

Semantics and pragmatics in the late 20th C

Semantics is the study and representation of the meaning of every kind of constituent and expression (from morph to discourse) in human languages, and also of the meaning relationships among them. Late 20th century semantics has roots that stretch back to the Pre-Socratics of Greece in the 6th–5th centuries BCE. Pragmatics deals with the context dependent assignment of meaning to language expressions used in acts of speaking and writing. Though pragmatics is often said to have arisen from the work of Peirce 1931, Aristotle also wrote on certain aspects of pragmatics and illocutionary types were identified by the Stoics and Apollonius Dyscolus, St Augustine, Peter Abelard, and Thomas Reid. In Europe, Ullmann 1951; 1962; 1975 wrote on etymology and semantic relations among lexemes and some grammatical morphemes. Cruse 1986 became a standard introduction to lexical semantics. Lyons 1977 is unsurpassed as a handbook on many aspects of semantics: it presents a background to much of what is discussed in this chapter.¹ Histories of some aspects of semantics in late 20th century America can be found in the introduction to McCawley (ed.) 1976, in Newmeyer 1986; R. Harris 1993; Huck and Goldsmith 1995.

The rise of componential analysis

Before ‘Structure of a semantic theory’ (Katz and Fodor 1963), 20th century linguistic semanticists focused on lexical semantics, in particular the componential analysis of listemes² and semantic relations among them. Componential analysis seeks to identify the sense³ of a listeme in terms of one or more semantic components. The principal means of accomplishing this has been through the structuralist method of contrastive distributional analysis. Listemes that share semantic components are semantically related. There is no consistent one-to-one correlation between semantic components and either the morphs or the morphemes of any language. Being components of sense, semantic components reflect the characteristics of typical denotata⁴. There is a hierarchy of semantic components which corresponds to perceived hierarchies among denotata. For instance, FELINE is a semantic component of *cat*

1. See Cresswell 1979 for an excellent review.

2. A listeme is a language expression whose meaning is not determinable from the meanings (if any) of its constituent forms and which, therefore, a language user must memorize as a combination of form and meaning. A listeme is stored in the dictionary (or lexicon, the terms are not differentiated here).

3. Sense is decontextualized meaning, abstracted from innumerable occurrences (in texts) of the listeme or combination of listemes. A dictionary gives the decontextualized sense of a word, abstracted from innumerable usages of it; the dictionary user must puzzle out for him- or herself what the speaker uses the word to refer to in the particular text in which it appears

4. The denotation of a language expression is what it is normally used to refer to in some possible world.

and entails the semantic component ANIMAL which is also, therefore, a component of *cat*. This suggests a thesaurus-like structure for semantic components. It follows that the set of semantic components for a language can be discovered by identifying all the relationships that can be conceived of among the denotata of listemes. In practice, this could be everything in all worlds, actual and non-actual. There have been numerous attempts to carry out such a task; among the most successful of them is *An Essay Toward a Real Character and a Philosophical Language* (Wilkins 1668), although this had no demonstrable influence on 20th century componential analysis.

Leonard Bloomfield was sympathetic to the cultural context of language, but he came to exclude semantics from the Bloomfieldian tradition in American linguistics on the ground that semantics is not directly observable in the way that phonemes, morphemes, and sentences are manifest in phones. So, from the 1940s until the 1960s, semantics was regarded by many American linguists as metaphysical and unfit for the kind of scientific enquiry into observable language structures that they believed linguistics should undertake. The advance towards semantic analysis was therefore made within morphosyntax, using as a model ‘Beitrag zur allgemeinen Kasuslehre’ “Contribution to the general theory of case” (Jakobson 1936). Jakobson utilized distinctive feature analysis based on the methodology of Prague School phonology; for instance, the Latin case system can be specified in terms of distinctive features from the categories of case, gender, number, and declension. In ‘Componential analysis of a Hebrew paradigm’, Z. Harris 1948 analysed the verb paradigm using the categories of tense, person, and gender in a similar manner to that just described for case. It is a small step from the componential analysis of closed morphosyntactic systems like noun and verb affixes to the componential analysis of closed semantic fields like kinship systems. Anthropologists had for many years been comparing widely differing kinship systems in culturally distinct societies by interpreting them in terms of universal constituents that equate to semantic components. Two of the earliest articles in the componential analysis of meaning, Lounsbury 1956 and Goodenough 1956 appeared consecutively in the same issue of the journal *Language* and were both analyses of kin terms. Without stepping far outside the Bloomfieldian tradition, these early writers on componential analysis were responsible for changing contemporary linguistic opinion by showing that semantic analysis could be carried out using approved methods of structural analysis, similar to those used to filter out the phonetic components of the Sanskrit stop phonemes. For instance, Lounsbury’s paper begins with a comparison of Spanish and English kin terms: *ti-o, hij-o, abuel-o, herman-o* (uncle, son, grandfather, brother) vs *ti-a, hij-a, abuel-a, herman-a* (aunt, daughter, grandmother, sister). He notes that English has no gender morphs corresponding to the Spanish suffixes *-o*

and *-a*, but gender is nonetheless a significant component in the meaning of the English kin terms. Their covert gender must be compatible with the sex of the person denoted; consequently, it is anomalous to call one's uncle *aunt*, or one's sister *brother*. Hence the anomaly of **My brother is pregnant*; and when the terms *aunt* and *uncle* are extended as terms of respect to an older generation, they are assigned on the basis of the sex of the referent⁵. There are grammatical consequences: the personal pronoun anaphoric to *uncle* is *he/him*; the one for *aunt* is *she/her*. *Father*, *uncle*, and *aunt* have in common that they are FIRST_ASCENDING_GENERATION. *Father* and *uncle* additionally have in common that both are MALE, whereas *aunt* is FEMALE. *Aunt* and *uncle* are both COLLATERAL, whereas *father* is LINEAL. The meaning relationships between *father*, *uncle*, and *aunt* can be seen in the semantic components identified.

Fields and differential values

Modern componential analysis grew out of Prague school distinctive feature analysis of inflexional morphology, anthropological interest in kinship systems, and semantic field theory. Semantic fields are constructed from the semantic relations among names for concepts. In effect this means that the semantic field of a listeme is determined from the conceptual field in which its denotatum occurs; the structure of a semantic field mirrors the structure of the conceptual field. The notion of semantic fields can be found in Humboldt 1836 and it was developed among German scholars Trier 1931; Porzig 1950; Weisgerber 1950; Geckeler 1971. Lyons 1963 examined the meanings that can be ascribed to words such as *téchnē*, *epistēmē*, *sophía*, *areté*, etc. in the semantic fields of knowledge and skill in Plato's works. He was motivated by Trier's survey of the shifting field of High German *wisheit*, *kunst* and *list* but unlike Trier's subjective speculations, Lyons presents a rigorous analysis using techniques derived from the works such as Z. Harris 1951 and Chomsky 1957. Few scholars have undertaken extensive analysis of a semantic field, but Bendix 1966 analyzed the field of *have* and its counterparts in Hindi and Japanese, Lehrer 1974 analyses the fields of cooking and sound and Backhouse 1994 is an extensive study of taste terms in Japanese. A conceptual field such as colour, kinship, or cooking terms is covered by a number of listemes in a language, each denoting a part of the field. Different languages, and at different times in history any one language, may divide the field differently among listemes. Although the sensory data in the colour spectrum is the same for all human beings, languages name parts of the field differently. The differential value ('valeur' in Saussure 1931) of any listeme is that

5. A referent is that which is spoken of.

part of the conceptual field that it denotes in contrast with the part denoted by other listemes in the same semantic field. Western Dani *laambu* divides the colour spectrum in half; the other half is *mili*. The differential value of *laambu* is very different from English *yellow*, even though it is a typical translation for English *yellow*. The value of *yellow* is only one-eleventh of the colour spectrum: thus, *laambu* implies not-*mili* “not cool-dark”, whereas yellow implies “not-white, not-red, not-green, not-blue, not-black, not-brown, not-pink, not-purple, not-orange, not-grey”. (This assumes these colour terms are ‘basic’ in the sense of Berlin and Kay 1969, which is not uncontroversial; see MacLaury 1997.)

Unlike the field of colour terms, the field of cooking terms is not neatly circumscribed. It is more difficult to decide whether the whole field is covered by the analysis in Lehrer 1974, and what effect extensions or diminutions of the field will have. Since 1974, microwave ovens have become ubiquitous. Because one can boil, roast, and poach in a microwave, the semantic field must be revised with the advent of this new form of cooking. To generalize: when new objects and new ways of doing things come into existence there is a change in the conceptual field that usually leads to a change in the semantic field and the addition or semantic extension of listemes. Seemingly closed fields such as case inflexions or kin terms should permit exhaustive componential analysis in which every term within the field is characterized by a unique subset of the universal set of semantic components defining the field. However, these systems invariably leak into other fields when meaning extensions and figurative usage are considered. Furthermore an exhaustive componential analysis of the entire vocabulary of a language is probably unachievable, because it proves impossible to define the boundaries – and hence all the components – of every field.

Semantic primes and Wierzbicka’s Natural Semantic Metalanguage

Semantic primes are primitive symbols that with their interpretations constitute the vocabulary of the semantic metalanguage⁶. We may suppose that semantic components are, or are composed from, semantic primes, but what are they and how many primes are there? The proponents of Natural Semantic Metalanguage (NSM) believe that semantic primes (originally named *primitives*) and their elementary syntax exist as a minimal subset of ordinary natural language (Goddard 1994: 10). A number of 17th century seekers after a universal language including Dalgarno 1661; Lodwick 1652 and the aforementioned Wilkins 1668 proposed primitive semantic components. Their contemporary, Antoine Arnauld

6. A metalanguage is the language which a linguist uses to describe and analyse the object language. The object language is the language under investigation.

