Semantics and Syntax

Heim and Kratzer

Chapter 3

3.1 Type-Driven Interpretation

- So far, we wrote a special semantic rule for each syntactic configuration that we encountered. To deal with sentenes containing intransitive and transitive verbs we needed 6 rules, We can simplify this by developing a system of more schematic rules.

- This approach was pioneered by Klein & Sag 1985 and is called “type-driven interpretation.”

- We need just three rules.

3.1 Type-Driven Interpretation (cont.)

(1) *Terminal Nodes* (TN)
If α is a terminal node, $[\![\alpha]\!]$ is specified in the lexicon.

(2) *Non-Branching Nodes* (NN)
If α is a non-branching node, and β is its daughter node, then $[\![\beta]\!] = [\![\alpha]\!]$.

(3) *Functional Application* (FA)
If α is a branching node, $\{\gamma, \beta\}$ is the set of α's daughters, and β is a function whose domain contains $[\![\gamma]\!]$, then $[\![\alpha]\!] = [\![\beta]\!]([\![\gamma]\!])$.

3.1 Type-Driven Interpretation (cont.)

- Notice that no linear order is specified in rule FA. The function always applies to the argument, whatever their linear order.

- Syntactic category labels are also irrelevant to the semantics.

- We will add a couple of rules to this list later in the book, but we will strive to keep this list as parsimonious as possible.

- We will assume binary branching, even for conjoined structures, as you saw in an exercise.

3.1 Type-Driven Interpretation (cont.)

- Sample lexical entries:

(i) [[**Ann**]] = Ann

(ii) [[**smokes**]] = λx $\in$ D_e . x smokes

(iii) [[**loves**]] = λx $\in$ D_e . [λy $\in$ D_e . y loves x]

(iv) [[**and**]] = $\begin{bmatrix} 1 \rightarrow \begin{bmatrix} 1 \rightarrow 1 \\ 0 \rightarrow 0 \end{bmatrix} \\ 0 \rightarrow \begin{bmatrix} 1 \rightarrow 0 \\ 0 \rightarrow 0 \end{bmatrix} \end{bmatrix}$

or, using the lambda notation:

[[**and**]] = λp $\in$ D_t . [λq $\in$ D_t . p = q =1].

etc.

3.2 The Structure of the Input to Semantic Interpretation

- We are assuming a syntactic component that produces phrase-structure trees to serve as the input to semantic interpretation.

- Our approach is compatible with a number of modular approaches to syntax, including Minimalism, which assumes that the input to semantic interpretation is a syntactic tree-structure that is specified at the level of Logical Form which feeds into the Conceptual-Intentional Interface of the grammar with more general cognitive systems.

- According to standard definitions, a phrase structure is a set of labelled nodes related to each other by a relation of *dominance* and a relation of linear *precedence*.

- Our approach is compatible with approaches, like current Minimalism, that don't assume a precedence relation, and also with approaches, like "Bare-Phrase-Structure" within Minimalism, that don't assume node labelling.

3.2 The Structure of the Input to Semantic Interpretation (cont.)

- Many syntactic relations can be defined in terms of dominance and precedence, e.g. “daughter-of”, “(non-)terminal node”,“(non-)branching node”, which we use in our rules.

- For convenience we will assume a set of node labels, e.g.:

V	Verb
N	Noun
A	Adjective
P	Preposition
D	Determiner
I	Inflectional elements (“do”, tense, modal auxiliaries, etc.)
C	Complementizer

3.2 The Structure of the Input to Semantic Interpretation (cont.)

- Labels for non-terminal nodes are coined according to standard procedure:

  S or IP (inflection Phrase) is used for a sentence.
  VP is used for a maximal verbal projection.
  V′ (V-bar) is used for an intermediate verbal projection.
  etc.

3.3 Well-Formedness and Interpretability

- Syntactic expressions can arguably be syntactically ill-formed (ungrammatical) but interpretable.
  What is an example?

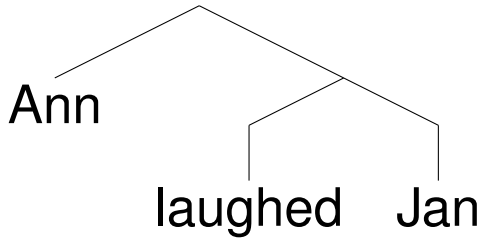
- Expressions can also be syntactically well-formed but uninterpretable, e.g. perhaps:

