Parsimonious Vole
A Systemic Functional Parser for English

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I would like to dedicate this thesis to my loving parents . . .

Declaration

I hereby declare that except where specific reference is made to the work of others, the contents of this dissertation are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other university. This dissertation is my own work and contains nothing which is the outcome of work done in collaboration with others, except as specified in the text and Acknowledgements. This dissertation contains fewer than 65,000 words including appendices, bibliography, footnotes, tables and equations and has fewer than 150 figures.

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Eugeniu Costetchi

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Acknowledgements

And I would like to acknowledge ...

Abstract

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Chapter 1

The systemic functional theory of grammar

Any description of language requires a theory that provides the frame, scope and the necessary concepts. Having a solid theory of grammar contributes to explaining what language is and how it works. It also frames how language is ought yo be analysed by either human or machines.

In his seminal paper Halliday (1961) addresses the ardent need of the time for a general theory of language and partially answers the proposal for a universal theory of language. He sets out what was known at the time as Scale and Category Grammar. In such a model *units* are set up to account for for pieces of language which carry grammatical patterns. They are seen as arranged on a hierarchical *rank* scale of words, groups and clauses. These and other foundational concepts are covered in the first part of this Chapter.

There are two variants of Systemic Functional Grammars: the *Sydney Grammar* started in 1961 by Halliday (2002) and the *Cardiff Grammar* proposed by Fawcett (2008) which is a simplification and an extension of the Sydney Grammar. To understand the underlying common motives and how they are different we shall start looking at their theories of grammar. They also have quite different historical developments.

Sydney and Cardiff grammars have been formalised to the point where they could be computationally applied to natural language generation. They have been implemented in PENMAN (Mann 1983; Penman Project 1989) and respectively COMMUNAL projects (Fawcett 1990). Both versions of SF grammars have been used predominantly for English and implementations of for other languages are also available. The major component of PENMAN is a computer model of Halliday's SF grammar described by Mann & Matthiessen (February 1983), Matthiessen & Bateman (1991), (Matthiessen

1995) and others. COMMUNAL is the computer implementation of Cardiff grammar described by Fawcett (1988), Fawcett (1993) and others.

This chapter first sets out the basic organisational dimensions for each of the theories and then discusses comparatively Halliday's (Halliday 2002) and Fawcett's (Fawcett 2000) versions of SFL.

1.1 A word on wording

Before going into deeper discussion I first make terminological clarifications on the terms: grammar, grammatics, syntax, semantics and lexicogrammar. I start with a definitions adopted in "mainstream" generative linguistics and then present how the same terms are discussed in systemic functional linguistics.

Radford, a generative linguist, in the "Minimalist Introduction to Syntax" (1997), starts with a description of grammar as a field of study, which, in his words, is traditionally subdivided into two inter-related areas of study: syntax and morphology.

Definition 1.1.1 (Morphology (Radford))**.** Morphology is the study of how words are formed out of smaller units (traditionally called morphemes) (Radford 1997: 1).

Definition 1.1.2 (Syntax (Radford))**.** Syntax is the study of how words can be combined together to form phrases and sentences. (Radford 1997: 1)

Halliday, in the context of *rank* scale discussion (see Definition 1.2.1 and 1.2.2), refers to the traditional meaning of syntax as the *grammar above the word* and to morphology as *grammar below the word* (Halliday 2002: 51). Such a distinction, he states, has no theoretical status and is deemed as unnecessary distinction. Halliday adopts this position to motivate the architecture of grammar he was developing and is inherited from his precursor, Firth, as he puts it:

> . . . the distinction between morphology and syntax is no longer useful or convenient in descriptive linguistics. (Firth 1957: 14)

Radford adds that, traditionally, grammar is not only concerned with the principles governing formation of words, phrases and sentences but also with principles governing their interpretation. Therefore *structural aspects of meaning* are said to be also a part of grammar.

Definition 1.1.3 (Grammar (Radford))**.** [Grammar is] the study of the principles which govern the formation and interpretation of words, phrases and sentences. (Radford 1997: 1)

Interestingly enough, the Definition 1.1.3 makes no mention at all to the lexicon. This is because the formal grammars focus primarily on unit classes and how they are accommodated in various structures and so in formal linguistics the lexicon is often disconnected from the grammar. The systemic grammar, on the other hand, along with formal descriptions of grammatical categories and structures, includes the lexicon as part of grammar to form a *lexicogrammar*. At this point I have to mention that systemic functional grammar is not the only lexicalised one and there are others taking the same approach such as Lexical Functional Grammar (LFG), Head Phrase Structure Grammar (HPSG), Combinatory Categorial Grammar (CCG) and others.

Another important aspect to notice is that the grammar is defined as a field of study rather than a set of rules. De divergence in perspective on the subject led Halliday, since his early papers, to become conscious the difference between a study of a phenomenon with the phenomenon itself. By analogy to language as phenomenon and linguistics as the study of the phenomenon, discussed in (Halliday 1997), Halliday adopts the same wording for *grammar* as phenomenon and *grammatics* as the study of grammar; the same distinction holds for *syntax* and *syntactics*.

Definition 1.1.4 (Grammatics (Halliday)). Grammatics is a theory for explaining grammar (Halliday 2002: 369)

Moravcsik, another generative linguist, stresses the same distinction, in her "An introduction to syntax" (Moravcsik 2006), and presents two ways in which the word *syntax* is used in the literature: (a) in reference to a particular aspect of grammatical structure and (b) in reference to a sub-field of descriptive linguistics that describes this aspect of grammar. In her words:

> . . . syntax describes the selection and order of words that make well-formed sentences and it does so in as general a manner as possible so as to bring out similarities among different sentences of the same language and different languages and render them explainable. . . . syntax rules also need to account for the relationship between string of word meanings and the entire sentence meaning, on one hand, and relationship between strings of word forms and the entire sentential phonetic form, on the other hand. (Moravcsik 2006: 25)

In her definition of grammar she includes the lexicon and semantics which is a somewhat more explicit statement than Radford's *interpretation*. She is also getting, in Definition 1.1.5, somewhat closer to what grammar stands for in SFL - Definition 1.1.6.

Definition 1.1.5 (Grammar (Moravcsik))**.** ... maximally general analytic descriptions, provided by descriptive linguistics, [are] called grammars. A grammar has five components: phonology (or, depending on the medium, its correspondent e.g. morphology), lexicon, syntax and semantics(Moravcsik 2006: 24–25).

Definition 1.1.6 (Grammar (Halliday))**.** To Halliday, lexico-grammar, or for short,simply grammar is a part of language and it means the wording system - the "lexical-grammatical stratum of natural language as traditionally understood, comprising its syntax, vocabulary together with any morphology the language may display [...]" (Halliday 2002: 369).

The last point I want to mention is the approach to semantics. Formal grammars aim to account for the realisation variations, that is formation of words, phrases and sentences along with their arrangements and mention of semantics is often restricted to what may be termed the *formal aspect of meaning.*

By contrast, a systemic grammar is a functional grammar, which means (among other things) that it is semantically motivated, i.e. "natural". So the fundamental distinctions between formal and functional grammars is the semantic basis for explanations of structure.

Also, in SFL, the meaning is being approached from a semiotic perspective, placing the linguistic semantics in perspective with the linguistic expression and the real world situation. In this respect, Lemke (1993) offers a well formulated theoretical foundation that "human communities are eco-social systems that persist in time through ongoing exchange with their environment; and the same holds true for any of their sub-subsystems [...]" including language. The social practices constituting such systems are both material and semiotic, with a constant dynamic interplay between the two. (Halliday 2002: 387)

To Halliday, the term *semiotic* accounts for an orientation towards meaning rather than sign. In other words, the interaction is between *the practice of doing and the practice of meaning.* As the two sets of practices are strongly coupled, Lemke points out that there is a high degree of redundancy between the *material-semiotic interplay.* And it perfectly resonates with Firth's idea of *mutual expectancy* between the text and the situation. This idea of interplay is incorporated in SFL as *language stratification* and is graphically represented in Figure 1.1.

Having that said, the stratification axis is a useful dimension to relate the formal and the systemic functional grammars. This is also an instrument employed by Hjelmslev (Taverniers 2011).
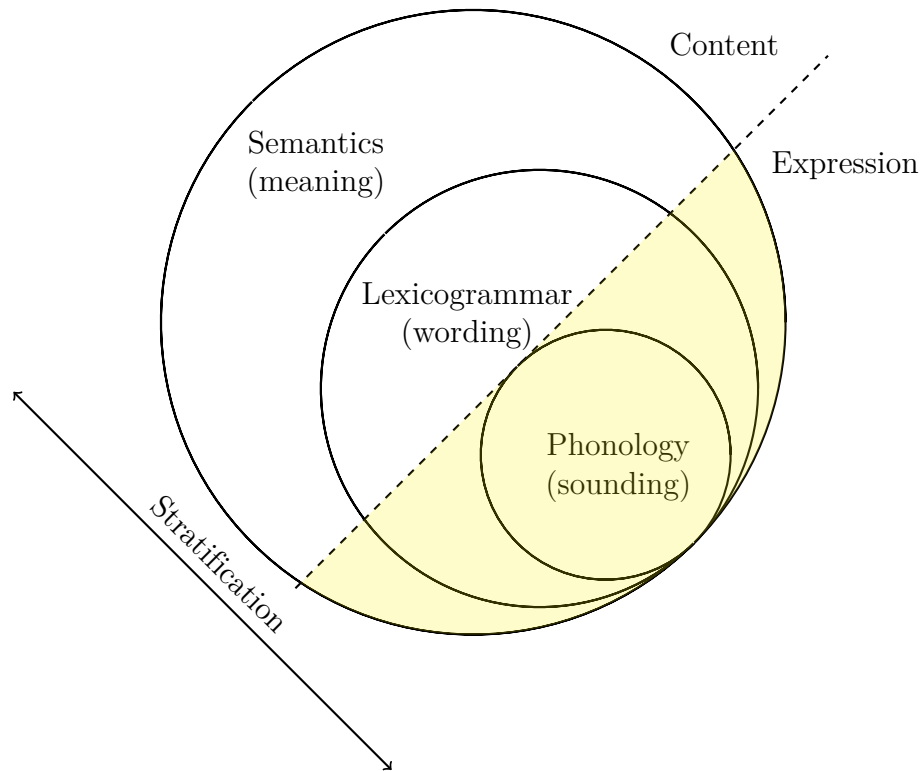
Fig. 1.1 The levels of abstraction along the realisation axis

The SFL model defines language as a resource organised into three strata: phonology (sounding), lexicogrammar (wording) and semantics (meaning). Each is defined according to its level of abstraction on the realisation axis. The realisation axis is divided into two planes: the expression and the content planes. Although debate about the precise division continues, for current purpose it is sufficient to see the first stratum (i.e. phonology/morphology) belongs to the *expression plane* and the last two (lexicogrammar and semantics) belong to the *content plane*. In this context, the formal grammar could be localised entirely within the expression plane, including the phonology/morphology, syntax, lexicon while formal semantics, stripped of any explanations in terms of the meaning potential, belongs in the content plane.

1.2   Sydney theory of grammar

I start introducing the terms of SFL theory with the Sydney grammar as this is in accordance with the historical development originating with Halliday (2002) defining the categories of the theory fo grammar. He proposes four fundamental categories:

unit, *structure*, *class* and *system*. Each of these categories is logically derivable from and related to the other ones in a way that they mutually define each other. These categories relate to each other on three scales of abstraction: *rank, exponence, delicacy.* Halliday also uses three scale types: *hierarchy, taxonomy* and *cline.*

Definition 1.2.1 (Hierarchy)**.** Hierarchy [is] a system of terms related along a single dimension which involves some sort of logical precedence. (Halliday 2002: 42).

Definition 1.2.2 (Taxonomy)**.** Taxonomy [is] a type of hierarchy with two characteristics:

1. the relation between terms and the immediately following and preceding one is constant

2. the degree is significant and is defined by the place in the order of a term relative to following and preceding terms. (Halliday 2002: 42)

Definition 1.2.3 (Cline)**.** Cline [is] a hierarchy that instead of being made of a number of discrete terms, is a continuum carrying potentially infinite gradations. (Halliday 2002: 42).

