LING4400: Lecture Notes 13
Intensionality

Contents

13.1 Intensions [Carnap, 1947]

The techniques we've covered so far won't let us predict entailments of verbs like *want*:

(1) a. *France never wants Etna to erupt.* (Maybe France has no opinion, as Etna is in Italy.)
b. (**not** entailed by 1a:) *France wants Etna never to erupt.*

Here's what we get if we define *want* as taking an argument that's a proposition or an eventuality:

1. If we model 1b using a **truth value** argument for Want, we get:

   $$\text{Want (None (Erupt Etna) } (\lambda_{e:\text{e}} \text{ True})) \text{ France}$$

   which, since Etna does erupt, is equivalent to:

   $$\text{Want False France}$$

   and which, since $1 = 2$ is also false, is equivalent to:

   (2) *France wants one to equal two.*

   This seems much stronger; not intuitively the same desire!

2. We may want to use an **eventuality** argument for Want in 1b, but this gives:

   $$\text{None (Erupt Etna) } (\lambda_{e:\text{e}} \text{ Want } e \text{ France})$$

   which is 1a. But 1a is not supposed to entail 1b! That's no good either!

Instead, we can represent *want* as a function that takes a set of **possible worlds** as an argument!

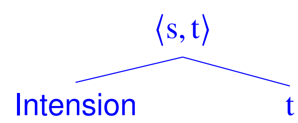
The set of possible worlds that satisfies an expression is called an **intension** of that expression:

$$[\![\text{Intension } \varphi]\!]^M = [\![\uparrow \varphi]\!]^M = [\![\lambda_{w:\text{s}} [\![\varphi]\!]^w]\!]^M = \begin{array}{|ccc|}\hline \text{input} & & \text{output} \\ \hline M & : & [\![\varphi]\!]^M \\ \textbf{Star Trek Universe} & : & [\![\varphi]\!]^{\textbf{Star Trek Universe}} \\ \textbf{Marvel Universe} & : & [\![\varphi]\!]^{\textbf{Marvel Universe}} \\ \vdots & : & \vdots \\ w & : & [\![\varphi]\!]^w \\ \vdots & : & \vdots \\ \hline \end{array} .$$

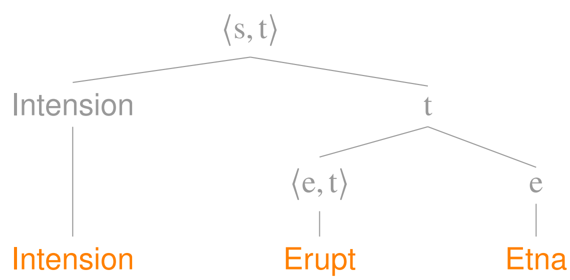
Intension is an **operator**, like the lambda operator, so it has its own interpretation function.

The result of this operator is a function from a new type, possible worlds, to truth values: $\langle s, t \rangle$.

We can draw this in a derivation tree using another kind of composition rule:



