Syntax and Metonymy

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Abstract

Metonymy is refering to one entity by describing a functionally related entity. When this is formalized in an "Interpretation as Abduction" framework, it can be seen that an isomorphic process solves a number of problems that have hitherto been viewed as syntactic. In these cases, the coercion function associated with the metonymy comes from material that is explicit in the sentence. For example, in "John smokes an occasional cigarette", it is the smoking rather than the explicit argument of "occasional", the cigarette, that is occasional; there is a coercion from the cigarette to the smoking event, where the coercion relation is provided by the "smokes" predication itself. Other phenomena analyzed in this manner are extraposed modifiers, container nouns, the collective-distributive ambiguity for some plural noun phrases, small clauses in disguise such as "This country needs literate citizens", and the assertion of grammatically presupposed material. These examples lie on the boundaries between syntax, semantics and pragmatics, and illustrate the utility of a framework in which the three areas are modelled in a uniform fashion.

1 Metonymy

Metonymy is the linguistic device by which an entity is referred to by refering to a functionally related entity. For example, when we say "John reads Proust." we really mean "John reads the novels by Proust." We may say that "Proust" has been *coerced* into "the novels by Proust". Alternatively, we may say that "read" has been *coerced* into "read the novels by".

Thus, there are two ways to characterize metonymy. Metonymy occurs when an explicit predication $P(X)$ is conveyed by a fragment of text and the intended interpretation is $P(F(X))$ for some function F. This can be viewed as X being coerced into $F(X)$; this corresponds to the usual characterization of metonymy as an entity being coerced into something functionally related to it. Or it can be viewed as the predicate P being coerced into the predicate $P \circ F$, or P composed with F. Nunberg (1995) refers to the first case as *deferred ostension* and to the second case as *predicate transfer*. He argues that the former occurs only in actual cases of ostension, as when a parking attendent holds up a key and says "This is parked out back." In non-ostensive cases, including the vast majority of examples that occur in discourse, he argues that the metonymies should be thought of as instances of predicate transfer. His arguments rest primarily on the availability of entities for subsequent pronominal reference and occurrence within elliptical constructions. In the following examples, the first two illustrate deferred ostension, the second two predicate transfer:

> This [holding up key] is parked out back and may not start.
> * This [holding up key] is parked out back and fits only the left front door.
> John is parked out back and has been waiting fifteen minutes.
> * John is parked out back and may not start.

In the first two examples the key X is coerced into the car $F(X)$ and the latter becomes the only possible subject for the second clause. In the last two examples, John X remains the same and is the only possible subject for the second clause; the predicate

$$\lambda X[X \text{ is parked out back}]$$

is coerced into something like

$$\lambda X[\text{the car belonging to } X \text{ is parked out back}]$$

In Section 2 of this paper I briefly introduce the framework of "Interpretation as Abduction". In this framework it is straightforward to formalize both varieties of metonymic coercion, and this is done in Section 3. Sections 4 through 8 present a range of examples of phenomena that have previously been viewed as syntactic that can in fact be viewed as a special kind of metonymy, where the coercion relation is provided by the explicit content of the sentence itself. The phenomena considered are extraposed modifiers, ataxis, container nouns, the distinction between distributive and collective readings of plurals, and what may be called "small clauses in disguise". There are cases where grammatically subordinated material in sentences functions as the main assertional claim of the sentence, and in Section 9 these are similarly analyzed as examples of metonymy where the coercion relation is provided by the explicit content of the rest of the sentence.

2 Background: Interpretation as Abduction

The framework adopted in this chapter is that of "Interpretation as Abduction" (henceforth, IA) (Hobbs et al., 1993). In this framework, the interpretation of a sentence is the least-cost abductive proof of the logical form of the sentence. That is, to interpret a sentence one tries to prove the logical form by using the most salient axioms and other information, exploiting the natural redundancy of discourse to minimize the size of the proof, and allowing the minimal number of consistent and plausible assumptions necessary to make the proof go through. Anaphora are resolved and predications are pragmatically strengthened as a by-product of this process.

More generally in the IA framework, the job of an agent is to interpret the environment by proving abductively, or explaining, the observables in the environment, thereby establishing that the agent is in a coherent situation. This perspective is expanded upon in Section 9 below.

The representational conventions used in this chapter are those of Hobbs (1985, 1983, and 1995). The chief features relevant to this chapter are the use of eventualities and the use of typical elements of sets to represent information about pluralities. The latter is described in Section 7. Here, eventualities will be explicated briefly.

Corresponding to every predication $p(x)$ there is a predication $p'(e,x)$ which says that e is the eventuality of p being true of x. Existential quantification in this notation is over a Platonic universe of possible individuals. The actual truth or existence of e in the real world is asserted by a separate predication $Rexists(e)$. The relation between the primed and unprimed predicates is given by the following axiom schema:

$$(\forall\, x)[p(x) \equiv (\exists\, e)[p'(e,x) \wedge Rexists(e)]]$$

That is, p is true of x if and only if there is an eventuality e of p being true of x and e exists or obtains in the real world.

Eventualities are posited not just for events, such as flying to someplace—$fly'(e, x, y)$—and activities, such as reading—$read'(e, x, y)$—but also for stable conditions, such as being a cigarette—$cigarette'(e, x)$—and even having a particular proper name—$John'(e, x)$. For economy, in the examples below eventualities will only be introduced where they are material to what is being illustrated, primarily when they appear as arguments in other predications. Otherwise the unprimed predicates will be used.

Using these notational devices, the logical form of sentences is an existentially quantified conjunction of atomic predications. The translations of several specific grammatical constructions into this logical form are given in the examples in the rest of this paper. In general, instead of writing

$$(\exists \ldots, x, \ldots)[\ldots \wedge p(x) \wedge \ldots]$$

I will simply write

$$\ldots \wedge p(x) \wedge \ldots$$

Knowledge in this framework is expressed in (generally defeasible) axioms of the form

$$(\forall x, y)[p(x, y) \supset (\exists z)q(x, z)]$$

These will be abbreviated to expressions of the form

$$p(x, y) \supset q(x, z)$$

The focus of the interpretation process is to make explicit the information conveyed by the text in context, rather than, for example, to determine its truth conditions.

In the IA framework, syntax, semantics, and pragmatics are thoroughly integrated, through the observation that the task of an agent in explaining an utterance by another agent is normally to show that it is a *grammatical*, *interpretable* sentence whose content is somehow involved in the *goals* of the speaker. It has already been said that a sentence is *interpretable* insofar as its logical form can be proved abductively. The linkage with *goals* is described in Section 9. A set of syntactic and lexical axioms characterize *grammaticality* and yield the logical form of sentences.

In Hobbs (1998) an extensive subset of English grammar is described in detail, largely following Pollard and Sag's (1994) Head-Driven Phrase Structure Grammar but cast into the uniform IA framework. In this treatment, the predicate Syn is used to express the relation between a string of words and the eventuality it conveys. Certain axioms involving Syn, the "composition axioms", describe how the eventuality conveyed emerges from the concatenation of strings. Other axioms, the "lexical axioms", link Syn predications about words with the corresponding logical-form fragments. There are also "transformation axioms" which alter the places in the string of words predicates find their arguments.

