# Adjectives
LING 255
February 7, 2008

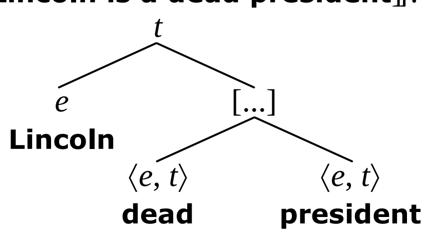
## 1. The Challenge Posed by Adjectives

Back on page 20, we decided that adjectives and nouns work just like (intransitive) verbs, i.e.

(1) ⟦**dead**⟧ = that function from individuals to truth values such that, given an individual, it returns TRUE if and only if that individual is dead = $[\lambda x \in D_e \,.\, x$ is dead$]$

(2) ⟦**president**⟧ = $[\lambda x \in D_e \,.\, x$ is a president$]$

Unfortunately, these work fine for ⟦**Lincoln ~~is~~ dead**⟧ and ⟦**Lincoln ~~is a~~ president**⟧. But what about ⟦**Lincoln ~~is a~~ dead president**⟧? We can draw a tree, labeled with types:

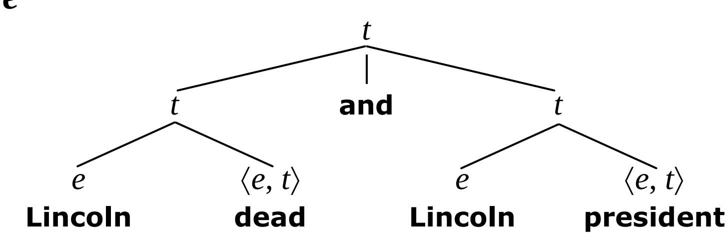



The overall meaning should be type *t*, i.e. a truth value. The problem comes with the bracketed node: we don't have a rule of composition that can tell us how to combine two meanings, unless one can be an argument for the other.

Our theory, quite simply, doesn't work. How can we repair it?

### *1.1. Assume a different structure*

Perhaps that's the wrong tree, above. Since the meaning is something like "Lincoln's dead, and Lincoln's a president", we want a structure that reflects that, like the one to the right.




That's a possibility. We won't really pursue it for a few reasons. One, we really want **dead president** to remain a unit for various syntactic reasons—one can run syntactic tests that might suggest that the above isn't right. Two, this kind of structure won't work well for, say, **a black laptop is on the table**, which we can't break into **a black thing is on the table, and a laptop is on the table**. (And three, it won't work for "former"...but that'll be all kinds of problems later on.)

## *1.2. Assume a new composition rule*

If the problem is that function application can't combine two $\langle e, t\rangle$ meanings, perhaps we need something that does.

(3) **Function Application**
If a node M has daughters $D_1$, $D_2$ , and $D_1$ is a function that can take $D_2$ as an argument...

(4) **New Composition Rule**
If a node M has daughters $D_1$, $D_2$ , and both have the semantic type $\langle e, t\rangle$...

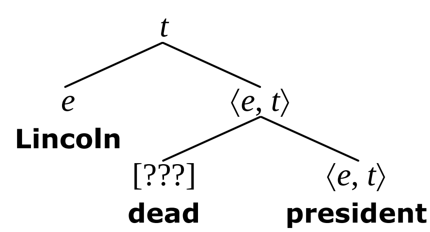
What should this rule look like? We want an "and" meaning—or, if we think of the sets characterized by the functions in (1) and (2), the set of dead things and the set of presidents, we want their intersection:

(5) If a node M has daughters $D_1$, $D_2$ , and $[\![D_1]\!]$ and $[\![D_2]\!]$ both have the semantic type $\langle e, t\rangle$, then $[\![M]\!] = [\![D_1]\!] \cap [\![D_2]\!]$.

Or, to use functions:

(6) **Predicate Modification (Rule of Interpretation #2)**
If a node M has daughters $D_1$, $D_2$ , and $[\![D_1]\!]$ and $[\![D_2]\!]$ both have the semantic type $\langle e, t\rangle$, then $[\![M]\!] = [\lambda x : x \in D_e \text{ . TRUE iff } [\![D_1]\!](x) = \text{TRUE and } [\![D_2]\!](x) = \text{TRUE}]$.

## *1.3. Assume a new meaning for* dead




If the problem is that function application can't combine two $\langle e, t\rangle$ meanings, perhaps we need meanings that function application can combine. If **president** has the type $\langle e, t\rangle$, and we want to produce an $\langle e, t\rangle$, then **dead** must denote a function whose type is $\langle\langle e, t\rangle, \langle e, t\rangle\rangle$.

What function do we want? It takes things with type $\langle e, t\rangle$ and returns things of type $\langle e, t\rangle$, so we know what its basic structure will be.

