

The Semantics of Definite DPs ¹

Thus far, our semantics is able to interpret common nouns that occupy predicate position (1a).

...However, the most ‘common’ position for common nouns to occupy is internal to phrases that occupy *argument positions*, as in (1b).

(1) The Possible Positions of Common Nouns

- a. Predicate Position: Obama is a **politician**.
- b. Argument Position: (i) [A **politician**] arrived from Washington.
(ii) Joe likes [the **politician**].
(iii) [Many **politicians**] are corrupt.

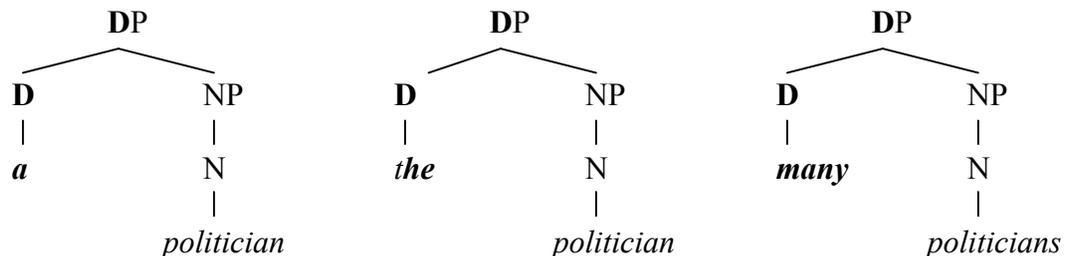
Much of our remaining work this term will be aimed at understanding how to interpret expressions like those in (1b), which are not proper nouns, but which are in argument position...

We have to start somewhere, and so we’ll get things going by introducing a ‘rough-and-ready’ system for the interpretation of *definite descriptions* like “the politician”.

(2) Crucial Syntactic Change, Part 1: DPs, Not ‘NPs’

- Thus far, we’ve assumed that expressions like *Barack* and *a politician* are ‘NPs’.
- However, for several decades, syntacticians have held that their category is actually ‘DP’ (that they are projections of the determiner), as in the following structures:

a. The ‘DP’ Structure of Nominal Arguments

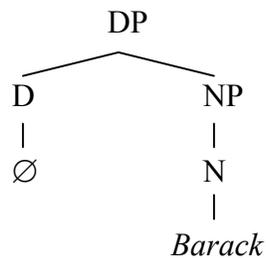


¹ These notes are based on the material in Heim & Kratzer (1998: 73-85).

(3) **Syntactic Change, Part 2: Proper Names as DPs**

- We will extend our ‘DP structure’ to proper names as well.
- For proper names, we will assume that there is a phonologically empty determiner that combines with them (3a).
- We will assume that this phonologically null D has the semantics in (3b).
- Under this semantics, the extension of the null D is simply the identity function on individuals. Consequently, the extension of the DP will be identical to the extension of the NP name.

a. The ‘DP’ Syntax of Proper Names



b. The Semantics of Null D

$$[[\emptyset_D]] = [\lambda x : x \in D_e . x]$$

(4) **The Semantics of Definite DPs**

Although this remains a controversial view, we will assume that definite DPs are of *type e*. They denote entities, just like proper names.

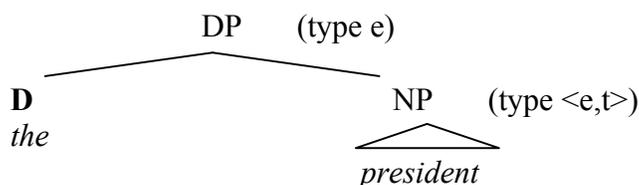
- [[the president]] = Barack Obama
- [[the professor for 610]] = Seth Cable
- [[the capital of Massachusetts]] = Boston
- [[the drummer for Rush]] = Neil Peart

With the extensions assumed in (4), let's now work out what the semantics of the definite determiner itself must be...

1. The Semantics of the Definite Article

Let's begin by figuring out what the semantic type of the definite article should be...

(5) Deducing the Semantic Type of the Definite Article



- It seems that the extension of *the* takes a type $\langle e,t \rangle$ function as argument, and returns an entity as the extension of the entire DP.
- Thus, the definite article *the* is of type $\langle \langle e,t \rangle e \rangle$

OK... but what is this $\langle \langle e,t \rangle e \rangle$ function? How is it defined, exactly?