(Arnauld and Nicole 1996) recognized that the meanings of most words can be defined in terms of others, but that ultimately there are some undefinable semantically primitive words. In recent times, Weinreich 1962: 36 identified a discovery procedure for a semantic metalanguage built upon natural language. This was to (a) stratify the language into a central core of semantic primes whose members are definable only circularly and by ostensive definition such as “colour of the sky” in the entry for *blue*. (b) The next stratum out uses items whose definitions contain only core items without (further) circularity. (c) Each more peripheral stratum uses items from the preceding strata without circularity. Anna Wierzbicka has been carrying out this program in a cross-language context since Wierzbicka 1972, searching for a universal set of semantic primes expressed principally through the vocabulary of English. It is claimed (e.g. in Goddard 1994: 12) that ‘any simple proposition’ expressed in NSM using any one natural language (e.g. English) will be expressible in NSM using any other language (e.g. Japanese). This embodies a claim that, like predicate logic, NSM is linguistically and culturally unbiased and that there is a heuristic or algorithm for translation. In fact, there is none. The number of semantic primes has grown from 14 in Wierzbicka 1972 to 63 in Goddard 2009. There is about the same number of semantic primes in every language, and an English NSM, French NSM, Mandarin NSM, etc. In many instances, primes are not isomorphic across languages as the figures 1, 2, 3 are. NSM primes are compositionally and often semantically different across languages; like most translated terms, the meanings show partial overlap rather than complete identity: English SOME = French IL Y A ... QUI; English THERE IS = French IL Y A. There is a professed need for alloloxes which makes the so-called ‘semantic primes’ far more like meaning clusters than true primes, for example: English I and ME; DO, DOES, DID; Italian TU, VOI, LEI, etc. There is no satisfactory account of the syntax of NSM, though see Wierzbicka 1996: 19–22, Goddard 1998: 329–36. It is described as ‘elementary’ but it behoves the proponents of the theory to be more precise and to explain what differentiates a well-formed semantic definition or description from an ill-formed one.

The NSM researchers’ quest for semantic primes recalls the Swadesh-list of basic vocabulary created to plot diachronic relationships between unwritten languages in Africa, the Americas, and elsewhere. The purpose of the Swadesh-list was to take a pair of languages and compare the 100–215 basic lexemes to discover how many are cognates (see Swadesh 1955), hence one name for the program is lexico-statistics (see Embleton 1986). In making the comparisons, literal meanings are preferred to semantic extensions; e.g. the body-part sense of English *tongue* is preferred to the sense “language”. The scale of vocabulary differentiation derives from studies of Indo-European languages for which there are historical records. For

related languages, the time of divergence from a common mother language is estimated from the proportion of vocabulary common to both. The procedure is sometimes called glottochronology. Words in the Swadesh-list are basic in the sense that they name things likely to be common to the experience of all human communities (the sun, human body parts and functions, etc.).

The expressions used in a semantic representation in NSM are supposed to match those that children acquire early. They are deliberately anthropocentric and subjective, referring to the natural world of sensory experience rather than intellectualized abstractions. Thus, *red* is the colour of blood or fire, not an electromagnetic wave focally around 695 nanometres in length (Wierzbicka 1980; 1990; 1992). Wierzbicka 1984: 207 commented that Labov's denotation conditions for *cup* (Labov 1973: 366f) 'need the help of a mathematician to understand' them; but her own definition is 831 words long and extraordinarily detailed, so that many readers find it just as confusing as Labov's denotation conditions (much better is that of Katz 1977b: 49).

There are important questions about the payoff between the effectiveness of a definition and its accuracy. What is the purpose of the semantic analysis? For whom or what is the resulting semantic specification designed? NSM semantic definitions are not designed to be used by machines that simulate language understanding, they are intended to be easily accessible to a non-native speaker of the language. But every such reader will already know what a cup, say, is, so a brief description would be sufficient. 'For dictionary purposes, the concept has only to be identified, not fully specified,' wrote Cruse 1990: 396.

Prototype and stereotype semantics

Prototype and stereotype semantics are alternatives to theories of meaning which postulate a 'checklist' of properties to be satisfied for the correct use of the expression *e* (Fillmore 1975: 123). For example, the default denotatum of *bird* is bipedal, has feathers, and is capable of flight. But there are several species of flightless birds (e.g. emus, penguins); a downy chick and a plucked chicken are featherless, but nonetheless birds; and a one-legged owl and a mutant three-legged hen are also birds. So the notion of a checklist of essential properties for the denotatum of *e* is problematical.

The prototype hypothesis is that some denotata are better exemplars of the meaning of a lexeme than others, therefore members of the category denoted by the lexeme are graded with respect to one another. How are prototypes discovered? Battig and Montague 1969 asked students to list as many Vegetables, or Fruits, or Diseases, or Toys, etc. as they could in 30

seconds. They hypothesized that the most salient members in each category would be (a) frequently listed and (b) high on the list. They found, for instance, that a carrot is the prototype for Vegetable, i.e. the best exemplar of the category because it was listed frequently and early. A tomato belongs to two categories: it is a Vegetable in folk belief and technically a Fruit. On the Battig and Montague scale, a tomato ranked 6th as a Vegetable and 15th as a Fruit. Using their figures for salience, the tomato's degree of membership of the category Vegetable is 68 per cent and of the category Fruit is only 14 per cent. Lakoff 1972a interprets such rankings in terms of fuzzy sets of objects with a continuum of grades of category membership between 0.0 and 1.0. The carrot is the best instance with a value 1.0, a tomato has the value 0.68 (0.14 membership in the fuzzy set Fruit), and a pickle only 0.006. Any entity assigned a value greater than 0.0 is a member of the category, i.e. the pickle is a Vegetable no less than the carrot. What the value of a fuzzy set member indicates is how good or bad an exemplar of the category a certain population of speakers perceives that entity to be. A tomato is vegetable-like because it is eaten, often with other vegetables, as part of an hors d'oeuvre or main course. It is not eaten, alone or with other fruits, for dessert. A tomato is fruit-like because it grows as a fruit well above the ground and not on or below it. Also, it is often eaten raw and the extracted juice is drunk like fruit juices. Flowers are cultivated for ornamentation, but tomatoes are cultivated for food. So it is our practice of eating tomatoes as if they are vegetables rather than fruit that explains the relative ranking in each category.

Prototype semantics is primarily associated with the work of Eleanor Rosch who carried out a series of experiments summarised in Rosch 1978. Rosch 1973 found that the common cold is a very poor exemplar of Disease – which conflicts with the Battig and Montague finding. The discrepancy between the two findings is explained by the fact that Rosch only gave her subjects six diseases to rank (cancer, measles, malaria, muscular dystrophy, rheumatism, cold) and a cold is the mildest of them. The salience would also be affected by the number of people suffering from colds at the time of the experiment. Obviously, establishing the prototype depends upon the experiences and beliefs of the population investigated. Consequently, the claimed prototypicality ranking is valid for the community surveyed, but not for all speakers of the language, or even the same subjects on a different occasion.

Wittgenstein 1953 wrote of 'family resemblances' which Lakoff 1987 adopted into prototype theory identifying chains of similarities among members of a category such as the various senses of *over*; the various nominals that take the Japanese classifier *hon*; the fact that the prototypical *mother* (the woman who produces the ovum, conceives, gestates, gives birth, and then nurtures ego) links to the *biological mother*, *donor mother*, *mother superior*, etc. A

prototype is as good an example as can be found for the purpose in hand. Some extended meanings are figurative (e.g. *mother superior*), and a very important development in late 20th century studies of meaning was the general acceptance, following Lakoff and Johnson 1980, that metaphor and metonymy are all pervasive in language and not clearly demarcated from ‘literal’ meaning.

Putnam 1975 proposed that the meaning of a language expression *e* (typically a lexeme) is a minimum set of stereotypical facts about its typical denotatum, including connotations. Connotations of *e* arise from encyclopaedic knowledge about the denotation of *e* and also from experiences, beliefs and prejudices about the context in which *e* is typically used. Connotations vary between contexts and speech communities independently of sense and denotation: a male chauvinist and a radical feminist might have quite different stereotypes for *man* and *woman*, and yet have no difficulty picking the denotatum of one from the other. Putnam expressly allows for experts to have considerably more knowledge at their command than their fellows – which raises the interesting question: Do the words *elm* and *beech* have the same stereotype and meaning for a botanist as they do for an inner city dweller who can’t distinguish an elm from a beech? Presumably not. However, if the botanist were to point out and name an elm, the inner city dweller would know that referent is not a beech, even if s/he could still not recognize another elm thereafter.

How is ‘a (stereo-)typical denotatum of *e*’ distinguishable from ‘as-good-an-exemplar-as-can-be-found among the class of things denoted by *e*’? Presumably, the stereotype properly includes the prototype. For instance, whatever the stereotype of *vegetable* may be, it properly includes the prototype carrot and the peripheral onion. The stereotypical *vehicle* includes the prototypical car and/or bus together with the peripheral horse-drawn wagon. If this is correct, then we should favour the stereotype in giving the semantics of language expressions.

Katz’s semantic markerese

Most semantic relations extend beyond listemes to the syntactic structures into which the listemes combine. Although the semantics of propositions has been considered within philosophy since Plato, Aristotle, and more particularly the Stoics, the first step within linguistics was (ironically) undertaken by a philosopher and a cognitive scientist in Katz and Fodor 1963 ‘Structure of a semantic theory’. It was Katz who was largely responsible for establishing semantic theory as one component of a transformational grammar. Katz’s metalanguage was dubbed ‘semantic markerese’ by Lewis 1970, because so-called ‘semantic markers’ are the principal kind of semantic component Katz uses. According to Katz 1967;

1972 a semantic marker names a concept that any human being can conceive of; hence, semantic markerese is applicable to all natural languages.

Katz sought to establish a theory of meaning that would

- Define what meaning (i.e. sense) is.
- Define the form of lexical entries.
- Relate semantics to syntax and phonology (by postulating semantic theory as an integral component of a theory of grammar).
- Establish a metalanguage in which semantic representations, properties and relations are expressed.
- Ensure the metalanguage is universal by correlating it with the human ability to conceptualize.
- Identify the components of meaning and show how they combine to project meaning onto structurally complex expressions.

Essentially, these are goals that should be met by any semantic theory – though what is meant by ‘component of meaning’ and the integration of semantics with phonology and syntax may be radically different. Missing from Katz’s conditions is the requirement that the meaning of language expressions needs to be related to the real and imaginary worlds people speak and write of. Semantic markerese made no claim to account for utterance or speaker meaning because Katz eschewed pragmatics, although his theory cannot avoid it completely.