The concept of cline may not necessarily originate in SFL but it is used quite extensively in the domain literature. Next I define and introduce each category of *grammatics* and the related concepts that constitute the theoretical foundation for the Sydney Theory of grammar.

1.2.1   Unit

Language is a patterned activity of meaningful organization. The patterned organization of substance (*graphic* or *phonic*) along a linear progression is called *syntagmatic order* (or simply *order*).

Definition 1.2.4 (Unit)**.** The unit is a grammatical category that accounts for the stretches that carry grammatical patterns (Halliday 2002: 42). The units carry a fundamental *class* distinction and should be fully identifiable in description (Halliday 2002: 45).

Generalization 1.2.1 (Constituency principles)**.** The five principles of constituency in lexicogrammar are:

1. There is a scale or rank in the grammar of every language. That of English (typical of many) can be represented as: clause, group/phrase, word, morpheme.

2. Each unit consists of *one or more* units of rank next below.

3. Units of every rank may form complexes.

4. There is potential for rank shift, whereby a unit of one rank my be down-ranked to function in a structure of a unit of its own rank or of a rank below.

5. Under certain circumstances it is possible for one unit to be enclosed within another, not as a constituent but simply in such a way as to split the other into two discrete parts (Halliday & Matthiessen 2013: 9–10).

For example, the down-ranking (Point 4) can be observed in nominal groups that incorporate a relative clause functioning as qualifier. In example 1 *that I got for Christmas* is a relative clause specifying which books are being referred. The unit split (Point 5) can be encountered in the instances of Wh-interrogative clauses containing a preposition at the end which in fact belongs to the Wh-group. In example 2 the prepositional phrase *Who ... about* is gapped and has an inverted order of constituents.

(1)   I haven't read any books *that I got for Christmas.*

(2)   *Who* are you talking *about?*

(3)   I am talking about George.

The relation between units is that of consistency for which we say that a unit *consists of* other units. The scale on which the units are ranged is the *rank scale.* The rank scale is a levelling system of units supporting unit composition regulating how units are organised at different granularity levels from clause, to groups/phrases to words and the units of a higher rank scale consist of units of the rank next below. Table 1.1 presents a schematic representation of the rank scale and its derived complexes.

Rank scale ↓	Complexing
	Clause complex
Clause	
	Group(/phrase) complex
Group(/phrase)	
	Word complex
Word	
	(Morpheme complex)
(Morpheme)	

Table 1.1 Rank scale of the (English) lexicogrammatical constituency

Generalization 1.2.2 (Rank scale constraints)**.**   The rank relations are constrained as follows:

1. in general elements of clauses are filled by groups,the elements of groups by words and the elements of words by morphemes.

2. downward *rankshift* is allowed i.e. the transfer of a given unit to a lower rank.

3. upward rankshift is not allowed.

4. only whole units can enter into higher units (Halliday 2002: 44).

The Generalization 1.2.2 taken as a whole means that a unit can include, in what it consists of, a unit of rank higher than or equal to itself but not a unit of rank more than one degree lower than itself; and not in any case a part of any unit (Halliday 2002: 42).

Following the rank scale constraints above the concept of embedding can be defined as follows.

Definition 1.2.5 (Embedding)**.**   Embedding is the mechanism whereby a clause or phrase comes to function as a constituent within the structure of a group, which is itself a constituent of a clause. (Halliday & Matthiessen 2013: 242)

Halliday states that embedding is a phenomena that occurs only when a phrase/-group or clause function within the structure of a group which is itself a constituent of a clause (Halliday 1994: 242). The above definition of embedding permits the only for a clause and groups that function as elements of groups which means that a clause cannot fill the elements of another clause (Fawcett 2000: 237).

1.2.2   Structure

Definition 1.2.6 (Structure)**.**   The structure (of a given unit) is the arrangement of *elements* that take places distinguished by the order relationship (Halliday 2002: 46).

Definition 1.2.7 (Element)**.**   Element is defined by the place stated as absolute or relative position in sequence and with reference to the unit next below (Halliday 2002: 47).

We say that a unit is composed of elements located in places and that its internal structure is accounted for elements in terms of functions and places taken by the lower (constituting) units or lexical items. The graphic representation of the unit structure
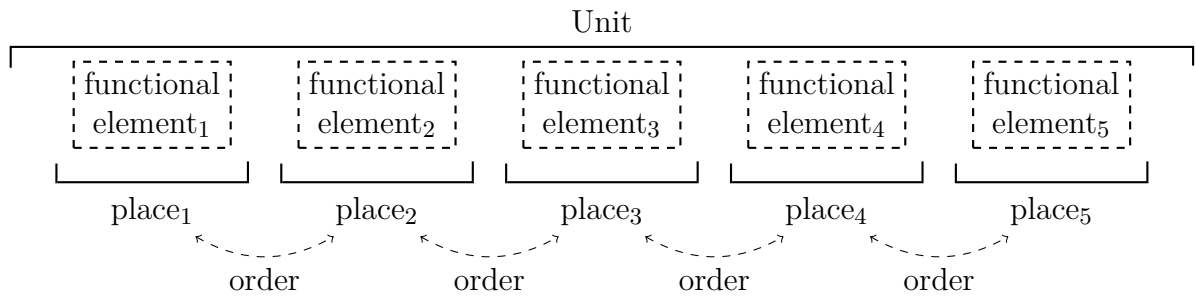
Fig. 1.2 The graphic representation of (unit) structure

is depicted in Figure 1.2. The unit structure is referred in linguistic terminology as *constituency* (whose principles are enumerated in Generalization 1.2.1). In the unit structure, the elements resemble an array of empty slots that are *filled* by other units or lexical items.

For example to account for the English clause structure four elements are needed: *subject*, *predicator*, *complement* and *adjunct*. They yield the distinct symbols, so that S, P, C, A is the inventory of elements. They then can be arranged in various orders falling in particular places, say SPC, SAPA, ASPCC etc. The places of elements are important with respect to the structure of the whole unit but also with respect to the relative ordering between these elements. For example S always fronts P, C is fronted by P unless the clause realises a Wh-interrogative whereas A is quite free and can occur anywhere in the unit structure.

1.2.3   Class

To one place in the structure corresponds one occurrence of the unit next below. This means that there will be a certain grouping of members identified by the functional element they take in the structure. Patterning such groupings leads to emergence of *classes* of units.

In the clause structure example, elements in the unit are occupied by units of lower rank and of a particular class. The relation between the element and the class is mutually determined. In each of these elements is placed a lower rank unit and of an expected class. For instance in the S position can be placed a *noun*, *nominal group*, *pronoun* or another *clause* (that will be a down-ranking situation defined above).

Definition 1.2.8 (Class)**.**   The class is that grouping of members of a given unit which is defined by the operation (i.e. functional element) in the structure of the unit next above (Halliday 2002: 49).

Halliday defines class (Definition 1.2.8) as likeness of the same rank *phenomena* to occur together in the structure. He adopts a top-down approach stating that the class of a unit is determined by the *function* (Definition 1.2.12) it plays in the unit above and not by its internal structure of elements. In SFG the structure of each class is well accounted in terms of syntactic variation recognizing six unit classes: *clause*, *nominal*, *verbal*, *adverbial* and *conjunction* groups and *prepositional phrase*. The Sydney grammar unit structure model is briefly summarised in the Appendix **??**.

1.2.4 System

As described above, structure is a syntagmatic ordering in language capturing regularities and patterns which can be paraphrased as *what goes together with what.* However in SFG most of the descriptive work is carried not syntagmatically but paradigmatically via *system networks* (Definition 1.2.9) describing *what could go instead of what* (Halliday & Matthiessen 2013: 22). Note that the paradigmatic-syntagmatic axes date back to the works of Saussure (1959 [1915]). Both are important for completing a linguistic description. Here lies one of the main differences between SFL and other approaches which is is taking the paradigmatic path whereas many others take the syntagmatic path to language representing it as an inventory of structures. The structure of course is a part of language description but it is only a syntagmatic manifestation of the systemic choices and one needs to account for both (Halliday & Matthiessen 2013: 23).

Definition 1.2.9 (System)**.** A system is a set of mutually exclusive set of terms referring to meaning potentials in language and are mutually defining. The system is considered self-contained, closed and complete with the following characteristics:

1. the number of terms is finite,

2. each term is exclusive of all others,

3. if a new term is added to the system it changes the meaning of all the other terms Halliday (2002: 41).

The concept of a system as presented in Definition 1.2.9 has its roots in the works of Saussure (1959 [1915]) and Hjelmslev (1953) and Halliday only cements it in SFL architecture of grammar.

Going back to the notion of class previously defined as a grouping of items identified by functions in the structure, it needs stressed here that class is not a list of formal items but an abstraction from them. By increase in *delicacy* a class is broken into secondary classes.

Definition 1.2.10 (Delicacy)**.**   Delicacy is the scale of differentiation or depth of detail whose limit at one end is the primary degree of categories of structure and class and on the other end, theoretically, is the point beyond which no further grammatical relations obtain. Halliday (2002: 58)

We say that a category is refined into more subtle distinctions of subcategories which form a system as define above. Subsequently those distinctions fo subcategories can be further refined in other systems. This relationship between these two systems is one of delicacy where the second one is more delicate than the first one and together they form a *system network.* As a side note, the delicacy in a system network is akin to sub-classification relation, which was originally the intended one and the predominant one. In practice, however, a few kinds of abstraction relations can be encountered as there are multiple kinds of abstraction (e.g abstraction as information reduction, or as approximation, or as idealisation etc.) that are extensively treated by Saitta & Zucker (2013). This discussion however is not in the scope of the current work.

The graphical notations introduced by Halliday & Matthiessen (2013) are useful in reading and writing system networks in this thesis. Below is a system network with a simple *entry condition* (Figure 1.3), a *system network grouping* that share the same entry condition (Figure 1.4), a system network with a *disjunctive* and *conjunctive* entry conditions (Figure 1.5 and 1.6).

$$a \;\rightarrow\; \left[\begin{array}{l} \text{x} \\ \text{y} \end{array}\right.$$
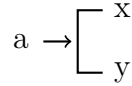
Fig. 1.3 A system with a single entry condition: if *a* then either *x* or *y*

$$a \;\left\{\begin{array}{l} \rightarrow \left[\begin{array}{l} \text{x} \\ \text{y} \end{array}\right. \\ \rightarrow \left[\begin{array}{l} \text{p} \\ \text{q} \end{array}\right. \end{array}\right.$$
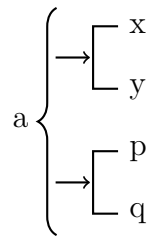
Fig. 1.4 Two systems grouped under the same entry condition: if *a* then both either *x* or *y* and, independently, either *p* or *q*
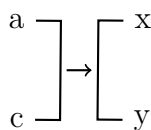
Fig. 1.5 A system network with a disjunctive entry condition: if either *a* or *c* (or both), then either *x* or *y*
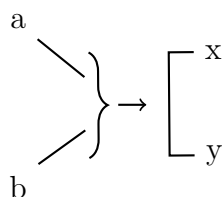
Fig. 1.6 A system with a conjunctive entry condition: if both *a* and *b* then, either *x* or *y*

It is worth noting that when a piece of language is analysed, it can be approached at various levels of delicacy. We say that delicacy is variable in description, and one may choose to provide coarse grained analysis without going beyond primary grammatical categories or it can dive into fine grained categorial distinctions, still being comprehensive with regards to the rank, *exponence* and grammatical categories.

Definition 1.2.11 (Exponence). Exponence is the scale which relates the categories of theory which are with high degree of abstraction to formal items on its low end. Each exponent can be linked directly to the formal item or by taking successive steps on the exponence scale and changing rank where necessary. Halliday (2002: 57)

And in relation to the previous section, the class stand in the relation of exponence to an element of primary structure of the unit next above. This breakdown gives a system of classes that constitute choices implied by the nature of the class (Halliday 2002: 41).

1.2.5 Functions and metafunction

Above, when talking about structure, I described a unit as being composed of elements accounted in terms of *functions* and places taken by the lower (constituting) units or lexical items.