(6) Some Initial Observations, Part 1

[[the]]	takes as argument:	[[president]]	and returns:	Barack Obama
		[[professor for 610]]		Seth Cable
		[[capital of MA]]		Boston
		[[drummer for Rush]]		Neil Peart

(7) Some Initial Observations, Part 2

Following our assumptions about the semantics of NPs, the following equations hold:

- a. [[president]]
 - b. [[professor for 610]]
 - c. [[capital of MA]]
 - d. [[drummer for Rush]]
- = [$\lambda x_e : \underline{x}$ is a president]
- = [$\lambda x_e : \underline{x}$ is a professor for 610]
- = [$\lambda x_e : \underline{x}$ is a capital of MA]
- = [$\lambda x_e : \underline{x}$ is a drummer for Rush]

(8) **Key Observation**

The functions in (7) above all share one rather salient property in common:
Each assigns 'true' to only one entity

- a. In all of D_e , $[\lambda x_e : x \text{ is a president}]$ is (currently) T of only Barack Obama
- b. In all of D_e , $[\lambda x_e : x \text{ is a professor for 610}]$ is (currently) T of only Seth Cable
- c. In all of D_e , $[\lambda x_e : x \text{ is a capital of MA}]$ is (currently) T of only Boston
- d. In all of D_e , $[\lambda x_e : x \text{ is a drummer for Rush}]$ is T of only Neil Peart

(9) **Key Generalization**

[[The]] takes a function of type $\langle e, t \rangle$ as argument, and returns **the one entity which the $\langle e, t \rangle$ function is (currently) true of!**

- a. $[[\text{the}]]([\lambda x_e : x \text{ is a president}]) =$ Barack Obama
- b. $[[\text{the}]]([\lambda x_e : x \text{ is a professor for 610}]) =$ Seth Cable
- c. $[[\text{the}]]([\lambda x_e : x \text{ is a capital of MA}]) =$ Boston
- d. $[[\text{the}]]([\lambda x_e : x \text{ is a drummer for Rush}]) =$ Neil Peart

(10) **A Lexical Entry that Captures the Idea in (9)**

$[[\text{the}]]$ =

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

The function whose domain is **those $\langle e, t \rangle$ functions f which assign true to exactly one entity**, and which for all such functions f , yields that unique entity y such that $f(y) = T$

Technical Side-Note

Note that the domain of $[[\text{the}]]$ is not all of $D_{\langle e, t \rangle}$, but only a *strict subset of it*. Consequently, it's not entirely accurate to say that $[[\text{the}]]$ is of type $\langle \langle e, t \rangle, e \rangle$

Technical Fix

- a. Partial Function:
A function f is a **partial** function from X into Y iff the domain of f is a *subset* of X , and its range is a subset of Y
- b. $\langle X, Y \rangle =$ the type of *partial* functions from things of type X into things of type Y
- c. $D_{\langle X, Y \rangle} =$ the set of all *partial* functions from D_X into D_Y

- g. $[[S]] = T$ iff (by FA, c, f)
- h. $[[VP]] ([[DP]]) = T$ iff (by c)
- i. $[\lambda x_e : x \text{ is smokes }] ([[DP]]) = T$ iff (by f)
- j. $[\lambda x_e : x \text{ is smokes }] (\text{Barack Obama}) = T$ iff (by LC)
- k. Barack Obama smokes.

2. A Key Consequence of Our Semantics: Presuppositions!

Consider our semantics for the definite article (repeated below), and consider what we assume the domain of its extension is:

(12) The Extension of “The”

$[\lambda f : f \in D_{\langle e,t \rangle}$ and there is exactly one x such that $f(x) = T$. the unique y such that $f(y) = T]$

(13) Key Prediction 1: The NP Complement of “The” Must be T of Exactly One Thing

- Under the semantics in (10)/(12), the domain of the extension of “the” is *those <et> functions which are true of exactly one entity...*
- Therefore, the extension of “the” can take as argument *only those <et> functions that are true of exactly one entity.*
- Therefore, it should be semantically impossible for “the” to combine with an NP whose extension is *not* true of exactly one entity.
- Thus, the following DPs will **not** be interpretable by our semantic system:
 - a. [the [**Pioneer Valley subway system**]]
 - b. [the [**United States single-payer healthcare system**]]
 - c. [the [**second season of Firefly**]]

But, does this prediction match reality?

(14) **Some Considerations in Support of the Prediction**

- Since there is no subway system in the Pioneer Valley, and no single-payer healthcare system in the US, and no second season of *Firefly*...
...then indeed I can't use any of the DPs in (13) to refer to anything...
- ... and, indeed, if I were to start talking about “the Pioneer Valley subway system”, or “the US single-payer system”, or “the second season of *Firefly*”...
there's a sense in which you wouldn't understand what I was saying..
- So, it does seem that such DPs *lack an extension*...
- Since our system aims at computing the extensions of natural language structures, it rightly ends up not being able to assign any extension to these DPs.

