ARCHITECTURES AND MECHANISMS FOR LANGUAGE PROCESSING

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On Interpretation: Minimal ‘Lowering’
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13.1 Introduction

In psycholinguistics, the investigation of grammatical aspects of interpretation has lagged behind the study of parsing. Ambiguity in the interpretation of a phrase has not generally been studied except in the case of lexical ambiguity. The present chapter will explore the preferences perceivers exhibit when a phrase might be interpreted in more than one way, focusing on the interpretation of Determiner Phrases (DPs). This will allow us to address the issue of whether the referential interpretation of a DP and its thematic interpretation must go hand in hand, occurring simultaneously, or whether these interpretation processes are initially (potentially) distinct. What is meant by “early” interpretation of a phrase (see the introductory chapter of this volume) is completely unclear until this issue of interpretive separability, or non-separability, has been resolved.

Two recent developments in linguistic theory open up a promising avenue to pursue in the investigation of semantic interpretation. The first development, critical to the arguments presented here, is Diesing’s (1992) Mapping Hypothesis, which establishes a constraint between syntax and interpretation. DPs outside VP (at L(logical) F(orm), in English) are presupposed or quantificational; the VP is identified as the “nuclear scope,” where asserted and thus focal information typically appears. Hence, only DPs within VP get an existential interpretation – essentially an interpretation where a new entity (one not presupposed in context or by shared background assumptions of the speaker and hearer) is introduced into discourse.¹ Compare (1a) and (1b).

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1 The specific version of Diesing’s Mapping Hypothesis that I will adopt is summarized in (i).

(i) VP-external at LF:
  - presuppositional interpretation
  - quantificational interpretations
  VP-internal at LF:
  - existential interpretations

I will assume that the VP is the nuclear scope, where asserted information is expected to appear. Perceivers seem to expect non-contrastively focused information to appear in the VP. However, I will not assume that only asserted information can appear in the VP.
Minimal ‘Lowering’

(1) a. There’s a dog in the garden.
    b. A (certain) dog is in the garden.

A dog is in VP in (1a) and therefore receives an existential interpretation. In (1b) a dog may get an existential interpretation if the subject ‘lowers’ into its VP-internal subject position at LF. However, it need not lower. If it doesn’t lower, it may be presupposed. (Consider A certain someone is in the garden, which naturally receives a presupposition interpretation.)

The predictions of the Mapping Hypothesis concerning the possible interpretation of a DP depend on the position that a DP occupies at LF. Following Runner (1995), I will assume that all subject and object DPs sit outside VP at surface structure in English. In this theory, the subject and object(s) move from VP-internal positions to Agreement nodes to receive case in the specifier of Agreement, as indicated in (2). The verb raises above the object to the Tense node. (Runner actually views movement as a copy and deletion process.) I make the standard assumption that a moved phrase and its corresponding trace(s) are coindexed and thus form a chain.

2 In the theory presented by Runner (1995), there is no explicit replacement at LF. (All forms of A-movement are prohibited at LF.) Therefore, a dog in (1a) must remain in VP at LF.

3 Runner’s theory, case is systematically checked in specifier position of subject agreement phrases (AgP) and object agreement phrases (AgP). Case checking occurs at s-structure, before the split to Logical Form (LF). Runner develops this idea in a theory where movement of a phrase is treated as an copy and deletion, yielding structures like (1) before the Phonetic Form (PF)/LF split (essentially before s-structure). Deleterious of a particular copy of a phrase at a particular level of representation is then governed by grammatical conditions. In (i), the lower copies must delete by s-structure (before the PF/LF split) because only the higher phrases in Spec AgP; Tense Phrase (TP) and Spec AgP are in the appropriate positions for checking case and tense features.

Runner’s theory is adopted here because it is explicit and offers an independently motivated theory of representations which places DPs in positions at s-structure (specifier positions) where they could be interpreted with respect to their referential (i.e., nonsemantic) properties. Given Runner’s representations, a subject or object DP could be interpreted as an operator at s-structure because it is not in an argument position – a position where an operator generally cannot appear since there would be no variable for it to bind. (Here and throughout, I set aside the strictly local prefixing required to get restricted quantification where only entities of the type of the N are quantified over.) Runner’s representations are also motivated by a wide range of basic empirical observations showing (a) that the direct object in English is external to VP, as indicated by coordination, right node raising, stylistic inversions, adverb placement, etc., (b) that the second object in double-object structures is VP-external, as indicated by binding properties, quantifier scope, coordination, and adverb placement, and (c) that the accusative NP in Exceptional Case Marking constructions (I believe him to have convinced Ben) is raised to Spec AgP; as indicated by binding properties, the distribution and interpretation of adverbs, the behavior of floated quantifiers, and the behavior of particle verbs (where the particle may follow the accusative phrase, as in I made him out to be a liar). In short, the representations are quite well motivated, especially with respect to the property that is crucial here, namely, VP-external placement of both subject and object DPs at s-structure.