Definition 1.2.12 (Function). The functional categories or functions provide an interpretation of grammatical structure in terms of the overall meaning potential of the language. (Halliday & Matthiessen 2013: 76).

Most constituents of clause structure, however, have more than one function, which is called a *conflation of elements*. For example in the sentence "Bill gave Dolly a rose", "Bill" is the Actor doing the act of giving but also the Subject of the sentence. So we say that Actor and Subject functions are conflated in the constituent "Bill". This is the concept of *metafunction* or *strand of meaning* comes into the picture. The Subject function is said to belong to the *interpersonal metafunction* while the Actor function belongs to the *experiential metafunction*.

Halliday identifies three fundamental dimensions of structure in the clause, each meaning: *experiential*, *interpersonal* and *textual*. He refers to them as *metafunctions* and they account for the functions that language units take on in communication. Table 1.2 presents the metafunctions and their reflexes in grammar as proposed by Halliday & Matthiessen (2013: 85).

Metafunction	Definition(kind of meaning)	Corresponding status in clause	Favored type of structure
experiential	construing a model of experience	clause as representation	segmental (based on constituency)
interpresonal	enacting social relationship	clause as exchange	prosodic
textual	creating relevance to context	clause as message	culminative
logical	constructing logical relations	complexes (taxis & logico-semantic type)	iterative

Table 1.2 Metafunctions and their reflexes in the grammar

Across the rank scale, with respect to structure and metafunctions, Halliday formulates the general principle of *exhaustiveness* (Generalization 1.2.3) saying that clause constituents have at least one and may have multiple functions in different strands of meaning; however this does not mean that it must have a function in each of them. For example interpersonal Adjuncts such as "perhaps" ot textual Adjuncts such as "however" play no role in the clause as representation.

Generalization 1.2.3 (Exhaustiveness principle)**.** Everything in the wording has some function at every rank but not everything has a function in every dimension of structure (Halliday 2002; Halliday & Matthiessen 2013).

This principle implicitly relates to the property of language meaning that there is nothing meaningless and thus every piece of language must be explained and accounted for in the lexicogrammar.

At the very top of the rank scale, clauses form complex structures. Halliday employs systematically the concepts of *taxis* and *logico-semantic relations* to account for inter-clausal relations.

Definition 1.2.13 (Taxis)**.** *Taxis* represents the degree of interdependency between units systematically arranged in a linear sequence where *parataxis* means equal and *hypotaxis* means unequal status of units forming a *nexus* together.

Of importance here is the concept of taxis which is very useful at describing unit relations not only at the group and clause ranks but all the way down to smallest linguistic unit such as morphemes and phonemes. I will also refer to it when describing the Cardiff theory of grammar and also briefly in the discussion of dependency relations in Section 2.5.

1.2.6   Lexis and lexicogrammar

In SFL the terms *word* and *lexical item* are not really synonymous. They are related but they refer to different things. The term *word* is reserved (in early Halliday) for the grammatical unit of the lowest rank whose *exponents* are lexical items.

Definition 1.2.14 (Lexical Item)**.** In English, a lexical item may be a *morpheme*, *word* (in traditional sense) or *group (of words)* and it is assigned to no rank (Halliday 2002: 60).

Examples of lexical items are the following: "'s" (the possessive morpheme), "house", "walk", "on" (words in traditional sense) and "in front of", "according to", "ask around", "add up to", "break down" (multi word prepositions and phrasal verbs).

If some theories treat grammar and lexis as discrete phenomena, Halliday brings them together as opposite poles of the same cline. He refers to this merge as *lexicogrammar* where they are paradigmatically related through delicacy relation. Hasan (2014), explores the feasibility of what would it mean to turn the "whole linguistic form into grammar". This then implies a assumption that lexis is not form and that its relation to semantics is unique which in turn is challenging the problems of polysemy.

1.3   The Cardiff theory of grammar

As presented in the introduction and explained by Bateman (2008), the accounts along the syntagmatic axis had gone missing in the Sydney grammar leaving unresolved how to best represent the structure of language at the level of form. This section present the theory of systemic functional grammar as conceived by Robin Fawcett at the University of Cardiff. His book "A theory of syntax for Systemic Functional Linguistics" (Fawcett 2000) presented a proposal for a *unified syntactic model* for SFL that contrasts several aspects of Hallidayan grammar but share the same set of fundamental assumptions about the language; it is an extension and a simplification in a way.

Fawcett questions the status of multiple structures in the theory and whether they can finally be integrated into a simpler sole representation. A big difference to Hallidayan theory is renouncing the concept of rank scale which has an impact on the whole theory. Another is the bottom-up approach to unit definition as opposed to top-down one advocated by Halliday. These two and a few other differences have important implications for the overall theory of grammar and consequently for the grammar itself. As a consequence, to accommodate the lack of rank-scale, Fawcett adapts the definitions of the fundamental concepts and changes his choice of words (for example "class" and "unit" turn into "class of unit" treated as one concept rather than two distinct ones).

Fawcett (2000) proposes three fundamental categories in the theory of grammar: *class of unit*, *element of structure* and *item*. Constituency is a relation accounting for the prominent compositional dimension of language. However a unit does not function directly as a constituent of another unit but via a specialised relation which Fawcett breaks down into three sub-relations: *componence*, *filling* and *exponence*. Informally it is said that a unit is composed of elements which are either filled by another unit or expounded by an item. He also proposes three secondary relations of *coordination*, *embedding* and *reiteration* to account for a more complete range of syntactic phenomena.

1.3.1   Class of units

Fawcett's theory of language assumes a model with two levels of *meaning* and *form* corresponding to *semantic units* and *syntactic units* which are mutually determined (which is the case for any sign in a Saussurean approach to language).

Definition 1.3.1 (Class of Unit)**.**   The class of unit [...] expresses a specific array of meanings that are associated with each one of the major classes of entity in semantics

[...and] are to be identified by the elements of their internal structure (Fawcett 2000: 195).

For English Fawcett proposes four main kinds of semantic entities: situations, things, qualities (of both situations and things) and quantities. Each of these semantic units corresponds to five major classes of syntactic units: *clause*, *nominal group*, *prepositional group*, *quality group* and *quantity group*. In addition he recognises two more minor classes i.e. the *genitive cluster* and the *proper name cluster* (Fawcett 2000: 193–194).

Fawcett's classification is based on the idea that the syntactic and semantic units are mutually determined and supported by grammatical patterns. However those patterns lie beyond the syntactic variations of the grammar and so blend into lexical semantics.

In Sydney theory the class is determined by the function it plays in the unit above. By contrast, in Cardiff theory, the class of unit is determined based on its internal structure i.e. by its *elements of structure* (and not by the function it plays in the parent unit).

1.3.2   Element of structure

The terms *element* and *structure* have roughly the same meaning as defined in Sydney theory of grammar (defined in Section 1.2) but with two additional stipulations presented below.

Definition 1.3.2 (Element of Structure)**.**   Elements of structure are immediate components of classes of units and are defined in terms of their *function* in expressing meaning and not in terms of their absolute or relative position in the unit. (Fawcett 2000: 213–214).

The definition above leads as a consequences to two important properties of elements formulated as follows.

Generalization 1.3.1 (Element functional uniqueness)**.**   Every element in a given class of unit serves a function in that unit different from the function of the sibling elements (Fawcett 2000: 214).

Even if for example, different types of *modifiers* in English nominal group seem to have very slight differences in functions, they are still there.

Generalization 1.3.2 (Element descriptive uniqueness)**.** Every element in every class of unit will be different from every element in every other class of unit (Fawcett 2000: 214).

Thus the terms of modifier and head shall not be used for more than one class of unit. In English grammar the head and modifier are used for nominal group only. And in other groups the elements of structure may seem similar to modifier and head, they still receive different names such as *apex* and *temperer* in the quality group.

The elements (of structure) are functional slots which define the internal structure of a unit but still they are *located* in *places*. One more category that intervenes between element and unit is the concept of *place* which become essential for the generative versions of grammar.

There are two ways to approach place definition. The first is to treat places as positions of elements relative to each other (usually previous). This leads to the need for an *anchor* or a *pivotal element* which may not always be present/realised.

The second is to treat places as a linear sequence of locations at which elements may be located, identified by numbers "place 1", "place 2" etc. This place assignment approach is absolute within the unit structure and makes elements independent of each other. This approach has been used in COMMUNAL (Fawcett 1990) and PENMAN (Mann 1983) projects.

1.3.3 Item

Definition 1.3.3 (Item)**.** The item is a lexical manifestation of meaning outside syntax corresponding to both words (in the traditional sense), morphemes and either intonation or punctuation (depending whether the text is spoken or written). (Fawcett 2000: 226–232).

Items correspond to the leaves of syntactic trees and constitute the raw *phonetic* or *graphic* manifestation of language. The collection of items of a language is generally referred to as *lexis*.

Since items and units are of different natures, the relationship between an element and a (lexical) item must be different from that to a unit. We say that items *expound* elements and not that they *fill* elements as units do.

Definition 1.3.4 (Exponence (restricted))**.** Exponence is the relation by which an element of structure is realised by a (lexical) item (Fawcett 2000: 254).

If in Sydney model exponence (Definition 1.2.11) is a relation that links abstract grammatical categorise to the data In Cardiff model it has a restricted meaning referring to relation between items and elements only.

1.3.4 Componence and obscured dependency

Definition 1.3.5 (Componence). Componence is the part-whole relationship between a unit and the elements it is composed of (Fawcett 2000: 244).

Note that componence is not a relationship between a unit and its places; the latter, as discussed in Section 1.3.2, simply locationally relate elements of a unit to each other.

Componence intuitively implies a part-whole constituency relationship between the unit and its elements. But this is not the only view. Another perspective is the concept of *dependency* (which I will address in Chapter 2) or strictly speaking the *sister* or *sibling dependency* (not parent-daughter). It is suitable for describing relations between elements of structure within a unit.

(4) the man with a stick

For example the componence of nominal group in Example 4 is (*dd h q*) which are symbols for (*determiner head qualifier*). The same can be expressed in terms of sibling dependency relations depicted in Figure 1.7. The relations from *stick* to *with a* are not depicted because they belong in description of prepositional group *with a stick*.
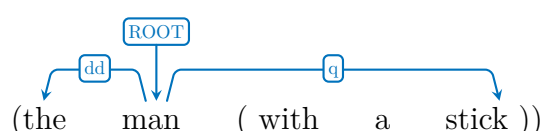
Fig. 1.7 Sibling dependency representation for "the man with a stick"

In both SFL theories, the sister dependency relations is considered a by-product or second order concept that can be deduced from the constituency structure thus unnecessary in the grammar model. I will come back to this point because current work relies on this dual view on elements of structure and relation to the whole unit.

The (supposed) dependency relation between a modifier and the head, in the framework of SFG is, not a direct one. Simply assume that what modifier modifies is the head. Here, however, the general function of the modifiers is to contribute to the meaning of the whole unit which is anchored by the head.

In the nominal group from Example 4, the *determiner* and *qualifier* are modifiers that contributes to the description of the referent stated by the *head*. So the head

realises one type of meaning that relates the *referent* while modifier realises another one. Both of them describe the referent via different kinds of meaning, therefore, according to Fawcett, they are related indirectly to each other because the modifier does not modify the head but the referent denoted by the head From this point of view, whether the element is dependent on a sibling element such as the head or on the parent unit is beside the point because in syntax we can observe its realization in system networks (Fawcett 2000: 216–217). Next I move towards last concept in Cardiff model, that of *filling*, which is a relation between the elements of structure and the units below.

1.3.5 Filling and the role of probabilities

Definition 1.3.6 (Filling)**.** Filling is the probabilistic relationship between a element and the unit lower in the tree that operates at that element (Fawcett 2000: 238, 251).

Fawcett replaces the rank scale with the concept of *filling probabilities.* The probabilistic predictions are made in terms of filling relationship between a unit and an element of structure in a higher unit in the tree rather than being a relationship between units of different ranks. This moves focus away from the fact that a unit is for example a group, and towards what group class it is.

In this line of thought, some elements of a clause are frequently filled by groups, but some other elements are rather *expounded* by items. The frequency varies greatly and is an important factor for predicting or recognizing either the unit class or the element type in the filling relationship.

