Levels of Representation and Semantic Interpretation: A Brief History and a Case Study
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(1)   "What we are suggesting is that the notion of 'understanding a sentence' be explained in part in terms of the notion of 'linguistic level'. To understand a sentence, then, it is first necessary to reconstruct its analysis on each linguistic level; and we can test the adequacy of a given set of abstract linguistic levels by asking whether or not grammars formulated in terms of these levels enable us to provide a satisfactory analysis of the notion of 'understanding'."   Chomsky (1957, p.87)

A. T-marker as locus of interpretation

(2)   "It is fairly clear from all the examples that we have discussed in this chapter that in some sense meaning is preserved under transformation. Naturally we could not hold that transform and transformed string are synonymous, since a transformation may add or subtract morphemes. But we might have proposed that transform and pre-image differ in meaning only in the meanings of the morphemes dropped or added. For example, 'John - is not here' differs semantically from 'John is here' in the meaning of *not*."

(3)   "But ... this cannot be the case, because [there are cases] of two distinct sequences of transformations with exactly the same starting point in unambiguous kernel sentences, and with exactly the same end point, but with different meanings associated with this final transform. While transformations have semantic correlation, it is not obvious just how this is to be described."   Chomsky (1955, p.509-510)

(4)   Thus, the interface with semantic interpretation is the T-marker, the entire history of the transformational derivation. [There was no Deep Structure in this model, as there was no recursion in the base. And Surface Structure couldn't determine thematic relations, as there were no traces.]

(5)   The case at issue here concerns the 'constructional homonymity' [structural ambiguity] of 'John kept the car in the garage'. Chomsky analyzes this example, on either interpretation, as having as its P-basis the pair of kernel sentences *(the car is in the garage, John kept it)*. Distinct transformational derivations ensue, with the PP winding up inside or outside the object NP.

(6)   So while it is true that the alternative derivations of two sentences have "exactly the same end point" in terms of words, morphemes, and lower level structure, the final derived phrase markers are actually distinct. Thus, the problematic situation implied by Chomsky does not obviously arise in this instance.

(7)   "More generally, it appears that the notion of 'understanding a sentence' must be partially analyzed in grammatical terms. To understand a sentence it is necessary (though not, of course, sufficient) to reconstruct its representation on each level, including the transformational level where the kernel sentences underlying a given sentence can be thought of, in a sense, as the 'elementary content elements' out of which this sentence is constructed. In other words, one result of the formal study of grammatical structure is that a syntactic framework is brought to light which can support semantic analysis." Chomsky (1957, p.108)

B. Deep Structure as locus of interpretation

(8)   "... *the only contribution of transformations to semantic interpretation is that they interrelate Phrase-markers* (i.e., combine semantic interpretations of already interpreted Phrase-markers in a fixed way). It follows, then, that transformations cannot introduce meaning-bearing elements (nor can they delete lexical items unrecoverably ...)"
                                Chomsky (1965, p.132)

(9)   "It is clear, as Katz and Fodor have emphasized, that the meaning of a sentence is based on the meaning of its elementary parts and the manner of their combination. It is also clear that the manner of combination provided by the surface (immediate constituent) structure is in general almost totally irrelevant to semantic interpretation, whereas the grammatical relations expressed in the abstract deep structure are, in many cases, just those that determine the meaning of the sentence."   Chomsky (1965, pp.161-162)

(10)   "... one major function of the transformational rules is to convert an abstract deep structure that expresses the content of a sentence into a fairly concrete surface structure that indicates its form."   Chomsky (1965, p.136)

(11)   "... we are, in effect, assuming that the semantic interpretation of a sentence depends only on its lexical items and the grammatical functions and relations represented in the underlying structures in which they appear."   Chomsky (1965, p.136)
        <part of the 'Standard Theory', which introduced recursion in the base, thus, the level of Deep Structure>

(12)   BUT, there is a potential problem:

(13)   "As it stands, this claim seems to me somewhat too strong ... For example, it seems clear that the order of 'quantifiers' in surface structures sometimes plays a role in semantic interpretation. Thus for many speakers - in particular, for me - the sentences 'everyone in the room knows at least two languages' and 'at least two languages are known by everyone in the room' are not synonymous."   Chomsky (1965, p.224)