(2) \[ (\text{Agr}_P \quad (= \text{Subject Agreement Phrase}) \]

\[ \text{John}_i \quad \text{TP} \quad (= \text{Tense Phrase}) \]

\[ \text{kissed}_j \quad \text{Ag}_P \quad (= \text{Object Agreement Phrase}) \]

\[ \text{Mary}_k \quad \text{VP} \]

\[ \text{DP}_i \quad \text{V} \quad \text{V}_j \quad \text{DP}_k \]

Given Runner’s surface structures, the subject and object already occupy potential operator positions (nonargument positions) at surface structure. Therefore, I will assume that Quantifier Raising of a subject or object is not obligatory for quantificational subjects or objects. In other words, in a sentence like Everyone kissed someone, the s-structure (one just like in (2)) already corresponds to a potential LF representation, namely the wide-scope universal representation, where the subject (everyone) takes scope over the object.

The assumption that the subject of an English sentence occupies a VP-external position at s-structure is completely uncontroversial. The assumption that objects of the verb also occupy a VP-external position at s-structure is controversial (see Note 3 for arguments supporting the assumption). However, only one of the arguments in this chapter (Section 2.5) crucially depends on this assumption. The other arguments would stand even if the assumption about the surface position of objects should prove incorrect.

Turning now to psycholinguistic issues, the question is how the processor interprets ambiguous DPs. With others, I assume that the parser initially constructs a s-structure representation of a sentence, as part of the overall comprehension process. In this chapter, I will argue that the position of the overt copy of a phrase, not the position of its trace, determines its interpretation with respect to referential (nonsemantic) properties. Specifically, I will argue that the processor follows the Minimal ‘Lowering’ principle in (3). To forestall any terminological confusion, it should be emphasized at the outset that ‘lowering’ is not a grammatical operation – this term is adopted only for expository convenience to indicate where in a structure the referential content of a phrase is interpreted.

(3) ‘Lower’ only when necessary, e.g., interpret a DP in its surface position if possible.
The principle in (3) may be viewed as an instruction to the language processor to assume, in the absence of evidence to the contrary, that the lexical phrase (or overt copy) is in the highest position in the clause and interpret the phrase in that position. The principle in (3) instructs the processor to lower the phrase (e.g., to a VP-internal position) only when presented with evidence requiring lowering. The referential interpretation of a phrase, as opposed to its thematic interpretation (what thematic role it receives), will be assigned to the overt phrase, not to its trace. Thus a phrase will, if possible, be referentially interpreted in the highest position it could occupy in the surface syntactic representation.

The Minimal Lowering (ML) principle makes numerous specific predictions. It is to these that we now turn.

13.2 Predictions and Evidence

13.2.1 Interpretation of Indefinite DPs

The ML principle predicts that lowering a lexical phrase into the VP will be dispreferred. Schematically, this is shown in (4), where lowering of the subject into the VP is not required.

(4)  A dog was in the garden.
     a. \[Spec_{\text{ArgP}} \, \lambda \text{dog}_i \, [\text{VP} \, t_{\text{TV}}, \text{PP in the garden}]]\]
     b. \[\text{DP}_i \, [\text{VP} \, \lambda \text{dog}_i \, t_{\text{TV}}, \text{in the garden}]]\]

This predicts that a presupposed interpretation of the subject is preferred. Intuitions in this case are subtle and complicated: the indefinite determiner a resists a presuppositional interpretation, which may constitute evidence that lowering of the DP is necessary.

In order to test the ML principle, it is necessary to find genuinely ambiguous examples where either a lowered or an unlowered interpretation is possible. Consider (5), for example. In (5b) three ships may be presupposed (included in the set of five ships introduced in (5a)), but three ships may be interpreted existentially, as introducing the existence of three new ships into the discourse context.

(5)  a. Five ships appeared on the horizon.
     b. Three ships sank.

Given the context provided by (5a), there is a clear intuitive preference to give a specific (presupposed) interpretation to (5b), where three ships are taken as a subset of the five ships introduced in (5a). In a written questionnaire study conducted with Chuck Clifton (Frazier and Clifton, in progress), twenty subjects were given sixteen examples like (5) and asked a question about the interpretation of the subject of the second sentence. For example, following (5b), the question was: Were the three ships that sank among the five ships that appeared on the horizon? 80% of the responses indicated that perceivers assigned the presuppositional interpretation. Thus, the unlowered interpretation was preferred, as predicted by the ML principle.

Intuitions about scope provide further evidence that indefinites are preferentially interpreted in their surface position. Consider (6).

(6)  a. A man seems/doesn’t seem to be sick.
     b. It seems/doesn’t seem a man is sick.

Despite the presence of the indefinite determiner a in (6), a man preferentially receives a presupposed interpretation in (6a), with scope over the entire sentence. This is clearest with the negative sentence form. A man doesn’t seem to be sick can clearly be used in a context where there are many sick men, providing that some man isn’t sick. Not so in (6b). It doesn’t seem a man is sick only receives the interpretation where a man is under the scope of the negative, meaning, roughly, that it seems no man is sick. Intuitions suggest that the initial or preferred interpretation of (6a) differs from the interpretation of (6b), indicating that perceivers have not taken the option of lowering the subject in (6a).