Filling may add a *single unit* to the element of structure or it can introduce *multiple coordinated units.* Coordination (Example 5) is usually marked by an overt *Linker* such as *and*, *or*, *but*, etc. and sometimes is enforced by another linker that introduces the first unit such as *both*.

Definition 1.3.7 (Coordination)**.** Coordination is the relation between units that fill the same element of structure (Fawcett 2000: 263).

(5) she is (friendly, nice and polite)

(6) she is (very very) nice!

Coordination is through by Fawcett as being not between syntactic units but between mental referents. It always introduces more than one unit which are syntactically and semantically in similar (somehow) resulting in a *syntactic parallelism* which often leads to *ellipsis*.

Definition 1.3.8 (Reiteration)**.** Reiteration is the relation between successive occurrences of the same item expounding the same element of structure (Fawcett 2000: 271).

Reiteration (Example 6) often is used to create the effect of emphasis. Like coordination, reiteration is a relation between entities that fill the same element of the unit structure which is problematic in my opinion and I further discuss it in Section 1.4.6.

Filling also makes possible the embedding relation which Fawcett treats as a general principle in contrast to more specific Definition 1.2.5 from Sydney model.

Definition 1.3.9 (Embedding (generic))**.** Embedding is the relation that occurs when a unit fills (directly or indirectly) an element of the same class of units; that is when a unit of the same class occurs (immediately) above it in the tree structure (Fawcett 2000: 264).

(7)   (To become an opera singer) takes years of training.

(8)   The girl (whom he is talking to) is an opera singer.

In Example 7 we can see an occurrence of direct embedding where an infinite clause acts as the subject of another clause. In Example 8 the embedding is indirect as the relative clause is part of the nominal group which functions as the subject in the parent clause. In both cases we say that a lower clause is embedded (directly or indirectly) in higher or parent clause. I will further discuss this in the context of rank-scale concept in Section 1.4.1.

A situation converse to reiteration and coordination where a element is filled by more than one unit, is known as *conflation* where a unit can take more than one function within another.

Definition 1.3.10 (Conflation)**.** Conflation is the relationship between two elements that are filled by the same unit having the meaning of "immediately after and fused with" and function as one element (Fawcett 2000: 249–250).

Conflation is useful in expressing multi-faceted nature of language when for example syntactic and semantic elements/functions are realised by the same unit. For example the Subject "the girl whom he is talking to" is also a *Carrier* while the Complement "an opera singer" is also an *Attribute*. Also conflation relations frequently occur between syntactic elements as well such as for example the *Main Verb* and *Operator* or *Operator* and *Auxiliary Verb*.

Both, coordination and embedding relations make it possible to deal without inter-clausal *hypotaxis* and *parataxis* relations described in Sydney Grammar.

Note also that filling and componence are two complementary relations that occur in the syntactic tree down to the level when the analysis moves out of abstract syntactic categories to more concrete category of items via the relationship of exponence.

1.4   Critical discussion on both theories

The two sections above cover the definitions and fundamental concepts from each of the two systemic functional theories of grammar. The work in this thesis uses a mix of concepts from both theories and this section discusses in detail what is being adopted and why attempting a rather pragmatic reconciliation for the purposes of achieving a parsing system than a theoretical debate. Next I draw parallels and highlight correspondences between the Sydney and Cardiff theories of grammar and where alter and present my position on the matter.

1.4.1   Relaxing the rank scale

The *rank scale* proposed by Halliday (2002) became over time a highly controversial concept in linguistics. The discussion whether it is suitable for grammatical description or not still continues. The historic development of this debate is documented in some detail (Fawcett 2000: 309–338).

In this section I present a few cases that highlighting when the rank scale as defined by Sydney is too rigid. As a consequence for the purpose of thesis I drop the *rank scale constraints* as enunciated in Generalization 1.2.2. Also the *rankshift* operation, exceptionally employed to accommodate special cases, is overridden by a broad definition of *embedding* operation (Definition 1.3.9) treated as naturally occurring phenomena in language at all ranks. I do not entirely dismiss the concept of rank scale as proposed in Cardiff school as I still find it useful in classification of units.

(9)   some very small wooden ones

Consider the nominal group 9. Here the modifying element, the Epithet "very small", is not a single word but a group (Halliday & Matthiessen 2013: 390–396). As the rank scale constraints mentioned above state that the group elements need to be filled by words. To account for this phenomena, Halliday, introduces a *substructure* of modifiers and heads leading to a logical structure analysis as the one in Table

1.3. In such a structure the modifier is further broken down into a Sub-Head and Sub-Modifiers.

some	*very*	*small*	*wooden*	*ones*
	Modifier			Head
δ	γ		β	α
	Sub-Modifier	Sub-Head		
	$\gamma\beta$	$\gamma\alpha$		

Table 1.3 Sydney logical structure analysis of Example 9

The corresponding experiential structure analysis is provided in the Table 1.4. Accordingly, the Epithet "very small" is composed of a quality adjective "small" and an enhancer modifier "very".

some	*very*	*small*	*wooden*	ones
Deictic	Epithet		Classifier	Thing
	Sub-Modifier	Sub-Head		

Table 1.4 Sydney experiential analysis of Example 9

As you can see the elements are further broken down into sub-elements composing in a way a structure of their own. This is possible because of the poly-structural and multi functional approach to text analysis which in this case leads to a complex structure of a nominal group. This kind of intricate cases can be simplified through the permission that elements of a group to be filled by other groups or expounded by words. This way, instead of having a sub-modifier construction simply consider that the Epithet is filled by an adjectival or nominal group which in turn has its own structure. Please note that I mention adjectival or nominal group because in Sydney grammar the adjectival group is considered as a nominal group with covert Thing where the Epithet acts as Head; this however is a discussion beyond the point I make here.

The same example analysed with Cardiff grammar would look like in Table 1.5. It follows precisely the above suggestion of filling the Epithet with another unit, in this case a Quality Group which in turn has its own internal structure.

some	*very*	*small*	*wooden*	*ones*
Quantifying Determiner	Modifier		Modifier	Head
	Quality Group			
	Degree Tamperer	Apex		

Table 1.5 Cardiff analysis of Example 9

(10)   Indians had originally planned to present the document to President Fernando
        Henrique Cardoso.

Indians	*had*	*originally*	*planned to present*	*the document*	*to President Fernando Henrique Cardoso*
Mood		Residue			
Subject	Finite	Adjunct	Predicator	Complement	Adjunct
nominal group		adverbial group verbal group		nominal group	prepositional phrase

Table 1.6 Sydney grammar Mood analysis of Example 10

Another case that deems the rank scale constraints too strict for the present work is in the case of Finite element in the Clause. Consider example 10 where the Finite and Predicator elements are filled by a single unit which is the verbal group which is against the constituency principles which restricts the composition relation to engage only with whole units.

Alternatively, if the unit filling the Finite element is considered separate from the verbal group filling the Predicator then it is always a single word, a modal verb, and never a verbal group. This again is a breach in the rank scale constraints which postulates that a unit may be composed of units of equal rank or a rank higher and cannot be composed of units that are more than one rank lower thus it is not permitted to have clause elements expounded by words directly.

The two cases above I use to demonstrate how the ranks scale construct as defined by Sydney grammar is too rigid and thus unsuitable for the current work. I drop the constituency constraints hence allowing the flexibility for elements to be filled by other units or, in other words, allow unit *embedding.* This approach removes the need of sub-structures in the unit elements reducing thus the structural complexity as seen in Table 1.5.

The weakening of constituency constraints makes embedding a normal (broadly defined in Definition 1.3.9) rather than an exceptional phenomena (strictly defined in Definition 1.2.5).

An approach to describe units outside the rank-scale was suggested by Fawcett (2000) and Butler (1985). Fawcett proposes replacing it with the filling probabilities to guide the unit composition simply mapping elements to a set of legal unit classes that may fill it. Units are carriers of a grammatical pattern, they can be described in terms of their internal structure instead of their potential for operation in the unit above. Nonetheless I do not abandon the rank scale completely and I use it as the top level classifier of grammatical units (see Figure 1.8) falling in line with more traditional syntactic classes.

1.4.2 The (unit) classes

In SFL at large there is the consensus that linguistic forms and meanings are intertwined and mutually determined just like for any sign in a Saussurean approach to language. Both Halliday (quote below) and Fawcett (Definition 1.3.1) adopt this position.

> something that is distinctly non-arbitrary [in language] is the way different kinds of meaning in language are expressed by different kinds of grammatical structure, as appears when linguistic structure is interpreted in functional terms (Halliday 2003).

When it comes to establishing the lexicogrammatical classes the two schools diverge. Halliday adopts the traditional grammar *word classes* or *parts of speech*: noun, verb, adjective etc. He then derives a set of groups (e.g. nominal group, verbal group, adverbial group etc.) that share properties of the word classes. In fact the class, in Halliday's words, "indicates the in a general way its potential range of grammatical functions" (Halliday & Matthiessen 2013: 76). For example the nominal group is a formation that functions as a noun may do and expresses same kind of meaning.

Following the idea that major semantic classes of entities (situations, things, qualities and quantities) correspond to the major syntactic units, Fawcett decided to mirror them into the lexicogrammar. This lead to a semantically based classification of syntactic units: clause, nominal group, prepositional group, quality group and quantity group (Fawcett 2000: 193–194) along with a set of minor classes such as genitive and proper name clusters. This is, in a way, a tight coupling of the grammatical units with an ontology which may be subject to change in the future.

The converse may also be stated that the traditional part of speech are disconnected from the semantics in the sense that there is no one to one correspondence (as Fawcett attempts) but rather complex set of mappings. Establishing the exact interface of syntax and semantics is a hot ongoing theoretical exploration across the entire linguistic discipline a difficult task in practice. This discussion however is beyond the scope here.

In the current work I side with the Sydney classification of syntactic units that is close in line with traditional syntactic classifications (Quirk et al. 1985). I adopt the clause as a unit plus the four group classes of the Sidney grammar depicted in Figure 1.8.

(a) The group classes
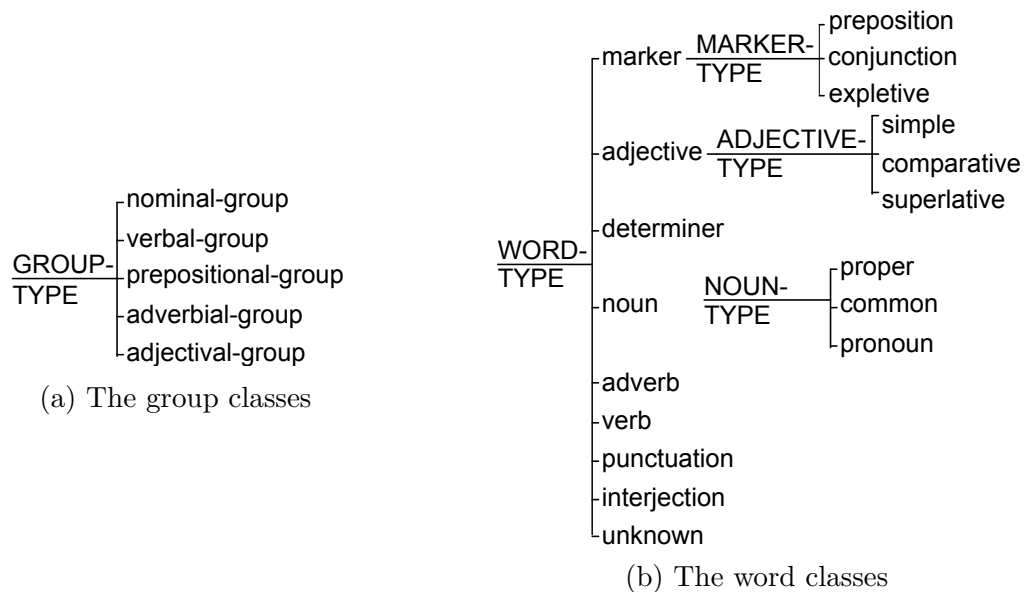
(b) The word classes

Fig. 1.8 The group and word classes

The word classes or part of speech tags that I adopt here are the ones employed to annotate Penn Treebank corpora called the Penn tag set (Marcus et al. 1993) which, like Sidney unit classes, are also in line with the traditional grammar. This tag set has become a widely accepted standard in mainstream computational linguistics and there are multiple implementation of the part of speech taggers. The Stanford Parser which plays an important role in the software implementation of this thesis and is described in the Chapter 2, employs precisely the Penn tag set.