In this chapter, a simplified version of the predicate Syn will be used. We will take Syn to be a predicate of seven arguments.

$$Syn(w, e, f, x, a, y, b)$$

w is a string of words. e is the eventuality described by this string. f is the category of the head of the phrase w. If the string w contains the logical subject of the head, then the arguments x and a are the empty symbol "$-$". Otherwise, x is a variable refering to the logical subject and a is its category. Similarly, y is either the empty symbol or a variable refering to the logical object and b is either the empty symbol or the category of the logical object. For example,

$$Syn(\text{"reads a novel"}, e, \mathbf{v}, x, \mathbf{n}, -, -)$$

says that the string of words "reads a novel" is a phrase describing an eventuality e and has a head of category verb. Its logical object "a novel" is in the string itself, so the last two arguments are the empty symbol. Its logical subject is not part of the string, so the fourth argument is the variable x standing for the logical subject and the fifth argument specifies that the phrase describing it must have a noun as its head. In Hobbs (1998) the full Syn predicate contains argument positions for further complements and filler-gap information, and the category arguments can record syntactic features as well.

Two of the most important composition axioms are the following:

$$\begin{aligned}&Syn(w_1, x, a, -, -, -, -) \wedge Syn(w_2, e, f, x, a, -, -)\\&\quad \supset Syn(w_1 w_2, e, f, -, -, -, -)\\&Syn(w_1, e, f, x, a, y, b) \wedge Syn(w_2, y, b, -, -, -, -)\\&\quad \supset Syn(w_1 w_2, e, f, x, a, -, -)\end{aligned}$$

The first axiom corresponds to the traditional "S $\rightarrow$ NP VP" rule. It says that if w_1 is a string describing an entity x and headed by a word of category a and w_2 is a string describing eventuality e, headed by a word of category f, and lacking a logical subject x of category a, then the concatenation $w_1 w_2$

is a string describing eventuality e and headed by a word of category f. The second axiom corresponds to the traditional "VP $\rightarrow$ V NP" rule. It says that if w_1 is a string describing eventuality e, headed by a word of category f, and lacking a logical subject x of category a and a logical object y of category b and w_2 is a string describing an entity y and headed by a word of category b, then the concatenation $w_1 w_2$ is a string describing eventuality e, headed by a word of category f, and lacking a logical subject x of category a, but not lacking a logical object.

A typical lexical axiom is the following:

$$read'(e, x, y) \wedge person(x) \wedge text(y) \supset Syn(\text{“read”}, e, \mathbf{v}, x, \mathbf{n}, y, \mathbf{n})$$

That is, if e is the eventuality of a person x reading a text y, then the verb "read" can be used to describe e provided noun phrases describing x and y are found in the appropriate places, as specified by composition axioms. Lexical axioms thus encode the logical form fragment corresponding to a word ($read'(e, x, y)$), selectional constraints ($person(x)$ and $text(y)$), the spelling (or in a more detailed account, the phonology) of the word ("read"), its category (verb), and the syntactic constraints on its complements (that x and y must come from noun phrases). The lexical axioms constitute the interface between syntax and world knowledge; knowledge about reading is encoded in axioms involving the predicate $read'$, whereas knowledge of syntax is encoded in axioms involving Syn, and these two are linked here. In the course of proving that a string of words is a grammatical, interpretable sentence, the interpretation process backchains through composition axioms to lexical axioms (the syntactic processing) and then is left with the logical form of the sentence to be proved. A proof of this logical form was the original IA characterization of the interpretation of a sentence.

The proof graph of the syntactic part of the interpretation of "John read *Ulysses*" is shown in Figure 1. Note that knowledge that John is a person and *Ulysses* is a text is used to establish the selectional constraints associated with "read".

There are systematic alternations due to which the arguments of predicates are not found in the canonical locations specified by the lexical axioms. Transformation axioms accommodate these alternations. The (somewhat simplified) rule for passivation illustrates this.

$$Syn(w, e, \mathbf{v.en}, x, a, y, \mathbf{n}) \supset Syn(w, e, \mathbf{pred}, y, \mathbf{n}, -, -)$$

If w is the past participle of a verb which takes a subject x of category a

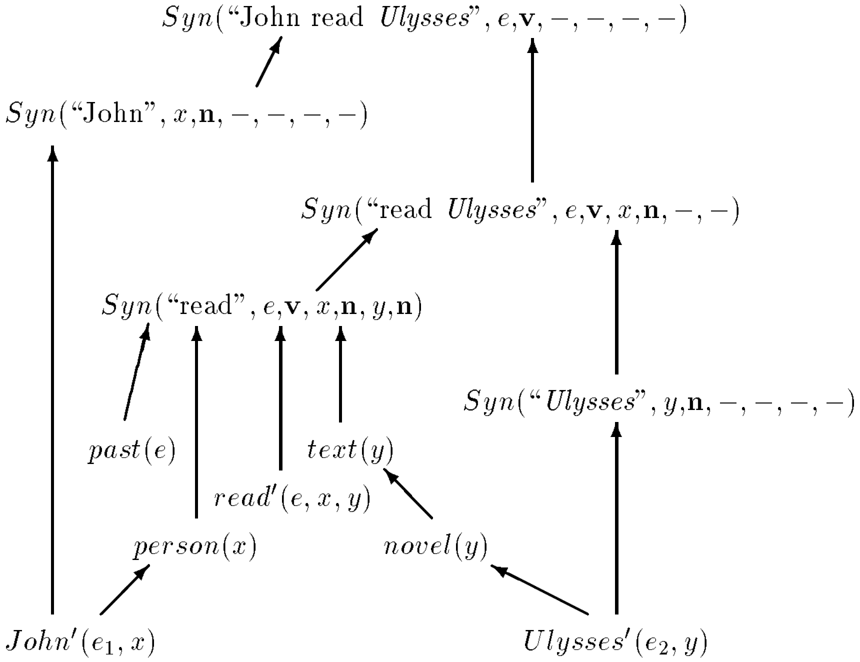

Figure 1: Parse of "John read *Ulysses.*"

and an NP object y, then w can function as a predicate complement, taking an NP subject refering to y.

Metonymy can also be characterized by transformation axioms.

3 Axioms for Metonymy

Both varieties of metonymic transfer can be easily captured in the present framework by means of transformation axioms. The coercion from X to $F(X)$ is a matter of substituting for the leading argument (or eventuality) variable in the *Syn* predication another variable representing a functionally related entity.

(1) $Syn(w, e, f, x, a, y, b) \wedge rel(e_0, e) \supset Syn(w, e_0, f, x, a, y, b)$

Here, e plays the role of X and e plays the role of $F(X)$. Viewed from the perspective of interpretation, this says that the phrase w is being used in the embedding context as though it referred to or described one entity or eventuality e_0 but in fact w, by itself, refers to or describes a related entity or eventuality e. From the perspective of generation, it says that if you want to refer to or describe an entity or eventuality e_0 you can do so by refering to or describing a related entity or eventuality e.

