Chapter 5: Event Semantics

Consider the following influential example from Donald Davidson:

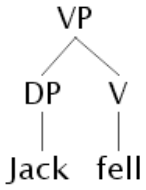
(1) Jones buttered the toast slowly with a knife in the bathroom at midnight.

What does '*slowly*', '*with a knife'*, '*in the bathroom*' and *'at midnight'* share in common? Well, according to Davidson, these expressions are all predicates of **events.** That is, '*slowly*' describes the manner in which the buttering event unfolded; '*with a knife'* describes the instrument used in the buttering event; '*in the bathroom*' describes the location of the buttering event; *'at midnight'* describes the time of the buttering event. How else are we to make sense of these expressions if not with reference to events? And how can we make sense of the fact that (1) entails (2)-(5) below if not with reference to events? Similarly for the entailment from (2) to (3)-(5), (3) to (4)-(5) and (4) to (5)?

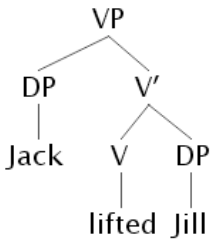
(2) Jones buttered the toast with a knife in the bathroom at midnight.
(3) Jones buttered the toast in the bathroom at midnight.
(4) Jones buttered the toast at midnight.
(5) Jones buttered the toast.

5.1 Events and Thematic Roles

Recall that our grammar makes the following logical form assignments:



fell(jack)



lifted(jack, jill)

These logical forms fail to capture the intuition that verbs like '*lift*' and '*fall*' describe events in the same way that '*buttered*' describes an event in (1). The goal in this chapter is to modify the grammar to try to capture that intuition, as well as the intuition that expressions like '*slowly*', '*with a knife'*, '*in the bathroom*' and *'at midnight'* are intricately related to the event described by the verb that these expressions modify. Ultimately what we'll want are rules that assign logical forms to verbs, as well as adverbs and prepositional phrases.

We start with verbs, which means that we would like to have a rule that assigns logical forms of the following kind:

the logical forms: **fell**(e) **lifted**(e)

where 'e' is a variable over events and where we understand the first logical form to be true if e is a falling event and the second to be true if e is a lifting event.

If a verb describes a given event, then the DP arguments of that verb describe participants in that event. For example, in the sentence

(6) Jack fell

the verb describes an event of falling and we understand Jack to be a participant in that event of falling. So the presence of the DP '*Jack'* in (6) should lead to a logical form that includes a statement indicating that Jack was a participant in the event. Once we consider transitive verbs, it becomes clear that sentences encode something more specific than just participation. Suppose Jack lifted Jill, then there was an event of lifting and Jack and Jill were the participants in that event. Similarly, if Jill lifted Jack, there was an event of lifting and Jack and Jill were the participants in that event. But these events are different and the language distinguishes them. The sentence:

(7) Jill lifted Jack

tells us not only that Jill participated, but also how she participated. It tells us what **role** Jill played as compared with Jack. In this case, Jill is the one who is actively doing something; she controls the event, in a sense, while Jack is having something done to him. We say that Jill is the **agent** of the event and Jack is the **patient** of the event.[1] In other words, (7) tells us:

(8) There was an event e:
Jill is the agent of e, Jack is the patient of e and e is an event of lifting.

To encode statements like '*Jill is the agent of e*' in our logical form we'll write:

(9) AGT(e, **jill**)

To encode statements like '*Jack is the patient of e*' in our logical form we'll write:

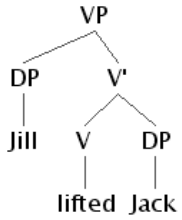
(10) PAT(e, **jack**)

So we can rewrite (8) as (11):

[1] Think of the noun 'patient' as in "the doctor examined the patient" – the doctor is doing something, the patient is having something done to him or her.

(11) ∃e (AGT(e, **jill**) & (PAT(e, jack) & **lift**(e)))

That statement captures the meaning of '*Jill lifted Jack*' in a way that is faithful to the intuition that *'lift*' describes events. And so, for example, when we get around to writing rules for interpreting VPs, the logical form for the structure:



will include the statement 'AGT(e, **jill**)' and that statement will come from applying a rule to the subject of the VP.