(14)   In fact, this problem had already been noted in Syntactic Structures with respect to the question, mentioned above, of what the contribution of transformations to semantic interpretation is:

(15) "... we can describe circumstances in which a 'quantificational' sentence such as 'everyone in the room knows at least two languages' may be true, while the corresponding passive 'at least two languages are known by everyone in the room' is false, under the normal interpretation of these sentences - e.g., if one person in the room knows only French and German, and another only Spanish and Italian. This indicates that not even the weakest semantic relation (factual equivalence) holds in general between active and passive."   Chomsky (1957, pp.100-101)

C. Deep Structure *and* Surface Structure as the locus of interpretation

(16) A while later, Chomsky returns to this phenomenon, and a closely related one:
(17) "It has been frequently noted that order of quantifiers in surface structure determines the preferred interpretation of a sentence ... Similarly, consider the interpretation of negations such as:

I didn't want to argue with Bill about money	*I didn't want to argue about money with Bill*
I didn't give the book to Bill	*I didn't give Bill the book*
I don't approve of John's actions wholeheartedly	*I don't approve wholeheartedly of John's actions*

(18) In all such cases, under normal intonation (i.e., nuclear stress and the associated pitch center on the final phrase) there is, it seems to me, a preferred interpretation, with the nuclear stressed phrase being the one that is 'negated'. The same is true, as Lakoff has pointed out, in such sentences as '*I didn't see John in England*', which suggests (under non-contrastive, normal intonation) that I saw him somewhere else; etc. Since the ordering in these cases is determined by fairly late transformations, it seems that once again surface structure is involved in determining semantic content or at least, preferred interpretation."   Chomsky (1970b, pp.258-259)

(19) Many of the arrows didn't hit the target.   ≠ in truth conditions to
(20) The target wasn't hit by many of the arrows.   Jackendoff (1969b, p.167), Jackendoff (1969a, pp.223-224)
(21) "Under the assumption that transformations do not change meaning, [this fact] will be very difficult to account for."   Jackendoff (1969b, p.168), Jackendoff (1969a, p.225)
(22) "If we give up the assumption that transformations do not change meaning and that all semantic information is represented in deep structure, it immediately becomes apparent how to go about explaining the interpretation of ... negation. We simply need a way to relate the understood order of quantifiers and negation to their position in the derived structure. We can do this informally by saying that the understood order is the same as the order in the surface structure."   Jackendoff (1969b, p.172), Jackendoff (1969a, p.228)

<An aside:
(23)   "If the preceding discussion is correct, we have found that the structural notion 'in construction with neg' ... has the semantic correlate 'within the scope of neg'."
                        Jackendoff (1969b, p.176), Jackendoff (1969a, p.230)
       This essentially follows Klima (1964), and anticipates Reinhart (1976)>

(24)   We conclude then that the scope of negation must be determined at surface structure (or perhaps at end-of-cycle structure ...)"   Jackendoff (1972, p.303)
(25)   Citing Jackendoff, Chomsky (1970a, p.81) says
       "Since it is the notion 'surface subject' that is involved in determining sameness or difference of meaning, the principle is inconsistent with the standard theory. Furthermore, the principle of interpretation of surface structures seems clear, and, in addition, the transformations that form passives can be left in a simple form (though they will drastically change meaning, if they change the order of quantifier and negation). These facts, then, provide strong support for the hypothesis that surface structure determines (in part, at least) the scope of logical elements, and serve as strong counter-evidence to the standard theory in its most general form."

(26)   "Jackendoff's arguments ... leave unaffected the hypothesis that the grammatical relations defined in the deep structure are those that determine semantic interpretation. If we modify the standard theory, restricting in this way the contribution of the base to semantic interpretation, we can take account of the fact that many aspects of surface structure appear to play a role in determining semantic interpretation; correspondingly, insofar as some development in syntactic theory is motivated by the demand that these aspects of semantic interpretation be expressed in deep structure, it will have lost its justification."
       Chomsky (1970a, pp.81-82)

(27)   "Among the important issues in the area of semantics and its relation to the rest of the grammar, the idea that transformations might be meaning preserving is one that has an interesting history and one whose fate is still far from clear.... I will talk about some of the more interesting phenomena with respect to which the meaning-preservingness of transformations seems to be called into question."   Partee (1971, p.1)