The coercion from P to $P \circ F$ is a matter of substituting for one of the x or y arguments in the Syn predication another variable representing a functionally related entity. Two axioms are required, one for each argument position. The first is

(2) $Syn(w, e, f, x_0, a, y, b) \wedge rel(x_0, x) \supset Syn(w, e, f, x, a, y, b)$

The effect of this axiom in interpretation is as follows: The axiom is applied to the predicate or head word w in the proof graph below the point at which it links up with its argument x. Above the application of this axiom, the argument is the variable x and refers to the explicit, uncoerced argument. The axiom introduces the coercion relation $rel(x_0, x)$. Below the application of the axiom, the argument is x_0, the implicit, coerced argument. It is this that becomes the argument of the predication associated with w and to which the selectional constraints are applied. The NP describing x then really does refer to x and is thus available for subsequent pronominalization.

The other "predicate transfer" axiom is

(3) $Syn(w, e, f, x, a, y_0, b) \wedge rel(y_0, y) \supset Syn(w, e, f, x, a, y, b)$

Figure 2 illustrates the use of Axiom (3) on the sentence

John read Proust.

in conjunction with axioms that say that Proust wrote novels, which are texts, and that the writing relation is a possible coercion.

The coercion occurs on the word "read", changing its logical object from Proust to the novels of Proust. This in effect "transfers" the predicate "read" into the predicate "read the novels of". Note that the phrase "Proust" is still and only an NP refering to the man Proust and not his works. This is what restricts the possibilities for subsequent pronominal reference.

By contrast, if this example were to be handled with Axiom (1), as a coercion from Proust to the novels of Proust, the interpretation would be as illustrated in Figure 3.

In this chapter, Nunberg's lead will be followed, and cases of metonymy will be treated as instances of predicate transfer, thus involving axioms (2) and (3).

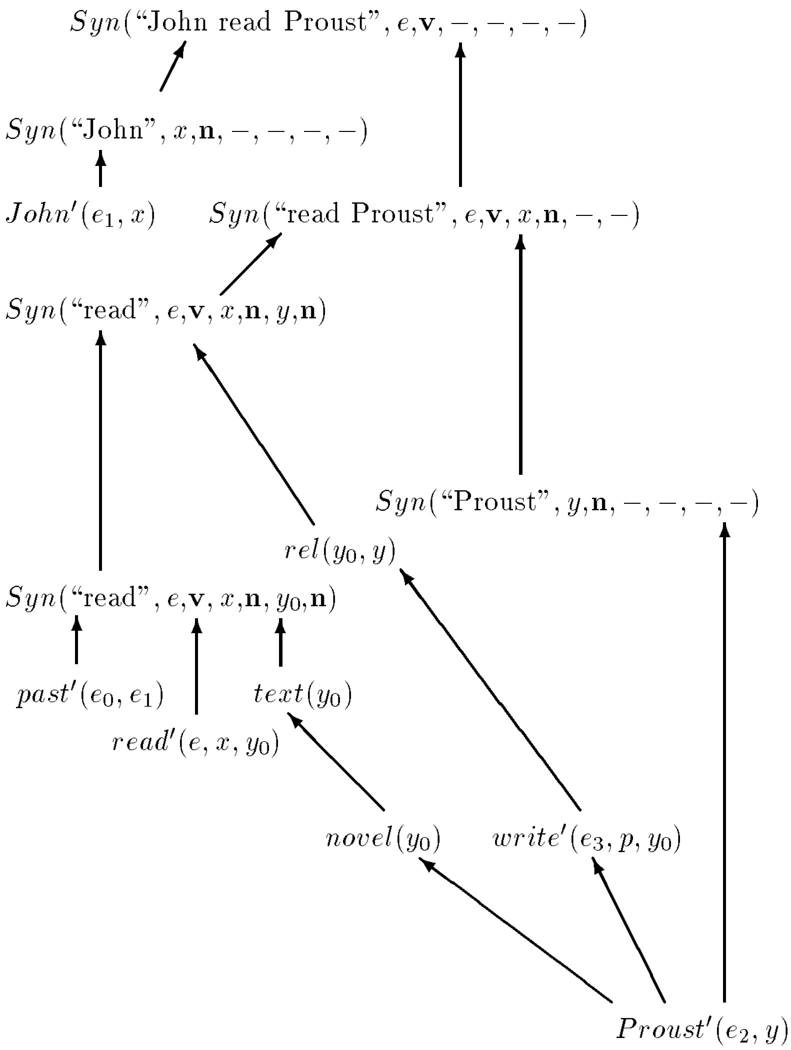

Figure 2: Parse of “John read Proust” using Axiom (3).

I will not attempt here to determine possible constraints on metonymic coercions. Here the coercion relation *rel* will be axiomatized in the loosest possible way. It is symmetric and transitive:

$$(\forall\, x, y)rel(x, y) \supset rel(y, x)$$
$$(\forall\, x, y, z)rel(x, y) \wedge rel(y, z) \supset rel(x, z)$$

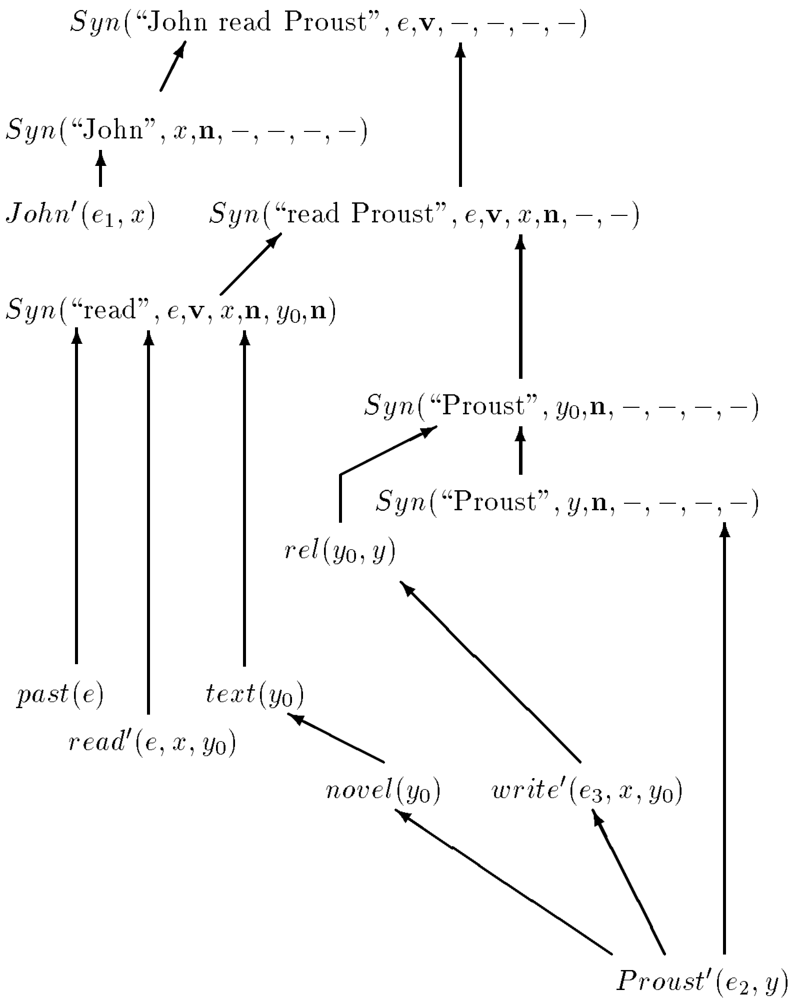

Figure 3: Parse of "John read Proust" using Axiom (1).