13.2.2 Quantifier Scope in Sentences with Multiple Quantifiers

The details of perceivers’ preferred interpretation of scopally ambiguous sentences are complicated and have never been fully explained. However, the gross pattern of preferences is clear. In cases of ambiguity involving more than one plausible interpretation, the subject tends to take scope over the indirect object (of a double object verb), which itself takes scope over the direct object, which in turn tends to take scope over a prepositional object (see Kurtzmann and MacDonald, 1993, Ioup, 1975, Van Lehn, 1978, Pritchett and Whitman, 1995, Tunstall, in progress). For example, Ioup (1975) reports that perceivers of the seven languages she checked preferred the indirect object to take scope over...
the direct object in sentences like *Martha told every child a story*, resulting in the reading where the particular story told may differ for each child. Van Lehn (1978) argues for an embeddedness hierarchy which itself correlates with c-command. Kurtzman and MacDonald (1993) argue for, among other things, a linear-order principle based on data from reading sentences like *Every kid climbed every tree*. Twinall (1996, in progress) argues for a surface scope principle (where quantifier scope is determined by surface c-command relations) using reading time data for sentences like *Kelly showed every photo to every critic*. In short, though investigators agree about the gross preferences in scope assignment, they have disagreed about whether these preferences follow from linear order, a grammatical function hierarchy, or some other principle.

On any account of scope preferences in scopally ambiguous sentences, the grammar must delimit the grammatically permissible readings of the sentence. I assume that a quantifier phrase may grammatically take scope over another phrase only if it c-commands that phrase at s-structure or LF. Some further principle, presumably a processing principle, must characterize the preferred scope assignment when the grammar allows various possibilities. The basic preferences just noted would follow automatically from the ML principle. At s-structure, the subject c-commands the indirect object, which (in Runner’s theory) c-commands the direct object, which c-commands in turn all material in the VP. Hence, ML can explain the basic preference for, e.g., a wide-scope universal interpretation of (7), where the choice of three men may differ for each woman.

(7) Every woman loves three men.

The ML principle is not required just for the treatment of scope. Hence, an independently motivated principle (ML) suffices to explain the gross scope preferences just noted. The ML account makes a further prediction which is of interest here. It leads us to expect that distinct quantifier phrases may have distinct intrinsic scope preferences related to their preference to be interpreted VP-externally versus VP-internally. It is well known that quantifier preferences do depend on the particular quantifiers in a sentence. Ioup (1975) and Van Lehn (1978) argue for a hierarchy where, for example, *each* is more likely to take wide scope than *every, and some* is more likely to take wide scope than *a*. For example, Ioup (1975) found that *each* took wide scope in sentences like *John made each girl a cake* in all of the thirteen languages she checked. She argued that *each* is highest on the scope hierarchy, above *every*, which in turn is above *some* and *a*. The preference of each quantifier to take wide scope seems to mirror its preference to be interpreted as presupposed or interpreted as d(iscourse)-linked. Indeed the paradigm in (8) and (9) may be related to this preference. Within each pair of quantifiers, the universals (*each, every) and the ‘existentials’ (*some, a*), the quantifier with a stronger preference for wide scope may grammatically occur with the presupposed set overtly expressed, as indicated.

(8) a. each of the men
   b. *every of the men

(9) a. some of the men
   b. *a of the men

An indication that the wide-scope preferences of individual quantifiers may reflect presupposition differences comes from intuitions about the preferred antecedents for pronouns. In a study with Radó and Clifton, we explored the processing of d-linked phrases like *which man*. A d-linked phrase is assumed to be presupposed in discourse in the sense that it selects a subset from an already familiar context set of entities (e.g., *men*). In the experiment, a d-linked phrase was chosen as the antecedent of a pronoun more often than a non-d-linked interrogative (*who* in ambiguous sentences like those in (10a, b). The second segment of unambiguous d-linked examples (10c) was also processed faster than the second segment of unambiguous who examples (10d) in a self-paced reading study using sentences that were disambiguated by eliminating all but the wh-constituent as a permissible antecedent of the pronoun, as in (10c, d). (In (10), the “*” indicates presentation segments.)

(10) a. Which guy did Bradley send a rifle to when he was threatened? (60% he = which guy)
   b. Who did Bradley send a rifle to when he was threatened? (44% he = who)
   c. Which little boy did Polly tell a story to / before he had an operation? (76 ms/character)
   d. Who did Polly tell a story to / before he had an operation? (84 ms/character)

As noted above, if *each and some* are intrinsically d-linked, like *which person*, then they intrinsically provide evidence that a presuppositional interpretation is appropriate whereas *every and a* do not. The d-linked property of *each and some* could explain the position of these quantifiers on the scope hierarchy. This approach predicts that position on the scope hierarchy (with which we can now dispense except as a descriptive convenience) should correlate with the goodness of a phrase as an antecedent for the pronoun: higher position on
the hierarchy \((each > every; some > a)\) should be reflected in goodness as an antecedent. My intuitions suggest that \(each\ (man)\) is indeed more likely to be chosen as antecedent than \(every\ (man)\) in \((11a, b)\), and that \(some\ (man)\) is more likely than \(a\ (man)\) \((11c, d)\).

\[(11)\ a. \ John \ hinted \ to \ every \ man \ that \ he \ needed \ to \ rectify \ the \ problem \ personally.\]
\[b. \ John \ hinted \ to \ each \ man \ that \ he \ needed \ to \ rectify \ the \ problem \ personally.\]
\[c. \ John \ hinted \ to \ a \ man \ that \ he \ needed \ to \ rectify \ the \ problem \ personally.\]
\[d. \ John \ hinted \ to \ some \ man \ that \ he \ needed \ to \ rectify \ the \ problem \ personally.\]

If these intuitions are confirmed by systematic testing, they would further support the idea that quantifiers are interpreted in their surface position if possible, but may need to move due to inherent specification of the quantifier as d-linked (to a presupposed context set) or not d-linked.