(28)   "... in talk about transformations preserving or changing meaning, the most common examples are transformations which can informally be thought of as relating sentences to other sentences. But transformations in fact operate not on sentences but on abstract phrase-markers, and it is not obvious that we have any direct semantic intuitions about these abstract structures, in particular any notion of synonymy between them."
                        Partee (1971, pp.4-5)
(29)   "For obligatory rules, ... the question of meaning-preservingness does not even make sense, for the input to the rule is an abstract structure with which we have no independent acquaintance. ... The question of whether transformations change meaning can therefore be meaningfully asked only of optional transformations. The clearest case is that in which two sentences are derived from the same deep structure, their derivations differing only in the application versus nonapplication of a certain optional rule. If the two sentences are

synonymous, and if the same is true of all pairs related by the given rule, the rule is meaning-preserving; otherwise it is not."   Partee (1971, p.5)

(30)   "A good bit of the current interest in quantifiers stems from the fact that there are a number of transformations which, as traditionally formulated, preserve meaning except when quantifiers are involved."   Partee (1971, p.9)

(31)   a. Nobody is (absolutely) certain to pass the test.
b. It is (absolutely) certain that nobody will pass the test.

(32)   These are "sharply nonsynonymous".   Partee (1971, p.18)

(33)   *"Certain must allow subject·raising because of sentences like [(34)]."*

(34)   There is certain to be an argument over that.

(35)   "And yet to allow subject-raising to apply to [(31)b] would lead to a change in meaning of a ... fundamental sort."   Partee (1971, p.18)

(36)   "... under a common kind of grading system, [(31)b] [is] false, while [(31)a] is true.... A logician would have no difficulty in representing the differences in the sentences of [(31)] in terms of differing 'scopes' of three elements: negation, an existential quantifier, and a modal operator 'certain' ..."   Partee (1971, p.18)

D. Logical Form (LF) as the syntactic level relevant to quantifier scope

(37)   Some politician is likely to address John's constituency   May (1977)

(38)   "[(37)] may be taken as asserting either (i) that there is a politician, e.g., Rockefeller, who is likely to address John's constituency, or (ii) that it is likely that there is some politician (or other) who will address John's constituency."

(39)   "... the reason that sentences like [(37)], containing raising predicates, are ambiguous is that they can be associated with two distinct logical forms ..."   [p.189]

(40)   [$_S$ [some politician]$_\alpha$ [$_S$ α is likely [$_S$ t to address John's constituency]]]]

(41)   This one arises from a standard raising instance of May's Quantifier Rule (QR).

(42)   [$_S$ α is likely [$_S$ [some politician]$_\alpha$[$_S$ t to address John's constituency]]]]

(43)   We get this one from a lowering instance of QR, as QR "applies freely".

(44)   " In [(40)] and [(42)] 'α' and ' t ' represent occurrences of the same variable, since they both arise from movement of the same noun phrase; hence they are both bound by this phrase."   [p.192]

(45)   "In [(40)], the quantifier 'some' has scope wider than the matrix predicate 'likely'; it corresponds to the (i) reading of this sentence as described above. In [(42)], on the other hand, the quantifier has scope narrower than 'likely'; this logical form corresponds to the (ii) reading above."

(46)   Finally, in effect, α in (42) can be ignored as it is not an argument position.

(47)   A popular more recent instantiation of May's basic idea assumes, with Chomsky (1995b), that movement is a copying operation and that there is (sometimes) a choice as to which copy to use for semantic interpretation. The 'lowering' phenomenon arises from using a lower copy for semantic purposes.

(48)   Sloan and Uriagereka (1988) suggested an interestingly different account of the Q-lowering phenomenon. Rather than having a lowering operation largely undoing the effects of raising, or calling upon activating a lower copy, they proposed, in the spirit of Lasnik (1972), and the conjecture of Jackendoff (1972) cited above, that quantifier scope is determined cyclically, but as part of the syntactic cycle, not as part of a later LF cycle. This is an obvious precursor of the multiple spell-out of Uriagereka (1999), which shortly led to Minimalist single-cycle syntax.