The Penn tag set was developed to annotate the Penn Treebank corpora (Marcus et al. 1993). It is a large, richly articulated tag set that provides distinct codings for classes of words that have distinct grammatical behaviour.

The Penn tag set is based on the Brown Corpus tag set (Kucera & Francis 1968) but differs in several ways. First, the authors reduced the lexical and syntactic redundancy. In the Brown corpus there are many unique tags to a lexical item. In the Penn tag set the intention is to reduce this phenomenon to a minimum. Also distinctions that are recoverable from lexical variation of the same word such as verb or adjective forms or distinctions recoverable from syntactic structure are reduced to a single tag.

Second the Penn Corpus takes into consideration the syntactic context. Thus the Penn tags, to a degree, encodes syntactic functions when possible. For example, *one* is tagged as NN (singular common noun) when it is the head of the noun phrases rather than CD (cardinal number).

Third, Penn POS set allows multiple tags per word, meaning that the annotators may be unsure of which one to choose in certain cases. There are 36 main POS and 12 other tags in the Penn tag set. A detailed description of the schema, the design principles and annotation guidelines are described in (Santorini 1990). Figure 1.8 depicts a classification summarising the Penn tag set.

1.4.3 The structure

The *unit* and *structure* are two out of the four fundamental categories in the systemic theories of grammar. Sydney and Cardiff theories vary in their perspectives on *unit* and *structure* influencing how units are defined and identified.

For Halliday, the *structure* (Definition 1.2.6) characterises each unit as a carrier of a pattern of a particular order of *elements*. The order is not necessarily linear realisation sequence but a theoretical relation of relative or absolute placement. This perspective has been proved useful in generation exercises where unit placement evolves in the realisation process.

The Cardiff School take a bottom up approach and defines class in terms of its internal structure describing a relative or absolute order of elements. This sort of syntagmatic account is precisely what is deemed useful in parsing and is the one adopted in this thesis. It is well established algorithmically how to recognise classes and construct them bottom up. So in our case easier to let the unit class emerge from recognition of constituent part-of-speech (word classes) and dependency relations between words or sequence of lower unit classes. In other words the unit class is defined by the unit structure and not by it's function in the parent unit, as Sydney school predicates, and this is precisely the reason why creation of constituency structure is computationally accessible.

1.4.4 Syntactic and semantic Heads

In SFG the heads may be semantic or syntactic. In most cases they coincide but there are exceptions when they differ or even miss. This is especially an important topic in the discussions of the nominal group structure on which Halliday & Matthiessen (2013) offer a thorough examination but Fawcett (2000) offers us a more generic perspective on this issue.

Consider the example of nominal group "a cup of tea" analysed in three different ways in the Table 1.7. The Sydney Grammar offers two analyses in which the semantic and the syntactic heads differ. In the *experiential* analysis the head is "tea" which

functions as *Thing*, while in the *interpersonal* analysis the head is "cup" which functions as *Head*.

Cardiff Grammar does not make the Head/Thing distinction because the functional elements are already established based on semantic criteria. discussed in subsection 1.5.3. Nevertheless the logical analysis of SG resonates closely with the traditional "semantically blinded" grammars because it always provides a syntactic Head even if differs from the "pivotal element" of the group.

		a	**cup**	**of**	**tea**
Sidney Grammar	experiential	*Numerative*			*Thing*
	interpersonal	*Modifier*	*Head*	*Qualifier*	
Cardiff Grammar		*Quantifying Determiner*		*Selector*	*Head*

Table 1.7 Example of dispersed semantic and syntactic heads

Fawcett argues that none of the constituting elements of the unit is mandatory realised even the so called *"pivotal element"* which is the group defining element. The logical structure heads are always realised and correspond dependency relations established in the DG. Depending on the unit class logical structure heads are conflated with specific functions, for instance in nominal group the Head is usually conflated with the Thing, in quality group with the Apex, in quantity group with the Amount, in clause with the Main Verb and so on. But in language it is not unusual to have nominal groups with the Thing missing or elliptic clauses with missing the Main verb so no rigid correspondence can be established between the Head, unit class and the corresponding pivotal element of the group. So because the unit class depends on its internal structure leading to a circular interdependency between the unit class and the unit structure. To solve this issue Fawcett argues for bototm-up approach where head-modifier relations are identified between lexical items and then between units (i.e. groups and clauses) serving as cues to identify elements of the higher unit and therefore it's class. Usually the class membership of head is raised to the unit class although sometimes the presence or absence of certain elements (during the reconstruction process) may alter the unit class to a different from the logical head.

(11)   The old shall pass first.

Consider the nominal group "The old" which is the subject in example 11. The head of the nominal group is the adjective "old" and not a noun as it would normally be expected. The noun modified by the adjective "old" is left covert and it shall be recoverable from the context. We can insert a generic noun "one" to form a canonical

noun group:"the old one". In such cases when the head noun is missing, the logical head is conflated with other element in this case the Epithet. The group class is not raised from the word class to quality group but is identified by internal structure of the whole group and in this case the presence of determiner signals a nominal class. I point out through this example that the class of the head is not always is raised to establish the group class but the whole underlying structure determines the group class.

1.4.5 Systems and systemic networks

Fore example consider polarity system represented in figure 1.9. It contains two choices either positive or negative. And when one says it is positive one means not negative which is obvious and self evident how the two choices are mutually exclusive.
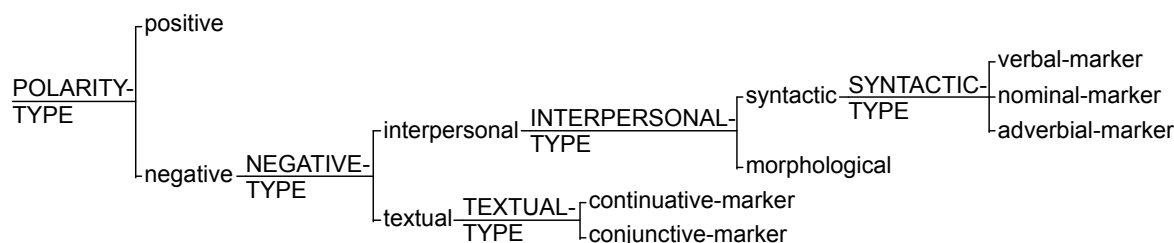
Fig. 1.9 System network of POLARITY

In language it may be often the case that a choice in a system may lead to re-entering the same system again to make another choice again forming this way recursive systems. Alternatively, we can say that a system allows multiple choices for the same unit. These perspectives are the sides of the same coin where the recursion perspective is useful for natural language generation while multiple choice perspective suits better the parsing task and next I explain why by continuing the discussion on polarity system.

The negative polarity in English clauses can be realised in several ways: via a noun group with intrinsic negative polarity feature like *"nobody"* (12), negation particle of the verb *"n't"* (13) or adverb with intrinsic negative polarity (14).

(12)   Nobody with any sense is going.

(13)   I don't have to mow my lawn.

(14)   Never expect her to come back.

Consider now, the cases of double negation from the example 15 where two kinds of negations are realised in the same clause: the negation by verb particle *"n't"* and the pronoun *"nobody"*.

(15) Nobody with any sense isn't going.

(16) I don't have nobody to mow my lawn.

The systems can be recursive and thus choices are not always mutually exclusive. Even though the system network clearly distinguishes one type of negation from another multiple negations can still occurring simultaneously. Note that this more delicate distinctions in kind of negation, still is a negation and for any of them it is impossible to co-occur with positive polarity. The issue here is not semantic about whether the clause is positive or negative but what kinds of grammatical choices can be identified within the clause. The problem of whether the double negation shall be interpreted as positive is not necessarily as relevant as the task of identifying the two instances of negation.

Halliday states that the speaker makes only one choice from a system. If this rule is interpreted as two choices from the same system at a time being impossible then it clearly does not cover the recursive systems and needs weakening to accommodate border cases. I propose relaxing the constraint of *mutual exclusivity* to *disjunction*. Correspondingly, two types of systemic networks emerge differing by *the relation among choices*: the original Hallidayan XOR systems (such as POLARITY TYPE in figure 1.9) and the OR systems for accommodating cases of multiple feature selections (such as SYSTEMIC TYPE in the same figure).

As system is expanded in delicacy to forms a systemic network of choices. Choice of a feature in one system becomes the entry condition for choices in more delicate systems below. I turn now to discuss the relationship types of relationships forming entry conditions to more delicate systems. For instance, an increase in delicacy can be seen as a taxonomic "is a" relationship between features of higher systems and lower systems like in the case of POLARITY TYPE and NEGATIVE TYPE in figure 1.9.
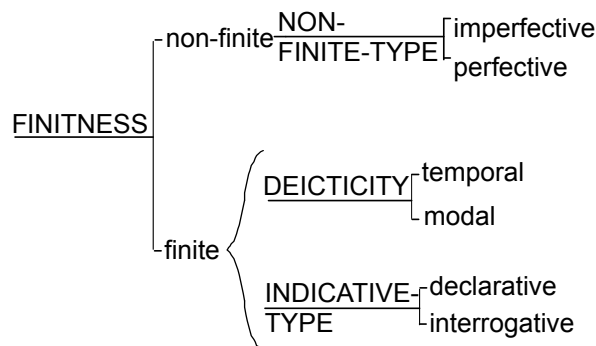

Fig. 1.10 A fraction of the finiteness system where increase of delicacy is not "is a" relation

The activation relation among systems in the cline of delicacy is not always tax-onomic. Another relation is "enables selection of" without a any sub-categorisation implied. For example see FINITENESS system in figure 1.10 where in case that the finite option is selected then what this choice enables are not subtypes of finite but merely other options that become available i.e. DEIXIS and INDICATIVE TYPE. The latter is there because selection of finite implies also selection of indicative feature in a FINITNES's sibling system MOOD-TYPE comprised of options indicative vs. imperative.

In this subsection I defined the system and systemic network, presented two system types by the relationship between their choices and distinguished two kinds of activation relations between systems on the cline of delicacy.

1.4.6   coordination as unit complexing

In SG unit complexes fill an important part of the grammar along with the *taxis relations* which express the interdependency relations in unit complexes. *Parataxis* relations bind units of equal status while the *Hypotaxis* ones bind the dominant and the dependant units. Fawcett bypasses the taxis relations replacing them with coordination and embedding (Fawcett 2000: 271) seemingly an oversimplified approach leading to abandonment of unit complexing as well. While embedding accounts for the depth and complexity of syntax his approach to coordination is problematic. I further discuss and argue for utility of unit-complexes for the coordination but this idea can be further extended to other phenomena which involve fixed idiomatic structures such as comparatives or conditionals.

Coordination is challenge not only for SFL but for other linguistic theories as well. CG treats this phenomena as two or more units filling or expounding the same element. For example, in table 1.8 "his shirt" and "and his jeans" are two nominal groups that are siblings and both of them fill the same complement.

Ike	*washed*	*his*	*shirt*	*and*	*his*	*jeans*
Subject	Main Verb	Complement				
		Nominal Group			Nominal Group	
		Deictic Determiner	Head	&	Deictic Determiner	Head

Table 1.8 Coordination analysis in Cardiff Grammar

In SG the coordination is analised as a *complex unit* held together through paratactic relations ensuring that only one unit fills an element of the parent constituent in our

example the complement of the clause. The table 1.9 illustrates an example analysis involving the complex unit approach.

Ike	washed	his	shirt	and	his	jeans
Subject	Predicate/Finite	Complement				
		nominal group complex				
		1		+2		
		Deictic	Thing	&	Deictic	Thing

Table 1.9 Coordination analysis in Sydney Grammar

The opinions are divided by whether to invite the notion of a complex unit to handle coordination or not. If we dismiss the unit complex then an element could be filled by more than one units and if we adopt it then the complexing relations need to be accounted along with unit class and what is its structure.