### 13.2.3 Reconstruction

The ML principle states that DPs are lowered only when necessary. In reconstruction sentences where an anaphor is contained in a moved constituent, it predicts a preference for the anaphor to be interpreted with a matrix antecedent, on the basis of a representation where the wh-phrase lowers only to the complementizer position. To obtain an interpretation where the anaphor has an embedded antecedent, further lowering is necessary. In a self-paced reading study, Frazier, Plunkett, and Clifton (1996) investigated the processing of sentences like those in \((12)\).

\[(12)\ a. \ Which \ rumor \ about \ herself \ did \ the \ matron \ claim \ the \ actress \ made \ up? \quad \text{(ambiguous, 68\% matrix antecedent)}\]
\[b. \ Which \ rumor \ about \ herself \ did \ the \ actress \ claim \ the \ newspaper \ made \ up? \quad \text{(matrix antecedent, 85 ms/character)}\]
\[c. \ Which \ rumor \ about \ herself \ did \ the \ newspaper \ claim \ the \ actress \ made \ up? \quad \text{(embedded antecedent, 85 ms/character)}\]

In ambiguous questions like \((12a)\), perceivers typically \((68\% \times \text{the time})\) assigned the matrix antecedent \((matron)\) to the reflexive, as indicated by answers to questions following the target sentence. Further, in unambiguous questions like \((12b)\) and \((12c)\), reading times were significantly faster when the antecedent for the reflexive was in the matrix clause \((12b)\) rather than the embedded clause

\[(12c). \ This \ suggests \ that \ perceivers \ lowered \ the \ wh-phrase \ only \ as \ low \ as \ necessary \ to \ bind \ the \ reflexive.\]

### 13.2.4 Focus

The expression of focus in natural languages is complex and differs considerably from one language to the next. In English, focus is largely conveyed by pitch accents. I will assume the grammar of focus proposed by Selkirk (1995). In this system, a pitch accent introduces a focus feature (F-marking) into the syntactic representation. In the syntactic representation, this feature may project from an internal argument to its head and from a head to its maximal projection (see especially, Selkirk, 1984, 1995 and, for experimental support, Birch and Clifton, 1995, Schafer, 1996). Focused material typically appears within the nuclear scope (= VP), where asserted information is expected to occur.

Given these assumptions, the focus structure of a sentence is often ambiguous. Intuitions suggest that perceivers prefer narrow focus. Consider \((13)\), for example.

\[(13)\ a. \ The \ caterer \ only \ delivered \ some \ POTATOES.\]
\[b. \ He \ didn’t \ deliver \ any \ ONIONS.\]
\[b’. \ He \ didn’t \ \textsc{select} \ the \ potatoes \ personally.\]
\[b” . \ He \ didn’t \ \textsc{prepare} \ the \ meal.\]

The grammar permits F-marking to optionally project from the direct object to the VP in \((13a)\). But intuitions suggest that preferentially it does not project, and that therefore perceivers expect a continuation like \((13b)\), not \((13b’)\) or \((13b”)\) where (either the verb or) the entire VP is in focus.\(^6\)

\[^{5}\text{Reconstruction examples are interesting precisely because they allow distinct aspects of interpretation to be teased apart. The examples in (12) indicate that each aspect of interpretation is preferentially accomplished as high in the already computed structure as is grammatically permissible. The scope of the wh-phrase is determined in the highest (s-structure) position. Binding of the reflexive requires lowering at least to a position where a c-commanding antecedent is available, i.e., the specifier of the embedded CP. Thematic interpretation requires further lowering to a theta-position within the lower clause. If the grammar permitted the reflexive to be bound in the highest (scope-determining) position of the wh-phrase, then ML would predict that the reflexive would preferentially be bound in that position. In short, on the theory advocated here, a syntactic chain is not interpreted all at once. Different aspects of interpretation may be separated, each occurring as high in the already computed surface structure as the grammar permits.}\]

\[^{6}\text{Sentence (13a) contains the focus particle only. The role of only in such examples is not entirely clear (Rooth, 1983, 1992). It seems to magnify and clarify perceivers’ intuitions about focus. If only is deleted, the same narrow-focus preference seems to be present, though the contrast between different continuations (e.g., (13b) vs. (13b’)) is less sharp.}\]
There is also some experimental evidence supporting a preference for narrow focus of just the phrase bearing the pitch accent, without projection of F-marking to a higher phrase. Crain, Philip, Drozd, Roepel, and Matsuoka (1992), reported in Crain, Ni, and Conway (1994), examined adult preferences in interpreting sentences like (14).

