

The Formal Semantics of Grammaticalization

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Grammaticalization is the gradual historical development of function morphemes from content morphemes. Among the commonly identified characteristics of this process is what is often called “semantic bleaching”: while becoming more and more functional the morpheme loses most of its meaning. In this paper, I ask what sense we can make of “semantic bleaching” from a formal semantic perspective. I consider several ways of characterizing the semantics of functional morphemes and discuss what has to happen to the meaning of a morpheme that is being grammaticalized. My main claims are:

- Functional morphemes are not meaningless.
- Their meanings are special however: they are permutation-invariant, have high types, and are subject to universal constraints.
- Grammaticalization enriches the inventory of functional meanings of a language by composing pre-existing functional meanings with “bleached” lexical meanings.

I write this paper with a lot of trepidation, since I haven’t even begun to get well acquainted with the vast literature on grammaticalization and the many detailed and sophisticated analyses of particular paths of grammaticalization. My discussion throughout will therefore stay at a shockingly abstract level. If there is any justification for this paper, it is that it presents a sketch of a different perspective that might be interesting both to scholars of grammaticalization and to linguists in the generative tradition. In any case, what follows is more a research proposal than a research report.

1. Functional Categories in Theoretical Linguistics

The distinction between functional morphemes and content morphemes is of course well-established in many linguistic frameworks. One of the crucial properties of functional morphemes is that, in any given language, their inventory is limited, as opposed to the open-ended lexicon of content items. A list of some important kinds of functional morphemes may give an idea of what we are dealing with:

- (1) Noun Class - Gender - Number - Determiner - Quantifier - Case - Verb Class - Voice - Aspect - Tense - Modality - Negation - Complementizer - Conjunction - 'Wh'-Elements - Degree Words - Comparative - Superlative

The notion of functional categories was brought into mainstream generative grammar by Fukui (1986) and Abney (1987). From looking at the list in (1), it seems that one could essentially write a grammar of a whole language by just describing the functional morphemes in that language. This intuition is often framed as a principle of natural language: grammatically relevant cross-linguistic variation is confined to the properties of functional morphemes (Borer 1983; Fukui 1986; Chomsky 1991). Of course, languages will differ in the inventory of content words, but that seems of comparatively little theoretical importance. We thus endorse the following claim:

- (2) Functional categories are what grammar is all about.

But what exactly are functional categories?

2. Two Examples of Grammaticalization

There is no way we can do justice here to the richness of the work being done in the framework of grammaticalization. Useful surveys can be found in Heine, Claudi & Hünnemeyer (1991) and Hopper & Traugott (1993). What I will do is briefly discuss (i) the origin of auxiliaries and (ii) the origin of determiners and quantifiers. These are two well-worn paths of grammaticalization (or "clines" as Hopper & Traugott call them), which I will later consider from a formal semantic point of view.¹

The Origin of Auxiliaries. Auxiliaries (and ultimately verb affixes derived from auxiliaries) have their origin in full verbs. One celebrated example concerns future auxiliaries/inflections that originate in various kinds of complementation structures (Fleischmann 1982; Bybee & Pagliuca 1985; Pinkster 1987). Romance futures developed from a construction where a verb of obligation embedded an infinitive complement:

- (3) haec cantare habeo
these sing-INF have-1sg
 "I have these to sing" or "I have to sing these"

The French future inflection as in *chanterai* ("I will sing") is developed from this collocation. Similar changes can be found again and again in languages around the world.

¹I will not spend any time on discussing whether the very phenomenon of grammaticalization presents a threat to the legitimacy of generative grammar. It seems to me that it doesn't even though some authors do see the apparently gradual and squishy nature of grammaticalization as an embarrassment for the clear-cut lexical/functional dichotomy built into generative grammar. But see Vincent (1993), Haspelmath (1992, 1994) for some reconciliatory moves. Similarly, an alleged threat to generative grammar from the phenomenon of iconicity is shown to be largely illusory in Newmeyer (1992).

The Origin of Determiners and Quantifiers. Determiners often develop out of particular kinds of adjectives: definite determiners originate in demonstrative adjectives (Greenberg 1978), while indefinite determiners come from numeral adjectives meaning ‘one’ (Givón 1981). Haspelmath (forthcoming) shows that universal quantifiers often come from adjectives as well.