For the purposes of this chapter any relation will be taken to be a possible coercion relation. This is captured by the axiom schema

(4) $(\forall \ldots, x, \ldots, y, \ldots)[p'(\ldots, x, \ldots, y, \ldots) \supset rel(x, y)]$

That is, any two arguments of the same predication are related to each other. Any predication can function as a coercion relation between any two of its arguments, including its eventuality argument.

Of the possible coercion relations, the most salient will be selected by the abductive interpretation process. Among the most salient relations between entities are those conveyed explicitly in the text itself. A number of seemingly disparate phenomena that are normally thought of as syntactic can be analyzed as examples of metonymy, where the coercion relation is provided by the explicit content of the sentence itself. Six such cases will be examined here—extraposed modifiers of the subject, ataxis, container nouns, distributive readings, small clauses in disguise, and the assertion of grammatically subordinated information.

4 Extraposed Modifiers

Consider the sentences

> Mary saw Denver flying to Chicago.
> A jolly old man arrived with an armload of presents.
> The man arrived whom John had invited to dinner.

Neither the seeing nor Denver was flying to Chicago, but Mary. It was the old man who had an armload of presents, not the arriving event. John had invited to dinner the man and not the arriving event. In each of these cases what seems as though it should be a right modifier to the subject NP is extraposed to the end of the sentence.

It is possible to interpret these cases as examples of metonymy, where the coercion relation is provided by the predication associated with the head verb. That is, normal syntactic processing would attach the postmodifier to the verb, and then that would be coerced to the subject, using the predication of the verb itself as the coercion relation. Thus, by normal syntactic processing, the seeing is flying to Chicago, the arriving event is with an armload of presents, and John had invited the arriving event to dinner. These interpretations will not satisfy the selectional constraints associated with "fly", "with", and "invite", respectively. Applications of axioms (2)and (3) thus coerce each of these arguments to the subject of the sentence. In the first sentence

$$see'(e, m, d)$$

coerces from the seeing e to Mary m, and in the second and third sentences

$$arrive'(e, m)$$

coerces from the arriving e to the man m.

Figure 4 illustrates this with the sentence "Mary saw Denver flying to Chicago." Here the preposition "to" is viewed as making the NP "Chicago" available as a "to" complement, and the reader can deduce the composition axiom for sentence-level adverbials from the top branch of the proof graph.

A similar analysis can be used to correct for incorrect prepositional phrase attachments. In

I saw the man in the park with the telescope.

if the park is incorrectly identified as the logical subject of "with", the *in* and *see* relations can be used to coerce it to the seeing event. Instead of the park being with the telescope, the seeing event by me of a man in the park is with the telescope.

Preposed right modifiers of nouns can be handled in the same way. In

Of all the options mentioned, several are viable.

the preposed PP "Of all the options mentioned" is first attached as a modifier to "viable". Metonymic interpretation then uses the viability relation itself to coerce the attachment onto "several". More precisely, suppose the logical form includes the predication $viable'(e, x)$, where x is the typical example of the several options. The explicit logical subject of the predicate *of* is first e. The predication $viable'(e, x)$ is then used as a coercion relation to coerce the logical subject of *of* from e to x.

Sometimes the complement of an adjective used prenominally appears as the noun complement, as in

a similar book to that.

This can also be viewed as an example of metonymy. The complement "to that" is taken first as a property of the book b.

$$Syn(\text{"to that"}, e, \mathbf{p}, b, \mathbf{n}, y, \mathbf{n})$$

This is then decomposed by the metonymy axiom (2) into

$$Syn(\text{"to that"}, e, \mathbf{p}, e_1, \mathbf{n}, y_1, \mathbf{n}) \wedge rel(e_1, b)$$

The first conjunct eventually bottoms out in the predication $to'(e, e_1, y_1)$, among others. The second conjunct, the coercion relation, is established using $similar'(e, b, y_2)$. Finally y_1 and y_2 are identified using the axiom

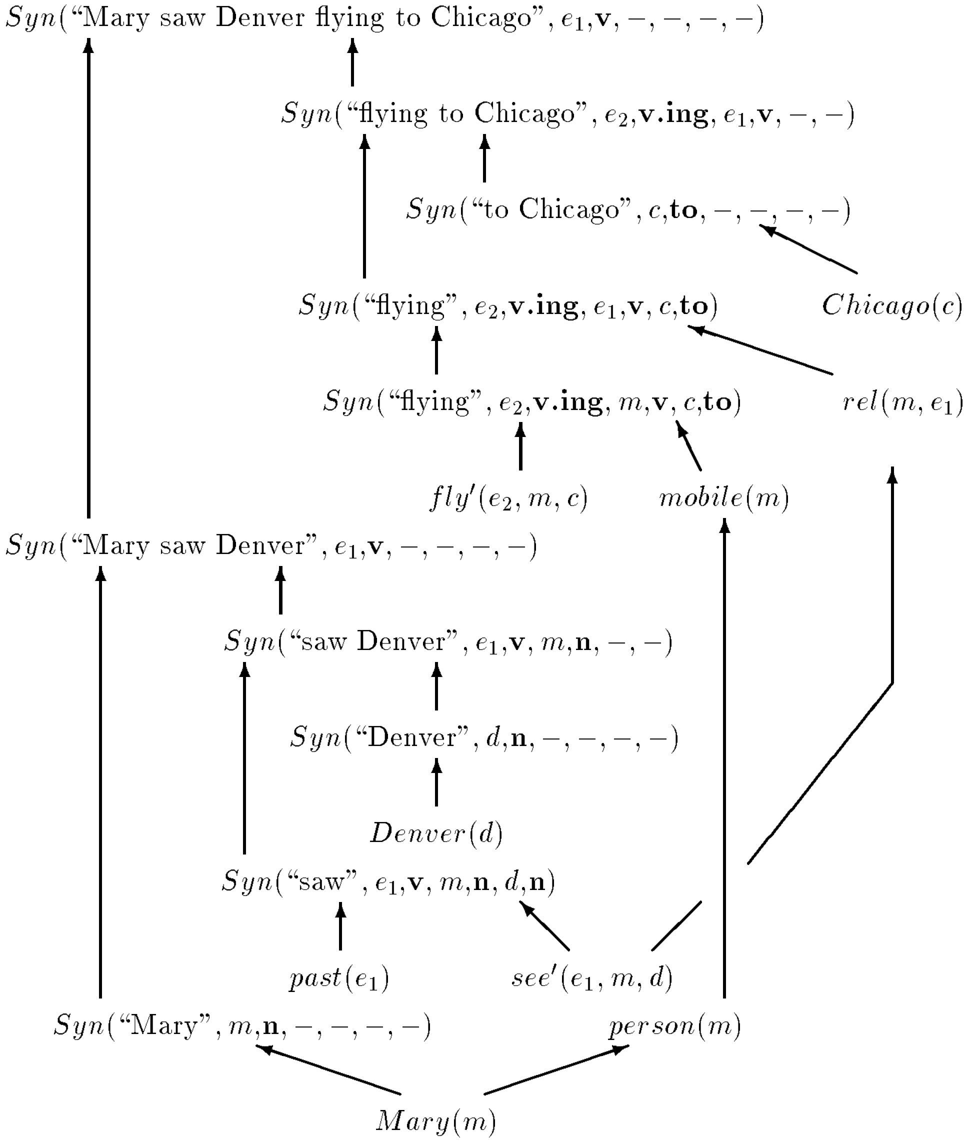

Figure 4: Parse of “Mary saw Denver flying to Chicago.”

$$(\forall\, e, x, y) similar'(e, x, y) \supset (\exists\, e_1) to'(e_1, e, y)$$

relating *similar* to the preposition used to signal its second argument.

