Class 4

Modification and Events

Modifiers in syntax

Modifier = constituent that doesn't change the syntactic category of its sister.

happy – adjective (phrase)
very happy – adjective phrase (AP)
➔ *very* is an AP modifier

women – noun (phrase)
tall women – noun phrase (NP)
➔ *tall* is an NP modifier (adnominal) **More examples?**

ran quickly – verb phrase (VP) modifier (adverb, adverbial)

very quickly – (also) adverb modifier **Further?**

men in the kitchen, men who knit, men and/or women,

almost every man

Semantics: Modifier Functions

Modifier function = a function of type *aa*.

happy – *et*
very happy – *et*
very – (*et*)(*et*)
➔ *very* denotes a modifier function

women – *et*
tall women – *et*
tall – (*et*)(*et*)

every man – (*et*)*t*
almost every man – (*et*)*t*
almost – ((*et*)*t*)((*et*)*t*)

Alternatively:
every – (*et*)((*et*)*t*)
almost every – (*et*)((*et*)*t*)
almost – ((*et*)((*et*)*t*))((*et*)((*et*)*t*))

Syntax-Semantics

Hypothesis:

All modifiers in syntax denote modifier functions.

[

In categorial grammar:

Type(N)=et Type(N→N)=(et)(et)

Type(NP)=(et)t Type(NP→NP)=((et)t)((et)t)

In general:

Type(X→X) = (Type(X))(Type(X))

]

But what denotations should modifier functions have?

Adnominal Modifiers

Intersective adnominal modifiers

[[*fast cars*]] = **car** ∩ **fast**

[[*houses in England*]] = **house** ∩ **in_England**

[[*houses where I lived*]] =

house ∩ { $x \in E$: **live_in**(**I**,x) }

A function F of type $(et)(et)$ is an **intersective modifier** if there is a set of entities B s.t. for every function g_{et} characterizing a set A, the et function $F(g)$ characterizes the set $A \cap B$.

Non-intersective adjectives

Jan is a skillful surgeon & Jan is a violinist

=/=> *Jan is a skillful violinist*

Conclusion 1: *skillful* is not intersective.

However, skillful has a weaker property, which we call restrictivity.

Jan is a skillful surgeon

==> *Jan is a surgeon*

Formally: ***M is restrictive (or "subsective") if for every set of entities A,*** **M(A) ⊆ A.**

Conclusion 2: *skillful* is restrictive.

In Lambdas:

$\mathbf{skillful}_{(et)(et)} = \lambda A.\ \lambda y.\ (\mathbf{skillful1}_{(et)(et)}(A))(y) \wedge A(y)$

More non-intersective, restrictive adjectives

typical, recent, good, perfect, legendary.

See Partee's paper

Non-restrictive adjectives

Jan is an alledged surgeon

=/=> *Jan is a surgeon*

Conclusion: *alleged* is not restrictive.

More examples (Partee):

potential, alleged, arguable, likely, predicted, putative, questionable, disputed.

Co-restrictive adjectives

This is a false diamond
=/=> *This is a diamond*

Conclusion 1: *false* is not restrictive.

However:
This is a false diamond
➔ *This is not a diamond*

Conclusion 2: *false* is co-restrictive.

Formally: M is *co-restrictive* (or "privative") if for every set of entities A, M(A) ⊆ E-A.

More co-restrictive adjectives (Partee)