I would like to note some important facts about such paths of grammaticalization, facts that will be relevant later. First, the origins of functional items do not lie in any old lexical concepts. The source items are usually found in fairly restricted semantic fields. Two major sources of future markers have been identified: (i) agent-oriented modalities of desire, obligation, and ability, and (ii) verbs of motion towards a goal. Hook (1974, 1991) identifies a set of “vector verbs” that are on the verge of becoming auxiliaries. Similarly, determiners and quantifiers seem to come from adjectives that have some kind of numerical meaning, not for example from adjectives meaning “old” (which wouldn’t be so strange from the point of view of a familiarity theory of definiteness).

Second, the syntactic projection of functional items reflects the projection of the original lexical items. Haspelmath (1994) makes this point and shows that it supports the tenet of recent generative work that functional items head their own projections.² Thus, an embedding verb is naturally seen as heading its own VP, and after grammaticalization the auxiliary will be heading its own phrase (TP or whatever we want to call it).

3. Syntax-Semantics Correlation in Grammaticalization?

Most authors seem to agree that within any particular process of grammaticalization there is a fairly tight correlation between syntax and semantics. It is felt that a morpheme that is being grammaticalized gradually loses its meaning. There are numerous suggestive terms for this aspect of grammaticalization: Heine, Claudi, & Hünnemeyer (1991: 40) mention “semantic bleaching”, “semantic weakening”, “semantic fading”, “desemanticization”, “generalization or weakening of semantic content”.³

In generative grammar as well, there is a prevailing position that there is a semantic reflex of the functional/lexical dichotomy: functional items are meaningless. Their contribution should be exhausted by the time semantic interpretation happens. In concert with the “Principle of Full Interpretation” (every symbol in an LF representation must have an interpretation), it is then natural to assume that functional items are deleted by the time we reach the end of the syntactic derivation. In the parlance of the minimalist program, their job is done after “checking” has happened.

Now, are functional items really vacuous? I concede that case and agreement markers might be meaningless, although at least so-called inherent cases seem to have semantic content, and some parts of agreement morphemes carry semantic information (person, number and gender are not necessarily meaningless features). For most other functional morphemes, the view that they have no meaning is entirely mistaken. The semantics of determiners, modals, tenses, aspects etc. is after all the bread and butter of

²Haspelmath seems to think that this line of reasoning shows that determiners do not head their own projections. This depends on the assumption that the source items for determiners, adjectives, are always mere modifiers of the noun they combine with. I am not sure whether this assumption can be maintained, but this is not the occasion to discuss this issue any further.

³There are some dissenters who typically point out that there are shifts in meaning that are more “sideways”, involving conventionalized implicatures and metaphoric or metonymic transfer, see for example Traugott (1988).

working semanticists. If there is a semantic reflex of the functional/lexical distinction it is not that functional items are vacuous.

4. The Semantics of Functional Morphemes

We are now at a point where we could give up the idea that there is a semantic characterization of functional morphemes. It might be that the distinction is largely or purely syntactic in nature and only loosely correlated with semantics. The intuition of researchers seems to be that there is a correlation, but since we have already dismissed the usual claim that there is loss of meaning, we might have to dismiss the whole notion of a syntax-semantics correlation in grammaticalization.

But, maybe we shouldn't give up so soon. If it is not vacuousness that characterizes the meaning of functional items, maybe there is some other semantic property that is correlated with functional status. Could it be that the meaning of functional morphemes is more abstract? Perhaps, but what does it mean for a meaning to be abstract? Could it be that their meaning is more grammatical/functional? Sure, but what *is* functional meaning? Is there a way of looking at the semantic composition of a sentence like (4) and identify the functional meanings in it without using syntactic criteria?

(4) The cat is not on the mat.

Let us see whether there is a way to characterize functional meanings.

