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# Terence Parsons (1990) : Events in the Semantics of English, A Study in Subatomic Semantics

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Martha Palmer

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# “Terminology”

$\rightarrow$  : Conditional if/then statement

$\exists$  : Existential quantifier, “a, an”

$\neg$  : Negation operator

$\&$  : ( $\wedge$ ) Conjunction operator

$(x)$  : ( $\forall$ ) “Every, all”  $(x)(\text{Person}(x)\dots)$

e.g. If  $a$  is a linguist,  $a$  is a scholar

$\text{Ling}(a) \rightarrow \text{Schol}(a)$

e.g. There is a linguist who is not a scholar

$\exists x(\text{Ling}(x) \wedge \neg \text{Schol}(x))$

PENGUINS ARE BLACK AND WHITE.  
SOME OLD TV SHOWS ARE BLACK AND WHITE.  
THEREFORE, SOME PENGUINS ARE OLD TV SHOWS.



# Background Assumptions

- Davidson (1967) verbs stand for kinds of events
- Verbs are like common nouns rather than proper nouns
- Thus, ‘hit’ is a kind of action, or event
- $(\exists e)$  [hitting (e)]
- There is an event and it’s a hitting event (with particular hittings as its instances)
- Panini (4th century BC), Davidson (1967)

# Subatomic Semantics

- Purpose: investigate *subatomic* structure of atomic formulas of English that other studies take as their inputs; investigate the the structure of the *constants* in more detail
- Subatomic level: three things blatantly present in English sentence--subject, verb, and tense--become separate conjuncts constraining the event
- Assumes “underlying quantification” over events

# Atomic vs. Subatomic

- “Caesar died”
- Atomic: “textbook logic”

$D(c)$

where  $D = \text{died}$  and  $c = \text{Caesar}$

- Parsons Subatomic representation:

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# Advantages of Parsons Representation

Can account for...

- Logic of modifiers
- Semantics of perception statements
- Semantics of causatives and inchoatives
- Relations between explicit/ implicit references

Other advantages: thematic roles, tense & eventuality types

# Representing Tense & “Eventuality” Types

- Theory employs distinction between eventuality’ s *culminating* and *holding*
- $Cul(e,t)$ : e is an event that culminates at time t (t can represent tense)
- $Hold(e,t)$ : e is a state that holds at time t



# Representing Tense & “Eventuality” Types

- Accomplishment-Events: + Cul(e,t)
- Achievement-Events: + Cul(e,t)
- States: + Hold(e, t)
- “Mary knows Fred”  
 $(\exists e)[\text{Knowing}(e) \ \& \ \text{Subject}(e, \text{Mary}) \ \& \ \text{Object}(e, \text{Fred}) \ \& \ \text{Hold}(e, \text{now})]$ .
- “Mary built the bookcase”  
 $(\exists e)[\text{Building}(e) \ \& \ \text{Subject}(e, \text{Mary}) \ \& \ \text{Object}(e, \text{the bookcase}) \ \& \ (\exists t)[t < \text{now} \ \& \ \text{Cul}(e, t)]]$ .
- These features allow Parsons to represent both tense and a distinction between state and event

# Adding Thematic Relations

- We can use syntactic assumptions (p. 69) to make semantic assumptions:

*Assumptions Involving Thematic Roles:*

4. In an active sentence, if an Agent is present it must be the subject; in a passive sentence, if an Agent is present it is marked with 'by'.
5. If a Theme is present with an Agent, the Theme must be the direct object in an active sentence and the subject in a passive sentence.
6. If an Instrument is present, it is marked with 'with' (unless it is the subject, in which case it is unmarked).

# Adding Thematic Relations

- With these assumptions, we can add thematic roles such as “agent” and “patient” to event representation
- “Brutus stabs Caesar”

Was:  $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Cul}(e) \ \& \ \text{Subj}(e,B) \ \& \ \text{Obj}(e,C)]$

Now:

$(\exists e)[\text{Stabbing}(e) \ \& \ \text{Cul}(e) \ \& \ \text{Agent}(e,B) \ \& \ \text{Theme}(e,C)].$

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# Benefits of Thematic Roles

- Allows us to posit relationships between syntax and semantics
- Allows us a cross-verbal comparison of relations between events and their participants
- Is an “agent” the same when used with different verbs?

# Davidson vs. Parsons

- “Brutus stabbed Caesar with a knife”
- Davidson (“Incorporation Analysis”):  
 $(\exists e)[\text{Stabbing}(e, \text{Brutus}, \text{Caesar}) \ \& \ \text{With}(e, \text{knife})]$ .
- Parsons (“Independent Conjunct”):  
 $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Agent}(e, \text{Brutus}) \ \& \ \text{Theme}(e, \text{Caesar}) \ \& \ \text{With}(e, \text{knife})]$ .
- Note “with” remains unique in both: adjuncts vs. arguments; to incorporate or not to incorporate?