  (1) ***Ann laughed Jan.**
  (2) ***It is not the case that greeted Ann.**

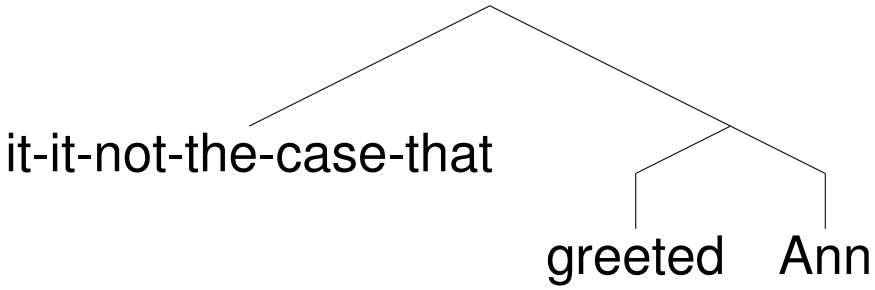
3.3 Well-Formedness and Interpretability (cont.)

Why don't these trees compute?

(1')



(2')



3.3 Well-Formedness and Interpretability (cont.)

- These trees are not in the domain of our interpretation function, $[\![\ ]\!]$, as defined by our current lexicon and compositional rules.

- It is reasonable to assume that it is this – and this alone – that accounts for their deviance.

- Such structures will be called *uninterpretable*, and we will assume that uninterpretabiity is one source of ungrammaticality.

- They are structures filtered out by the *semantic* component of the grammar.

3.3 Well-Formedness and Interpretability (cont.)

- Now more precisely, we can define the interpretation function $[\![\ ]\!]$ as the smallest function that fulfills the following conditions

(3) *Terminal Nodes* (TN)
If α is a terminal node, then α is in the domain of $[\![\ ]\!]$ if $[\![\alpha]\!]$ is specified and in the lexicon.

(4) *Non-Branching Nodes* (NN)
If α is a non-branching node, and β is its daughter node, then α is in the domain of $[\![\ ]\!]$ if β is. In this case, $[\![\alpha]\!] = [\![\beta]\!]$.

(5) *Functional Application* (FA)
If α is a branching node and $\{\gamma, \beta\}$ is the set of α's daughters, then α is in the domain of $[\![\ ]\!]$ if both β and γ are and β is a function whose domain contains $[\![\gamma]\!]$. In this case $[\![\alpha]\!] = [\![\beta]\!]([\![\gamma]\!])$.

3.3 Well-Formedness and Interpretability (cont.)

(6) *Principle of Interpretability*
All nodes in a phrase structure tree must be in the domain of the interpretation function ⟦ ⟧.

- This principle makes explicit the filtering function of the semantic component.
- We are adopting a view of the grammar as a whole on which syntax and semantics are independent modules.
- Each imposes its own constraints on the grammatical structures of the language.
- We expect there to be structures that are interpretable though syntactically illegitimate, as well as structures that are syntactically correct but uninterpretable.

3.4 The θ-Criterion

- Examples like (1) and (2) are often said to be ruled out by the θ-Criterion:

(1) ***Ann laughed Jan.**
(2) ***It is not the case that greeted Ann.**

(3) *θ-Criterion*

Each argument bears one and only one θ-role, and each θ-role is assigned to one and only one argument.

- What are θ-roles (theta-roles, thematic roles)?

3.4 The θ-Criterion (cont.)

- Each predicate is associate with a certain number of specific θ-roles: If a kicking takes place, there is a kicker and a kickee, and if a greeting takes place, there is a greeter and a greetee. The verbs assign these specific θ-roles to their arguments.

- General θ-roles like “Agent”, “Patient”, etc. are generalizations over specific θ-roles, but it is specific θ-roles that the θ-Criterion is talking about.

- Whenever a lexical element requires an argument with a certain θ-role, then there must be such an argument somewhere in the syntax.

3.4 The θ-Criterion (cont.)

(4) **Ann laughed Jan.**
(5) **Greeted Ann.**

- How does the θ-Criterion rule out (4) and (5)?

- The Principle of Interpretability rules out (4) as uninterpretable, and predicts that (5) cannot be used to make a statement (since it composes into a VP-denotation).

- Are the Principle of Interpretability and the θ-Criterion equivalent, or is the θ-Criterion stronger?

3.4 The θ-Criterion (cont.)

- The θ-Criterion is stronger.

- Suppose that $[\![\alpha]\!]$ is of type $< e, t >$. According to the θ-Criterion it must appear with something which receives its θ-role, α has to have a sister node of type e.

- However, according to the Principle of Interpretability, it could have a sister of type $<< e, t >, e >$.

- So we could have an interpretable structure which does not contain any argument for α.

- Can we find examples of this phenomenon? And are they grammatical (as predicted by Interpretability) or ungrammatical (as predicted by the stronger θ-Criterion?

3.4 The θ-Criterion (cont.)

- In the following chapter, we will propose that common nouns like “barn” are 1-place predicates (of type $< e, t >$, so they have a θ-role to assign. This is fine in (6) but what about (7)?

