Chapter 3
Analysing Academic Texts

Chapter Overview
This chapter introduces a theoretical framework and metalanguage that researchers and teachers can use for analysing how language is used in academic contexts, in particular the variation of language according to different subject domains and the recurrent genres in these domains. The special features of genres specific to different academic subjects will be examined and how text analysis can be conducted by teachers and researchers to inform teaching will also be discussed.

3.1 A Functional View of Language

Academic language can be analysed using different linguistic theories. For instance, traditional school grammar books which draw on a structuralist linguistic theory usually teach sentence grammatical structures such as the 'passive voice', and the passive voice is said to be a feature of academic language (e.g. science laboratory reports). However, we do not get a lot of mileage if we analyse academic texts only focusing on linguistic structures without seeing these structural patterns as resources for achieving communicative purposes. A functional view of language will enable us to both ask and answer questions such as Why is the passive voice used frequently in academic genres such as laboratory reports or academic theses? What communicative function(s) does this linguistic structure realize in these types of texts? Can the function(s) be realized or achieved by using other kinds of linguistic structures? Are there disciplinary variations in these patterns? Are there some functions which are more important in science than in History, for instance? Is a similar function realized by different linguistic features in different subjects at different levels (and in different languages and cultures)? Furthermore, how can language teachers and

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different content subject teachers develop metalinguistic awareness about these questions and help their students identify and appreciate linguistic and functional variations across subject domains (and across different languages such as L1 and L2) so that they can make useful connections and comparisons of different academic language styles across different subjects (and languages)?

The approach to linguistic analysis of academic texts adopted in this chapter draws mainly on the seminal work by Michael Halliday, Raquia Hassan, Clare Painter, Jim Martin and David Rose in systemic functional linguistics (SFL) and the Sydney School of genre analysis and genre-based pedagogy. However, other linguistic and genre theories will also be drawn upon when they are relevant to the topic in focus. The difficulty created by the technical terminology of SFL will also be mitigated by drawing on some of the traditional pedagogical grammar terminology that most teachers and students are familiar with.

A functional approach to language analysis 'looks at how language enables us to do things in our daily lives' (Derewianka 2011, p. 3) or how we mobilize language as a resource to understand and construct (or 'construe'—i.e. construct using semiotic resources) the world around us, our social relationships, as well as our texts in both spoken and written modes.

A succinct summary of the SFL assumptions about language is presented by Derewianka (2011):

- Language is a dynamic, complex system of resources for making meaning.
- Language reflects the culture in which it has evolved. It is not a neutral medium, but expresses certain world views, values, beliefs and attitudes.
- Our language choices change from situation to situation, depending on the social purpose for which language is being used, the subject matter, who is involved and whether the language is spoken or written.
- The emphasis in language study is on how people use authentic language in various contexts in real life to achieve their purposes… [e.g.] on the language needed for successful participation in school contexts.
- A knowledge of grammar can help us to critically evaluate our own texts and those of others (e.g. identifying point of view; examining how language can be manipulated to achieve certain effects and position the reader in different ways; knowing how language can be used to construct various identities or a particular way of viewing the world) (Derewianka 2011, p. 3; words in square brackets added).

We can add to the above list the importance of multimodal and new media texts as increasingly we are immersed in not just spoken/written linguistic texts but also linguistic texts that are 'meshed with' visuals, (moving) images, hyperlinks [to other texts/images, music and sounds—in short, multimodalities (see Kress and van Leeuwen 2006)]. Also, language use in both primary/secondary and tertiary academic contexts will be discussed in this book.

3.2 The 'Genre Egg': A Metalanguage for Dissecting the Language Learning Task

A functional view of language focuses on analysing language use in context (i.e. as *text-in-context*) rather than on analysing language as abstract patterns and elements detached from real people using language as a resource to achieve their social purposes in real-life situations. In order to do this, an analytical framework is needed.

Martin (2010) provides a very good visual summary (Fig. 3.1) of the SFL model of how language is structured as hierarchical patterns at different layers (called strata). Linguistic analysis starts at the most macro-stratum of genre (e.g. analysis of the primary social goals of a genre) to the stratum of register (e.g. analysis of how the social goals of the genre interact with and shape the three dimensions—field, tenor and mode—of the register that affects language choices). The analysis then proceeds to the stratum of discourse semantics (e.g. analysis of how a text is schematically structured into stages, phases and messages to achieve its primary social goal) and to the stratum of lexico-grammar (e.g. analysis of how morphemes[1] combine to form words and how words combine to form groups, clauses and sentences) and ultimately to the microstratum of phonology/graphology (e.g. analysis of how phonemes combine to form syllables and tone groups).

In the above linguistic analysis, we do not start with the most microlevel (phonology/graphology) working up to the macro-levels of register and genre. That is, we do not start our linguistic analysis using a bottom-up approach, which is the way in which linguistic students and language teachers in education courses are usually taught (i.e. a bottom-up approach to linguistic analysis of the target language). As Rose (2015) points out, this bottom-up approach needs to be changed in order to help language learners to be able to apply bottom-level linguistic knowledge in authentic contexts of language use (i.e. to connect bottom-level patterns to register and discourse patterns):

> A similar [bottom-up] assumption underlies traditional language pedagogies–namely that by teaching the grammatical structures of classical and modern languages, linguistic analysis skills transfer to other learning tasks. Although grammar is explicitly taught, transference depends on students intuitively applying these skills to register and discourse patterns (Rose 2015, p. 5; words in square brackets added).

Rose (2015) continues to point out that this approach might work for some students, but other students might not benefit from it. In fact, many students might be turned off by the boredom of this bottom-up approach. Or, if they can bear with it to pass the tests and exams, it is very likely that they cannot apply the bottom-level linguistic knowledge (e.g. grammar knowledge) in authentic contexts of language use (i.e. in real-life registers and genres to achieve authentic communicative goals). The Reading to Learn (R2L) genre-based pedagogy (Rose 2010, 2015; Rose and Martin 2012) was developed to recontextualize this bottom-up approach to language analysis by starting from the level of genre and register patterns and helping students to connect these macro-discourse patterns to lexico-grammatical patterns.

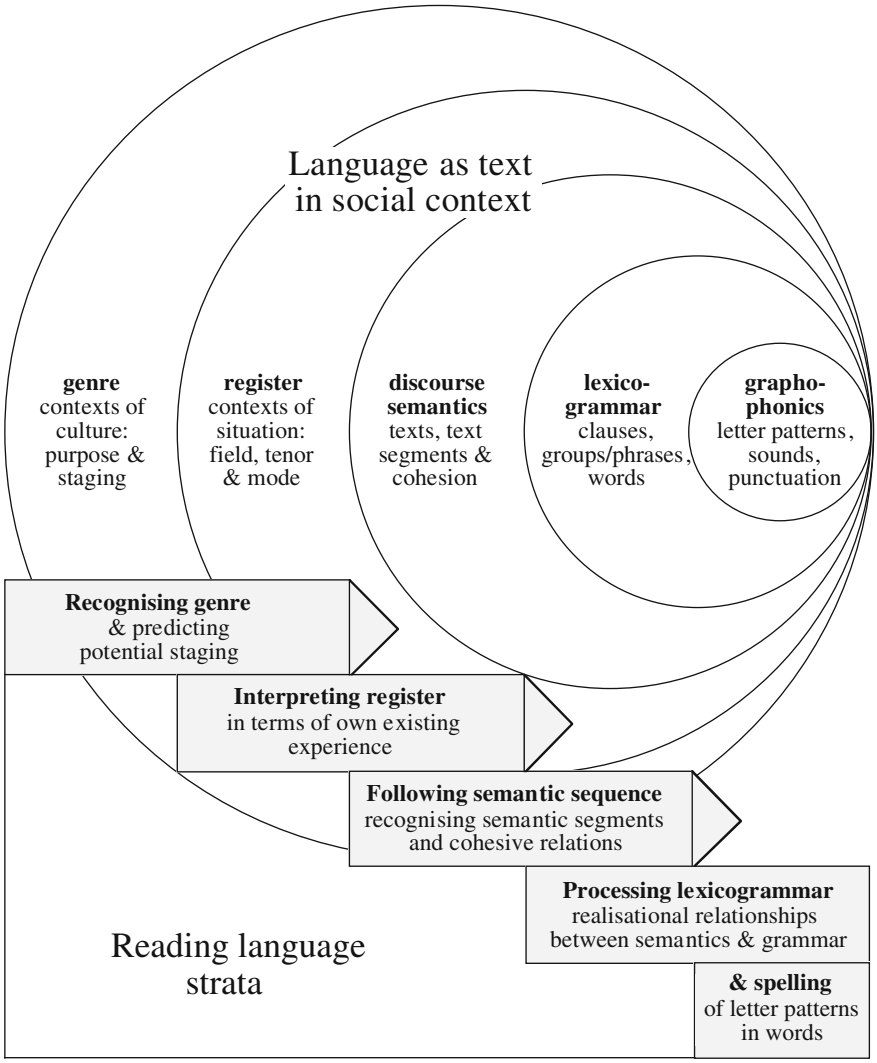


Fig. 3.1 Stratal and rank hierarchies in the linguistic model of SFL (image from Martin 2010, Slide 40; reproduced here by permission of Prof. Jim Martin)

