A Little Bit on Adverbs and Events

1. From Adjectives to Adverbs to Events

We’ve just developed a theory of the semantics of adjectives, under which they denote either functions of type \(<et>\) or of type \(<et,et>\).

(1) The Lexical Semantics of Intersective and Subsective Adjectives

a. Intersective Adjectives (Type \(<et>\)):
   \[
   [[ \text{male} ]] = [ \lambda x : x \text{ is male} ]
   \]

b. Subsective Adjectives (Type \(<et,et>\)):
   \[
   [[ \text{young} ]] = [ \lambda f_{<et>} : [ \lambda x : f(x) = T \text{ and } x \text{ is below the average age for } \{ y : f(y) = T \} ]
   \]

Of course, adjectives aren’t the only kind of modifier in natural language...

(2) Adverbial Modifiers

a. [ Dave [ walked quickly ] ]

b. [ Dave [ walked around South College ] ]

c. [ Dave [ walked before 3PM ] ]

(3) Initial Observation

If we assume adverbs to also be of type \(<et>\), then we could interpret sentences like those in (2) via Predicate Modification.

S

\[
\begin{array}{c}
\text{NP} \ e \\
\text{Dave}
\end{array}
\quad
\begin{array}{c}
\text{VP} \ <e,t>
\quad
\text{AdvP} \ <e,t>
\end{array}
\]

\[
\begin{array}{c}
\text{walked}
\quad
\begin{array}{c}
\text{quickly}
\quad
\text{around South College}
\quad
\text{before 3PM}
\end{array}
\end{array}
\]

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1 For further reading complementing these notes, students are referred to Chapter 1 of Kratzer (2002).
Immediate Question: What should be the $\langle e, t \rangle$ denotation of these adverbs?

- a. $\langle$ quickly $\rangle = \langle \lambda x : x \text{ is quick} \rangle$
- b. $\langle$ around South College $\rangle = \langle \lambda x : x \text{ is around South College} \rangle$
- c. $\langle$ before 3PM $\rangle = \langle \lambda x : x \text{ is before 3PM} \rangle$

Immediate Problem:

If we assume the lexical entries in (4), then interpreting the structure in (3) via PM will yield truth-conditions that don’t sound quite right.

- a. $\langle$ Dave walked quickly $\rangle = T \text{ iff Dave walked and Dave is quick.} \ [\text{not bad}]$
- b. $\langle$ Dave walked around South College $\rangle = T \text{ iff Dave walked and Dave is around South College.} \ [\text{erm…}]$
- c. $\langle$ Dave walked before 3PM $\rangle = T \text{ iff Dave walked and Dave is before 3PM.} \ [\text{this is insane}]$

What’s Going Wrong Here? (Davidson 1967)

- In sentences like those in (2), it isn’t Dave that is ‘quick’, ‘around South College’ or ‘before 3PM’.
- Rather, it’s his walking that is ‘quick’, ‘around South College’, ‘before 3PM’.
- Or, to put a slightly different spin on it, it’s the event of Dave walking that is ‘quick’, ‘around South College’, ‘before 3PM’.

Core Hypotheses Behind Event Semantics

- a. VPs are predicates of events (a semantic type distinct from entities or t-values)
- b. Adverbs are also predicates of events
- c. Adverbs modifying VPs are interpreted via PM (or a similar such rule)

We’ll now work towards implementing these core hypotheses using the tools already at our disposal!...
2. Basic Implementation of Event Semantics

(8) Expanding Our Semantic Types

- In addition to the types e and t, we will have the type $\varepsilon$, for events.
- Consequently, our domains now also include a set $D_\varepsilon$ (the domain of events)

(9) The Semantics of Adverbs

As previewed above, we’ll view adverbs as denoting predicates of events.

a. \[[ \text{quickly} ]\] = \[\lambda e_\varepsilon : e \text{ is quick}\]
b. \[[ \text{around South College} ]\] = \[\lambda e_\varepsilon : e \text{ is around South College}\]
c. \[[ \text{before 3PM} ]\] = \[\lambda e_\varepsilon : e \text{ is before 3PM}\]

(10) Problem: The Syntactic Position of the Subject

- The core ideas in (7a) and (7c) imply that VPs and adverbs are of type $<\varepsilon, t>$.
- But, if this is the case, how is the subject combined semantically with the VP?

```
S
  NP e
  Dave  VP $<\varepsilon, t>$
  walked
  AdyP $<\varepsilon, t>$
  \{ quickly around South College \}
  \{ before 3PM \}

TYPE MISMATCH!!
```

- The proper solution to this problem will not be possible until we’ve covered the syntax and semantics of movement structures.
- For now, however, suspend your disbelief, and accept the provisional (though presently unclear) idea in (11) below.
Solution: The VP-Internal Subject Hypothesis

Although the structure in (10) is the ‘pronounced’ form of the sentences in (2), when these sentences are semantically interpreted – when their extensions are computed – they are assumed to have the syntactic form below.