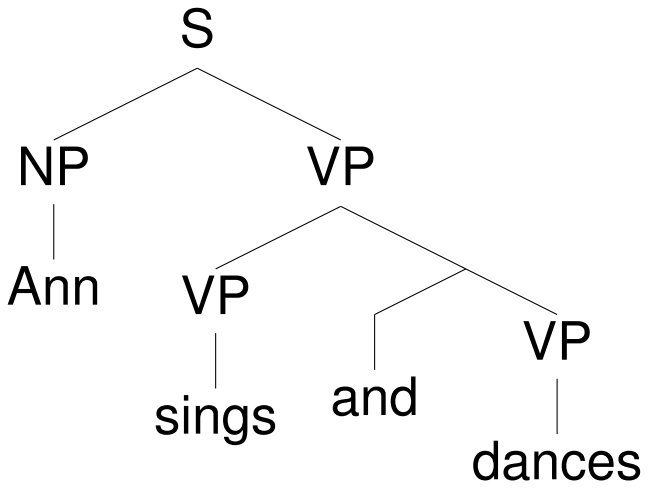
(6) **This is a barn.**
(7) **The barn burned down.**

- We’ll assign “the” the semantic type $<< e, t >, e >$ and thus account for the grammaticality of this example, but the θ-Criterion would wrongly predict it to be ungrammatical.

- (But see Higginbotham 1985, 1991 for a theory that “discharges” θ-roles in more than one way.)

3.4 The θ-Criterion (cont)

- What about the structure below?



- We can interpret it with a new lexical entry for the homonym of “and” that we encounter here:

(9) [[**and**]] = λf $\in$ $D_{<e,t>}$. [λg $\in$ $D_{<e,t>}$. [λx $\in$ D_e . f(x) = g(x) =1]].

- Can the θ-Criterion handle it?

3.5 Argument Structure and Linking

- Some syntactic theories posit a syntactic representation of a verb's argument structure that is distinct from the representation of the verb's denotation.

- These are meant to encode "the syntactically relevant argument-taking properties of a verb" (and any lexical item that takes arguments).

- Argument structure representations play a role in theories of *linking* – that is, theories about how a verb's arguments are linked to syntactic positions in a tree.

3.5 Argument Structure and Linking (cont.)

- Grimshaw (1990) proposes that argument structure representations reflect prominence relations among arguments, as in (3) for the verb "introduce" (the general θ-role labels merely identify the verb's arguments):

(3) **introduce** (agent (goal (theme)))

- (3) says that "introduce" has three arguments that are hierarchically ordered, with the agent argument as the highest, next the goal argument and last the theme argument.

- A prominence relation among arguments is part and parcel of our Fregean verb denotations: The first argument to be processed is the theme, then the goal, and finally the agent.

(4) λx $\in$ D_e . [λy $\in$ D_e . [λz $\in$ D_e . z introduces x to y]]

3.5 Argument Structure and Linking (cont.)

- We can conclude that we do not need separate argument structure representations to display prominence relations among arguments. This information is already provided by the representation of the verb's denotation.

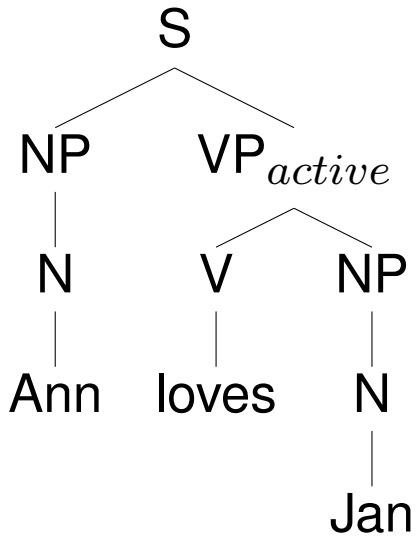
- A stronger claim is implicit in our approach: The lexically determined prominence relations must be preserved in the syntax.

- This means that there couldn't be a natural language that has structures like (7) and (8) on the next slide, with truth conditions (7') and (8'):

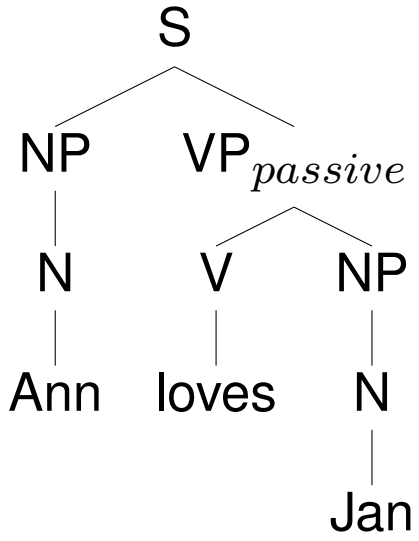
(7') *Truth-conditions*: $[\![7]\!]$ = 1 iff Ann loves Jan.
(8') *Truth-conditions*: $[\![8]\!]$ = 1 iff Jan loves Ann.