4.1 Two Unsuccessful Attempts

Could it be that functional meanings are blander than other meanings? It is easy to say why *cat* is blander than *domestic shorthair feline*: the former is true of more individuals than the latter, hence its meaning is more general. Unfortunately, this counting of elements in the range of a function won't help us much because it doesn't provide a way of comparing the blandness of meanings that are of different types. So, it wouldn't explain the intuition that *not* is blander than *cat*.

Could it simply be that the functional meanings are the most frequently employed ones? That is clearly incorrect: there are some fairly infrequent functional morphemes such as *unless*, *lest*, *ought*, etc. Here is a snapshot of very frequent words in English:

1. *the*, 2. *of*,..., 43. *said*,..., 69. *time*,..., 72. *make*,..., 501. *shall*,..., 901. *train*,..., 1000. *pass*,..., 1150. *unless*,...

[from Carroll et. al. (1971)]

So, while there is some link between frequency and functional status, it has little predictive value. The only thing we might say is that functional items tend to be frequent because their presence is obligatory and there is a small inventory of them.

4.2 Permutation Invariance, High Types, and Semantic Universals

There is in fact work that has tried to identify a special class of meanings. The target notion, however, was not the meaning of functional items but the meaning of "logical" items, items whose meaning made them suitable for treatment in a system of logic. We might consider identifying logical meanings with functional meanings. The most common idea is that functional/logical meanings are invariant under permutations of

the universe of discourse (Mautner 1946; Tarski 1983; van Benthem 1989; Sher 1991). The intuition is that logicity means being insensitive to specific facts about the world. For example, the quantifier *all* expresses a purely mathematical relationship between two sets of individuals (the subset relation). Its semantics would not be affected if we switched a couple of individuals while keeping the cardinality of the two sets constant. There couldn't be a logical item *all blonde* because it would be sensitive to more than numerical relations. And in fact, we can conjecture that no language has a determiner *all blonde*.⁴

There is another relevant idea in the literature: the idea that functional meanings have high types (Chierchia 1984; Partee 1987).⁵ Let us assume that there are two basic levels of expressions: expressions that refer to entities or situations and expressions that denote predicates of entities. Functional categories have high semantic types, beyond these levels of entities, situations, and predicates. Quantificational determiners for example relate two sets of entities. Tenses (perhaps) are quantifiers relating two sets of situations. And so on.⁶ There are even fourth order operators: for example the higher order modifiers of modifiers *almost* and *very*. Chierchia links the high type proposal to another interesting property of functional items: there are no grammatical processes that involve quantification over functors. For example, *almost*, *again*, *too* etc. do not represent a possible answer to *how*-questions. Similarly, they do not enter comparative formation or act as the antecedent of proforms like *thus* or *so* (Chierchia 1984: 86).

Something that has not been explored much at all is the question whether there is a link between permutation-invariance and high type. There are a priori some low type permutation-invariant meanings; for example, identity might be just a transitive verb type ($\langle e, \langle e, t \rangle \rangle$). But perhaps even the adjective *same* has a high type (incorporating reference to a standard of comparison: x is the same P as y). I will conjecture that in natural language permutation-invariance and high type go hand in hand.

There are other more specific constraints on functional/logical items. A celebrated example is the semantic universal that all determiners are conservative, where conservativity (or the "lives on" property) is defined as follows:

- (5) A determiner is conservative iff for all sets A, B :
 $[[]](A, B) \implies [[]](A, A \cap B)$.

What this means is that the first argument of a determiner "sets the scene". To evaluate the quantificational statement, we only have to look at the members of the set A picked

⁴There are some exotic examples of function morphemes that are not obviously permutation-invariant. Mark Hale drew my attention to Rennelles/Bellona which has a set of pejorative pronouns that basically translate as "you shit" and the like (Elbert 1988). And of course, many pronoun systems contain fairly specific honorific content. Another problematic area (pointed out to me by David Gil) are classifiers whose content can be fairly specific but which seem fairly functional in nature, but see Adams & Conklin (1973) for a discussion of possible natural constraints on classifier meanings. To maintain the permutation-invariance claim, we would have to analyze categories that violate it as syntactic amalgams of functional and lexical morphemes. I have no idea whether that is a promising avenue.