I would argue for adoption of such unit type for two reasons. First, only units are accounted for structure while the elements can only be filled by an unit. Allowing multiple units to fill an element requires accounting at least for order if not also for the relation between the units. The structure as it is described in theories of grammar by Halliday (Halliday 2002) and Fawcett (Fawcett 2000) is defined in the unit and not the element. A unit has a specific possible structure in terms of places of elements however if an element is filled by two units simultaneously it constitutes a violation of the above principle as the order of those units is not accounted for but it matters.

(17)   (Both my wife and her friend) arrived late.

(18)   * (And her friend both my wife) arrived late.

(19)   I want the front wall (either in blue or in green).

(20)   * I want the front wall (or in green either in blue).

If the order would not have mattered then we could say that the conjunctions from the example 17 can be reformulated into 18 and the one from 19 into 20. But such reformulations are grammatically incorrect. Obviously the places do matter and they need to be described in the unit structure.

Secondly, the lexical items that signal the conjunction are not a part of the conjuncted units. This is contrary to what is being described in Cardiff and Sydney grammars. Fawcett present the Linker elements (&) which are filled by conjunctions as parts of virtually any unit class placed in the first position of the unit. Halliday omits to discuss in IFG (Halliday & Matthiessen 2013) the place of Linkers but implicitly proposes the same as Fawcett through his examples of paratactic relations at various

rank levels where the lexical items signalling conjunction are included in the units they precede.

For example in the "or in green" the presence of "or" signalls the presence at least of one more unit of the same nature and does not contribute to the meaning of the prepositional group but to the meaning outside the group requiring presence of a sibling. Even more, the lack of a sibling most of the time would constitute an ungrammatical formulation. I say sometimes because it is perfectly acceptable to start a clause/sentence with a conjunction most often "but". But even in those cases it still invites the presence of a sibling clause/sentence preceding the current one to be resolved at the discourse level.

So conjunctions and pre-conjunctions shall not be placed as elements of the conjuncted units because they do not contribute to their meaning.

Adopting the unit complex and in particular coordination unit requires two clarifications (1) does the unit complex carry a syntactic class, and if so according to which criteria is it established? (2) Does it have any intrinsic features or not?

Zhang states in her thesis that the coordinating constructions do not have any categorial features thus there is no need to provide a new unit type. Instead the categorial properties of the conjuncts are transferred upwards (Zhang 2010). For example if two nominal groups are conjuncted then the complex receives the nominal class. This principle holds for most of the cases however there are rare cases when the units are of different classes. Consider the example 21 where the conjuncts are a nominal group "last Monday" and a prepositional group "during the previous weekend".

(21)   I lost it (either last Monday or during the previous weekend).

In this case there are two unit types that can be raised and it is not clear how to resolve this case. Options are to leave the class unspecified, transfer the class of the first unit upwards, or semantically resolve the class as both represent temporal circumstances even if they are realised through two different syntactic categories. Another option is to leave the class generic and assign the conjunction unit the class of *"coordination complex"* without sub-classifying it according to the constituent units below, i.e. without upward unit class transfer.

I address the second question regarding the intrinsic features of the complex unit. The coordination complex can have categorial features which none of the constituting units has. In the example 22 the conjunction of two singular noun groups requires plural agreement with the verb. Even though semantic interpretation that only one item is selected at a time, syntactically both items are listed in the clause and attempting third person singular verb forms like in 23 is grammatically incorrect.

(22)   A pencil or a pen **are** equally good as a smart-phone.

(23)   * A pencil or a pen **is** equally good as a smart-phone.
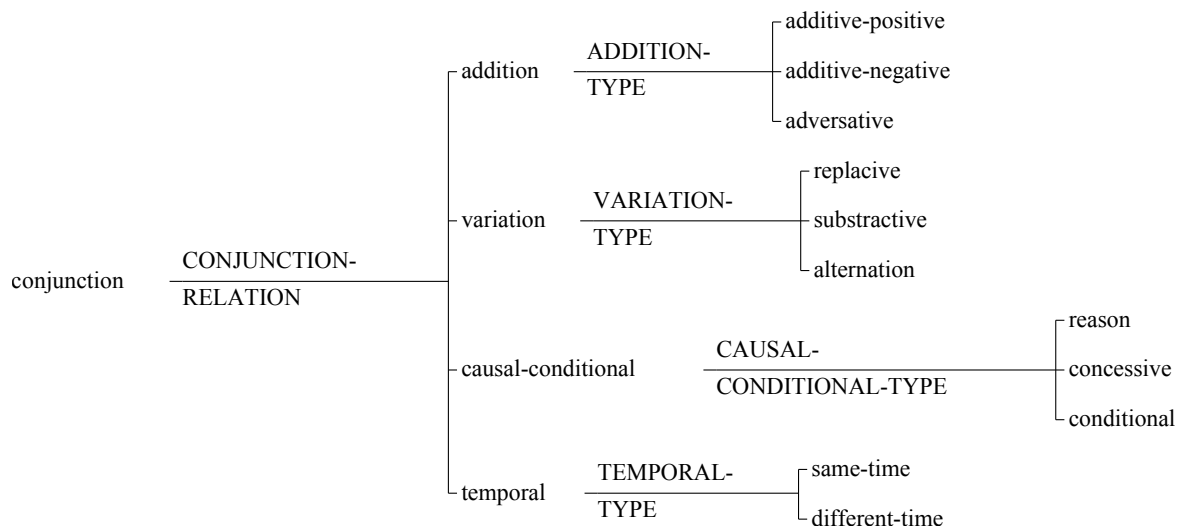
Fig. 1.11 Systemic network of coordination types

In the case of nominal group conjunction we can see that the plural feature emerges even if each individual unit is singular. For other unit classes it is not so obvious whether there are any linguistic features that emerge to the conjunction level. The meaning variation is rather semantic as for example conjunction of two verbs or clauses might mean very different things like consecutive actions, concomitant actions or presence of two states at the same time and so on. This brings us to another feature of the coordination complex - the type of the relationship it constructs. The lexical choice of head conjunct is the indicator of relationship among the conjuncts. Either *and*, *or*, *but*, *yet*, *for*, *nor* or *so* they express different meanings which are well representable as a relationship types systemic network in figure 1.11.

Adopting the unit complexing enables various kinds of constructions and coordination is only one of them. Below we discuss taxis relations and their role in unit complexing.

1.5   Critical discussion of the grammatical units

Now that the important theoretical details have been covered I would like focus on the grammars of the two schools. They have common parts and also differ in large parts on their paradigmatic and syntagmatic descriptions. This section discusses the main units considered in each of the grammars. Like in the previous section I argue on pragmatic

grounds for adoption of unit structures from either grammar. This may seem like an inconsistency add below I try to convince you of the opposite below. The argument runs along the line that some unit structures are closer to the syntactic analysis and thus are easier to detect and parse and the other ones may be a level of abstraction higher falling more on the semantic grounds thus becoming more difficult to capture in structural variance and requiring lexico-semantic resources.

For the reasons of limited space I skipped introducing the Sydney and Cardiff grammars and in turn assume that the reader is familiar with the details fo both of them. And for a general overview of the unit structure in each of the grammars please refer to Appendix **??**. Nevertheless, as it is a parallel contrastive discussion, even if the reader is familiar with one grammar only I hope it becomes clear how does certain phenomena are dealt with in the other one.

1.5.1 The verbal group and clause division

In SG the verbal group is described as an expansion of a verb just like the nominal group is the expansion of the noun(Halliday & Matthiessen 2013: 396). There are certainly words that are closely related and syntactically dependent on the verb all together forming a unit that functions as a whole. For example the auxiliary verbs, adverbs or the negation particles are words that are directly linked to a lexical verb. The verb group functions as Finite + Predicator elements of the clause in mood structure and as Process in Transitivity structure.

In CG the verb group is dissolved moving the Main Verb as the pivotal element of the Clause unit. All the elements that form the clause structure and those that form the verb group structure are brought up together to the same level as elements of a clause. The clause structure in CG comprises elements with clause related functions(like Subject, Adjunct, Complement etc.) and other elements with Main Verb related functions(Auxiliary, Negation particle, Finite operator etc.).

Regarding from the Hallidayan rank scale perspective, merging the elements of the verb group into clause structure is not permitted because the units are of different rank scales. However it is not a problem for the relaxed rank scale version presented in subsection 1.4.1. The reason for adopting such an approach is best illustrated via complex verb groups with more than one non-auxiliary verb such as in examples 24–26.

Next I address the impact of this merger on (a) the clause structure (b) the clause boundaries and (c) semantic role distribution within the clause.

(24) (The commission **started to investigate** two cases of overfishing in Norway.)

(25)   (The commission **started** (**to investigate** two cases of overfishing in Norway.))

(26)   (The commission **started** (**to finish** (**investigating** two cases of overfishing in Norway.)))

In SG "started to investigate" (example 24) is considered a single predicate of investigation which has specified the aspect of event incipiency despite the fact that there are two lexical verbs within the same verbal group. The "starting" doesn't constitute any kind of process in semantic terms but rather specifies aspectual information about the investigation process. The boundaries of the clause governed by this predicate stretch to entire sentence.

Semantically it is a sound approach because despite the presence of two lexical verbs there is only one event. However allowing such compositions leads to unwanted syntactic analysis for multiple lexical verb cases like in example 26.To solve this kind of problems Fawcett dismisses the verb groups and merges their elements into clause structure. He proposes the syntactically elegant principle of *"one main verb per clause"* (Fawcett 2008). Apply this principle to the same sentence yields a structure of two clauses illustrated in example 25 where the main clause is governed by the verb "to start" and the embedded one by the verb "to investigate". Note the conflict between "one main verb per clause" with Halliday's principle that only whole units form the constituency of others (the (c) principle of rank scale described in subsection 1.4.1). So allowing incomplete groups into the constituency structure would breach entire idea of unit based constituency.

Semantically the clause in SFL is a description of an event or situation as a figure with a process, participants and eventually circumstances where the process is realised through a lexical verb. Looking back to our examples, does the verb "to start" really describes a process or merely an aspect of it? Halliday treats such verbs as aspectual and when co-occurring with other lexical verbs are considered to form a single predicate. Accommodating Fawcett's stance, mentioned above and contradicting Halliday's approach, requires weakening the semantic requirement and allowing aspectual verbs to form clauses that contribute *aspectually or modally* to the embedded ones. I mention also the modal contribution because some verbs like *want, wish, hope*, etc. behave syntactically exactly like the aspectual ones. Moreover, Fawcett introduces into CG Transitivity network "influential" process type including all categories of meanings that semantically function as process modifiers: tentative, failing, starting, ending etc.

Fawcett's "one main verb per clause" principle changes the way clauses are partitioned, leads to abolition of the verbal group and introduces the "influential" process type.

1.5.2 The Clause

It is commonly agreed in linguistic communities that the unit of clause is one of the core elements in human language. It is consider the syntactic unit that expresses semantic units of a situation referring to a potentially rich array of meanings. The clause structure has been studied for long time and the main clause constituents are roughly the same in SFL as the ones in the traditional grammar (Quirk et al. 1985), transformational grammar (Chomsky 1957) an indirectly in dependency grammar (Hudson 2010).

In current work I adopt the CG Clause structure with the *Main Verb* as pivotal element. Though there is no element that is obligatorily realised in English language, the Main Verb is realised with a reliably high degree of probability. Exceptions are the minor clauses (exclamations, calls, greetings and alarms) that occur in conversational contexts and elliptical clauses Halliday & Matthiessen (2013) such as the one in example 27 which are not currently covered.

(27)   They were in the bar, *Dave in the restroom and Sarah by the bar.*

As mentioned before **??** the elements of a structure are defined in terms of their function contributing to the formation of the whole unit. The elements of an English clause are *Subject*, *Finite*, *Main Verb*(a part of the Predicator), up to two *Complements* and a various number of *Adjuncts*. All the elements of the assumed verbal group are part of the clause as well such as Auxiliary Verbs, Main Verb Extensions, Negators etc. (see Appendix **??** for a complete list).

1.5.3 The Nominal Group

The nominal group expresses things, classes of things or a selection of instances in that class. In the table 1.10 is presented an example analysis of the nominal group proposed in Sydney grammar (Halliday & Matthiessen 2013: 364–369).