# Core vs. Adjunct

- Davidson suggests reducing number of places of underlying verbal predicate to smallest number that will yield complete sentence
- This is debatable: Does stab require only an agent and an instrument?

Brutus stabbed Caesar with the knife =

$(\exists e)[\text{Stabbing}(e, \text{Brutus}, \text{knife}) \ \& \ \text{Theme}(e, \text{Caesar})]$ ,

# Core vs. Adjunct: More Problems

- A transformation from “Brutus stabbed Caesar in the back,”  
 $(\exists e)[\text{Stabbing}(e, \text{Brutus}, \text{Caesar}) \ \& \ \text{In}(e, \text{back})]$
- to “Brutus stabbed”  
 $(\exists e)[(\exists y)\text{Stabbing}(e, \text{Brutus}, y)]$ .
- Latter requires that Brutus stabbed *something*, he couldn't have missed

# The Dream Machine

- Should representation correspond to “reality” or an utterance?
- *In a dream last night, I was stabbed, although in fact nobody had stabbed me and I wasn't stabbed with anything*
- Dream may be incoherent, but utterance is not; therefore, utterance should not contain a self-contradictory logical form
- Missing NPs are genuinely missing; this is not a defect



# The Dream Machine

- I was stabbed, although in fact nobody had stabbed me and I wasn't stabbed with anything
- Thus, although this representation reflects reality:
- It contradicts  $\forall (e)[\text{Stabbing}(e) \rightarrow (\exists x)\text{With}(e,x)]$
- Thus, there are no “core” roles that should leave a placeholder constant in the representation

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# Thematic Roles Summary

- The addition of thematic roles allows us to identify what role each independent conjunct is playing with respect to the verb
- Independent conjuncts are necessary in lieu of a verb with placeholders because no particular roles are “required” for a verb

# Modifiers

- What do we need to account for?
  - A Brutus stabbed Caesar in the back with a knife.
  - B Brutus stabbed Caesar in the back.
  - C Brutus stabbed Caesar with a knife.
  - D Brutus stabbed Caesar.
- 1. (A) entails (B), (C), (D), but not vice versa
- 2. (B) and (C) together do not entail (A)
- 3. How do we handle scope ambiguity?

# 1. Correct Entailments

- Logic textbook version:

x stabbed y	Sxy
x stabbed y violently	Vxy
x stabbed y with z	Wxyz
x stabbed y violently with z	Gxyz

- To represent ‘x stabbed y violently with z’ w/o problems of modifier scope we could combine:  
Sxy & Vxy & Wxy
- Incorrectly entails that if Brutus stabbed Caesar violently and also stabbed him with a knife, he must have stabbed him violently with a knife

# 1. Entailments

- Correct entailments represented when modifiers are separate conjuncts:
  1.  $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y)]$
  2.  $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y) \ \& \ \text{violent}(e)]$
  3.  $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y) \ \& \ \text{with}(e,z)]$
  4.  $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y) \ \& \ \text{violent}(e) \ \& \ \text{with}(e,z)]$
  
- With quantification over events as seen above, Parsons has the ability to distinguish between a single event where “Brutus stabs Caesar violently with a knife,” and “Brutus stabs Caesar violently (with an icepick) and (then) with a knife”

## 2. Scope of Modifiers

- Traditional “operator approach” requires that one modifier take scope over another:

[with z (violently (stabbed (y)))](x)

- Entails: violently (stabbed (y))(x)
- Doesn't entail: with (z, stabbed (y))(x)

## 2. Scope of Modifiers

- AND there is no evidence that modifiers truly have scope
- Operator approach requires neutralization of modifier scope ambiguity
- Parsons approach: alternative scope readings are logically equivalent:  
 $(\exists e)[\text{Stabbing}(e) \ \& \ \text{Subj}(e,x) \ \& \ \text{Obj}(e,y) \ \& \ \text{Violent}(e)].$
- Thus, Parsons approach predicts correct entailments and does not involve modifier scope

# Semantics of Perception Statements

- Perceptual Idioms:

*Mary saw Brutus stab Caesar.*

- Traditionally, must be represented as:

*Mary saw Brutus & Brutus was stabbed*

- Confusing temporal relations: how do we represent that the *seeing* event coincided with *stabbing* event, which was thing seen?



# Semantics of Perception Statements

Mary saw Brutus stab Caesar

- Easily handled by Parsons representation, where the object of perceiving event can be another event:

$(\exists e)[\text{Seeing}(e) \ \& \ \text{Subj}(e, \text{Mary}) \ \& \ (\exists e')[\text{Stabbing}(e') \ \& \ \text{Subj}(e', \text{Brutus}) \ \& \ \text{Obj}(e', \text{Caesar}) \ \& \ \text{Obj}(e, e')]]$ .