A greatly abbreviated proof graph for this interpretation is shown in Figure 5. I have ignored the determiner and used dots to avoid the details of composition within NPs.

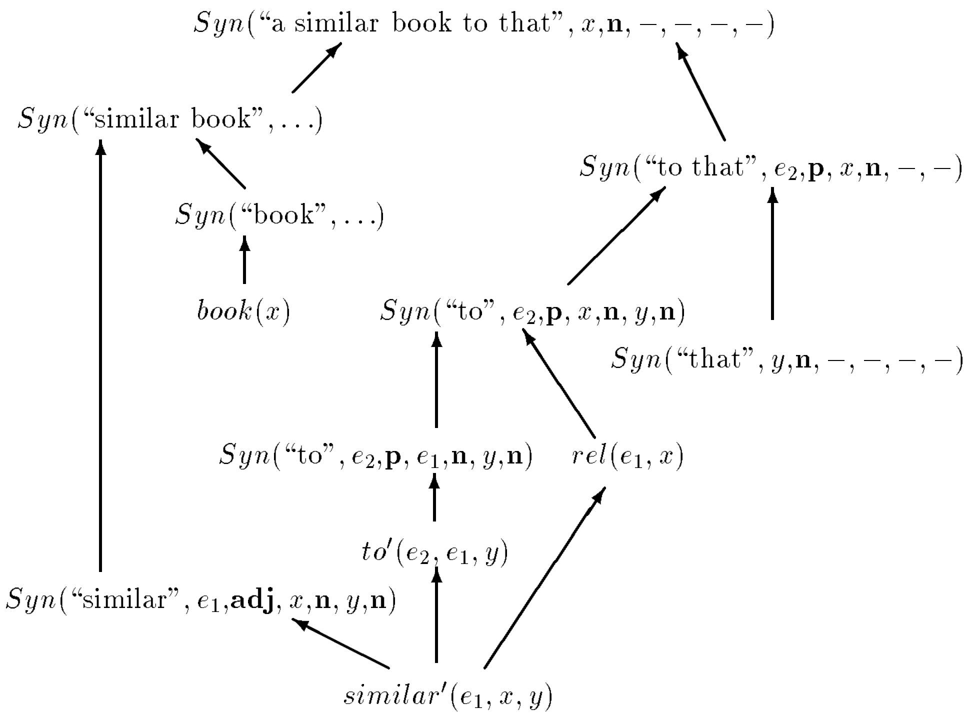

Figure 5: Parse of "a similar book to that"

In languages that have a freer word order than English has, many of the elements displaced from their unmarked position can be treated similarly.

5 Ataxis

Bolinger (1988) discusses a number of examples of what he calls "ataxis". In

> The plane crashed with no apparent survivors.

the adjective "apparent" does not really modify "survivors", say, in contrast to *real* survivors. Rather, it is the quantifier "no" that is apparent. The meaning is that the plane crashed with apparently no survivors. In

> He held some of the most powerful men in the world at his complete mercy.

his mercy is not complete. Rather the holding at his mercy is complete. In

> We appreciate every automobile you ever purchased.

"every" quantifies purchases, not automobiles (and "appreciate" similarly takes purchases and not automobiles as its logical object). In the most likely reading of

> She lost her first tooth.

"first" really modifies the loss, not the tooth—she had her first loss of a tooth. Similarly, in

(5) John smokes an occasional cigarette.

it is the smoking and not the cigarette that is occasional. During the Senate impeachment trial of President Clinton, a television reporter signed off with

John Palmer, on a nervous North Lawn of the White House.

Bolinger defines ataxis as "the tendency for more routinized syntactic processes to invade the domain of less routinized ones." He talks about "migrant modifiers". In addition to the above examples, he gives a number of attested examples that sound less good but are nevertheless easily understandable.

Bolinger quotes Tommola (1978) as saying, "the listener ... focuses his attention on the content words in the message, and interprets them in the light of normal experience, predicting and building up a representation of what the speaker intends to convey. This strategy makes it possible for him to predict the correct internal relationships between message units even independent of any syntactic structure." He further quotes him, "Speech comprehension proceeds with fairly little direct reference to grammar as formulated by linguists."

In this paper I take a less radical stance. Grammar is used where the meaning derived from it makes sense. But there are other interpretive devices that can be applied when it fails to make sense. Metonymic coercion is one such device, and in an important class of applications of metonymic coercion, the coercion function is taken from the explicit content of the sentence itself, that is, from the logical form that is recognized by virtue of the "grammar as formulated by linguists". Bolinger's examples of ataxis yield to this approach.

Consider sentence (5). The adjective "occasional" requires an event for its argument, but its explicit argument is a cigarette, which is not an event. The reference to the cigarette must be coerced into a reference to an associated event. The main verb of the sentence provides that event—the smoking of the cigarette. It has the cigarette as one of its arguments, and consequently can function as the desired coercion relation.

Figure 6 gives a somewhat abbreviated proof graph of this interpretation. Where y is the cigarette, the nonmetonymic predication that syntax alone would give us, $occasional'(e_3, y)$, is coerced into $occasional'(e_3, e_1)$, and the coercion relation that effects this is $smoke'(e_1, j, y)$.

