Definite Descriptions

Lecture 12

March 5, 2024

Announcements:

This lecture is supplemented by the following readings:

- Heim & Kratzer: Ch.4 (73–75)

Your fifth homework assignment is available and is due on March 21st.

1 Introduction

We currently have a semantic system for interpreting sentences that relies on the following set of rules:

(1) **Functional Application (FA)**
If X is a node that has two daughters, Y and Z, and if $[\![\text{Y}]\!]$ is a function whose domain contains $[\![\text{Z}]\!]$, then $[\![\text{X}]\!] = [\![\text{Y}]\!]([\![\text{Z}]\!])$.

(2) **Predicate Modification (PM)**
If X is a node that has two daughters, Y and Z, and if $[\![\text{Y}]\!]$ and $[\![\text{Z}]\!]$ are in $D_{\langle e,t\rangle}$, then $[\![\text{X}]\!] = [\lambda x : x \in D_e \,.\, [\![Y]\!](x) = T \text{ and } [\![Z]\!](x) = T\ ]$

(3) **Non-Branching Nodes (NN) Rule**
If X is a non-branching node that has Y as its daughter, then $[\![\text{X}]\!] = [\![\text{Y}]\!]$

(4) **Terminal Nodes (TN) Rule**
If X is a terminal node, then $[\![\text{X}]\!]$ is specified in the lexicon.

These rules are able to interpret structures built from lexical entries like the following:

(5) **Proper Nouns as entities**
$[\![\text{NAME}]\!]$ = the thing referred to with NAME

(6) **Type $\langle e,t\rangle$ expressions**

a. $[\![\text{VERB}_{intrans}]\!] = [\lambda x : x \in D_e \,.\, x \text{ VERBs}\ ]$
b. $[\![\text{ADJ}_{int}]\!] = [\lambda x : x \in D_e \,.\, x \text{ is ADJECTIVE}\ ]$
c. $[\![\text{NOUN}]\!] = [\lambda x : x \in D_e \,.\, x \text{ is a NOUN}\ ]$

(7) **Type $\langle e, \langle e, t \rangle\rangle$ expressions**

$[\![\text{VERB}_{trans}]\!] = [\lambda x : x \in D_e . [\lambda y : y \in D_e . y \text{ VERBs } x]$

(8) **Type $\langle e, \langle e, \langle e, t \rangle\rangle\rangle$ expressions**

$[\![\text{VERB}_{ditrans}]\!] = [\lambda x : x \in D_e . [\lambda y : y \in D_e . [\lambda z : z \in D_e . z \text{ VERBs } x\ y]]]$

(9) **Type $\langle\langle e, t \rangle, \langle e, t \rangle\rangle$ expressions**

a. $[\![\text{is}]\!] = [\lambda f : f \in D_{\langle e,t \rangle} . f]$

b. $[\![\text{a}]\!] = [\lambda f : f \in D_{\langle e,t \rangle} . f]$

c. $[\![\text{ADJ}_{sub}]\!] = [\lambda f : f \in D_{\langle e,t \rangle} . [\lambda x : x \in D_e . f(x) = T \text{ and } x \text{ is ADJ for entities in } \{y : f(y) = T\}]]$

These results have allowed us to interpret the meaning of sentences with predicative and attributive adjectives and sentences with common nouns in predicate positions:

(10) Felix is **gray**. (11) Felix is **a cat**. (12) Felix is **a gray/tall cat**.

Of course, common nouns regularly appear in positions other than the predicate position of a sentence. Common nouns can typically be found in the **argument** positions of a predicate:

(13) a. Felix likes **the professor**.

b. **A professor** walked into the room.

c. **Every professor** dances.

Much of our time over the next couple of weeks will spent developing our semantic system to interpret sentences likes those above, which have various types of common nouns in argument positions.

Our specific goal this week is to develop our semantic system to interpret so-called **definite descriptions**. These are nominal constituents of the form "the X" as in (13a) above.