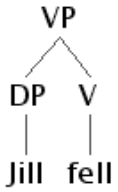
ABBREVIATION
It will be convenient to introduce an abbreviation into the way we write formulas of the symbolic logic. It follows from our semantic rules that the following sentences are logically equivalent:

(12) ((Ca & Kb) & Ac) ≡ (Ca & (Kb & Ac))

In general, the order in which you conjoin 3 or more sentences doesn't affect truth conditions. So, to reduce clutter, when we conjoin several statements we'll leave off the middle parentheses. With that abbreviation, (11) will be written as:

(13) ∃e (AGT(e, **jill**) & PAT(e, **jack**) & **lift**(e))

Above we concluded then that the subject of the verb '*lift*' describes the agent of the lifting. But not every sentential subject describes the agent of the event described by the verb. In the sentence:



'*Jill*' is the subject of the sentence, but Jill need not be an agent of an event of falling in which she participates. Above we observed that '*Jill lifted Jack*' says that Jill is actively

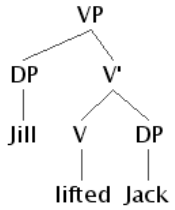
doing something. More precisely, she undertakes willful activity within the event and without that activity the event would not occur. That's very different from what happens when she falls. She could intentionally fall, but falling per se doesn't require that. The sentence '*Jill fell*' doesn't say that Jill is the agent, rather it says that Jill is the patient and we have:

(14) ∃e (PAT(e, **jill**) & **fall**(e))

The verb *fall* is intransitive: it takes only one DP argument. As the formula above indicates, the DP subject of '*fall*' describes the patient in the event of falling. There are other intransitive verbs whose subject describes an agent. Suppose Jill is swimming. In that case, she is actively controlling the event. And so we capture the meaning of '*Jill swim*' with the formula[2]:

(15) ∃e (AGT(e, **jill**) & **swim**(e))

To some extent then, it seems that which role a DP describes is determined by the verb. This gives rise to the idea that a verb assigns a role to its argument. These roles are called ***thematic roles*** or **θ-roles** ('θ' is pronounced theta). And we might say the verb *fall* assigns its subject the Patient role, while the verb *swims* assigns its subject the Agent role. But there is reason to believe that assignment of θ-roles is not completely up to the verb. Above we associated the transitive clause:



with the symbolic logic sentence:

(16) ∃e (AGT(e, **jill**) & PAT(e, **jack**) & **lift**(e))

This captures the following facts about the sentence '*Jill lifted Jack*':

- It describes an event.
- The subject-DP describes the agent of the event and the object-DP describes its patient.

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[2] A verb like '*fall*', whose subject describes a patient, is called an "unaccusative verb". A verb like '*swim*', whose subject describes the agent, is called an "unergative verb". Although there is no obvious connection between the word '*unergative*' and the idea of an agentive subject, the term is nevertheless used. For a different approach to the terminology, see:

van Valin, Robert (1990), 'Semantic Parameters of Split Intransitivity'. *Language* 66(2): 221-260. Available at: http://www.jstor.org/stable/414886

It turns out to be very hard, if not impossible, to find a verb that works in the opposite way: where the subject describes the patient and the object describes the agent. This is true of English and corresponding facts hold across a wide variety of languages. Two possibilities suggest themselves, outlined in (17)-(18):

(17) This could be a constraint on how verbs are allowed to assign thematic roles.

(18) This could be taken to indicate that some θ-roles are the result of a syntactic configuration itself, regardless of what the verb is.

On the option in (18), in the tree above, '*Jill*' denotes the agent of the lifting because of where that DP occurs in the structure. Both options are pursued in current research and so from now on, we'll refer to "the thematic role assigned to the DP", remaining neutral on how or what does the assigning. We'll use capitalized words to name the θ-roles that are assigned, for example 'Agent'.

EXERCISE A

Can you find a sentence of English of the form NAME VERB NAME in which the object is understood to be the agent of the event described by the verb?

Up to this point, we have considered two θ-roles: Agent and Patient. But there are other types of thematic roles that are linguistically relevant. We'll discuss just a few of them.

Di-transitive verbs can combine with three argument-DPs: subject, object and indirect object. There are at least two sorts of indirect objects, ones in which the indirect object can be paraphrased with '*to*' and ones in which it can be paraphrased with '*for*':

(19) He sold her a watermelon = He sold a watermelon to her
(20) They threw her a party = They threw a party for her

These typically are thought to require two additional thematic roles: Goal for (19) and Benefactive for (20). In our logical forms we'll use BEN and GOAL for these θ-roles.

EXERCISE B

Consider the following generalizations about the assignment of θ-roles in simple transitive and intransitive clauses:

(i) If a DP describes an agent, that DP will be the subject of the sentence.
(ii) If a DP describes a patient and no DP describes an agent, then the Patient-DP will be the subject of the sentence.
(iii) If a DP describes a patient and another DP describes an agent, the Patient-DP will be the object of the sentence.