Key Property: The subject occupies a position inside the VP

```
S t
   ...
   VP <ε,t> ...
   VP <ε,t>  AdvP <ε,t>
   NP e      V
   Dave     walked { quickly
                   around South College }
                   before 3PM
```

Key Observation 1:
In order for the types here to all work out, we have to assume that intransitive verbs like walked are of type <e, <ε,t>>.

```
[[ walked ]] = [ λe : [ λe : e is an event of walking and x is the agent of e ] ]
```

• Note: The ‘agent’ of an event is the ‘doer’, the thing that brings the event about. (Recall your discussion of theta roles in LING 601)

Major Semantic Predictions

a.  

```
[[ [VP Dave walked] ]] = (by FA)
[ λe : e is an event of walking and Dave is the agent of e ]
```

b.  

```
[[ [VP [VP Dave walked] quickly] ]] = (by FA and PM)
[ λe : e is an event of walking and Dave is the agent of e and e is quick ]
```

c.  

```
[[ [VP [VP Dave walked] before 3PM] ]] = (by FA and PM)
[ λe : e is an event of walking and Dave is the agent of e and e is before 3PM ]
```

d.  

```
[[ [VP [VP Dave walked] around South College] ]] = (by FA and PM)
[ λe : e is an event of walking and Dave is the agent of e
  and e is around South College ]
```
Key Observation 2
In order for the types here to all work out, we have to assume that there is some kind of phonologically null thingy just below S, which takes the VP as argument and returns a truth-value.

\[
\begin{align*}
S & \quad t \\
\emptyset & \quad \langle\epsilon, t\rangle \\
\text{VP} & \quad \langle\epsilon, t\rangle \\
& \quad \text{Dave walked quickly}
\end{align*}
\]

- But what does this phonologically null thingy actually denote?

- To develop an answer, let’s lay out some assumptions regarding the truth-conditions of sentences like the ones in (2).

Assumptions Regarding the Truth-Conditions of the Sentences in (2)

a. \(
[[ \emptyset \text{Dave walked quickly } ]] = T \iff
\) There is an event e such that e is an event of walking and Dave is the agent of e and e is quick.

b. \(
[[ \emptyset \text{Dave walked around South College } ]] = T \iff
\) There is an event e such that e is an event of walking and Dave is the agent of e and e is around South College.

c. \(
[[ \emptyset \text{Dave walked before 3PM } ]] = T \iff
\) There is an event e such that e is an event of walking and Dave is the agent of e and e is before 3PM.

With these truth-conditions, and the assumption that \(\emptyset\) is of type \(<\epsilon, t>\ t>\), we can deduce \([[\emptyset]]\)

Deducing the Extension of ‘\(\emptyset\)’, Part 1

- First, by FA, we know that:
  \([[[\emptyset \text{Dave walked quickly } ]] = [[\emptyset]]([[\text{Dave walked quickly}]]))

- Next, by (13b), we know that:
  \([[\emptyset]]([[\text{Dave walked quickly}]])) =
  [[\emptyset]]((\lambda e_{\epsilon}: e \text{ is an event of walking and Dave is the agent of e and e is quick}))

- Next, given our notation, we know that:
  There is an event e such that e is an event of walking and Dave is the agent of e and e is quick \(\iff\)
  There is an event e such that \([\lambda e_{\epsilon}: e \text{ is an event of walking and Dave is the agent of e and e is quick}])(e) = T
Deducing the Extension of ‘∅’, Part 2

- Putting together the ingredients in (14) and (15), we know that:

\[
[[\emptyset]](\[\lambda e : e \text{ is an event of walking and Dave is the agent of } e \text{ and } e \text{ is quick}\]) = T \iff \\
\text{There is an event } e \text{ such that } [\lambda e : e \text{ is an event of walking and Dave is the agent of } e \text{ and } e \text{ is quick}](e) = T
\]

- Thus, \([[\emptyset]]\) denotes a function which takes as argument a predicate of events \(P\), and returns \(T\) iff there is an event \(e\) such that \(P(e) = T\)

\[
17 \quad \text{The Deduced Semantics} \\
[[\emptyset]] = \[\lambda P_{e,t} : \text{there is an event } e \text{ such that } P(e) = T\]
\]

Putting the Pieces Together

- In the system we’ve developed, the sentences in (2) are assumed to have the syntactic structure in (18a).