This will require us to develop an extension for the definite article *the*. We will pursue the meanings that is shown below:

(14) **Type $\langle\langle e, t \rangle, e\rangle$ Definite Determiner**

$[\lambda f : f \in D_{\langle e,t \rangle} . \text{the unique } x \text{ such that } f(x) = T]$

During our next meeting we will explore some limitations for this lexical entry. Namely, the use of *the* is not appropriate in all contexts:

(15) #Sam used **the escalator in HHB**.

(16) #**The chair in this room** is dirty.

Observations of this type will lead us to introduce the idea of **contextual domain restriction** as a means of formalizing presupposed informational content introduced by *the* and other determiners.

This will lead us in our next meeting to further refine this lexical entry.

2 On the Syntax of Nominal Constituents

We have assumed up until now that proper names and common nouns are NP constituents.

(17) a. b.

There is, however, a significant amount of evidence suggesting that nominal constituents—at least in English—are projections of a determiner. That is, they are **Determiner Phrases** (DPs).

(18) a. b.

2.1 Introducing DPs

Part of the evidence for the claim that English nominals are projections of a determiner comes from the distribution of pronouns.

For some background, it is a familiar observation that pronouns "replace" nominal constituents.

(19) a. **That professor** golfs.
 b. **He** golfs.

Regular observations of this kind support the conclusion that nominal constituents and pronouns are syntactically equivalent. That is, given their overlapping distribution, it stands to reason that they have the same syntactic category.

Traditional syntactic theorizing held that both have the category NP:

(20) a. b.

However, as early as the 1960's it was observed that pronouns actually have a distribution that suggests a syntactic equivalence, not with Ns and NPs, but with other determiners like *the*, *this*, and *that*.

Prenominal Pronouns. Like determiners, pronouns can appear in a position that precedes a noun and any attributive adjectives.

(21)
a. **the** smart students
b. **these** stubborn linguists
c. **those** folks

(22)
a. **you** smart students
b. **we** stubborn linguists
c. %**them** folks

This observation suggests that determiners and pronouns are syntactically equivalent and, moreover, distinct from Ns.

Complementarity. While determiners and pronouns and have an overlapping syntactic distribution, they are in complementary distribution.

(23)
a. *the you* smart students
b. **these we** stubborn linguists
c. **those them** folks

(24)
a. **you the** smart students
b. **we these** stubborn linguists
c. **them those** folks

This observation suggests that determiners and pronouns are in fact two realizations of the same syntactic category.

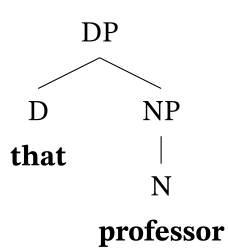
Taken together, facts like those above suggest that pronouns and determiners are a specific realization of a broader category D(eterminer). This is an influential idea that has become the standard among syntacticians.

But, consider now how this affects the kind of reasoning that was employed above:

- If pronouns represent projections of the category D and are therefore DPs, and
- if pronouns "replace" nominal constituents, then
- it stands to reason that nominal constituents have the category DP.

This leaves us with structures like those below, in which nominal constituents and pronouns are DP projections.

(25) a.



b.

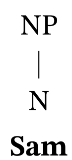
As we will see over the remainder of the semester, these are structures that also make a lot of sense given the type of semantics that seems to be appropriate for determiners like *the*, *some*, and *every*.

Namely, there is good reason for thinking that determiners take an NP as a semantic argument.

2.2 Rethinking Proper Nouns

This shift in our semantic assumptions will require us to interrogate our treatment of proper nouns as NPs:

(26)



We are likely familiar with the observation that proper names can also be "replaced" with pronouns:

(27) a. **Sam** golfs.
b. **He** golfs.

Given the reasoning laid above, we are left to conclude that proper names also represent DP constituents.