1. For each generalization, give a sentence of English that exemplifies the generalization. Choose a sentence of the form NAME VERB or NAME VERB NAME. Underneath each sentence,

write a sentence of symbolic logic that indicates how the θ-roles are assigned, following the pattern used in the text above.

2. Try to come up with counterexamples to the generalizations – that is, sentences of the form NAME VERB or NAME VERB NAME, that violate one of the generalizations. Underneath each counterexample, write a sentence of symbolic logic that indicates how the θ roles are assigned.

3. Does generalization (iii) add anything that is not already in generalizations (i-ii)? Justify your answer.

✪ IMPORTANT ✪
If you are having trouble deciding whether a given DP denotes an agent or a patient (or neither), don't get frustrated. Try to state the source of your uncertainty.

EXERCISE C

Here is a summary of the two thematic roles discussed above.

• Agent: initiator or doer in the event

• Patient: affected by the event, or undergoes the action

Here are five other thematic roles that are often assumed in semantic theorizing:

• Goal: location or entity toward which movement (sometimes abstract) occurs.
• Source: location or entity from which movement (sometimes abstract) occurs.
• Instrument: entity used to perform an action
• Benefactive: The entity that benefits from the action or event.
• Location: where the event takes place

For each thematic role listed in this exercise, provide a sentence of English that has a DP that is assigned that role. Underline the DP and write the name of the role below it. You can use the same sentence more than once if it has more than one DP in it.

KEY IDEAS

- Verbs describe events.
- Sentences describe the roles of the participants of the event.
- The subject-DP of many transitive verbs describes its agent and the object-DP describes its patient. However, there are no verbs that work in the opposite way.
- Here are two hypotheses that explain this asymmetry: (a) there is a constraint on how verbs are allowed to assign thematic roles or (b) some θ-roles are the result of a syntactic configuration, regardless of what the verb is.
- This textbook remains neutral between (a) and (b).

5.2 States

The verbs we've looked at so far (*lift, fall, swim, sell, throw*) all describe events. An event is something that happens and people and objects participate in these happenings. But there are also verbs that describe states that an individual or an object can be in. Such a verb is called a **stative verb**. Each of the following examples below contains a stative verb:

(21) Sentences with verbs describing states

a. Jack has a cold.
b. Jack owns a bike.
c. Jack lives in Maine.
d. Jack owes me $40.
e. The milk smells bad.
f. This music sucks.
g. A solution exists.
h. A small gift will suffice.

Adjectives and prepositional phrases also describe states:

(22) Sentences with adjectives and prepositional phrases describing states

a. Jack is cold.
b. Jack is afraid.
c. Jack is American.
d. Jack is in his room.
e. The article is about hair dryers.
f. This gift is for Maria.

The state/event distinction has a wide range of syntactic and semantic consequences. In the section on '*and*' at the end of Chapter 3, we discussed narrative progression and there we observed that eventive sentences tend to advance the time in a narrative while stative sentences do not. Another difference has to do with the use of the **progressive**. In (23) below, the verb ends with *–ing* and is preceded by a form of *be*. This configuration is called 'the progressive'.

(23) Jill is lifting Jack.

In our dialects of English, stative sentences such as those in (24) and (25) below do not sound good when they are in the progressive:

(24) #Jack is owning a bike.
(25) #Jack is owing me 40 euros.

There is a corresponding fact in English that has to do with verbs that are not in the progressive form. Non-progressive statives are fine in the present tense:

(26) Jill owns a bike.

But if a non-progressive eventive is used in the present tense, it cannot describe an event occurring at the time when the sentence is uttered. If you are watching Jill lifting Jack, you cannot use the first sentence below to describe what you are seeing. Likewise, if you are watching Jill swim across the pond, you cannot use the second sentence below to describe what you are seeing.

(27) Jill lifts Jack.
(28) Jill swims.

The present tensed, non-progressive forms of the verb viz. (27) and (28) are often called 'the simple present'. Statives are good in the simple present. Eventives are either peculiar or they lead to a generic or habitual statement.

Summarizing, the simple present can be used to describe a state that holds at the time of utterance, but the simple present cannot be used to describe an event occurring at the time of utterance.