The SFL model of *language strata* and *instantiation of meanings* provides a theoretical framework to understand and design studies on learning, curricular and pedagogical issues. It answers questions such as How is language structured and organized? How are these linguistic patterns hierarchically related? How do they simultaneously instantiate (i.e. exemplify) social meanings in context? From the SFL perspective, every time we produce or comprehend an instance of language, we are at once immersed in two contexts: (i) the context of the multiple levels of

contrasts (or options) in the language system (i.e. *paradigmatic* contrasts: What could go instead of what—choices about *selection*), and (ii) the context of the immediate contrasts in the unfolding text (i.e. *syntagmatic* contrasts: What goes together with what—choices about *combination*). The following family interaction reported in Painter (1993) helps to illustrate this:

> Father: This car can't go as fast as ours.
>
> Child: I thought–I thought all cars could–all cars could go the same–all cars could go the same (pause) fast…
>
> Mother: The same speed.
>
> Child: Yes, same speed.
>
> (Painter 1993, cited in Rose 2012a, p. 3)

In this example, the child is guided through the mother–child interaction in the context of shared experience (both the mother and child are in the car sharing the here-and-now context) to develop mastery of the linguistic contrast between 'fast' and 'speed' within the linguistic system of lexico-grammar (i.e. the contrast between an adjective and a noun). At the same time, the child is also immersed in the shared social context of interaction (i.e. the unfolding conversation text). Prior to the mother's provision of the right word ('speed'), the child seems to be struggling to find the appropriate linguistic item (from his fledging language system) to express his meaning, hence the pause before his coming up with the word 'fast', which has got the semantic meaning right but not the lexico-grammatical contrast (permitted by the language system) right (i.e. it is an adjective instead of a noun). This struggling effort seems to be reflected in his shifting extra conscious attention to finding the right linguistic structure from the linguistic system (of English) in order to instantiate a social meaning that he wants to contribute to the ongoing conversation (that all cars can go the same speed—that the father's statement needs to be corrected or qualified).

L2 learners, likewise, also often have this experience of struggling to find the right linguistic structure or contrast (from their fledging mastery of the L2 system) to instantiate a meaning which is often important in the context of ongoing social interaction. This linguistic struggle is one that many English language learners (ELLs) can resonate with: they feel that they have something important to say in this matter (e.g. in the ongoing academic argument) but only that they cannot find the right linguistic means to do so. In the same vein, 'focus on form/focus on meaning' is the researcher's analytic term to capture these quick moments of shifting extra conscious effort/attention between the *twin* contexts that every speaker, writer or user of language seems to be experiencing all the time (whether it is in one's L1, L2, L3 …). Notice that the mother's linguistic scaffolding (provision of the right linguistic structure) is *just in time* and *just in need* (Gee 2003). In second language acquisition (SLA) theoretical terms, it seems to be a focus-on-form (FonF) technique (Lyster and Ranta 1997) that the mother is using (a recast: 'the same speed') which has resulted in the child's *noticing* and subsequent *uptake* (i.e. using

the correct form 'speed' instead of 'fast') without interrupting the conversation flow. This focus on form would not be perceived by the child as equally helpful if the mother were to give the child a preconversation drill on the conversion between adjectives and nouns (e.g. fast ↔ speed), not to mention the fact that the mother could not have anticipated *all* the specific linguistic needs of the child as they arise moment-to-moment in everyday conversations. Also, chances are that the child will remember this linguistic feature better, and more importantly, how to use it in the appropriate context, as it is provided to him just when he is struggling to put *his* meaning into words (notice that it is *his* meaning and not the mother's meaning). All these will have important implications in our discussion on how to integrate content and language learning in Chap. 7.

How does this linguistic theory help us conceptualize the nature of the language learning task confronting the student? With a series of schematic representations of what I call the 'Genre Egg', Rose illustrates the different aspects of the language learning task based on the notion of *text-in-context*, which is delineated in (Fig. 3.2a–c).

Let us first look at Fig. 3.2a. The diagram conceptualizes the language learning task as one of learning to understand and produce not just a text but a *text-in-context.* That is to say, a text (whether spoken or written) is always a text produced and understood *in context*. The learner's task of understanding a *text-in-context* involves first understanding the primary social goal of the text (genre) and the three dimensions of the context—field, tenor and mode (register):

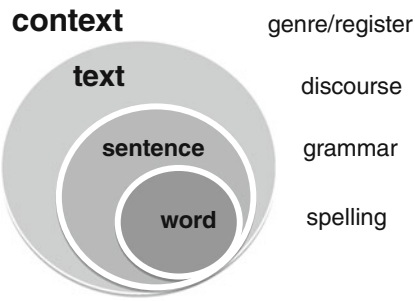
- What it's about—its subject matter (field);
- Who is involved—such as writer and readers, teacher and students, parent and child; and
- The social purpose of the text—what the speakers, writers and readers are trying to achieve (i.e. the social goal of the genre which the text instantiates).

Figure 3.1a shows that the linguistic *text(-in-context)* is crafted out at different linguistic levels: the levels of discourse (text), grammar (sentence) and spelling (word). In other words, the learner needs to simultaneously understand the text's contextual aspects (genre goals and register dimensions) as well as its linguistic aspects (e.g. linguistic choices made at the levels of discourse, grammar and spelling). As Rose (2010) delineates:

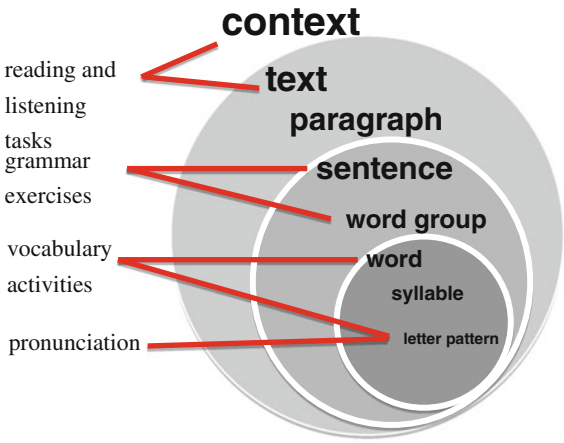
> This model of language as 'text-in-context' is derived from the theory of systemic functional linguistics (SFL). It seems like common sense because SFL is a theory of how people make meaning in language (Halliday 1994; Martin and Rose 2007), so it is very useful for investigating how language works, and how it is learnt, and then for designing effective language teaching strategies. (Rose 2010, p. 8)

So, how does the SFL theoretical framework inform us when we design language teaching and learning strategies? Figure 3.2b, c shows two different ways of approaching the language teaching/learning task: (i) the disintegrating approach and (ii) the integrated approach. In Fig. 3.2b, under the disintegrating approach, the language learning task is disintegrated into separate tasks such as reading and

(a) The language learning task–text-in-context



(b) Disintegrating the language learning task



(c) An integrated approach

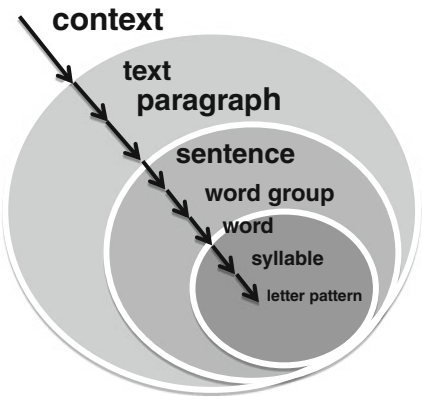


Fig. 3.2 **a–c** Illustrating different conceptualizations of the language learning task (images from Rose 2013, Slide 3, 7 and 8; reproduced here by permission of Dr. David Rose)

listening to texts, grammatical exercises, vocabulary activities and pronunciation practice. These tasks might be done separately and might not need to follow any particular sequence. In contrast, in Fig. 3.2c, under the integrated approach, the language learning task is always approached by reading the text-in-context while at the same time drawing students' attention to the linguistic choices that the author made at different linguistic levels (e.g. paragraph, sentence, word group, word…) to achieve the overall communicative purpose of the *text-in-context*.