In SG it is constituted by a head nominal item modified by descriptors or selectors such as: *Deictic*, *Numerative*, *Epithet*, *Classifier*, *Thing* and *Qualifier*. Each element has a fairly stable correspondence to the word classes, expected to be expounded by

those	*two*	*old*	*electric*	*trains*	*from Luxembourg*
pre-modifier				head	post-modifier
Deictic	Numerative	Epithet	Classifier	Thing	Qualifyier
determiner	numeral	adjective	adjective	noun	prepositional phrase

Table 1.10 The example of a nominal group in Sydeny Grammar

lexical items. The table 1.11 presents the mappings between the functions and the word classes.

Experiential function in noun group	**class (of word or unit)**
Deictic	determiner, predeterminer, pronoun
Epithet	adjective
Numerative	numeral(ordinal,cardinal)
Classifier	adjective, noun
Thing	noun
Qualifier	prepositional phrase, clause

Table 1.11 The mapping of noun group elements to classes

The elements in CG differ from those of SG. The table 1.12 exemplifies a noun group analysed with CG covering all the possible elements. The table 1.13 provides a legend for CG acronyms along with mappings to unit and word classes that can fill each element.

or	*a photo*	*of*	*part*	*of*	*one*	*of*	*the best*	*of*	*the*	*fine*	*new*	*taxis*	*in Kew*	*,*
pre-modifiers												head	post-modifiers	
&	rd	v	pd	v	qd	v	sd or od	v	dd	m	m	h	q	e

Table 1.12 The example of a nominal group in Cardiff Grammar

The elements in CG have are based on semantic criteria supported by lexical and syntactic choices. Consequently some elements cannot be derived based on solely syntactic criteria requiring semantically motivated lexical resources. Semantically bound elements are predominantly determiners *Representational, Partitive, Fractional, Superlative, Typic Determiners* while the rest of the elements: *Head, Qualifier, Selector, Modifier and Deictic, Ordinative and Quantifying Determiners* can be determined solely on the syntactic criteria. The latter correspond fairly well to Sydney version of nominal group which is adopted in present work with the benefits of relaxed rank system replacing the sub-structures with embedded units and simplifying the syntactic structures.

symbol	function meaning	class (of word or unit)
rd	representational determiner	noun, noun group
v	selector "of"	preposition
pd	partitive determiner	noun, noun group
fd	fractional determiner	noun, noun group, quantity group
qd	quantifying determiner	noun, noun group, quantity group
sd	superlative determiner	noun, noun group, quality group, quantity group
od	ordinative determiner	noun, noun group, quality group
td	tipic determiner	noun, noun group
dd	deictic determiner	determiner, pronoun, genitive cluster
m	modifier	adjective, noun, quality group, genitive cluster
h	head	noun, genitive cluster
q	qualifier	prepositional phrase, clause
&	linker	conjunction
e	ender	punctuation mark

Table 1.13 The mapping of noun group elements to classes in Cardiff grammar

Another simplification is renouncing to distinction between the Head and Thing (Halliday & Matthiessen 2013: 390–396) for the semantic ambiguity reasons as the determiners in CG. Thus if the logical Head of the nominal group is a noun then it is labelled as the Thing leaving the semantic discernment as a secondary process and out of the current scope. Otherwise, in cases of nominal groups without the Thing element, if the Head is pronoun(other than personal), numeral or adjective (mainly superlatives) then they function as Deictic, Numerative or Epithet. So I propose to parse the nominal groups in two steps: first determine the main constituting chunks and assign functions to the unambiguous ones and second perform a semantically driven evaluation for the less certain units.

In other cases the Thing is present but it is different from the Head. Consider example 28. In Sydney grammar they're treated as a nominal groups with qualifiers introduced by the *"of"* preposition. But these nominal groups are not really about the "cup", "some" or "another one" but rather about "tea", "youngsters" and "eruptions".

(28) (a cup) of (tea)

(29) (some) of (those youngsters)

(30) (another one) of (those periodic eruptions)

So then the syntactic Head still remains the first noun in the nominal group, but then by a semantic evaluation the Thing is shifted into the Qualifier introduced by "of" preposition. Cardiff Grammar weakens the assumption that every prepositional phrase

acts as Qualifier in a nominal group and it the special case of the preposition "of". It is allowed to act not as the element introducing a prepositional phrase but as a end mark of a determiner-like selector. Thus making the former noun group a determiner in the latter one. This approach shifts the noun group head into the position of semantically based Thing and erases the discrepancy problem between them. Nonetheless this is not straight forward solution as it requires lexical-semantic informed decision. For example in 31 (Head/Thing marked in bold) the preposition "of" introduces Qualifiers.

(31)   He was the **confidant** of the prime minister.

(32)   It was the **clash** of two cultures.

The distinction between cases when the proposition "of" introduces a Qualifier or ends a Selector/Deictic requires a semantic evaluation answering the questions "what is the Thing that this nominal group is about?". While it is easy to just assume that the first noun in the nominal group is the head.

Therefore, I propose to parse the nominal groups in two steps: first determine the main constituting chunks and assign functions to the unambiguous ones and then in the second step to perform a semantically driven evaluation for the less certain units. This evaluation can be performed by further capturing the structure of nominal groups that act as Dyslectics through their lexico-syntactic realisation patterns.

1.5.4   The Adjectival and Adverbial Groups

Following the rationale of head-modifier like in the case of nominal groups, the adjectives and adverbs function as pivotal elements to form groups. The structure of adverbial and adjectival constructions is briefly covered in Sydney grammar in terms of head-modifier logical structures without an elaborated experiential structure like in the case of nominal groups. While the adverbial group is recognised as a distinct syntactic unit the adjectival group is treated as a special case of nominal group specifically as a sub-structure of Epithet or Classifier elements.

(33)   He is *very lucky.*

For example "very lucky" in 33 is analysed as a short form of the nominal group "very lucky one" where "lucky" is the head of the nominal group with a missing Thing element "one". In this example "very" is not nominal modifier, it does not modify the missing nominal head but the adjective "lucky" so they constitute a head-modifier structure filling the Epithet element and as the rank scale system does not allow groups to fill elements of groups then it is described as a substructure of the nominal group.

In SG "The adverbial group has an adverb as Head which may or may not be accompanied by modifying elements"(Halliday & Matthiessen 2013: 419). The adverbial groups may fill modal and circumstantial adjunct elements in a clause corresponding to eight semantic classes of: time, place, four types of manner and two types of assessment. The adverbial pre-modifiers express polarity, comparison and intensification along with only one comparison post-modifier (Halliday & Matthiessen 2013: 420-421).

A thorough systemic functional examination has been provided for the first time by Tucker Tucker (1997, 1998) materialised into a lexical-grammatical systematization of adjectives and the structure of Quality Group in CG. Fawcett uses the quality group structure for Adverbials as well as they follow similar grammatical behaviour. He avoids calling the group according to the word class but rather refers to the semantic meaning of what both groups express, i.e. the quality of things, situations or qualities themselves. The qualities of things have adjectives as their head while the qualities of situations an adverb.

In Cardiff Grammar, the head of the quality group is called *Apex* while the set of modifying elements: *Quality Group Deictic, Quality Group Quantifier, Emphasizing Temperer, Degree Temperer, Adjunctival Temperer, Scope* and *Finisher*. The quality group most frequently fills complements and adjuncts in clauses and fill modifiers and superlative determiners in nominal groups but there are also other cases found in the data.

Just like in the case of nominal group the adverbial and adjectival groups in Cardiff grammar are semantically motivated. To automatically identify elements of the quality group requires lexico-semantic resources.

Some adverbs are different from others at least because not all of them can be heads of the adverbial group like for example *very, much, less, pretty* also being able to act as adjectival modifiers whereas others cannot. So a naive attempt is to use a list of words to identify the Emphasizing and Degree Temperers.

Other elements of the quality group like the *Scoper* or *Finisher* are more difficult to identify and localize as part of the group only by syntactic cues and/or lists of words because of their inherent semantic nature. The problem is similar to detecting whether a prepositional phrase is filling a qualifier element in the preceding nominal group or it is filling a complement or adjunct in the clause. Not surprisingly the Scopers and Finishers are most of the time prepositional phrases.

Another issue is continuity. The question is whether a grammar shall allow at least at syntactic level for discontinuous constituents or not. And then if so how to detect all the parts of the group even if they do not stand in proximity of each other.

For example, comparatives, a complex case of a quality group, could be realised in a continuous or discontinuous forms. Compare the analyses presented in 1.14 and 1.15. In the first case the comparative structure is a continuous quality group. In the second case the comparative is dissociated and analysed as separate adjuncts.

On one hand it is not a problem treating them as two adjuncts, because that is what they are from the syntactic point of view. However, semantically as Fawcett proposes, there is only one quality group with a discontinuous realisation whose Scope element is placed in a thematic position before the subject. For an automatic process

I	*am*	*much*	*smarter*	*today*	*than*	*yesterday*
Subject	Main Verb	Adjunct				
pronoun	verb	quality group				
		Emphasizing Temperer	Apex	Scope	Finisher	

Table 1.14 Comparative structure as one quality group adjunct

Today	*I*	*am*	*much*	*smarter*	*than*	*yesterday*
Adjunct	Subject	Main Verb	Adjunct			
adverb	pronoun	verb	quality group			
			Emphasizing Temperer	Apex	Finisher	

Table 1.15 Comparative structure split among two adjuncts

to identify a complex quality group is a difficult task. It needs to pick up queues like a comparative form of the adjective followed by the preposition "than" and then look for two terms being compared. Given some initial syntactic structure such patterns could be modelled and applied but only as a secondary semantically oriented process.

Since both the adverbial and adjectival groups have similar structures, it is syntactically feasible to automatically analyse them in terms of head-modifier structures in a first phase followed by a complementary process which assigns functional roles to the quality group components.

1.6   Discussion

This chapter introduces the fundamentals of systemic functional linguistics and presents an adaptation of Sydney and Cardiff theories of grammar to the task of parsing.

Because of bottom up approach to unit structure, rank scale relaxation and accommodation of embedding as a general principle Cardiff systemic functional theory is

more suitable for parsing than Sydney one. Nonetheless the unit definitions in Cardiff grammar are deeply semantic in nature. Parsing with such units requires most of the time lexical-semantic informed decisions beyond merely syntactic variations. This is one of the reasons why the parsing attempts by O'Donoghue (1991) and others in COMMUNAL project were all based on a corpus.

As there was no corpus available and because the parsing approach is based on syntactic backbone none of the theories could be fully used as such. The second part of the chapter attempts to merge and adapt the grammars and theories of grammar to this parsing approach.

Next chapter lays the theoretical foundations of Dependency Grammar and introduces the Stanford dependency parser used as a departing point in current parsing pipeline. Because there is a transformation step from dependency to systemic functional consistency structure, next chapter also covers a theoretical compatibility analysis and how such a transformation should in principle look like.

Chapter 2

The dependency grammar

The Stanford dependency analysis of a given text constitutes the input for the algorithm developed in the current work. It provides the foundation to build the syntactic backbone used adopted here. This chapter offers an overview of the grammar and the parser developed at the Stanford university. In the last part of the chapter is discussed the cross theoretical connection between the dependency and systemic functional grammars.

2.1 A briefing on the theory of dependency grammar

Traditionally, Latin language tended to be analysed with the *dependency model* based on theories of what was called *government.* It explains the syntagmatic relations of the subtype Firth called *colligation* (i.e. relations between grammatical categories). Government is a way of explaining the rich inflections of language (such as Latin) in terms of how particular words govern, that is to say, determine, the inflection of other words. (McDonald 2008: p.66)

Tensiere (2015) explains how government works by giving example of Latin text analysis where the inflections immediately give aloto of information about relations between different words. For example the verb agree in person and number with its subject. From this point of view the verb governs the subject. The verb also governs complements and adjuncts which can be seen as relations of dependency between a governing element or controller and a governed element or dependant. It is important to note that Tensiere analysed syntax at the level of clause where he identified a verb node as the main controller.