(14) The dinosaur is only painting a house,
   a. not doing anything else (VP focus)
   b. not painting anything else (DP focus)

Adults systematically preferred (14b), indicating that sentence (14) was assigned narrow focus on just the direct object. Though Crain et al. (1994) do not attribute this preference to a preference for narrow focus, the results are exactly what are expected given a general preference not to project focus out of an F-marked phrase. (Crain et al., 1994, attribute the effect to a preference for the reading with a smaller contrast set. See Frazier, 1999, for problems with such an account.)

The preference for narrow focus can be derived from the ML principle. Assuming that (noncontrastively) focused material appears in the nuclear scope (= VP), then narrow focus on the direct object requires only the object to lower into VP, as indicated in (15).

(15) [Spec,AGrp] The caterer [TP delivered [Spec,AGrp] some POTAJOES [VP he [t+4]]]]

Projecting focus beyond the object would presumably entail also lowering the verb into VP. The verb and the object cannot lower together. The only constituent containing both of them (TP) could not lower since the VP contains no trace corresponding to this constituent.²

13.2.5 Conflicting Evidence About Whether DP Must Lower

If the ML principle is correct, perceivers should have difficulty interpreting a DP when evidence about whether it should be interpreted as VP-internal is mixed. To this point, the evidence discussed includes evidence about whether the DP may receive a VP-external interpretation (i.e., a presuppositional, quantificational, or generic interpretation), intrinsic properties of determiners (e.g., some easily receives a specific interpretation, a does not), as well as evidence about the scope of the DP, binding of an anaphor in the DP, and

By contrast, in (16b), each does seem to imply a familiar context set of girls, and a does not easily receive a specific interpretation. Thus, in (16b) all evidence converges on the wide-scope universal interpretation of the subject.

In general, other things being equal, the ML principle predicts a preference for a specific/presuppositional interpretation of a subject. However, when the subject contains the determiner a, as in (17), a specific or presuppositional interpretation does not seem to be readily available.

(17) A tall man appears.

In a null context, given the determiner a, the present (nonpast) tense and a predicate which resists a generic interpretation as in (17), the perceiver has little choice but to assign the subject an existential (VP-internal) interpretation. Along with the existential (VP-internal) interpretation of the subject, it is well known that a pitch accent in (17) will fall on the subject (on man), thereby ending up with focus in the nuclear scope (in VP), as expected. Hence, despite the fact that the subject needs to be lowered in (17), the sentence should be easy to process because all evidence converges: the subject must be lowered.

Beckman (1996) investigates a case where the evidence about whether lowering is required does not converge. She studied double object sentences. In Runner’s (1995) theory, double objects are analyzed as clausal DPs, as illustrated in (18).

² This account entails that projection of F-marking is defined at deep structure or more likely at LF.
Each DP raises to its own AgrDP, as illustrated in (19); the whole clausal DP raises to Agr0P, then DP1 raises out of the clausal DP to Agr1P.

(19) DP1

\[ \text{a child} \quad \text{Agr}_0 \quad \text{Agr}_1 \quad \text{Agr}_2 \]

Now consider sentences like those in (20), which Beckman investigated in her self-paced reading study. She showed that a sentence like (20b) with an indefinite first object (Goal) takes longer to comprehend than a sentence like (20a) with an indefinite second object (Theme).

(20) a. John gave the man a book.
   b. John gave a man a book.

In (20a), there are no problematic constraints on the focal structure of the sentence. John and the man may both be presupposed; a book may be lowered into VP and presumably assigned focus. By contrast, in (20b), there is a problem. DP1 (a man) provides the likely focus of the sentence. It is not marked as being already familiar and, as new material, it would likely receive focus. Hence, it is a likely candidate for lowering into the nuclear scope (= VP). But in order for DP1 to lower into VP, DP2 must lower into VP: until DP2 lowers, the VP does not contain a trace of DP1. This is illustrated in (21a), where no trace of DP1 is in VP before lowering DP2. (21b) illustrates that a trace of DP1 is contained in VP once DP2 has lowered.

(21) a. [subject [verb [SpecAgrP a child] [SpecAgrP t1 the book] [VP t2]]]
   b. [subject [verb [SpecAgrP a child] [t1 the book] [VP t2]]]

The fact that DP2 must lower in order for DP1 to be interpreted VP-internally is the source of the difficulty in (21b), where DP1 is indefinite and DP2 is definite. The processor receives conflicting evidence about whether to lower DP2. In order to interpret DP1 as focused and presupposed, DP1 should lower (hence, DP2 needs to lower). But, the definite DP2 is marked as familiar and likely presupposed. Thus DP2 looks as if it needn’t lower.

This account can explain why (20b) took longer to read than (20a) in Beckman’s study. It also explains why it is (20b) which seems awkward intuitively. The contrast in (20) may be considered in the fuller paradigm in (22).

(22) a. John gave the man the book.
   b. John gave a man the book.
   c. John gave the man a book.
   d. John gave a man the book.

A problem or a conflict arises only in (20b), repeated as (22d). In (22d), there is a pressure for DP1 to lower without also lowering DP2. But in the other sentences (22a–c), there is no conflict. In (22a), nothing might lower. In (22b), DP1 and DP2 may lower: both phrases naturally receive an existential interpretation. Alternatively, DP2 alone might lower, as in (22c). It is only in (22d) that conflicting evidence is present. The fact that (22b) is not awkward or complex intuitively suggests that in (22d) it is not the complexity of the structure or the lowering phrase that is at issue (since the same structure/lowering is needed in (22b)), but that instead it is the conflicting interpretive requirements of DP1, which wants to lower, and DP2, which wants not to lower but needs to in order for DP1 to lower.