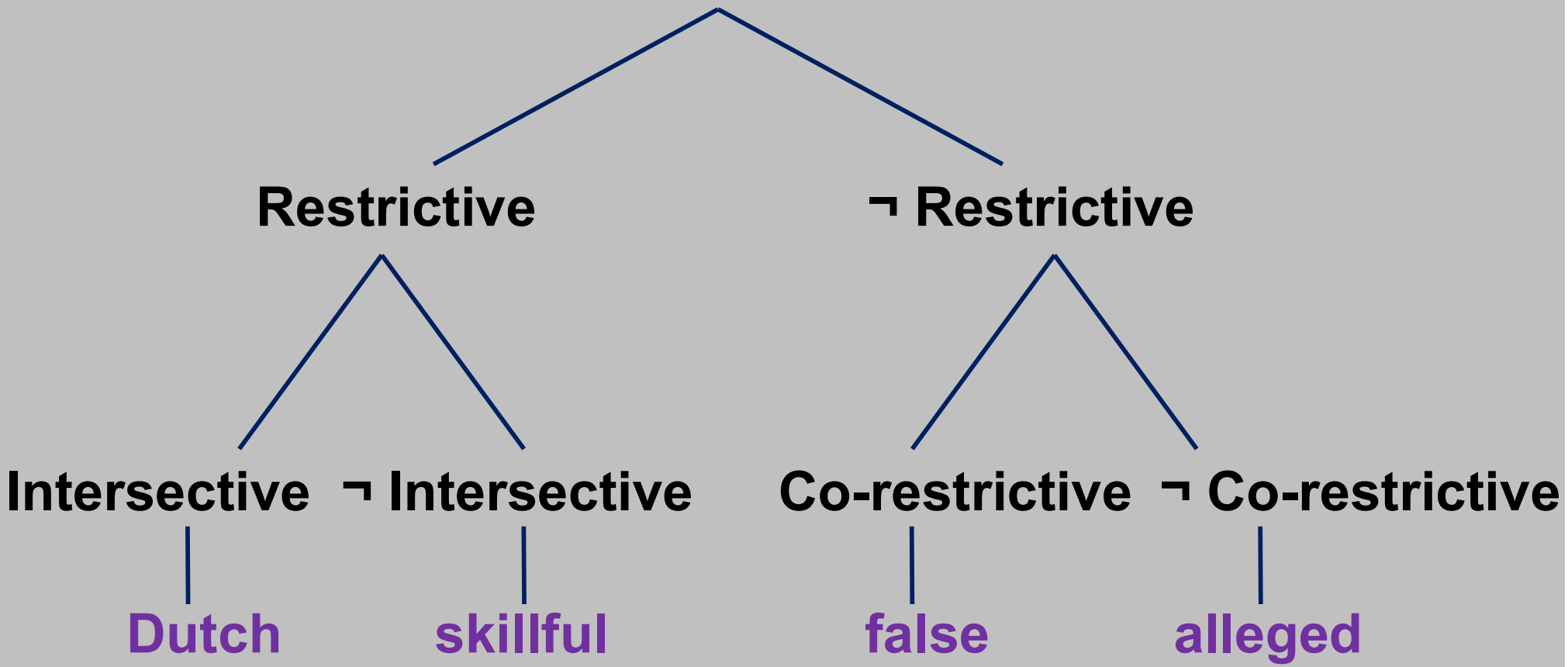
non-subsective and privative: *wouldbe, past, spurious, imaginary, fictitious, fabricated* (in one sense), *mythical* (maybe debatable); there are prefixes with this property too, like *ex, pseudo, non*.

Note:

John is an alleged criminal, and indeed he is a criminal.

Conclusion: *alleged* is not co-restrictive.

Adjectives - summary



Intersective ➔ Restrictive

Co-restrictive ➔ ¬Restrictive (ignoring trivial cases)

These properties can be generalized (and studied) for modifiers of other types besides (*et*)(*et*).

Adverbial Modifiers

Adverbials – similarity to adnominals

	Adnominals	Adverbials
Adjectives/ Adverbs	*fast cars*	*ate fast*
Preposition Phrases	*houses in England*	*ate in England*
Relative Clauses	*houses where I lived*	*ate where I lived*

Question: Can we treat adverbials as intersective modifiers?

Common answer:

- Surely not as (et)(et) modifiers.
- But we can treat them as intersective (e(et))(e(et)) modifiers, using the notion of **events.**

Intersective entailments with adjectives

Attributive/predicative alternation:

Mary is a Dutch woman ⇐⇒
Mary is Dutch and Mary is a woman

Permutation:

Mary is a Dutch pregnant woman ⇐⇒
Mary is a pregnant Dutch woman

Replacement of noun:

Jan is a Dutch surgeon & Jan is a violinist
→ *Jan is a Dutch violinist*

These entailments are all explained by the treatment of *Dutch* as an (*et*)(*et*) intersective modifier.