# Semantics of Causatives & Inchoatives

Trans.	Intrans.	Adjective	Sample Transitive Use
fell	fall	fallen	"fell the tree"
cool	cool	cool	"cool the soup"
break	break	broken	"break the window"
burn	burn	burnt	"burn the wood"
close	close	closed	"close the door"
harden	harden	hard	"harden the metal"
awaken	awaken	awake	"awaken the child"
fill	fill	full	"fill the tank"
melt	melt	molten	"melt the wax"
alert	—	alert	"alert the burglar"
solidify	solidify	solid	"solidify the emulsion"
brighten	brighten	bright	"brighten the color"
redden	redden	red	"redden the solution"
lighten	lighten?	light	"lighten the load"
randomize	—	random	"randomize the digits"
dirty	—	dirty	"dirty the rug"

- What representation links TV, IV, and ADJ?

# Semantics of Causatives & Inchoatives

- “Mary flew the kite” = Mary did something that caused the flying of the kite

$(\exists e)[\text{Agent}(e, \text{Mary}) \ \& \ \text{Cul}(e) \ \& \ (\exists e')[\text{Flying}(e') \ \& \ \text{Cul}(e') \ \& \ \text{Theme}(e', \text{kite}) \ \& \ \text{CAUSE}(e, e')]]$ ,

- This logically entails the intransitive version, “The kite flies”

$(\exists e')[\text{Flying}(e') \ \& \ \text{Cul}(e') \ \& \ \text{Theme}(e', \text{kite})]$ .

- This representation posits two events: the causing event and the flying event

# Other approaches to Causative

- Do causatives require positing two events?
- The causative, with an agent, could be viewed as merely a difference of optional cases:
- “Mary closed the door” vs. “The door closes”

$(\exists e)[\text{Closing}(e) \ \& \ \text{Cul}(e) \ \& \ \text{Theme}(e,\text{door}) \ \& \ \text{Agent}(e,\text{Mary})]$

versus

$(\exists e)[\text{Closing}(e) \ \& \ \text{Cul}(e) \ \& \ \text{Theme}(e,\text{door})].$

# Other approaches to Causative

- “One-event” approach fails to account for modifiers that seem to modify either the causing event or the verb event

- Mary flew her kite behind the museum

1 event:  $(\exists e)[\text{Flying}(e) \ \& \ \text{Agent}(e, \text{Mary}) \ \& \ \text{Theme}(e, \text{kite}) \ \& \ \text{Behind}(e, \text{museum})]$ .

2 events:  $(\exists e)[\text{Agent}(e, \text{Mary}) \ \& \ (\exists e')[\text{Flying}(e') \ \& \ \text{Theme}(e', \text{kite}) \ \& \ \text{Behind}(\text{—————}, \text{museum}) \ \& \ \text{CAUSE}(e, e')]$ ,

- 2 event approach appropriately represents causatives, inchoatives

# Relations between explicit/ implicit references

- Events can be referred to in different ways, e.g. as nominal gerund vs. verb

\_\_\_\_\_└ explicit reference to an event

A After the singing of the *Marseillaise* they saluted the flag

B After the *Marseillaise* was sung they saluted the flag.

- Nominal gerund contribute same predicates to logical form as verb counterpart:

A'  $(\exists e)[\text{Saluting}(e) \ \& \ \text{Subj}(e, \text{them}) \ \& \ \text{Obj}(e, \text{the flag}) \ \& \ \text{After}(e, \text{SM})]$ ,

where 'SM' is '(the e')(Singing(e') & Obj(e', the M))'.

- Therefore, we have captured underlying relationship between nominal and its verb counterpart

B'  $(\exists e)[\text{Saluting}(e) \ \& \ \text{Subj}(e, \text{them}) \ \& \ \text{Obj}(e, \text{the flag}) \ \& \ (\exists e')(\text{Singing}(e') \ \& \ \text{Obj}(e', \text{the } M) \ \& \ \text{After}(e, e'))]$ .

# Advantages of Parsons Representation

Can account for...

- Tense & Eventuality types (events vs. states)
- Thematic roles included
- Logic of modifiers: independent conjuncts
- Semantics of perception statements: second event object of first event
- Semantics of causatives and inchoatives: two events (causing event and verb event)
- Relations between explicit/ implicit references: same predicate logic for nominals as verbs

# In Closing...



## Davidson

1. Verb alone does not describe single act
2. Multi-place predicates
3.  $\exists(x)(\text{Kicked}(\text{Bob}, \text{Sue}(x)))$
4. Thematic roles?
5. “Missing” args leave existential constant
6. Buttering? Causatives are a problem...
7. Slowly? Attributives are a problem



## Parsons

1. Agreed: kind of action
2. No pre-defined places
3.  $(\exists e)[\text{kicked}(e) \ \& \ \text{Agent}(e, \text{Bob}) \ \& \ \text{Patient}(e, \text{Sue})]$
4. Thematic roles!
5. Missing args are *gone*
6. Causatives have two events
7. That's a *sentence* modifier, but check out my other modifiers!



# The End



Julius Caesar is Assassinated in the Senate by Brutus and His Companions  
by [Hermann Vogel](#)