SOMETHING TO THINK ABOUT

In the text, it was noted that the simple present can be used to describe an ongoing state but not an ongoing event. This difference might be explained in terms of the following difference between events and states:

States and events differ in the way they develop in time. As a general rule, a state can hold at a moment and if it holds for a period of time, it holds for every moment in that period. If Jack is in class for an hour, then he is in class for any moment in that hour. Events usually are not true at a moment. If Jill lifts Jack, then some time passes from the beginning of the lift to the end, and we cannot say that Jill lifted Jack at every moment in that period.

(i) What needs to be said about the present tense in English so that it follows from the above that an eventive sentence cannot be used in the simple present to describe an ongoing event?

(ii) A simple past tensed eventive (e.g. *Jill lifted Jack*) can be used to describe an event that occurred prior to the time of utterance. State a general rule about the contribution of the past tense to the meaning of a sentence, bearing in mind what you wrote in (i), if it is relevant.

(iii) If you know a language that differs from English with respect to simple present eventives vs. statives, provide an example. Can you think of a reason why the languages differ on this point?

EXERCISE D

In the text, it was noted that the simple present can be used to describe an ongoing state but not an ongoing event. This fact about eventives was illustrated with the two sentences below:

Jill lifts Jack.

Jill swims.

(i) The term 'simple present' is somewhat misleading – it is a label for the **form** of the verb (e.g. *lifts* vs. *lifted*) but, in fact, that verb form is used in storytelling to describe events that occurred in the past. Provide a short text that describes events in the past and that begins in the past tense and then continues in the simple present. Your text can be taken from a short story or other published writing or it can be a text that you composed.

(ii) Do you detect any meaning differences arising form the choice of tense marking in your text? Is there any generalization about when the author transitions from past tense to present tense?

A final difference between eventives and statives concerns clefts. A cleft with *do* works with eventives but not with statives. Compare the following examples, the first with eventive *lift* and the second with stative *owe*:

(29) What Jill did was lift Jack.

(30) #What Jack did was owe me 40 euros.

Earlier, when we began discussing events, we talked about the roles that an individual can play in an event and these included Agent and Patient. The agent controls the event. The agent engages in willful activity without which the event would not occur. The patient doesn't control the event. Something is done to the patient in the event. These roles, however, do not make sense for states such as owning, owing, being sick or being at home. In these cases, we simply say that the individual is **in** the state. So, for example, the logical form of the LF for '*Hamburg rocks*' is the one in (31), where we see the relation 'IN(s, **hamburg**)', indicating that *Hamburg is in a state s*.

(31) ∃s(IN(s, **hamburg**) & **rocks**(s))

Oftentimes a stative verb or adjective comes with an additional argument, which denotes what we'll call the **theme** of the state. So, for example, the logical form of the LF for '*Jack owns Bello'* is the one in (32), where we see the relation 'THM(s, **bello**)', indicating that Bello is the theme of the owing state s.

(32) ∃s(IN(s, **jack**) & THM(s, **bello**) & **owns**(s))

Note that the symbolic logic statements in (31) and (32) use the variable 's' for states. Oftentimes, states and events are collected together under the heading **eventuality**. In that case, authors will typically use 'e' for eventuality (despite the possible confusion that may occur). We will distinguish events from states from here on out, using 'e' for the former and 's' for the latter.

KEY IDEAS

- Stative verbs are ones that describe states, which differ from events:
- A state can hold at a moment and if it holds for a period of time, it holds for every moment in that period; events usually are not true at a moment.
- Stative verbs occur with the present tense, but are generally not good with the progressive; eventive verbs are good with the progressive and can only describe a habit or generalization when in the present tense.
- A cleft with '*do'* works with eventive verbs but not with stative verbs.
- Sentences with stative verbs describe an **in** role ('IN'), signifying that the subject is in a particular state.
- When a sentence has a transitive stative verb, it describes a theme role ('THM'), signifying the role of the direct object.

NEW TERMINOLOGY

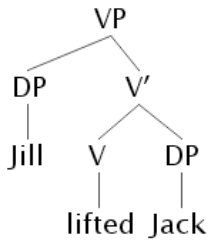
- states
- stative verb
- eventuality
- in
- theme

5.3 Event semantics for simple VPs

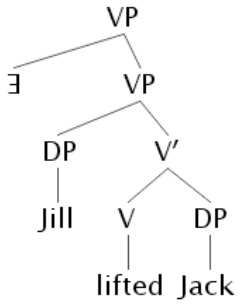
The goal in this section is to introduce new rules of translation that will take us from the LF for the sentence in (33) to the logical form in (34).