Intersective entailments with adverbials?

Attributive/predicative alternation (?):

Mary dug under the castle / quickly ←??→
Mary dug and Mary was under the castle / quick

Permutation (yes!):

Mary dug quickly under the castle ←→
Mary dug under the castle quickly

Replacement of verb (no!):

Jan ran quickly / in the park & Jan ate
=/=> *Jan ate quickly / in the park*

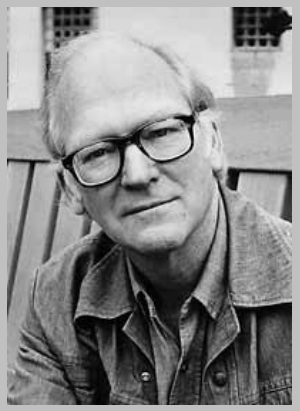
Conclusion: it's hard to treat adverbials as intersective (et)(et) modifiers.

Approaches to adverbial modifiers

1. **Montague:** Non-intersective modifiers!

2. **Davidson:** Intersective modifiers of covert argument positions.

Davidson's insight



Davidson, D. (1967). The logical form of action sentences. In N. Rescher (Ed.), *The Logic of Decision and Action* (pp. 81-96). University of Pittsburgh Press.

Donald Davidson
(1917-2003)

Mary dug quickly under the castle

$= \exists \mathbf{e}.\ \mathit{dig}(\mathbf{m},\mathbf{e}) \wedge \mathit{quick}(\mathbf{e}) \wedge \mathit{under\_the\_castle}(\mathbf{e})$

- Using events, we can treat verb modification as involving conjunction, similar to intersective modification of nouns.

Davidson's event argument

A verbal predicate has a covert semantic argument, just like nouns do

Noun denotations:

cat: *et* no syntactic argument corresponds to *e*

Intransitive Verb denotations (Montague):

sing: *et* subject argument corresponds to *e*

Intransitive Verb denotations (Davidson):

sing: *e*(*et*) subject argument corresponds to *e*

no syntactic argument corresponds to *e*

This *e* is the "event" argument!

Questions for Davidson

1- How to think of the denotation of verbs?

sing: *et* = the set of singers

sing: *e*(*et*) = the binary relation between singers and singing events

[[sing]](*x*)(*y*) =1 iff *x* sings in the event *y*

2- How to think of the denotation of adverbs?

Intersective modifiers of the event argument!

3- How do we modify the event argument?

Adjectives with relational nouns

beautiful:

predicative $[\![beautiful]\!] = B \subseteq E$

attributive $[\![beautiful]\!] = \mathbf{beautiful} : \wp(E) \to \wp(E)$

For every set $X \subseteq E$:

$\mathbf{beautiful}(X) = B \cap X$

beautiful girl:

$[\![beautiful\ girl]\!] = \mathbf{beautiful}(G) = B \cap G$

'girl' = Unary relation

beautiful friend of Mary:

$[\![friend]\!] = \mathbf{friend} : E \to \wp(E)$

$[\![of\ Mary]\!] = \mathbf{m} \in E$

$[\![friend\ of\ Mary]\!] = \mathbf{friend}(\mathbf{m}) \subseteq E$

$[\![beautiful\ friend\ of\ Mary]\!] = B \cap \mathbf{friend}(\mathbf{m}) \subseteq E$

'friend' = Binary relation

Adverbs with verbs

beautiful friend of Mary:

$$[\![\textit{friend}]\!] = \textbf{friend} : E \to \wp(E)$$

$$[\![\textit{of Mary}]\!] = \mathbf{m} \in E$$

$$[\![\textit{friend of Mary}]\!] = \textbf{friend}(\mathbf{m}) \subseteq E$$

$$[\![\textit{beautiful friend of Mary}]\!] = B \cap \textbf{friend}(\mathbf{m}) \subseteq E$$