Katz’s semantic theory is interpretative: in its later versions it was designed to assign meanings to the output of autonomous syntactic rules of a transformational generative grammar of the kind described in *Aspects of the Theory of Syntax* by Chomsky 1965 and was not updated to accommodate later developments in transformational syntax. The earliest version of theory, Katz and Fodor 1963, was geared to the syntactic model of Chomsky 1957 and was woefully inadequate in that it simply recursively conjoined meaning components, thus destroying input from syntactic structure (see Weinreich 1966: 410; Allan 1986: II, 287). Katz never properly justified, evaluated, or even seriously discussed the vocabulary and syntax of semantic markerese. We can only learn to interpret his metalanguage by abduction from his examples. Unfortunately, there is little consistency among these examples, and semantic markerese remains only a partially comprehensible language. Compare (1), the semantics for *chase* given in Katz 1967: 169, with (2), given in Bierwisch 1969: 160.

- (1) (((Activity of X) (*Nature:* (Physical)) (Motion) (*Rate:* (Fast)) (*Character:* (Following Y)) (*Intention:* (Trying to catch ((Y) (Motion))))

The categorization of the variables in (3) is to be ‘given in terms of grammatical relations between the tense constituents and the verb within the same predicate phrase and between temporal adverbials and the verb within the same predicate phrase’ (*ibid.*). Similarly (Movement) in Figure 1 is analysed in terms of ‘covers the distance between’ one location and another. Katz and Postal 1964: 16 had proposed a set of semantic redundancy rules to reduce the number of semantic markers in a dictionary entry – all semantic theories propose some counterpart to this. For instance, from the rule in (4), for every occurrence of (Human) the redundancy rule adduces the entailed markers to give a full semantic specification.

(4) (Human) \rightarrow (Physical Object) \wedge (Sentient) \wedge (Capable of Movement)

Katz claimed that markerese directly captures all the subtleties of natural language and offers a natural logic which is a better instrument for semantic analysis than the metalanguages of formal logics because it is supposedly a formal language that maps knowledge of language without confusing it with use of language (Katz 1975a; b; 1977a; 1981). Whatever Katz believed, this is by no means obvious. We can only interpret Katz’s semantic markers for *chase*, for instance, because it uses English words whose meanings we combine to match up with our existing knowledge of the meaning of *chase*. In short, Katz’s metalanguage is a degenerate form of English. If we reword his various semantic markers for *chase* into more or less normal English, they will read something like *X is quickly following the moving object Y with the intention of catching it*. As a metalanguage this is superior to Katz’s unconventional, nonstandard, and ill-explained metalanguage; furthermore, it is no less revealing as a semantic analysis. Katz has claimed (as have other semanticists, too) that the English used in the semantic metalanguage is not English, which is used only as a mnemonic device. Such claims are utterly dishonest because the only way to make any sense of the metalanguage is to translate it into a natural language. That is why to analyse *bachelor* into {(Human), (Adult), (Male), (Single)} as did Katz and Nagel 1974: 324 is a more enlightening semantic analysis than {(48), (41), (4D), (53)}. Semantic markerese often lacks clarity and simplicity and it may be thought these are a consequence of it bring a formal theory of semantics; yet formalism, especially unconventional formalism, can only be justified if it increases explicitness of statement, rigour of analysis, and promotes clarity of expression. Markerese has none of these virtues.

Markerese was supposed to solve the ‘projection problem’, that is, the projection of the meanings of lexical items and grammatical morphemes such as tense and number from the lexicon into a lexically specified underlying phrase marker. Informally the projection rule

proceeds from the terminal nodes of the rightmost S in the categorization, through its mother and each supersequent mother node until the highest S node is reached (see Katz 1972: 114f).

I have discussed Katz's semantic markerese at length because it was the first comprehensive theory of linguistic semantics. For reasons that have been given, it was not successful but it did identify the parameters that other theories needed to engage with. Its major scope limitation was a lack of a proper treatment of pragmatics and no obvious extension beyond sentences to texts. These faults are also to be found in many of its rivals.

Identifying selectional restrictions

In Figure 1 there are symbols for selection restrictions. Language combines the meaning encapsulated in listemes into the complex meanings of phrases, sentences, and longer texts. Such combination is conditioned by the rules of syntax and at least four kinds of selectional restrictions (see Chomsky 1965). There are category features (Noun, Verb, ...), which determine different morphological and collocational possibilities, e.g. of *fly*_{Verb} and *fly*_{Noun} in *His hand flew to his fly*. Strict subcategorization identifies other syntactic categories that collocate with the listeme. Syntactically transitive verbs, for instance, are defined by some notational variant of the strict subcategorization feature [+ ___NP] "takes a 1st object"; *open* (as in *Fred opened the box*) has this feature, whereas the intransitive verb in *The door opened easily* has the feature [- ___NP]. Supposedly syntactic inherent features such as [+ human, + female, ...] for *woman*; or [+ active, ...] for *go* in fact have a semantic basis. The selectional features of one listeme refer to the inherent features of collocated listemes (e.g. for a verb [+ [+ animate]___[+ abstract]] "has an animate subject NP and an abstract 1st object NP"). So there are no grounds for the syntactic selectional features originally postulated to constrain a supposedly purely syntactic process of lexical insertion into syntactic phrase markers; in reality the procedure is semantically conditioned. It would otherwise be impossible to generate meaningful sentences like Shakespeare's *Grace me no grace, nor uncle me no uncle* or Scott's *But me no buts*. What governs the co-occurrence of listemes is that the collocation has some possible denotation (be it substance, object, state, event, process, quality, metalinguistic statement, or whatever). Consider an example marked anomalous in McCawley 1968a: 265.

(5) *That electron is green.

(5) is judged anomalous because electrons are theoretical constructs that cannot absorb or reflect light, and therefore cannot be felicitously predicated as green. But suppose an explanatory model of an atom were constructed in which an electron is represented by a green

flash: there would be no anomaly stating *That electron is green* with respect to such a model. Comparable explanations are possible for most apparent violations of selection restrictions, including the celebrated *Colorless green ideas sleep furiously* (Chomsky 1957: 15).⁷

Empirical evaluations of sequences of listemes for coherence and sensicalness depend upon what they denote; evaluations must be matched in the grammar by well-formedness conditions, in part expressed by selection restrictions. To describe the full set of well-formedness conditions for the occurrence of every listeme in a language entails trying every conceivable combination of listemes in every conceivable context, and such a task is at best impracticable and at worst impossible. Perhaps the best hope is to describe the semantic frames (*q.v.*) for every listeme.

Generative semantics

Noam Chomsky was educated in the Bloomfieldian school that eschewed semantic theory as speculative. For him semantics was at best an add-on for the syntactic base, a position affirmed by Katz and Fodor 1963 and in subsequent work by Katz, and a decade later by Jackendoff. The *Aspects* theory developed in Chomsky 1965 had a level of deep structure at which the meaning of each of sentence constituent was specified and the meaning ‘projected’ upwards through nodes in the phrase marker to develop a reading for the sentence. Deep structure was separate from a level of surface structure at which the form of the sentence is specified. This conception of grammar leads naturally to the view that pairs of formally distinct but semantically equivalent expressions such as *X caused Y to die* and *X killed Y* or *X reminds me of Y* and *X strikes me as similar to Y* or *my mother* and *the woman who bore me* arise from the same deep structure by different transformations. The next theoretical development, which became known as generative semantics⁸ was to propose that the initial structures in a grammar are semantic rather than solely syntactic. Despite its name, generative semantics was always primarily a theory of syntax in which there was little serious examination of any aspects of semantics other than the structuring of meaningful elements. It grew directly from the ground that had produced those stalwarts of what was dubbed ‘standard theory’, Katz and Postal 1964 and Chomsky 1965, whence the emphasis on syntactic justification derived. One of the earliest works in generative semantics was Lakoff 1965, originally conceived as an extension of standard theory. Lakoff postulates phrase

7. See Yuen Ren Chao’s (1971) story at <http://www-linguistics.stanford.edu/Archives/Sesquipedalian/1996-97/msg00033.html>.

8. The first use of the term was by Lakoff in 1963 (Lakoff 1976); the first published use of the term is in Bendix 1966: 12.

markers that terminate in feature bundles like those in *Aspects*; he differs from Chomsky in proposing that listemes be inserted into only some of these terminal nodes, the rest functioning as well-formedness conditions on lexical insertion and semantic interpretation. In 1965 Lakoff believed that lexical insertion preceded other transformations. Gruber 1965 contains lexical structures that have most of the syntactic characteristics of standard theory trees, but some terminal nodes were semantic components. Gruber argued that some transformations must operate on prelexical syntax (prior to lexical insertion). Semantic interpretation is made before certain other transformations apply, thus semantics and syntax are interdependent. A similar conclusion was reached in Postal 1966; 1970; 1972 and Lakoff and Ross 1976 [1967]. Weinreich 1966 showed that lexical insertion is semantically governed and that syntactic structure is just the skeleton for semantics. McCawley 1968b assumes that all natural language syntax can be represented by the symbols S(entence), V (predicate) and one or more NPs (arguments). In initial structure, V consists of a semantic component or ‘atom’ and NP either a recursive S node or a variable (an index) designating the referent. Thus, in generative semantics, initial symbols represent semantic components set into structures that are a hybrid of predicate logic and natural language syntax – both well established conventional systems. These structures can be rearranged in various ways by transformations before lexical forms are mapped onto them. Then transformations may rearrange or delete nodes until the final derived phrase marker gives a surface form for the sentence together with its structural description. Because the starting point is the meaning of the sentence, there is no projection problem because meaning is determined directly from that initial semantic structure.

The problem for generative semanticists was to give consistent semantic descriptions for listemes, phrases, etc. as they occur in different sentence environments in such a way that the meaning of any sentence constituent could be determined from the initial sentence structure. The semantic metalanguage was based on a natural language, and both Lakoff 1972b and McCawley 1972 claim that a semantic component such as CAUSE is distinct from the English verb *cause* but they fail to identify the difference; in fact CAUSE is necessarily interpreted as meaning “cause”. No rules governing the insertion of semantic predicates under V were ever specified. Either selectional restrictions must apply to constrain insertion or there will be unrestricted insertion subject to output conditions such as the semantic evaluator of Weinreich 1966. Neither was identified, probably because no one has proved capable of specifying such devices in practice. There is also the problem identified by Fodor 1970: a simple sentence like *X killed Y* supposedly derives from the complex *X caused Y to die*. One line of defence would be to claim that postlexical and not prelexical clauses denote events, but this is contrary to the

spirit of generative semantics. In a sentence like (6) one might claim that the adverbial ‘on Sunday’ blocks the insertion of *kill*. However the adverb in (7) has no such effect.