13.3 Fitting ML into the Human Language Processor

Why does the human language processor behave in accord with the ML principle? Though in general the human language processor does seem to build the minimal structure consistent with its evidence, notice that minimizing representational complexity at any given level does not really explain why the processor adopts the ML principle. A DP’s entire chain must be constructed, whether the DP lowers or not, in order for the phrase to receive a theta-role. Further, there’s no particular reason to believe that a representation with a high copy (23a) is any easier or less complex than a representation with a low copy (23b).

(23) a. [SpecAgrP A man [TP arrived [VP a t1]]] PF
   b. [SpecAgrP a [TP a [VP a a man arrived]]] LF

One possibility is that Minimal Lowering is favored because it allows a correspondence between levels of representation, i.e., given a phonetic P(ron) or s-structure of a given form, perceivers assume an identical LF when possible.
To evaluate this Correspondence Hypothesis, a summary of the basic generalizations in Section 13.2 may be helpful. Those generalizations are summarized schematically in (24).

\[
\begin{align*}
\text{(24) a. } & \text{subject}_{TP} \{VP \} & \text{ (specific interpretation of subject)} \\
\text{X} & \\
\text{b. } & \text{[Spec,Agp,]QP}_1 \{[\text{Spec,Agp,} \text{QP}_2 \{VP \} t_1 t_2]\} & \text{ (QP}_1 \text{ takes scope over QP}_2 \\
\text{X} & \\
\text{c. } & \text{[which picture of self}_1 \{[VP \} \{CP \} t_1 \} \{[VP \} t_1 \} & \text{ (matrix antecedent)} \\
\text{X} & \\
\text{d. } & \text{... \{VP \} \{CP \} \{[Spec,Agp,] \text{object}_1 \{VP \} \{[VP \} t_1 t_2\} & \text{ (narrow focus)} \\
\text{X} & \\
\text{e. } & \text{... \{VP \} \{CP \} \{[Spec,Agp,] \text{object}_1 \{VP \} \{[VP \} t_1 t_2\} & \text{ (definiteness constraint)} \\
\text{X} & \\
\end{align*}
\]

It is readily apparent in (24) that (a), (b), and (d) would follow from a preference for correspondence between s-structure and LF, because the higher copy of a phrase (the overt phrase in the input) need not lower at LF to receive its referential interpretation. Arguably, the double object fact's summarized in (24c) also could be seen to follow from the Correspondence Hypothesis, though explaining why two indefinite objects seem more natural than an indefinite DP followed by a definite DP will still require an account based on conflicting evidence about where DP should be interpreted. What will not follow is the preference for matrix antecedents in reconstruction sentences (24c). Perhaps one could argue that (25b) corresponds more closely to the s-structure representation (25a) than (25c) does.

\[
\begin{align*}
\text{(25) a. } & \text{[CP \{which picture of: self}_1 \{Spec,Agp,\} \{VP \} \{CP \} t_1 \} \{VP \} t_1 \} \{[VP \} \{CP \} t_1 \} \{[VP \} \{CP \} t_1 \} \\
\text{b. } & \text{[CP \{which picture of: self}_1 \{Spec,Agp,\} \{VP \} \{CP \} \{VP \} \{CP \} t_1 \} \{VP \} t_1 \} \{[VP \} \{CP \} t_1 \} \{[VP \} \{CP \} t_1 \} \\
\text{c. } & \text{[CP \{which picture of: self}_1 \{Spec,Agp,\} \{VP \} \{CP \} \{VP \} \{VP \} \{CP \} t_1 \} \{VP \} t_1 \} \{[VP \} \{CP \} t_1 \} \{[VP \} \{CP \} t_1 \} \\
\text{In Runner's (1995) copy and deletion theory, in effect each member of the chain is a copy at each level (see Note 3). 'Free' deletion deletes all but one copy. Which copy remains is determined by the particular well-formedness conditions at that level of representation. In this framework, it would be necessary to assume that at LF copy deletion is harder if it deletes a copy nearer to the s-structure copy, as in (25c), than if it deletes a copy farther away, as in (25b). It is not obvious why this should be the case.}
\]

A second possibility is that the ML principle follows from 'laziness' on the part of the processor. The processor doesn't execute a task unless confronted with evidence that it is necessary to do so. Though this sort of explanation is appealing in general, it does not really apply to the circumstances discussed in Section 13.2. Constructing the lower position of a DP is necessary regardless of whether the (referential) interpretation of the DP is determined in the higher (surface) or lower (e.g., deep structure) position. In all cases, the lower position will be required, e.g., for thematic role assignment. Thus not lowering a DP for referential interpretation does not result in a savings of effort, because the lower position must be constructed in any event.