'friend' = Binary relation

Mary sang beautifully:

$$[\![\textit{sang}]\!] = \textbf{sing} : E \to \wp(E)$$

$$[\![\textit{Mary}]\!] = \mathbf{m} \in E$$

$$[\![\textit{Mary sang}]\!] = \textbf{sing}(\mathbf{m}) \subseteq E$$

$$[\![\textit{Mary sang beautifully}]\!] = B \cap \textbf{sing}(\mathbf{m}) \subseteq E$$

$$= \text{“the beautiful events in which Mary sang”}$$

'sang' = Intrans. verb = Binary relation

Intersective adverbials formally

Let *M* be a modifier function of type (e(et))(e(et)).
➔ *M* sends any binary relation over entities *R* to binary relation over entities *M*(*R*).

We say that M is "intersective on an argument **a**" if modification is based on intersection with some set of enities X with that argument.

Formally: M is *a2-intersective* if there is a set of entities X such that for every binary relation over entities R –

$M(R) = \{ \langle x,y \rangle \mid y \in X \ \& \ \langle x,y \rangle \in R \}$

Intersective adverbials in lambda's

$$\mathbf{M}^{X}_{(e(et))(e(et))} = \lambda R_{e(et)}.\lambda x_e.\lambda y_e.X(y) \wedge R(x)(y)$$

Example: *Mary sang beautifully*

$$\mathbf{beautifully}_{(e(et))(e(et))} = \lambda R_{e(et)}.\lambda x_e.\lambda y_e.\mathbf{B}(y) \wedge R(x)(y)$$

$[\![sang\ beautifully]\!]$

$= \mathbf{beautifully}(\mathbf{sing})$

$= \lambda x_e.\lambda y_e.\mathbf{B}(y) \wedge \mathbf{S}(x)(y)$

$[\![Mary\ sang\ beautifully]\!]$

$= (\mathbf{beautifully}(\mathbf{sing}))(\mathbf{m})$

$= \lambda y_e.\mathbf{B}(y) \wedge \mathbf{S}(\mathbf{m})(y)$

= "the beautiful events in which Mary sang"

Questions for Davidson (cont.)

4- How does a sentence with a Davidsonian event argument receive its denotation?

Existential closure: Any set of events *Y* can be mapped to the truth-value $\exists x.Y(x)$.

$$[\![\textit{Mary sang beautifully}]\!]$$
$$= (\mathbf{beautifully}(\mathbf{sing}))(\mathbf{m})$$
$$= \lambda y_e.\mathbf{B}(y) \wedge \mathbf{S}(\mathbf{m})(y)$$
$$= \text{“the beautiful events in which Mary sang”}$$

After existential closure

$$[\![\textit{Mary sang beautifully}]\!]$$
$$= \exists y_e.\mathbf{B}(y) \wedge \mathbf{S}(\mathbf{m})(y)$$
$$= \text{“there is a beautiful event in which Mary sang”}$$

Entailments with adverbials (1)

Permutation:

John sang beautifully in the shower ⇐⇒
John sang in the shower beautifully

Replacement of verb (no!):

Jan ran quickly / in the park & *Jan ate*
=/=> *Jan ate quickly / in the park*

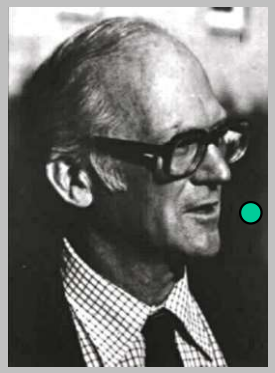
Entailments with adverbials (2)

Attributive/predicative alternation (?):

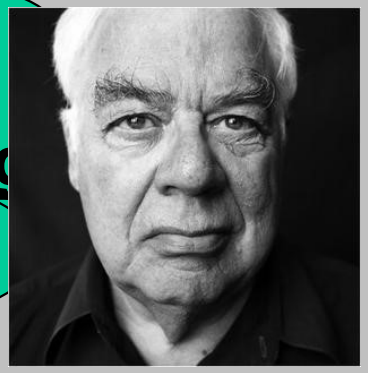
John sang beautifully ←??→
John sang and John was beautiful

But note:

John sang beautifully ←→
John sang and **John's singing** was beautiful



Elementary, my dear
linguist: **John's singing**
is my mysterious event



From a conversation with Richard Rorty:

https://www.youtube.com/watch?v=EjWTuF35GtY

Event nominals

singing = the set of events in which someone sang

Formally:

$$[[\,sang\,]] = S \subseteq E^2$$

$$[[\,singing\,]] = \{x : \exists y.S(y)(x)\} \subseteq E$$

This accounts for entailments like:

John sang ➔ There was a singing (event)

Or more naturally:

John destroyed the city

➔ There was a destruction (of the city) (by John)

Radical "Neo-Davidsonian" approach

Jones buttered the toast in the bathroom with the knife at midnight.

Davidsonian event-based proposition:

∃e [BUTTER (jones, the toast, e) & IN (e, the bathroom) & INSTR (e, the knife) & AT (e, midnight)]

Neo-Davidsonian approach – radical interpretation:

- Verbs denote one-place predicates over events (type *et*). No room for thematic argument slots in verbal denotations!
- The thematic argument slots are generated by syntax.

∃e [BUTTER (e) & AGENT (e, jones) & PATIENT (e, the toast) & IN (e, the bathroom) & INSTR (e, the knife) & AT (e, midnight)]

No distinction between adjuncts and complements in semantics!

Moderate "Neo-Davidsonian" approach

Decompositional Davidsonian entries:

to close: $\lambda y\, \lambda x\, \lambda e$ [CLOSE (e) & AGENT (e, x) & THEME (e, y)]

to close: $\lambda y\, \lambda x\, \lambda e$ [AGENT (e, x) & THEME (e, y) & $\exists$e' [CAUSE (e, e') & THEME (e', y) & $\exists$s [BECOME (e', s) & CLOSED (s) & THEME (s, y)]]]

An advantage of the radical view

Unaccusatives vs. Passives:

John fell =/=> Something felled John

John was felled ==> Something felled John

The door closed =/=> Something closed the door

The door was closed ==> Something closed the door

Carlson:

CLOSE = predicate characterizing the set of events in which something closed

[[*close*-UNACC]] =

$$\lambda x.\lambda e.CLOSE(e) \wedge theme(e,x)$$

[[*close*-PASS]] =

$$\lambda x.\lambda e.CLOSE(e) \wedge theme(e,x) \wedge \exists y.agent(e,y)$$

A disadvantage of the radical view

Dowty:

- Any event of *selling* is an event of *buying*.
- Thus, corresponding sets of events satisfy

SELL = BUY.

- How can we reconstruct the right argument structure with thematic arguments for active transitive verbs like sell and *buy*?

Note:

X sells Y to Z ⟷ *Z buys Y from X*

Reason to doubt the radical view.

Further reading

General Overview

Claudia Maienborn, Event semantics, in Claudia Maienborn, Klaus von Heusinger & Paul Portner (eds.), Semantics. An international handbook of natural language meaning; Volume 1. (HSK Handbook series), Berlin, New York: Mouton de Gruyter.
http://www.uni-tuebingen.de/fileadmin/Uni_Tuebingen/SFB/SFB_833/A_Bereich/A1/Maienborn-2010-HSK_Event_semantics.pdf

Radical Neo-Davidsonian approach

Carlson, G. (1984). Thematic Roles and their Role in Semantic Interpretation. Linguistics 22, pp. 259-279.
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.189.2471&rep=rep1&type=pdf

Events and compositionality

David Dowty, The Dual Analysis of Adjuncts and Complements in Categorial Grammar", in Modifying Adjuncts, ed. Lang, Maienborn, and Fabricius-Hansen, de Gruyter, 2003.
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Yoad Winter and Joost Zwarts. Event semantics and Abstract Categorial Grammar. In Makoto Kanazawa and others, editors, Proceedings of Mathematics of Language, MOL12, Lecture Notes in Artificial Intelligence, LNAI, pp. 174–191, Springer-Verlag, Berlin, 2011.
http://www.phil.uu.nl/~yoad/papers/WinterZwartsEventSemantics.pdf