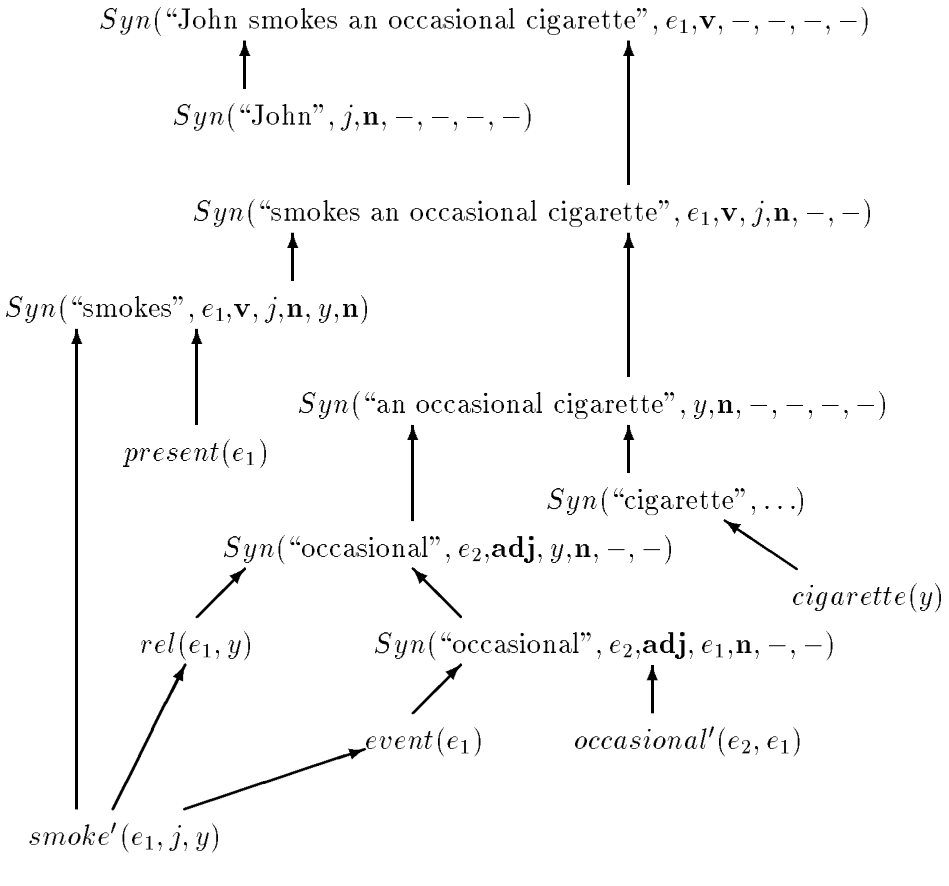

Figure 6: Parse of "John smokes an occasional cigarette."

Of course, the most salient event associated with cigarettes is smoking them, regardless of the rest of the sentence, so in

An occasional cigarette can't be harmful.

the coercion will again be to the smoking. However, this salient event is overridden in such sentences as

John buys an occasional cigarette.
John eats an occasional cigarette.

where the coerced events are the buying and the eating, respectively.

Bolinger's other examples yield to the same approach.

6 Container Nouns

In the sentence,

(6) John drank a cup of coffee.

John did not drink the cup; he drank the coffee. Similarly, in the following sentences, the real participant in the action designated by the main verb is not the grammatical object (or the object of "with") but the object of the preposition "of".

John ate a bag of potato chips.
John bought a tank of gas.
John visited a large number of friends last week.
John shook hands with a group of men.

Without coercion, the relevant part of the logical form of sentence (6) would be

$$Past(e_1) \wedge drink'(e_1, j, x) \wedge cup(x) \wedge of(x, y) \wedge coffee(y)$$

That is, in the past there was a drinking event e_1 by John j of a cup x where there is an "of" relation (to be pragmatically strengthened to "contains") between x and a portion of substance y describable as coffee. The cup does not satisfy the selectional constraints on the logical object of "drink" that it must be a liquid. The "of" relation between x and y is used to coerce the logical object from x to y.

This interpretation is illustrated in Figure 7.

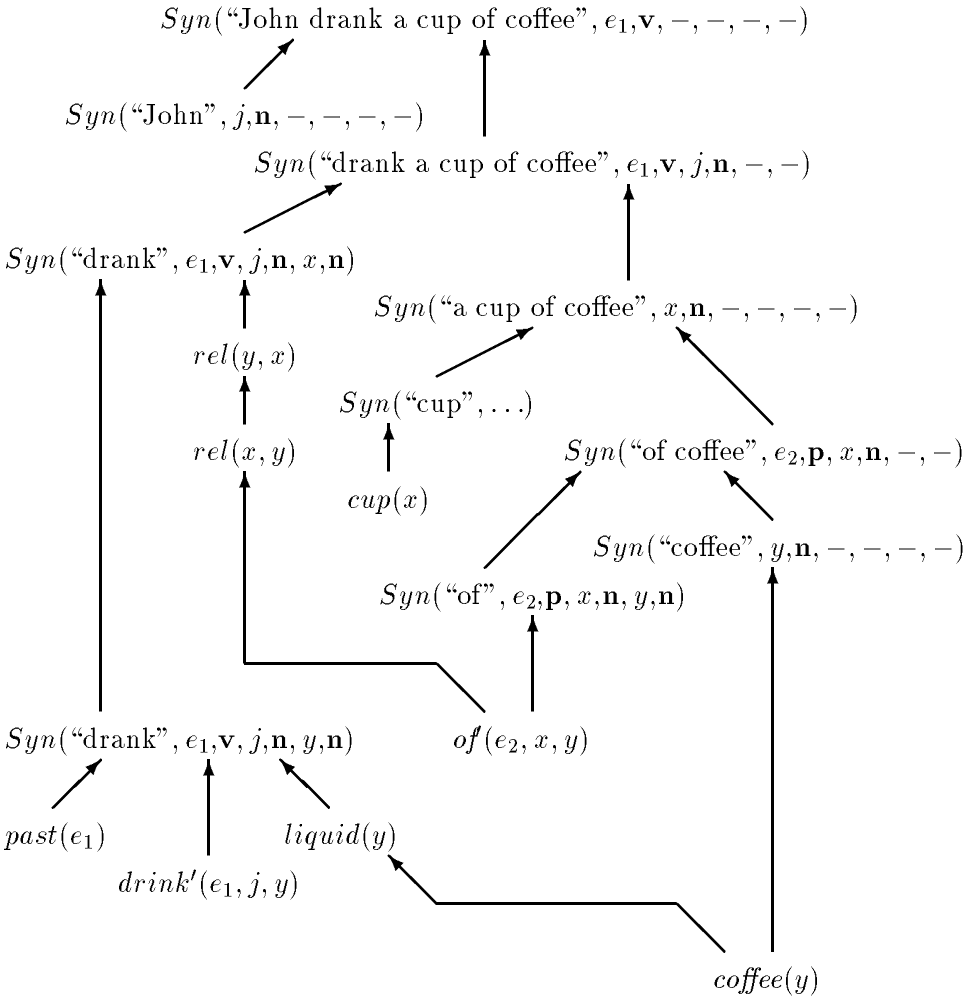

Figure 7: Parse of “John drank a cup of coffee.”

7 Distributive and Collective Readings

There are two entities associated with plural NPs—the set of entities referred to by the NP and the typical element of that set. In

The men ran.

each individual man must run by himself, so the predicate *run* applies to the typical element. This is the distributive reading. In

The men gathered.
The men were numerous.

the predicates *gather* and *numerous* apply to the set of men. This is the collective reading of the NP. The sentence

The men lifted the piano.

is ambiguous between the two readings. They could each have lifted it individually, the distributive reading, in which case the logical subject of *lift* would be the typical element of the set, or they could have lifted it together, the collective reading, in which case it would be the set, or the aggregate.

Typical elements can be thought of as reified universally quantified variables. Their principal property is that they are typical elements of a set, represented as $typelt(x, s)$. The principal fact about typical elements is that their other properties are inherited by all the elements of the set. Functional dependencies among such elements are represented by independent predications discovered during interpretation. Difficulties involved in this approach are worked out in Hobbs (1983, 1995).