To understand the theoretical basis of these two approaches as discussed by Rose, let us revisit in more detail the SFL theory of the stratified organization of language as *text-in-context* and the relation between language systems and instances in texts, i.e. *stratification* and *instantiation*. As mentioned in Sect. 3.1, SFL theorizes language as a hierarchical system of different stratified layers (i.e. strata) of patterns of different combinations of elements, which together instantiate meanings (see Fig. 3.1). Rose (2010) delineates stratification and instantiation as follows:

> Stratification refers to the organisation of language and its social contexts as a hierarchy of levels or strata. The relation between strata is modeled in SFL as *realisation*. Thus patterns of meaning in texts (or discourse semantics) are realised (manifested/symbolized/expressed) by function of words in clauses (lexico-grammar), which are realised by patterns of sounds or letters (phonology or graphology). Looking up the hierarchy to social context, language enacts social relations between speakers (tenor), construes the activities they are involved in (field), and plays various roles in doing so (mode). Collectively, field, tenor and mode are referred to as register … and together realise the global social purpose of a cultural context or genre. …
>
> … Instantiation refers to the relation between features in language systems and instances of meaning in actual texts. Thus each genre and its attendant register variables (field, tenor, mode) is a specific instance of the language system as a whole. Within each genre we can then distinguish more variable sub-types, and each text is recognizable as an instance of one of these types. Instantiation occurs at all language levels, for example, … sequences of phonemes in a word instantiate phonological systems. (Rose 2010, pp. 1 and 3; italics added)

The disintegrating approach (Fig. 3.2b) is one that many of us are familiar with, e.g. the Chinese practice of teaching children to write by starting with tracing the pattern of the strokes to form a Chinese character. The phonics approach is also an example of explicit teaching of bottom-level linguistic (e.g. phonological, graphological) patterns by helping students to form letter–sound relationships early on so that they can have the skills to decode or 'sound out' new words. The disintegrating or bottom-up approaches are criticized by top-down approaches such as the whole language approach (Goodman 2005) which emphasizes literacy learning in holistic meaningful contexts and de-emphasizes explicit teaching of bottom-up patterns and skills. In L2 learning, the top-down approach is manifested

as the communicative language teaching (CLT) approach (Littlewood 1981). Migrant children, linguistic minorities and L2 learners (e.g. EAL learners), however, might need to be explicitly taught some of the bottom-level skills as they often do not have enough naturalistic experience with the L2 to infer these patterns/relationships themselves without explicit teaching. How to resolve the tension between bottom-up approaches (often criticized as decontextualized) and top-down approaches (often criticized as neglecting the development of basic language skills) remains a key question in the literature (e.g. No *Phonics* against *Whole Language*). Rose (2010) summarizes this situation well:

> Different approaches to literacy try to handle the complexity of learning to read and write in different ways, depending on the particular theory of language they come from.
>
> - Phonics, phonemic awareness and basal reading book programs start at the bottom, with sounds and letter patterns, then words, then phrases, then sentences.
> - 'Sight word' approaches and spelling lists focus on recognizing words and their letter patterns.
> - Grammar activities in school and ESL programs focus on rules for word groups and sentences.
> - Traditional composition writing focused on sentences in paragraphs.
> - Whole language and critical literacy approaches focus at the top, on what the text is about. This also includes shared big book reading in the early years.
> - Genre writing (text types) starts with the context, then focuses on the staging of texts, as well as various language features.
>
> Most teachers use a 'balanced approach' that addresses the various parts of reading and writing tasks with a combination of strategies. However, each activity may be done in a separate part of the day's program, using different texts, sentences, words and letter patterns. For children with rich experience of reading in the home, each of these activities is meaningful, so they can put them together and develop as readers and writers. But children without such experience often struggle to understand and synthesize all these activities, and so develop more slowly. (Rose 2010, p. 11)

Up to now, the reader might think that the integrated approach is similar to the top-down approach. However, Rose's notion of the *integrated* approach is actually very different from the top-down approach. To Rose, the top-down approach errs in not providing enough scaffolding to the learner in acquiring the bottom strata patterns. To Rose, in the extreme form of top-down approaches,

> all explicit teaching of language features was rejected from both the classroom and teacher training, leading to generations of students and teachers without the rudimentary knowledge of language afforded by traditional school grammars (2012a, p. 4)

Rose's integrative approach refers to the Sydney School genre-based pedagogy, which seeks to integrate both bottom-up and top-down approaches by proposing a *teaching/learning cycle (TLC)*; as Rose (2012a) explains:

> …[genre] pedagogy begins not with low level language features nor with a generalized notion of communicative contexts but with the specific social purposes and staging of written genres. Furthermore, its starting point is not with decontextualised language systems but with instances of actual texts. In the teaching/learning cycle designed by Joan Rothery and colleagues (Rothery 1994), an instance of a genre is 'deconstructed' by the teacher and students by reading it together and guiding students to recognise its stages and key relevant language features. After deconstructing the model text, teacher and students then jointly construct a new text, using similar organisation and key language features, but writing about a field that they have built up together. (Rose 2012a, p. 4)

These different layers of pedagogical activity—building content (field), analysing (deconstructing) the genre and jointly constructing a text—all prepare students for the task of constructing a new text of their own. The teaching/learning cycle (Rothery 1994/2008) is schematized in Fig. 3.3. The Sydney School of genre-based pedagogy will be discussed in more detail in Chap. 5. In this chapter, we shall mainly look at the first layer of the teaching/learning cycle: deconstructing or analysing the text.

Our discussion has so far focused on different conceptualizations of and approaches to the language learning task. The content teacher might be asking this question: What has the language learning task got to do with my content teaching? Since one fundamental principle underlying this book is the assumption that language and content cannot be separated, the learner's task of learning content cannot be separated from the task of learning the kinds of linguistic resources that are

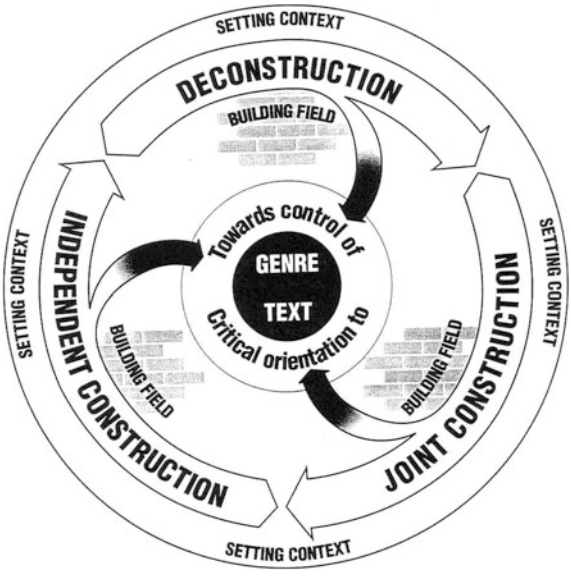


Fig. 3.3 The teaching/learning cycle (image from Martin and Matthiessen 2014, Fig. 9.6, p. 149; reproduced by permission of Springer)

essential to construing (or constructing) the content in a specific field or domain. Below, we shall focus our discussion on how we can develop a metalanguage for both content teachers and language teachers to talk about and analyse academic texts in different content fields.