E. An empirical difficulty: QL is much less general than it is expected to be.

(49)   None of these accounts predicts any limitation on lowered interpretations. Whenever there is a raising construction, 'lowered' readings should be possible. But, as first observed by Partee (1971), cited above, and as I discussed in Lasnik (1998) and Lasnik (2010), among other places, such readings are very often unavailable, as indicated by the standard test of paraphrase by the *it ...* [finite clause] alternant. Below, I provide a sampling of examples from those works, as well as some new ones, and some brief discussion. (I use ≠ to indicate that the first example cannot be paraphrased by the second.)

(50)   a. Nobody is (absolutely) certain to pass the test   ≠
          b. It is (absolutely) certain that nobody will pass the test   Partee (1971)
(51)   a. No large Mersenne number was proven to be prime ≠
          b. It was proven that no large Mersenne number is prime
(52)   a. Noone is certain to solve the problem ≠
          b. It is certain that noone will solve the problem
(53)   a. Every coin is 50% likely to land heads ≠
          b. It is 50% likely that every coin will land heads
(54)   a. Every coin is 3% likely to land heads ≠
          b. It is 3% likely that every coin will land heads
(55)   In (54), if we have 5 coins, the b. reading (i.e., the lowered one) would be far more plausible. Yet it is still unavailable.
(56)   However, Boeckx (2001) argues that unlike *likely*, *3% likely* is not a raising predicate (using the Partee test above). Then the only source for (54)a would be control, and lowering is not expected with a control structure.
(57)   *There is 30% [sic] likely to be a man in the garden   [p.541]
(58)   In fact, a number of my consultants agree with Boeckx's judgment on (57). But not all of them do. Yet none of them get the lowered reading for (54)a.

(59)   Some examples like (54), but where many speakers (in fact, nearly all of my consultants) clearly allow raising, by standard tests:

(60) a. Every student is quite likely to pass the exam ≠
      b. It is quite likely that every student will pass the exam
(61) a. There is quite likely to be an investigation
      b. The cat is quite likely to be out of the bag
(62) a. Everyone is fairly certain to pass the exam   ≠
      b. It is fairly certain that everyone will pass the exam
(63) a. There is fairly certain to be a storm today
      b. The shit is fairly certain to hit the fan (when this news breaks)

(64) Another possible failure of 'lowering' comes from an observation about scope that
      Zubizarreta (1982) attributes to Chomsky, and that is discussed again by Chomsky
      (1995a):
(65) a. (it seems that) everyone isn't there yet
      b. everyone seems [t not to be there yet]
(66)   Chomsky (p.327) argues as follows: "Negation can have wide scope over the Q in
      [(65)a]... but not in [(65)b]", concluding that "...reconstruction in the A-chain does not
      take place, so it appears."

(67) This kind of example might still be compatible with May style literal lowering (as in fact
      Chomsky suggests), but would still be incompatible with activation of a lower copy in a
      movement chain (a point that Chomsky makes).

F. Towards a theory?

(68) A theory of what?

(69) QL exists, as it would under any of the accounts above. Then we need an account of why
      it is so often blocked (basically, with anything except indefinites.
OR
(70) QL doesn't exist. Then we need an account of why it doesn't. And we also need an
      account of why it looks like it does with indefinites.

(71) Suppose it doesn't exist. Well, there are at least three standard powerful arguments
      against this point of view.

(72) First, though in many lowering situations, the truth conditional differences between the
      claimed two readings are not very easy to pinpoint, Fox (1999) presented a case with
      sharper differences:
(73) Someone from New York is very likely *t* to win the lottery
(74) Fox explicates the situation as follows.
      "One interpretation results when the quantifier takes scope in the final landing site. For
      the sentence to be true under this interpretation, there must be a person from New York
      who is very likely to win the lottery (e. g. , a person who bought enough tickets to make
      winning a likely outcome). Under the second interpretation, in which the quantifier has

scope in the position of *t* , the truth conditions are much less demanding; they merely require that there be enough ticket buyers from New York to make it likely that the city would yield a winner. "   [p. 160]

(75)   Let's now strengthen the situation:

(76)   Someone from New York is certain *t* to win the lottery

(77)   Imagine that a particular New Yorker bought all the tickets. Or, alternatively, imagine that only New Yorkers bought tickets. (76) is a good description of either situation, parallel to what was seen with the Fox example. And, as in that example, it is tempting to implement the second reading via lowering, with *Someone from New York* below *certain* at LF.