(33) Jill lifts Jack.
(34) ∃e(AGT(e, **jill**) & PAT(e, **jack**) & **lift**(e))

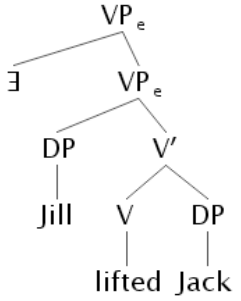
Recall that the deep structure for (33) is:



In the symbolic language formula in (34) there are three conjuncts, and the basic idea will be to have rules that associate each of those conjuncts with a part of the syntactic structure: the first two conjuncts with the subject and object and the last with the verb. There are two related challenges that arise at this point. The formula has a variable 'e' in it and a quantifier '∃e'. Where do they come from? In the next chapter, we'll associate the quantifier with the tense. For now, we'll just assume an ad-hoc rule of syntax that allows us to adjoin a null '∃' to a VP. So we have this structure:



In the past, we had logical forms with variables in them, and those variables always corresponded to an index in the tree – always an index on a DP. In this case, we'll assume that VPs are indexed and that will be the source of the event variables. So that gives us the final tree below:



With that syntax in mind, we can now write our rules of translation:

VERB
Anything of the form:

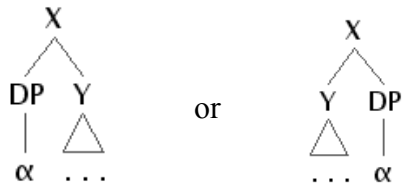
has the logical form: **π**(u)
where 'u' corresponds to the eventuality variable index on the VP headed by **π**.

∃-RULE
Anything of the form:

has the logical form: ∃uϕ

where 'ϕ' is the logical form assigned to the VP sister of ∃.

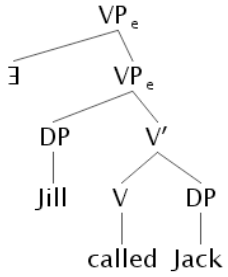
NONBRANCHING DP
Anything of the form:



has the logical form: (θ(u, **α**) & φ)

where 'θ' is the thematic role assigned to the DP, 'u' corresponds to the event or state variable index on the VP containing the DP and 'φ' is the logical form assigned to Y.

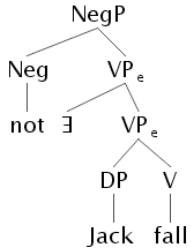
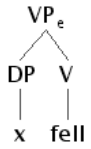
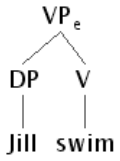
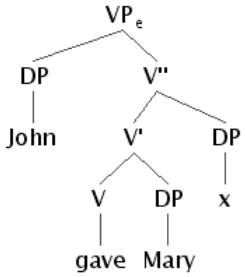
By applying these rules to:



We get:

Subtree dominated by node:	**Rule that applies to that subtree**	**Logical form assigned to that subtree**
V	VERB	**called**(e)
V′	NONBRANCHING DP	PAT(e, **jack**) & **called**(e)
lower VP_e	NONBRANCHING DP	AGT(e, **jill**) & PAT(e, **jack**) & **called**(e)
higher VP_e	∃-RULE	∃e(AGT(e, **jill**) & PAT(e, **jack**) & **called**(e))

Here are some more examples.

(Incomplete) LF	Corresponding Logical Form
	¬∃e(PAT(e, **jack**) & **fell**(e))
	PAT(e, x) & **fell**(e)
	AGT(e, **jill**) & **swim**(e)
	AGT(e, **john**) & PAT(e, x) & GOAL(e, **mary**) & **gave**(e)

The rules introduced in this section replace our earlier rules for VP. All the other rules from previous chapters remain as is. A full list of rules (including those from Chapters 1-3 and those from this chapter) is provided at the end of this chapter. **Before continuing further in this chapter, make sure you understand why the logical form on the right corresponds to the LF on the left.**

EXERCISE E

Our Grammar now refers to the set of rules introduced in the previous chapters, with the old rules for VP replaced by the event semantic rules just introduced.

1. For each of the following sentences, give the logical form assigned to it by our Grammar:

   (a) *Alan beat Carl.*

   (b) *Carl cried.*

   (c) *Alan knows Carl.*

If you are unsure about what thematic role is assigned to a given DP, choose one for your logical form and explain why you are uncertain.

2. For each of the following sentences, provide an LF-structure that is assigned a logical form by our Grammar. Don't forget the symbol '∃' that is adjoined to VP. Below your structure, provide the logical form that is assigned to it by our Grammar. Note: You will need to use rules from Chapter 3 (in addition to the rules provided in this chapter!) to complete this exercise. A full list of our rules (Chapters 1-3 and 5) are provided at the end of this chapter.