3.3 Analysing Academic Texts in Content Subject Domains

The 'Genre Egg' framework is useful in providing a metalanguage (or a common vocabulary) for both content teachers and language teachers to work together to analyse academic texts found in content subject areas. Without a common vocabulary, it is almost impossible to foster collaboration between the language specialists and content specialists as they are typically trained in different disciplines with different theories and concepts underpinning their pedagogical practices. For instance, a math teacher once said to me, 'In math lessons we focus on communication, not language'. At that time, I found it hard to make sense of her sentence, precisely because she seems to be making a semantic contrast between 'communication' and 'language' as if the two are not related, or perhaps, what she wanted to say is that math teachers do not focus on highlighting language aspects but just focus on getting messages across. Many language teachers might have a similar experience when trying to communicate with content teachers about language matters (and how language *matters* in content learning and teaching). On the other hand, content teachers might find it hard to communicate with language teachers as they are often put off by the language teacher's use of technical linguistic terms (e.g. gerunds, imperatives and type I/II conditionals).

How would the 'Genre Egg' framework provide an accessible common vocabulary for both content specialists and language specialists to communicate with each other about the language demands of academic texts and genres found in content subject domains? I have developed an adapted version of the SFL Genre Egg (Fig. 3.4) to present to both content teachers and language teachers in seminars

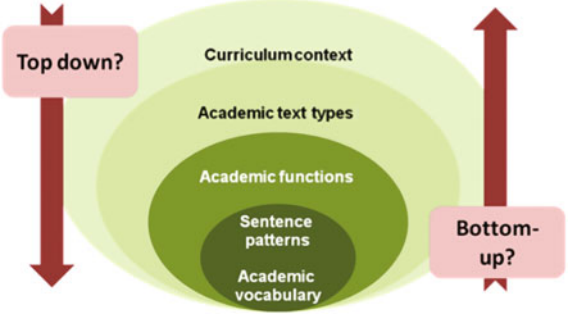


Fig. 3.4 The 'Genre Egg' (from Lin 2010)

on language across the curriculum. Usually, a practical concern of teachers is how they can provide language support to students learning content subjects in an L2 and how content teachers and language teachers can collaborate in providing this support. With the Genre Egg as a common analytical framework, both content teachers and language teachers can conduct analysis of the linguistic demands at different levels (e.g. vocabulary, sentence patterns, language functions, genre conventions) of key academic texts in a subject domain and then to collaborate on designing tasks that would provide language support to their students (more on task design in Chaps. 5 and 6). In the following, I shall demonstrate how the adapted 'Genre Egg' can assist teachers and researchers in conducting analysis of academic texts and how the analysis can inform our teaching.

3.3.1 Analysing Academic Vocabulary

The research literature speaks of three general types of academic vocabulary (Mercuri 2010). The first type is field-specific, technical vocabulary, for instance, in the field of science, e.g. *water cycle, pollination, antioxidant, partition coefficient and photodiode*. The second type is general academic vocabulary which is found in academic texts across a range of subjects. For instance, Coxhead (2000) has collated a list of 570 high-utility academic *word families*. The word family of 'analyse' will contain words such as analysis, analyser, analytical and analytically. The third type is linking words or logical connectors such as *however, in contrast, firstly and secondly*, which indicate the logical relationships between different parts of the text.

Application Scenario 3.1
In Text 3.1, can you find examples of the three types of academic vocabulary? Use a different colour to highlight the three different types of academic vocabulary.

Text 3.1
In the process of photosynthesis, carbon dioxide is taken in by plants through the *stomata* of their leaves. Simultaneously, the plants release oxygen and excess water through the stomata, providing us with fresh air.

Application Scenario 3.1 represents a simple *focus-on-form* exercise that teachers can use to raise both their own and their students' academic language awareness. Examples of field-specific technical vocabulary are *photosynthesis, carbon dioxide and stomata*. Examples of general academic vocabulary include *release and excess*. An example of logical connectors is *Simultaneously*. It is

important to notice that the boundaries between field-specific vocabulary can be blurred as more and more technical words have spilled into everyday life through repeated exposure in the mass media, e.g. QE (quantitative easing, subconsciousness, antioxidant, high-maintenance). Likewise, the boundary between field-specific vocabulary and general academic vocabulary can be porous, e.g. 'the water cycle' is a technical name given to a process in science and yet the word 'cycle' is found in many other academic texts as a productive element in the formation of names of field-specific processes (e.g. the teaching/learning cycle; the recession cycle). Sometimes, the field-specific technical vocabulary looks like everyday vocabulary and can lead to misunderstanding of academic concepts. For instance, words such as 'force' and 'pressure' in physics have specialized definitions, and if students interpret them using their everyday life understanding of these words, confusion can arise.

The aim of this kind of simple vocabulary analysis is to gauge the language demands of a text at the vocabulary level. For instance, if there is too high a concentration of academic vocabulary, the text might need to be adapted to suit the proficiency level of students in a particular class. For instance, 'release' can be replaced by 'give out'; 'excess' can be omitted without considerably changing the meaning of the text. While this will be very useful for EAL students, this will also be relevant to L1 speakers of English especially those students coming from disadvantaged backgrounds or those who speak a local variety of English as a home language. On the other hand, if the texts used in a subject curriculum are all simplified texts that do not provide students with enough exposure to field-specific vocabulary, then some intervention needs to take place (more on this in Chaps. 4–6). Content teachers and language teachers can also discuss how they can design enrichment tasks and coordinate their efforts in helping students master these different kinds of vocabulary across the curriculum (more on this in Chap. 7).

3.3.2 Analysing Sentence Patterns that Realize Language Functions

Lexico-grammatical patterns (or 'sentence patterns', which is a term that can be more easily understood by both content and language teachers) realize a range of language functions that are commonly found in academic texts, e.g. comparing and contrasting, exemplifying, defining, classifying, interpreting, hypothesizing, predicting, giving evidence and expressing conditional or causal relationships. More or less similar lists of functions are given different names under different theoretical frameworks, e.g. knowledge structures (Mohan 1986; Kong 2009); aspects of the scientific method (Zimmerman 1989); rhetorical functions (Hirvela 2004); and language functions (ELDAC). I have chosen to call them 'language functions' following ELDAC as this term can be easily understood by teachers. An example of

an important language function in academic texts is *defining*. Let us analyse Text 3.2 to illustrate how this function is realized in lexcio-grammatical (sentence) patterns.

Application Scenario 3.2
Can you find the sentence that realizes the function of defining? Can you analyse the lexico-grammatical (sentence) pattern of such sentences?

Text 3.2
Preservatives are additives that maintain the freshness and quality of food. They prevent food from spoilage caused by mould, bacteria and yeast and from flavour and colour changes due to exposure to oxygen.
Many countries have laws that ensure that manufacturers list all preservatives used together with the amounts on the ingredient part of the label. Chemical names such as *sodium nitrate* and *sodium benzoate* are often found on the labels of food products.

You would notice that the author of this Grade 4 science text chooses to define 'preservatives' right at the beginning of the text just as this term is introduced: '**preservatives** are additives that maintain the freshness and quality of food'. Similarly, Text 2.2 in Chap. 2 has a similar pattern: '**flowering plants** are classified as high-class plants'. The field-specific term ('flowering plants' and 'preservatives') is bolded to highlight its key term status, and it is immediately defined by first classifying it into a category of entities (e.g. 'high-class plants' and 'additives'). Then, some unique features are provided (although this part is omitted in the sentence in the flowering plants text).

A sentence pattern that is useful in realizing the language function, *defining*, can thus be outlined (Table 3.1).

Here, we minimize the linguistic terminology to make this sentence pattern easily grasped by content teachers who do not have a linguistic background. When content teachers read this text with students, it is useful to highlight at some point how useful language functions such as *defining* can be realized by sentence patterns like this. As teachers guide the students to experience instances of *defining* like this

Table 3.1 A sentence-analysis/sentence-making table to analyse and generate useful sentences to do *defining*

X	=	Y	
Preservatives	are	additives	that maintain the freshness and quality of food.
Technical term	Relating verb	General class word	Clause/phrase giving specific characteristics

in repeated encounters with them in different academic texts, the academic language awareness of students will be raised. They will start to become not just *information readers* or *form readers* (Cai 2014), but also *rhetorical readers* (Hirvela 2004) or *writerly readers*, i.e. they will now have an eye for noticing the lexico-grammatical resources (e.g. words and sentence patterns) useful in achieving different rhetorical or language functions such as *defining*, which they can use themselves when they are constructing an academic text of their own (e.g. in assignments, projects, presentations or examinations). It is important to highlight to students that there are usually many more diverse ways of achieving a rhetorical or language function although some basic linguistic resources (such as the sentence pattern outlined above) can be useful to start with. Students can be encouraged to keep a 'writerly reader's notebook' where they jot down instances of different recurrent functions which they come across in different texts in different subject areas.