This is a conclusion corroborated by other facts, including coordination. There is reason to believe, however, that proper names themselves represent projections of the category N.

Coordination with DPs. Proper names can be coordinated with DP constituents.

(28) [$_{\text{DP}}$ Sam] and [$_{\text{DP}}$ those professors] golf.

Understanding that coordination brings together constituents of the same category, *Sam* must have the same category as the DP constituent *those professors*.

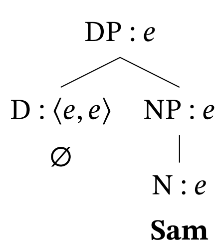
Cooccurrence with Determiners. Proper names are not in complementary distribution with determiners and appear in positions following the determiner and any attributive adjectives.

(29) a. the tall **Taylor**
b. that **Taylor**
c. every **Taylor**

This observation suggests that proper names are syntactically equivalent to Ns.

To accommodate these results, we can assume that proper names are part of DP constituent with a phonologically null and semantically vacuous determiner:

(30)



(31) **A type $\langle e, e \rangle$ identity function**
$[\![\varnothing_D]\!] = [\ \lambda x : x \in D_e \,.\, x\ ]$

3 The Semantics of Definite Descriptions

Our goal, again, is to develop our semantic system to interpret common nouns in the argument positions of predicates. We are beginning this project by investigating the semantics of definite descriptions:

(32) **The president** golfs.

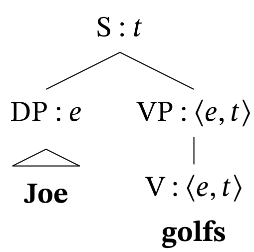
While it is a controversial issue, we can start from the basic intuition that definite descriptions, much like proper names, serve to denote entities.

(33) **Definite descriptions as type *e* expressions**

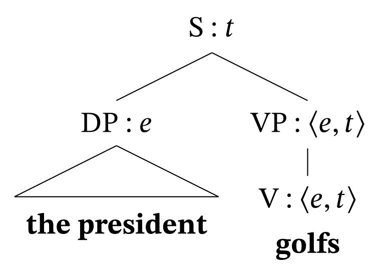
a. $[\![$ the president of the US $]\!]$ = Joe Biden
b. $[\![$ the professor of LIN 4307 $]\!]$ = Jason Overfelt
c. $[\![$ the capital of Michigan $]\!]$ = Lansing

In addition to being intuitive, this assertion makes it relatively straightforward to integrate such expression into our current semantic system:

(34)



(35)



How to Move Forward. With this as our starting position, providing a semantics for definite descriptions will involve doing a few things:

- We will need to determine what semantic type the definite article *the* must have.
- We will need to an extension for *the* that delivers an accurate set of truth conditions for sentences containing definite descriptions.
- We will need to demonstrate that our semantic system can compute the correct truth conditions of sentences containing a definite description in an argument position.

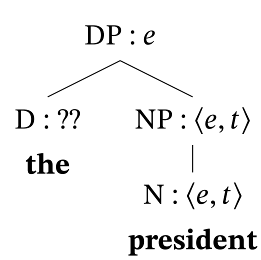
3.1 The Semantic Type of the Definite Article

1. Known Semantic Types. We start by listing out the semantic types we know and annotating the syntactic representation with this information.

(36) **Known Semantic Types in (37)**

a. $[\![$ DP $]\!] \in D_e$
b. $[\![$ president $]\!] \in D_{\langle e,t\rangle}$

(37)



2. Reasoning out the Semantic Type of the definite article *the*. We appeal to the known semantic types, as well as the rules of composition, to determine that *the* must be of type $\langle\langle e,t\rangle,e\rangle$.

- The DP node fits the structural description specified by Functional Application and Predicate Modification. So, $[\![\text{ the }]\!]$ must combine with the $[\![\text{ NP }]\!]$ via one of these rules.