(6) X caused Y to die on Sunday by stabbing him on Saturday.

(7) X almost killed Y.

Die is supposedly based on BECOME NOT ALIVE or *cease to be alive*. The fact that (8) are acceptable but (9) are not suggests that DIE is a semantic component (atom, prime).

(8) X died in agony.

X died emaciated.

(9) *X ceased to be alive in agony.

*X ceased to be alive emaciated

Allan 1986 argued against semantic decomposition of most listemes in favour of recognizing entailment relations such as those in (10).

(10) X dies \rightarrow X ceases to be alive

X ceases to be alive \rightarrow X dies

Y kills X \rightarrow X dies

This certainly seems to be justified from a psycholinguistic point of view, cf. Fodor, Garrett, Walker et al. 1980.

Pronominalization, definiteness, and reference

In the 20th century arose new ideas on anaphora and reference, which intersect with definiteness. Early transformational grammar posited only syntactic constraints on pronominalization (Lees and Klima 1963; Langacker 1969). But Weinreich 1966 and McCawley 1968a argued that pronominal gender was semantic rather than syntactic, and Stockwell, Schachter and Partee 1973: 182 concluded ‘English tolerates discrepancies between formal and referential identity of certain sorts in certain environments, not easily describable in simple syntactic terms.’ Ross 1970 proposed a performative clause to underlie every utterance, which accounts for first and second person pronouns and their reflexives in e.g. (11).

(11) a. Only Harry and myself wanted to see that movie.

b. Max said nothing about yourself, but he did criticize me.

Although Ross' hypothesis was principally a syntactic device, it opened the gate to pragmatic constraints on pronouns relevant in exophora (*Just look at her!* said of a passing woman) and recognizing the most likely actor in *I took my dog to the vet and she bit her*.

Chomsky 1965: 145f suggested that referential indices be introduced on nouns to enable reflexivization. McCawley 1968b; c introduced referential indices into the grammar on analogy with variables in predicate logic and, ever since, they have been used to mark coreference even by those who reject McCawley's hypothesis. Chomsky 1981 distinguished the empty and ungoverned category (big) PRO [+anaphor, +pronominal] as in (12) from (little) *pro* [-anaphor, +pronominal], which is free in the local domain, cf. (13), from [+anaphor, -pronominal], the reflexive in (14), from the referring expression which is free – both NPs in (15). A *wh*-trace, *t*, is [-anaphor, -pronominal] as in (16).

(12) Sam asked Jo₁ [PRO₁] to bring Jack.

(13) Amy₁ praised her₂ [= *pro*]

(14) Amy₁ praised herself₁.

(15) Amy₁ praised Amy₂.

(16) a. Who [*t*] said that?

b. Who(m) did Ed tell you that Jo slept with [*t*].

Intuitively, argument binding is a matter of semantics rather than syntax, e.g. the pronoun *her* appropriately refers to Amy for semantic not syntactic reasons. In German, *das Mädchen* “girl” is rendered neuter by its diminutive suffix *-chen* but is normally pronominalized in colloquial speech by the feminine *sie* and not the neuter *es*, though the matter is hotly debated and in the written language syntactic conformity is the norm. Problems with Chomsky's binding constraints were soon pointed out and all seem to be accountable for pragmatically in terms of Levinson's I, Q, and M principles (Levinson 1995; 2000) which are based on Grice 1975. (The I-principle can be simplified to “What is expressed simply is stereotypically exemplified”; the Q-principle “What isn't said, isn't”; the M-principle “What's said in an abnormal way isn't normal”.) That a pronoun is free in the local domain results from the Q-principle: the use of a pronoun where a semantically stronger reflexive could occur gives rise to a conversational implicature which conveys the negation of the more informative, coreferential interpretation associated with the use of the reflexive, compare (13) with (14). The binding condition on referring expressions can also be eliminated: wherever a reflexive could occur, the use of a semantically weaker proper name, as in (15), Q-implicates the non-applicability of the more informative, coreferential interpretation associated with the use of the reflexive (see Huang 2000). The choice of what are generally referred to as anaphoric

forms in texts (which subsume Chomsky pronouns) has been discussed under the familiarity hierarchy of Prince 1981; the centering theory of Grosz 1977 and Sidner 1979; the ‘topic’ (actually referent) continuity of Givón (ed.) 1983; and the accessibility theory of Ariel 1988; 1990. These all emphasize the importance of context in selecting what form of anaphor to use.

It became clear during the 20th century that the indefinite NP requires the hearer to create a subset x from a set y such that $x \subset y$ as in *Two coffees, please* (a set of two from the set of all possible coffees). Bertrand Russell 1905 presented a theory of definite descriptions in which a sentence such as (17) has the logical translation (18): for some x such that x is a lamb, and for every y such that if y is a lamb then y is identical with x , such that x is sick.

(17) The lamb is sick.

(18) $\exists x (Lx \wedge \forall y (Ly \rightarrow y=x) \wedge Sx)$

The definite indicates a readily identifiable referent by equating set x with set y (perhaps by naming it) such that a definite article is similar to a universal quantifier. This has become known as the quantificational reading of the definite article and there is one view that holds that the referential use of a definite description rests on prior understanding of its quantificational meaning (Bach 2004a; Kripke 1977; Neale 2001; Salmon 1991). There is a contrary view, refuting the quantificational analysis in favour of what is sometimes called ‘direct reference’, that effectively sees the use of definites as analogous with pointing, thus rendering the definite unanalysable (Devitt 2007; Kaplan 1978; 1989; Reimer 1998; Wettstein 1983). The controversy shows no sign of abating.

Frege 1892 distinguished *Sinn* “sense” from *Bedeutung* which is often translated “reference” but, as the terms are used here, is “denotation”. There are many different views and definitions of reference (see Sullivan 2006 for a survey). Mostly, reference is a relation that obtains between language expressions and what speakers use those expressions to talk about. For instance, the speaker of (19) refers to someone called Saddam Hussein whom s/he supposes we shall be able to identify from common ground; s/he also refers to the (purported) fact of Saddam’s death at some unspecified time in the past.

(19) Saddam Hussein is dead.

Referring is a pragmatic act. For some (e.g. Reimer 2003) reference is naming. It is true that to name is to refer; but the relationship is asymmetric because to refer is not necessarily to name. In (19) an event is referred to and in (20) the italicized NPs refer – in (a) to a nullity and in (b) to an unknown.

(20) a. *No human* has walked on Mars.

b. Is there *life on Mars*?

Donnellan 1966 identified as attributive reference the italicized NP in (21), where the identity of the referent is unknown and never likely to be known, and also (22) asked of someone drinking water from a martini glass – which, therefore, is an example of mistaken reference; though it is quite likely that the intended referent will be correctly identified.

(21) *The person who designed Stonehenge* was very accomplished.

(22) Who is *the man drinking a martini*?

It is generally agreed that attributive reference functions through quantificational meaning of the definite article.

Conceptual semantics

Like Katz's markerese, the conceptual semantics of Ray Jackendoff, most succinctly collected in Jackendoff 1990, lacks a proper treatment of pragmatics and makes no obvious extension beyond sentences to texts. According to Jackendoff, semantics is a part of conceptual structure in which linguistic, sensory, and motor information are compatible (see Jackendoff 1983; 1987; 1992; 2002; 2007). This breadth of vision has a consequence that is unusual in semantic theories: Jackendoff believes that word meaning is a large, heterogeneous collection of typicality conditions with no sharp distinction between lexicon and encyclopedia.

Conceptual structure includes a partial three-dimensional model structure based on visual perception such that the actions denoted by *run*, *jog*, and *lope* look different but have a common semantic base represented by the primitive verb GO. A partial model for such verbs represents the manner and stages of motion, but is unspecified so as to enable an individual to recognize different instances of running, jogging, etc. as the same kind of activity. The different manners of motion visible in each of *run*, *jog*, and *lope* on the one hand, and *throw*, *toss*, and *lob* on the other, Jackendoff refers to as differences in model structures. Along with visual differences are other sensory differences that would be perceived by the unsighted as well as the sighted person. No semanticist has discussed these, but if visual data is to be accounted for, so should other sensory data. All this information is encyclopaedic rather than lexical. (An encyclopedia functions as a structured data-base containing exhaustive information on many (perhaps all) branches of knowledge; a dictionary (lexicon) is a bin for storing listemes; see Allan 2006).

Every content-bearing major phrasal constituent of a sentence corresponds to a conceptual constituent. S expresses STATE or EVENT. NP can express almost any conceptual category. PP expresses PLACE, PATH, and PROPERTY. Jackendoff is principally interested in the

semantic structure of verbs, with a secondary interest in ‘function-argument structures in the spatial domain’. He has made no attempt to semantically decompose nouns, treating them as semantic primitives. In his view, only kin terms and geometric figures admit of satisfactory semantic decomposition. By contrast, he finds that verbs decompose into comparatively few classes (as also in Role and Reference Grammar, *q.v.*).

Jackendoff’s vocabulary of semantic primitives is very much larger than the set used by NSM researchers. The syntax of his lexical conceptual structure (LCS) is a configuration of functions ranging over arguments. For instance, (23) is a conceptual structure in which function F has two arguments [A] and [B]. Note that conceptual structures and primitives are bounded by square brackets, and the range of the function in parentheses. An example is (24).

(23) [F([A],[B])]

(24) [PLACE] → [_{Place}PLACE-FUNCTION([THING])]

EVENT is exemplified in (25)–(26), STATE in (27), CAUSE in (28). There are no representations for definiteness or tense.

(25) *Bill went to Boston* [_{Event}GO([_{Thing}BILL], [_{Path}TO([_{Thing}BOSTON])])]

(26) *The light changed from red to green* [_{Event}GO([_{Thing}LIGHT], [_{Path}TO([_{Property}RED], [_{Property}GREEN])])]

(27) *Bill is in Boston* [_{State}BE([_{Thing}BILL], [_{Place}IN([_{Thing}BOSTON])])]

(28) *Bill drank the beer* [_{Event}CAUSE([_{Thing}BILL], [_{Event}GO([_{Thing}BEER], [_{Path}TO([_{Place}IN([_{Thing}MOUTH OF([_{Thing}BILL])])])])])]

A preferred alternative to the double appearance of BILL in (28) is Argument Binding, symbolized ‘ α ’ in the lexicon entry for *drink* in 10 (Greek superscripts α, β, γ stipulate binding between argument positions).