My research associate Emily He and I have analysed the Sarasas Science Corpus (which we have built from the grades 1–6 science textbooks used in and published by the Sarasas Affiliated Bilingual Schools, Thailand) and have found many more instances of the 'defining' function in the corpus (Table 3.2).

The key point in deconstructing/analysing academic texts is thus to heighten the academic language awareness of both (content/language) teachers and students so that each individual experience (or encounter) with a curriculum text becomes a learning opportunity to infer the linguistic resources (e.g. vocabulary and sentence patterns) useful for achieving functions, and these resources can come in useful when students are constructing texts of/on their own (i.e. they become *writerly* readers—reading with an eye to becoming a writer themselves). It is important that students are encouraged to discover these patterns from the texts they read in their subject domains (initially under the teacher's guidance), and they can keep *a writerly reader's notebook* on these patterns, instead of just teaching them a list of

Table 3.2 Instances of the language function *defining* in the Sarasas Primary Science Corpus (from Lin and He 2014)

Terms	→	**General class**	**Specific details**
Fertilizers	are	compounds	made to support plants' growth.
Vitamins	are	organic compounds	found in fruits, vegetables, also in meat, eggs, milk and animals' internal organs.
Minerals	are	organic chemical elements	found in vegetables, fruits, milk, meat, egg yolks and all kinds of seafood.
Calorie	is	a unit of energy	used as a measurement for the amount of energy a particular food provides.
Flowers	are	the structures	where reproduction takes place.
Fruits	are	ripened ovary walls of flowers	that contain seeds.
Fertilization	is	the process	where the male's pollen grains fuse together with the female's ovules inside the ovary and become one new cell.

decontextualized sentences outside of the curriculum context. In other words, these instances of language functions need to be experienced and noticed in a meaningful *text-in-context*. And this 'noticing' process (or 'focus on form') must not impede content learning (i.e. not turning a content lesson into a language lesson), and this requires skilful 'shifting' between *focus on form* and *focus on content* on the part of the teacher. We shall discuss this in more detail in Chap. 5.

There are many other useful language functions such as *exemplifying*. In Text 3.2, can you find the sentence pattern(s) used to achieve this academic function? Notice that there are often diverse ways of achieving a similar function in different texts and genres. Different researchers have come up with different categories of functions. For instance, researchers of the English Language Development Across the Curriculum (ELDAC) Project have come up with a list of 19 language functions (ELDAC Functions Index, see Department of Education Queensland, 1989). Kong and Hoare (2008), following the knowledge structure framework of Mohan (1986) and Tang (1992), have come up with a list of knowledge structures, which resemble what other researchers call functions. Cutting-edge research is being conducted by Dalton-Puffer (2013) on cognitive discourse function (CDF) which seeks to provide a comprehensive and yet teacher-friendly list of CDFs (more on this in Chap. 9).

Whatever theoretical traditions or functional taxonomies we choose to follow, it is important to recognize the need to allow students the opportunity to discover how these functions are realized in texts that are meaningful to them. A pitfall exists for teachers to organize their lessons simply according to a list of 'functions—sentence patterns' that are presented to students in decontextualized ways. It is very important to help students to see how these functions contribute to achieving the overall communicative purpose of a text in a specific genre (e.g. a descriptive report) rather than as a set of isolated functions standing on their own.

Academic texts in tertiary education are usually much more complex, and functions are generally realized with much more sophisticated lexico-grammatical patterns that can be outlined in a few basic sentence patterns. They are also tightly related to the generic structuring or organization of the text to achieve the overall purpose of the text. Teachers can encourage students to read with a 'writer's eyes' to see how these functions are typically realized in context. Teachers can continue to raise students' academic language awareness to a point when students can see these patterns on their own. We shall discuss more of this in Chap. 5.

3.3.3 *Analysing Academic Genres in a Curriculum Context*

In the Genre Egg (Fig. 3.5) that guides our analysis of academic texts, the layer embedding language functions and vocabulary is text type or 'genre'. While genre is defined slightly differently under different theoretical traditions (see review of the three traditions by Hyon 1996), the Sydney School's definition seems to be most useful to teachers:

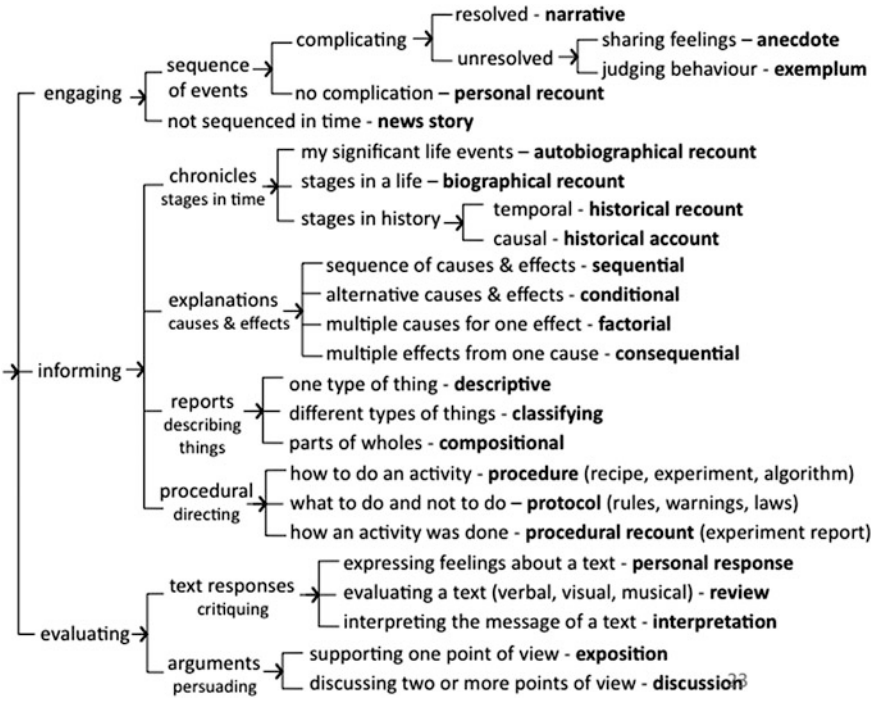


Fig. 3.5 Genres in the school curriculum (from Rose 2012b, Slide 12; reproduced here by permission of Dr. David Rose)

> The Sydney School approach starts with a broad definition of genres as 'staged goal-oriented processes': they are goal-oriented because a text unfolds towards its social purpose, and staged because it usually takes more than one step to reach the goal. Genres evolve in a culture to achieve common social purposes that are recognised by members of the culture so that the stages they go through are generally predictable for members of the culture. (Rose 2012a, p. 1)

Genres are thus patterned ways of organizing our speaking and writing for specific communicative purposes in specific contexts. To succeed in school or university, a student needs to master a number of key academic genres for different academic subjects, e.g. to write a book review for the English class, to write an expository essay for a social studies assignment, to write a descriptive report on endangered species or to write a research proposal or research report for the science or engineering project. Genres are usually introduced to students as 'text types', though we must remind students of the fluid and evolving nature of genres so that students see text types as helpful tools rather than static, set-in-stone templates for speaking and writing.

Different theoretical traditions have approached genre analysis using slightly different terminologies, but they basically follow the same procedure of identifying

Table 3.3 Genre analysis of a Grade 4 science text—flowering plants

Introduction	
Classifying	Flowering plants are classified as high-class plants.
Description 1: adult stage	At the adult stage, they produce flowers which develop into fruits and seeds after being pollinated and fertilized.
Description 2: examples	Tulips, water lilies, mangoes and bananas are examples of flowering plants.

stages and phases in a text (called 'moves and steps' in John Swales' genre analysis tradition) as the text unfolds to achieve its primary communicative purpose.