(38) $[\![\text{ the }]\!] + [\![\text{ NP }]\!] = [\![\text{ DP }]\!]$

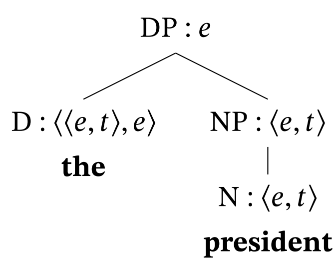
- Because $[\![\text{ DP }]\!]$ is of type e, Predicate Modification would incorrectly generate an expression of type $\langle e,t\rangle$. So, $[\![\text{ the }]\!]$ and $[\![\text{ NP }]\!]$ must be composed via Functional Application.

- Because $[\![\text{ NP }]\!]$ is type $\langle e,t\rangle$ and $[\![\text{ DP }]\!]$ is type e, $[\![\text{ the }]\!]$ must be a function that takes $[\![\text{ NP }]\!]$ as its argument and returns the type e $[\![\text{ DP }]\!]$.

(39) $[\![\text{ the }]\!]([\![\text{ NP }]\!]) = [\![\text{ DP }]\!]$

- Thus, $[\![\text{ the }]\!]$ must be an expression of type $\langle\langle e,t\rangle,e\rangle$.

(40)



3.2 The Extension of the Definite Article

We now know what kind of expression the definite article *the* must be. It is a type $\langle\langle e,t\rangle,e\rangle$ function, meaning it maps functions from entities to truth values to entities.

We therefore need to develop a lexical entry for *the* that does the following:

- assigns as its extension a function of type $\langle\langle e,t\rangle,e\rangle$ and
- allows our system to derive an appropriate truth-conditional statement for sentences with definite descriptions.

Reasoning out the extension of *the*. Here we turn to reasoning out a type $\langle\langle e,t\rangle,e\rangle$ extension of the definite article *the*.

- Considering data like those we saw above in (33), we can observe that $[\![\text{ the }]\!]$ takes an NP as an argument and returns an entity.

(41) a. $[\![\text{ the }]\!]([\![\text{ president of the US }]\!])$ = Joe Biden
b. $[\![\text{ the }]\!]([\![\text{ professor of LIN 4307 }]\!])$ = Jason Overfelt
c. $[\![\text{ the }]\!]([\![\text{ capital of MI }]\!])$ = Lansing

- Given our beliefs about the extension of NPs as $\langle e, t \rangle$ expressions, the NP arguments above are equivalently represented as the following functions:

(42) a. $[\![$ president of the US $]\!]$ = $[\lambda x \in D_e \, . \, x$ is a president of the US$]$

b. $[\![$ professor of LIN 4307 $]\!]$ = $[\lambda x \in D_e \, . \, x$ is a professor of LIN 4307$]$

c. $[\![$ capital of MI $]\!]$ = $[\lambda x \in D_e \, . \, x$ is a capital of MI$]$

- Now, observe that these functions all share a fairly salient key property: out of the entirety of D_e, each function returns T for only a single entity.

(43) a. $[\lambda x \in D_e \, . \, x$ is a president of the US$]$ $= T$ *iff* applied to <u>Joe Biden</u> (currently)

b. $[\lambda x \in D_e \, . \, x$ is a professor of LIN 4307$]$ $= T$ *iff* applied to <u>Jason Overfelt</u> (currently)

c. $[\lambda x \in D_e \, . \, x$ is a capital of MI$]$ $= T$ *iff* applied to <u>Lansing</u> (currently)

- The key generalization to be appreciated here is that *the* systematically combines with a function of type $\langle e, t \rangle$ are returns that unique entity for which that function returns T.