(29)
$$\left[\begin{array}{l} \text{drink} \\ \text{V} \\ \left[\begin{array}{l} \text{CAUSE}([\text{Thing }]^{\alpha}_A, [\text{Event GO}([\text{Thing LIQUID}]_{<A>}, \\ \text{Event } [\text{Path TO}([\text{Place IN}([\text{Thing MOUTH OF}([\text{Thing } \alpha])])])])]) \end{array} \right] \end{array} \right]$$

Subscript $<A>$ marks an option: what is drunk must be liquid, but need not be mentioned, cf. *Bill drinks*. All arguments are indexed by subscript $_A$. Thematic roles are assigned according to a thematic hierarchy by ‘argument linking’. In (29), [_{Thing}] $^{\alpha}_A$ will be assigned what Jackendoff calls the actor role. [_{Thing}] $^{\alpha}_A$ is co-indexed with [_{Thing} α] into whose mouth the liquid goes – namely ‘Bill’ in (28). The $_A$ in [_{Thing}LIQUID] $<A>$ indicates that it holds the role of theme. The theme NP is optional; syntactically intransitive *Bill drank* is nonetheless

transitive in its semantic structure. The revised conceptual structure for *Bill drank the beer* is therefore (30).

- (30) [EventCAUSE([ThingBILL]^α_{A-actor}, [EventGO([Thing-liquidBEER]_{A-theme},
[PathTO([PlaceIN([ThingMOUTH OF([Thingα]))])])])])]

Conceptual semantics shows that a semantic decomposition of verbs making extensive use of just a few primitives is a feasible project. The syntax of LCS is a function-argument structure similar to that of predicate calculus, so that someone acquainted with predicate calculus can construct a lexical conceptual structure despite the fact that Jackendoff does not employ standard logical formulae. Although LCS makes no use of logical connectives, some of the more complex formulae imply conjunction between the function-argument structures in a lexical conceptual structure. There is a score of primitive verbs so far identified, so although the set of functions is restricted, the vocabulary of primitive arguments is unbounded. Conceptual semantics is designed to integrate with a dominant syntactic theory in late twentieth century linguistics: A-marking links the semantic interpretation to a node in the syntactic phrase marker. Jackendoff suggests that argument binding in LCS (using Greek superscripts) does away with the need for the level of logical form (LF) in syntax. LF has not yet been abandoned in favour of conceptual structure; but Jackendoff's conceptual semantics has been a real force within the development of grammatical theory.

Role and Reference Grammar, RRG, (Van Valin 2001; 2005; (ed.) 1993; Van Valin and LaPolla 1997; Foley and Valin 1984; <http://wings.buffalo.edu/linguistics/research/rrg.htm>) is a functionalist theory that does not posit underlying and surface representations as different strata but integrates morphology, syntax, semantics, pragmatics, and information structure in a readily accessible monostratal representation. RRG has been specifically developed to apply to every natural language and seeks to show how language expressions are used to communicate effectively. The basic clause structure consists of a predicate, which together with arguments (if any) form the Core, other constituents are peripheral. The Periphery may be located in different places in different languages, and it can be omitted. RRG structures are more like nets than like trees. All lexical, grammatical and pragmatic meanings are represented in the net, see Figure 2.

In RRG verbs are semantically classified according to aspect on the basis of the restrictions on their co-occurrence with adverbials and aspects, and certain of their conventional implicatures and entailments building on work by Vendler 1967 and Dowty 1979. The classification underlies the 'logical' (=semantic), structures of verbs, e.g. do'(x,[PRED(x or x,y)]) marks activity, PRED(x or x,y) state – where (x or x,y) indicates either one or two

arguments; PRED is a variable to be replaced by the particular name of the predicate. RRG escapes most of the problems that arise with the management of thematic roles. The original motivation for identifying thematic roles was to indicate in the syntactic frame of a predicate which surface cases, prepositional, or postpositional phrases it governs – all of which typically identify the roles of participants (people, objects, places, events) within the states of affairs. Thematic roles are referred to by many terms: ‘valencies’, ‘(deep) cases’, and ‘ θ -/theta roles’. Each such term is theory-dependent and the definition of a particular role in one theory is likely to be different in at least some respects from its definition in another theory, despite the same label (e.g. agent, patient) being used in both. Even trying to define each role in terms of a common set of entailments or implicatures leaves many problems unresolved. There is probably a boundless number of thematic roles; for instance, roles such as effector and locative have a number of subcategories, and it is possible that ever finer distinctions can be drawn among them; so it is hardly surprising that no one has satisfactorily identified a full set of roles for any language. (31) lists some that have been identified:

(31) attributant, attribute, cognizer, consumed, consumer, creation, creator, creator-theme, createe-way, desiror, effector (which includes agent, force, instrument, and means), emitter, emoter, existant, experiencer (which includes cognizers and perceivers of various kinds), hander, handee, handed, implement, indicator, judge, a host of spatial and temporal locations, lurcher, mover, object of knowledge/belief, observer, patient, perceiver, performance, performer, possessed, possessor, recipient, sensation, sneezer, speaker, stimulus, target of emotion/desire, theme (moved or static), user.

The definition of thematic roles in grammar is unsatisfactory and there is no sign that the situation is about to improve. Better definition is possible if we admit just two macroroles ‘actor’ and ‘undergoer’ in the grammar. The macroroles (MRs) of RRG are similar to the proto-roles in Dowty 1991; they are defined on the logical structures of verbs. The maximum number is 2, the minimum is 0 (in sentences like Latin *pluit* and English *It's raining*). The two MRs are ‘actor’ and ‘undergoer’, which roughly correspond to what is sometimes called ‘logical subject’ and ‘logical object’ respectively. They are called macroroles because they subsume a number of thematic roles but they are properly dependent on hierarchies such as the actor hierarchy, $DO(x, \dots \prec do'(x, \dots \prec PRED(x, \dots$; the undergoer hierarchy without an actor, $PRED(x, \dots \prec PRED(\dots, y) \prec PRED(x)$ (where $A \prec B$ means “A outranks B in the hierarchy”). DO only appears in the few logical structures that necessarily take an agent; for instance, in (32), DO indicates that *murder* necessarily takes an agent, whereas *kill* in (33) does not.

(32) Jo_x murdered Sam_y [DO(x_A ,[do'(x,Ø)])] CAUSE [BECOME dead'(y_U)]

(33) Jo_x killed Sam_y [do'(x_A,Ø)] CAUSE [BECOME dead'(y_U)]

In contrast to the uncertainty of assigning thematic roles, assigning MRs to a clause predicate is well-defined.

To sum up: the RRG analysis of the sentence *What did Dana give to Pat yesterday?* is shown diagrammatically in Figure 2. Functionalists seek to show that the motivation for language structures is their communicative potential; so the analysis is meaning-based and compatible with what is known about psychological mechanisms used in language processing. As well as the propositional content, participant functions (roles) need to be captured, but also all semantic and pragmatic information (such as speech act characteristics and information structure) needs to be directly represented along with the syntactic structure. The whole monostratal analysis is as close to psychologically real as any linguistic analysis can be.

Insert Figure 2 here

Scripts and frames

Beyond earliest childhood, very little we encounter is totally new in all its aspects. Most of what we hear and read can be interpreted wholly or partially in relation to structured knowledge arranged into modules of information. A speaker presupposes this common ground when constructing a text so that understanding, (34) is to invoke the restaurant script (Schank and Abelson 1977; Schank 1982; 1984; 1986) as a set of conversational implicatures (see Allan 2001: 193f).

(34) Sue went to a restaurant last night with her boyfriend.

Scripts contain structured information about dynamic event sequences. Regular components of a script are predictable and deviations from a script are potentially newsworthy. Scripts have personae, props, and action sequences. A restaurant script has customers, servers, cooks, etc. The props include tables, chairs, menus, cutlery, plates, food. The events include the customer entering the restaurant, ordering food, the food being brought by the server, the eating of the food, the requesting, presentation, and paying of the bill, and the customer leaving the restaurant. The vocabulary used in the script evoked by going to a

restaurant indicates its semantic associations, but it is unhelpful to simply list the terms: bill, chairs, cook, customer, drink, eating, entering, exiting, food, menu, order, server, tipping, etc. The script is much more valuable because it shows how the semantic associations are organized in respect of one another. Some are logically necessary: you cannot exit from a place before entering. Other parts of the script are simply conventional and can vary: in some establishments you pay before getting food; in some the cooking precedes the ordering. There is a very large number of scripts; many overlap and there must be networking among them. For instance, entering a restaurant has much in common with entering any other business premises and is distinct from entering a private home. There is a hierarchy: generally applicable script-like memory organizational packets have more specific scripts (like the restaurant script) and finer-grained scenes within them (e.g. ordering food). There is much research to be done, but it is certain that communication and language understanding make use of scripts, and that the vocabulary used in describing the scripts constitutes a semantic field of words whose interrelationships are defined in terms of the frames and event sequences in the script.