If we revisit Text 2.2 in Chap. 2 (which is reproduced in Table 3.3 with genre structure analysis in the left margin), we shall notice that this short Grade 4 science text is an instance of a descriptive report under the taxonomy of school genres developed by the Sydney School of genre analysis (Martin and Rose 2008, 2012). A descriptive report usually has two stages: Introduction ^ Description (the symbol ^ is used to indicate 'followed by'). In the Introduction stage, the topic is introduced, usually by defining or classifying it. Then, the text unfolds into the Description stage, where more descriptive details are given. While the *stage*s are quite predictable across different instances of the genre, the *phases* under each stage can be quite variable, and so instead of prescribing a template for writing a descriptive report, students can be encouraged or guided to discover both the predictable stages and the variable phases across different texts in different curricular contexts.

The school genres identified by the Sydney School researchers are divided into three main types depending on their global communicative purpose: Informing, Engaging, Persuading (Fig. 3.6). David Rose, in particular, has written a series of booklets entitled *Reading to Learn* (http://www.readingtolearn.com.au/) which presents the Sydney School genre-based pedagogy in teacher-friendly language with many practical examples drawn from genre analysis of the Australian school curriculum texts.

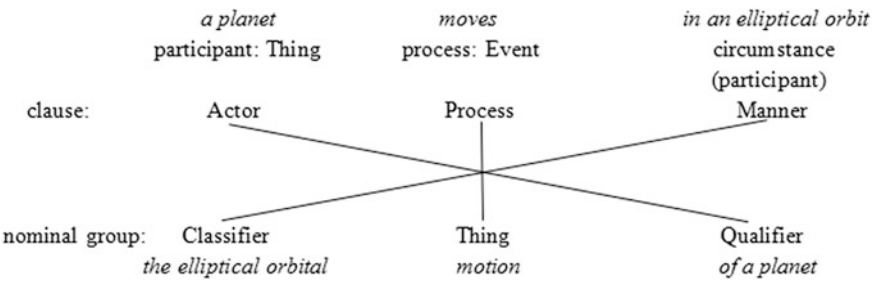


Fig. 3.6 Grammatical metaphor: shifts in grammatical class and functional status

The Sydney School genre researchers have mostly worked on analysing school genres and have made great contribution to the teaching of academic literacies in school settings. As for genre analysis of academic texts in university settings, it is the English for Academic Purposes (EAP) and English for Specific Purposes (ESP) studies which are influential in the literature. John Swales and his colleagues have conducted genre analysis on research writing genres, catering for the L2 EAP needs of international students in universities in the US Swales' CARS (Creating A Research Space) model (1990) for writing in research genres which is classic now and frequently drawn upon in academic writing courses in universities.

3.4 Technicality and Abstraction

It is generally rather easy to distinguish academic writing from other kinds of writing, as academic language is usually characterized by a high level of *technicality* and *abstraction*, two notions introduced by Halliday and Martin (1993). Halliday (2004) describes the 'history' of the evolution of language forms on the individual plane (ontogenesis), on the societal plane (phylogenesis), as well as on the textual plane (logogenesis). 'History' is here understood as having three dimensions:

(1) the history of the child's language development,
(2) the history of the evolution of language, and
(3) the unfolding of the text (or information flow of the text).

On the ontogenetic plane, the child goes through three stages:

- from protolanguage to language,
- from everyday spoken grammar to the grammar of written language (or literacy), and
- from the grammar of written language to that of the language of the subject disciplines (e.g. science, mathematics, geography, history).

Speaking in terms of knowledge development, the critical moments are when the child learns to develop additional layers of knowledge:

- Common-sense knowledge (age 1–2),
- literate educational knowledge, (age 4–6),
- technical knowledge (age 9–13) and
- theoretical knowledge (age 18 onwards).

Developing the additional layers of educational and technical knowledge, the child needs additional language resources to construe and configure these new layers of knowledge. The language for these additional layers of knowledge is characterized by increasing *lexical density* but decreasing *grammatical delicacy* (or clausal complexity). Let us illustrate these ideas with the hypothetical 'repacking' examples provided by Halliday (2004: 31–32):

1. Look—it must be raining! People have their umbrellas open.

The above sentence might very naturally be said by a 3-year-olds, and Halliday shows how this sentence can be 'repacked' step by step going up the age range (age is included in brackets at the end of each sentence):

2. How can you tell that it's raining? You can see that people have got their umbrellas open. (6)
3. We can prove that there's rain falling by seeing that people's umbrellas are open. (9)
4. What best proves that it's rainy weather is the fact that the umbrellas have been extended. (12)
5. The best proof that the weather is pluvious is the fact that the umbrellas are extended. (15)
6. The truest confirmation of the pluviosity of the weather is the extendedness of the umbrellas. (18 up)

To successfully participate in school work, the child needs to learn how to repack sentence 1 into sentences 2 and 3 in primary school and further into sentences 4–6 in secondary school. As the child gets increasingly apprenticed into school ways of writing, the sentences that they produce are marked by increasingly complex nominal groups but decreasing grammatical delicacy. Grammatical delicacy or intricacy refers to the complexity of clause structure. For instance, sentences 2–3 are dominated by verbal clauses and their structure can be schematically represented as follows:

Sentence 2: How can you tell *A*? You can see *X*.
(*A* = that it's raining) (X = that people have got their umbrellas open)

Sentence 3: We can prove *A* by seeing *X*.
(*A* = that there's rain falling) (*X* = that people's umbrellas are open.)

On the other hand, sentences 4–6 have a simpler sentence structure but increasingly more generalized and abstract nominal (i.e. noun) groups:

Sentences 4–6: **B** is **Y**.
(**B** = What best proves *A'*) is (**Y** = the fact that *X'*),
(**B** = The best proof that *A''*) is (**Y** = the fact that *X''*),
(**B** = The truest confirmation of *A'''*) is (**Y** = *X'''*),
Wherein:
A' = that it's rainy weather,
A'' = that the weather is pluvious,
A''' = the pluviosity of the weather,
X' = the umbrellas have been extended,
X'' = the umbrellas are extended, and
X''' = the extendedness of the umbrellas.

We can notice that the nominal groups (B, Y) in sentences 4–6 are becoming increasingly abstract, and they function to re-present a dynamic process into a static nominal entity. This abstraction process takes away the specificities of the 'here and

now' of what is happening (it's raining) and turns it into a general, impersonal, atemporal, static and abstract concept (the pluviosity of the weather). However, the clause structure is a relatively simple one, i.e. a relational clause (B = Y). It can be said that the child initially lives in a world of rich clause complexes (e.g. If you don't give me …. I'll tell Mum about it…!), and upon entering the school, the child starts to encounter both technical and abstract nominalizations; e.g., preservatives are additives that help maintain the freshness and quality of food. In this sentence, preservatives and additives are both technical terms. Preservative is a nominalized entity; i.e., the verb *preserve* is turned into the noun *preservative* (to refer to the chemicals that function to preserve food) and becomes further technicalized—it is a technical term. The same process has taken place with the verb *add* which is converted into the noun *additive* (chemicals that are added to food) and is given field-specific, technical meaning in the discipline of science. The adjective *fresh* is turned into the noun *freshness*; however, it has not gained the status of technical term and can readily be unpacked back into everyday language and its meaning is not field-specific (i.e. not technical). We can see that technicality and abstraction are the result of linguistic transformation processes, which are called *nominalization* and *grammatical metaphor*. Both are technical terms themselves in the discipline of linguistics and need to be unpacked with further explanations below.