(44) a. $[\![$ the $]\!]([\lambda x \in D_e \, . \, x$ is a president of the US$])$ = Joe Biden

b. $[\![$ the $]\!]([\lambda x \in D_e \, . \, x$ is a professor of LIN 4307$])$ = Jason Overfelt

c. $[\![$ the $]\!]([\lambda x \in D_e \, . \, x$ is a capital of MI$])$ = Lansing

- With this in mind, it is possible to provide a lexical entry for *the* that takes a type $\langle e, t \rangle$ NP as its argument and returns the unique entity for which $[\![$ NP $]\!](x) = T$.

(45) $[\![$ the $]\!] = [\lambda f : f \in D_{\langle e,t \rangle} \, . \,$ the unique x such that $f(x) = T]$

Before we see how a definite description fits into the calculation of an entire sentence, let's see how our extention for *the* contributes to the meaning of a definite description:

(46) **Calculation of the extension of the DP *the president***

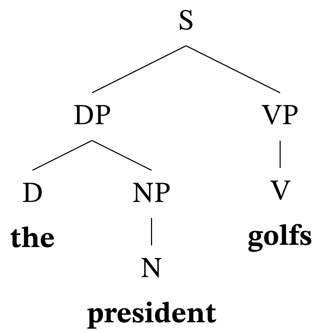
i.	$[\![\, [_{DP}$ the $[_{NP}$ president $]] \,]\!]$	=	(by FA)
ii.	$[\![$ the $]\!]([\![$ NP $]\!])$	=	(by NN)
iii.	$[\![$ the $]\!]([\![$ president $]\!])$	=	(by TN)
iv.	$[\lambda f \in D_{\langle e,t \rangle} \, . \,$ the unique x such that $f(x) = T]([\![$ president $]\!])$	=	(by LC)
v.	the unique x such that $[\![$ president $]\!](x) = T$	=	(by TN)
vi.	the unique x such that $[\lambda y \in D_e \, . \, y$ is a president$](x) = T$	=	(by LC, def.)
vii.	the unique x such that x is a president	=	(by facts)
viii.	Joe Biden		

3.3 A Semantic Proof

Our syntactic assumptions regarding a simple sentence containing definite description in an argument position is as follows:

(47) a. The president golfs.

b.



The lexical entries for the component parts of this sentence include:

(48) **Lexical entries**

a. $[\![\text{the}]\!] = [\lambda f : f \in D_{\langle e,t \rangle}$. the unique x such that $f(x) = T]$

b. $[\![\text{president}]\!] = [\lambda x \in D_e$. x is a president $]$

c. $[\![\text{golfs}]\!] = [\lambda x \in D_e$. x golfs $]$

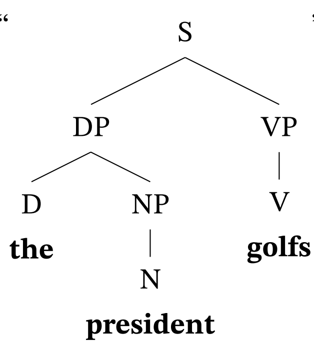
Given what we have done up to this point, the predicted truth-conditions for this sentence are as follows:

(49) **Truth-conditional Statement of *The president golfs***
The president golfs is T *iff* the unique x such that x is a president golfs

(50) **Truth-conditional Statement of *The president golfs* as uttered on March 5, 2024**
The president golfs is T *iff* Joe Biden golfs

(51) **Calculation of the Truth Conditions of *The president golfs***

i. "The president golfs" is T *iff* (by syntax)

ii. "  " is T *iff* (by notation)

iii. $[\![\text{S}]\!]$ $= T$

iv. *Calculation of* $[\![$ VP $]\!]$

a. $[\![$ VP $]\!]$ = (by NN, TN)

b. $[\lambda x \in D_e \,.\, x$ golfs $]$

v. *Calculation of* $[\![$ NP $]\!]$

a. $[\![$ NP $]\!]$ = (by NN, TN)

b. $[\lambda x \in D_e \,.\, x$ is a president $]$

vi. ***Calculation of*** $[\![$ **DP** $]\!]$

a. $[\![$ DP $]\!]$ = (by FA, LE, iv.)