So, we've just concluded that our system rightly assigns no extension of the DPs in (13)...

... consider, then, what our system predicts for sentences like those in (15), which *contain* such 'uninterpretable' DPs...

(15) **Sentences Containing 'Uninterpretable' Definite DPs**

- a. [[The [**Pioneer Valley subway system**]] is running efficiently.]
- b. [[The [**United States single-payer healthcare system**]] needs more money]
- c. [[The [**second season of *Firefly***]] was disappointing]

(16) **Key Prediction 2: The Presuppositions of Sentences Containing Definite DPs**

Sentences such as those in (15) cannot be assigned an extension by our system, and so such sentences are *neither T nor F*.

- Our 'interpretation function' [[]] maps phrases to their extensions.
- Since '[[]]' cannot deliver a value for the definite DPs in (15), it cannot deliver a value for the sentences as a whole.
- *Consequently, these sentences can't get an extension... they can be neither T nor F*

But does **this** prediction match reality?...

(17) **Some Considerations in Support of the Prediction**

- The sentences in (15) are clearly not *true*... but is it right to say that they aren't *false* either?...
- Well, some would say that it's not really *false* to say that the Pioneer Valley subway system is running efficiently (15a)...
- After all, if the sentence in (15a) were *false*, then our semantics predicts that the following sentence would be *true*:
 "It is not the case that the Pioneer Valley subway system is running efficiently."
- ...However, *that* negated sentence doesn't seem true either...
 ... So, there seems to be a sense in which (15a) – as well as (15b,c) – are *neither true nor false*...

(18) **Towards a Theory of Presupposition?**

Our semantics for the definite article – where it denotes a *partial* function – allows us, in a very basic, initial way – to begin to derive the **presuppositional content** of certain natural language expressions.

(19) **Presupposition (Our Basic Definition; See the First Handout)**

- a. Rough Definition:
 p is a **presupposition** of sentence $S = p$ is 'taken for granted' by S
- b. Empirical Test: p is a **presupposition** :: S is true *or false* only if p

(20) **Prediction of Our Semantics**

A sentence containing a DP of the form '[the NP]' can be true or false only if *there is exactly one entity x for which* $[[NP]](x) = T$.

(21) **Conclusion**

For a very limited set of structures, our semantic system is able to capture their *presuppositions* as well as their *asserted* content.

(...*though we aren't 'deriving' them in the way we do for the asserted content...*)

(22) **One Final Problem: Contextual Restriction**

- According to our semantics in (10), “the” can only take an NP as argument if the extension of the NP is true of *exactly one* entity.
- This means that “the” cannot take as argument NPs which are (intuitively) true of *many* entities, like “cat”.
- But, we say things like “the cat” all the time, and are perfectly well understood!
(Even though that there are many cats out there in the world!)

(23) **The Generally Accepted Solution**

- In any given context, there is actually only a very small, strict subset of D_e that we are ‘talking about’, that we ‘have in mind’.
- Let’s call this limited set of entities C (for ‘contextually relevant entities’)
- When we use a definite DP like “the NP”, we are referring to that unique entity *from* C that satisfies $[[NP]]$.
- Thus, even though we know there are many cats *in the world* (D_e), we can use the DP “the cat” in a context *exactly when* the set of contextually relevant entities (C) contains one and only one cat.

(24) **Slightly Revised Semantics for ‘The’**

$$\begin{aligned} [[\text{the}]] &= \\ [\lambda f : f \in D_{\langle e,t \rangle} \text{ and there is exactly one } \underline{x} \in C \text{ such that } f(x) = T . \\ &\quad \text{the unique } y \in C \text{ such that } f(y) = T] \end{aligned}$$

(25) **Prediction: Acceptability of Definite DPs Depends Upon the Context (C)**

- If I own exactly one cat, then I can in my house say “the cat is hungry”
Because there would only be one cat in C (the things that are conversationally salient)
- If I own two cats, then I *can’t* in my house say “the cat is hungry” (unless one of the other two cats is gone or something...)
Because in this case, there would be more than one cat in C

A full formalization of ‘the generally accepted solution’ in (23) would be premature for us, since we don’t yet have a theory of what context is and how it can affect the meaning of linguistic elements...

...but we will soon...