3.4.1 Nominalization and Grammatical Metaphor: The Linguistic Engine for Constructing Technicality and Abstraction

Consider the adjective, 'hot'. When it is used in everyday language, one can say, 'Be careful, the water is hot!' However, in a science textbook, the adjective 'hot' becomes nominalized (i.e. turned into a noun) as 'heat', which is then turned into a technical term that can be classified into different types, e.g. latent heat and radiant heat. Scientists can also talk about 'heat transfer' (e.g. it would be difficult to talk about 'heat transfer' if there is only the word 'hot' without the technical term 'heat' in the language of science). Sometimes, the L1 of the students might not encode or construe technicality in the same way as English. For instance, the Chinese word for 'heat' (technical term, a noun) and 'hot' (everyday word, an adjective) is the same: 熱 and this has an impact on Chinese students' learning of the concept of 'heat transfer' (Fung and Yip 2014). Another example is the verb, 'move'. When it is used in everyday language, it is easy for an EAL learner to pick it up in conversations, e.g. 'Move on! Quick!' However, in a science textbook, the verb 'move' becomes nominalized as 'motion' and becomes a technical term, as Halliday explains:

> So, for example, when we turn *move* into *motion* we can say things like *all motion is relative to some fixed point*; we can set up *laws of motion*, and discuss problems like that of *perpetual motion*; we can classify *motion as linear, rotary, periodic, parabolic,*

> *contrary, parallel*, and the like. Not because the word *motion* is a noun, but because in making it a noun we have transformed 'moving' from a happening into a phenomenon of a different kind: one that is at once both a happening and a thing. … By calling 'move' *motion*, we have not changed anything in the real world; but we have changed the nature of our experience of the world. (Halliday 2004, pp. 15–16; italics original)

There is no mystery in academic language as we can actually trace the origins of academic language (and their technicality and abstraction) in everyday interpersonal conversations. For instance, Halliday mentions the example of his son, Nigel, when he was 3:

> When my son was small, he used to play with the neighbour's cat, which was friendly but rather wary, as cats are with small children. On one occasion he turned to me and said 'Cats have no other way to stop children from hitting them; so they bite'. He was just under three and a half years old. Some years later, in primary school, he was reading his Science textbook. One page was headed: 'Animal Protection'; and underneath this heading it said 'Most animals have natural enemies that prey upon them. … Animals protect themselves in many ways. Some animals … protect themselves with bites and stings.' (Halliday 2004, pp. 12–13)

So, in repackaging a verbal process (*so they bite*) into a nominal entity (some animals protect themselves with *bites*), the primary science textbook has re-presented the child's common-sense knowledge as school knowledge or educational knowledge. If one needs to help an L1 child to go through these linguistic transformation processes in order to succeed in school, helping L2 learners (e.g. EAL students) to *unpack* academic language into everyday language as well as to *repack* everyday language into academic language (e.g. in writing assignments and examinations in schools or writing research reports or papers in university) becomes an even more important curricular and pedagogical design question when L2 is used as the medium of instruction (MOI) in schools. In order to do this, it is worth spending some more effort in understanding the lexico-grammatical resources that have evolved in the English language (and in many other languages as well, e.g. Chinese) to construct *technicality* and *abstraction* in different academic disciplines through nominalization and the use of grammatical metaphor.

Technicality 'refers to the use of terms or expressions … with a specialised field-specific meaning' (Halliday and Martin 1993, p. 144). In the example above, the word 'bites' has not been turned into a technical term. It functions mainly to make school language more abstract and to package information in a more compact manner (e.g. with higher lexical density). However, the disciplines of physical sciences (physics, chemistry, biology, earth science) have employed a process of technicalizing which involves two steps: (i) naming the phenomenon and (ii) making that name technical (i.e. with field-specific meaning) (Halliday and Martin 1993).

To support students in tackling technical academic texts, this two-step process can be highlighted to students to show how a term has become technicalized in a specific discipline. This explicit discussion can heighten students' awareness of how everyday words are transformed into technical terms (e.g. add → additives; preserve → preservatives). Likewise, students can be explicitly engaged in

discussing the different technical (i.e. field-specific) meanings that different disciplines give to seemingly similar terms (e.g. the word 'field' has a very different meaning in science, Mathematics and daily life, respectively). Once these action-processes (verbs) are turned into entities (nouns), a lot of things can be done with them, e.g. you can pluralize them (e.g. additives), qualify them (e.g. food additives) and 'tag' more information onto them (e.g. modern-day food additives).

Technicality is closely linked to an important practice that the disciplines of modern physical sciences have evolved to embrace. Modern sciences are basically about naming, defining, describing, classifying phenomena and establishing hierarchies of taxonomies of these phenomena (Halliday and Martin 1993). Mastering the academic subject science is about mastering these taxonomies which consist of technical terms that enter into different taxonomic oppositions (e.g. living things vs. non-living things; flowering plants vs. non-flowering plants; vertebrates vs. invertebrates; plant cells vs. animal cells). Naming, defining, classifying, describing, exemplifying, comparing and contrasting and so on thus become important *cognitive discourse functions* that students need to learn to master in relation to the subject content of modern sciences. These functions are simultaneously cognitive and linguistic/discursive as they require students to apply the technical terms and taxonomies (embedded in the specialized discourses of the disciplines) to name, define, describe, compare, contrast and classify different physical (and social) phenomena. Learning content in the science subject is thus a semiotic process, i.e. learning to use the technical terms and taxonomies (i.e. specialized discourses) handed down from the traditions of the disciplines to see (or construe) the world around them or to make technical sense of (or technical meaning out of) their everyday experience (i.e. to turn or reconfigure their experience into technical knowledge) (Lemke 1990).

However, technicality is only half of the story of the evolution of the academic language in the past five hundred years (Halliday 2004). Analysing the science writings of key figures (e.g. Bacon, Descartes, Newton) in Western science, Halliday comes to the conclusion that starting from the sixteenth century and increasingly so into the nineteenth centuries, science writings in the Western tradition have gone through not just a technicalizing process but also an abstracting process. Specifically, these writings have used the lexico-grammatical resources of nominalization and grammatical metaphor to construe the technical and abstract knowledge of their disciplines. We have explained nominalization above, and let us explain grammatical metaphor below.

Grammatical metaphor is closely linked to nominalization. When a nominalized word or group functions *as if* it were a grammatical *participant* (e.g. grammatical *subject* or *object* in traditional grammar terminology), it is called a grammatical metaphor. For instance, consider the following clause and its nominalized counterpart:

clause: a planet moves in an elliptical orbit

nominal group: the elliptical orbital motion of a planet

Figure 3.6 shows a schematic explanation of how the verb *move*s which functions as a *process* (in the original clause: a planet moves in an elliptical orbit) becomes nominalized as *motion* and functions as a *thing* in the nominal group (the elliptical orbital motion of a planet). This analysis is modelled on the analysis offered by Halliday and Martin (1993) in their example:

> clause: an electron moves in an orbit
>
> nominal group: the orbital motion of an electron (Halliday and Martin 1993, p. 128).

This nominal group ('the orbital motion of an electron') can in turn function as a constituent further embedded in a more complex nominal group:

> the combined motion of an electron resulting from the coincidence of the orbital with the rotational motion [X] (Halliday and Martin 1993, p. 129; [X] is added by the author)

In principle, such further embedding can go on and on to create an increasingly complex and compact nominal group [X] which can function as a *participant (e.g. as a grammatical subject or object)* in a sentence that has a simple relational structure: [X] is/is known as [Y] (where both [X] and [Y] are called *participants* in Halliday's systemic functional grammar), for instance:

> The combined motion of an electron resulting from the coincidence of the orbital with the rotational motion is known as…[Y]

Halliday calls this 'grammatical metaphor' to contrast with lexical metaphor. To unpack the meaning of grammatical metaphor, let us start with an example of a lexical metaphor, which is easier to understand, e.g. 'Juliet is cold to her father'. We know that 'cold' here is a metaphor because it is based on comparison or analogy with temperature (e.g. the weather is cold → she is cold to her father). But now let us consider another kind of metaphor, e.g. the coldness of Juliet to her father is due to her love for Romeo. This is an example of grammatical metaphor. What is originally an adjective or a *quality* of things ('cold') gets nominalized into a noun or a *thing* ('coldness'), which now functions in another sentence as a *grammatical participant* (as the *grammatical subject*) of the sentence—hence the name, *grammatical* metaphor.