   (a) *No dog barked.*

   (b) *Jack ate every apple.*

   (c) *Jack didn't call Jill.*

5.4 Adverbial modifiers

Now that we have an event semantics for verbs, it becomes possible to explain how some adverbials work. We'll be focusing on VP adverbs as in (35) and on PP modifiers as in (36):

(35) Jack prayed quietly.
(36) Jack partied in Newton.

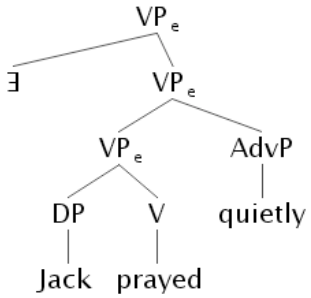
The engine of our analysis will be the idea that adverbials inside the VP further specify the kind of event that is being described. The logical forms for the sentences above will include statements in which the adverb or preposition contributes a predicate of events:

(37) **quietly**(e)
(38) **in**(e, **newton**)

These are conjoined with the statement about events that the verb contributes, giving us:

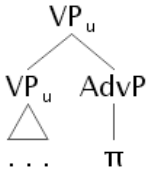
(39) ∃e(AGT(e, **jack**) & **pray**(e) & **quietly**(e))
(40) ∃e(AGT(e, **jack**) & **partied**(e) & **in**(e, **newton**)

Let's start with the adverbs, which we take to be adjuncts:



Next we introduce a new rule for assigning logical forms to adjoined adverbs:

ADVERB
Anything of the form:



has the logical form: (φ & **π**(u))
where 'φ' is the logical form associated with the sister of AdvP.

For the structure above for *Jack prayed quietly,* the rules we introduced in the previous section will give us the logical form of the lowest VP:

(41) AGT(e, **jack**) & **pray**(e)

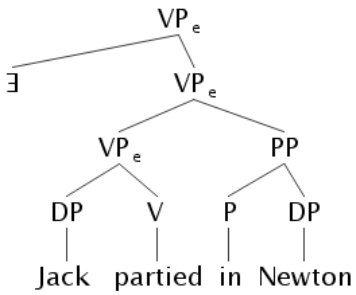
Then the ADVERB rule will use that to produce:

(42) (AGT(e, **jack**) & **pray**(e) & **quietly**(e))

Finally, the ∃-RULE will give us:

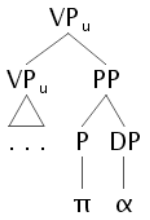
(43) ∃e (AGT(e, **jack**) & **pray**(e) & **quietly**(e))

Next we turn to PP modifiers and again we take these to be VP adjuncts:



This requires a new rule for assigning logical forms to PP adverbials:

PP ADVERBIAL
Anything of the form:



has the logical form: (φ & **π**(u, **α**))

where 'φ' is the logical form associated with the sister of PP.

The rules we introduced in the previous section will assign to the lower VP in the structure above for *Jack partied in Newton* the logical form:

(44) AGT(e, **jack**) & **partied**(e)

Then the PP ADVERBIAL rule will use that to produce:

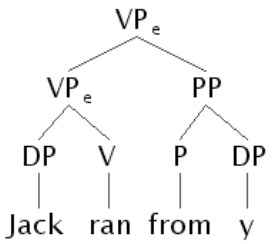
(45) (AGT(e, **jack**) & **partied**(e) & in(e, **newton**))

Finally, the ∃-RULE will give us:

(46) ∃e(AGT(e, **jack**) & **partied**(e) & **in**(e, **newton**)

SOMETHING TO THINK ABOUT

The PP ADVERBIAL rule makes use of α which could be a variable or a name. So far we have only seen cases where α is a name. However, think about a case where α is variable, as in the LF below. What logical form would be assigned to this LF?