- Given the lexical entries in (9), (12), and (17), these sentences are predicted to have the truth-conditions in (18b)

a. Syntax:

```
S t
  \emptyset <<e,t>, t> VP <<e,t> \\
    VP <<e,t> AdvP <<e,t> \\
      NP e V<<e,<e,t>> \\
        Dave walked \{ \text{quickly around South College} \{ \text{before 3PM} \}
```

b. Predicted Truth Conditions:

\([[S]] = T \iff \\
\text{There is an event } e \text{ such that } e \text{ is an event of walking and Dave is the agent of } e \text{ and } e \text{ is quick} / e \text{ is around South College} / e \text{ is before 3PM.} \]
3. Extending This to Transitive Verbs

Under the regime of ideas above, we would need to assume that transitive sentences like (19a) have the syntax in (19b).

(19) Event Semantics and Transitive Verbs: Syntax

a. Sentence: Dave kissed Mary quickly.

b. Syntax:

```
S t
∅ <<ε,t>, t> VP <ε,t>
       VP <ε,t> AdvP <ε,t>
          NP e V'<ε,ε,t>> NP e
         Dave V<'ε,ε,t>> kissed Mary
        kissed
```

Consequently, we can deduce that transitive verbs in this system must be of type <e,<e,ε,t>>.

- We can assume that they have a lexical semantics akin to that in (20).

(20) Event Semantics and Transitive Verbs: Semantics

[[ kissed ]] =
[ λy. [ λx. [ λe. e is an event of kissing and x is the agent of e, and y is the theme of e ] ]]

- Note: The ‘theme’ of an event is the ‘do-ee’, the thing affected by the event.
  (Recall your discussion of theta roles in LING 601)

(21) Predicted Truth-Conditions of Transitive Sentences

[[(19b)]] = T iff

There is an event e such that e is an event of kissing and Dave is the agent of e and Mary is the theme of e and e is quick.
4. Severing External Arguments and the Little vP

For reasons that you’ll learn about in LING 601, there is evidence that transitive verbs like “kiss” are actually of type \(<e, \epsilon, t>>\), and only take their ‘themes’ as arguments.

- That is, there is reason to suspect that the lexical entry for ‘kiss’ should be as in (22)

\[
[[ \text{kissed} ]] = [\lambda y. ([\lambda e. e \text{ is an event of kissing and } y \text{ is the theme of } e ]]
\]

(22) Revised Lexical Semantics for Transitive Verbs

(23) Obvious Immediate Question
How the heck does a VP like ‘kissed Mary’ combine semantically with the subject ‘Dave’ in (19)?

(24) The Answer: Little-\(v\)

a. Step 1: Syntactic Assumption
The VP is dominated by a projection vP (‘little vP’). The subject appears in the specifier of ‘little’-\(v\)

b. Step 2: Semantic Assumption
The meaning of the little-\(v\) head does the work of introducing the ‘Agent’ role into the semantic representation of the sentence.

\[
[[ v ]] = [\lambda P \epsilon, \epsilon > \cdot [\lambda x. [\lambda e. P(e) = T \& x \text{ is the agent of } e ]]]
\]

With these ideas in place, we can now derive the desired event-based semantics for the sentence 

Dave kissed Mary.

Side Note:
Under these assumptions, we must also assume that adverbs are modifiers of vP (not VP)
(25) **The Semantics of Transitive Sentences with vP**

a. **Sentence:** Dave kissed Mary quickly.

b. **Syntax:**

```
S t
∅ <<ε,t>, t> VP <<ε,t>>
  ∅ vP <<ε,t>>
  NP e vP <<ε,t>>
  Dave v <<ε,t>, <ε,t>> VP <ε,t>
    v <ε,t>, <ε,t>> VP <ε,t>
      V <<ε,t>>
        kissed NP e
          Mary
```

c. **Predicted Truth Conditions:**

\[ [[ S ]] = T \text{ iff} \]

There is an event e such that e is an event of kissing and Mary is the theme of e and Dave is the agent of e and e is quick.

(26) **Now Forget Everything You’ve Just Seen**

- As interesting and important as the ideas presented here are, we are going to put them on the ‘backburner’ for a while.

- That is, in the immediately following units, we’ll revert back to the idea that VPs are of type <ε,t> and that transitive verbs directly take the subject as argument.

- We’ll come back to the ideas in this handout towards the end of the course…