We are, of course, not trying to turn Shakespeare's play into a technicalized or abstract academic text by writing modern-day 'fan fiction' on it. However, if we do this experiment of taking a literary work and transforming the text into one full of nominalizations and grammatical metaphors, we can see how a literary text can be transformed into an academic text through mobilizing what Halliday calls the lexico-grammatical resources (the linguistic powerhouse) of the English language. In literary writing, accomplished writers use lexical metaphors to achieve the purpose of engaging the audience by turning some abstract processes into concrete, visualizable processes. For instance, consider the following sentence from Suzanne Collins' popular fiction, *The Hunger Games—Catching Fire*:

> 'Just the sound of his voices twists my stomach into a knot of unpleasant emotions like guilt, sadness and fear.' (Collins 2013, p. 11)

We know that 'twists' and 'knot' are lexical metaphors as their meanings here are based on analogy with the concrete action of twisting (verb) something into a knot (a physical entity). By employing these lexical metaphors, Collins visualizes for the reader vividly the sudden invisible change of emotions in the female protagonist (Katniss Everdeen) upon hearing the voices of President Snow.

In academic writing, we use grammatical metaphor for just the opposite effect: turning what is concrete and everyday into something abstract and technical. But why do scientists do that? Halliday (2004) argues that the use of grammatical metaphor in scientific writing enables the writer to construe not only technicality but also rationality. To understand this, we need to turn to the next topic: thematic progression and logical flow.

3.5 Thematic Progression and Logical Flow

Nominalization and grammatical metaphor play an important role in construing rationality (Halliday 2004, p. 124) by enabling the writer to construct logical semantic relations in the text. Logical semantic relations are not a privilege of scientific or academic texts. Hasan (1992) shows the importance of reasoning in the conversation of three-year-old children. However, what is special about scientific discourse, according to Halliday, is:

(1) that it constructs an argument out of a long sequence of connected steps, and
(2) that at any one juncture a large number of previous steps may be marshalled together as grounds for the next. (Halliday 2004, p. 124)

The language unit for construing one such step is a clause (e.g. 'If you don't take the medicine'). A clause is both a unit of experience and a unit of information. Clauses are the building blocks of an argument. Consider the following hypothetical conversation (A child is coughing hard but refuses to take the medicine and his mum tries to 'reason' him into taking it):

> Mother (to Child): If you don't take the cough syrup, you'll be coughing all night. Coughing all night will make your Mum and Dad unable to sleep well. Not sleeping well will make us unable to do our job well tomorrow. Not doing our job well will make us lose our jobs. Losing our jobs will make us unable to buy you the computer games you want…

To understand how the mother constructs the flow of information and the logic of her argument, let us do a theme–rheme analysis of the above utterances. The theme is the stable part, the anchor or the point of departure, and it is typically a noun or a nominal group (usually the subject of the sentence, together with any minor clause or phrase). It is also the given (or shared) information. The rheme is the new information or the focus (usually the main clause) in a sentence or utterance. Table 3.4 shows a theme–rheme analysis of the utterances.

We can see in the above hypothetical example that nominalization takes place to 'pack' or summarize the rheme (the main clause) of the previous sentence into the

Table 3.4 Theme–rheme analysis of the mum's utterances

	Theme (given/shared information)	Rheme (new information)
1	If you don't take the cough syrup	you'll be coughing all night.
2	*Coughing all night*	will make your Mum and Dad unable to sleep well.
3	*Not sleeping well*	will make us unable to do our job well tomorrow.
4	*Not doing our job well*	will make us lose our jobs.
5	*Losing our jobs*	will make us unable to buy you the computer games you want…

new theme (a nominal group) of the next sentence. And this process repeats itself to move the argument forward step by step.

Imagine what you would feel if we interrupt this information flow or thematic progression by reverting the theme–rheme sequencing (i.e. put new information in the place of the theme and old information in the place of the rheme) as in the following reconstructed utterances of the Mum above:

> Mother (to Child): If you don't take the cough syrup, you'll be coughing all night. Your Mum and Dad will be unable to sleep well if you're coughing all night. We will be unable to do our job well tomorrow if we are unable to sleep well. We will lose our jobs if we are unable to do our job well. We will be unable to buy you the computer games you want if we lose our jobs…

The above example helps us to understand the ways in which scientists or academic writers present their information systematically and construct their argument logically. Halliday uses the following example from a science text to illustrate how the presentation of logical reasoning hinges on mobilizing the linguistic resources of nominalization and grammatical metaphor to 'pack' the rheme(s) in previous sentence(s) into the theme(s) in new sentences:

> If electrons were not absolutely indistinguishable, two hydrogen atoms would form a much more weakly bound molecule than they actually do. The absolute *indistinguishability* of the electrons in the two atoms gives rise to an 'extra' attractive force between them. (Layer 1990, pp. 61–62; cited in Halliday 2004, p. 125; italics added)

In the theme–rheme analysis of this example (Table 3.5), we see that what has been presented in a clause in the theme of the first sentence ('If electrons were not absolutely indistinguishable') is condensed into a nominal group and condensed as a more compact theme in the next sentence ('The absolute indistinguishability of the electrons in the two atoms…'). This succinctly phrased or highly condensed packet of information serves as a point of departure and anchor to which further

Table 3.5 Theme–rheme analysis of a science text

	Theme	Rheme
1	If electrons were not absolutely indistinguishable	two hydrogen atoms would form a much more weakly bound molecule than they actually do.
2	The absolute *indistinguishability* of the electrons in the two atoms	gives rise to an 'extra' attractive force between them.

new information ('gives rise to an 'extra' attractive force between them') is attached. Halliday argues that the linguistic resources of nominalization and grammatical metaphor enable the academic or scientific writer to achieve systematicity and logicality—rationality—in their writing.

Learning how to mobilize these linguistic resources to achieve a systematic information flow and logical argument in their writing is precisely that part of invisible learning that confronts every school child if he/she is to participate successfully in different school subject lessons. This task is often made more difficult by the jumbled ways of presenting information in the school textbooks, especially those written for EAL learners as the textbook writers tried to 'make the language simpler' by turning text into a cluster of bullet points or scattering the information among pictures and visuals. My colleague, Dr. Dennis Fung, who is a science subject specialist, laments the lack of coherent texts in many of the science textbooks produced in Hong Kong. On one occasion, we were preparing for a teacher seminar and were looking for a coherent text to present the process of energy conversion in a closed circuit, and we looked in several science textbooks in Hong Kong and could not find a good model text to illustrate the kind of thematic progression and information flow discussed above. In the end, we worked together to reconstruct a text as a model text. How we can make this invisible learning task visible and help both teachers and students notice the operation and functioning of these linguistic resources in academic texts will be discussed in Chap. 5.

Note 1:
A 'morpheme' is the smallest unit of meaning in a language; e.g., 'love' has one morpheme, while 'lovely' is made up of two morphemes. A 'phoneme' is the smallest unit of meaning-differentiating sound, e.g. /h/ in 'hat' and /s/ in 'sat', by changing the sound from /h/ to /s/, the meaning of the word is changed.

Chapter Summary Points

- The SFL theoretical framework and the 'Genre Egg' as a metalanguage for both content teachers and language teachers to talk about and analyse the language demands of academic texts,
- Different conceptualizations of the language learning task: the bottom-up, top-down and integrated approaches,

- The Sydney School genre-based pedagogy, the teaching/learning cycle (TLC) and analysis of school genres (text types),
- Construing technicality and abstraction through the use of nominalization and grammatical metaphor, and
- Theme–rheme analysis, thematic progression and information flow.

End-of-Chapter Discussion Questions

1. What kind of learning goals do you want to set for your students ultimately? Can you use the concepts of 'information reader', 'rhetorical reader' and 'writerly reader' to discuss how they are related to the content or language focuses of the lesson?
2. How can we avoid showing students a list of language functions with a number of sentence patterns under each? How can we teach functions and the sentence patterns realizing these functions in a meaningful, contextualized way?
3. What would you do if you find that the curricular text that you are analysing does not fit into the genre taxonomy and the predictable stages and phases in the existing research literature?
4. By understanding the 'linguistic engines' of academic language (technicality and abstraction), is it possible to develop a systematic way to help students unpack and repack the abstract and technical sentences of academic texts?
5. What are the practical constraints on doing a guided analysis of academic language in class, especially the possible impact on the logical flow and coherence of content delivery?
6. If you were a language specialist, what would be the biggest challenge in persuading content subject teachers to pay attention to the hidden linguistic devices that may hinder students' understanding of the content?

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