3.5 Argument Structure and Linking (cont.)

(7)



(8)



3.5 Argument Structure and Linking (cont.)

- Since the V-denotation must combine with the denotation of the direct object by Functional Application, the lexical meaning of “loves” determines that “Jan” is interpreted as the one who is loved in both (7) and (8).

- Consequently, (7) and (8) cannot have different truth conditions.

- Many syntactic theories consider it necessary to stipulate principles that prevent a language from having *both* structures like (7) *and* structures like (8), like Mark Baker’s UTAH:

(11) *The Uniformity of Theta Assignment Hypothesis (UTAH)*
Identical thematic relationships between items are represented by identical structural relationships.

3.5 Argument Structure and Linking (cont.)

- On a weak interpretation of UTAH, it says that NPs that bear the same *specific* thematic role bear the same syntactic relationship to their verb.

- What consequences does this version of UTAH have for a syntactic theory assuming it?

- This weak version is close to being superfluous for us.

- However, on a strong interpretation, the UTAH says that NPs that bear the same *general* thematic role (given some inventory of general thematic roles) bear the same syntactic relationship to their verb.

- Thus, all agents have to appear in the same syntactic position, all experiencers, all patients, etc.

3.5 Argument Structure and Linking (cont.)

- Both versions rule out the hypothetical situation described above with regard to (7) and (8).

- What about *general* thematic roles in our framework?

- It is fairly obvious that the prominence relations among a verb's arguments do not have to be learned separately for each verb. Agent arguments are generally higher than theme or patient arguments, for example.

- The exact nature of such generalizations is still a matter of debate. Dowty (1991) assumes that thematic roles like agent or patient are cluster concepts with a prototype organization.

- The argument with the greatest number of proto-agent properties is selected as the lexically most prominent argument, for example.

3.5 Argument Structure and Linking (cont.)

- With ditransitive verbs, the argument with the greatest number of proto-patient properties would be the lowest argument. The middle argument would have fewer proto-patient properties than the lowest argument and fewer proto-agent properties than the highest argument.

- Be this as it may, whatever the correct generalizations about lexical prominence relations are, our semantic interpretation system automatically imposes them on the hierarchical line-up of arguments in the syntax. The syntax does not have to worry about thematic roles.

- Thus, what appear to be generalizations about the syntactic realization of arguments might in fact be rooted in uniformities of prominence relations across lexical items.

3.5 Argument Structure and Linking (cont.)

- Does this mean that we can dispense with syntactic linking principles altogether? Not quite yet

- Work in Relational Grammar has established that not all arguments that are lexically most prominent show the same syntactic behavior.

(12) Unaccusative verb: [[**die**]] = λx $\in$ D_e . x dies
(13) Unergative verb: [[**work**]] = λx $\in$ D_e . x works

(14) Transitive agentive verb: [[**greet**]] = λx $\in$ D_e . [λy $\in$ D_e . y greets x]
(15) Transitive experiencer verb: [[**worry**]] = λx $\in$ D_e . [λy $\in$ D_e . y worries x]

3.5 Argument Structure and Linking (cont.)

- As far as lexical prominence relations are concerned, there is no difference between “die” and “work”, or between “greet” and “worry”. Yet syntactically these types of verbs differ. Does anyone know how?

- Williams (1981) says the most prominent argument of unergative and agentive transitive verbs is an *external* argument, while the most prominent argument of unaccusative and object experiencer verbs is an *internal* argument.

- According to Williams, the external argument is located external to the maximal projection of the verb, whereas internal arguments appear within the maximal projection of the verb (at some level of representation).

- This difference has been held responsible for the fact that subjects of unaccusative and object experiencer verbs show certain properties of objects, unlike the subjects of unergative and agentive transitive verbs..

3.5 Argument Structure and Linking (cont.)

- The syntactic impact of the distinction between external and internal arguments cannot be directly derived from our semantics as it is.

- One possible conclusion is that the distinction between external and internal arguments might be the only piece of information about a verb's argument structure that has to be taken care of in the syntax.

- Another idea, from Marantz (1984), is that external arguments are not arguments at all. Kratzer (1996) shows how to develop this idea in a theory that construes verb denotations along the lines of Donald Davidson. What is a Davidsonian theory of verb meaning?

- If Kratzer's proposal is accepted, there would be no syntactic theory of argument structure or linking; all information about a verb's argument structure would be directly derivable from its denotation.