(7) $[\lambda P \in D_{\langle e, t\rangle} \text{ . } [\lambda x \in D_e \text{ . TRUE iff } \_\_\_\_\_ ]]$

What needs to be the case? For one thing, that $x$ is dead. For another, that $P$ is true of $x$ as well:

(8) $[\lambda P \in D_{\langle e, t\rangle} \text{ . } [\lambda x \in D_e \text{ . TRUE iff } x \text{ is dead and } P(x) = \text{TRUE}]]$[1]

[1] Note: *not* "...and *x* is a *P*". *P* is a variable over functions; what will go in its place is not **president** but the meaning of **president**, i.e. [λ*y* . *y* is a president], and it's certainly not true that "*x* is a [λ*y* . *y* is a president]".

### 1.4. *Which is right?*

We have two possibilities to consider:

- Introduce a rule of Predicate Modification

  Advantages:
  ◦ We haven't had to do anything unpleasant to the meaning or semantic type of *dead*

  Disadvantages:
  ◦ We had to introduce a new composition rule

- Change the type of adjectives

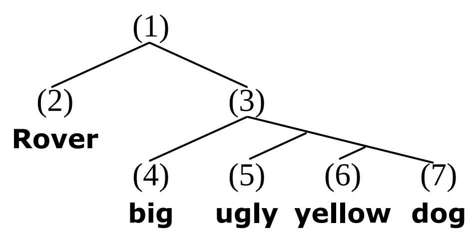
  Advantages:
  ◦ This gives us the same semantics as predicate modification, but without having to introduce a new composition rule.

  Disadvantages:
  ◦ The meaning of an adjective just got more complicated.

How do we decide between them? We could do so on the aesthetic grounds just mentioned. Or we could look at more data, and see whether the theories can actually cover them.

## 2. DATA TO DIFFERENTIATE THE TWO THEORIES

### 2.1. *Series of adjectives*




Perhaps one theory or the other will be unable to account for stacked adjectives, e.g. **Rover is a big ugly yellow dog**. If so, we can reject that theory.

Well, what happens? If we use Predicate Modification:

- (6) is an $\langle e, t\rangle$ meaning something like "is yellow" and (7) is an $\langle e, t\rangle$ meaning something like "is a dog", so combining them will give an $\langle e, t\rangle$ meaning "is yellow and a dog".
- Then combining this with (5) gives another $\langle e, t\rangle$ meaning "is ugly and [is yellow and a dog]".
- Finally, combining with (4) gives us a meaning for (3): it's an $\langle e, t\rangle$ meaning "is big and [is ugly and [is yellow and a dog]]". That's about right.

If we use the higher type for adjectives:

- (6) is an $\langle\langle e, t\rangle, \langle e, t\rangle\rangle$ which combines with (7), which is an $\langle e, t\rangle$, to give an $\langle e, t\rangle$ meaning something like "is yellow and a dog".
- Now (5) is an $\langle\langle e, t\rangle, \langle e, t\rangle\rangle$ which takes this new $\langle e, t\rangle$ as its argument and produces an $\langle e, t\rangle$....

Essentially, the same thing happens here: after each adjective combines with the $\langle e, t\rangle$ we have so far, we get a new $\langle e, t\rangle$ that can combine with the next adjective. So this could have distinguished the theories; but it happened not to.

## *2.2. Kinds of adjectives*

We started with **dead** because things are either dead or not. Adjectives like this—that divide the world neatly into things that are and things that are not (**dead**, **pregnant**, **bearded**...)—are called **INTERSECTIVE**. But there are other kinds:

| | **INTERSECTIVE** (**dead**) | **SUBSECTIVE** (**tall**) | **PRIVATIVE** (**former**) |
|---|---|---|---|
| ⟦Adj Noun⟧ ⊆ ⟦Noun⟧ | yes | yes | no |
| ⟦Adj Noun⟧ ⊆ ⟦Adj⟧ | yes | no | no |

**SUBSECTIVE** adjectives like **tall** show a kind of ambiguity, i.e.

⟦**tall kindergartener**⟧ =
- "tall, and a kindergartener"
- "tall for a kindergartener; tall as kindergarteners go"

How can we get this meaning from the approaches discussed above? For Predicate Modification, it's going to be tough, because intersection is written right into the rule. For the higher-type adjective meaning, we have a somewhat better chance...

- ⟦**tall**⟧ = $[\lambda P : P \in D_{\langle e, t\rangle} . [\lambda x : x \in D_e .$ TRUE iff ______]]

Part of it must still be that $P(x)$ = TRUE: a tall kindergartener may not be tall, but she's still a kindergartener. The other part is that $x$ is tall when compared to other things in set $P$. So perhaps something like:

- $[\lambda P : P \in D_{\langle e, t\rangle} . [\lambda x : x \in D_e .$
  TRUE iff $P(x)$ = TRUE and $x$ is taller than the average $y$ such that $P(y)$ = TRUE]]

That's a starting point, at least...