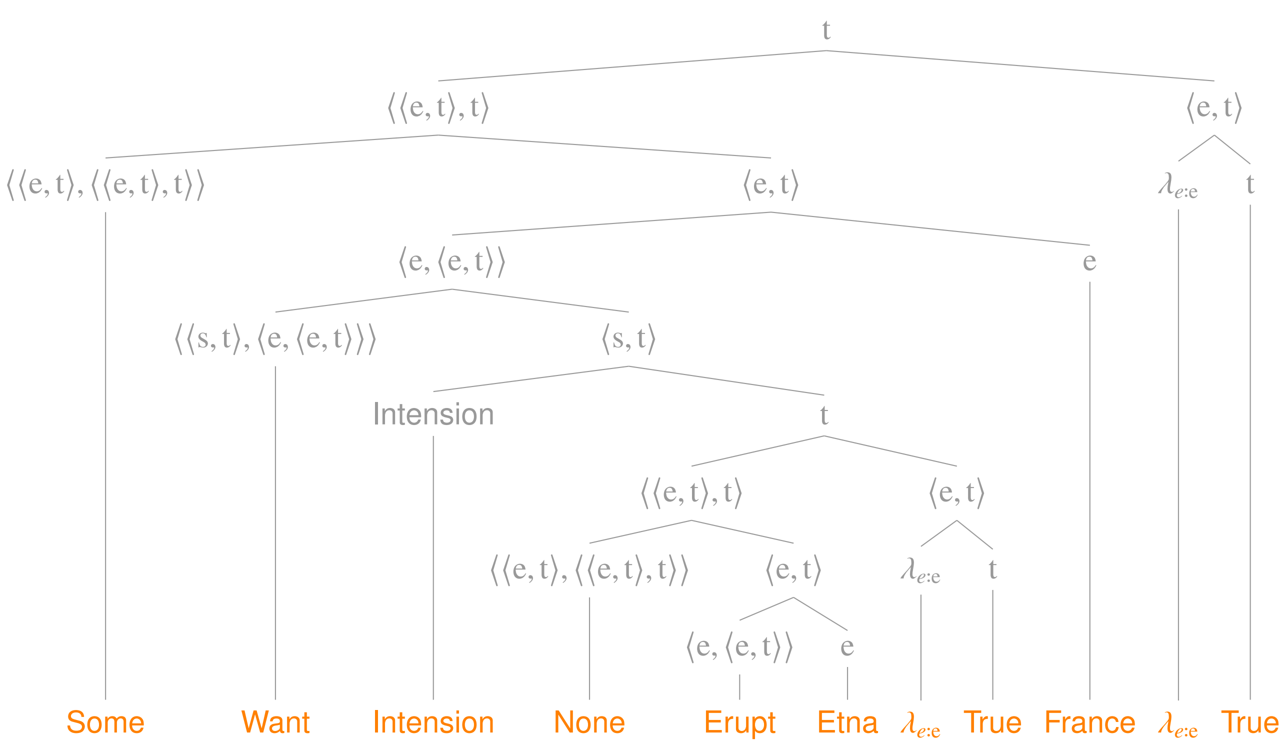
For example:



This means *the set of possible worlds where Etna erupts.*

If we now define Want with a function like this as an argument, we get the following for 1b:

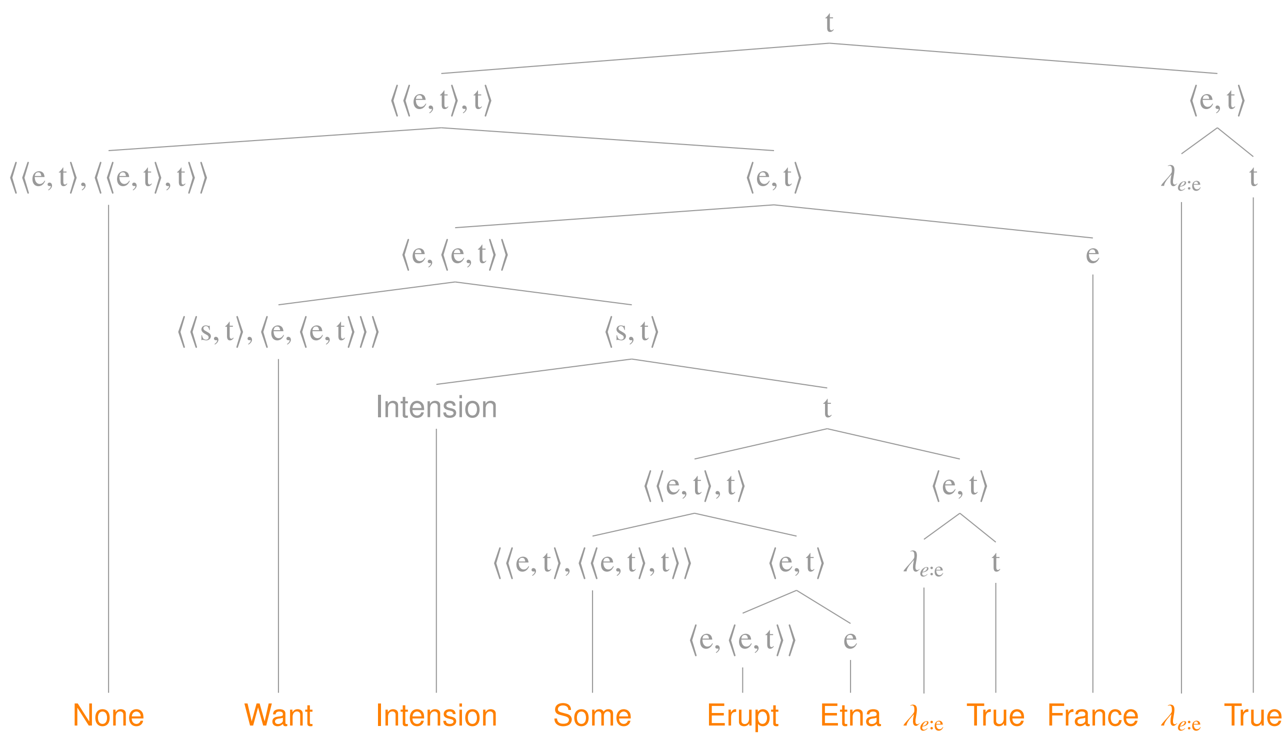
Some (Want (Intension (None (Erupt Etna) ($\lambda_{e:e}$ True))) France) ($\lambda_{e:e}$ True)