⁵There are two old masters who envisioned a similar hierarchy of meanings. Sapir (1921: 101) has a four-level hierarchy: basic (concrete) concepts, derivational concepts, concrete relational concepts, and pure relational concepts. Jespersen (1924), who is cited as an inspiration by Chierchia, has a hierarchy of primaries, secondaries and tertiaries.

⁶There are some problems with the high types proposal. As Jacqueline Guéron pointed out to me, pronouns are usually thought to be functional morphemes but they are also usually analyzed as being referring expression of type e . One obvious way of maintaining the high types approach is to appeal to more sophisticated analyses of pronouns where they are a spell-out of a combination of definite determiner and contextually supplied restrictions (the E-type analysis of pronominal meaning).

out by the first argument. An intuitive test for conservativity is illustrated by the following equivalences:

- (6) Every man smokes every man is a man who smokes.
 Some man smokes some man is a man who smokes.
 No man smokes no man is a man who smokes.
 Most men smoke most men are men who smoke.
 Few men smoke few men are men who smoke.
 Many men smoke many men are men who smoke.

Barwise & Cooper (1981) essentially formulate the following universal:

- (7) Every determiner in every natural language is conservative.

To see the empirical force of the universal, consider two possible non-conservative determiner meanings. First, an example discussed by Chierchia & McConnell-Ginet (1990: 426f):⁷

- (8) [[all non-]](A,B) (D-A) B.

We would use this determiner to say things like *all non-students smoke*. This is a perfectly plausible thing to want to say. This determiner is not conservative as you can see intuitively from the failure of the following equivalence:

- (9) All non-students smoke / all non-students are students who smoke.

It is easy to imagine a situation where the first sentence is true while the second sentence is false (in fact, the second one will be false as long as there are non-students). As far as we know, there is no language that has a determiner expressing the meaning in (8).⁸ Since, this is not an implausible meaning to encapsulate in a determiner (it is perfectly easy to convey the meaning in a more roundabout way), this lexical gap is surprising. The semantic universal that says all natural language determiners are conservative therefore has real bite to it. Another, much more important, candidate for a non-conservative determiner is *only*, with a semantics as follows:

- (10) [[only]](A,B) B A.

Again, it is easy to see the nonconservativity:

- (11) Only students smoke / only students are students who smoke.

The second sentence is always true. In set-theoretic terms, it says that the students who smoke are a subset of the students. But, for any two sets A,B, it always holds that A ⊆ B. From this, it does not follow that A ⊆ B as claimed in the first sentence. So, *only* is not conservative. Barwise & Cooper's universal would be in trouble if we couldn't argue that *only* is not a determiner. Some of the familiar arguments for this claim are that (i) *only* can combine with pronouns or names, other determiners cannot, (ii) *only* can occur "on top of" other determiners. (iii) *only* combines with categories other than noun phrases.

⁷Here, D stands for the universe of discourse, the set of all entities.

⁸The category 'determiner' is conceived of rather broadly in Keenan & Stavi (1986). I'm not sure whether they would have a problem excluding *all non-*.

Only is therefore not a determiner.⁹ It is more likely an adverbial category of some sort (albeit with a “quantificational” meaning).

There is thus some evidence beginning to accumulate in cross-linguistic research into semantics that suggests that functional meanings come from a small universal inventory, from a restricted set of “natural” meanings. If there are strong universal constraints on what a possible functional meaning is, we can envision that learning functional meanings will be considerably easier. In fact, authors like Partee and May have suggested that functional meanings are innate:

“Another important general point ...: the open-ended lexical classes, the lexical nouns, verbs, adjectives, etc., nearly all have interpretations that are virtually never higher than first or second order in the type hierarchy. Natural language expressions which seem to call for an analysis in higher types than first or second order ... tend to belong to small closed syntactic categories whose members seem very close to being universal. Examples are determiners, conjunctions, words like ‘only’, ‘almost’, ‘very’, the ‘more than’ construction, etc. These function words that belong to small closed classes typically involve the most lambdas when their meaning is spelt out explicitly. That suggests that in acquiring those items that really involve the higher types, children do not have to find their way through the whole domain of possible meanings. In the higher types we presumably do not conceptualize full domains, since we not only lack open-class lexical items but also anaphora, quantification, or question-words. Rather there seem just to be certain very useful particular meanings of higher types that we have evolved into our language faculty.” (Partee 1992: 124f).