Contrary to Latin, languages like English or Chinese, where there is little or most of the time none of the inflectional marking to identify dependency relations, are much harder to analyse in terms of such relations. This was a motivation for Tensiere to reinterpret dependency relation in semantic terms rather than inflectional marking. As McDonald (2008) points out, this can be regarded as extending syntagmatic relations of the clause to include what Firth was calling *collocation* relations (i.e. links between lexical items). Tensiere framed his theory in terms of syntagmatic relations as expressing a model of experience. He compares the verbal node of the clause to a complete little drama. Like a drama, it obligatorily consists of an action, most often actors and features of settings. Expressed in terms of syntactic structure, the action, actors and settings become the verb, participants and circumstances (Tensiere 2015).

Further, Tensiere explains *categories of language* as *categories of thought.* The human mind shapes the world in its own measure by organising experience into a systematic framework of ideas and beliefs called categories of though. Likewise, the language shapes thought in its own measure by organising it into a systematic framework of grammatical categories (Tensiere 2015). He stresses though, that the latter ones can vary considerably from language to language and that the analysis of syntactic relations shall be carried on not in terms of grammatical categories but rather in terms of functions. He explain through an example that analysis in terms of nouns and verbs i.e. grammatical categories, tells nothing about the tie that links the words, whereas if we turn to notions such as subject and complement it all of the sudden becomes clear: the connections are established, the lifeless words become a living organism and the sentence take on a meaning (Tensiere 2015).

2.2 Stanford dependency grammar (and parser)

Dominant Chomsky (1981) theories define grammatical relations as configurations of *phrase structure* representations, which is nesting of multi word constituents. Other theories such as Lexical-Functional Grammar reject the adequacy of such an approach (Bresnan 2010) and advocate a functional representation for syntax.

When motivating its stance, Marneffe et al. (2006) insists on practical rather than theoretical concerns proposing that structural configurations be defined as grammatical roles (to be read as grammatical functions)(Marneffe et al. 2006). For example she insists that, information about functional dependencies between words grants direct access to the predicate-argument relations which are not readily available form the phrase structure parses and can be used off the shelf for real world applications. She

avoids going into theoretical debates and focuses on the suitability of the grammar for parsing within the context of relation extraction, machine translation, question answering and other tasks.

The functional dependency descriptions is precisely the aspect which makes possible the link between the Stanford Dependency Grammar and Systemic Functional Structures targeted in the current thesis.

The design of Stanford dependency set (Marneffe et al. 2006; Marneffe & Manning 2008; Marneffe et al. 2014; Natalia Silveira et al. 2014) bears a strong intellectual debt to the framework of Lexical Functional Grammars (Bresnan 2010). Marneffe et al. (2006) started designing the relation typology from GR (Carroll et al. 1999) and PARK (King & Crouch 2003) schemes following a LFG style and according to the principles described in Generalization 2.2.1.

Generalization 2.2.1 (Design principles for Stanford dependency set)**.**

1. Everything is represented uniformly and some binary relation between two sentence words.

2. Relations should be semantically contentful and useful to applications.

3. Where possible, relations should use notions of traditional grammar (Quirk et al. 1985) for easier comprehension by users.

4. The representation should be spartan rather than overwhelming with linguistic details.

When proposing the Stanford dependency, Marneffe et al. (2006) inherits many relations from Lexical Functional Grammars(Bresnan 2010) and departs from the sets described by Carroll et al. (1999) and King & Crouch (2003). She arranges the grammatical relations into a hierarchy rooted in a generic relation *dependent*. This is then classified into a more fine-grained set of relations between a head and its dependent.

2.3   Stanford Parser: collapsed-cc output

The Stanford Dependency Parser is capable of generating several types of dependency representations. The most convenient and informative version is Collapsed-CC-processed. This structure is created after the initial parse is ready and constitutes a simplified and more intuitive representation of the dependency parse. The collapsed

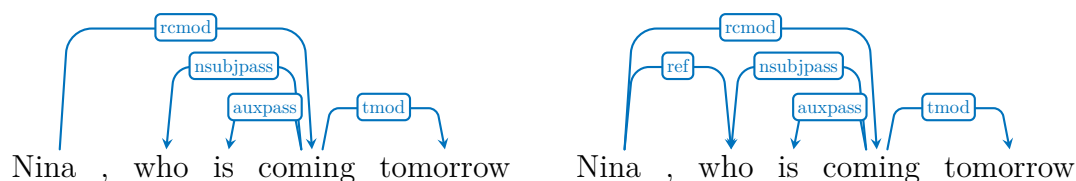Fig. 2.2 Collapsed   preposition   depen-
          dency

Fig. 2.4 Collapsed   preposition   depen-
          dency

form concerns prepositions, conjunctions and relative clause referents. Dependencies involving prepositions and conjunctions are transformed from basic form in Figure 2.1 to the form where preposition are embedded into the edge relation, as in Figure 2.2. Similar transformation is done for conjunctions.

Besides collapsing prepositions and conjunctions the DG is further processed to introduce more relations (i.e. connections) even if they break the tree structure. For example the *ref* relation does not appear in the basic dependency structure in figure 2.3 but it appears in the processed dependency structure forming a cycle with *rcmod* and *subjpass* relations.

Relations like *ref* introduce cycles but add valuable information useful in various stages of further processing. However, ensuring a tree structure in important for the CG creation stage because it is based on a top down traversal. This is taken care of in the preprocessing stage described in the next stage.

2.4   Penn part-of-speech tag set

Stanford dependency parser starts creation of the parse structure process from the list of tokens annotated with Penn part-op-speech tags. Embedded into the dependency graph, these tags are the part of the syntactic context from which SFG constituency graph is built.

2.5 Cross theoretical bridge from DG to SFL

The concept of dependency between pairs of words is long acknowledged in linguistic communities. In traditional terms dependencies are treated as *hypotactic expansions* (see Definition 1.2.13) of word classes (or parts of speech) where the expanded word acts as *heads* and expanding ones as *dependent* establishing parent-daughter structural relations illustrated in Figure 2.5a.

In SFL community the concept of dependency is less salient than the foundational role it plays in the Dependency Grammars. Dependencies are regarded as orthogonal relations between sibling elements of a unit (Figure 2.5b) and link the *heads* to their *modifies* in by Hallidayan *logical structure*(Halliday & Matthiessen 2013).

Figure 2.5 illustrates side by side the parent-daughter and sibling dependency relations. In Figure 2.5a dependency are the only relations between the units of structure whereas in Figure 2.5b there are multiple levels (ranks) of units and the dependency relations are relevant only between siblings at the same level within the structure of an unit. SFL regards dependency relations holding only between elements of a unit whereas the relations that connect the units of lower and higher rank are *constituency relations*. Yet when we look at the two structures they resemble in a way each other and next I show how.

(a) The parent-daughter relations in DG   (b) The head-modifier relations in SFG
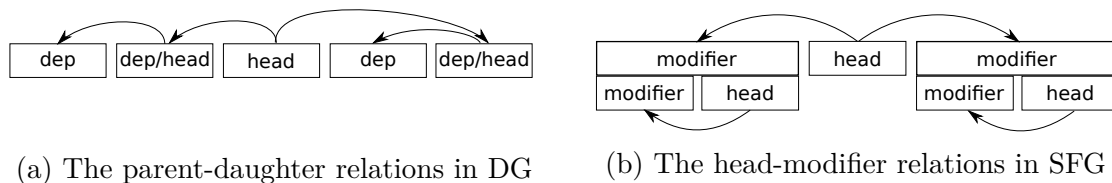
Fig. 2.5 The dependency relations in DG and SFG

In a nutshell, the parent-daughter dependency relations in dependency grammar unpack into multiple function in systemic functional grammar and specifically it is the head-modifier indirect relation, unit-element componence relation and the head of unit a "representativeness" function.

This difference implies that, when translated to a constituency unit (described in Section **??**), the dependency unit, stands for both a unit and that unit's head element. In other words a DG node corresponds to two functional elements at different rank scales. For example the root verb in dependency graph corresponds to the clause node and the lexical item which fills the Main Verb of the clause. By analogy, the head noun of a Nominal Group anchors the entire unit (as a group) and fills the head element of the group.

text	some	very	small	wooden	ones
units	**Nominal Group**				
elements	*Quantifying Determiner*	*Modifier*		*Modifier*	*Head*
units		**Quality Group**			
elements		*Degree Tamperer*	*Apex*		

Table 2.1 SF analysis of Example 9 (reproduced from Table 1.5)

det
amod
advmod
amod

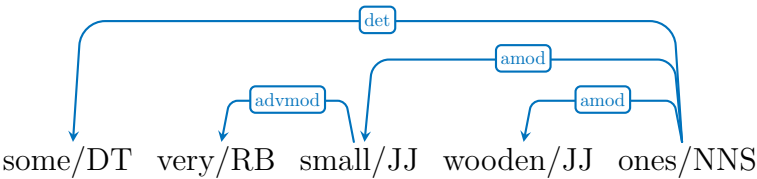some/DT   very/RB   small/JJ   wooden/JJ   ones/NNS

Fig. 2.6 Dependency analysis for Table 2.1

Figure 2.6 and the Table 2.1 represent the analysis of a nominal group from Example 9 ("some small very small wooden ones") in Cardiff grammar and Stanford dependency grammar exhibiting a contrast of the two structures. Consider the dependency relation "det" a link between the noun "ones" and the determiner "some". When translated into SF variant the dependency relation stands within Nominal Group between the Head element (filled by word "ones") and the Quantifying Determiner element (filled by the word "some"). By definition all elements in a unit are equal in the structure so the Head and Quantifying Determiner are siblings. So the items (words) filling those elements are sibling. How is then the dependency relation established?

In SFL there is the concept of Head and Modifier. There is no direct relationship between them but it is said that what the Modifier modifies is the Head. The relation is not a direct one, the Modifier and Head stand for two different kinds of meaning and what the Modifier modifies is not the Head per se but the referent denoted by the head (and thus construed by the entire unit). It is precisely this modification of the head that is called a (sibling) dependency relation and is seldom mentioned in SFL literature because it is considered implicit and recoverable from the SF constituency structure.

The Head also is the element that anchors the entire unit and plays a constitutive role. In this sense the word "ones" realizes not only the Head function (sided with Determiner "some") but also anchors the entire unit. The relation between the group and it's elements is one of *componence* (Definition 1.3.5) described in Section 1.3.4. Yet in the role of unit anchor we cannot say that there is a componence relation between "one" and "some" because it is merely a proxy to the referent rather than the entire

unit. So in this role "one" can be said to be standing in a parent-daughter dependency relation to "some" incorporating the filling and componence relations.

I just showed how the dependency relation in dependency structure (Figure 2.5a) can be unpacked into two relations in systemic functional structure (Figure 2.5b): sibling dependency considered an indirect relation between Head and Modifier (Logical Metafunction) and parent-daughter dependency between unit anchor and the compounding elements, relation which resembles unit componence but is not.

Lets look at a second example of two relations "advmod" from "small" to "very" and "amod" from "ones" to "small". The interesting case here is the item "small" which is the Head of the Quality Group, it anchors the meaning of the whole group and the Quality group fills the Modifier element within the Nominal group. What is not covered in previous example is that the Apex "small" not only is a representative of the entire group but it also is a *representative filler* of the Modifier element within Nominal Group. Using the similar translation mechanism as above, this means that, the incoming dependency needs to be unpacked into three levels: the element within the current group (Modifier), the unit class that element is filling (Quality Group) and finally the head of the filler group (Apex). In fact, to be absolutely correct there is one more level. The elements of a unit are expounded by lexical items, so fourth relation to unpack is the expounding of the Apex by "small" word.

In this section I laid the theoretical principle for transforming the dependency structure into systemic functional structure. In practice to achieve this level of unpacking the algorithm requires a bottom up and a top down contextualization in terms of elements of structure within a unit and realised sequence of textual units. This implied that the unpacking needs two traversals, a bottom-up and a top one. More on that and the exact algorithm for the translation is provided in Section **??**.

Next follows the chapter on Governance and Binding Theory needed to account for the unrealised, covert (Null) Elements in the syntactic structure. It is also an opportunity to perform a similar theoretical translation exercise (as in this section) from one theory of grammar into another.

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