Compositional semantics in the approach taken here is strictly local, in the sense that composition rules acting at a level higher than an NP cannot reach inside the NP for information. The Syn predication associated with NPs only carries information about the entity referred to, and in the case of plural NPs, only about the typical element. The details of how the internal structure of NPs is analyzed will not be explicated here; it is in Hobbs (1998). Here we will only note that one of the properties made available by this analysis is the typical element property, $typelt(x, s)$. Thus, to simplify the example, we will assume that the lexical axiom for the word "men" is

$$man'(e, x) \wedge typelt(x, s) \supset Syn(\text{“men”}, x, \mathbf{n}, -, -, -, -)$$

That is, if e is the eventuality of x being the typical element of a set s of men, then x can be described by the word "men". We will also assume there is an axiom that says that if x is the typical element of s, then s is a set.

$$typelt(x, s) \supset set(s)$$

In cases where the collective reading is the correct one, there must be a coercion from the typical element to the set. This can be effected by using the typical element relation, $typelt(x, s)$, as the coercion relation. That is, distributive readings are taken as basic, and collective readings are taken as examples of metonymy.

Figure 8 illustrates the interpretation of "Men gathered." The predicate *gather* requires a set for its argument. The explicit subject x of the verb phrase "gathered" is the typical element of the set of men, rather than the set itself. Thus, there is a coercion, in which the predication $typelt'(x, s)$, relating x to s, is used as the instantiation of the coercion relation $rel(s, x)$.

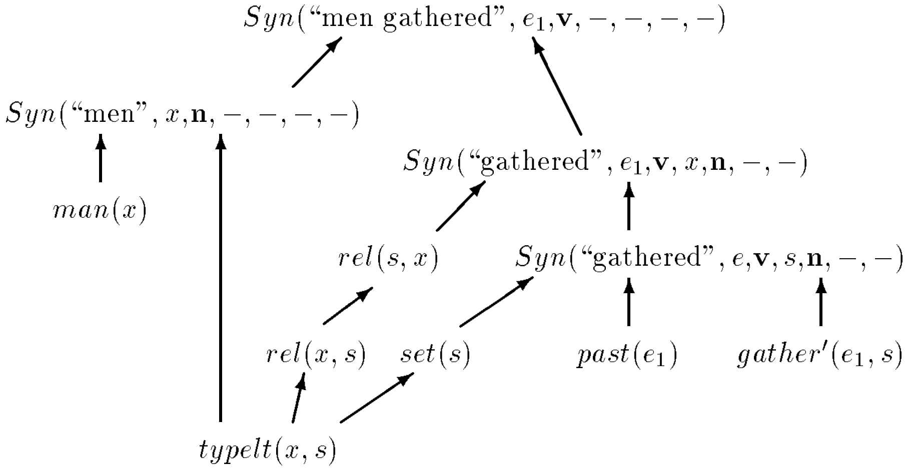

Figure 8: Parse of "Men gathered."

The opposite approach could have been followed, taking the basic referent of the NP to be the set and coercing it into the typical element when the distributive reading is required. This approach is perhaps more intuitively appealing since a plural NP by itself seems to describe a set. However, in the majority of cases the distributive reading is the correct one, so the approach taken here minimizes appeals to metonymy.

8 Small Clauses in Disguise

The intended message of the sentence

(7) This country needs literate citizens.

is not that this country is underpopulated, but that more of the population that it already has should be literate. Thus, the sentence really conveys the same message as the sentence

This country needs its citizens to be literate.

The logical object of the *need* relation is not the set of citizens, but the eventuality of their being literate.

A teacher who says to a class whose enrollment is already determined,

I want motivated students.

can only mean that he or she wants the students already in the class to be motivated.

Once again, this phenomenon can be viewed as an instance of metonymy where the coercion function is provided by the explicit content of the sentence itself. In particular, the word "literate" conveys a relation between the eventuality of being literate and its logical subject, the typical citizen. This relation becomes the coercion relation, coercing the logical object of "need" from the typical citizen to the literacy eventuality.

In the formal notation, the sentence initially conveys

$$need'(e_1, x, y) \wedge literate'(e_2, y) \wedge citizen(y) \wedge typelt(y, s)$$

The country x needs y where y is a typical citizen and is literate. After coercion, the interpretation is as follows:

$$need'(e_1, x, e_2) \wedge literate'(e_2, y) \wedge citizen(y) \wedge typelt(y, s)$$

Now it is the literacy of the citizens that is needed. The coercion relation between e_2 and y is provided by the predication

$$literate'(e_2, c_2)$$

This interpretation is illustrated in Figure 9.

9 Asserting Grammatically Subordinated Information

In uttering the sentence

(8) An innocent man was hanged today.

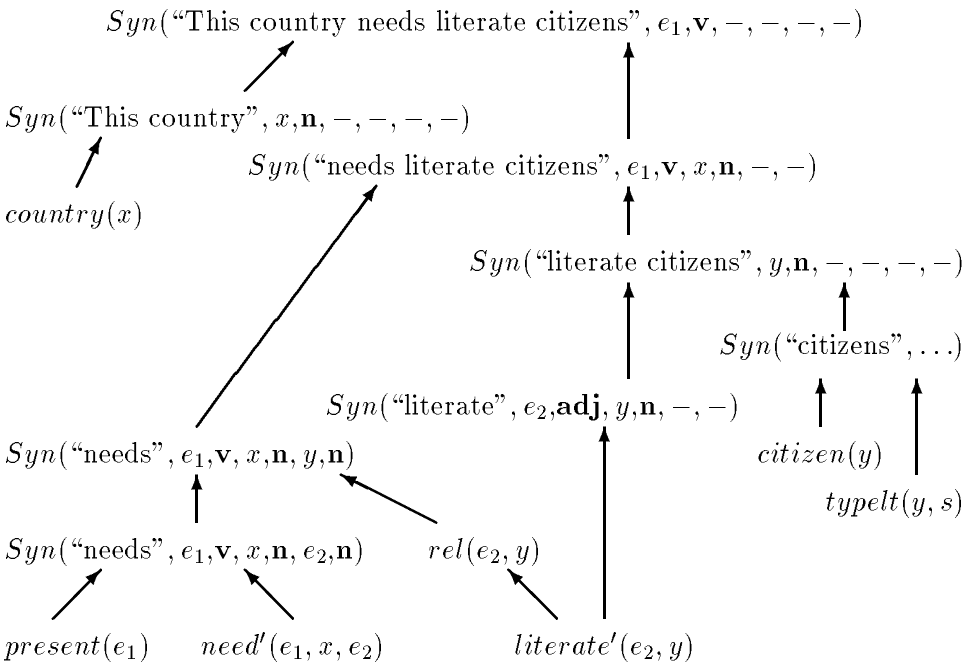

Figure 9: Parse of "This country needs literate citizens."

it is quite likely that the speaker means to convey primarily not the fact of the hanging, which is probably mutually known, but rather the innocence of the victim. That is, the new information is not, as in the canonical case, the predication associated with the main verb, but a predication associated with a grammatically subordinated element, a prenominal adjective. That is the primary assertional claim of the sentence.

The logical form of the sentence, without coercion, will contain the predications

$$hang'(e_1, x, m) \wedge innocent'(e_2, m)$$

That is, e_1 is a hanging of the man m by someone x, and e_2 is m's innocence. The entire sentence would normally be described by the Syn predication

$$Syn(\text{"An innocent man was hanged today."}, e_1,\mathbf{v}, -, -, -, -)$$

where the sentence is taken to be a description of the hanging event e_1.