A third possibility is that perceivers expect both given and new information to appear in a sentence, and that they expect given information to precede new information, at least in English. It is not clear how this could explain the quantifier scope generalizations, however. Nor is it obvious how it would explain the preference for narrow focus (24d). In fact, even data supporting Beckman's definiteness constraint (24e) is not readily explained by this account, since a given--new preference seems to apply only to DPs in a double object structure, not to the DPs in a DP--PP structure. For example, John gave a book to the girl is not intuitively odd, even though the indefinite object a book precedes the definite goal (to) the girl. Thus even for characterizing the fully acceptable or felicitous order of internal arguments, a given--new constraint is not satisfactory.

Another possibility is that perceivers prefer early interpretation, and that ML is just a consequence of this preference. In general, one may not simply claim that all linguistic interpretation takes place as soon as possible without further specifying a grammatical framework and a processing framework. To take a simple example, immediate interpretation of a pronoun implies that the adjective in a phrase like an old friend is interpreted before the noun is processed, there is an x and old(x). This incorrectly predicts a preference for the interpretive, where the friend is old, not the subjective interpretation, where the friendship is old. To correctly account for interpretive preferences, one needs to assume the existence of some form of head primacy principle (see Kamp and Partee, 1995). (See Frazier, 1999, for discussion and for a range of counterexamples to a strong immediate interpretation principle.) However, given particular explicit assumptions about the grammatical and the processor's tasks, something along the lines of early interpretation seems correct or at least defensible.

Imagine that interpreting some phrase necessarily involves both assignment of a thematic role to the phrase and assignment of a referential value and, further,
that the processor treats this task as a single step in its analysis of a sentence, with thematic processing and referential processing inextricably bound to each other. This approach to interpreting a phrase implies the existence of a unified process that could be carried out only when both thematic and referential information about the phrase is available to the processor. However, if instead we distinguish the referential interpretation of a DP from its thematic interpretation, then two distinct interpretive steps may be postulated, by dissociating referential and thematic interpretation, allowing each interpretive task to be accomplished on its own. By allowing this type of modular interpretation of a DP, referential interpretation of the phrase may begin immediately without waiting until a theta-assigner is available to support thematic interpretation of the phrase.

We might look at Minimal Lowering in terms of a language processing system which is task-driven, such as the system sketched in Frazier (1990) (also Frazier, 1995), where linguistic representations define the tasks the processor must accomplish. Dealing only with postlexical modules, Frazier (1990) suggests that (26) characterizes the architecture of the human language processing system.

<table>
<thead>
<tr>
<th>central system</th>
<th>reference</th>
<th>binding</th>
<th>c-command</th>
</tr>
</thead>
<tbody>
<tr>
<td>θ-predication</td>
<td>c-structure</td>
<td>sisterhood</td>
<td></td>
</tr>
</tbody>
</table>

The task of the syntactic modules is to build a well-formed syntactic representation using only the output of the phonological and lexical modules and relevant syntactic information: information about sisterhood relations and constituent structure for the c-structure module, and information from c-structure and c-command relations for the binding module. An input sentence together with the grammar defines the tasks implicit in identifying a well-formed representation for the sentence. For instance, a connected phrase marker must be identified with all positions licensed and all non-head members of a chain appropriately bound. The grammatical form of a phrase may also define a processing task. For example, reflexives must be bound to be grammatical; hence, they intrinsically define a task for the processor.

Two interpretive modules were also postulated: a theta- or predication module that takes the c-structure as input and identifies the appropriate thematic representation (see discussion of the thematic processor in Frazier, 1987); and a reference module concerned with c-command and the interpretation of DPs and scope. The interpretive modules are 'pseudo-encapsulated': they may import nonlinguistic world knowledge into the module in order to accomplish a particular task. For example, the theta- (or thematic) processor may consult world knowledge (and the discourse representation) to determine whether binoculars would make a good instrument for seeing or for shooting in the analysis of sentences like those in (27).

(27) a. John saw the cop with binoculars.  (Exper, Theme, Instr)
    b. John shot the cops with binoculars.  (Agent, Theme, Instr)

The reference processor might also import world knowledge (and discourse) to accomplish a task. For example, to determine whether a generic interpretation may be assigned in (28) the processor may need to find out something about the properties of genies and Jesuits (as well as the basic meaning of appears).

(28) a. A genie (just) appears.
    b. A Jesuit (just) appears.

Intuitions suggest that a (non-lowered) generic interpretation is all right in (28a) due to the properties of genies, whereas an existential (lowered) interpretation is required in (28b) since, under normal conditions, appear cannot easily be generic and hence cannot support a non-lowered generic interpretation of a Jesuit.

Where in this system does Minimal Lowering apply? Assuming that LF is the interface between syntax and (nonthematic aspects of) interpretation, it belongs in the reference module – the subsystem which takes the output of the binding module and determines the (nonthematic) interpretation of DPs and their scope.

The view just sketched perhaps elucidates the division of labor in interpreting a chain. The overt copy of a DP needs to be interpreted as quantificational, generic, existential, and so on. The position where an overt copy is interpreted (its LF position) need not be its underlying position, where it receives a theta-role. The reference module is thus a specialist bringing to bear on its task information relevant to the interpretation of overt copies at s-structure or LF. By contrast, the theta- (or thematic) processor is concerned with the tail of a chain (where the overt copy sits at d-structure).