“In distinguishing the logical elements in the way that we have, we are making a cleavage between lexical items whose meanings are formally, and presumably exhaustively, determined by UG - the logical terms - and those whose meanings are underdetermined by UG - the non-logical, or content, words. This makes sense, for to specify the meaning of quantifiers, all that is needed, formally, is pure arithmetic calculation on cardinalities, and there is no reason to think that such mathematical properties are not universal. For other expressions, learning their lexical meanings is determined causally, and will be affected by experience, perception, knowledge, common-sense, etc. But none of these factors is relevant to the meaning of quantifiers. The child has to learn the content of the lexical entries for the non-logical terms, but this is not necessary for the entries for the logical terms, for they are given innately.” (May 1991: 353).

We can conclude at this point that not only do functional items have meanings, but they are subject to universal semantic constraints: they are permutation-invariant, they have high types, and there are further more specific constraints like conservativity. We now have to ask whether these are merely necessary properties of functional items or whether they are also sufficient. Are there lexical items that have similar meanings?

4.3 Intermediate Categories

Permutation-invariance does not obviously single out the functional meanings. The identity relation between two individuals is a permutation-invariant function. But the adjective *same* is arguably not a functional morpheme. Other “logical” words in the class of content morphemes include the adjectives *mere*, *former*, *alleged*, the verbs *believe*, *deny*. Most of these are also items with high types: propositional attitude verbs for example are usually analyzed as involving quantification over possible worlds.

⁹But see de Mey (1991) for a dissenting opinion.

At this point, I am not sure how to deal with this intermediate category. The obvious solution would be to superimpose two classifications: the lexical/functional dichotomy of syntax and the logical/non-logical dichotomy of semantics:

(12)

	Lexical Morpheme	Functional Morpheme
Non-Logical Meaning	horse, run, purple	***
Logical Meaning	mere, deny, majority	all, not, most, must

It would be nice if we could analyze away the existence of the items that stand in the way of a perfect syntax-semantics correlation. But I don't know whether that is possible.¹⁰ On the other hand, if such items truly exist, then we would want to be able to characterize the syntactic dichotomy in a way that is independent of semantics. Carlson (1983) identifies two properties of functional items that may be of interest here. He proposes that functional items are endocentric: they do not change the category of their arguments. For example, sentence modifiers like negation take sentences and make sentences. This is in accordance with a widely assumed characteristic of inflectional morphology: inflectional morphemes do not change the category that a word belongs to. Note immediately that endocentricity can again only be a necessary property of functional items, not a sufficient one. Sentence modifiers like *last week* are not obviously of a functional nature. Carlson's proposal also depends on particular assumptions about the inventory of categories: in most current generative theories, negation is not endocentric but projects its own new projection NegP. There might be ways of recasting Carlson's idea in a system where functional morphemes head their own projections: Grimshaw's notion of "extended projection" might help, or we could explore ways of maintaining that functional morphemes are both endocentric and exocentric at the same time (Breheny & Cormack 1993). Carlson (1983) also proposes that functional morphemes do not in fact have meanings by themselves. They instead mark the presence of a certain kind of construction and it is the construction itself that carries the functional meaning. He discusses a variety of examples where functional morphemes are in the "wrong" place, which is a problem if they themselves have meaning but becomes tractable if they just mark a construction. He points out that his conception is very similar to the ancient idea that functional morphemes have meaning only in combination with other concepts. Note that it is usually easy to convert a syncategorematic meaning into a categorematic one. Whether an item is functional or not would then not be a decision made by the semantics. And that is precisely what we might want in the light of the intermediate categories we found above. Perhaps, the only difference between *most* and *the majority of* is purely one of syntax.

4.4 The Necessary Functional Glue¹¹

One sense in which we can find a syntax-semantics correlation is that both syntactic theory and formal semantics will say that sentences without functional categories/meanings would not be real sentences. Consider a hypothetical example:

(13) cat purr

¹⁰Emmon Bach in his work on North Wakashan comes to the conclusion that in fact most of the "logical" meanings are expressed by lexical morphemes there (Bach 1989).