There is a distinction between the restaurant script – consisting of a dynamic structure of event sequences – and a restaurant frame (built from encyclopaedic knowledge) identifying the function of a restaurant and what kind of thing it is. Frames (Goffman 1974; Fillmore 1982; 2006; Fillmore and Atkins 1992) identify the characteristic features, attributes, and functions of a denotatum, and its characteristic interactions with things necessarily or typically associated with it. A restaurant is a public eating-place; its attributes are: (1) business premises where, in exchange for payment, food is served to be eaten on the premises; consequently, (2) a restaurant has a kitchen for food preparation, and tables and chairs to accommodate customers during their meal. Barsalou 1992: 28 describes attributes as slots in the frame that are to be filled with the appropriate values. The frame for *people* registers the fact that, being living creatures, people have the attributes of age and sex. The attribute sex has the values male and female. It can be represented formally by a function BE_SEXED applied to the domain $D = \{x: x \text{ is a person}\}$ to yield a value from the set {male, female}. The function BE_AGED applies to the same domain to yield a value from a much larger set. Frames interconnect in complicated ways. For instance, the social status and the appearance of a person are usually partly dependent upon their age and sex, but not necessarily so. Knowledge of frames is called upon in the proper use of language. Part of the frame for *bird* is that birds are FEATHERED, BEAKED and BIPEDAL. Most birds CAN_FLY, applied to an owl this is true, applied to a penguin it is false. Birds are sexed, and a (normal) female bird has the attribute CAN_LAY_EGGS with the value true. Attributes for events include

participants, location, and time of occurrence, e.g. the verb *buy* has slots for the attributes buyer, seller, merchandise, payment: these give rise to the thematic structure (valencies, case frames) of the verb. An act of buying occurs in a certain place at a certain time (a world~time pair with values relevant to evaluation of truth, see below). To sum up, frames provide a structured background derived from experience, beliefs, or practices, constituting a conceptual prerequisite for understanding meaning. The meaning of a language expression relies on the frames, and it is these that relate listemes one to another.

The ‘lexical semantic structures’ of Pustejovsky 1995 systematically describe semantic frames for every listeme, and may offer a solution to the problem of selection features, discussed earlier. Pustejovsky’s ‘generative lexicon’ entries potentially have four components. ‘Argument structure’ specifies the number and type of logical arguments and how they are realized syntactically. ‘Event structure’ defines the event type as state, process, or transition. For instance, the event structure of the verb *open* involves a process wherein X carries out the act of opening Y, creating a state where Y is open. ‘Qualia structure’ identifies the characteristics of the denotatum. There are four types: constitutive (material constitution, weight, parts and components); formal (orientation, magnitude, shape, dimension, colour, position); telic (purpose, function, goal); agentive (creator, artefact, natural kind, causal chain); Lexical inheritance structure (identifies relations within what Pustejovsky calls the lexicon, but which is arguably encyclopaedic information). Figure 3 demonstrates that *book* and *newspaper* have in common that they are print matter, and that *newspaper* can refer to both the readable product and the organization that produces it.

Insert Figure 3 here

Pustejovsky’s (*ibid.* 101) entry for *book* is (35):

$$(35) \quad \left(\begin{array}{l} \text{book} \\ \text{ARGSTR} = \left[\begin{array}{l} \text{ARG1} = \text{x:information} \\ \text{ARG2} = \text{y:phys_obj} \end{array} \right] \\ \text{QUALIA} = \left[\begin{array}{l} \text{information.phys_obj_lcp} \\ \text{FORMAL} = \text{hold(y,x)} \\ \text{TELIC} = \text{read(e,w,x.y)} \\ \text{AGENT} = \text{write(e',v,x.y)} \end{array} \right] \end{array} \right)$$

In the qualia, *information.phys_obj_lcp* is a ‘lexical conceptual paradigm’ (lcp) represented in a type cluster that says *book* is a physical object that holds information, cf. ARG2 and ARG1 and *hold(y,x)* in the formal quale. The type cluster is:

information.phys_obj_lcp = {information.phys_obj, phys_obj, information}

All three members of the set are available for expression by *book*. In (35), the agent quale captures the fact that a book is written by someone (v); the event of writing is e'.⁹ The telic quale captures the fact that a book is for reading (e) by someone (w).

Meaning in construction grammar

In construction grammar (Fillmore and Kay 1987; Goldberg 1995; 2006) meaning is not projected onto syntactic structures from listemes. A projection model (like that of Katz, Jackendoff) would require the italicised verbs in (36)–(39) to be distinct from default meanings: *pant* is not normally a motion verb; *bark* and *sneeze* are not normally causative; *knit* is not normally ditransitive.

(36) All in a sweat, Marlow *panted* up to the door and rapped on it loudly.

(37) The prison warden *barked* them back to work.

(38) Adele *sneezed* the bill off the table.

(39) Elaine *knitted* George a sweater for his birthday.

The additional verb meanings result from the construction in which the verb occurs.

Construction grammar proposes various integration types. For instance in (36) and (38) the construction indicates the motion, the verbs *pant* and *sneeze* the manner of motion; in (37) and (38) the constructions are causative, indicating a theme and result; in (39) the valence of *knit* is augmented to make it a verb of transfer by mentioning the recipient/beneficiary. The construction coerces an appropriate interpretation by imposing the appropriate meaning. This is exactly what happens with apparent violations of selectional restrictions discussed earlier; also in interpreting variable countability constructions such as (40)–(42) (see Allan 1980).

(40) Have another/some more potato.

(41) The herd is/are getting restless and it is/they are beginning to move away.

(42) She bought sugar. / He put three sugars in his tea.

The importance of truth conditions

Davidson 1967b: 310 was surely right when he wrote 'to give truth conditions is a way of giving the meaning of a sentence.' But truth is dependent on worlds and times: *Marilyn Monroe would have been 74 on June 1, 2000* is true; although MM died in 1962 we can imagine a possible world of June 1, 2000 at which she was still alive, and given that she was

9. See below on event-based semantics.

born June 1, 1926, she would indeed be 74. McCawley 1968b; c was one of the first linguists to adopt and adapt predicate logic into grammar, writing *Everything that Linguists Have Always Wanted to Know about Logic* (McCawley 1993 [1981]). The importance of truth conditions had often been overlooked by linguists. Hjelmslev 1943; Lyons 1968 and Lehrer 1974 suggest that the nine listemes *bull, calf, cow, ewe, foal, lamb, mare, ram, stallion* – which constitute a fragment of a semantic field – can be contrasted with one another in such a way as to reveal the semantic components in Table 1.

Insert Table 1 here

How can we determine that the analysis is correct? The basis for claiming that BOVINE or MALE is a semantic component of *bull* cannot be a matter of language pure and simple. It is a relation speakers believe exists between the denotata of the terms *bull* and *male* and *bovine* (i.e. things in a world that they may be felicitously used to refer to). Doing semantic analysis of listemes, it is not enough to claim that (43) is linguistic evidence for the claim that MALE is a semantic component of *bull*, because (44) is equally good until a basis for the semantic (and therefore grammatical) anomaly has been established that is independent of what we are seeking to establish – namely the justification for the semantic components identified in Table 1.

(43) A bull is male.

(44) A bull is female.

The only language-independent device available is an appeal to truth conditions, and this takes us to the denotata of *bull* and *male*. In fact what we need to say is something like (45).

(45) In every admissible possible world and time an entity which is a bull is male and in no such world is an entity which is a bull a female.

Note that the semantic component MALE of Table 1 must be equivalent to the relevant sense of the English word *male*. Thus, on the assumption that semantic components reflect characteristics of typical denotata as revealed through their intensions¹⁰ across worlds and times, the justification for postulating the semantic components in Table 1 is a set of inferences such as those in (46).

(46) For any entity *x* that is properly called a *bull*, it is the case that x is adult \wedge x is male \wedge x is bovine.

10. Intensions are what ‘senses’ describe. Some people think of them as concepts, others as the content of concepts. See below.

In fact it is no part of a general semantic characterization of *bull* that it typically denotes adults; one can, without contradiction, refer to a *bull calf*. Rather, it is part of the general naming practice for complementary sets of male and female animals. Nor is *bull* restricted to bovines, it is also used of male elephants, male whales, male seals, male alligators, etc. The initial plausibility of Table 1 and (46) is due to the fact that it describes the prototypical or stereotypical bull. The world of the English speaker is such that *bull* is much more likely to denote a bovine than any other species of animal, which is why *bull elephant* is usual, but *bull bovine* is not. This reduces (46) to something more like (47).

(47) For any entity x that is properly called a *bull*, it is the case that x is male and probably bovine.

What is uncovered here is that semantics is necessarily dependent on truth conditions and the probability conditions that are sometimes equated with implicature.

Formal semantics

Since about the time of Cresswell 1973; Keenan (ed.) 1975 there have been many linguists working in formal semantics. Formal semantics interprets formal systems, in particular those that arise from the coalescence of set theory, model theory, and lambda calculus with philosophical logic – especially the work of Richard Montague (Montague 1974; Dowty, Wall and Peters 1981), and the tense logic and modal logic of such as Prior 1957 and Kripke 1963; 1972. By and large, formal semantics has ignored the semantics of listemes such as nouns, verbs, and adjectives – which are typically used as semantic primes (but see Dowty 1979). It does, however, offer insightful analyses of secondary grammatical categories like number and quantification, tense, and modals. When adverbs are investigated, it is primarily to examine their scope within a construction, e.g. establishing the similarities and differences in meaning among (48).

- (48) a. Only Max voted for himself.
 b. Max only voted for himself.
 c. Max voted only for himself.

Event-based semantics was initiated by Davidson 1967a. The idea is to quantify over events, thus *Ed lifts the chair* would be (49), in which *lift* is a three place predicate.

(49) $\exists e \text{ lift}(\text{Ed, the chair, } e)$

In *Ed hears Jo call out* there is a complex of two events as shown in (50), where there is the event e of Jo's calling out and the event e' of Ed hearing e .

(50) $\exists e[\text{call out}(\text{Jo}, e) \wedge \exists e' \text{hear}(\text{Ed}, e, e')]$

Following a suggestion of Parsons 1980; 1990 participant roles can be incorporated as in (51), *Max drinks the beer*.

(51) $\exists e[\text{drink}(e) \wedge \text{agent}(e, \text{Max}) \wedge \text{patient}(e, \text{the beer})]$

This facilitates the nonspecification of the characterizing statement *Max drinks* in (52).

(52) $\exists e[\text{drink}(e) \wedge \text{agent}(e, \text{Max})]$.

Event-based semantics also renders it easier to capture the semantic difference between the togetherness sense of (53) versus the separate comings of (54).

(53) Max and Jo came to the party.

(54) [Both] Max and Jo came to the party.

There is always the question of how the meanings of complex expressions are related to the simpler expressions they are constructed from: this aspect of composition is determined by model theory in Montague semantics, which is truth conditional with respect to possible worlds. Where traditional predicate (and propositional) logic was concerned only with extension (existence) in the (real) world, intensional logics allow for existence in a possible (hypothetical) world. Just as intensions are comparable with ‘sense’, extensions are comparable with ‘reference’ or, better, denoting something within a particular model (or set of models). In Montague semantics semantic structure is more or less identical with syntactic structure. For Montague, NPs constitute a set of properties. This is even true of proper names (as in Frege 1892; see Kripke 1972 for a different view), thus the semantics of *Max* is given as (55) where P is the set of properties of individuals (e.g. being bald), $\forall P$ denotes the extension of P at a given world and time.