Now imagine that each task is accomplished as soon as possible. The Minimal Lowering generalizations would immediately follow without any need to assume that deletion of one copy is easier than deletion of some other copy (see discussion of (24)).
Why would the human language processor accomplish each of its tasks as soon as possible? After all, early decisions are also risky decisions since they may be incompatible with subsequent information. Further, it is clear that a complete chain must be established regardless of when a referential interpretation is assigned to an overt DP. So early interpretation does not reduce the complexity of the DP’s chain.

Early interpretation of a DP does nevertheless seem to have two advantages. Once a DP has been securely, or confidently, interpreted, presumably the overt lexical copy of the phrase need not be held in immediate memory, which has a highly restricted capacity. For whatever reasons, humans are simply better at holding semantically interpreted material in memory than semantically uninterpreted material. Thus, holding the interpretation of a DP in immediate memory may impose a lesser burden than holding an overt copy of its surface form in memory (if it is assumed that the theta-module only requires an indexed trace to assign a theta-role, no overt copy of the DP is needed once referential interpretation occurs). An obvious further advantage of early referential interpretation is that it will aid the theta-processor. Determining the most plausible assignment of thematic roles is dependent not on the overt phrase of, say, the external argument, but on the interpretation of that phrase, including, for example, the particular discourse entity to which it is used to refer. For example, though binoculars might make a plausible instrument for seeing in general and thus favor VP attachment of with binoculars in (27), the effect of the bias may be contravened if the external argument of see has a referent known not to be in possession of binoculars whereas the internal argument is a phrase used to refer to an individual in possession of binoculars.\footnote{I assume, as in earlier work (Frazier, 1987), that with binoculars is first (minimally) attached to the VP during initial syntactic processing, and that this initial syntactic hypothesis is thematically evaluated. During the later evaluation stage, referential information might contravene a “positive” thematic evaluation of the initially computed syntactic structure.}

The division of labor in (26) allows early interpretation of a DP by separating referential interpretation of the DP from theta-role assignment to the DP (though obviously the ultimately most plausible interpretation will depend on both types of information). The proposed division of labor also offers an explanation for an empirical puzzle concerning unexpressed theta-roles.

Carlson and Tanenhaus (1988) argued that unexpressed theta-roles are immediately entered into the discourse representation as an index. This allows a subsequent phrase to be more readily integrated into the discourse if it (or its referent) may be taken to satisfy the implicit theta-role. For example, in (29a) unloaded introduces an implicit theme into discourse. When (29b) is processed, the suitcases may be taken to instantiate this role.

By contrast, in (29a)'s hurrying does not introduce an implicit theme. As predicted, comprehension times for (29b) were faster following (29a) than following (29a').

Let’s assume that Carlson and Tanenhaus are correct. This would seem to suggest that any time after a verb’s complement has been processed, implicit theta-roles should be available to guide subsequent processing. However, some recent results of Frazier and Clifton (1998) indicate otherwise. In a series of self-paced reading studies of sluicing (constructions where only the wh-phrase of an embedded question remains overt), we tested sentences like those in (30) with argument (30a, b) or adjunct (30c, d) antecedents for the wh-phrase. The antecedent for the wh-phrase was either overt (30a, c) or covert (30b, d).

Given the findings of Carlson and Tanenhaus, we expected an interaction: the expected penalty for a covert (as opposed to overt) antecedent should be greater for adjuncts than for arguments. After all, the covert argument should already be represented in the verb’s theta-grid and in discourse representation according to their proposal. But this is not what was found. Instead, the penalty for covert antecedents was just as large for arguments as for adjuncts.

The discrepancy between these findings and those of Carlson and Tanenhaus makes sense given the architecture sketched in (26). In constructing an LF, the reference module is operating on the output of the binding module. An unexpressed theta-role will presumably not be present in this representation, assuming that it is the theta-module that operates with a verb’s theta-grid. The discourse representation of the unexpected theta-role will appear irrelevant to the reference module. Only phrases at LF will appear to be relevant, because the

\footnote{In order to “sprout” an antecedent for a wh-phrase with an implicit argument antecedent (see Chung, Ladner, and McClary (1995), presumably the processor must check that the “antecedent” verb (typed in (30)) may take an argument of the syntactic category of the wh-phrase. But assigning the most plausible thematic role to the wh-phrase will presumably be accomplished by the thematic module as usual.}
antecedent for the wh-phrase in a sluicing construction must be checked at LF to ensure that it is a free indefinite (see Chung, Ladusaw, and McCloskey, 1995).

13.4 Conclusions
Various generalizations (some old, some novel) have been used to argue that phrases are interpreted in a position no lower than necessary, in their surface position if possible. The ML principle has been developed in a task-driven processing system where tasks are defined implicitly by grammatical representations and organized into subsystems based on basic relations of the grammar (sisterhood for constituent structure, theta-relations, and predication; c-command for binding and reference). Given this division of labor, a chain is interpreted in possibly distinct stages: interpretation of a DP is accomplished in the reference module, and interpretation of its theta-role in the theta-module. This division of labor permits the ML principle to be derived from a pressure for each processing task to be accomplished early. It also explains why unexpressed theta-roles sometimes act as if they are present, and sometimes not.

References