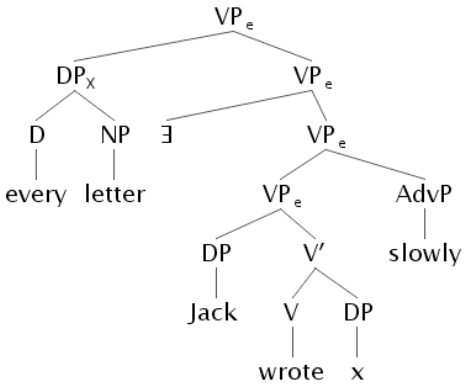


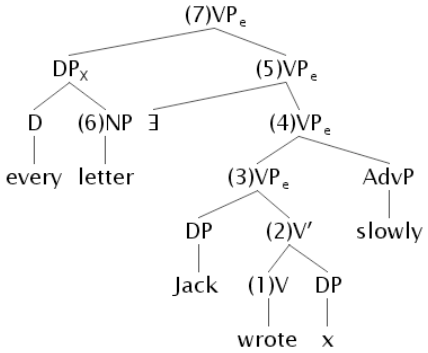
EXERCISE F

1. For sentence below, provide an LF-structure that is assigned a logical form by the Grammar. Below your structure, provide the corresponding logical form.

   Jack drove carefully into Somerville.

2. Below is an LF-structure for '*Jack wrote every letter slowly*'. Next to it is the same structure but with certain nodes numbered. Fill in the chart, indicating what rule in the Grammar applies to the tree dominated by the numbered node and what logical form is assigned.





Subtree dominated by node:	**Rule that applies to that subtree**	**Logical form assigned to that subtree**
1		
2		
3		
4		
5		
6		
7		

3. In the LF in exercise 2, the DP was raised above '∃'.
   (i) Provide an LF in which [$_{DP}$ *every letter*] is adjoined below '∃'.
   (ii) Provide the logical form that is assigned to your LF in (i).
   (iii) The truth conditions for the logical form you provided in (ii) could never be met as long as there is more than one letter. Why is that?

Because of the logic of '∃' and '&' encoded in the semantic rules that assign truth conditions to logical forms, we now capture the fact that (47) entails (48).

(47) Jack prayed quietly.
(48) Jack prayed.

To see that, consider the logical form for (47):

(49) ∃e(AGT(e, **jack**) & **pray**(e) & **quietly**(e))

If that statement is true, then there exists an event that is both a praying event and a quiet event and whose agent is Jack. But then that very event is a praying event whose agent is Jack. In other words, the following is true:

(50) ∃e(AGT(e, **jack**) & **pray**(e))

But that is exactly the logical form for (48)! So, if the truth conditions for (47) are met, then the truth conditions for (48) are met. In other words, (47) entails (48).

5.4 Summary

In this chapter we changed our grammar so that it captures the intuition that verbs describe events and states. Our grammar has the following features:

- Verbs are treated as one place eventuality predicates.
- Thematic roles connect the meanings of DPs to the events described by the verbs they combine with.
- Adverbs are treated as one-place eventuality predicates. They add further descriptive information about the events described by the verbs they modify.

Here is what you should be able to do at the completion of this chapter:

A. Assign a deep structure, an LF and a logical form to English sentences formed using: negation, transitive and intransitive verbs that describe eventualities (events and states), adverbs, prepositions, conjunction, and one or more DPs formed from a name or a determiner and a noun. Here are examples of such sentences:

(1) Jack didn't praise Jill loudly.
(2) Some farmer beat a donkey with a stick.
(3) At least one politician carefully avoided Jack and no politician avoids Jill.

B. You should be able to show how our grammar assigns two truth-conditionally distinct logical forms to sentences such as in (4)-(6) and then derive their truth-conditions.

(4) Every passenger didn't run quickly.
(5) At least one man called every woman.
(6) Jack called every politician from Boston.

Metavariables:

π	predicates (1-place and 2-place)
θ	thematic role (2-place predicates)
α, β,	variables and individual constants
u, δ, X, Y	variables
ϕ, ψ	sentences / formulas
M	lexicons

Syntactic Rule:

Quantifier Raising (QR): A DP consisting of a determiner and an NP may be adjoined to a node that dominates it. The place it is moved from is indicated by a variable, and the moved DP is indexed with that variable.

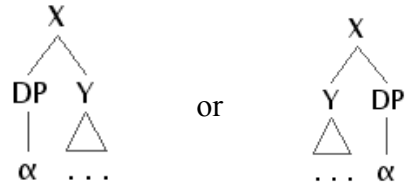
Rules of Translation:

VERB
Anything of the form:

has the logical form: $\boldsymbol{\pi}$(u)

where 'u' corresponds to the eventuality variable index on the VP headed by $\boldsymbol{\pi}$.

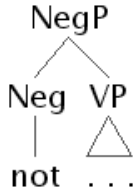
NONBRANCHING DP
Anything of the form:



has the logical form: $(\theta(u, \alpha) \& \varphi)$

where 'θ' is the thematic role assigned to the DP, 'u' corresponds to the event or state variable index on the VP containing the DP and 'φ' is the logical form assigned to Y.