(55) $\lambda P[\forall P(\text{Max})]$

The property of being bald is represented by the intension $\wedge \text{bald}$ (a property applicable to everything bald in all possible worlds). If it is true in model $M^{w,t}$ that *Max is bald* then we write (56) which undergoes lambda conversion to generate (57), where $\forall \wedge \alpha = \forall \alpha$, the extension of α .

(56) $\lambda P[\forall P(\text{Max})](\wedge \text{bald})$

(57) $\forall \wedge \text{bald}(\text{Max})$

So $\forall \wedge \text{bald}(\text{Max}) = \text{Max is bald}$ has extension in $M^{w,t}$, i.e. it is true. *Someone is bald* would be represented as (58), which lambda converts to (59).

(58) $\lambda P[\exists x[\text{person}(x) \wedge \forall P(x)]](\wedge \text{bald})$

(59) $\exists x[\text{person}(x) \wedge \text{bald}(x)]$

In later developments (see Gamut 1991¹¹; Chierchia and McConnell-Ginet 2000) valuation functions were proposed. Suppose there is set of men a , b , and c (Arnie, Bob, Clive) who constitute the domain of a model world at a particular time, M , in which a and c are bald. The extension of baldness in M is represented $\llbracket \text{bald} \rrbracket^M$. Let x stand for any member of $\{a, b, c\}$. A valuation function takes a sentence x is bald as its domain and assigns to it a value in the range Fairclough where 1 is true and 0 is false. So the function $\llbracket \text{bald} \rrbracket^M$ applies in turn to every member of the domain X in model M to assign a truth value. The extension of *being bald* in M is $\llbracket \text{bald} \rrbracket^M = \{a, c\}$. Put another way: in M , $\text{bald}(x)=1 \leftrightarrow x \in \{a, c\}$ “ x is bald is true if, and only if, x is a member of the set $\{a, c\}$ ”. To evaluate *Someone is not bald* in M , a variable assignment function would check all assignments of x until one instance of x is not bald is found to be true (in our model, when x is assigned to b).

Anaphora typically results from making successive references to the same entity; as a rule, any two successive references to an entity involve some kind of change to it on the second reference. For instance:

(60) Catch _[it₁] a chicken₁. Kill _[it₂]. Pluck _[it₃]. Draw _[it₄]. Cut _[it₅] up. Marinade _[it₆]. Roast _[it₇]. When you’ve eaten _[it₈], put _[the bones₉] in the compost.

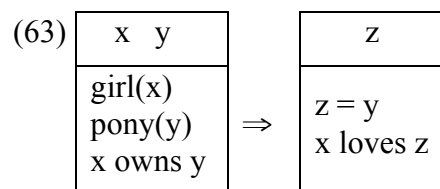
All nine subscripted NPs refer to the creature identified in ‘a chicken₁’, which refers to a live chicken. By 2 it is dead, by 3 featherless, by 5 dismembered, by 7 roasted, and by 8 eaten. 9 refers to the chicken’s bones after the flesh has been stripped from them. Thus 7, for instance, refers not to the chicken in 1, but to the caught, killed, plucked, drawn, cut up, and marinated pieces of chicken. Heim 1983; 1988 described this as updating the file on a referent. These successive states of the chicken are presented as changes in the world–time pair spoken of: although the world stays constant throughout (60), each clause corresponds to a temporal change time₁, time₂, ... time₉. The aim of Heim’s file change semantics has much in common with that of Discourse Representation Theory (Kamp 1981; Kamp and Reyle 1993) where the interpretation of one in a sequence of utterances (a discourse) is dependent on co-text such that the next utterance is an update of it. DRT has been especially successful in capturing the complex semantics of so-called donkey sentences, originating in Walter Burley’s *Omnis homo habens asinum videt illum* from *De Puritate Artis Logicae* 1324–8 (Burley 2000); for instance, (61) – which paraphrases as (62).

11. L. T. F. Gamut is a collective pseudonym for Johan F. A. K. van Benthem, Jeroen A. G. Groenendijk, Dick H. J. de Jongh, Martin J. B. Stokhof, and Henk J. Verkuyl.

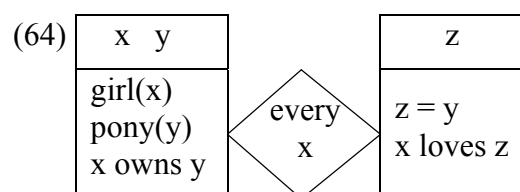
(61) Every girl who owns a pony loves it.

(62) If a girl owns a pony, she loves it.

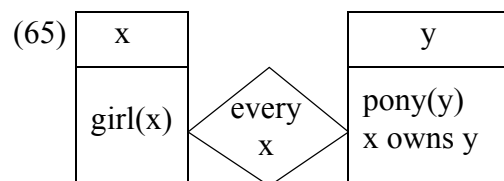
A discourse representation structure (DRS) for (62) is (63). The arrow indicates that the second box is a consequence of the first. The lefthand box is interpreted first, then the righthand box.



Notice that the anaphor for a-pony-loved-by-the-girl-who-owns-it is z, and it does not occur in the lefthand box. The DRS for (61) is (64).



Notice that (64) does not say that *Every girl owns a pony*, whose DRS is (65).



DRT is undergoing extensions in the 21st century, see Asher and Lascarides 2003; Jaszczolt 2005.

Contextualism

There are two ways in which the meaning of a new word can be revealed by whomever coins it: it may be formally defined – a rare procedure in normal language use, where the hearer or reader is left to figure out the meaning from its use in the prevailing context. The term *context* denotes any or all of four things: the world and time spoken of; the co-text (i.e. the text that precedes and succeeds a given language expression); the situation of utterance and the situation of interpretation. The meaning ascribed by use in particular contexts will take precedence over any formally defined meaning. As Wittgenstein 1953: 43 famously wrote: ‘the meaning of a word is its use in the language.’ What he should have said is that the meaning is determined by the way the word is used. Assignment of meaning by ordinary use is phylogenetically and ontogenetically prior to defined meaning – but for words (listemes) not sentences, because at any one time the set of listemes is bounded, but the set of sentences

is not. However the ways in which the meanings of sentences are constructed are determined by use, so although no speaker could literally and truthfully say *I've just been decapitated*, the meaning is readily interpretable via its intension. One problem with the use theory of meaning is that it risks confusing denotation with connotation: the denotations are the same of *faeces* and *shit* or *my mum* and *the woman who bore me*, but the connotations are different. Each of these two pairs is used of a common referent, but the contexts of use are normally different.

Malinowski 1923 coined the term *phatic communion* to refer to the social-interactive aspects of language (greeting, gossip, etc.) and to focus on the importance of the 'context of situation' in representing meaning. This view was adopted by J.R. Firth, the most celebrated British linguist of his generation. Firth, who was also influenced by the Prague school functionalists (Mathesius 1964; Vachek 1964), emphasized the importance of studying meaning in the context of use, taking into account the contribution of prosody (Firth 1957; 1968). His own work in these areas is less significant than the effect it had on one of his students, Michael Halliday, who worked on prosody and also developed a polysystemic grammatical theory on Firthian lines, originally called System-Structure Grammar, then Scale and Category Grammar, and now Systemic Functional Grammar (SFG) (see *The Collected Works of M.A.K. Halliday*, Halliday 2002-2009). Halliday and his school have always been interested in the grammatical analysis of text and discourse and the Hallidayan approach has been taken up in Rhetorical Structure Theory (see Halliday and Hasan 1976; 1989; Mann, Matthiessen and Thompson 1992; Mann and Thompson 1986; Matthiessen and Thompson 1988). Hallidayan theory has also been adopted by critical discourse analysts (e.g. Hodge and Kress 1988; Kress and Leeuwen 2001). An important Hallidayan contribution to linguistic terminology is the labelling of *metafunctions*. The idea is that languages reflect the speakers' construal of experience in terms of an 'ideational metafunction', which expresses experiential and 'logical' aspects of meaning (*logical* refers to functional and constituency relations within and between categories). Essentially it captures the propositional content of a text. Second is the 'interpersonal metafunction', which captures aspects of illocutionary and perlocutionary force and generally responds to pragmatic matters such as politeness and cooperation in social interaction. Third, there is the 'textual metafunction', which deals with the informational structure (theme~rheme, given~new, topic~focus aspects) of the text and so is the way that texts are constructed to accommodate the other two metafunctions.

The situations of utterance and interpretation provide anchors for deictic or indexical categories such as tense, personal pronouns, deictic locatives and demonstratives. The term *deixis* derives from the Stoic δειξις "demonstration, indicated referent"; *indexical*, in this sense, was introduced by Peirce 1931, Vol 2, Chapter 2. Although study of these grammatical

categories had been proceeding for more than two millennia, there was an upsurge of interest after World War II (see Lyons 1977; Levinson 1983; Fillmore 1966; 1997). Corresponding to the fact that in personal pronoun systems, the speaker is first person, hearer is second person, all others are third person, many languages, including some English dialects, have corresponding locatives meaning roughly “near speaker” (*here*), “near hearer” (*there*), “not-near either speaker or hearer” (*yonder*). The situations of utterance and interpretation may determine choices of adverbials and directional verbs relative to the location of speaker and hearer; e.g. the choice among the verbs *come*, *go*, *bring*, *come up*, *come down*, *come over*, etc. Situation of utterance and assumptions about the hearer also play a role in determining the topic and the linguistic register or jargon – that is, the variety of language associated with a particular occupational, institutional, or recreational group: for instance, legalese, medicalese, cricketese, linguistialese, and so forth (Biber and Finegan (eds) 1989; Allan and Burridge 1991; 2006). They influence politeness factors such as terms of address and reference to others (see Brown and Gilman 1960; Ervin-Tripp 1972; Geertz 1972; Shibatani 2006); and influence kinesic acts such as gesture, facial expression, and the positions and postures of interlocutors (Hall 1959; Argyle 1988; Clark 1996; Danesi 2006).