¹¹This section was partly inspired by a handout of a talk by Barbara Partee (1983).

The common noun *cat* denotes a predicate of type $\langle e,t \rangle$, in other words a set of entities, the set of cats. The intransitive verb *purr* also denotes a predicate of type $\langle e,t \rangle$, the set of purring objects. Or perhaps it denotes a two-place predicate relating situations and entities. In any case, the types of the two words will not combine by function application. Something needs to mediate between the two basic types. What is needed is a functional meaning, a higher type meaning that takes the two low-level types and results in a normal sentence meaning. The simplest meaning I can imagine would be one that says that there is a situation in which there is something which is both a cat and a purring object. But there are other possibilities: we could add both a determiner meaning to the common noun and an inflectional meaning to the verb. So, semantically we need functional meanings as a kind of glue holding together the low-type meanings of content morphemes. From the point of view of generative syntax also, a sentence like (13) without functional categories is not a well-formed sentence. Functional categories are needed to complete the small clause structure in (13) and yield a fully formed sentence.

Could there be languages that do without functional categories? As we have seen, the meanings of functional categories seem indispensable even in the most primitive examples. Nevertheless, particular linguistic systems may do without certain functional meanings. Slogans like “Hopi has no tense” or “Salish has no quantificational NPs” come to mind. Are there systems that do without any functional categories? Claims like that have been made about early stages of the language acquisition process, about pidgin languages, about the state of language in patients suffering from agrammatism, and about the sublanguage used in telegrams. But crucially, none of these systems are natural languages in the full sense of the term. In each case, it has often been recognized that they are deficient in precisely the sense of not employing functional categories.

It is important to realize that the claim is not that functional categories are necessarily overtly expressed.¹² In fact, Carlson (1983) notes that functional meanings are often present even in the absence of overt morphemes expressing them. There are various technical options at this point: empty functional items, type-shifting, features on lexical categories, “constructional” meaning. It seems likely that the reason that functional meanings can be present even when there is no overt morpheme marking them is that their inventory is small & innate. There is no large search space. In the absence of overt marking, other mechanisms presumably apply that help identify the intended functional meaning. There is semantic work on how the functional glue is supplied in constructions like free adjuncts (Stump 1981) and genitives (Partee 1984).

4.5 Conclusion

Here then is the outcome of our preliminary meditations on the status of functional categories/meanings in generative grammar:

- Functional meanings are permutation-invariant.
- Functional meanings have high types.
- There are universal semantic constraints on possible functional meanings.
- There is therefore only a limited inventory of possible functional meanings.
- There is quite possibly an intermediate kind of morpheme with logical meaning but lexical syntax.
- Natural languages never just string lexical meanings together. Functional meanings are needed as semantic glue.

¹²We therefore need to be careful whenever we are tempted to claim that a particular language lacks a certain functional category or even a certain functional meaning. See Gil (1991) for a claim that there is a language without ‘and’.

- Although not all functional meanings need to be expressed by specific morphemes in any given language, functional meanings (at least basic ones) are universally available.

We can now address our central question: what does all this mean for the process of grammaticalization? What has to happen to the meaning of a morpheme that is becoming a functional morpheme?

5. The Semantics of Grammaticalization

When a lexical item wants to become a functional item, it needs to become permutation-invariant, it needs to shed any reference to particular entities, properties, or situations in the world. The item also will have to assume a high semantic type. Lastly, it will have to conform to whatever semantic universals apply to the particular functional category it wants to belong to. I think that among these semantic changes it is probably the first one (becoming permutation-invariant) that is the proper formal reconstruction of the intuitive notion of “semantic bleaching”.