NEGATION
Anything of the form



has the logical form: $\neg \varphi$

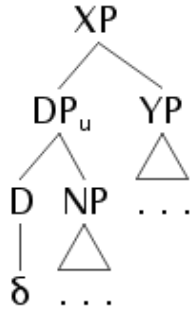
where 'φ' is the logical form of the VP.

NON-BRANCHING NP
Anything of the form:

has the logical form: $\boldsymbol{\pi}$(u)

where 'u' corresponds to the variable subscripted on the DP that immediately contains NP.

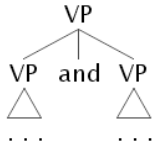
BRANCHING DP:
Anything of the form:



has the logical form: $\boldsymbol{\delta}_u\{\varphi\}\ \psi$

where 'φ' is the logical form associated with the NP and 'ψ' is the logical form associated with YP.

AND
Anything of the form:



has the logical form: $(\varphi \ \& \ \psi)$

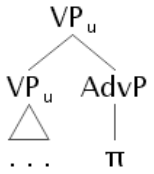
where 'φ' is the logical form of the lefthand VP and 'ψ' is the logical form of the righthand VP.

∃-RULE
Anything of the form:

has the logical form: ∃uφ

where 'φ' is the logical form assigned to the VP sister of ∃.

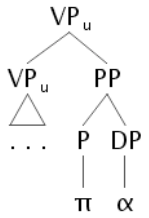
ADVERB
Anything of the form:



has the logical form: (φ & **π**(u))

where 'φ' is the logical form associated with the sister of AdvP.

PP ADVERBIAL
Anything of the form:



has the logical form: (φ & **π**(u, **α**))

where 'φ' is the logical form associated with the sister of PP.

Semantic Rules:

ATOMIC-1
'**π**(α)' is true with respect to M *iff* M(α) ∈ M(π)

ATOMIC-2
'**π**(α,β)' is true with respect to M *iff* M(α) bears the relation M(π) to M(β)

AND
'(ϕ & ψ)' is true with respect to M *iff* 'ϕ' is true with respect to M and 'ψ' is true with respect to M

NOT
'¬ϕ' is true with respect to M *iff* it is not the case that: 'ϕ' is true with respect to M

EXIST
'∃*u*ϕ' is true with respect to M *iff* there is at least one object o such that, 'ϕ' is true with respect to M+<*u*,o>

UNIVERSAL
'∀*u*ϕ' is true with respect to M *iff* every object o is such that 'ϕ' is true with respect to M+<*u*,o>

EVERY
'**every**$_u${ϕ} ψ' is true with respect to M *iff* for every object o such that 'ϕ' is true with respect to M+<*u*,o> , 'ψ' is also true with respect to M+<*u*,o>

NO

'**no**$_u$ {ϕ} ψ' is true with respect to M *iff* there is no object o such that 'ϕ' is true with respect to M+<*u*,o> and 'ψ' is also true with respect to M+<*u*,o>

THE

'**the**$_u${ϕ} ψ' is true with respect to M *iff* there is exactly one object o such that 'ϕ' is true with respect to M+<*u*,o>, and 'ψ' is also true with respect to M+<*u*,o>

SOME

'**some**$_u$ {ϕ} ψ' is true with respect to M *iff* for some object o such that 'ϕ' is true with respect to M+<*u*,o>, 'ψ' is also true with respect to M+<*u*,o>

ATLST1

'**atlst1**$_u$ {ϕ} ψ' is true with respect to M *iff* there is at least one object o such that 'ϕ' is true with respect to M+<*u*,o> and 'ψ' is also true with respect to M+<*u*,o>

Pragmatic Rule:

Narrative Progression
In the course of a narrative, when an event is described, it is usually understood to follow in time a previously mentioned event. When a state is described, it is usually understood to hold at the time of a previously mentioned event.

Rules of Inference:

REPLACE [Rule of Inference]

If two statements ϕ and ψ are logically equivalent (ϕ *iff* ψ), then from a statement including ϕ, we can infer the statement that results from replacing ϕ with ψ.

If two expressions E1 and E2 name the same entity, then from a statement that includes E1, we can infer the statement that results from replacing E1 with E2.

INSTANTIATE [Rule of Inference]

From a rule stated in terms of metavariables, infer the result of substituting the metavariables with expressions of the right kind – taking care to substitute all occurrences of a given variable with the same expression.