(More literally, *There is some want by France to be in a world with no eruption of Etna.*)

And we get the following for 1a, which does not entail 1b:

None (Want (Intension (Some (Erupt Etna) ($\lambda_{e:e}$ True))) France) ($\lambda_{e:e}$ True)



(More literally, *There is no want by France to be in a world with some eruption of Etna.*)

Predicates like Believe can also take this type of argument.

Practice 13.1:

Write **logical translations** that distinguish the following sentences:

1. *France believes it's not true that Etna erupted twice.*
2. *It's not true that France believes Etna erupted twice.*

13.2 Questions as intensions

Intensions can be used to model questions as well:

(3) a. *What erupts?*
b. (entailed by 3a:) *I (the speaker) want to know everything that erupts.*

like this (here, to simplify, Want, Believe and Erupt are defined without eventualities):

All ($\lambda_{x:e}$ Erupt x) ($\lambda_{x:e}$ Want (Intension (Believe (Intension (Erupt x)) Speaker)) Speaker)

(Literally, *For each erupter, I want to be in a world where I believe I'm in a world where it erupts.*)

13.3 Intensions interact with quantifiers

Intensions interact with quantifiers. For example (again with no eventualities):

1. When quantifiers outscope intensions:

   $$\text{All } (\lambda_{x:e} \text{ Volcano } x) \ (\lambda_{x:e} \text{ Want } (\text{Intension } (\text{See } x \text{ Speaker})) \text{ Speaker})$$

   This means: *I want to (be in a world where I) see every volcano (in this world).*

   This is called a **de re** reading (because it's based on the set of volcanoes in reality).

2. When intensions outscope quantifiers:

   $$\text{Want } (\text{Intension } (\text{All } (\lambda_{x:e} \text{ Volcano } x) \ (\lambda_{x:e} \text{ See } x \text{ Speaker})) \text{ Speaker})$$

   This means *I want to (be in a world where I) see every volcano (in that world).*

   This is called a **de dicto** reading (because it's based on the definition of volcano).

So the second speaker would be satisfied in a world with no volcanoes, but not the first.

Practice 13.2:

Draw **derivation trees** (with just types at each branch) for the above expressions:

1. $\text{All } (\lambda_{x:e} \text{ Volcano } x) \ (\lambda_{x:e} \text{ Want } (\text{Intension } (\text{See } x \text{ Speaker})) \text{ Speaker})$
2. $\text{Want } (\text{Intension } (\text{All } (\lambda_{x:e} \text{ Volcano } x) \ (\lambda_{x:e} \text{ See } x \text{ Speaker}))) \text{ Speaker}$

Practice 13.3:

Write an **English translation** of the following logical form (with no eventualities) and draw a **translation tree with a logical form at each branch** for your translation:

$$\text{Want } (\text{Intension } (\text{Two}_{\langle e,t \rangle} \text{ Island Contain Italy})) \text{ France}$$

You may assume the following expression for the word *want*:

$$\lambda_{p:t} \ \lambda_{x:e} \text{ Want } (\text{Intension } p) \ x$$

References

[Carnap, 1947] Carnap, R. (1947). *Meaning and Necessity: A Study in Semantics and Modal Logic*. Chicago: University of Chicago Press.