b. $[\![$ the $]\!]([\![$ NP $]\!])$ = (by TN)

c. $[\lambda f \in D_{\langle e,t\rangle} \,.$ the unique x such that $f(x) = T]([\![$ NP $]\!])$ = (by LC)

d. the unique x such that $[\![$ NP $]\!](x) = T$ = (by v.)

e. the unique x such that $[\lambda y \in D_e \,.\, y$ is a president $](x) = T$ = (by LC, def.)

f. the unique x such that x is a president

vii. *Calculation of* $[\![$ S $]\!]$

a. $[\![$ S $]\!]$ $= T$ *iff* (by FA, iv., vi.)

b. $[\![$ VP $]\!]([\![$ DP $]\!])$ $= T$ *iff* (by iv.)

c. $[\lambda x \in D_e \,.\, x$ golfs $]([\![$ DP $]\!])$ $= T$ *iff* (by vi.)

d. $[\lambda x \in D_e \,.\, x$ golfs $]$(the unique x such that x is a president) $= T$ *iff* (by LC)

e. the unique x such that x is a president golfs $= T$ *iff* (by facts)

f. Joe Biden golfs

Thus, (48i) *iff* (48vii), or **"The president golfs" is *T iff* the unique x such that x is a president (Joe Biden) golfs**.

In combination with our previous results, this lexical entry for the definite article produces the correct truth-conditional statements for a range of sentences containing definite descriptions:

(52) a. "The president likes the White House" is T *iff* Joe Biden likes the White House.
b. "The president is a politician" is T *iff* Joe Biden is a politician

There are, however, several instances where it is not obvious that we are obtaining the correct results. For example, what is the intuition if there isn't a unique entity for which the NP is true?

(53) a. **The escalator in HHB** is broken.
b. **The chair in this room** is dirty.
c. **The cat** is hungry.

These DPs lack an extension because there is not a unique x. So, can these sentences be true or false?

Understanding the facts surrounding such cases will lead us to incorporate presuppositions into our model. We will do this by introducing the idea of **contextual domain restrictions** on functions. Put more simply, we will allow the context to provide additional restrictions on the domain condition of a function.

(54) **Lambda Notation for Functions**

$$[\ \lambda x :\ \underbrace{x \in D}_{\textit{domain condition}}\ .\ \ldots\ x\ \ldots\ ]$$

(55) **Contextually restricted lexical entry for *the***

$[\![$ the $]\!]$ =

$[\lambda f : f \in D_{\langle e,t\rangle}$ and there is exactly one x in a contextually relevant set of entities C such that $f(x) = T$. the unique x such that $f(x) = T]$

Allowing for a bit of mathematical notation simplifies this unwieldy entry somewhat:

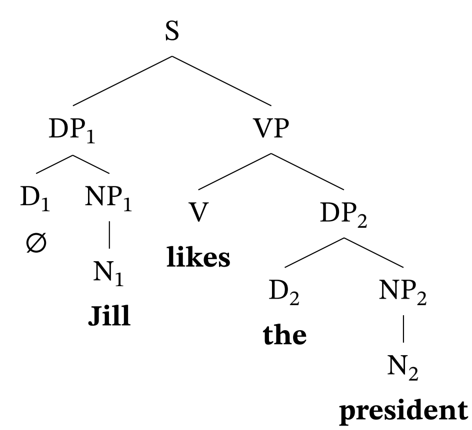
(56) $[\![$ the $]\!]$ =

$[\lambda f : f \in D_{\langle e,t\rangle}$ and $|\{x : x \in C$ and $f(x) = T\}| = 1$. the unique x such that $f(x) = T]$

4 Practice

Exercise. Please provide a semantic proof of the truth-conditions of the following sentence:

(57)



In order to do this, we will need to provide the extensions of the lexical items and provide a step-by-step proof of the intuitive truth conditions.