(78)   But now imagine the exact same pair of situations concerning ticket purchasers (and the speaker's knowledge thereof). And suppose the drawing has already taken place, but the winner has not yet been announced. Suppose the speaker were to utter (79):

(79)   Someone from New York won the lottery

(80)   (79) seems to be an accurate and felicitous report of either situation, just as in the case of Fox's (73) or my modification in (76). But (79) is a completely transparent extensional context. If the "lowered reading" is to be instantiated by lowering of *Someone from New York*, what operator does that expression lower below?

(81)   Second, the classic 'trapping' effects (as in May (1985) and Lebeaux (1998)), where the need to bind something in the matrix clause evidently precludes the low interpretation for the quantifier:

(82)   a.   No agent$_i$ was believed by his$_i$ superior to be a spy for the other side $\neq$
        b. *It was believed by his$_i$ superior that no agent$_i$ was a spy for the other side
                                    May (1985)

(83)   Note, though, that there are two interfering factors here: Negatives don't lower in the first place, as seen above; and, even controlling for that, what can we really conclude from the fact that a particular sentence cannot be paraphrased by an ungrammatical sentence (one violating weak crossover)?

(84)   a.   Some agent$_i$ was believed by his$_i$ superior to be a spy for the other side $\neq$
        b. *It was believed by his$_i$ superior that some agent$_i$ was a spy for the other side

(85)   Third, 3-way scope interactions:

(86)   Someone seems [*t* to love everyone] $\forall$ can scope over $\exists$ Aoun and Li (1993)

(87)   Someone wants [PRO to kiss everyone]   ?$\forall$ cannot scope over $\exists$

(88)   Note that for the issue at hand, it does not suffice to show that $\forall$ can scope over $\exists$. Rather, it must also be true that *seem* scopes over both of them. I am willing to believe that that is true, but I am not certain. The following example is relevant:

(89)   Two women seem to each other to be expected to dance with every senator
                                    Lebeaux (1998)

(90)   *Two women* must be high (to license *each other*). $\forall$ cannot scope over 2. Thus, it is reasonable to conclude that in (86) also, the scope of $\forall$ is limited to the embedded clause, and hence that the scope of $\exists$ is the lower clause.

Another pretty clear instance of apparent distinct interpretations:

(91)   Two of the students in the room are (almost/virtually) certain to have the same birthday [Suppose there are 60 students in the room. The low reading has truth conditions clearly distinct, and they are satisfied.]

G. A new approach (one excluding lowering in general, but allowing genuine low scope where it plausibly exists)

(92)   Recall the Sloan and Uriagereka (1988) approach to lowering phenomena, one that fits neatly into single cycle syntax.

(93)   And suppose, following May (1977), that scope is generally achieved via QR, but where QR is always an Ā raising operation.

(94)   Then, to get embedded scope QR would have to operate on the embedded cycle.

(95)   But then subsequent raising to matrix subject position would constitute an instance of 'improper movement' from Ā-position to A-position (a constraint first discussed by Chomsky (1973)).

(96)   Matrix scope would cause no such problem. Its derivation would involve perfectly standard A-movement (raising) followed by Ā-movement (QR), similar to what happens in:

(97)   Who [t is likely [t to solve the problem]]

(98)   But what of the low readings of indefinites in raising constructions?

(99)   For these we can rely on a special property of indefinites: that they are, or can be, variables rather than quantifiers, an idea developed by Heim (1982).

(100) These variables are then provided with binders by existential closure.

(101) Following Reinhart (1997) among others, I would take existential closure to be available in all clausal domains, not just the matrix.

(102) If closure is introduced in the lower clause in the examples at issue, we get low scope. And no constraint on improper movement would prevent subsequent A-movement of the indefinite up to subject position of the higher clause (though the raising would be semantically vacuous, at least with respect to scope).

(103) An alternative derivation would have raising, then closure in the higher clause. This gives high scope.

(104) The Lebeaux and Hornstein examples with high binding and no possibility of low scope fall out, as low scope implicates low closure. But then the high pronoun or variable could not be in the scope of the introduced existential.

(105) One remaining task (maybe a hard one): Develop a principled theory of improper movement that would be effective here. As far as I know, noone has until now claimed that improper movement might block raising of the subject of a raising complement.

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