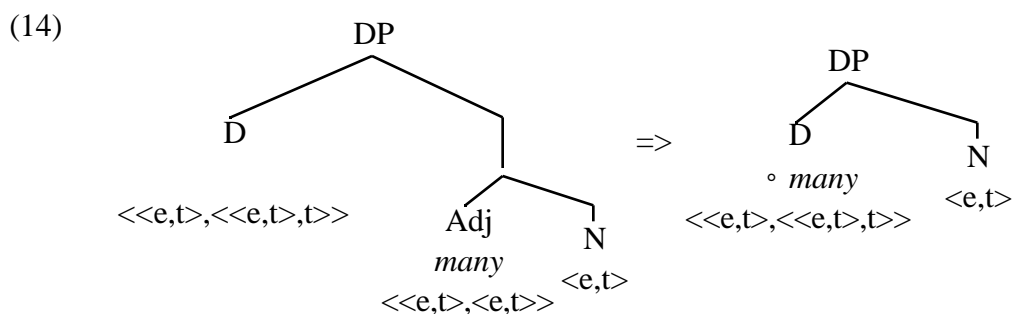
Now some bad news. Although I have not in any sense conducted a sufficiently detailed review of the literature, there is reason to suspect that there is not much evidence for “bleaching”. In particular, most examples I have seen start with a source item that is already fairly abstract and belongs to a special semantic field. It seems to me that source items already have a “logical” meaning. They may all belong to the intermediate category discussed above. The one clear example of some kind of bleaching that I’d like to point out here is the change from control to raising verbs (Higgins 1989). Here there is a loss of entailments about the subject with the end result that raising verbs allow expletive subjects (which have no semantic content). In the next step, raising verbs turn into auxiliaries. It would be interesting to try to find a parallel development in the nominal domain: is there a prior bleaching that derives “logical” adjectives which then serve as the source for determiners and quantifiers?

The other semantic step in grammaticalization is the assumption of a high type. From the perspective of the high type hypothesis, an item that becomes a functional morpheme has to assume a higher type. An adjective (type $\langle\langle e,t \rangle, \langle e,t \rangle\rangle$) becomes a determiner ($\langle\langle e,t \rangle, \langle\langle e,t \rangle, t \rangle\rangle$). A raising verb ($\langle\langle s,t \rangle, \langle s,t \rangle\rangle?$) becomes a tense operator ($\langle\langle s,t \rangle, \langle\langle s,t \rangle, \langle s,t \rangle\rangle?$). How can semantic ascent happen? What are natural ways of type-raising? What is there before the functional category is born? Here I also have bad news: I think that what happens is fairly uninteresting and is essentially much ado about nothing.

Grammaticalization, as I see it, is a way of enriching the inventory of overtly expressed functional meanings. What happens is that the meaning of a lexical category is composed with a functional meaning to yield a new, more complex functional meaning. At the start of the process, the target item is fully lexical and occurs in construction with either an empty functional category or a type-shifting operation. Remember that at least basic functional meanings are necessarily present as a sort of functional glue tying together lexical concepts. In the second stage, the meaning of the lexical item gradually shifts towards a point where it can function-compose with the functional meaning to yield a UG-permissible new complex functional meaning. For this to happen the lexical item must take on a permutation invariant meaning. In the last stage, it is most economical for the language learner to assume that the (now fully grammaticalized) item is in fact the only exponent of the higher level function. The reanalysis is catastrophic in the sense that functional categories have a fundamentally different status in the semantic hierarchy (correlated presumably with a radical difference in syntactic category). On the

phenomenological level, the change is still minimal: the entire construction remains (largely) constant in meaning. In effect, the new functional item amalgamates the meanings of the former implicit higher level function and the “bleached” lexical item.

The notion of function composition that I am using here works as follows. Take two functions: f , a function from type $\langle e, t \rangle$ to type $\langle \langle e, t \rangle, t \rangle$, and g , a function from type $\langle e, t \rangle$ to type $\langle e, t \rangle$. Then instead of taking an argument of type $\langle e, t \rangle$, applying first f , and then applying g to the result, we can create a new function $f \circ g$, the composition of f and g , which applied to the argument directly gives us the end result. Let us look at a simple example of such a step in grammaticalization:



The adjective *many* which can be seen as taking plural nouns and identifying those sets/groups that have many members can compose with an implicit existential quantifier to yield a new functional item which combines existential force with the cardinality requirement of the original *many*.¹³

So, from a formal standpoint there is not much happening here. We can however view things a little more enthusiastically. What this process does is enrich the inventory of functional categories in a language. Before what we had was a small number of (implicit) functional categories and a certain number of logical items (which weren't yet functional morphemes). Afterwards, we have a new functional item. Functional meanings that before were just floating around without an overt foothold can get one this way. Lexical meanings shift until a UG-permissible functional meaning is reached. Grammaticalization is “the harnessing of pragmatics by a grammar” (Hyman 1984: 73), in the sense that while before pragmatics had to help in identifying which functional meaning was at work, now we have an overt functional item.