In Section 2, it was stated that in the IA framework, the job of an agent is to interpret the environment by proving abductively, or explaining, the observables in the environment, thereby establishing that the agent is in a coherent situation. When the observable is an utterance by a speaker i to a hearer u of a string of words w, the most plausible explanation is that w is a grammatical, interpretable sentence (or an otherwise coherent text) describing an eventuality that the speaker wants the hearer to believe or to adopt some other cognitive stance toward. For the purposes of this chapter we will take the goal to be the hearer's belief. Thus, the linkage between syntax and compositional semantics, represented with *Syn* predications, and pragmatics, involving the predicates *goal* and *believe*, is effected by axioms of the following flavor:

$$Syn(w, e, \mathbf{v}, -, -, -, -) \wedge goal(i, e_0) \wedge believe'(e_0, u, e) \supset utter(i, u, w)$$

That is, if w is a grammatical, interpretable sentence describing the eventuality e and a speaker i has the goal e_0 that a hearer u believe e to obtain, then (defeasibly) i will utter to u the string of words w. This axiom is used to explain the occurrence of the utterance.

In the case of sentence (8) the pragmatic part of the interpretation would seem to be

$$goal(i, e_0) \wedge believe'(e_0, u, e_1)$$

involving a belief in the hanging event, whereas what is wanted is

$$goal(i, e_0) \wedge believe'(e_0, u, e_2)$$

involving a belief in the innocence.

This again can be seen as an instance of metonymy where the explicit content of the sentence is used as the coercion relation. The desired top-level *Syn* predication is

$$Syn(\text{"An innocent man was hanged today."}, e_2, \mathbf{v}, -, -, -, -)$$

indicating that the innocence is what the sentence asserts. The metonymy axiom (1) decomposes this into

$$\begin{aligned}&Syn(\text{"An innocent man was hanged today."}, e_1, \mathbf{v}, -, -, -, -)\\&\quad \wedge rel(e_2, e_1)\end{aligned}$$

The first conjunct is proved as it is normally, yielding the parse tree and the logical form of the sentence. The transitivity of *rel* decomposes the second conjunct into

$$rel(e_2, m) \wedge rel(m, e_1)$$

The first conjunct is established using $innocent'(e_2, m)$, and the second conjunct is established using $hang'(e_1, x, m)$ and the symmetricity of rel.

In a sense, we have coerced the sentence "An innocent man was hanged today" into the sentence "The man who was hanged today was innocent."'

Similarly, in

(9) I have a sore throat.

it is not the possession of a throat that is being asserted, but the soreness of the throat the hearer already knows the speaker has. This can be viewed as an instance of metonymy as well. The explicit assertion of the sentence, the possession, is coerced into the soreness of what is possessed. The possession is related to the throat and the throat is related to the soreness, both by properties that are explicit in the logical form of the sentence and are thus emminently accessible.

This example requires that both possession and soreness be possible coercion relations, that is, instances of axiom schema (4):

$$have'(e_1, z, x) \supset rel(e_1, x)$$
$$sore'(e_2, x) \supset rel(e_2, x)$$

These coercion relations compose through the transitivity and symmetricity of rel.

Figure 10 shows an abbreviated version of the proof graph for the interpretation of example (9). The having e_1 is taken as the eventuality conveyed by the verb phrase, but that is coerced into the soreness e_2, using as a coercion relation a composite of the having and the soreness.

The sentence "I have a sore throat" is coerced into the sentence "My throat is sore."

These two examples used Metonymy Axiom (1). The eventuality is coerced, rather than one of its arguments.

I have not said what constraint forces this coercion, but it could be the constraint that what is said should be informative, an instance of the more general principle that one does not usually have the goal to achieve a state that already holds.

A similar story can be told about examples in which high stress changes what is asserted or alters our interpretation of predicate-argument structure. For example, in

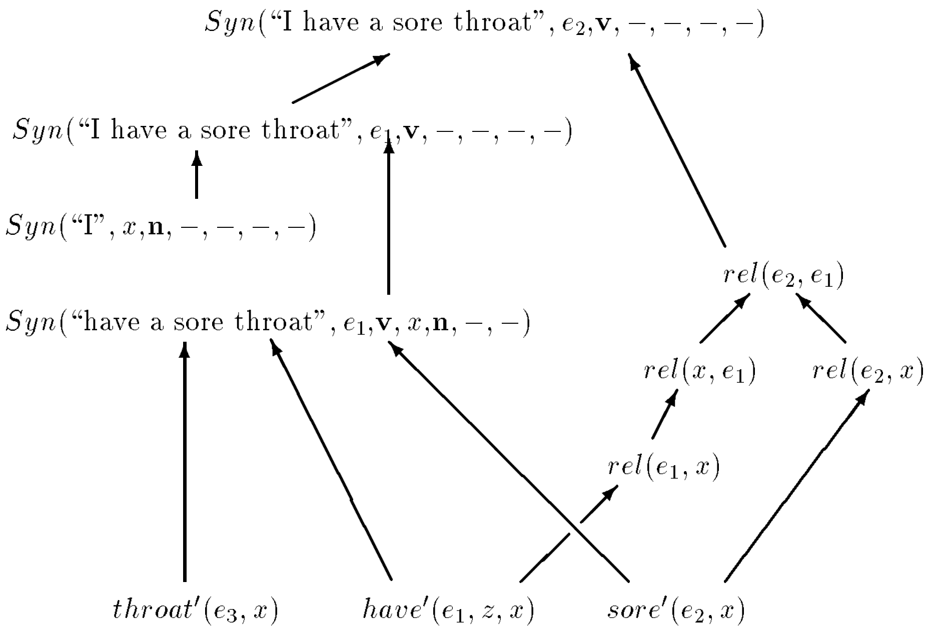

Figure 10: Interpretation of "I have a sore throat".

John introduced Bill to MARY.

the assertional claim of the sentence is "It was Mary that John introduced Bill to." In

John didn't introduce Bill to MARY.
John only introduced Bill to SUE.

the high stress forces a coercion of the arguments of *not* and *only* from the e such that $introduce'(e, j, b, m)$ to the e_0 such that $Mary'(e_0, m)$. It was not Mary that John introduced Bill to. It was only Sue that John introduced Bill to.

High stress indicates new information, and the new information in a sentence is generally what the speaker wants the hearer to believe. The coercion is one way to bring the intonation and the rest of the interpretation into correspondence with one another. Similarly, in example (8) the word "innocent" is likely to be given high stress.

In Hobbs (1995) it is shown how a similar move is a key part of an account of how the correct interpretation of monotone-decreasing quantifiers can be extracted from a flat logical form. Essentially, the sentence "Few men work" is reinterpreted as "The men who work are few."

10 Conclusion

Metonymy is a pervasive phenomenon, and metonymic interpretation is a powerful interpretive device. In generation, it can be used to achieve economy of expression wherever a sufficiently salient coercion relation will yield an unambiguous interpretation. Among the most salient relations are those provided by the explicit content of the text itself. Allowing these as possible coercions, we see how a combination of syntax, compositional semantics, and metonymic interpretation can explain a diverse set of supposedly syntactic phenomena.

The examples discussed in this chapter all lie on the boundaries between syntax, semantics and pragmatics. That they all yield to the same solution illustrates the utility of a framework in which the three areas are modelled in a uniform fashion.

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