell us about the people who lived there almost 2000 years ago.

Lack of finance is usually given as the reason for poor site management, but in this case it is only part of the problem. In 1984 the European Community gave 36 billion lire for the restoration of Pompeii and at the same time admission charges were increased. Corporate sponsorship was gained for particular projects associated with the site, such as the NEAPOLIS project sponsored by IBM Italia and Fiat Engineering. This project is a vast database of all known archaeological remains and archival documents relating to Pompeii. There is great interest in the site from Italian and international bodies. What seems to be lacking is the establishment of an authority with the ability to coordinate and implement an effective management plan for the site now, before any more damage is done.

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