What I am saying is not that there was no grammar before: functional categories and functional meanings are always present. But a barebones functional system may be enough to get by. In grammaticalization, the functional system of a language gets richer, although overall no new meanings get created. Grammaticalization is a re-arrangement of meaning, not a change of meaning. Many examples of grammaticalization have always been analyzed in a similar, “musical chairs” kind of way. Jespersen's famous cycle of negation is a prime example.

We now actually have an interesting analytical task. We need to show how the meanings of grammaticalized expressions can be decomposed into a basic functional meaning and a lower type lexical meaning. This is in fact a favorite pastime of logicians/semanticists, who often look for the central meanings in a type family that can serve as the basis for the definition of other meanings. For example, logicians have

¹³While this looks similar to a synchronic operation of head-raising (N-to-D), it's really not the same since the syntactic operation doesn't seem to be subject to semantic constraints.

amused themselves by finding out how truth-functional connectives can be defined in terms of each other. Here are some sketchy ruminations:

For determiners and quantifiers, the intuition is that there are two basic meanings: existential and universal quantification. Weak quantifiers can be decomposed into + amount predicates (cardinal adjectives). For downward monotone weak quantifiers like *no* or *few*, we also need to use negation. For the development of definite determiners from demonstrative adjectives, we first have to figure out whether Russell was correct in treating definite descriptions as universal quantifiers. (In general, issues of presupposition have a very unclear relation to grammaticalization). Applying a demonstrative adjective to a common noun predicate will all but ensure that the predicate only truthfully applies to a unique entity (sometimes a plural entity), which means that the predicate is semantically constrained to be the argument of a higher level function that is “definite” in the sense of generalized quantifier theory. Such an adjective is therefore primed to assume the task of definite determiner. The semantic leap in this case is fairly minimal. A particularly difficult problem is posed by *most*. It is now well-known that *most* cannot be defined in a first order logic, in other words that it cannot be reduced to and/or . It could be that *most* always involves a comparative or superlative meaning (which itself is already a functional meaning). Remember also that in general any new determiner or quantifier has to be UG-permissible, in particular it has to be conservative. No language can grammaticize *all non-* into a determiner (although both *all* and *non-* are presumably logical).

What happens when raising verbs become auxiliaries? I conjecture that the meaning of the raising predicate is composed with the simple assertoric meaning of an empty functional category. We could imagine that on top of a simple small clause, which denotes a set of situations, there is always at least an assertion operator meaning, let’s call it ASS. ASS claims that the utterance situation overlaps with a situation described by its complement clause. How can a future tense arise? Take a raising modifier that says that an -situation is obligated to happen. This can shift into a meaning that says that an -situation follows in time. Then, this can compose with ASS to give a future tense meaning. The cross-linguistic inventory of auxiliary meanings is quite restricted (Steele and others 1981), supporting a view that confines grammaticalization to move within the semantic boundaries set by Universal Grammar.

6. Connections, Outlook

The project sketched here combines insights from recent theoretical work on the syntax-semantics interface with the results and concerns of research on grammaticalization. Further research will have to address the differences between meaningful functional categories and vacuous functional categories (especially case & agreement systems). We need to investigate the structured domain of quasi-functional meanings: cardinality adjectives, non-intersective adjectives, raising verbs, etc. Other instances of grammaticalization need to be studied in detail. There are many potentially fruitful connections to other research topics: the notion of logicity in the philosophy of logic, the special role of functional categories in language acquisition and pidgin & creole research, cross-linguistic variation in the inventory of functional meanings. It is clear that grammaticalization can and should become a research topic of interest to generative linguistics.

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