Once the meaningful interpretation of a language expression makes recourse to context, pragmatics intrudes (see Gazdar 1979; Levinson 1983). The boundary between semantics and pragmatics was specifically raised by Grice 1975: 43 as a distinction between *what is said* – the truth-conditional aspects of meaning – and *what is implied, suggested, meant* – the non-truth-conditional pragmatic overlay that is implicated. Grice writes of (66), ‘B implicates that Smith has, or may have, a girlfriend in New York’ (*ibid.* 51).

(66) A: Smith doesn’t seem to have a girlfriend these days.

B: He has been paying a lot of visits to New York lately.

The implicature is inferred from what B actually says given the cooperative assumption that it is a rational response to A’s remark, i.e. that it is relevant to the co-text. The four Gricean (categories of) maxims that give rise to such implicatures were reduced to three in Levinson 1995; 2000, two in Horn 1984, and one in Sperber and Wilson 1995 [1986]. It has become a matter of controversy whether or not there is a clear distinction between *what is said* and *what is meant*. Horn 1972 identified sets of scalar implicatures (e.g. *three N* +> *exactly three N*; *some N* +> *not all N*; *warm* +> *not hot*) which Grice 1978 accepted as Generalized Conversational Implicatures because they do not rely on a particular context, unlike the Particularized Implicature in (66). Grice 1978: 117 ‘Senses are not to be multiplied beyond necessity’ (Modified Occam’s Razor) favoured the underspecification of semantics, the

additional meanings supplied from pragmatics; this became known as radical pragmatics (see Cole (ed.) 1981). The idea is that the negative in a sentence like (67) is not ambiguous and that truth value is determined on the utterance in context: (67) was true of Louis XIV in 1650 but today there is no appropriate referent and that fact can account for the negative.

(67) The King of France is not bald.

In (68) we assume that the light came on as a result of Sue flicking the switch, whereas in (69) Sue's flicking the switch seems to follow the light coming on.

(68) Sue flicked the switch and the light came on.

(69) The light came on and Sue flicked the switch.

These are pragmatic inferences that can be cancelled and, certainly out of context, (68) and (69) have the same truth conditions, because $(p \wedge q) \leftrightarrow (q \wedge p)$. However, according to Carston 1988 though they have the same logical form they have different truth conditions which are determined on the basis of pragmatic enrichment (e.g. (68) is true just in case Sue's flicking the switch caused the light to come on).

Grice held that implicature steps in where literal meaning gives way to figurative meaning, so he distinguished *saying* from *making as if to say*. It is now generally believed that pragmatic inference kicks in *ab initio* and is needed to recognize literal as well as nonliteral language (Bach and Harnish 1979; Allan 1986; Sperber and Wilson 1995 [1986]; Jaszczolt 1999; Recanati 2004). The meaning of *open* is contextually distinct in *open a door*, *open a window*, *open mind*, *open a wound*, *have eyes opened*. The fact that *It's raining* is necessarily understood as referring to rain in some particular locality has led Relevance Theorists to name this an 'explicature' on the basis it enriches logical form by making it more explicit; Bach 1994 calls it an 'implicature' because it is an implicit expansion of the semantic content. According to Carston 2002, (71) is an explicature of (70) and (72) an implicature (because it is functionally independent).

(70) I've already eaten [uttered at lunchtime]

(71) I've already eaten lunch.

(72) I am not longer hungry.

Explicatures as first conceived were not defeasible. However, it does seem possible that *I've already eaten*; *I had a large mid-morning snack in place of lunch* is an alternative to (71). It is a moot point whether this is not simply an alternative to (71) rather than cancelling it. What it does show is that the content of explicature is far less certain than the identity of the understood eater in the nonfinite clause of *I want to eat lunch*. All this muddies the boundary

between semantics and pragmatics; but as Bach 2004b says, semantics concerns the meanings of sentences, which may often fail to determine complete propositions but they have properties independent of anybody's act of uttering them. Pragmatics is concerned, not with sentences themselves, but with utterances of sentences in the course of communicating, and truth conditions apply to these utterances.

The debate over the semantics~pragmatics interface continues. Jaszczolt's Default Semantics (Jaszczolt 2005) seeks to merge interpretations available from logical form and from pragmatic inferences of various kinds without giving priority to any one source. There is an assumption that lexical meanings can be dispensed with because words act like pointers to particular senses in particular contexts (which is somewhat akin to construction grammar, q.v.). Whether this is feasible, remains to be seen.

Computational developments in lexicography

Computers are good for recognizing strings of symbols for the purposes of counting the instances of a word or phrase in a document. Lexicography relies on access to data about usage and this is greatly facilitated by machine reading of large corpora which can identify how often an item occurs and its co-text. In 1980 the Cobuild dictionary project was launched as a cooperative effort between Collins publishers and Birmingham University. Developments in optical scanning enabled the corpus to expand to 20 million words by 1985. By 2002 the Collins Bank of English was up to 500 million words. Online dictionaries readily permit regular updates and hyperlinks to additional information; the ubiquity of the World Wide Web makes them very easily accessible.

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Allan, Keith 1943–

Argyle, Michael 1925–2002

Ariel, Mira 1952–

Aristotle 384–322 BCE

Arnauld, Antoine 1612–94

Augustine of Hippo 354–430

Bach, Kent 1943–

Backhouse, Anthony E. 1944–

Barsalou, Lawrence W. 1951–

Battig, William F. 1929–79

Bendix, Edward Herman 1929–

Bentham, Johan F. A. K. van, 1949–

Berlin, Brent 1936–

Biber, Douglas E. 1952–

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Brown, Roger William 1925–1997

Burley (Burleigh), Walter *c.* 1275–1345

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 Fillmore, Charles J. 1929–
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 Geertz, Clifford James 1926–2006
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 Givón, Talmy (Tom) 1936–
 Goddard, Cliff 1953–
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Figures

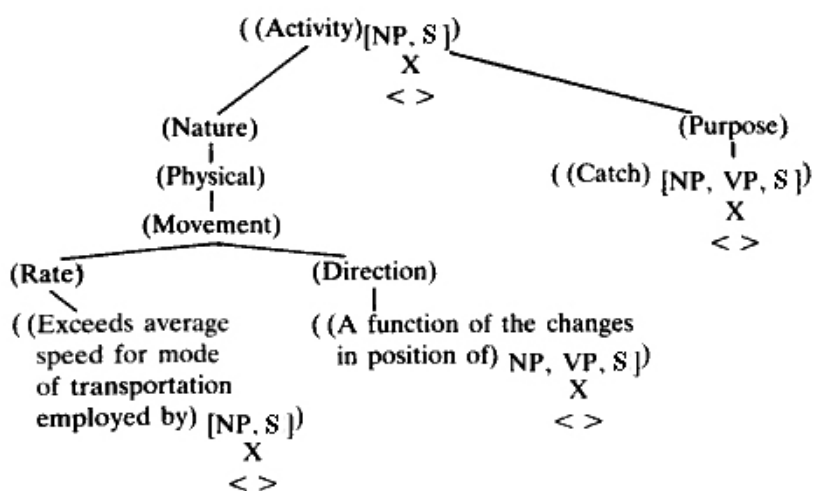


Figure 1. The semantic reading for *chase* in Katz 1977c: 62

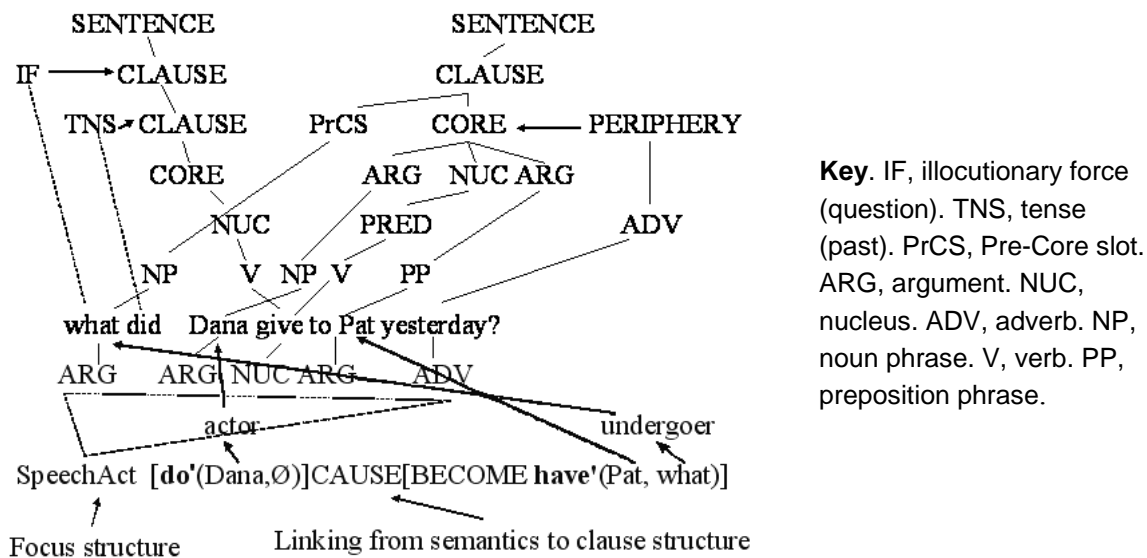


Figure 2. The syntax, semantics, and pragmatics of *What did Dana give to Pat yesterday*

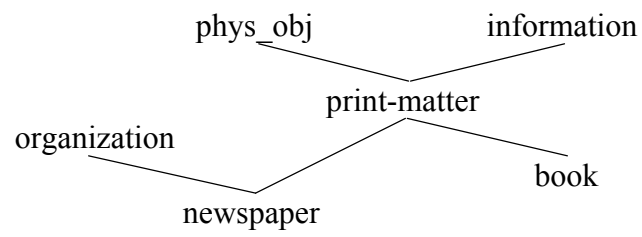


Figure 3. Relations within the lexicon (Pustejovsky 1995: 95)

Table

Table 1. A componential table

BOVINE	<i>bull</i>	<i>cow</i>	<i>calf</i>
EQUINE	<i>stallion</i>	<i>mare</i>	<i>foal</i>
OVINE	<i>ram</i>	<i>ewe</i>	<i>lamb</i>
	MALE	FEMALE	YOUNG
	ADULT		